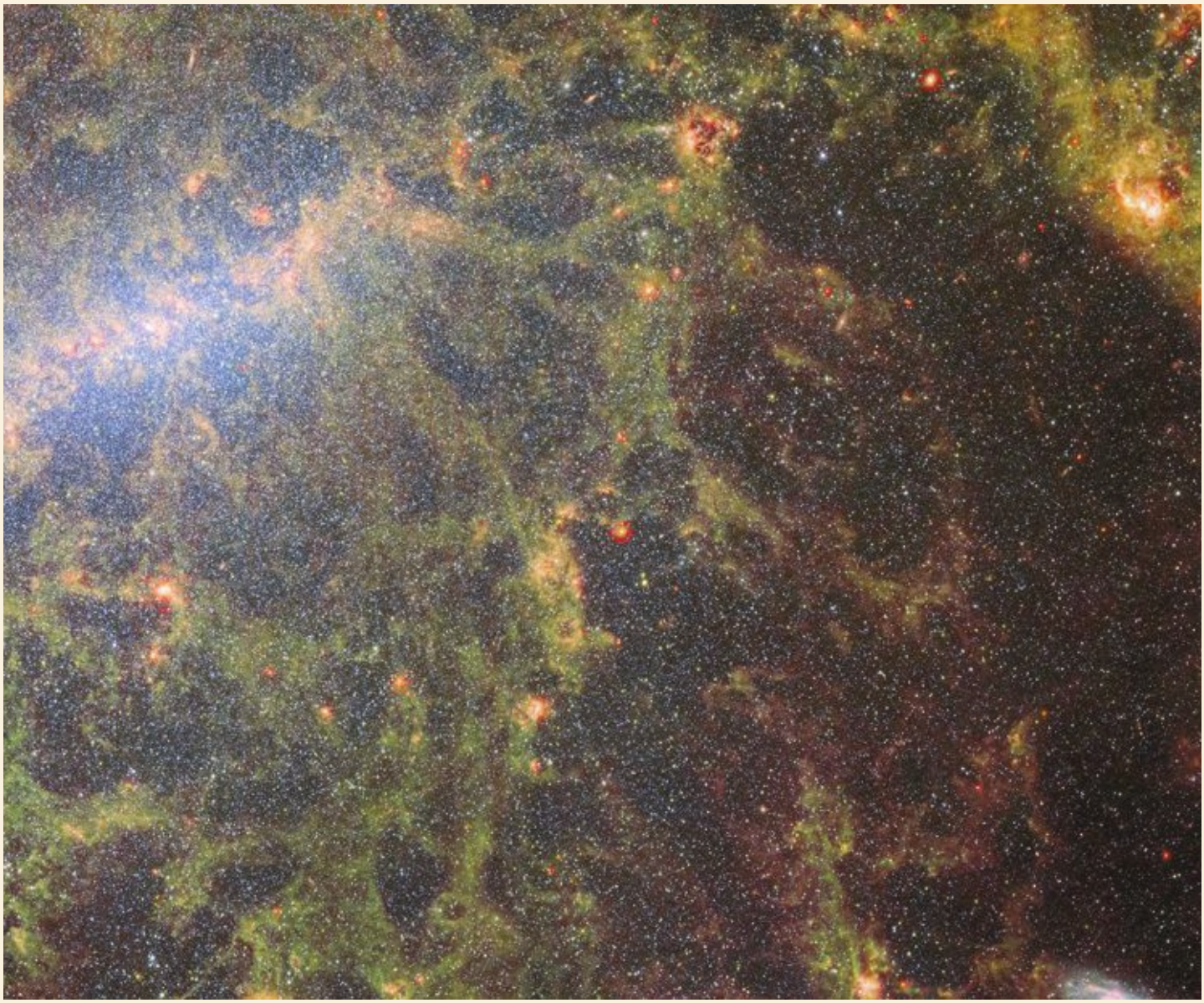
TEXAS ASTRONOMICAL SOCIETY PRESENTS.....

SUMMER 2023 VOLUME 01 ISSUE 01

SPACETIME ARCHIVES

BY RISHIKA PORANDLA



[WEBB'S PHOTO OF THOUSANDS OF STARS IN A GALAXY 17 MILLION LIGHT-YEARS AWAY (IMAGE CREDIT: ESA/WEBB, NASA)]

PICTURED...

IS A PHOTO OF NGC 5068, A GALAXY LOCATED 17 MILLION LIGHT-YEARS AWAY FROM EARTH, TAKEN BY WEBB IN JUNE 2023. THIS GALAXY IS A VITAL PART OF A RESEARCH PROJECT BY ASTRONOMERS IN ORDER TO BETTER UNDERSTAND STAR FORMATION.

FEATURING...

- INTERVIEW WITH MARA JOHNSON-GROH (NASA SCIENCE WRITER)
- CONVERSATIONS W/ CASEY SWAILS (NASA DEPUTY ASSOCIATE ADMINISTRATOR)
- NASA ASTROCAMP PARTNERSHIP
- SPACETIME ARCHIVES STUDENT RESEARCH FELLOWSHIP
- BLOGS, PODCASTS, NEWS, RESEARCH, & MORE.

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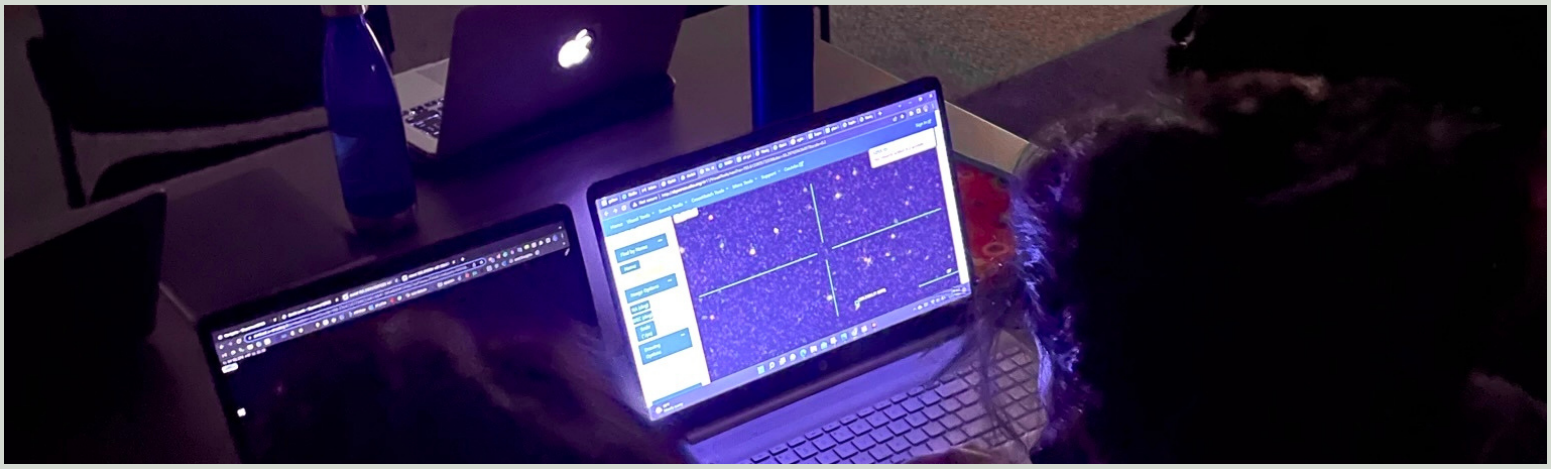
FEATURING: RISHIKA PORANDLA ANGEL HU

JAQUELINE PEÑA DORI STEIN RIHA MUSA

Image Credit: NASA, ESA, the Hubble Heritage Team (STScI/AURA)-ESA/Hubble Collaboration, and W. Keel (University of Alabama)

LETTERS FROM THE DIRECTORS

LEARNING TO LOVE THE INTRICACIES OF EMPIRICISM AND LOGIC WITHOUT LOSING SIGHT OF THOUGHT

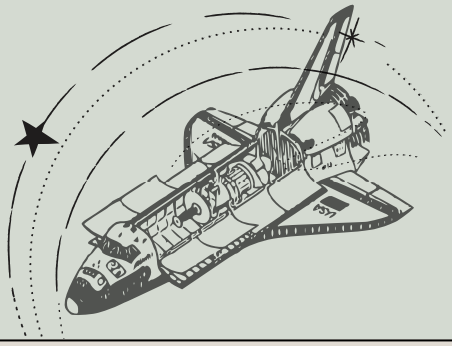


Shifting Gears & Changing Terrains

Last-minute trips to the outskirts of Houston, to the Florida coast, to the heart of Washington D.C. remind me of being ten years younger and seeing my reflection in prop astronaut helmets, widening my wingspan to try to fit the body of Saturn V within it, gripping the leather seats of space shuttle simulators with the naive spirit of a child in love. I didn't know then that there was something more to stars than the pinpricks of light I squinted at, nor did I understand that "space" was *actually* empty, dark, lonely nothingness (euphemisms are annoying). Really, I knew nothing scientific or factual, other than that the picturesque appearance of NASA held all my hopes and dreams—at least in my tiny conception of what the world was.

I have nurtured, voiced, and embodied my fixation for astronomy for as long as I can remember. I was the child that spent half her life at the NASA space centers; I was the teenager that wasted nights and days and hours and weeks wondering about how the singularity within a black hole fundamentally exists; I was the young adult who crafted research and words and speeches about why humans should even care about all of it.

Outer space consumed whatever the part of my mind that dictates curiosity is—just searched it up, it's the hippocampus—and regurgitated a tendency to bury my nose in literature about the universe. I suppose I was doomed from the beginning, since that *Moustronaut* picture book suddenly morphed into dense National Geographic textbooks larger than my head.



A few blinks left me with *A Briefer History of Time* by Stephen Hawking clenched between my fingers, and then the "er" suffix went away, and there I was on my fifth reread of *A Brief History of Time* at thirteen years old.

A shift in thought process must have occurred somewhere in those transitions, since now someone could offhandedly ask me about that comet that just flew by, and I might not know what they're talking about. It's true that more of my screen time is spent on Phys.org rather than Space.com, and that I have more particle physics equations memorized than astrophysics, and that I'm more interested in Hawking's quantum work than his classical work—that's all as true as the fundamental constants of the universe.

"I might've been the young girl who trembled with awe in front of rockets, but I'm also the young adult who tangles herself into research groups that study electrons rather than stars and pull all-nighters over particle collisions rather than galactic mergers."

Of course, electrons and stars are one and the same, and there's no difference between particle collisions and galactic mergers, but it doesn't feel that way when they're inevitably part of two different fields of study and there's a nagging reminder in my head about how I left one for the other.

That all being said, my ears still perk up when I hear the prefix "astro" and my bedroom wall is adorned with a tapestry of the night sky. My water bottle still has a worn NASA decal across it, and I still take out my telescope once a month and point it at the sky. First loves might fade with time, but I don't think I'll ever be fully ready to let this one go.

VISIT OUR WEBSITE FOR MORE OF RISHIKA'S WORK: SPACETIMEARCHIVES.COM

ABOUT THE AUTHOR

Rishika Porandla
17 | Founder & Director

Rishika Porandla is a rising senior at Coppell High School who has explored her passion for astrophysics and scientific research in various different avenues, now currently the Founder and Director of the astrophysics outreach program "Spacetime Archives," a NASA intern, and Vice President of Teen Texas Astronomical Society. She is also an astrophysics research mentor for high school research groups and the winner of the U.S. Agency of International Development (USAID) Science Champion Award. When Rishika isn't interning or learning new things about the universe, she spends her time writing short stories and blogs and reading her favorite classics.

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A JOURNEY THROUGH SPACE & A COLLECTION OF VOICES – AND LEARNING TO FIND MY OWN

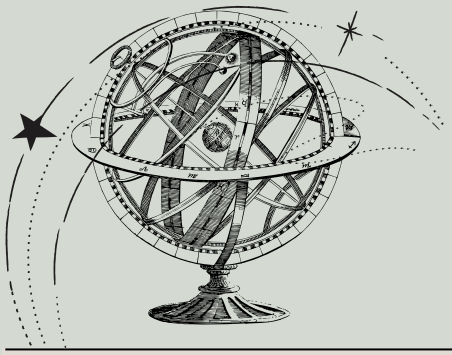
On Conversation, Complexity, and Community

When I first began diving deeper into the world of STEM, I was often easily intimidated. Not just by the subject material but by the people I was surrounded by and the ideas I believed I had to emulate.

STEM is both feared and revered for its relentless complexity, and I, as a budding student, was a victim to the gap between "complexity" and "simplicity" – from watching my peers shy away from physics because they've been told that they're "not cut out for such a difficult subject" to physicists and mathematicians who scorn biologists because their field is "easy."

There's the phrase, "It's not rocket science!" that's constantly used to draw a distinction between a task that's easy and a task that's so difficult it's reserved for only the brightest. In a way, this phrase makes it as if "rocket science" was something to be feared. As if the elegant equations and mechanics behind ordinary curiosities simply couldn't be communicated to everyday citizens, leaving everyone in the dark when it came to such a pivotal development in the progress of science and humanity.

"*When we lock the crux of STEM in an ivory tower, we lose the very essence of the subject: the ability to create change. We risk witnessing the gap growing so big that it becomes a chasm.*"



I've seen some lament the "dumbing down" of STEM in popular media. Complex subjects like mathematics and physics are not for the general public, and orienting them to the general public completely erases their true meaning. But despite the rigorous and advanced training that goes behind studying STEM, it's a subject meant for the voices of many, the conversations and insights of a diverse range of perspectives. I'm glad I spend just as much time in STEM fields scribbling down numbers and equations as I do carefully choosing the best words to explain a concept or listening to peers solve a seemingly simple problem in a completely new way.

In the creative writing world, there's this idea of "having your own voice." When my passion for writing and communication joined with my passion for STEM, I learned that having my own voice meant exploring outward – and translating my personal experiences into words for other people to learn from. I welcome my use of physics metaphors in the poems I write, even if their basis isn't all that scientific; I laugh at jokes about Schrodinger's Box and Heisenberg's Uncertainty Principle, even if the punchline is vastly simplified, and I widen my eyes in excitement when I hear science references in movies, even if the concept isn't that complex.

When I think about the most defining moments in my STEM journey, I don't always jump to the times I won an award or got a good grade on a test. I remember all the people, lessons, and reflections that got me there – and even the times where I didn't get there.

Conversation is the crux of the vibrant community of scientists, researchers, advocates, and leaders that I find myself working with and constantly awed by today. But despite these lofty titles, these people are foremost my friends, my teammates, and my mentors. They are the reason why, despite the doubts and fears, I still chase STEM in all its mental and emotional complexities.

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Angel Hu

17 | Blogging Director

Angel Hu is a rising senior at Central Magnet School in Murfreesboro, TN who is motivated by her dual passion in the sciences and the humanities. She has conducted research in astrophysics and particle physics and seeks to spread her love of STEM through outreach efforts in her local community. Additionally, Angel serves as Tennessee's inaugural Youth Poet Laureate, using creative writing to discover and share her voice.

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PICKING APART THE STRENGTH IN SUBSTANCE, FOLDING OVER THE LAYERS OF PERSEVERANCE

What I Carry On My Shoulders

That my hometown built on mesquite and river mud fills my memoir of lessons to be taught and told.

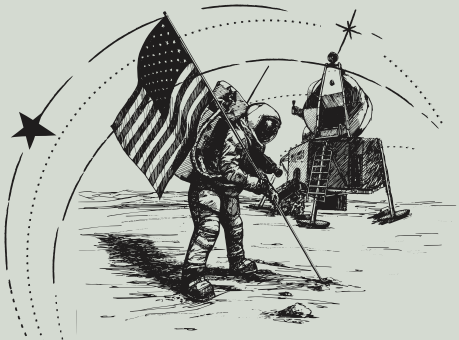
It's surpassing the traditional values, it's grieving the guilt of leaving others behind, it's looking at your home with eyes big as moons hoping for a sense of validation. It's surpassing the lone-wolf, caballero mentality.

I see it when I get my morning coffee at the gas station. Work boots speckled with paint remind me of the sunspots that form on my skin when I spend time in the sun. It creeps up on me at the dinner table when my mom worries about my plate staying warm.

If there's one thing home taught me, it would be the strength in resistance. That I can look at the situation in front of me and always, always tilt my head, and fish for a thought on progression. It's talent in the blood. It's chasing a dream in land unpaved, just as they did before me.

When I take gratitude apart I find what fuels my work ethic. Between hot flashes at night, sticky fingers graze my face and little voices sing as the birds do.

"For a culture so cold in sacrifice, the sun holds no mercy melting away the layers of your solitude."



Because the uncertainty of your own success maps out in numbers that assure you a challenge, that ensures your reflection, your passiveness to situations of rigor. I've learned resilience like calluses. I've learned to make it what I need it to be, through a struggle I make peace with when I pray at night.

I think of my younger cousins, faces dripping from mango nectar as they watch hands graze over the pictures of galaxies. I watch them attempt to count all the stars on their fingers, knowing the sky here looks nothing like these photographs, and I can do nothing but promise them better sights.

And so, we'll be playing cards over smoldering concrete, we'll talk about our future plans over shaved ice. I'll feel the syrup coat my throat, and I'll feel like a toddler choking on sweet sugars. The dirt doesn't wash off our knees and elbows and the rosary on your rearview mirror is a metronome to the seconds passing, the years passing, as I pretend to avoid the topic of sleeping somewhere else that's not home.

I'd like to share the philosophy that humble beginnings mold you to a sense of solidarity, because you grew up different and because you grew up the same. I want to share the lesson of wanting more, of saying I want to do more for myself in order to do more for you.

If in the end I'm left with more than a cowboy, lone wolf mentality.

I'm given a sweeter epilogue of arroz con leche and the bare value of fighting for something.

VISIT OUR WEBSITE FOR MORE OF JACKIE'S WORK: SPACETIMEARCHIVES.COM

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Jaqueline Peña

18 | Blogging Director

Jacqueline Peña is an intern and ambassador for the South Texas Astronomical Society. Born and raised in Brownsville, TX, she draws inspiration from her experiences growing up on the border and simultaneously on the frontier of space development. She spends her time working towards educational outreach in her community, focusing on space science as well as avenues for pursuing college. She will be attending Stanford University in the fall with a study focus on a space initiative.

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INTERPRETING HOW INEVITABILITY AND DECISIONS CAN ASCEND A LIFE

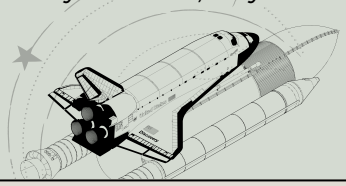
How Our Actions Shape Us

When a person gains ambition and drive, this state doesn't just come out of the blue. With every emotion or thought, an action is the primary cause of it. Even a mere walk outside can initiate a plethora of ideas. Newton's gravitational theory wasn't just produced on the spot—his decision of sitting under an apple tree was part of this crucial law. This distinct example depicts how a small action can lead to large consequences.

Throughout human history, exploration has continuously been the source of progress and innovation. From a young age, I've loved exploring – be it in my backyard or on the Science channel. There is something about making a discovery, no matter how large, that truly excites me. When that knowledge relates to humanity's final frontier – space – I become even more excited; however, there is no beginning without an action to pursue it.

Similarly, my STEM passion began at a young age. When I was four, my dad was renovating our house and would often bring boxes back home. As I ran downstairs one day, he told me that he got a chair from IKEA. But, to my surprise, there was no chair - just a hardwood box. *There is no way a chair could fit into that box*, I remember thinking to myself. Then, I realized that my dad was about to build the chair himself. Excitedly, I watched as he opened all the parts and started reading the instruction manual. I remember rolling the tools in my hands, reveling at the power that such tools can give. Then, he pointed at a picture in the instruction manual. Ecstatic about the opportunity to contribute, I got to work. Within an hour, I had finished the chair.

"Watch your thoughts; they become words.
Watch your words; they become actions.
Watch your actions; they become habits.
Watch your habits; they become reality."



The sense of accomplishment and inspiration was unbelievably strong, and sitting on that chair every day filled me with pride and excitement. Without my action and perseverance to complete the chair, I wouldn't have learned a key part of me —my love for engineering. Plus, the empty box definitely entertained my cat.

I have always found the most value in learning from subjective experiences. Throughout my life (so far), I have gained the most insight from my perspectives, not others'. Although many mentors, teachers, parents, and even subordinates think that they know the best advice to give, I disagree; the best lessons a person can learn are from themselves. Every individual experience that a person deals with carries much more meaning when the person themself takes moral from it. For instance, throughout the past year, I have learned how a clock can detrimentally slow down; I struggled a lot contemplating life's existence and purpose. Nonetheless, I learned to cope with myself by learning from my faults and taking action instead of sitting in misery and negativity. Specifically, I was introduced to an abundance of mental challenges that can only be resolved by me. As stubborn as I may be sometimes, I didn't listen to anyone else's advice – except for mine. I learned how to cope with my emotions and find my place here on this planet. Regardless of what anyone says, the person within can only decide their destiny and life choices. Now, every second of every day I make sure I am living the best version of myself. I took this lesson from one of my favorite books, The Four Agreements, by Don Miguel Ruiz. I realized that life is futile if every moment isn't enjoyed or lived to its best possibility.

Now, when I tackle any activity, I make sure I understand the bouts of actions. Whether it's the decision to stay in bed or read another chapter, I am the one who chooses its significance.

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Dori Stein
18 | News & Education Director

Dori Stein is a rising freshman at Embry Riddle Aeronautical University (Daytona Beach, FL) studying Astronomy and Astrophysics. Born in Manhattan and raised in Staten Island, NYC, she has undoubtedly always had a passion for anything STEM related. In her sophomore year of high school, she was certain about getting a career in the space field. She has pursued various STEM fields such as computer science, game design, calculus, and conducted research in particle physics and global health (NASA SEES). In addition to her STEM realm, she owns and runs a small business on Etsy.

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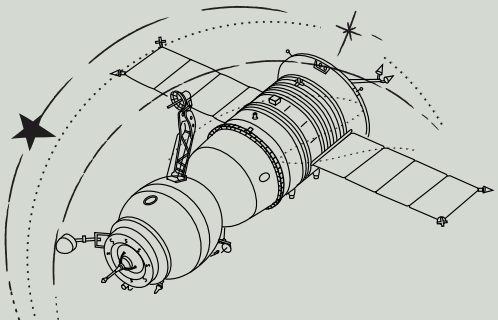
The Stories We Share

In the tapestry of our existence, the stories we tell continue to be the ones that have stood the test of time. They echo emotions and carry their essence from one setting to another. They convey the joys, sorrows and wisdom of those who come before us and most importantly, serve as the foundation and dictator to innovation.

The basis of all remarkable things stem from a singular idea: a spark that has the potential to leave an undeniable mark on this world. Presently, I am pursuing one of my own sparks and working towards building it in real life: accessible multi-plane hologram projections. Visualize having a hologram of your favorite movie playing in the middle of your living room, interconnected with hearths of light and beams arranged in such calculated composition that they form motion pictures. This vivid imagination of mine alone has driven me to pursue my designs and not only envision them but to transcend them from realm of abstraction and find materialization in the real world.

"To progress as a society, we must all share our stories—tell them to all that will hear because the foundation of our very future relies on it ."



Weaving together the threads of the past, present and future, storytelling serves as a catalyst for innovation. For me, it is the source of my courage to be audacious, to dream differently.

This is a profound time in my life due to the fact that I am transcending from the role of the mere and humble story-listener to the vibrant and perceptive storyteller.

The weight of the impact made by this transition can only be described in the person I am today, however I have no doubt in my mind that I will repeat the pattern of listening to stories to telling them throughout my life. I look forward to it but I would also like to capture the essence of this snapshot of my life. This moment in time symbolizes my ascension from an admirer to a contributor.

My desk, adorned in circuits, wires and batteries and my laptop filled with blueprints and simulations of rovers, microcontrollers and what not, are all a testament to my affinity for modernization and mechanization. Because my stories look for their plots in the future, they look for their characters who will forge new paths, and they will embody the spirit of exploration.

I will always be in search of the contemporary, no matter the time period. I will always speak from my heart, regardless of the audience. I will always share my stories, in every and any instance.

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Riha Musa

15 | Podcast Director

Riha Musa is rising junior at Coppell High School who is heavily involved in the research and curation of various electronic systems. She is currently in the process of designing a multi-plane projection technology, which can be utilized in the fields of education, technology and medicine. She is extremely passionate in the inclusion of artistic formats in the STEM space, which she exemplifies in her unique format of podcasts and articles. She has also conducted micro-projects in efforts to build devices and gadgets in an environmentally-sustainable way. One of these projects initiated on the basis of creating a recycled insulation device, which she successfully carried out and presented to other groups trying to achieve the same. Riha also enjoys performing classical dance and reading interpretive novels.

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STUDY GUIDES & RESOURCES RESEARCH FELLOWSHIP CAMPS

CAREER & EXTRACURRICULAR GUIDES INTERVIEWS SEMINARS

EDUCATION & PRESENTATIONS

Image Credit: NASA, ESA, CSA, STScI, Webb ERO Production Team)

Highlights of Summer 2023: Interview with Mara Johnson-Groh, Interview with Casey Swails, Astrophysics resource guide, NASA SEES seminar, Calculus study resources, Presentation with Dr. Judit Ries, Spacetime Archives Student Research Fellowship, NASA ASTROCAMP 2023.

MARA JOHNSON-GROH

AN EXPLORATION

of scientific journalism.

WHO IS MARA?

AWARD-WINNING NASA SCIENCE WRITER

Mara Johnson-Groh is an award-winning science writer at NASA's Goddard Space Flight Center. She works in the Heliophysics Division, sharing mission news and new scientific discoveries about the Sun and its influence across space, from giant eruptions on the solar surface to auroras on Earth. She has also taken photographs and written science news articles for dozens of magazines and online publications.

TRANSCRIPT

INTRODUCTION &
MARA'S BACKGROUND

Rishika: Hi everyone! My name is Rishika Porandla. I am the Director of Spacetime Archives and I am here with Mara Johnson-Groh. She is a NASA Scientific Author and a journalist, and we are going to be having an interview today.

Rishika: A quick background about her: she has a Bachelor's in Physics and a Master's in Astronomy. She is an award-winning scientific author and photographer, and she depicts everything on Earth and even things beyond the Sun—as she puts it on her website. She freelances for magazines and online sites, and she's also a scientific writer for NASA. Her work has earned numerous accolades. I'll let Mara get into her personal presentation.

Mara: So, I'll just give a brief background here. As you said, I have a background in science. I started out studying physics, and went on to study astronomy in graduate school because I've always loved astronomy and those big-picture questions. But then, when I was working on my Masters, I really loved the process of being an astronomer. At the time I was finding new exoplanets and galaxies, and I really loved that, but I didn't enjoy all of the day-to-day work behind that. So, I started thinking more about other avenues.

Mara: While I was doing that, I started writing for this website called Astrobites. This is a website run entirely by graduate students where they take new papers in astronomy and write summaries about them for an undergraduate audience. I really liked that, so I thought: why not become a science writer? When I finished my Masters, I got a job at NASA's Goddard Space Flight Center. It's a huge campus with tons of scientists and engineers, but specifically I work with the Heliophysics Division.

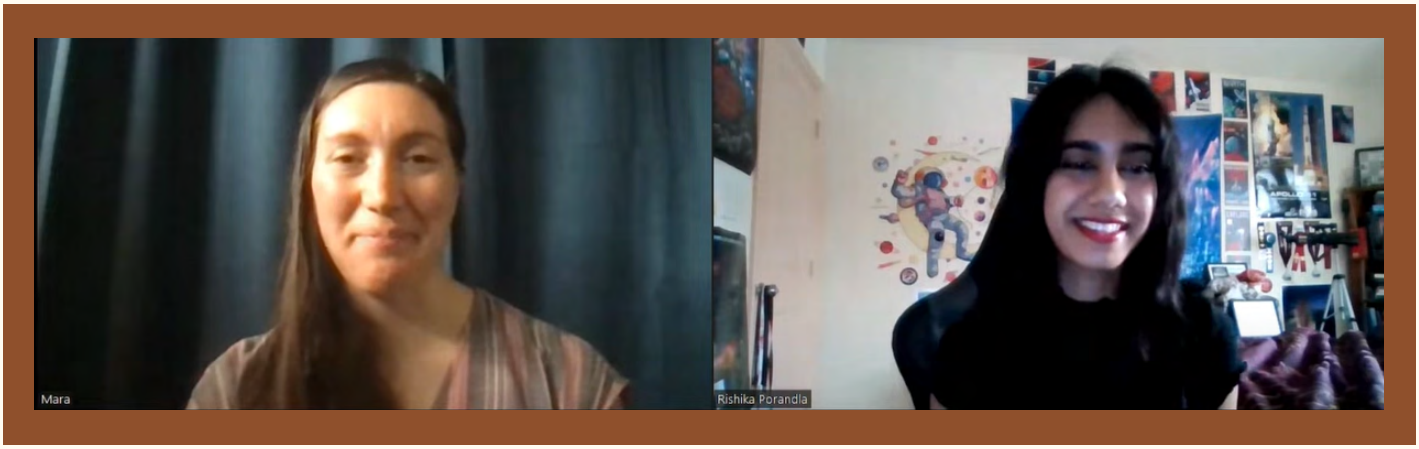
Mara: Heliophysics is essentially the study of the Sun and everything the Sun's light touches. So, that's from flares on the Sun to auroras on Earth to the very extent of the Sun's influence past the planets. So, the majority of my work is writing about new discoveries. Typically what that looks like is one of our scientists will make a new discovery, which they'll publish in a scientific journal. I'll take that and write it in a way that hopefully anybody can understand. We're really trying to write for a high school level audience.

Mara: We write articles, and of course we're also putting that on social media and writing posts as well. In addition to that work, I work with an amazing team who makes all kinds of scientific visualizations, such as this one, which shows how a particle moves through a particular type of magnetic field in space. I also work with graphic designers who make these incredible posters and things that show stuff in ways that's hard to describe in words alone.

Mara: I also work with a bunch of video producers who make wonderful content and videos for us, including a new six-part documentary series that is coming out at the end of this month. For this series, my coworker and I went to Australia last year to document the launch of two sounding rockets, which are these small rockets which just take instruments—no humans—into space for a brief flight. We created this really fun documentary series about that.

Mara: So, sometimes my job as a science writer entails a bit more than just writing. In addition to that I do a bit of freelance science writing for different publications and magazines both online and print. This is a fun way for me to write about things that don't have to do with the Sun sometimes, things a bit closer to Earth often.

27 QUESTIONS WITH MARA



It's apparent that you have a passion for both writing and photography. Break down those interests for me. Do they coexist, or do you find yourself prioritizing one more than the other?

Yeah, they definitely coexist—and quite nicely actually. I am a Science Writer and that's sort-of the basis of my job, but I've always loved photography and it's always been a hobby. Now, it's great that I can use it in my job from time-to-time. When I'm doing reporting from the field, I can take photos, which can add to the story that I'm writing and can help people really visualize the place. I love being able to combine those two things.

If you're hired for a writing job, is it always welcomed to accompany that with your photography, because it's probably something that you prefer as well?

Yeah, I prefer it and the editors and publications definitely love to have that as well. It's great to be able to offer that.

As a photographer, you would've seen a lot of picturesque places. Which is your favorite that you have captured, and do you remember your experience photographing it?

I've done a lot of traveling, I'm very privileged in that way. But, I think one of my favorite photos is one I took almost in my backyard. I just went for a hike one day in the forest and it was just a beautiful, foggy morning and the light came through just right, and I snapped a photo. I think that's one of my favorites; it's close to home.

I know everyone is familiar with the saying "a picture means a thousand words." You have a unique perspective on that since you write words and take pictures; do you think that saying is correct?

I think it really does. There are things that you can capture in words that you can't always capture in photos, but there are definitely things photos bring forth that you would need a lot more words for.

I noticed that both of your degrees are science-based. How did you get into writing from there?

I think I always liked writing, and for my undergraduate degree I went to a liberal arts college, so there was a lot of focus there on writing. There were a lot of classes that we took that had to have a writing component in them, even our science classes. I think that really gave me a good background in writing and how to become a good writer, but it's definitely been a learning journey along the way. Now that I'm fully a writer, I'm still learning how to be a better writer.

You said it was college that immersed you into scientific journalism. In high school or when you were younger, did you have any interest in writing, or was it something that came later on?

Definitely, I think I wrote a few little novels and stuff when I was in high school. I also loved reading science journals, even though I didn't recognize it as that at the time—National Geographic articles and stuff like that.

27 QUESTIONS WITH MARA

Which feels the most rewarding or satisfying to you: creating work for others, whether that be freelancing for magazines or writing for NASA or writing for yourself?

I think I find writing for others more rewarding. One thing that I like about my job is I'm creating this project that anyone can access, and anyone can learn from. It's not something that you have to go out and buy.

What is the appeal of astrophysics to you? Talk to me about how you view the field of study and how you approach it in your work, because it's obviously very complex and it's hard to break it down into layman's terms, like you said in your presentation.

I've always loved astrophysics. Like I said, I've always loved those big questions and understanding the way that our universe works. Now that I'm a science writer, I love that I get to talk to all kinds of different scientists and astronauts and Nobel Laureates about their work and get to hear first hand about new discoveries. It's challenging, but it's a lot of fun to be able to take that and think "how can I make this so that anyone could understand it?"

You said you talked to Nobel Laureates and extremely experienced professionals. Do you have a particular experience that was just a "wow" moment for you?

I think the first time I talked to a Nobel Laureate, I was very intimidated. They're like celebrities, essentially. But while talking to them, they were just so helpful and willing to answer all of my very simple questions. It's cool to have that interaction and think "these people really love science" no matter what level you're coming from.

Tell me about the five-part science documentary series that you mentioned on your website.

We just dropped the trailer for that. Last summer, my colleague and I went to Australia to follow the sounding rockets as they were launching. The mission was trying to look at Alpha Centauri A and B, which are two of our closest stars to the Sun. They were looking at those stars to try to figure out how stars influence the planets around them, in the context of looking for life. So we got to go along and do a bunch of videography for that to answer that question and share that journey with everyone.

This was obviously a collaborative project. What was the specific role you played and how did you work with the people around you to create this product?

It started with one of my coworkers who is also a science writer. We worked together in Australia to film the series and write the script. The series is hosted by my colleague, so he's onscreen, talking us through things while I was doing a lot of the videography. When we came back from that trip, we've been working with an amazing team of video producers here to help us put it all together and make it into this short documentary series.

Was the transition to cinematography natural, since you were already familiar with cameras as a photographer, or was it a skill you had to ease into?

Definitely both. Since I have a background in photography, I already understood some of those basic elements of composition and how to use different settings on a camera. But, photography is entirely different from cinematography in some ways, so there was definitely a lot of learning curve—especially in the beginning—to figure out how things work in that context.

Do you have a favorite scene or a favorite moment you filmed?

Yeah, there's a few actually. We wanted this series to be humorous and light-hearted and fun, so there's a lot of funny little scenes that we recorded along the way that you'll see when it comes out.

27 QUESTIONS WITH MARA

Is there anything about your job that gets redundant or tiring? Are there certain topics that you are less interested in covering than others?

I've been doing this job for about seven years now, and there are definitely some topics that get a little tiring. A lot of the stuff we're talking about is fairly complex. Like we're talking about small electrons and particles flying through space around Earth; it can be very abstract. Some of that gets very repetitive in some of what we're covering. But, the advantage of that is I understand it a lot better now than when I started, which makes it easier to write about every time. It's a double-edged sword.

Do you hold yourself to a standard while writing and constantly want to improve, or is your job more relaxed now, since you've been doing it for about seven years?

I think some of both. There's some things that I write that I know how to write about. I haven't perfected it, but I have a good way of doing it. But at the same time, I'm always trying to just overall become a better writer. So always trying to think of new ways to do things, and reading other people's work to see how they've approached different topics.

Were you "discovered" in any way? How did you gain a platform with your work so your work is noticed?

I don't really have a personal platform since all my work is published through different magazines or through NASA. But, I think it's like a mini snowball. The more I write, the more people see my work, and the more editors see my work, so it kind of grows from there.

Did you have a spotlight piece that got a lot of media attention and led to you getting more opportunities?

I can't think of one thing in particular, I do know some other science writers who have covered one topic, which led them to become the science writing expert on that topic. People typically come to them for that subject.

A lot of people want to work for NASA, especially students with passions for STEM. Was the job what you expected?

I think it's been even better than I expected. I work with such an amazing team of people. There's so many talented people at NASA in general, whether it's the scientists or engineers or administrators, or all of the support teams. It's a really wonderful environment to meet all kinds of new people and have lectures and learn things that you would otherwise know nothing about. A lot of fun. And, there's a ton of internships available for people from high school to graduate school.

Do science writers at NASA work completely individually or is there a lot of collaboration that occurs?

It's a bit of both. There's a bunch of different divisions: the Heliophysics division I'm in; there's the Astrophysics division, Earth Sciences... Usually, we work as a team in each of the divisions, so we don't usually work with other divisions. We do collaborate and say "hey, I have this thing coming up, do you want to help promote it?" But then, within Heliophysics we do work really closely together. I'm always working with our data visualizers and graphic designers to help complement the writing that I'm doing.

How do you balance your employment with NASA, your freelance work, and your other creative activities like your documentary series?

It's a lot of prioritizing what needs to get done. That's true of a lot of writing; you're sort-of juggling a bunch of things at once and trying to just be organized with stuff really helps with that.

27 QUESTIONS WITH MARA

As a student journalist with a massive interest in all things related to astrophysics, how do you balance these two interests of science and writing in your job?

All the writing is very focused on science at the center, like writing about a new scientific discovery, for example. That's the motivating thing that I'm trying to describe and then the creative aspect comes on top of that and helps make it more accessible, whether it's through metaphors or creative language to help people understand. At the heart of it, like the most important thing, is conveying the science and making sure that's accurate. Second to that is making it fun to read for people.

Is scientific journalism the field you want to stay in for the rest of your career?

Yeah, I think staying in science writing; I really enjoy getting to learn new things, I think that's really fun and like love always. Getting to learn new things makes it new everyday too; it's not like I'm just writing the same thing all of the time.

How in-depth do you have to understand the scientific concepts behind what you write about, and is it something I should study more in my undergrad?

I have more of a higher-level understanding; it's not like super in-depth. When I get a new paper from a scientist that I'm going to write about, I go through and read it and try to get a basic understanding of it. I write down a whole bunch of questions that I have and things I don't really understand. Then, I get to talk to the scientist, and maybe other scientists as well, and they really help me understand it enough so that I can write about it for the public. Perhaps more important that becoming an expert in every single aspect of science, which is impossible, it's better to have a basic understanding of how science works and how to read a scientific journal—which is a huge skill in itself—as well as how to ask questions to make sure you understand things. I think the biggest skill is learning how to ask questions. In undergrad, if you know you want to write about something specific, then it's good to take classes in that. Or, take classes in everything if you want to study everything. But I will say that it's more helpful to come to science writing from a science background than a writing background since it's easier to learn writing along the way than learning a whole field of science. I do know people who have gone both ways.

What does a typical day look like for you?

Typically, I like to start working pretty early in the morning. I find that I write and focus the best in the morning—I'm a morning person, I guess. Some days I'll be doing research or conducting interviews or having meetings with my teammates. Other days I'll set up chunks of time to really focus on writing since I need more space in my schedule to be able to do that more—the writing side of things. I like to get all my work done early and I can go outside and do other hobbies later in the day.

How do you get started on your assignments and what does each assignment demand from you?

For my work at NASA, our scientists will come to us and say "I have this new discovery that I think will be important to share with the public." Then, I'll take that paper, or what they might have, to read through it and try to get that understanding. That's where I'll ask a bunch of questions before sitting down to write the news story, whatever it is. Science is sort-of the most important part, so I'll make sure all of that text gets fact checked by the scientist and that it's all accurate and there's nothing that I got wrong on the way—which can happen because I am not an expert.

In the process of scientists coming to you with their novel discoveries, have you ever denied a writing request?

Sometimes we're just too busy. There's some things we don't have the time to cover; we're a limited team size so unfortunately we are not able to cover every new scientific discovery.

Are there any resources you'd recommend for aspiring science journalists to look into for more guidance?

There's a great website; it's called The Open Notebook. They have all kinds of resources, whether you're looking to get into science writing, or you have specific areas you want to learn about more—like how to conduct a good interview, or technical aspects of writing. So that's a really great one for people interested in science writing.

CASEY SWAILS

NASA HEADQUARTER DEPUTY ASSOCIATE ADMINISTRATOR

Casey Swails is NASA's deputy associate administrator. In this role, she leads and integrates mission support functions across the agency, builds and advances the agency's industry partnerships, and acts as the deputy and principal advisor to the associate administrator on overall day-to-day operations and NASA's long-term strategic direction. Previously, Swails served as the chief of staff and senior advisor to the associate administrator, as well as the agency's acting deputy chief of staff during the presidential transition. In those positions, she ensured the effective flow of operations across NASA's workforce and represented the agency in the alignment of policy, strategy, priorities and program development.

read rishika porandla's experience interviewing casey swails on her biggest achievements

Whether it's your first time speaking with NASA Deputy Associate Administrator Casey Swails, or your second, there's no way to feel anything less than privileged. A mixture of gratitude and revelation populated what little mind space I had open while trying to find words to say that were even half as substantive as Casey's. I suppose the Bachelors degree from Georgia Tech and Masters from Duke were successful in crafting a woman who knows how to speak, but that's not all she can do.

It's a true privilege: connecting with a woman that has revolutionized management and conducted the "largest human capital transformation effort in NASA's history." Those aren't light words when Swails' competitors for that title include the 50% workforce reduction at Headquarters, the shift from aging personnel to prioritizing the onboarding of youth, and the "one NASA" program. Credit is given where credit is due and it lies deserved with Casey Swails: the woman who effectively fused 10 distinct NASA human resources offices into a conglomerate that operates successfully today. If that's not astounding enough for your desensitized ears, more numbers that might catch your attention include the realignment of more than 500 employees and the $90 million budget that Casey facilitated.

Casey and I discussed the topic, her speech coated in passion and mine in awe. In her words: *"If you go back in NASA's history, we have 10 centers across the U.S. that are geographically dispersed. Every center was structured with different mission support offices. If we look at Johnson Space Center in Houston, since we both know that one the best, they have their own HR office, procurement office, CIO shop, protective services organizations, infrastructure group, and so on. So, the agency made this decision years ago, in the 2017 timeframe, to consolidate all of those—since it was very inefficient. We would have 10 HR shops, 10 procurement shops, 10 CIO shops, and they were offering essentially different lines of business. If you look at human capital, we weren't capitalizing on both buys. You could say—this is just an example—we were procuring 120 different leadership development classes instead of having a strategy at the agency level for how we approached human capital.*

I was working at the Johnson Space Center at the time. We had a new Head of Human Capital that had come in from the Department of Energy and I had just stood up what is now our HR business partner model across the agency. He asked me if I could come to Headquarters and lead the human capital consolidation and transformation. I was responsible for the merger of those 10 different HR offices into one enterprise organization. We had 500 employees and $90 million dispersed across the agency, tons of different contracts, and IT systems; we hadn't defined service delivery for what human capital was going to invest in. That was essentially what I did. It was the first of the projects to go through this enterprise transformation. Ultimately, there were 13 organizations that went through it, and human capital was the first. It was quite controversial—mainly the money and the people used to align up to the head of the centers, geographically. We took away dollars and people, which took away trade space at local centers and shifted capital to Headquarters. It was a big management and cultural change for the agency—in many ways we're still going through that transformation."

Transforming human potential into numbers isn't a simple feat, but Casey Swails, from Houston, TX to Washington D.C. made it happen.

READ THE FULL ARTICLE

ARTIST: DORI STEIN *(NEWS & EDUCATION DIRECTOR)*

ACRYLIC PAINTING

Inspiration Photo

Earthrise is a famous photograph taken by astronaut William Anders on December 24th, 1968 during the Apollo 8 mission.

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RESOURCES TO PURSUE AEROSPACE ENGINEERING

EDUCATIONAL RESOURCES

1. Everaise Academy

- Everaise Academy is a free online summer camp for physics, astronomy, biology, and competition math taught by accomplished STEM Olympiad competitors. These self-paced courses are conducted via Discord and the Everaise Launch portal, providing free online textbooks and video resources, numerous practice problems with solutions, and discussion opportunities with instructors and other students.

2. Textbooks

- An Introduction to Modern Astrophysics by Bradley Carroll and Dale Ostlie
- Fundamental Astronomy by Karttunen et. al.
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- Foundations of Astrophysics by Barbara Ryden

3. Other Online Educational Platforms

- **MIT OpenCourseware:** Select Courses: Introduction to Astronomy, Astrophysics I, Astrophysics II, Modern Astrophysics, Cosmology, Exploring Black Holes: General Relativity & Astrophysics, Orbital Mechanics
- **edX:** Select Courses: Introduction to Astrophysics, Astrophysics: Cosmology, Astrophysics: The Violent Universe, Astrophysics: Exploring Exoplanets
- **Coursera:** Select Courses: Astronomy: Exploring Time and Space, The Evolving Universe, From the Big Bang to Dark Energy, Astro 101: Black Holes, Data-Driven Astronomy

RESOURCES TO PURSUE ASTROPHYSICS

EXTRACURRICULARS

1. United States Astronomy and Astrophysics Olympiad (USAAAO)

- The USAAAO is a series of astronomy and astrophysics exams given throughout the spring semester and culminating in the International Olympiad for Astronomy and Astrophysics (IOAA) in August. There is a First Round of 30 multiple choice questions, and high-scoring students are invited to take the National Astronomy Competition, a free response exam. The top 10 scorers will represent the U.S. in the IOAA with additional high scorers invited to an online training camp.

2. International Astronomy and Astrophysics Competition (IAAC)

- Like the USAAAO, the IAAC is an engaging way for students to test their astronomy knowledge and engage with challenging concepts. With three rounds of a combination of multiple choice and free response questions, the tests will cover topics related to theoretical astrophysics, calculations, and research problems.
- Students can also become an official IAAC ambassador and coordinate activities relating to the IAAC and astronomy to local schools.

3. Citizen Science Research

- Online astronomical databases are available to the general public, and interested high school students can help classify, analyze, and process data to help scientific missions as well as create their own research projects based on their observations.
- Zooniverse has numerous astronomy projects available that extends across many subfields from dark energy to supermassive black holes to gravitational waves.
- The Pulsar Search Collaboratory allows students to gain access to radio astronomy data from the Green Bank Telescope to search for pulsars and conduct research with a community of students, teachers, and scientists to study and classify pulsar prepfold plots.
- The Boyce-Astro BRIEF program provides dozens of online video tutorials for astronomical analysis methods, such as light curve fitting and photometry. Upon completing enough tutorials, groups of student researchers also work on citizen science projects like NASA and JPL's Exoplanet Watch, analyzing databases like the Transiting Exoplanet Survey Satellite (TESS).

SUMMER PROGRAMS

1. Summer Science Program (SSP)

- Who: Rising seniors and rising juniors
- Where: University of Colorado Boulder, New Mexico State University, or University of North Carolina Chapel Hill
- What: SSP is a five week educational experience for students to deepen their experience in scientific research and collaboration while living on a college campus. Students will attend lectures and complete problem sets on topics in astronomy, physics, mathematics, and programming in order to complete an orbit determination report for an asteroid they observe using telescopes and campus facilities.

2. NASA STEM Enhancement in Earth Science (SEES)

- Who: Rising seniors and rising juniors
- Where: University of Texas Austin or online
- What: NASA SEES is a summer long educational opportunity in the fields of Earth and space science that allows students to complete learning modules in those fields and analyze online citizen science data to answer a research question. From astrobiology to galaxy classification to moon exploration, SEES projects span across many different interests. Students will present their research at the NASA SEES Symposium and can submit and present an abstract and poster at the American Geophysical Union conference.

3. Yale Summer Program in Astrophysics (YSPA)

- Who: Rising seniors
- Where: Yale University
- What: YSPA is a two week online, four week onsite astrophysics enrichment program. Like SSP, students take classes in astronomy, physics, mathematics, and programming and learn to operate instruments at the Leitner Observatory. The program culminates with a research paper and presentation based on the data collected from the observatory and analyzed using the techniques learned in the classes.

4. NASA Internships

- Who: Students at least age 16
- Where: NASA centers across the nation or online
- What: Providing opportunities in the fall, spring, and summer sessions, NASA internships extend across a variety of disciplines from astrophysics to aerospace engineering to machine learning to computer science. Projects vary based on location, but all students will gain the opportunity to collaborate with one another, analyze data, and possibly design a product.

Image credit: NASA SEES

EDUCATION

RESOURCES TO PURSUE ASTROPHYSICS

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EDUCATIONAL RESOURCES

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EXTRACURRICULARS

4. Cold Emailing

- While structured programs and internships can provide helpful guidance and direction to student research, cold emailing professors is also a viable option that shows initiative. Reach out to astronomy professors at local universities and ask if they would be willing to take a high school researcher. There are also numerous professors, graduate students, labs, and research groups from universities all over the world who are willing to work with high school students virtually, so don't be afraid to reach out.

5. Community Outreach

- Apart from research, community outreach is also an activity in astrophysics that is easy to jumpstart and has a lot of potential to grow into something meaningful. Students can reach out to local observatories, science museums, astronomy clubs and ask if they need help with outreach. Outreach projects can include giving lectures to the general public, teaching astronomy to elementary and middle school students, or performing science experiments for kids. Working with high school clubs like Science National Honor Society, Science Olympiad, or Robotics is also an easy way to network with local schools to provide scientific enrichment opportunities.

SUMMER PROGRAMS

5. Northwestern CIERA REACH

- Who: High school students
- Where: Northwestern University
- What: At CIERA REACH, students learn astronomical concepts, research skills, and research analysis methods like Python programming and receive mentorship from scientists and graduate students to develop and carry out their own astrophysics research project.

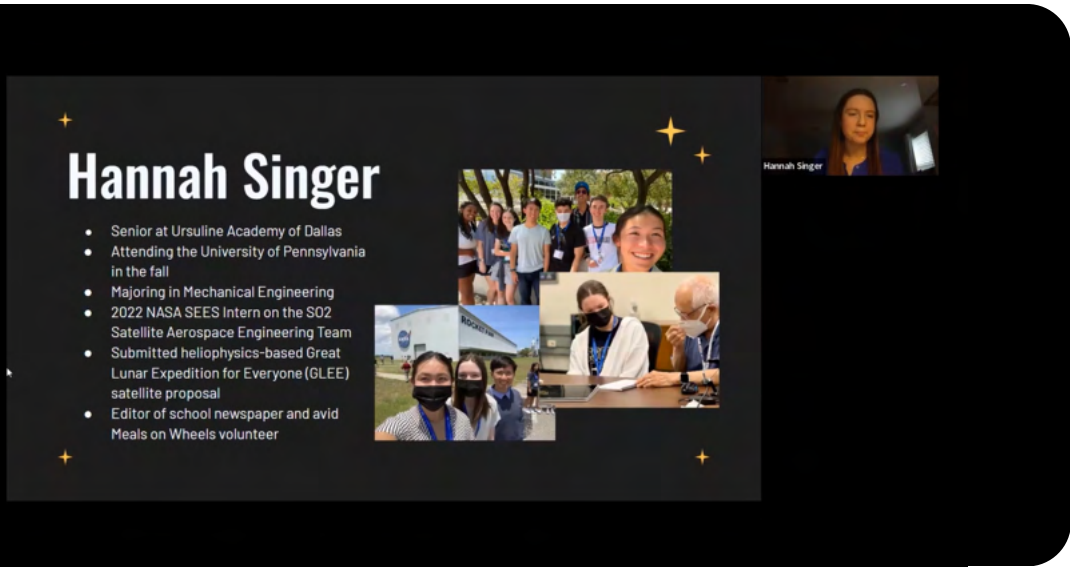
6. International Summer School for Young Physicists

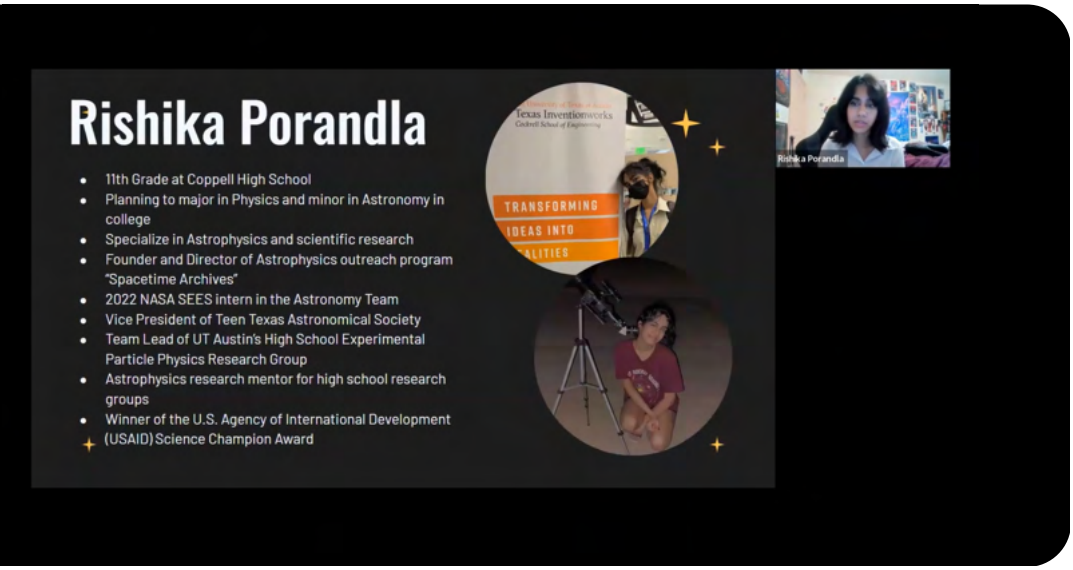
- Who: Students who have completed Grade 11 physics
- Where: Online
- What: ISSYP is a two week immersive online experience for students interested in theoretical physics. Students will attend lectures pertaining to topics like quantum mechanics, relativity, cosmology, and black holes and be able to interact with fellow students, intructors, and scientists at the Perimeter Institute. There are also problem sets, hands on experiments, and research questions that students can collaborate on.

OUR EXPERIENCES IN NASA SEES

with hannah singer and rishika porandla

Rishika Porandla and Hannah Singer, both high school students in Dallas, TX, attended the prestigious earth and space sciences research program NASA SEES in July 2022. Their presentation overviews the experience of conducting high-level scientific analysis, living and working with students within UT Austin research facilities, and producing research that they eventually presented at the AGU Fall Conference in December 2022.





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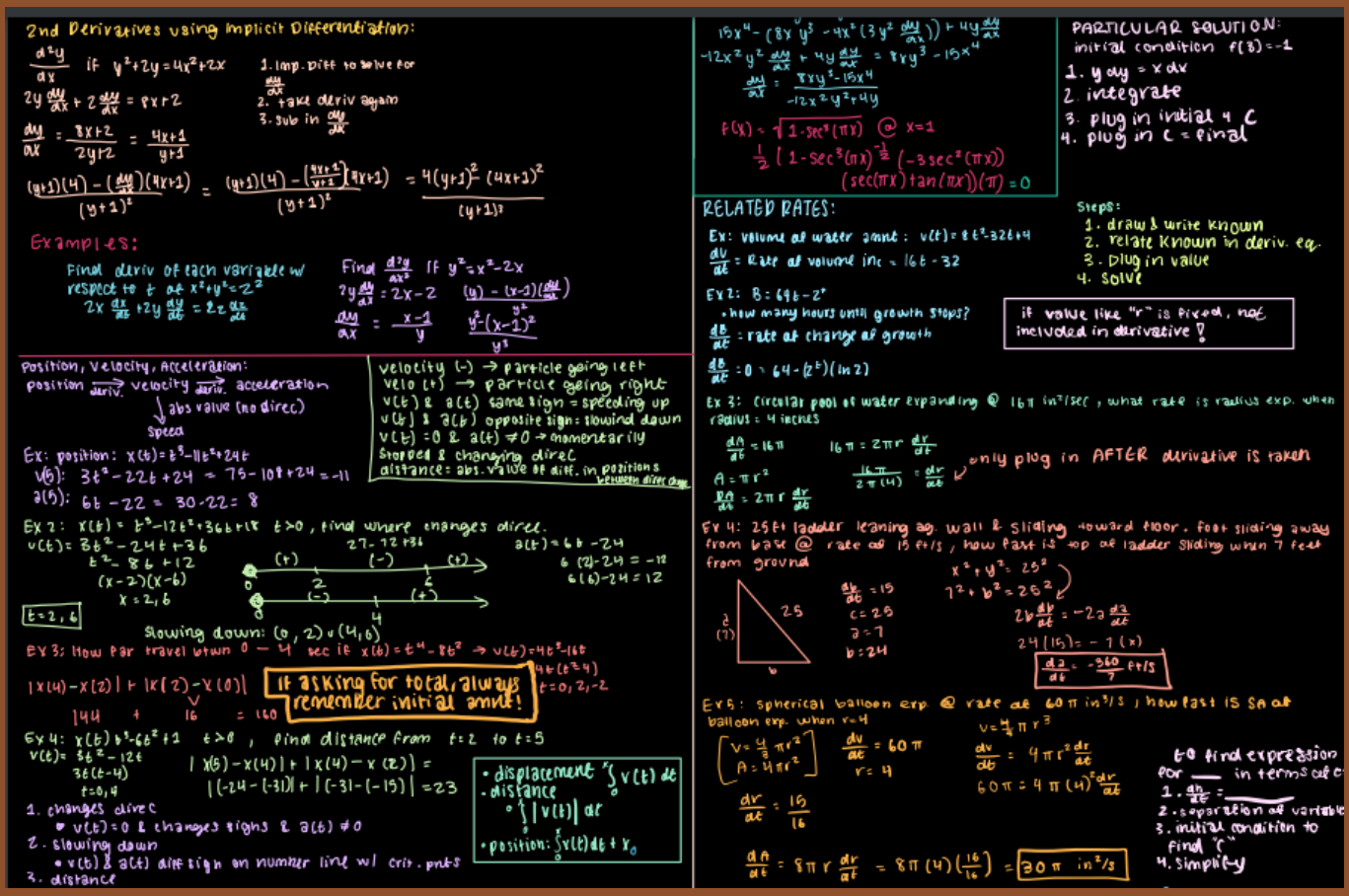
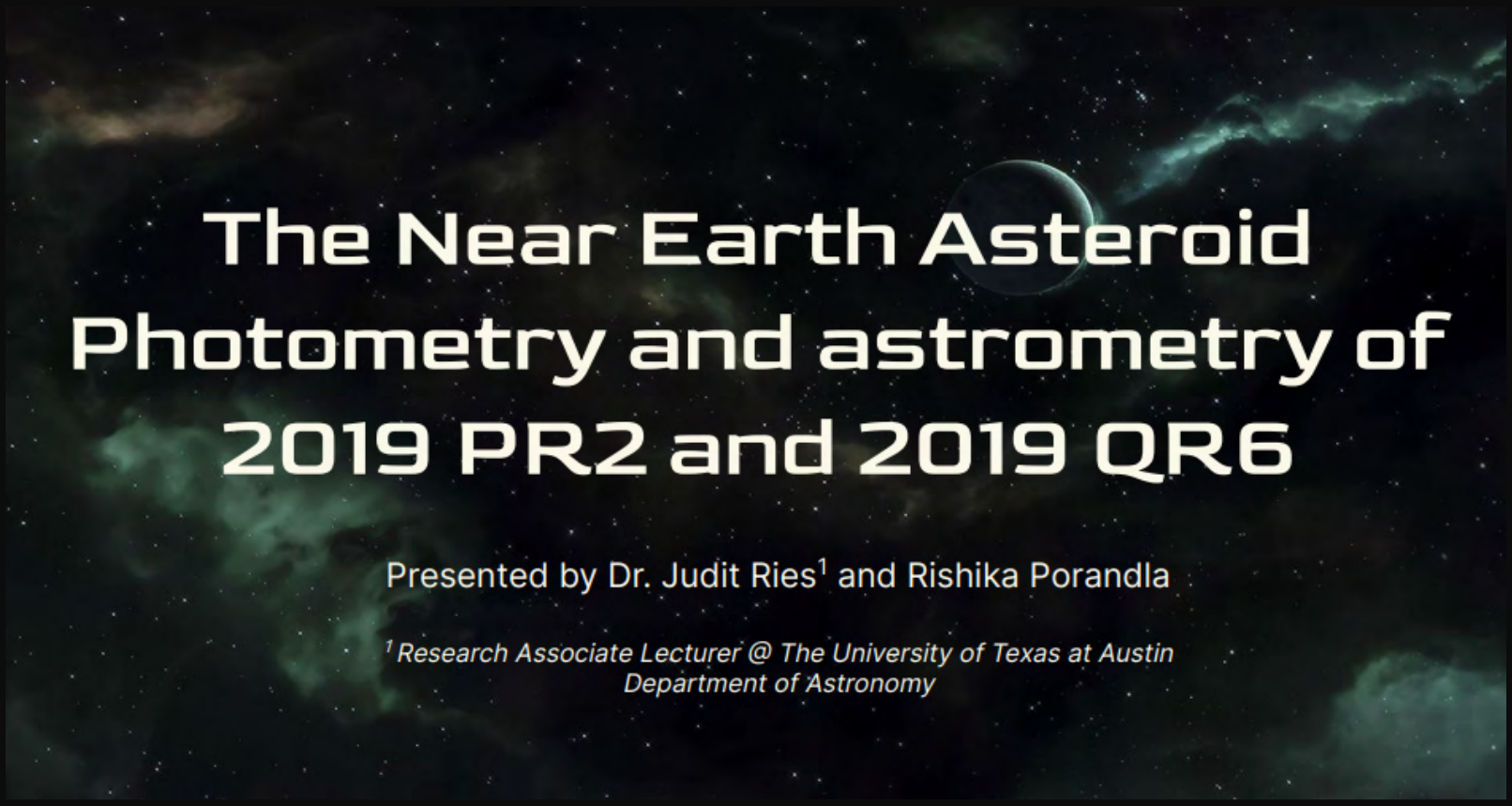


presentation with dr. judit ries

speakers: rishika porandla and dr. judit ries (research associate lecturer @ the university of texas at austin | department of astronomy)



Judit Györgyey Ries was born in Hungary, and got her B.S. in Astronomy from the Eötvös University in Budapest. She came to the US in 1982 and received an M.S. in Aerospace Engineering, in 1992 she received a Ph. D. in Astronomy. She worked with the Mcdonald Observatory lunar laser ranging experiment doing data analysis. In 1997 she joined the the NEO observing program, and started regular observations. In 2012 she took over the program and continued it until 2022. She started Education and Public Outreach work with the Center for Space Research Outreach Team and conducted numerous STEM workshops in the underserved areas of Texas.

01

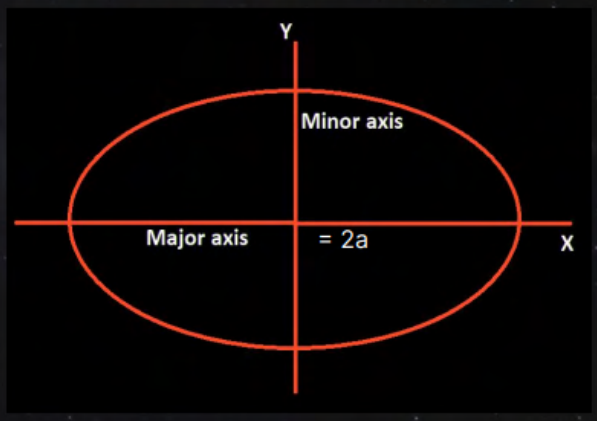
Hypothesis

Because 2019 PR2 and 2019 QR6 (two Near Earth Asteroids) move on very similar orbit and and have similar physical characteristics, these objects could be genetically-related

The case for being twin asteroids

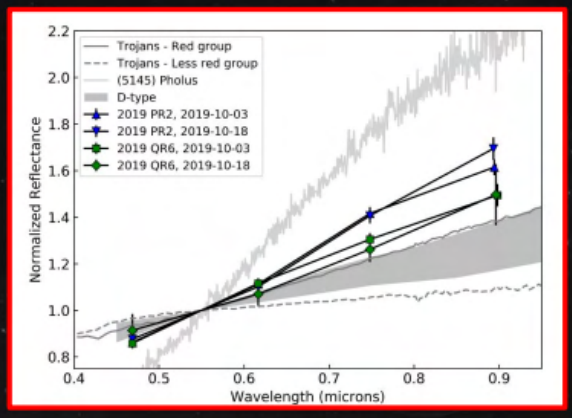
They move on almost identical ellipses:

2019 Pr2: a = 5.7716, e =0.79834, i = 10.9926
2019 Qr6: a = 5.7723, e =0.79837, i = 10.9745



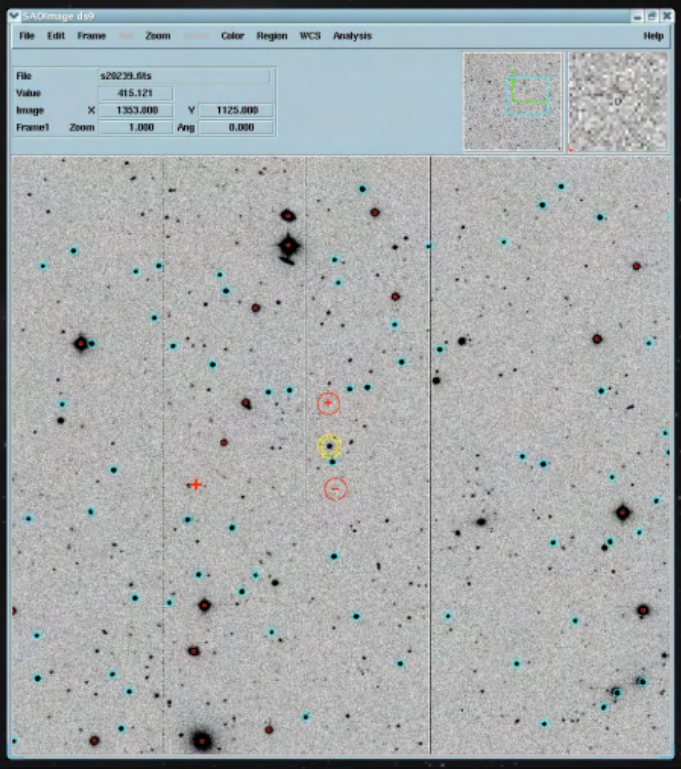
They have very similar colors (spectral type)

They are both very red, redder typical D type



- The asteroids are spectrally similar to D-types, which is rare amongst NEOs (near-earth objects.
- Orbit integrations taking into account gravity and the Yarkovsky effect only did not bring them close to each other in the past.
- The next model assumed quasi-continuous, comet-like activity following separation, suggesting a formation time of 300+120 −70 years ago.
- Second model assumed short-term activity for up to one heliocentric orbit (~13.9 years) after separation, implying that the pair formed 272±7 years ago
- 2019 PR2 had no activity during its last perihelion passage
- Signifies a common origin that makes these objects the youngest asteroid pair known to date

Astrometry and (relative) Photometry



We need a catalog to calculate the position of the asteroid:

1. Find the reference stars on the image
2. Get their coordinates
3. Based on the coordinates (ξ and η) find the relationship between pixel coordinates, x,y and ξ,η for the whole image

$$\xi = a_1X + a_2{}^*Y + a_3 + a_7{}^* (X^2 + Y^2)$$

$$\eta = b_1{}^*Y + b_2{}^*X + b_3 + b_7{}^* (X^2 + Y^2)$$

4. **Locate the asteroid, and measure its X and Y coordinates**
5. **Using the plate solution calculate the asteroids ξ and η**

For photometry also

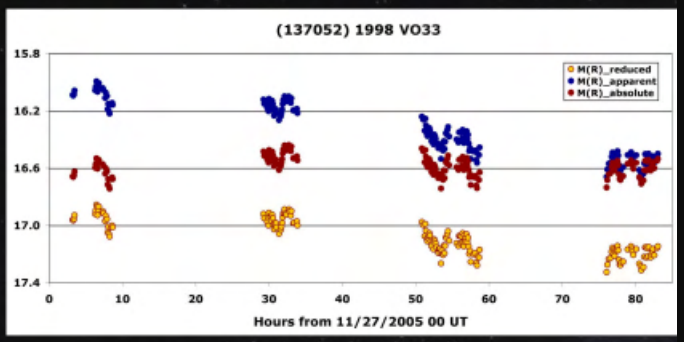
1. Extract the reported magnitudes for the reference stars
2. Find relationship between the plate magnitudes and the catalog magnitudes
3. Measure the asteroids plate magnitude
4. Convert it into catalog magnitudes using the photometric solution

Finishing the Photometry

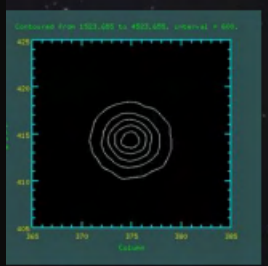
The brightness of an asteroid changes because:

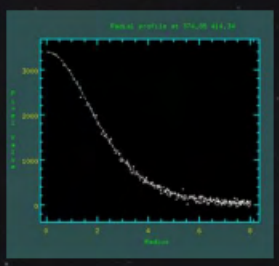
1. The distance from the Sun changes
2. The distance from the Earth changes
3. The viewing phase changes
4. Rotational effect - non-spherical shape and varied surface

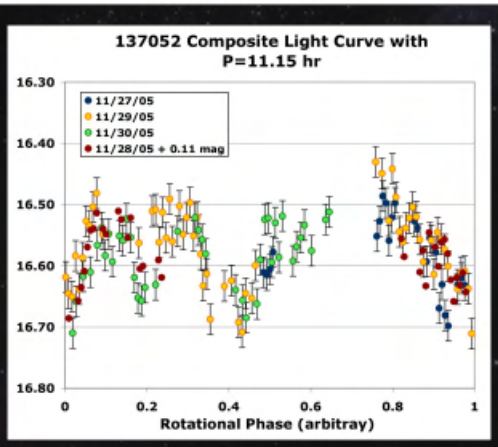
To obtain rotational periods and compare the actual brightness we need to remove 1 - 3



Cometary activity - detection of a tail







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THE FUTURE OF TECHNOLOGY MADE ACCESSIBLE WITH

MULTI-PLANE HOLOGRAM PROJECTIONS

RIHA MUSA


Image Credit: Getty

Multi- Plane Hologram Projections detail images and movies that create captivating visuals by occupying multiple layers or planes within three-dimensional spaces. Holograms replicate images of repeated interconnected patterns and light hearths from a competent device like a computer system, projection box and potentially even a mobile phone in the future. Despite the promising potential of multi-plane hologram projections, the field remains relatively unexplored, with limited information and research available. However, the current limitation of this field remains to be the financial barrier preventing individuals from purchasing such devices and actively being exposed to it in all its glory.

This absence in knowledge inspired me to delve deeper into this new realm of technology. The realization that existing knowledge about hologram technology is confined exclusively to the hands of the exceedingly affluent and select institutions fueled my determination to initiate research and design for a multi-plane hologram projection device with my intent for it being that it is affordable and accessible to all. This means that it could be utilized in many spaces, not restricted to education, medicine, engineering, space exploration, and simulation.

Though am only scratching the surface of my research, I have concluded that by using optimal design principles and selecting the appropriate material, an affordable and high functioning multi-plane hologram projection box is undoubtedly within reach. By closing the gap between aspirations and actualization, this transformative device will equalize access to awe-striking holographic experiences. It will empower individuals from all walks of life, regardless of financial constraints,, to witness the mesmerizing realm of holographic wonders.

The transformative nature of this envisioned multi-plane hologram projection box lies not only in its affordability but also in the captivating experiences it can deliver. Imagine a world where holographic projections seamlessly blend with our reality, where education takes on a new dimension, where medical simulations provide lifelike training, where engineers can visualize and refine complex designs, and where space exploration becomes an immersive endeavor.

If you would like to contribute to the research in anyway, please contact Riha at rihadurani@gmail.com


Image Credit: Getty

THE HERMEUS MACH 5 JET ENGINE: CHIMERA

On November 17th, 2022, at the Notre Dame Turbomachinery Laboratory, Atlanta-based aerospace company, Hermeus, tested their new jet engine, which is said to bring the startup one step closer to a reusable hypersonic aircraft. Hermeus' engine, commonly referred to as Chimera, was successfully able to switch from turbojet power to ramjet power. This is believed to be the first time anybody has been able to successfully complete this type of transition.

In order to fly at Mach 5 (five times the speed of sound!), the plane must use two types of engines that engineers at Hermeus have combined. The first engine is called a Turbojet. Turbojets power the aircraft at lower speeds such as when the plane is landing or when it is taking off. Turbojets work by compressing airflow and then mixing fuel with the compressed air. Then, it passes the hot, compressed air through a turbine and a nozzle. Turbojets can only power an aircraft to around Mach 2.5 to Mach 3. When the aircraft is around Mach 2 - 3, the turbojet then transitions to a ramjet. Ramjets are airbreathing jet engines that rely on the forward motion of the aircraft to produce thrust. They work the same way as a turbojet, but they need lots of air intake to work. Because they produce no thrust when stationary, they only work efficiently at around Mach 3. Ramjets can make the aircraft fly at Hypersonic speeds or Mach 3 - Mach 5 or 6.

"That's actually pretty tricky and pretty difficult," Glenn Case, Hermeus' chief technical officer, said. These engines work by combusting incoming airflow and turning it into thrust, during the five-second switch a series of doors and valves reroute the airflow being sucked into the engines. At around Mach 3, this happens to reroute the air intake from the turbojet into the ramjet. Hermeus was able to simulate speeds of about Mach 4 during their testing. They achieved this several times throughout their three-month testing period.

In 2024, Hermeus will test the Chimera engine on their Quarterhorse aircraft. If successful, they will shatter the previous speed record of Mach 3.3 set by the fabled SR-71 Blackbird in 1976. "It's really a proof point that small teams can do special things, such as rapidly design, build, and test hardware, with significantly lower budgets than our industry peers," says Glenn Case "We're not an airplane company till we start building airplanes. We're funded to flight - and we're gonna go fly."

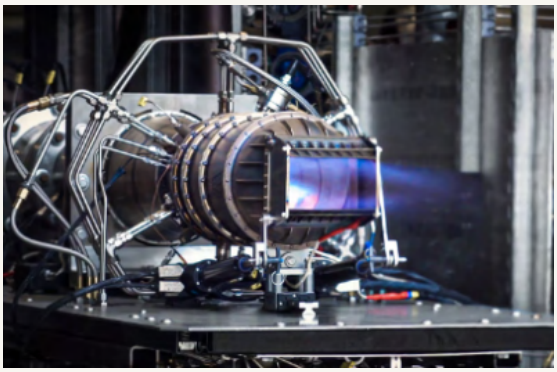


Image Credit: Hermeus

Image Credit: Hermeus

Image Credit: Hermeus

SOURCES:
https://newatlas.com/aircraft/hermeus-chimera-hypersonic-test/
https://www.defenseone.com/technology/2022/11/engine-tests-move-hypersonic-aircraft-closer-first-flight/379855/
https://www.hermeus.com/press-release-tbcc-milestone

CREDIT: **Sathvik Dasari** is a 13-year-old who is interested in aerospace technology. He is passionate about STEM and aerospace engineering and hopes to pursue a career in this field. In his free time, he likes to swim, play chess, play games, read books, and learn about airplanes.

spacetime archives student research fellowship

fall 2023 program

Eligibility

- United States Citizens and Permanent Residents.
- Rising middle or high school student (grades 6-12).
- Strong academic ability and interest displayed through application responses.

Details

- The Spacetime Archives Student Research Fellowship is a highly rigorous, three-month research mentorship program. Students will apply using the form below between June 20, 2023 and July 20, 2023 @ midnight CDT in order to be considered, and then will be notified of their application decision on July 31, 2023.
- Accepted students will be paired with an experienced mentor, either individually or within a research group of shared interests. The researchers will then identify a research topic/question of interest, and their mentor will facilitate and assign their preliminary assignments, data collection, and data analysis.
- The researching period will last from mid-August to mid-November. Synchronous meetings may be involved. The time commitment is 3-4 hours per week.

apply by july 20, 2023 @ midnight cdt

at spacetimearchives.com/research-fellowship

Admission is NOT guaranteed and depends on the number of mentors available to assist. You may be placed on a waitlist if we reach full student capacity.

Further inquiries? View our Frequently Asked Question on our website to learn about details like acceptance rate, program structure, and exclusive resources.

SPACETIME ARCHIVES STUDENT RESEARCH FELLOWSHIP

A middle and high school research program created by Rishika Porandla and conducted in collaboration with Texas Astronomical Society (TAS) subject-matter experts and NASA intern alumni mentors

what?

Pursue scientific research

The Spacetime Archives Student Research Fellowship enables middle school and high school students to pursue a mentored, introductory research project. We give you the resources, you give your field of study something to talk about.

why?

Build opportunities and exposure

Finding research opportunities as a student is hard. Other programs have a frustrating expectation of "previous research experience," but our Student Research Fellowship breaks down those barriers and gives you access to data, mentors, and lessons free of pressure and free of charge. You will be given the opportunity to publish your work in journals and present at scientific conferences.

how?

Pick your field of study and work on a complex research inquiry

You will first select your preferred field of study (astrophysics, earth sciences, or aerospace) and then will be assigned a high school or undergraduate mentor who will provide you with research and data analysis resources. After the 3 month researching period, you will produce a research abstract ready for publication.

APPLICATIONS ARE DUE JULY 20, 2023 AT MIDNIGHT CDT.

APPLY AT OUR WEBSITE

questions? contact rishika@spacetimearchives.com

Find out eligibility, expectations, and the application process at our page.

spacetimearchives.com/research-fellowship

SPACETIME ARCHIVES STUDENT RESEARCH FELLOWSHIP student testimonies

sylvia johnson | 15

I'm currently working on radio imaging detection with research mentor Prathi Mathur, and this research program provided such a easy and natural transition to rigorous astronomical computation. I would encourage every aspiring researcher to apply!

rohan sai reddy | 17

I was actually rejected from the majority of the programs I applied to, so I was thankful that Spacetime Archives didn't see my lack of experience as a lack of passion or potential. I learned so much from my research with Feynman Diagrams and I am thankful for the opportunity to present at an IEEE conference in the fall!

alexia mendoza | 13

I actually only applied cause my parents made me, but looking back, that might've been the best decision. I was always good at biology, but this research fellowship gave me a tangible outlet for my knowledge. I tracked biodiversity fluctuations in polluted coastal regions, and I am presenting at the AGU Fall 2023 conference.

trevor hollen | 16

I made lifelong friends from the research group that I was assigned to, and now my research mentor is my college counselor. If you're not joining the Spacetime Archives Student Research Fellowship for the academic aspect, join for the community you'll gain.

Texas Astronomical Society
2023 NASA ASTRO CAMP®

In essence, NASA's ASTRO CAMP® provides NASA-unique STEM engagement activities and experiences to youth, families, and educators in their own communities. The NASA ASTRO CAMP® strives to allow all students to have access to authentic NASA Science experiences, ASTRO CAMP methodology and current STEM activities aligned to Next Generation Science Standards, engineering challenges, and NASA resources highly focused to reach into under-served and under-represented communities. NASA's ASTRO CAMP brings real-world opportunities for every student to join and contribute to NASA's Science Missions, enhancing understanding through powerful science career connections, inspiring life-long learners for NASA's future science teams to continue the journey to explore our universe.

WHAT IS TEXAS ASTRO?

Texas Astronomical Society of Dallas (TAS), a nonprofit organization that was chartered in 1955 to promote the study of astronomy and related fields and to pursue observation and construction of instruments as a hobby.

WHEN & WHERE?

Saturday, July 15, 2023
& Sunday July 16, 2023
from 1:30 pm to 4:30 pm
Cozby Library and
Community Commons
177 N. Heartz Drive
Coppell, TX 75019

WHAT ARE BENEFITS?

We will be reinforcing basic biology, chemistry, and physics skills, while also introducing students to engineering principles and mathematics that they will employ in their future classwork and careers.

NASA-designed project-based learning activities will enable program attendees to develop their critical-thinking and collaboration skills as they work with fellow students to design a space mission of their own. With our program material coming straight from NASA-designed initiatives, this is an authentic opportunity for Coppell student citizens to immerse themselves in engaging, stimulating STEM activities. Many learners have budding passions for STEM fields, but lack a proper outlet to explore those interests, which is a gap we are attempting to fill.

SPACETIMEARCHIVES.COM/2023-NASA-ASTROCAMP

GET READY TO JOIN

NASA ASTROCAMP®

Do you have a desire to explore the universe? During the **official DFW Metroplex NASA Astro Camp**, get ready to reach for the stars while participating in STEM (Science, Technology, Engineering, and Mathematics) learning activities that will motivate future astronauts and engineers to pursue a career in space exploration. Together, YOU (the explorers) will perform **NASA-designed project-based learning activities.**

WHO CAN JOIN? Incoming 5th – 12th graders

WHEN? Saturday, July 15 and Sunday, July 16th. We will host one trial day program over a weekend this summer, and then several during the next school year.

PRICE? Absolutely 100% FREE for students and families attending. We intend to diffuse STEM opportunities across DFW without barriers.

WHERE? Cozby Library — 177 N Heartz Rd, Coppell, TX 75019

HOW DO I SIGN UP? Register through the Cozby Library by visiting their calendar sign-up page or scanning the QR code to the right.

NASA ACCP is bringing **NASA STEM Engagement Science Mission activities to grades K-12 in your own community.** We use the uniquely developed 2023 ACCP Facilitators Guide for support, making NASA STEM lessons, resources, and challenges accessible to all, while relying on **proven NASA STEM ASTRO CAMP® Methodology.**

NASA ACCP consists of student-centered, standards-based STEAM activities that utilize NASA resources to provide students with engaging, high-quality STEM learning experiences.

HOSTED BY TEXAS ASTRONOMICAL SOCIETY: An official NASA ASTROCAMP (ACCP) Community Partner

Student Director: **Rishika Porandla**
rishika.porandla@gmail.com

Texas Astronomical Society Facilitator: **Yaqin Tu**
tuyaqin3@gmail.com

2023

WATER AROUND COMET

NATURAL SYMMETRY PROVEN WRONG

MEDICINE & PARTICLE PHYSICS

NEW COLLISION THEORIES

SCIENTIFIC NEWS

Image credit: NASA, ESA, CSA, and STScI

Highlights of June 2023: James Webb Space Telescope discoveries, groundbreaking research in quantum physics and particle physics, exoplanet spotting, Starship Launch, & more.

JWST NEWS

JAMES WEBB SPACE TELESCOPE LOCATES WATER AROUND A COMET

MORE ON OUR WEBSITE...

NEW IMAGE CAPTURED BY NASA'S JUNO PROBE

GRAVITATIONAL LENS REVEALS SUPERNOVA

[Artist's illustration of Comet 238P (Image credit: NASA, ESA)]

James Webb spots water around a rare comet found in the central asteroid belt between Mars and Jupiter. This observation is a significant breakthrough for Webb because it demonstrates the first time that water vapor has been found around a comet in an asteroid belt.

JAMES WEBB TELESCOPE GETS HELP FROM A SATELLITE TO SEARCH FOR HABITABLE PLANETS

[Artist illustration of the MANTIS satellite (Image credit: Dana Chafetz)]

The MANTIS (Monitoring Activity from Nearby Stars with UV Imaging and Spectroscopy), a small satellite that will focus on star activity, is expected to launch in 2026. This cubesat, or in other words a small satellite, was selected by NASA for $8.5 million. Both James Webb and the MANTIS will harmonize together in order to get a better idea of exoplanets around us as well as stars near them. The MANTIS will look at the sky in ultraviolet light; specifically, it will use the most energetic set of wavelengths, extreme ultraviolet. It will be the first satellite to examine the sky with this much energy since 2001.

JAMES WEBB TELESCOPE SHOWS EVIDENCE OF HOW GALAXIES MADE THE EARLY UNIVERSE TRANSPARENT

[Evidence from James Webb depicts how galaxies caused the early universe to be transparent (Image credit: NASA, ESA, CSA, ETH, MIT, NCSU)]

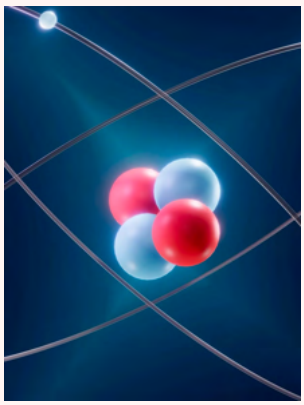
After the Big Bang, there was vast darkness in our universe; however, after observations from an international team of astronomers, it was found that galaxies were transparent. After looking back 900 million years after the Big Bang, the team noticed that most of the gas in the universe was in between visible and transparent. Although this was the case, everything directly around those galaxies was clear. "With Webb's data, we are seeing galaxies reionize the gas around them," Daichi Kashino, lead author of a new paper sharing the results, stated. Thanks to the illumination of a quasar, a bright black hole, the team was able to see a phenomenon: As galaxies grow, bubbles of the reionized gas combine, therefore creating larger areas of transparency.

REPEATED INCONSISTENCIES COULD BE LEADING TO THE DISMANTLING OF THE RESPECTED EFFECTIVE FIELD THEORY

MORE ON OUR WEBSITE...

WHAT NOBEL PRIZE WINNING RESEARCH IS TELLING US

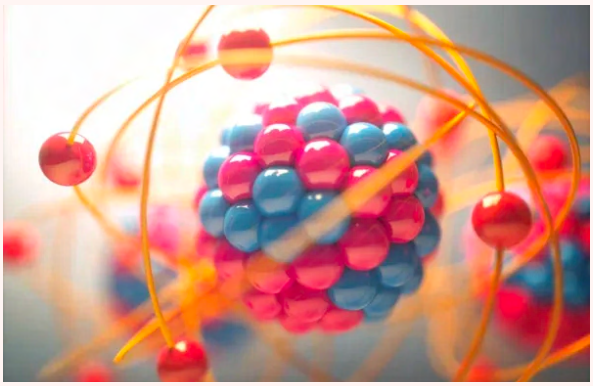
SEDRAKYAN'S REVELATION BRINGS NEW QUANTUM UNDERSTANDING



[Helium atomic nuclei. Image Credit: Getty]

A strange result surfaced from an April research study by atomic physicists analyzing an ionized container of helium atoms. What was expected was the helium atoms being found in an excited state with swollen nuclei; what wasn't theorized was the response of the nucleons to the electron beam veering away from the generally-accepted Effective Field Theory (EFT). This theory approximates the forces and interactions within atomic nuclei, and its incompatibility with observed results raised alarm. In order to mitigate some of these unexpected outcomes, Simon Kegel and physicists at the Johannes Gutenberg University Mainz utilized their high-precision MAMI electron accelerator to conduct a follow-up experiment. Surprisingly, even with more exact parameters of the density of the helium atoms and intensity of the electron beam, the new dataset followed the prior trend.

IMPOSSIBLE TO REALITY: FINDING NEW ISOTOPES OF SODIUM



[Representation of sodium isotope. Image credit: KTSDESIGN/SCIENCE PHOTO LIBRARY]

The general consensus on creating a neutron-rich sodium isotope was that the feat was impossible, until physicists at RIKEN, a Japanese research institute, proved countless models of atomic nuclei wrong. Beginning with an experiment led by Toshiyuki Kubo where one nucleus of sodium-39 was found, Kubo's team went on to create nine distinct nuclei of the isotope within RIKEN's Radioactive Isotope Beam Factory. This discovery has tremendous implications for neutron study, specifically determining the neutron drip line—the maximum number of neutrons an element is capable of having before it begins leaking. Determining this limit allows for more concrete nuclear mass models and nucleosynthesis theories.

NATURAL SYMMETRY IS FINALLY PROVEN WRONG

[Asymmetrical galactic field. Image Credit: NASA/Webb]

Symmetry is a theorized condition of the universe that held its merit until the 1960s, when it was predicted that there is actually more matter than antimatter in the universe. This circumstance allows tangible entities to exist, due to the abundance of matter, but causes an "existential symmetry violation." Tackling this finding to attempt to find actual evidence of broken symmetry in the universe, University of Florida researchers analyzed a million trillion galactic quadruplets. Their notable discovery is simple: the early universe preferred assuming specific shapes over mirror images. This theory, referred to as parity symmetry violations, indicates that the primordial universe demonstrated different fundamental laws of physics than today. Even more, this idea suggests that there was exponential inflation in the first moments of the universe, thus causing parity violations in future galaxies and providing an explanation for the current matter/anti-matter imbalance.

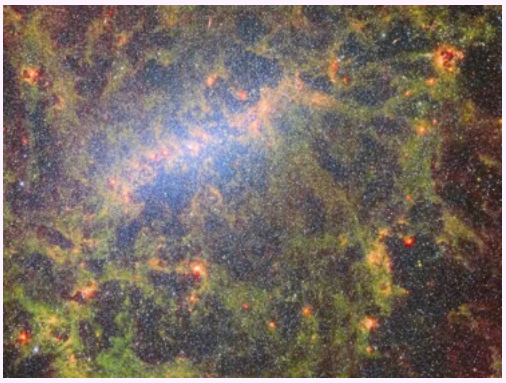
JAMES WEBB DEPICTS SPIRAL GALAXY IN FASCINATING DETAIL

MORE ON OUR WEBSITE...

HUMANS VERSUS KNOWLEDGE (BLOG)

PUBLIC SPEAKING CHANGES MINDS: THE ART AND SCIENCE OF SPEECH WITH RIHA MUSA (PODCAST)

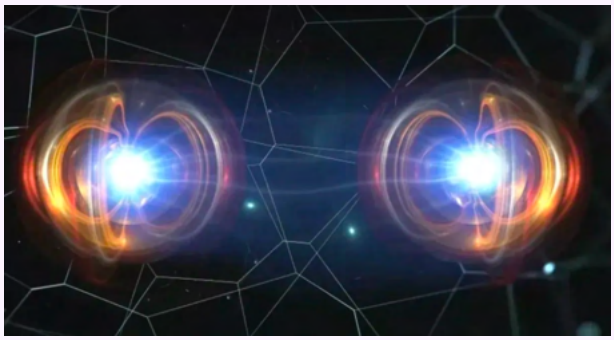
STEPHEN HAWKING'S COSMIC INFLUENCE (BLOG)



[Webb's photo of thousands of stars in a galaxy 17 million light-years away (Image credit: ESA/Webb, NASA)]

A photo of NGC 5068, a galaxy located 17 million light-years away from Earth, was taken by Webb in June 2023. This galaxy is a vital part of a research project composed of astronomers in order to better understand star formation.

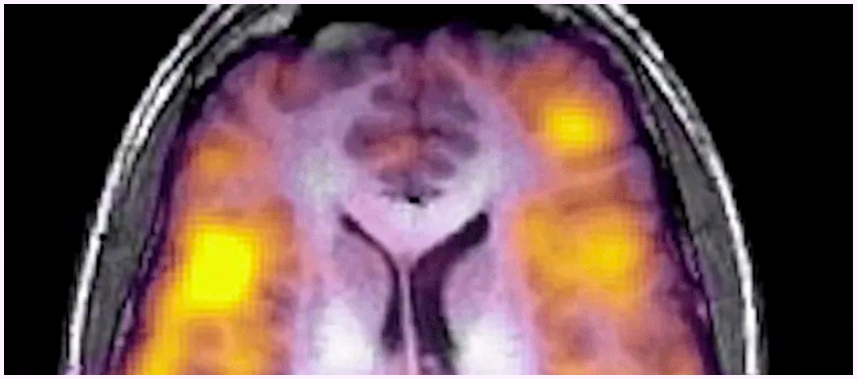
WHAT NOBEL PRIZE WINNING RESEARCH IS TELLING US



[An artist's depiction of quantum entanglement. (Image Credit: Jurik Peter via Shutterstock)]

Quantum physics, a nuanced field with direct relations to our concept of time and its passage, has been the consistent recipient of the Nobel Prize for Physics. Scientific experimentation in quantum research argues two distinct conclusions: locality (distant objects require a physical medium for interaction) and realism (objectivity dictates scientific outcomes). However, recent developments with phenomena, including Berkson's bias and superdeterminism, suggest retrocausality and indicate that measurement choices and fundamental properties of particles are actually correlated. This means that our measurement choices are predetermined and Einstein's theory of special relativity is factual again. Experimental evidence? The 2022 Nobel Prize in Physics.

YET ANOTHER PARTNERSHIP BETWEEN MEDICINE AND PARTICLE PHYSICS



[Image of a brain scan employing dissolution dynamic nuclear polarization (Image credit: James Grist)]

Particle physics and medical advancement find an intersection in the study of dynamic nuclear polarization and its application in cancer and chemical imaging. The rate that a vital molecule is metabolized, known as pyruvic acid or 2-oxypropanoic acid, is an indicator for imbalances in the human body, including an abundance of cancerous cells. Physics is incorporated in the tracking of this acid since it has intrinsic properties of angular momentum and nuclei spin, two quantitative observables in particle physics, meaning that an experimental method called dissolution dynamic nuclear polarization (d-DNP) can be utilized to produce modified acids. These hyperpolarized pyruvic acids, where more carbon-13 nuclei are in one spin state, can be injected into biological systems to improve magnetic-resonance imaging's signal-to-noise ratio and depict the metabolization of pyruvic acid in the human body.

STELLAR INTERACTIONS LEAD TO NEW COLLISION THEORIES

MORE ON OUR WEBSITE...

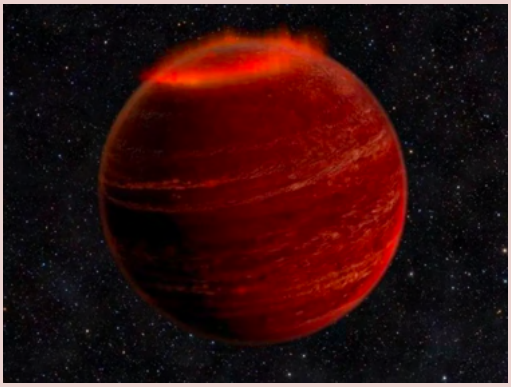
GALAXY CLUSTER X-RAY SUCCESSFULLY SUPPORTS THE LAMBDA COLD DARK MATTER MODEL OF COSMOLOGY

DEAD NASA SATELLITE LAUNCHED IN 2002 EXPECTED TO CRASH INTO EARTH

[Artist's illustration of a gamma-ray burst (Image credit: International Gemini Observatory/NOIRLab/NSF/AURA/M. Garlick/M. Zamani)]

A study by Radboud University in the Netherlands analyzed a gamma-ray burst detected four years prior, determining that the event was most likely caused by a stellar collision. The paper goes on to describe how similar dense collisions could have implications for gravitational waves.

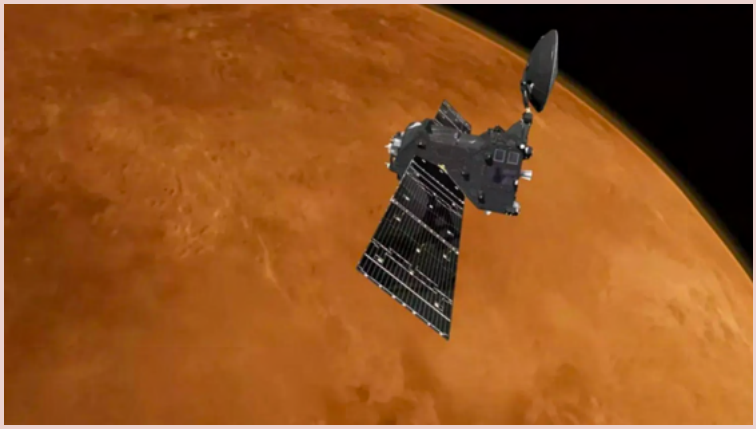
BROWN DWARF HEATING ITSELF TO DESTRUCTION



[Artist illustration of a brown dwarf (Image credit: NASA Goddard)]

"Weird" is one way to describe the notable brown dwarf WD0032-317B which has an orbit of 2.3 hours, a surface temperature of 13,900 degrees Fahrenheit, and is extremely close to its ultra-hot white dwarf star. This brown dwarf, being tidally locked, is only superheated on one side, which will eventually cause its evaporation by its host star.

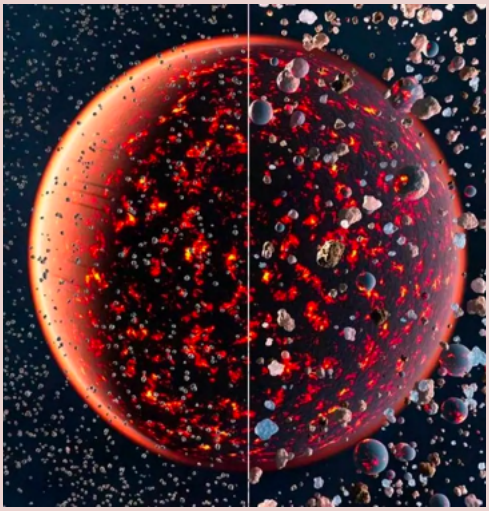
ALIEN SIGNAL FROM MARS TO EARTH IN SETI TEST



[Artist's illustration of Europe's Trace Gas Orbiter around Mars (Image credit: ESA/ATG medialab)]

At 3 pm on May 24th, 2023, Europe's Trace Gas Orbiter beamed a message toward Earth. Received by three large radio telescopes, efforts are still being made to decipher the message.

NEW THEORY STATES WHERE EARTH MAY HAVE GOTTEN ITS WATER FROM



[Artist's illustration of Earth getting its liquid (Image credit: ETH Zurich)]

A new theory regarding how Earth has gotten its water can be a novel path to finding life beyond our solar system. Specifically, with this new theory, Earth may have grown more rapidly than anticipated. Instead of water coming to Earth from icy comets, this theory can reassure us that there are many planets out there that are absorbing water.

TWO LARGE EARTH-LIKE EXOPLANETS SPOTTED NEAR NEIGHBORING STARS

MORE ON OUR WEBSITE...

JAMES WEBB DISCOVERS GARGANTUAN GEYSER ON SATURN'S MOON

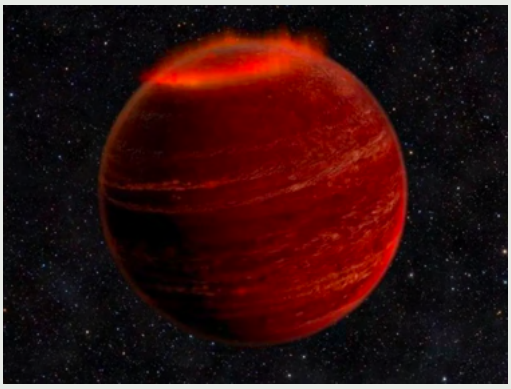
BE MENTORED BY NASA INTERN ALUMNI (OUTREACH)

DEVELOP PUBLICATION-WORTHY RESEARCH (APPLY AT OUTREACH)

[Artist's representation of two exoplanets (Image credit: ESA/Hubble, Robert Lea)]

Spotted by NASA's Transiting Exoplanet Survey Satellite (TESS), two exoplanets were approximated to be 137 light years away from Earth. Both planets are larger than ours and were determined to orbit around the same red dwarf star.

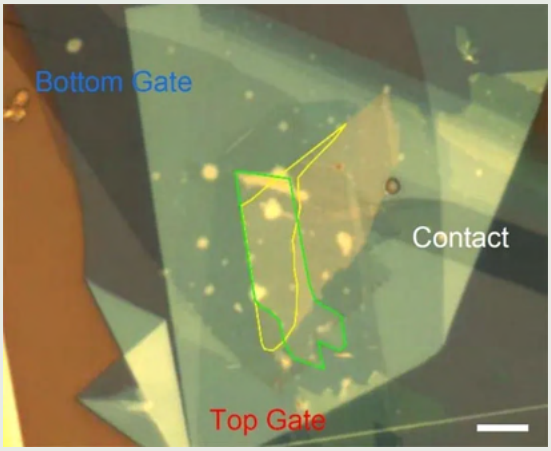
BROWN DWARF HEATING ITSELF TO DESTRUCTION



[Artist illustration of a brown dwarf (Image credit: NASA Goddard)]

"Weird" is one way to describe the notable brown dwarf WD0032-317B which has an orbit of 2.3 hours, a surface temperature of 13,900 degrees Fahrenheit, and is extremely close to its ultra-hot white dwarf star. This brown dwarf, being tidally locked, is only superheated on one side, which will eventually cause its evaporation by its host star.

FINDING THE FUTURE OF PUMP-PROBE SPECTROSCOPY



[Richen Xiong's observation of a correlated insulator of excitons consisting of tungsten diselenide and tungsten disulfide. (Image Credit: Xiong et)]

The University of California at Santa Barbara is propelling leaps in exciton creation and identification with graduate student Richen Xiong and senior author Dr. Chenhao Jin developing a system for pump-probe spectroscopy. This complex process involves the exciton state, where a fermion is bound to another fermion, resulting in the two half-integer spins combining into a bosonic particle. The two lattices of electrons from tungsten disulfide and holes from the tungsten diselenide were layered by researchers, and then put under strong lights, forming an environment for exciton formation and interaction during measurement. Xiong noted that he "discovered the correlation that drove the bosons into a highly ordered state" and identified pump-probe spectroscopy as a method for investigating bosonic particles.

NASA MANAGER PREDICTS MOVING THE DATE OF THE ARTEMIS ASTRONAUT MOON LANDING IN 2025

MORE ON OUR WEBSITE...

MARA JOHNSON-GROH: AN EXPLORATION OF SCIENTIFIC JOURNALISM

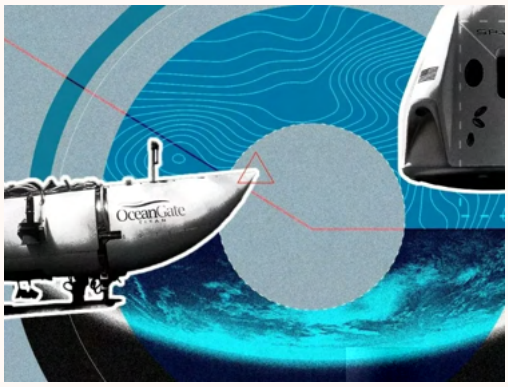
IF YOU GROW OUT OF THE "ASTRO," THEN IT'S JUST "PHYSICS" (BLOG)

COMPARISON: A SHIFT IN MENTALITY (BLOG)

[Artist's illustration of SpaceX Starship Moon Lander (Image credit: NASA)]

While the Artemis 3-moon landing mission has been planned to launch by the end of 2025, it is predicted that it will be pushed back by a year. As a result of SpaceX's recent test flights that have shown unpromising results, precautions were necessary in order to prevent future catastrophes.

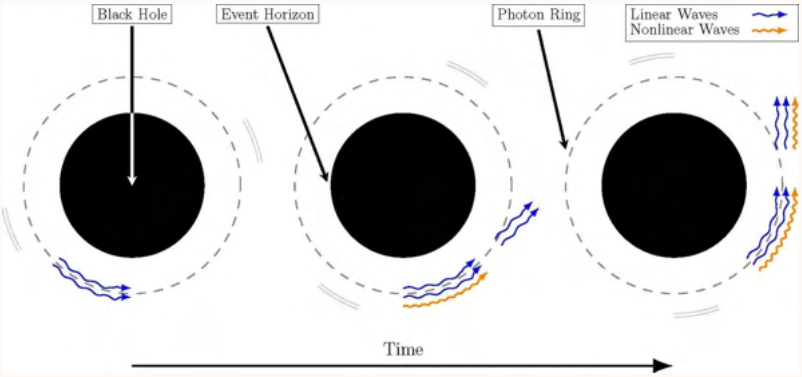
TITANIC SUBMERSIBLE DISASTER REVEALS TREMENDOUS FLAWS IN RECREATIONAL HUMAN SPACEFLIGHT



[Photo Illustration: Lindsey Bailey/Axios. Photo: Anadolu Agency, Robyn Beck/Getty Images]

Blue Origin, Virgin Galactic, and SpaceX, the current companies in the space tourism industry, have received recent backlash for the lack of regulations in their spaceflight programs. The controversy was stimulated by the media coverage of OceanGate's poor infrastructure, leading many to draw parallels.

LIGO SCIENTISTS CREATE NEW MODEL OF BLACK HOLE COLLISIONS



[Image Credit: L. Stein (University of Mississippi)/K. Mitman (Caltech)]

LIGO (Laser Interferometer Gravitational-Wave Observer) has been detecting gravitational waves in space for years. Black hole collisions are one of the prime ways of detecting these fascinating waves. As two black holes collide, ripples surge across the fabric of spacetime, owing to the gravitational waves that are detected on Earth. While LIGO has previously modeled gravitational waves using linear math – that is without accounting for the ways these waves interact with each other – a new analysis seeks to model the "nonlinear effects" of black hole collisions.

"Nonlinear effects are what happens when waves on the beach crest and crash," says Caltech graduate student Keefe Mitman. The interactions between black holes can create nonlinear waves, which have completely different frequencies due to the influence of another.

As scientists begin to account for nonlinear effects, they'll better understand how Albert Einstein's theory of relativity is applied within black hole collisions and push the bounds of future gravitational wave detection methods.

JAMES WEBB DISCOVERS GARGANTUAN GEYSER ON SATURN'S MOON

MORE ON OUR WEBSITE...

WHEN WHY BECOMES HOW (BLOG)

ON THE BORDER, BY THE SEA, AND BEYOND (BLOG).

ADDRESSING THE STEM SUPERIORITY COMPLEX (BLOG)

[Artist's illustration of NASA's Cassini orbiter flying through Moon Enceladus (Image credit: NASA/JPL-Caltech)]

Scientists detect Enceladus, one of Saturn's moons, spraying water vapor into space. This signals possible evidence of life on Enceladus; thus, NASA scientists are discussing a potential mission to seek life by releasing a spacecraft to orbit Enceladus for six months.

DEAD NASA SATELLITE LAUNCHED IN 2002 EXPECTED TO CRASH INTO EARTH

[Image Credit: ESA/Hubble & NASA, M. Sun]

The Hubble Space Telescope has taken an image of a trio of merging galaxies in the Boötes constellation. Known as SDSSCGB 10189, these gas-rich galaxies are only 50,000 light years away from one another and could potentially form one of the brightest, most massive galaxies in the universe.

THE GLOBAL EFFORT TO UNRAVEL THE SECRETS OF NEUTRINOS

[The installation of a cryostat module in the Majorana Demonstrator. (Image Credit: Sanford Underground Research Facility)]

Neutrinos, fundamental particles without electric charge, are plentiful in the universe but their strange and concealed interactions make them difficult for researchers to study. With this obstacle in mind, Indiana University undertook the Majorana Demonstrator experiment, aiming to deduce whether neutrinos could act as their own anti-matter particles and observe neutrinoless double-beta decay. The investigation, a collaboration consisting of 60 researchers from across 24 global institutions, studied nearly 1026 atoms over six years within one of the quietest environments on Earth: the Sanford Underground Research Facility. The results of the experiment were bittersweet; the researchers failed to find the decay they were looking for, but instead found that the neutrino's decay scale is longer than their initial approximation. There's already a second phase of the project, LEGEND-200, with more information to come.

BRIGHT OBJECT 10 MILLION TIMES BRIGHTER THAN THE SUN BREAKS THE EDDINGTON LIMIT

MORE ON OUR WEBSITE...

SUMMER BREAK: TIME TO UNWIND OR TIME TO GRIND? (BLOG)

ON IMPOSTER SYNDROME IN STEM (BLOG)

THE SCIENTIFIC METHOD OF LEARNING TO BE PROUD OF MYSELF (BLOG)

[Image Credit: NASA Artist Illustration]

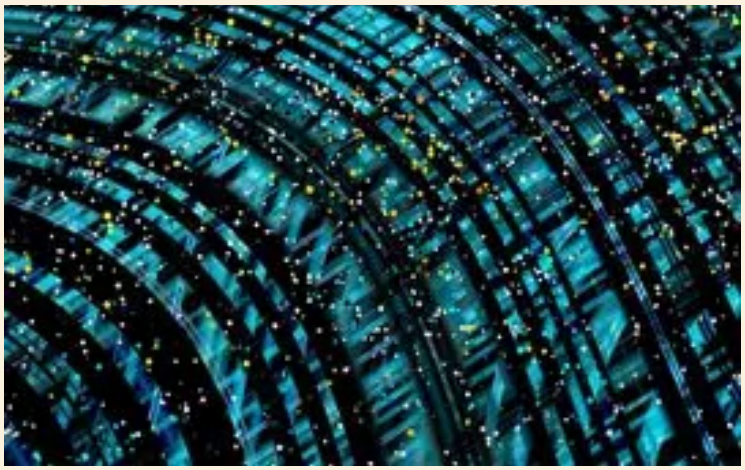
NASA's RHESSI (Reuven Ramaty High Energy Solar Spectroscopic Imager) satellite—launched in 2001 and destroyed in 2018—will begin crashing down to Earth on April 19th, 2023. Expected to reenter the Earth's atmosphere at 9:30 pm EST (only weighing 600 pounds), it will mainly be decomposed of gases such as vapor and ash.

GALAXY CLUSTER X-RAY SUCCESSFULLY SUPPORTS THE LAMBDA COLD DARK MATTER MODEL OF COSMOLOGY

[Image Credit: NASA's Hubble Space Telescope]

As depicted in the image above, scientists from Stanford University measured a ray data model in order to prove the matter emissions coming from the clusters. With this data model, scientists were able to correlate the image with The Lambda Cold Dark Matter Model; specifically, suggesting that the early universe was very hot.

SEDRAKYAN'S REVELATION BRINGS NEW QUANTUM UNDERSTANDING



[Depiction of a frustrated quantum state. Image credit: Credit: Gerd Altmann / Pixabay]

University of Massachusetts assistant professor, Tigran Sedrakyan, claims to have proven a new phase of matter dubbed the "chiral bose-liquid state." Sedrakyan explains his discovery in the context of temperatures approaching absolute zero and the interactions of particles smaller than a fraction of an atom: wild quantum states. He specifically studied frustrated quantum systems, where the collision of particles can cause infinite potential effects, including new quantum states. Sedrakyan developed a frustration machine, essentially a bilayer semiconducting device, which demonstrates electrons and holes moving with the same velocities and then being separated under higher fields. The long-range entanglement provides clues for the particles being in a chiral bose-liquid state.

SPACE & PHYSICS NEWS

LUMINOUS GAMMA-RAY BURST SEEN ONCE EVERY 1000 YEARS

MORE ON OUR WEBSITE...

THE UNCOMFORTABLE PART OF SPACE EXPLORATION: HUMAN LIMITS (BLOG)

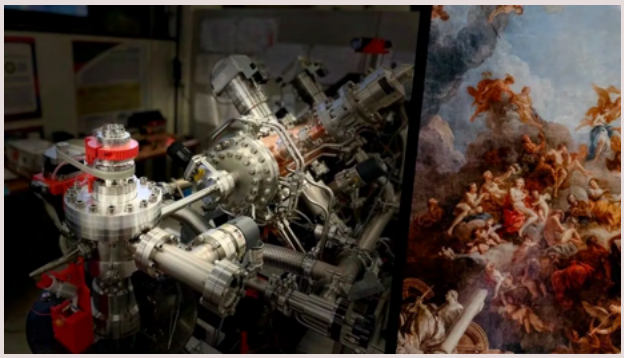
LONGEVITY ALWAYS WINS (BLOG)

FEMALE PIONEERS IN PHYSICS (BLOG)

Image Source: Hubble Space Telescope

This astronomical burst of light was stated to be 70 times brighter than any eruption ever observed. The image above merges two images taken on November 8th and December 4th, 2022. Specifically, the composition of light depicts the burst in an extended afterglow taken around one month apart. Gamma-ray bursts produce more energy in just a few seconds than Earth's Sun can produce in its entire life. So, it's no surprise that this occurrence was labeled 'absolutely monstrous.'

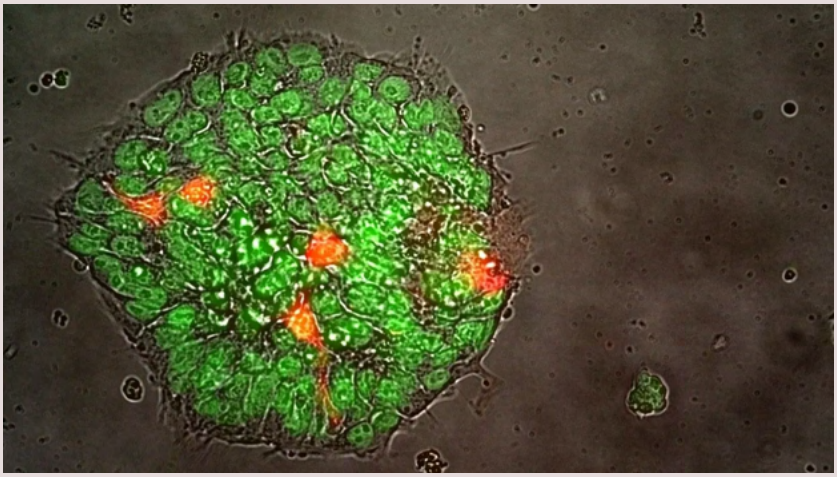
NEW ACCELERATOR BY CERN AND INFN TO PRESERVE OLD ARTWORKS



[The MACHINA accelerator and an artwork (Image credit: CERN)]

Both CERN and INFN came together to develop a compact accelerator specifically designed to preserve cultural artwork. Created in 2017, MACHINA's primary basis on radio-frequency-quadrupole accelerating cavity was still being tested in 2022. Although this project has taken longer than preferred, the results will inevitably be useful and advanced. MACHINA plans to be available at the INFNLABC laboratory, where the first measurements using ion beam analysis will be performed. In the future, MACHINA is planned to be transferred to Florence, Italy, where it will become used for daily diagnostic performances. With this modern advancement in particle physics and art history preservation, many new advancements are bound to come.

SPACEX AX-2 MISSION PLANS TO GROW FIRST STEM CELLS ON THE ISS



Induced pluripotent stem cells (iPSCs) under a microscope (Image credit: Cedars-Sinai)

In early May, scientists plan on sending stem cells to space in order to investigate the impact that weak gravity has on them. Specifically, these stem cells are called induced pluripotent stem cells (iPSCs), which are significantly beneficial if produced at their highest quality. These powerful cells can be reprogrammed back into a state called "pluripotency". When in this state, they can be transformed into almost any type of cell found in the human body; however, Earth's gravity makes it difficult to do so. Thus, at the ISS (a place with low gravity), producing iPSCs will be revolutionizing. Scientists are hopeful that the potential experiments conducted this year will benefit humanity.

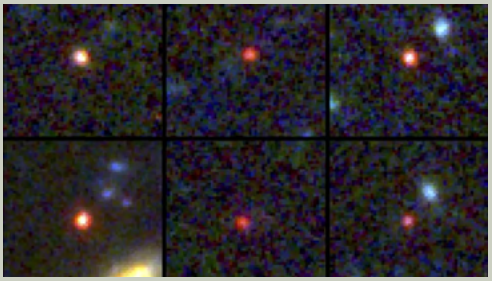
BREAKING NEWS: SIX UNEXPLAINED GALAXIES FOUND BY JAMES WEBB

MORE ON OUR WEBSITE...

STEPHEN HAWKING'S COSMIC INFLUENCE (BLOG)

WHY I CAN'T SEPARATE MATHEMATICS FROM METAPHORS (BLOG)

THE FUTURE OF SPACE EXPLORATION (BLOG)



[Image credit: NASA, ESA, CSA, I. LABBE]

Six extremely redshifted galaxies with tens or even hundreds of billions of stars have been found by Webb, estimated to date back to 500 million years after the Big Bang. Simply said, we don't anticipate that the early cosmos could arrange itself so rapidly. It shouldn't have been possible for these objects to develop.

EARTH IS DETERMINED TO GET HOTTER AT A FASTER RATE

[Climate change depicted from space (Image credit: Getty Images)]

Notwithstanding government efforts to reduce climate change, Earth is warming up at faster rates than anticipated. From 2010 to 2019, global temperatures have increased on average by 1.93 degrees Fahrenheit. In addition, global temperatures have increased by 2.05 degrees Fahrenheit from 2013 to 2022. This study was concluded to be caused by human activity.

JAMES WEBB DEMONSTRATES DUST, GAS, AND STAR FORMATION IN GALAXIES

[Image Credit: NASA, ESA, CSA, and J. Lee (NOIRLab). Image processing: A. Pagan (STScI)]

Looking at the images taken by Webb at infrared wavelengths, researchers and astronomers are astonished by what they see. With just this single image, a new perception of how star formation (one of the smallest processes of the universe) can influence the evolution of large-scale objects in the universe has been recently discussed. Compared to the Hubble Telescope, Webb reveals intricate detail depicting gas and dust absorption through light. With already twenty-one research papers created since the release of this image, more ideas are yet to come.

WEBB CAPTURES THE COLLISION OF II ZW 96

MORE ON OUR WEBSITE...

UNSCRIPTED WITH RIHA MUSA: AIR QUALITY, CANCER TREATMENT, AND ANIMAL HEALTH & WHY IT ALL MATTERS TO ME (PODCAST)

PUBLIC SPEAKING CHANGES MINDS: THE ART AND SCIENCE OF SPEECH WITH RIHA MUSA (PODCAST)

[Image credit: ESA/Webb, NASA & CSA, L. Armus, A. Evans]

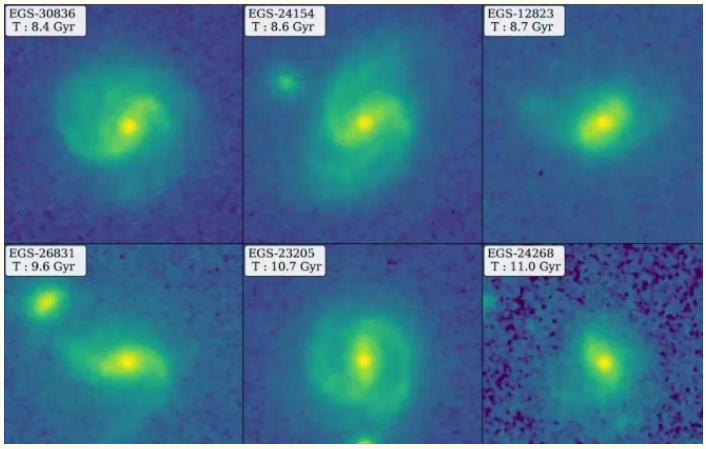
The infrared image taken by JWST of a galactic merge depicts the spiraling cores of two structures as they fuse together, accompanied with the gravitational distortion of their spiral arms. These galaxies are best seen at infrared wavelengths and boast luminosities more than 100 billion times our Sun's. As a result, Webb is suited to observe these structures with high detail and is currently embarking on a wider project involving the evolution of Luminous Infrared Galaxies.

CEERS SURVEY REVEALS DIVERSE UNIVERSE BEYOND HUBBLE'S CAPABILITY

[Credit: NASA/STScI/CEERS/TACC/S. Finkelstein/M. Bagley/Z. Levay; Cutout images: NASA/STScI/CEERS/TACC/S. Finkelstein/M. Bagley/J. Kartaltepe]

The Near Infrared Camera on the James Webb Space Telescope formed a mosaic covering 8 times the area of Webb's first deep field image. The mosaic is one of the early products of the Cosmic Evolution Early Release Science Survey (CEERS) and revealed that the previous imaging by the Hubble Space Telescope underrepresented the true detail of the galaxies. The CEERS image depicts 850 redshifting (from 3 to 9) galaxies 12 billion years in the past, suggesting that these nebulas had already evolved immensely in structure by that point. Hubble had previously identified these galaxies but a dramatic 488 were reclassified after the CEERS image due to higher quality imaging.

BARRED GALAXIES CAN BE YOUNG TOO: WHAT DO THEY MEAN FOR STARS?



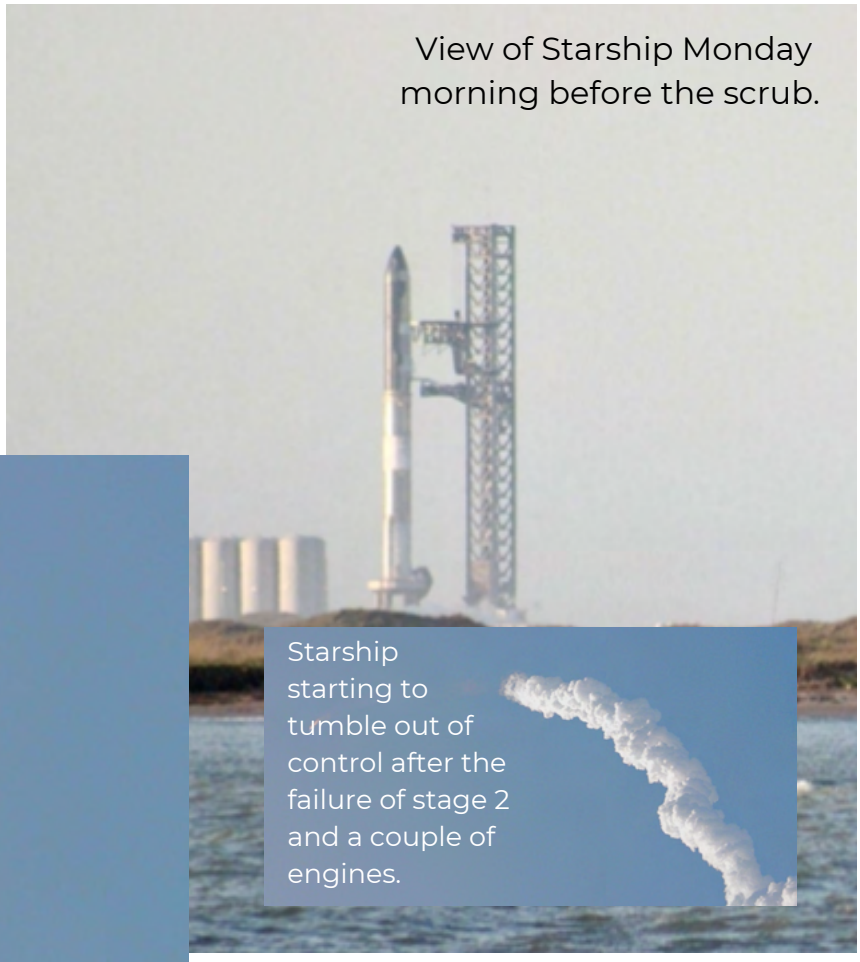
[Image Credit: NASA/Guo, Jogee, Finkelstein and CEERS collaboration/University of Texas at Austin]

The James Webb data released by NASA in July has been available for months, but it was only recently that researchers at the University of Texas discovered barred galaxies in the images. Bars are structures expanding from the galactic center to the outer edge of the galaxy, known for circulating gas and dust throughout the spiral. These phenomena were previously only known to be present in older galaxies, as implied by the imaging of the Hubble Space Telescope, but after the JWST images captured young, 11 billion year old galaxies with bar-like structures, we must revisit this assumption. The discovery of bars in young galaxies has tremendous implications for our knowledge of star formation and supermassive black hole growth. The ability of these structures to bring gas into central, star-forming regions in a galaxy and also provide matter for active galactic nuclei to feed on is something we were never able to confirm—until now.

PHOTOGRAPHY: THE STARSHIP ARCHIVES

BY MYKEL DEL ANGEL

CREDIT: **Mykel Del Angel** is a high school graduate from James Pace Early College High School and has worked with STARSociety and Cosmic Perspective as a media intern and volunteer. He holds many awards from the Technology Student Association for music production, audio podcasting, and digital video production and was awarded Best News Package by the MACA Student Film Awards this year for his video, "Igniting Curiosity". Mykel will be continuing his studies and career at Berklee College of Music this upcoming spring and pursue composition and music technology.



View of Starship Monday morning before the scrub.

Starship starting to tumble out of control after the failure of stage 2 and a couple of engines.

Starship leaving a trail of smoke in the air as it launches into the sky.

Above. Photographs of the crowd on the day of Starship's launch.

The view of Starship in the fog from Isla Blanca the morning before the launch.

PHOTOGRAPHY: THE STARSHIP ARCHIVES

HOPES FEARS DREAMS

DOUBTS JOURNEYS INSPIRATIONS

OUR THOUGHTS, IN BLOGS

Image Credit: NASA/CXC

Highlights of June 2023: Delve into the cosmos of voices of Spacetime Archives. From learning to conquer imposter syndrome to witnessing space travel stretch the bounds of human limits, there's still much left to explore.

Stephen Hawking's Cosmic Influence

written by rishika porandla

Gemma Levine/Getty

"There should be no boundaries to human endeavor. We are all different. However bad life may seem, there is always something you can do, and succeed at. While there's life, there is hope."

Stephen Hawking, or rather a reimagination of him with the face of Oscar-winning actor Eddie Redmayne, graced 2014 movie screens in a poignant depiction of the renowned physicist's rises and defeats—the film The Theory of Everything. I knew of Hawking before The Theory of Everything gained critical acclaim and Academy Award wins, but only in a "Yeah... he's the smart guy with that illness, right?" way. It might be a little embarrassing to admit that my passion for physics blossomed from a movie that skeptics call only 40% accurate, but the impetus of Hawking's story found another purpose in propelling my spark of interest into numerous internship successes and published research papers.

Hawking's evolution was partially disguised in the biopic by the emphasis of his turbulent relationship with his wife, but I still consumed every scene showcasing Hawking's curiosity and high-speed engagement in his physics studies at Cambridge University. The Theory of Everything depicted physics as a subject of repeated failure and subsequent gratification, depicted messes of overlapping equations on chalkboards as a beautiful maze, and depicted Hawking's headaches over textbooks as the storm before the calm.

t's not like the storm wasn't important, however. The Theory of Everything was wholly characterized by its suffering. Stephen Hawking's tears had just as much screen time as his triumphs, and I believe that stimulated the emotional attachment that made me cry with him and regard the studies of physics and cosmology with the respect and adoration he did. Learning black hole dynamics with Hawking as he stumbled through his graduate studies and watching as his paralysis diffused throughout his body, and yet never was able to conquer the complexity and movement of his mind, helped me appreciate physics' ability to render everything else inconsequential.

It's not like the storm wasn't important, however. The Theory of Everything was wholly characterized by its suffering. Stephen Hawking's tears had just as much screen time as his triumphs, and I believe that stimulated the emotional attachment that made me cry with him and regard the studies of physics and cosmology with the respect and adoration he did. Learning black hole dynamics with Hawking as he stumbled through his graduate studies and watching as his paralysis diffused throughout his body, and yet never was able to conquer the complexity and movement of his mind, helped me appreciate physics' ability to render everything else inconsequential.

Hawking said "there should be no boundaries to human endeavor," and finding myself solving complex problems from the film within my own head by my fifth rewatch affirmed that statement. Hawking's work with black holes and radiation invoked the realization that not only do I love the equations—I'm good at them. The Theory of Everything brought forth an intuitive understanding from me of the conceptual foundation of the theory of special relativity, the mathematical basis of the redshifting of light, the need for a unified theory of quantum gravity: the theory of everything.
"While there is life, there is hope," as Hawking said. Watching Hawking claim his life again, even bound to a wheelchair and communicating through a computer, and seeing his hope for his future diffuse into published works and academic success proved to me the possibility of it all. Stephen Hawking had the world against him, and still left his name in textbooks and scientific history with his proven theory of black hole evaporation and revolutionary interpretations of anti-matter, so what's stopping me?

Image Credit: NASA/JPL-Caltech/DSS

BRIDGING STEM AND THE HUMANITIES: WHAT PHYSICS MEANS TO ME

Written by Angel Hu

I've gone through most of my academic career knowing that STEM and humanities were two staunch opposites. One is objective, the other is subjective; one is difficult, the other is easy; the list goes on. So I guess it's a little strange that my journey into physics – the hardest of the "hard sciences" and the foundations of STEM – also became the gateway into my love and appreciation for the humanities.

Yet the more I think about it, the less strange it is. I became fascinated by physics because of the way books, websites, and videos made such a daunting field feel accessible and welcoming. I loved the creativity, insight, and wit that went into blog posts, stories, and scripts and was inspired to find ways to share my own knowledge and experiences – which is why I'm here now.

In a field so complex yet so vital to our understanding, it's extremely important that scientists and researchers are able to effectively and convincingly communicate their findings. Even beyond academia, reading, writing, and debating about STEM enables us to think outside of the box and come to conclusions that incorporate nuances which would be lost in mere plug and chug formulas.

And perhaps STEM and the humanities aren't so separate from each other after all. The process of scientific inquiry emerged from philosophical questions about the nature of existence and the universe. In physics, as we further our knowledge into the quantum realm or reach the ends of the universe, objective principles and equations will begin to break down. What's left is a constantly fluctuating superposition of theories and "objective truths" that are really just as subjective as the humanities.

HUMANS VERSUS KNOWLEDGE

by Rishika Porandla

The universe is a complex specimen that still holds secrets close to its heart, far from the eager eyes of physicists and astronomers and those who are hungry to evade the limits of human wisdom. There's an argument that humans will eventually find all that there is to know, that the technological innovation that brought us this far and familiarized us with the mathematics of a planet's orbit and the physics of galactic collisions, will only continue to propel us past skeptics and to the interstellar expanse. There's also an argument implying fruitlessness and impracticality, littered with remarks of "focus on us before you focus on what's up there" and "intangible knowledge can only get you so far."

Inevitably, perspectives overlap and compound and cancel each other out, leaving behind only the harsh reality of cosmic matter that accelerates at speeds unknown to us and spirals towards black holes with an amount of volatility that would make us mundane humans shiver. We can know all the knowledge that exists—we can consume all the theory inscribed in textbooks and the minds of the brilliant—and still we will not know the structure of the singularity of a black hole, or the true value of Einstein's cosmological constant, or the form that dark matter takes.

Spacetime likes to mock us in that way. It's the esteemed library of knowledge whose pedestal stands atop the steep cliff of human endeavor—a cliff that none of us have the agility or erudition to traverse yet.

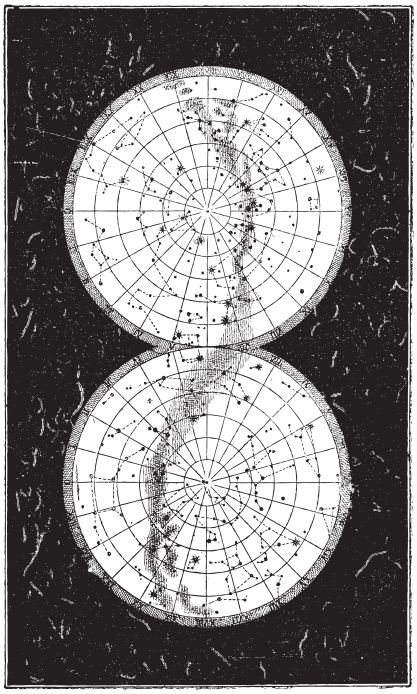
Spacetime, our fatal enemy, is a concept that scientists like to refer to as a mathematical model, something that can be dimensionally visualized. We swallow down our resentment and call it an inference of the entanglement between the space and time that we know exists, since we believe we can sense the consequences of its warping. We add some illustrative words and call it "the fabric of spacetime," but in truth, it's not a fabric that is being warped, but rather simply space. Matter and energy are placed within spacetime to form elements of the Universe: stars, galaxies, gas clouds, the list goes on.

Our theory of spacetime begins with the revered Albert Einstein and his notion of special relativity…

COMMERCIAL BREAK: Einstein's theory of special relativity argues that the fundamental laws of physics, including the speed of light, must be constant for all uniformly moving observers.

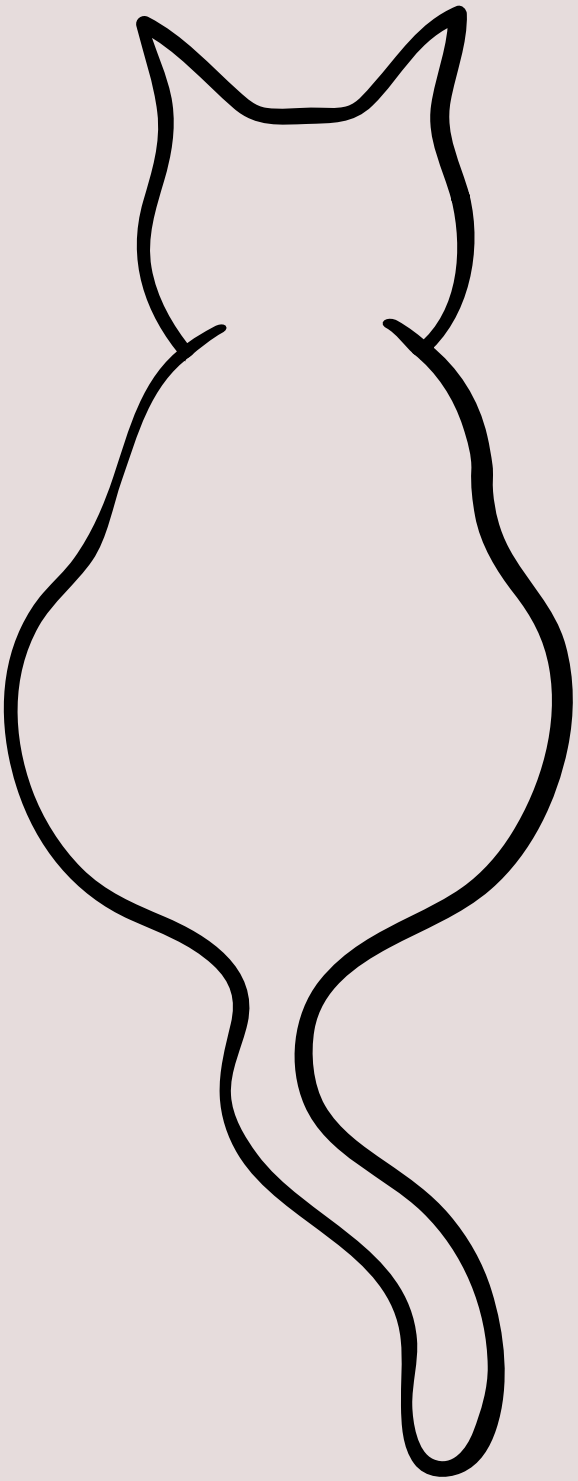
…and is furthered by the results of FitzGerald and Lorentz: that space and time are not independent of each other, but rather converted into each other along a path in space in order to maintain a constant speed of light for all observers.

This is where we say that the men of modern physics gave us something concrete about spacetime—something measurable and scientific—but then we learn that these laws of classical physics break down at the singularity of a black hole and then suddenly we are again mundane humans who know nothing.



Why I Can't Separate Mathematics From Metaphors

WRITTEN BY JAQUELINE PEÑA



I'm not a fan of theoretical physics, no. I don't like the idea of dedicating so much to something that's not necessarily tangible. I think my brain is wired to absorb all things around me as signs sent to guide, like all valuable thoughts are lessons to remember. I'm rounding the hedge but, admittedly, I take things too personally. Of course, this is all personal.

Don't hate me, but I don't like sitting on theories...I don't like... morally...relying on theories.

I have a bone to pick with the physicist Erwin Schrödinger. I believe the moment I heard about Schrödinger's Cat was the moment a seed of delusion planted itself into a very impressionable part of my brain.

The idea that something can have all possible outcomes if undetermined sounds exactly like the voice of anxiety, of absolutely unreasonable paranoia. This argument, which is now stated as a structural law to understanding physics, is exactly what I use to convince myself of delusions.

Kind of like the way you get upset at a friend for spewing their intrusive thoughts out loud, I'd like a conversation with the man himself, and I'd tell him to never speak of the cat in the box. I'd really tell him that.

Schrödinger's theory should've stayed strictly mathematical, not metaphorical.

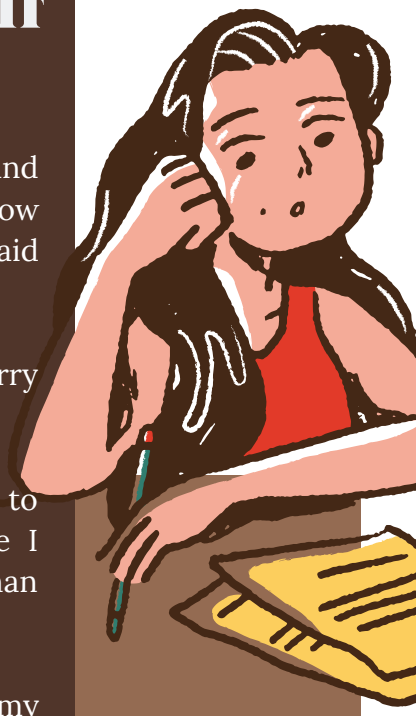
Did he not think of the unlimited possibilities that could come forth the golden law of gaslighting, a simple "believe what you want" where nothing can be disproven?

Oh, if there was an office style camera on my face when I first put the pieces together, you'd see thought after thought go through both frameworks at once. The beauty of brute thought, all scientific applications out the window; I too want to ruin someone's day.

Send me back in time, and I'd watch Schrödinger grow old. I'd sit on his grave to make sure, if I could not see his state of unliving, of existence, I'd watch the dirt spread over him. The cat needs to stay in the box.

The Scientific Method of Learning to Be Proud of Myself

written by rishika porandla

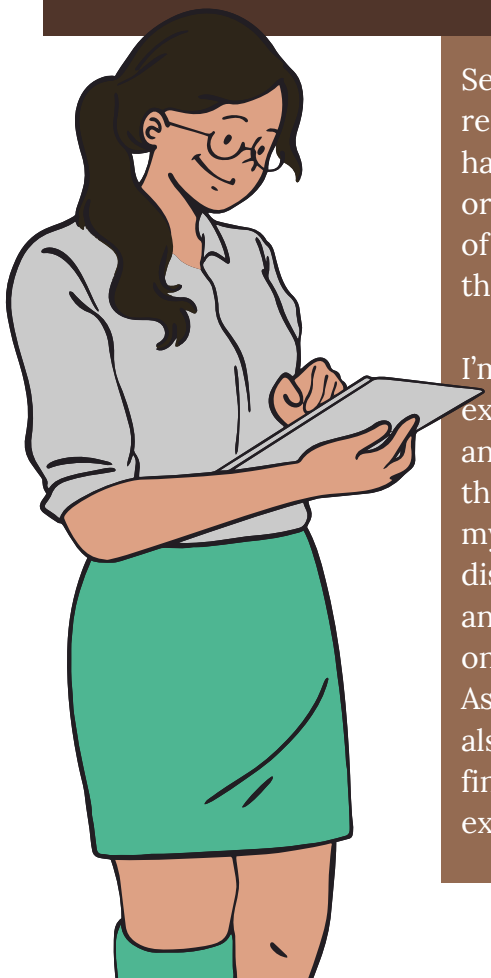


Amid the stuttered laughter from the card game occurring at the other table and the hushed conversation to my right about college and internships and how someone's class rank is dropping since they got an A- in Spanish, someone said something in my direction that imprinted itself within my eardrums.

"What do you mean you're stressed? You're cracked. You have nothing to worry about."

How come "having nothing to worry about" feels more like having everything to worry about, and no amount of worrying feels like enough worrying, since I couldn't possibly be measuring up right now, what else would I do other than worry?

Self-evaluation is an interesting thing since, in my head, how I view myself and my accomplishments feels like the only metric that holds any merit in an empirical sense. Who else knows me better than I know myself? Who else understands the dejection I feel when I realize that I have more internship rejections than I do acceptances? Who else sees that the research I strain my frontal lobe over pales in comparison to the exhaustive poster boards of the Regeneron STS Top 40?



Self-evaluation, or rather self-degradation, drowns out all the attempts of reassurance that circle me. I guess this is my formal apology to everyone that has told me that I'm doing great, or that my achievements leave them in awe, or that they cannot fathom how I could "do all of this" and still not be proud of myself. I love you all, thank you for all the words, and I'm sorry that more than half of them never rang true once my responsive smile faded.

I'm self-aware enough to know that I'm being irrational, but when expectations compound and peer pressure escalates, and science—as logical and systematic as it is—fails to provide me with results that accurately reflect the time and tears I invest, I realize I'm not resilient enough to simply pat myself on the back and move on. Maybe it's a new theory of natural selection: dishearten the ones that aren't self-assured enough to blink the tears away, and perhaps they'll weed themselves out one day, and it'll only be the smart ones left.

As much as I learn about physics and stars and colliding particles, though, I also learn about leniency and forgiveness. There's a scientific method for finding ways to be proud of yourself, and I think I'm finding a footing in the experimentation phase. I'll let you know when I find a conclusion.

ON THE BORDER, BY THE SEA, AND BEYOND.

Written by Jaqueline Peña

I only heard it in snippets of conversation – under the yellowing porch lights or in dinner table murmurs.

“They’re building something big down there right?”

“Looks scary. The lights look scary.”

“They’re talking about sending that thing up.”

“Like to fly?”

“Like into space.”

And the conversations ended after that. Ended with a mere sigh – maybe an added remark about the new foreigners in town. I thought about what it feels like to be on the other end of that comment. It seemed like talking about it made it worse, like it meant unfamiliarity and waters not to tread.

Even when I tried explaining it between sips of coffee, my finger traced wet rings on napkins. Around and around... orbiting.

Although, I fully knew what chasing the silence meant. I made the same sighing noise when I saw the murals painted all over downtown. I’ve never seen that many out of state license plates and I knew better than to bring it up now.

It's a tough perspective. All eyes in, gouged and rolled, shut and peeled back, I end up at the same point. After having explained it so many times, I look down to my fingernails having left indents on the circular stain.

And I can sit here and tell you I’ve written so many essays pleading my case of uncertainty. No, I haven't made peace with it, nor do I think I will.

Image Credit: NASA

Yes, advancement takes risks, and risks mean sacrifices, but I don't know if my dreams are interchangeable with my home.

Even now as I look up from the porcelain rim, I have trouble playing devil's advocate right in front of eager eyes that swell twice as big as moons.

What am I without my experiences? Without something to look back on. When do these experiences blur in the rumble of Raptor engines? Because a billionaire's rocket garden has sprung up in my backyard, and I’m not sure what to tell my mom when I saw a video of our windows shaking.

WHY ASTROPHYSICS?

Written By Angel Hu

Image credit: ESA/Hubble & NASA

But maybe that's why I was drawn to astrophysics as a subject in the first place. We don't know what we'll discover out there. We don't know how much of our traditional laws of physics will even hold up in the presence of high energy collisions and warps in the fabric of spacetime. Every bit of discovery we encounter is only a tiny piece to this never-ending puzzle.

There's this sense of mystery that coincides with simply knowing that we're going to change, that what we're researching or the ideas we're researching may be completely different a day, month, or year later. One simple force can send particles veering off in another direction, and soon enough, I'm chasing them down this new path.

When I reflect on the concepts that have led me down a winding rabbit hole, the dreams I've conjured up, and the activities I've thrown myself towards faster than the speed of light this past year, they've all emerged from my passion for astrophysics. Right now, I can picture my future of exploring the stars, so bright and clear, and I can only see my passion expanding––just like the universe.

Yet part of me also wonders if I'm even being true to myself when I say that I'll stick to this passion. Yes, I'm currently living the dream of my elementary school self who was obsessed with the Solar System and constellations, but it was a dream that peaked and then fell, peaked and then fell. Even now, I feel the initial feeling of passion and excitement pulling away, like a redshifted galaxy, and colliding with other budding interests of mine: particle physics, computer science, quantum mechanics.

NASA/CXC/Wisconsin/D.Pooley & CfA/A.Zezas

We'll never be satisfied with our current knowledge and our current dreams, so why not break free and journey beyond the stars?

THE UNCOMFORTABLE PART OF SPACE EXPLORATION: HUMAN LIMITS

WRITTEN BY JAQUELINE PEÑA

Fueled by a cloudy haze of hope, the metaphor “reach for the stars” will inevitably become clear within the Martian atmosphere that awaits us. But with this advancement, the booming industry of space exploration will undeniably be met with ethical questions in the wake of a new scientific revolution.

As with any innovation, moralistic debates regarding our future conditions and life in space have surged. However, simply put, humans are not apt to live long terms out of the comfort of Earth's atmosphere and pressure. Faced with any form of change to its environment, a biologically responsive organism will see changes in their lineage as to maintain their survival, and this idea should hold true when humans leave their home planet. This is only a mere possibility now, but what happens when the future data matches the hypothesis? Are we willing to risk human life for this venture? Are we willing to genetically modify our candidates? Is human experimentation under the guise of space exploration worth being reflected as the forefront of biotechnology?

It will be framed as human enhancement. This genetic alteration and perhaps bionic integration can deface what we consider natural.

On the contrary, let the image be reflected as a beneficial form of bioengineering as these changes will be used to address issues of our human systems. Would these prospects not be vital to the progress of our existence? This rising industry could jumpstart new testing facilities and perhaps lay the path to revolutionary health science rooted in the diffusion of space technology.

Discussion on political rights for the betterment of humankind bleeds further into the image of ethical debate in the question of human advancement. But in the end, we simply land right back to the undeniable fact these are humans we have extensively trained for prodding and picking – and perhaps – an inevitable death.

Image Credit: Getty

BOOKS TO PIQUE YOUR PHYSICS INTEREST

Written by Angel Hu

So\you've decided that you want to try physics? Be prepared for many dead ends, incorrect answers, and the occasional shedding of tears.

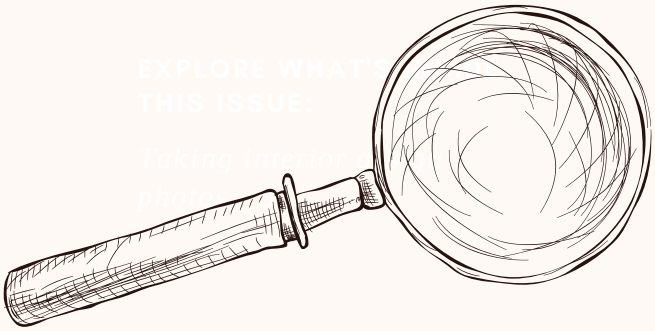
While physics is a notoriously dense field brimming with mind-boggling equations and theories, the following books break down complex topics with analogies, diagrams, and even a little bit of humor as you journey beyond the physical universe and into the quantum, relativistic, and cosmological worlds.

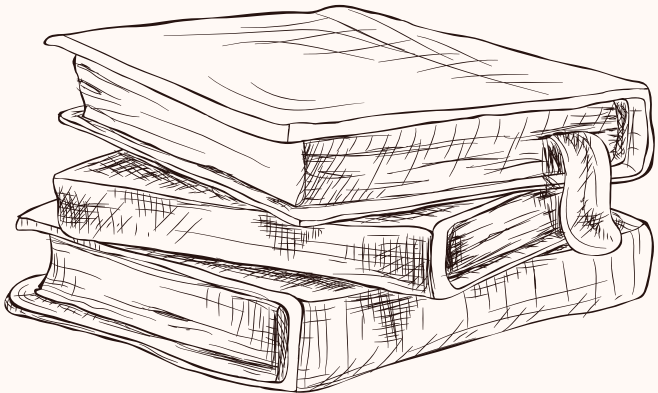
1. ***A Brief History of Time by Stephen Hawking***
The man whose theories left a permanent imprint on theoretical physics – his books are no exception to his genius. Requiring no in-depth knowledge of physics, this book describes the very minute elementary particles to the most supermassive black holes and the ever-expanding universe. Fellow science fiction lovers will be awed by the discussions of wormholes and time travel, and all readers will be puzzled by the philosophical questions and paradoxes that mark the boundaries of our knowledge of physics.

2. The Little Book of String Theory by Steven Gubser
Like the strings that make up our world, this book is tiny – less than 200 pages. Yet its content is substantial. Making creative analogies to music and rock climbing and including a dash of wit, Gubser transforms a topic that still puzzles scientists today into a more manageable introduction, just like how string theorists transform the vast universe into subatomic strings. Companion books to check out are The Little Book of Cosmology, The Little Book of Black Holes, and The Little Book of Exoplanets.

3. The Elegant Universe by Brian Greene
This is one of my personal favorites. Greene steers away from complex terminology and dense equations as he deftly discusses Einstein's theories of relativity, the fabric of spacetime, quantum mechanics, and the conflicts between them – ultimately proposing an elegant solution – string theory. The book does not shy away from thought experiments or philosophical musings, and there will definitely be times where you'll read a section and just simply think "woah."

4. The Feynman Lectures on Physics by Richard Feynman
More computational and terminology heavy than the others yet just as captivating – theoretical physicist and Nobel laureate Richard Feynman's famous lectures are all housed in this book (which is also free and accessible online!). Feynman delves through the main branches of physics: mechanics, electromagnetism, and quantum mechanics, offering step-by-step derivations, diagrams, examples, and explanations for both the dedicated and aspiring physics student.





WHEN WHY BECOMES HOW

Written by Jaqueline Peña

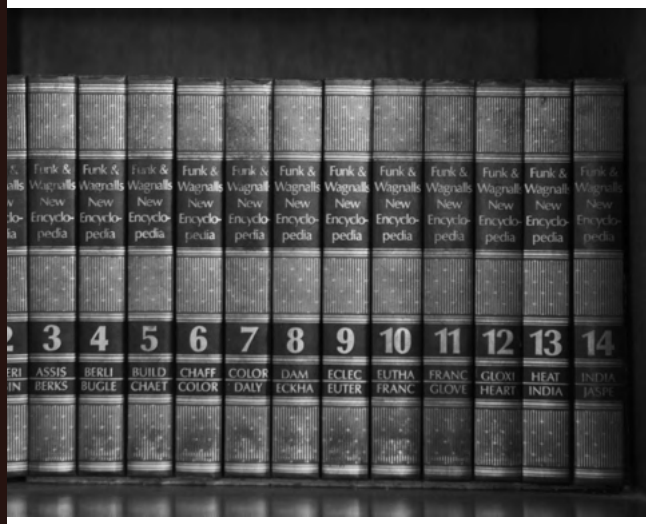


Image Credit: Getty

Innovative initiatives and unbounded revelations, it is the age of Aquarius--for even the stars predict an era of evolution and enlightenment. It is beauty in creation; it is human curiosity.

From the beginning of time, humanity has shown a pattern of advancement. Those who think ahead, go ahead. It's not a Darwinistic ideology, simply a nod to the invention of stone-age tools and the creation of encyclopedias.

Questioning who was the first weirdo to drink cow's milk, discovering that we can split atoms, and learning how to freeze time in pixels, all join together to call upon the spirit of inquiry.

You must think of the call as an instinct tied to curiosity. Do you remember being young and playing with worms? What within you made you sympathetic to the stories of old mammoths? Why did you dig?

The philosophy of inquiry burns in a light show. Advancement is the unanimous feat that connects curiosity to innovation.

We pointed lenses at the cosmos, squinted at the sea above us, and stared at the same pale moon. There are stories tied to the stars where we thought only the gods could ride the sky in chariots of precious metals.

Now, to even think of these beautifully shared moments blossoming in space flight control rooms. To conceive of action. The air bursts into the roar of history being written.

Is it not exciting? Is it not the backbone of the indomitable human spirit?

For now, don't ignore the idea of chickens and eggs and cats in boxes.

Wonder, wander, and play past the idea of sticks.

We are always on the cusp of discovery, and we will always journey past its rim.

LONGEVITY ALWAYS WINS

BY RISHIKA PORANDLA

I find it extremely easy to value longevity over substance. It's a repeatedly reinstated human mindset —just look at the adults who remain in mediocre, non-stimulating occupations after turning their tired eyes away from the job they truly want due to fear of financial instability. I see the hesitance infiltrating the demeanors of my friends who have held extracurriculars close to their heart since middle school, and then––once the strings that pull their attachment taut finally fray––they, for some reason, continue holding on anyway. Maybe that's a fundamental human truth: we embrace what has been with us for the parts of our lives that we remember and discard the budding aspirations and passions that could build into future moments to remember.

I always like to think that I managed to swerve these traditional traps humans fall into, that I'm somehow unique and immune to the circles of insecurity and uncertainty that characterize life. But then, I remember that this is yet another intrinsic human condition that will affect everyone, and it turns out I'm not special after all.

I have nurtured, voiced, embodied my fixation for astronomy for as long as I can remember. I was the child that spent half her life at the NASA space centers; I was the teenager that wasted nights and days and hours and weeks wondering about how the singularity within a black hole fundamentally exists; I was the young adult who crafted research and words and speeches about why humans should even care about all of it.

But recently, I was also the young adult who suddenly tangled herself into a research group that studied electrons rather than stars and pulled all-nighters over particle collisions rather than galactic mergers. Of course, electrons and stars are fundamentally the same, and there's no difference between particle collisions and galactic mergers, but it doesn't feel that way when they're inevitably part of two different fields of study, and I still can't fathom how I left one for the other.

Because the longevity of our past-loves always wins in our head, doesn't it?

FIRST LOVES & FIRST PASSIONS

BY RISHIKA PORANDLA

First passions are like the known and revered notion of first loves. Growing into adolescence and finding a crush fading into the past—although it perhaps continues to nag you through your teens—doesn't seem much different to me than finding a connection to learning that dissipated once practicality came into the picture. Maybe people don't care; maybe the past is the past, and fixating on what you used to love creates a barrier between you and the future. That future seems great, I'm sure. It's lucrative, stable, and probably accompanied with those pretty statistics of job growth and the Forbes articles that tell you that you're safe from artificial intelligence rendering you unemployed.

As a child, my family used to joke about the jobs they thought were unfathomable for them: their first loves. What if my sister didn't let her hospital volunteering go to waste and decided to pursue medicine instead of data science? What if my father stayed a university professor instead of starting his own business? What if I went back to my first passion and left behind the realm of computations, physics, and tedious algorithms?

Even now, well established in the field I want to pursue, I think about it far too much. I could drop the physics books and research papers and turn to the other types of literature that have been receding from my daily routine since I decided I was too busy for them. I could write another book, a real one, instead of the glorified astrophysics textbook that is always open in an adjacent Google Docs tab. With just one turn of my mind, English and the philosophy of science could be my defining characteristic instead of a regretful afterthought.

Copernicus and the theory of heliocentrism could have been the culmination of my studies, rather than the precursor to all the physics they gave rise to. Feynman's bridge between the pandemonium of particle interactions and the tangible nature of reality could have been viewed conceptually. An empiricist turns his theories into a tangle of calculations that make less sense in the end than they did in the beginning—and that's beautiful too–but it's a filtered, quantized beauty that leaves the ironic dog tag of: "Oh, we tried to make this make sense."

But the 14.5% projected physicist job growth looks nice, doesn't it?

COMPARISON: A SHIFT IN MENTALITY

Written by Jaqueline Peña

Imagine yourself in a pool of still water. You know a few things for certain: your name, your skills, and your worth. Now, allow yourself to succumb to the inevitable perception of your surroundings.

Comparison is a funny thing, considering a large part of one's reference is the certainty––or lack thereof––behind personal understanding.

"How long did you study last night?"

"Can we be partners for the peer review?"

"How'd you format your resume?"

. It's a subtle fine print, really––hard to catch and so very easily misconstrued.

In reality, it's "Why are you better than me?"

Subconsciously, absentmindedly, you sit there and analyze the only way you know. You analyze on a scale you know no better than your very own.

However, here's where it gets tricky: while comparison can be a parasite of insecurity that feeds from one's perception, it alone is not a vice.

To shift this mentality is a sense of self-security.

For the sake of this message, we focus on the productive.

Comparison is helpful. It sets the marker for your own abilities and exposes the hidden riches of talent, like an amateur artist standing amongst the statues of Michelangelo.

We know what to admire because it is rare––but even more importantly, we know how to mimic.

If there is one thing to take away from comparison, it is, as the saying goes: monkey see, monkey do.

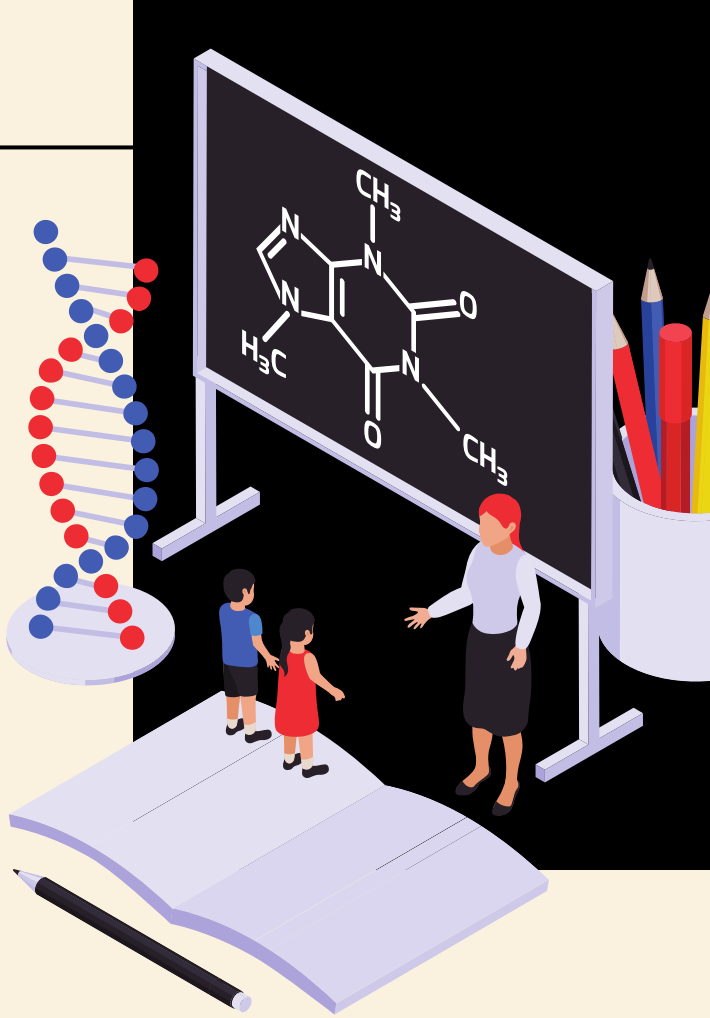
After all, it is to learn from the greats who have kept the classics afloat. It's the way most practices are carried on, a weaving of visual notations and informal tips. You learn ways to move your hands in presentations and how your posture on a podium carries your thesis past your teeth.

In a field that demands both certainty and the ability to question inconsistencies, STEM gives you no room but to compare. Let the act not be detrimental.

From my experiences, I've learned not to let insecurity foster behind comparison. I've learned to become a mosaic of mannerisms for a field that forces the best performance out of me.

Addressing the STEM Superiority Complex

Rishika Porandla



What epistemological foundation is there for the self-importance and arrogance held in not only individuals themselves, but fields of study as a whole?

I'm sure there's a superiority complex for everything. I'm positive that I could enter a publishing house and find that certain employees believe their curated, cash-funded bindings surpass the artistic expression of indie self-publishers. I'm aware that if I took a diversion through Silicon Valley, I would come across people who saw their companies as the pinnacle of achievement and believe that those with less wealth enjoy being lazy and ineffective. Nevertheless, I find myself in another atmosphere that stresses ideologies of scientific and technological superiority over the role of theory, history, art, and literature.

The STEM superiority complex is not simply a societal afterthought or a consequence of repeated success by scientific visionaries. No, it is a continually calculated and reinforced construct underpinned by the desire for capital and advancement. STEM is practical and marketable—leaders, employers, and innovators know it. As the path to confronting real-world issues, fostering the strenuous tasks of mathematical computation and physical sciences is idealized and admirable. Most of all, it's reputable.

Our strange, self-glorifying culture frequently associates intellect with competence, and the degree of intellect one has is lately determined by their ability to earn money, solve the unsolvable, advance in competitive careers, and do this all while benefiting humanity from an empirical standpoint. Through the decades—the centuries—of circulating this belief, a rather intentional devaluing of non-STEM fields has followed, lending to the impression that those who choose to pursue studies that are deemed "less concrete" lack the capacity to do anything else.

I write this with bias: a tremendous amount of bias that has been conditioned by my scholastic environment of high school and my career environment of physicists and scientists believing that their work propels humanity like no other. Thus, I have reservations while making claims insinuating that STEM precedence isn't wholly warranted. I believe we cannot overstate the involvement of programming in developing our automated systems or the contributions of proton therapy in addressing cancerous tumors. I cannot fully repress my belief that the fundamental works in physics form the foundation of philosophy, or that technological innovation isn't enabling the success of business and literature.

I find that valuing the practicality and prestige of science is justified. What I can't rationalize is the harmful propagation of the ideal that humanities and social sciences are somehow less significant or relevant to the difficulties that our society faces.

GUESS YOU HAVEN'T TRIED QUANTUM

by rishika porandla

Quantum Mechanics: The Theoretical Minimum by Leonard Susskind and Art Friedman is brilliant. It's digestible, allows for those who are unfamiliar with multivariable calculus to breathe a little, and doesn't make fun of you for not being able to pronounce "ehrenfest" or "hysteresis." However, as I gradually make my way through the novel—as in spending hours and hours on each lecture, no matter how short they are—I have to recognize the funny part of it all.

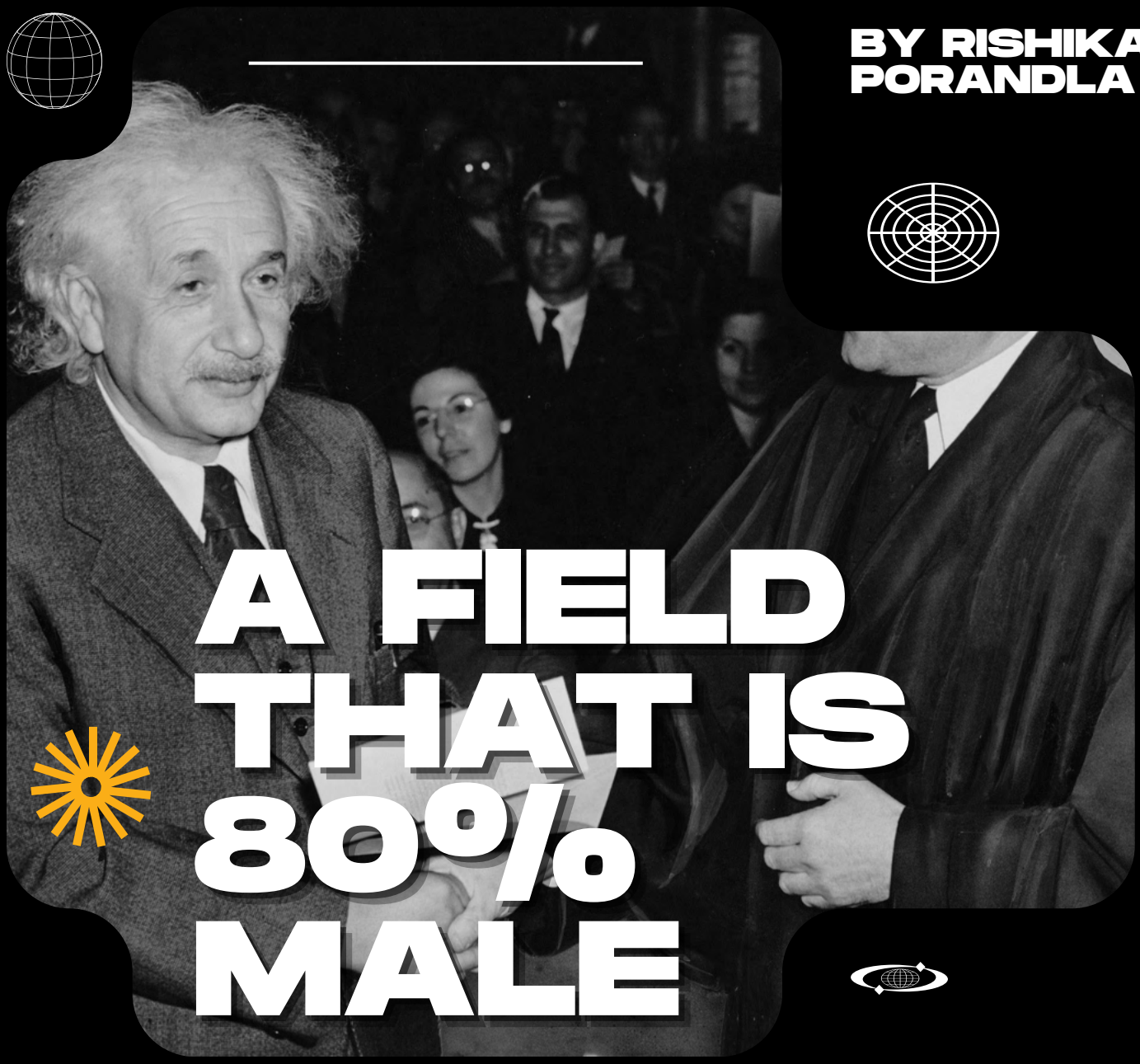
These authors dumbed down quantum physics infinitely and still can't mask the sheer difficulty of it. If I were trying to explain the contents of this textbook to another person, I wouldn't blame them for laughing at me because everything I could possibly put forth would feel unimaginably abstract. You should try explaining quantum decoherence without feeling as if you just made your entire definition up.

Honestly, that scenario isn't far from the truth. Classical mechanics is finite and practical enough for hopeful physicists to understand without straining our minds too much—but quantum succeeds in being the exact opposite. It's difficult to conceptualize something that occurs on particle levels too small for us to visualize accurately, much less quantify those interactions.

Heisenberg's uncertainty principle will never be as easy to write down as Einstein's equivalence principle is. We can forget about even trying with wave-particle duality.

You can find security in one constant state, however. Quantum mechanics can be just as relative as spacetime. No matter how much it is stressed that quantum theory is the truly fundamental, concrete field of physics, its principles are up for interpretation with every physicist. None of them will ever give you the same definition, so give yourself a break.

BY RISHIKA PORANDLA



A FIELD THAT IS 80% MALE

In a high-school environment, the physics gender ratio seems somewhat equal. I can attend an internship or visit a student-led astrophysics seminar and not feel like the isolated minority. I can work with a group of undergraduates, yet still see myself represented in those around me. For those reasons, it took months in the field for me to notice discrepancies. The first conference I attended, where scientific minds ran rampant and the air tasted of theory and complexity, was the first instance where I recognized that the comfort I took for granted as a student does not transfer into academia.

Male physicists, as keynote speakers, commanded the attention of all those in the lecture hall. They could attempt to justify a finding that was more theoretical than quantitative, yet the questions circulating through the room were not "are you sure?" but rather "why is that?"

Following that turbulent presentation, was another by a more academically-distinguished individual. They projected their findings onto the expansive screen behind them and proceeded meticulously through some of the most complex research the conference had sponsored as of late. Their audience was half what their companions had in attendance, and the comments thrown at their feet were more doubtful than they were congratulatory. The woman sighed as the lecture hall lights brightened to signify the end of her session, and her gratification dimmed in the process.

But the field is 80% male, so what can we do?

SUMMER BREAK: TIME TO UNWIND OR TIME TO GRIND?

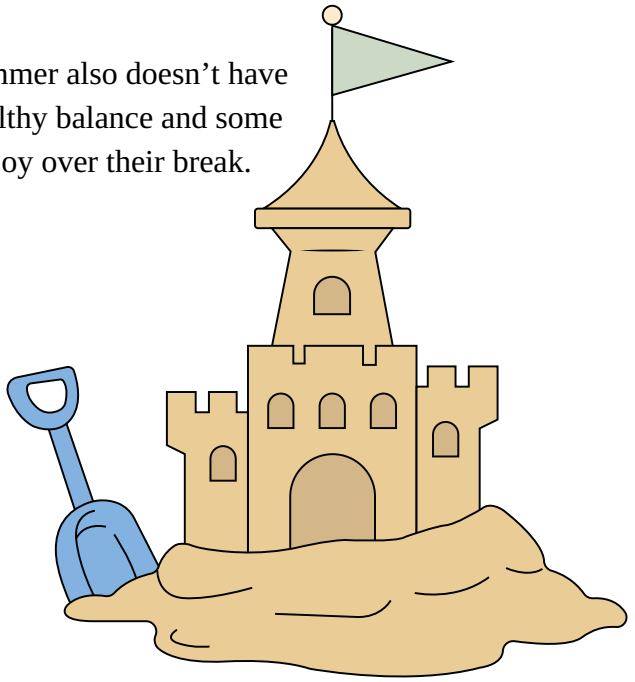
Written By Angel Hu

After a laborious year of frantically cramming for AP classes and exams, adding yet another leadership position and club membership to your ever-growing resume, and pulling together internship applications and research projects before the deadline, the prospect of a two-month break seems like the perfect silver lining on the horizon, right? Unfortunately, the fast-paced, competitive culture of today's workforce has seeped into the mindsets of high school teenagers. We're so used to being overwhelmed by mountains of work that it just feels wrong to have nothing at all.

Thus, with this much free time, we have to fill it with something. For many overachievers, summer is the perfect time to pursue one's extracurriculars, without the nagging need to do hours' worth of school and homework. The mindset is that "if there's nothing for me to do, I'll just find something myself." From volunteering to summer camps to supplemental courses, the grind never seems to stop. The looming cloud of the college admissions process isn't helping either. Stumbling through the weeds and thorns of admission to "prestigious" colleges is a dive into an alphabet soup of summer program acronyms and the words "internship" and "research" constantly floating around.

It's unfortunate that summer break is no longer a time solely to unwind from stress and have fun with family and friends, but a time to boost one's resume. It is possible, however, to have an educationally fulfilling summer while being able to relax. You can learn a new skill or pick up a new hobby – like coding or foreign languages – that ties into your current passions or future field of study. With so many online blogs, documentaries, and resources out there, you're bound to stumble upon an entertaining, eye-opening way to learn, and without the stress of exams attached to your education, you'll be able to intellectually blossom at your own pace. Even if you decide to go down the route of a research internship or a rigorous summer program, make sure to socialize with the people there and balance your work with plenty of rest and play.

Summer doesn't have to be an extension of the school year. Summer also doesn't have to be two empty months to tide over the school year. With a healthy balance and some personal initiative, everyone can find something to learn and enjoy over their break.



ON IMPOSTER SYNDROME IN STEM

Written by Angel Hu

Image Credit: Getty

I've sat in the back of physics classes, too scared to raise my quivering hand. I've participated in math and science competitions with the same thought running through my mind: "I shouldn't have come here. I'm not smart enough for this."

This feeling is all too common for students in STEM, especially women and underrepresented minorities. You don't feel like you belong; you don't feel like you're "smart enough" for the fields that promise to cure cancer or explore the corners of the universe. Imposter syndrome is so prevalent in STEM because of the lofty values it exudes: pure brilliance, raw intelligence, and unparalleled progress. In this bubble of rapid advancement and innovation, you either keep up or risk being exposed as a fraud who simply isn't "cut out" for this. In this zero-sum game, we have no choice but to retreat into fixed mindsets oriented towards perfection and fueled by rampant insecurities.

We've put STEM on such a high, intellectual pedestal that we've forgotten what it truly means.

STEM: the field rooted in experimenting, questioning, and thinking outside the box has become a standard its students must abide by. No invention was created out of thin air; no major breakthrough didn't have its roots in numerous disputes, failures, and contributions. After all, we can learn more from our shortcomings and gain insights from the support of peers and teachers, and the fear of being incorrect or being seen as "unintelligent" only holds us back. Not to mention, STEM is all about constantly challenging and refining our beliefs, so why should the scientific community still hold on to outdated notions like that women aren't good at science?

Whether you're a middle or high schooler just beginning your STEM journey, a college student laying the foundations for STEM research and professions, or a tenured professor with years of experience, it's all too easy to get caught up in the eye-catching notions of prestige, achievement, and brilliance. But when we take a step back and learn to incorporate empathy, communication, and patience into the scientific method, we can all revel in our shared discoveries.

BY RISHIKA PORANDLA

THE REDSHIFTING OF PHYSICS

When I'm asked for the best modern physicist, my thoughts consistently settle on four names. Some of them have been marked in history more than others; others have been ingrained in textbooks more times than some. But, despite the varying nature of their global prominence, I find that they all rank equally in my mind.

The question can be modified slightly, however, and my answer inevitably changes with it. The most resilient physicist? Hawking wins all those awards, and an infinite amount beyond that. The most committed physicist? Feynman will always take that victory in my mind. The most brilliant? Lisa Randall's intellect will forever be unparalleled by her peers. The most ingenious? Brian Greene's celebrated string theory TED Talk can give the answer to that question.

Physics is a broad spectrum, with the creators and refiners of the field stretching that spectrum even further with the range of their thinking. A select few have nurtured their minds into the atmosphere of quantum mechanics, and thus spew out convoluted, innovative theories of particle interactions—all of which are far too abstract for simple-minded humans to conceptualize. Others remain within the bounds of classical knowledge, but expand it far beyond the revelations of Newton and instead curate a definition of gravity that paints it as an illusional consequence of space-time curvature, rather than a fundamental force.

Perhaps I have a inclination toward one of those groups, considering that my four most-loved physicists all partake in the quantum realm more than the classical realm. I'm beginning to believe that popular physics is evolving to one side of the spectrum, away from the Newtonian and Einsteinian ideals we have navigated for decades. I call it the Redshifting of Physics.

TEASERS BEHIND THE SCENES TRANSCRIPTS

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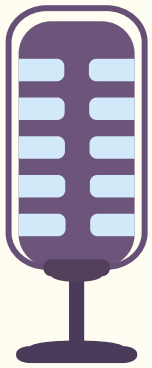
OUR THOUGHTS, IN PODCASTS

Image Credit: NASA/CXC/Univ. of Potsdam/L. Oskinova et al.

Highlights of June 2023: The future scientists of tomorrow discuss their experiences in facing stigmas, learning string theory, delivering TED Talks, and more.

Our Podcast

Conversations with the Future: Season 1 + Transcript Teasers



Episode 01

S01 E01 - Our Future Doctors: Exploring the Latest Developments in Medical Education with Riha Musa

Conversations with the Future | Spacetime Archives by Rishika Porandla

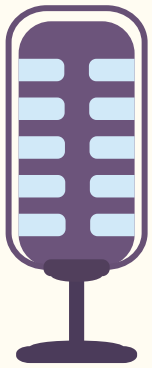
Riha Musa from Spacetime Archives brings you a thought-provoking, honest account of the stigma and tribulations surrounding medical education.

The first word that comes to mind when you think about medical school, dental school, or nursing school is intense. 36 to 48 months of additional schooling along with training after is the amount of time an average health care professional in America studies to earn their respective title. In that time, medical students spend at least 40 - 50 hours studying outside of class. To say the least, medical education is laborious and demanding. As the dropout rate increases over time, the amount of accessibility to proper health care decreases significantly. However, new developments to ease the academic and physical stress are being utilized in classrooms all across the world. So let's take a look at the methods and technologies that will be assisting our future doctors!

But before that, I would like to address education developments that are happening in high schools right now. With every coming year it is apparent that finding a job is getting more and more competitive. To counter this, high schools are introducing career endorsement classes to create highly employable and knowledgeable students.

As a health science student myself, I see new changes in my classroom everyday, especially in my teachers approach to teaching material and technology. For example, instead of dissecting an animal to see its organs and relate them to their human counterparts, we can actually use an online simulation to see the different body systems and their functions whilst viewing them in 3D.

Our Podcast



Conversations with the Future: Season 1+ Transcript Teasers

Episode 02

S01 E02 - Addressing the STEM Superiority Complex with Rishika Porandla

Conversations with the Future | Spacetime Archives by Rishika Porandla

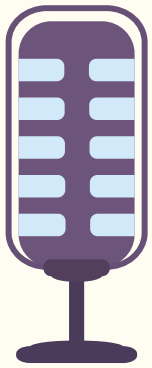
Listen to Rishika's brief take on the interaction between STEM fields and the public image of intellect and competence.

Hi! I'm Rishika, the founder of Spacetime Archives, and today I will be addressing the STEM superiority complex. What epistemological foundation is there for the self-importance and the arrogance in not only individuals themselves but fields of studies as a whole? I'm sure there is a superiority complex for everything. I'm positive that I could enter a publishing house and see that certain employees find that their curated cash-funded bindings surpass the artistic expression in indie self publishers. I'm aware that if I took a diversion through Silicon Valley, I would come across people who saw their companies as the pinnacle of achievement and believed that those with less wealth enjoy being lazy and ineffective.

Nevertheless, I find myself in another environment that stresses ideologies of scientific and technological superiority over the rules of theory, history, arts and literature. The STEM superiority complex is not simply a societal after thought or a consequence of repeated success by scientific visionaries. It's a continually calculated and reinforced construct underpinned by the desire for capital and advancement.

STEM is practical and marketable. Leaders, employers, and innovators all know it. As the path to confronting real world issues, fostering the strenuous tasks of mathematical computation and physical sciences, is idealized and admirable. Most of all, it's reputable.

Our Podcast



Conversations with the Future: Season 1+ Transcript Teasers

Episode 03

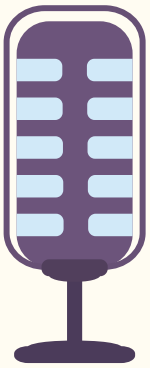
S01 E03 - The Ever-Changing Journey of STEM with Angel Hu

Conversations with the Future | Spacetime Archives by Rishika Porandla

Listen as Angel Hu evaluates her progression through STEM fields and encourages other youth to not fear making the same mistakes and reversals.

As a young student just starting to venture into the world of STEM, from choosing classes to joining clubs to finally picking an answer to the dreaded question "what do you want to study in the future?" the possibility seemed daunting, I still remember the number of times my younger self changed her mind when choosing the subjects, classes, and extracurriculars that would mold her entire future. At first I said I want to do something in the medical field, then I somehow stumbled upon astronomy and then it was just regular physics, and then it was mathematics, and now I am settling on astrophysics, although with some strings attached. I wouldn't have made these changes without the experiences I encountered then, Most of them I would've never imagined when navigating the world of STEM. In the beginning, you tend to have a vision in mind. This is what I need to do in high school (insert whatever career choice I had in mind), I told myself. I remember reading The Elegant Universe by Brian Greene several years back and thinking that I would pursue quantum physics in the future. This would be the beginning of my lifelong journey with physics, I told myself as I launched into physics classes and competitions. Back then, I over inflated my passion, but I didn't know how easily perspectives and situations could change—for both the better and the worse.

Our Podcast



Conversations with the Future: Season 1 + Transcript Teasers

Episode 04

S01 E04 - Environmental Consciousness in a Modern World with Riha Musa

Conversations with the Future | Spacetime Archives by Rishika Porandla

Riha Musa explores interpretations of environmental sustainability and the initiative humans should take to embody their role as Earthkeepers

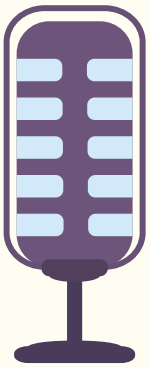
What are Earthkeepers exactly? If you thought they sound a lot like goalkeepers, you wouldn't be wrong. Earthkeepers, much like goalkeepers, seek to their ground: Earth. And if you're wondering who Earth keepers are, they're everyone. I'm an Earthkeeper, you're an earthkeeper. Essentially, all of earth's inhabitants are earthkeepers. Whether you're metal straw fanatic or someone who doesn't know how to recycle, at birth we are all assigned the duty of preserving our planet. This planet does its job by providing us with water, sustenance, and resources and in return we should be seeking to sustain its glorious entities. However, in recent times we haven't been doing our part.

I don't blame anyone for the lack of environmental education globally but I also think that it is wrong for me, someone who has the ability to teach others how to live an environmentally conscious life, to stay silent. So I come here today, hoping to teach anyone listening about just how immense our impact on planet earth is.

Truthfully, we live in a fast paced society that doesn't wait for ecologically-safe decisions but instead praises fast ideas. Convenience is one of the things that come from these fast ideas. Everyone loves convenience, me included. However, are harmful conveniences worth the cost of the ecosystem? It's easy to grab that plastic bag at the groceries, it's easy to just use the single use straw at the cafe, but at what cost?

Our Podcast

Conversations with the Future: Season 1 + Transcript Teasers



Episode 05

S01 E05 - What Good Is STEM Anyway? with Angel Hu

Conversations with the Future | Spacetime Archives by Rishika Porandla

Angel Hu delves into the intersection of the seemingly useful and useless aspects of STEM, justifying the validity of studying scientific fields

We all know that STEM will fuel the future—from the advancements in technology that will bring us to the stars, to how AI has rapidly permeated nearly every part of society, to the unparalleled growth of jobs in computer science and software engineering.

But why is STEM so attractive in the first place? What good is STEM anyway? Of course, we have to address the obvious financial benefits: jobs in the computer science and medical fields are some of the most lucrative and stable. In this case, STEM seems like the easier way out, only if we disregard the complexities and abstract materials that we never fully understood. In school, when delving into these extremely theoretical and complex topics teachers are met with a chorus of "Why do we even have to learn this. It's not going to benefit us in the future." It seems like STEM, along with many other concepts have been split into two dichotomies: useful and useless. And today, usefulness is driven by the amount of profit a field can generate. I mean, why would I choose to pursue a field like theoretical physics, full of dejections and dead ends, instead of something more practical and lucrative—like engineering. It is true for most that learning imaginary numbers and infinite series is another inevitable obstacle on the road to pass a required course. Even for the future STEM majors, it can be hard seeing the value of topics so abstract.

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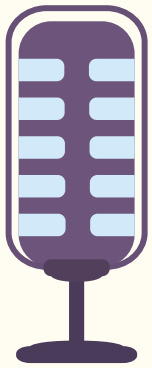

Episode 06

Join an unscripted conversation with Riha Musa about her passions for environmental engineering, oncology, and zoology and her affinity for the growing intersection of STEM and the arts.

Hi everyone, and welcome to this week's podcast episode! This week's podcast is going to be a little bit different in the sense that it'll be more casual and in the fact that I don't have a script in front of me. Quite frankly, this scares me, but I am excited to talk about this week's topic in a more conversational manner.

I wanted to talk to everyone about scientific concepts that mean the most to me and their prevalence in my life.

Now, the ones that mean the most to me are usually because I've been affected by them personally, or those around me have been affected by it personally.

The first concept that comes to mind is the intersection between environmental sciences and engineering. I'm already an engineering student and in class we always discuss things we can design and build to help the world. It always got me thinking about things I care about and how I can help through engineering. If you couldn't tell by my last podcast, I am a really big advocate for environmental consciousness. So, the first thing that always comes to mind is environmental engineering. I don't know how many times I've said this, but our air quality is deteriorating day by day, and this affects me personally because my brother and a lot of people close to me have asthma. Having polluted air can only worsen asthmatic symptoms. I mean, after all the troubles humans face, I feel like being afraid to go out shouldn't be one.

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Episode 07

Explore Riha's experience delivering a TED talk and how her passion, infused with hesitance, drove her to success

Two weeks ago I had the pleasure of being a part of a TEDx event and giving a speech about environmental consciousness. I remember vividly watching the person in front of me and thinking: “How am I supposed to follow that?” They used a range of hand gestures, spoke loudly and clearly, moved across the room, and used a variety of tones. But most importantly, they captured the audience. I nervously looked to bear witness to the amazed audience right behind me. As my name was called, recollections of the moments that led up to that moment played in my mind. Starting from the first brainstorming session all the way up to final rehearsals, I remember thinking “Why am I doing this?” I was not a public speaker at any point in my life so why now? Why spend months preparing to be something I was not?

For those of you that have the notion that only extroverted and talkative people can do a public speech, I don’t deny that it may be easier for that array. But, anyone with an idea that should be shared can and most definitely should speak publicly.

I blink a lot by nature; it makes it appear as though I’m more nervous than I actually seem. I vividly recall squirting eye drops every 6 hours into my eyes to combat this, but my nervous nature still protruded even with all the devising and practicing. Then, it hit me, the reason why I chose to put myself out there—why I chose to dedicate months of my sophomore year to this. I had a message. Regardless of who was in the audience or who even chose to listen to my speech, I had something I needed to say to the world.

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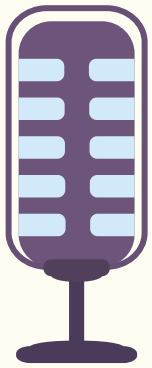


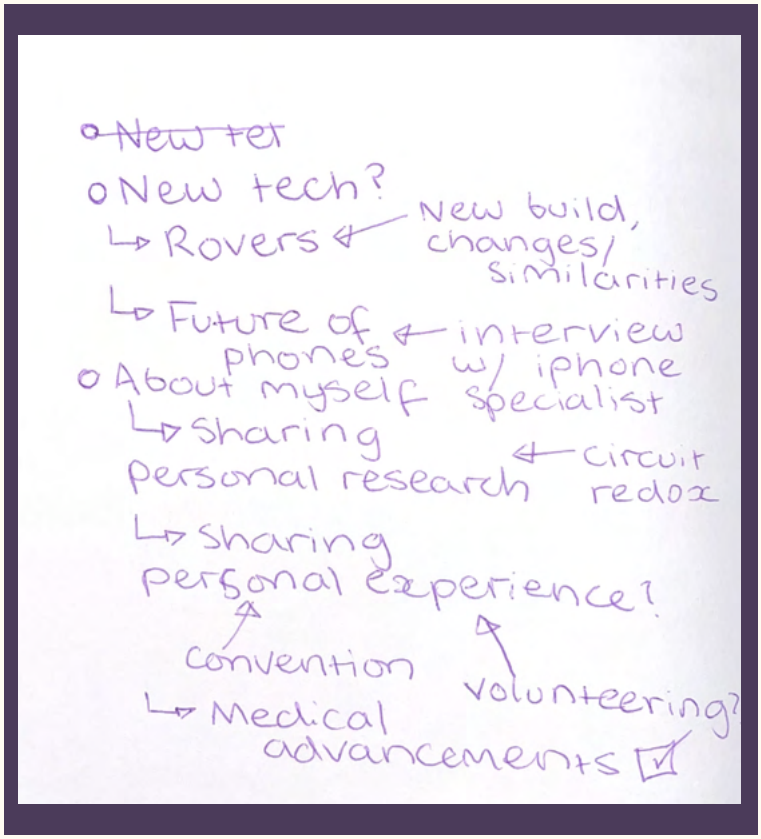
Episode 08

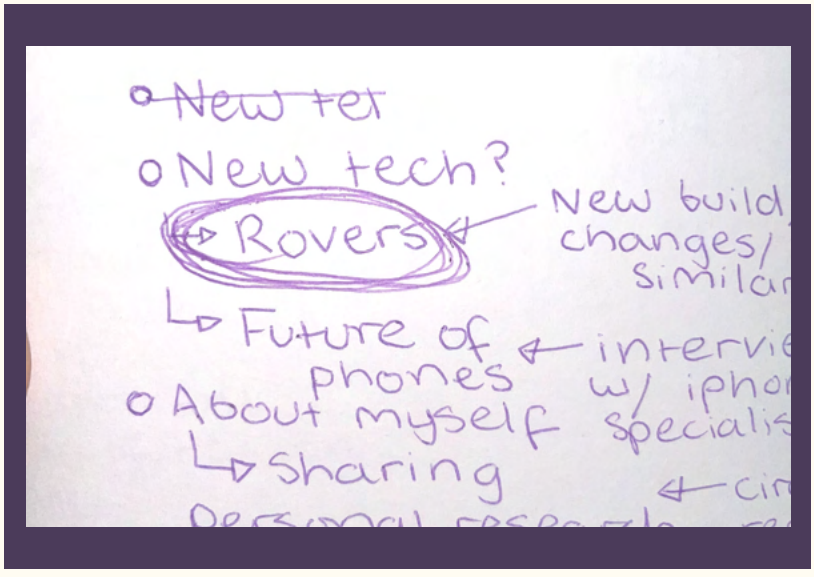
Listen to Rishika's 8 minute explanation of string theory and its importance to the future of physics, exploring the intersection of gravity and quantum forces and why physicists even care about it.

How many dimensions do you think there are? Pragmatically, we would say three, because that's what we humans experience here on earth. We can move forward-backward, up-down, left-right. Those are the three different dimensions—an x, y and z axis—and then if you wanted to expand your outlook a little more and you wanted to not only consider spatial dimensions, you could also say time is a dimension. This is true because the universe is expanding, the earth is moving, our galaxies are moving. So technically, the position that I am at right now, I cannot say that I will be in this exact position five minutes from now because my position is not absolute or fixed. It is relative to something else.

Listen to our full podcast episodes at spacetimearchives.com

Podcast: Behind the Scenes

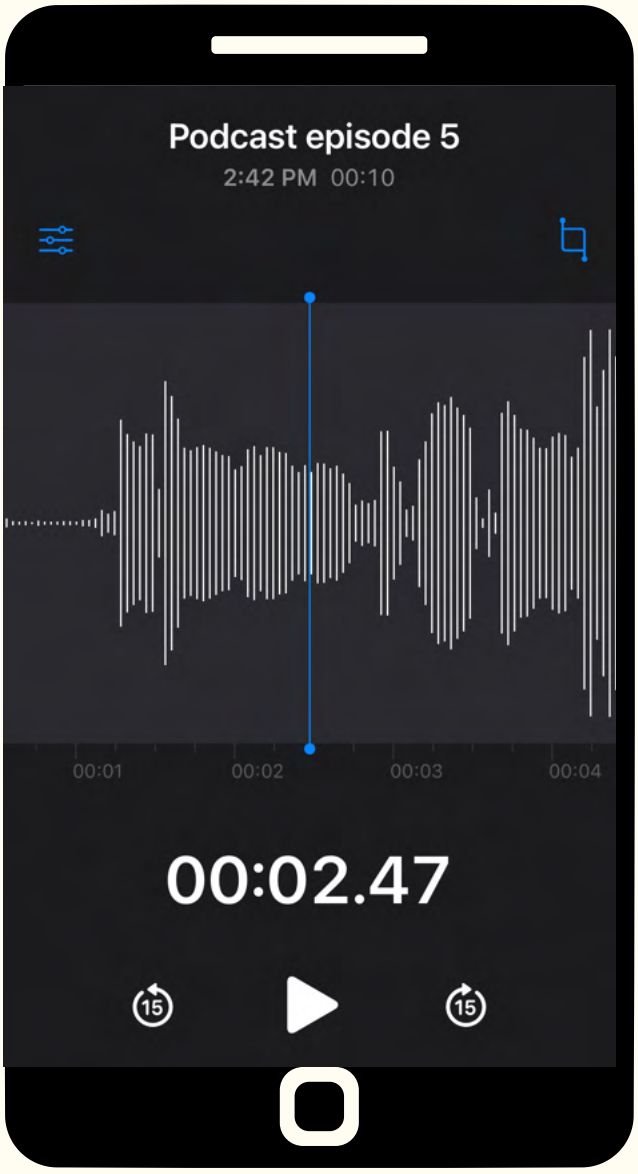




1. Brainstorming

No two podcasts can be alike, which is why before producing an episode our podcasters go through an ideation process to create a riveting and depthful topic worth sharing with our listeners. Though our podcast topics are rooted in science, the podcasts themselves are in an artistic format which create a seamless and beautiful symposium of both the sciences and arts. Once a topic is picked, our hosts often write a "loose script" filled with talking points to give structure to each and every episode. Every episode is given careful thought and produced with the best quality possible.

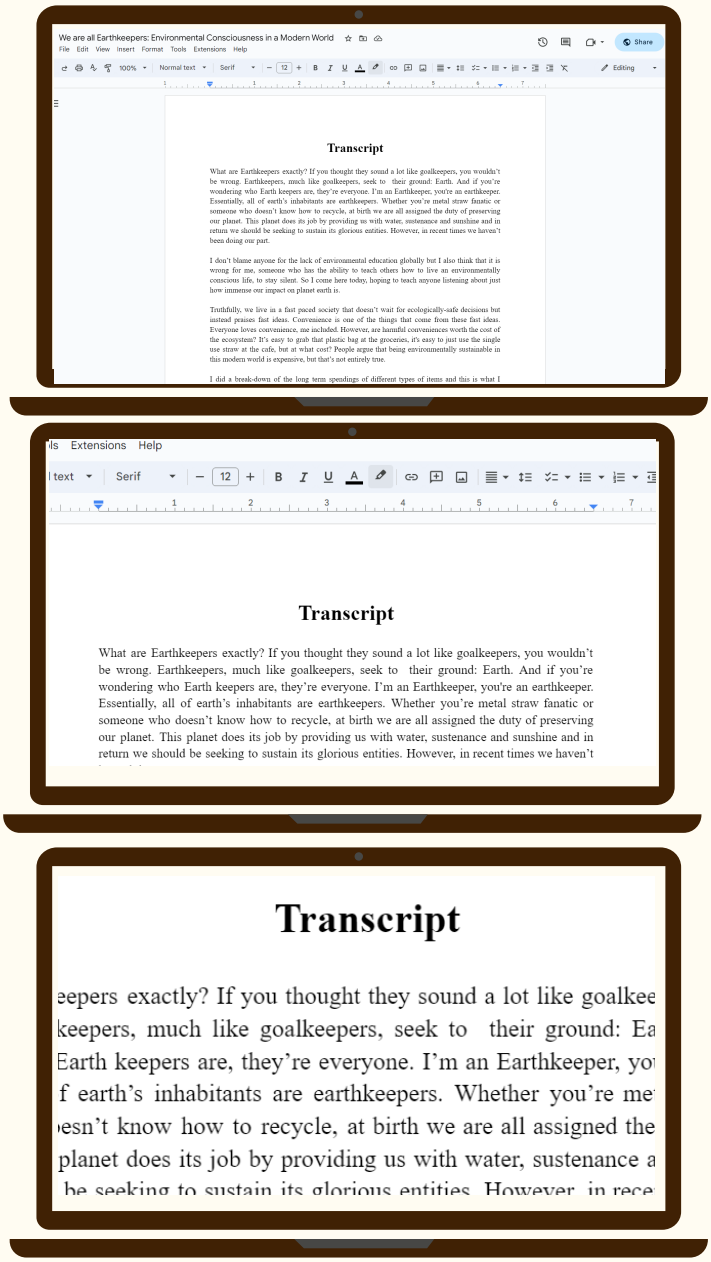
Podcast: Behind the Scenes



2. Recording

When recording our podcasts, we encourage the episodes' hosts to speak to engage-tone inflection and enthusiasm are crucial to building meaningful connections with the listeners. Through our unique content format our podcasts often emphasize key points, create suspense, convey excitement, and evoke empathy. Our voices continue to contribute to the STEM space, serving as one of the exclusive science based podcasts that adapt an artistic format of delivery.

Podcast: Behind the Scenes



3. Transcript

Although podcasts are traditionally presented in audio files, we recognize the importance of inclusivity and accessibility. This is why we also take the initiative to write transcripts because we believe that everyone should have access to the intelligent conversations of the future. By offering both audio and written formats, we strive to empower individuals from various backgrounds to engage with our content, contribute to the conversation, and expand their horizons.

GAMES & ACTIVITIES

Image Credit: NASA/CXC/SAO/van Weeren et al

Highlights of June 2023: The future scientists of tomorrow discuss their experiences in facing stigmas, learning string theory, delivering TED Talks, and more.

VOLUME 1

SPACE WORD SEARCH

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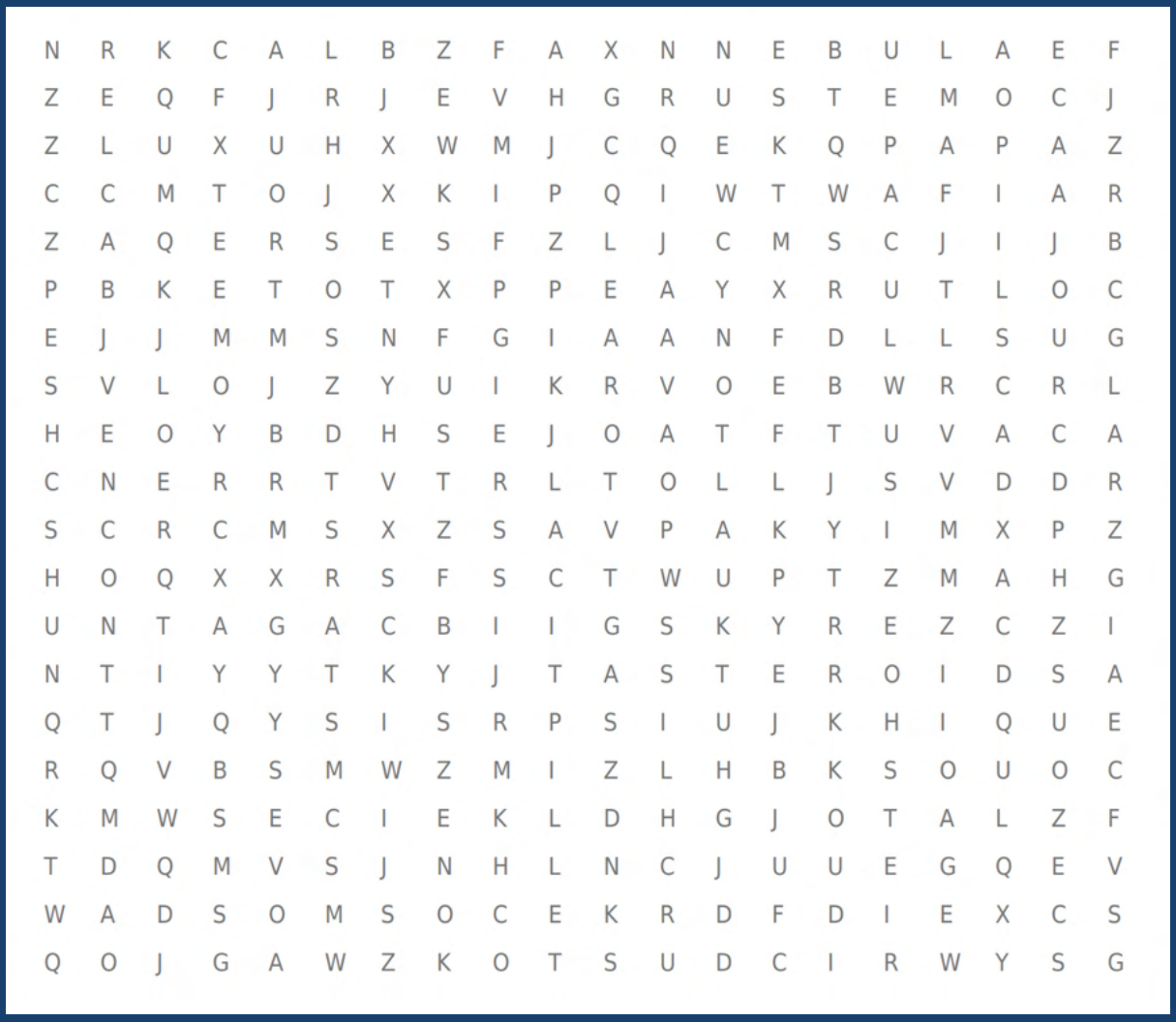

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W A D S O M S O C E K R D F D I E X C S
Q O J G A W Z K O T S U D C I R W Y S G

WORD BANK

1. dust
2. spiral
3. comets
4. cosmos
5. moons
6. planets
7. neutron
8. nebulae
9. elliptical
10. stars
11. holes
12. black
13. starsystem
14. gravity
15. cluster
16. asteroids

VOLUME 1

STA CROSSWORD

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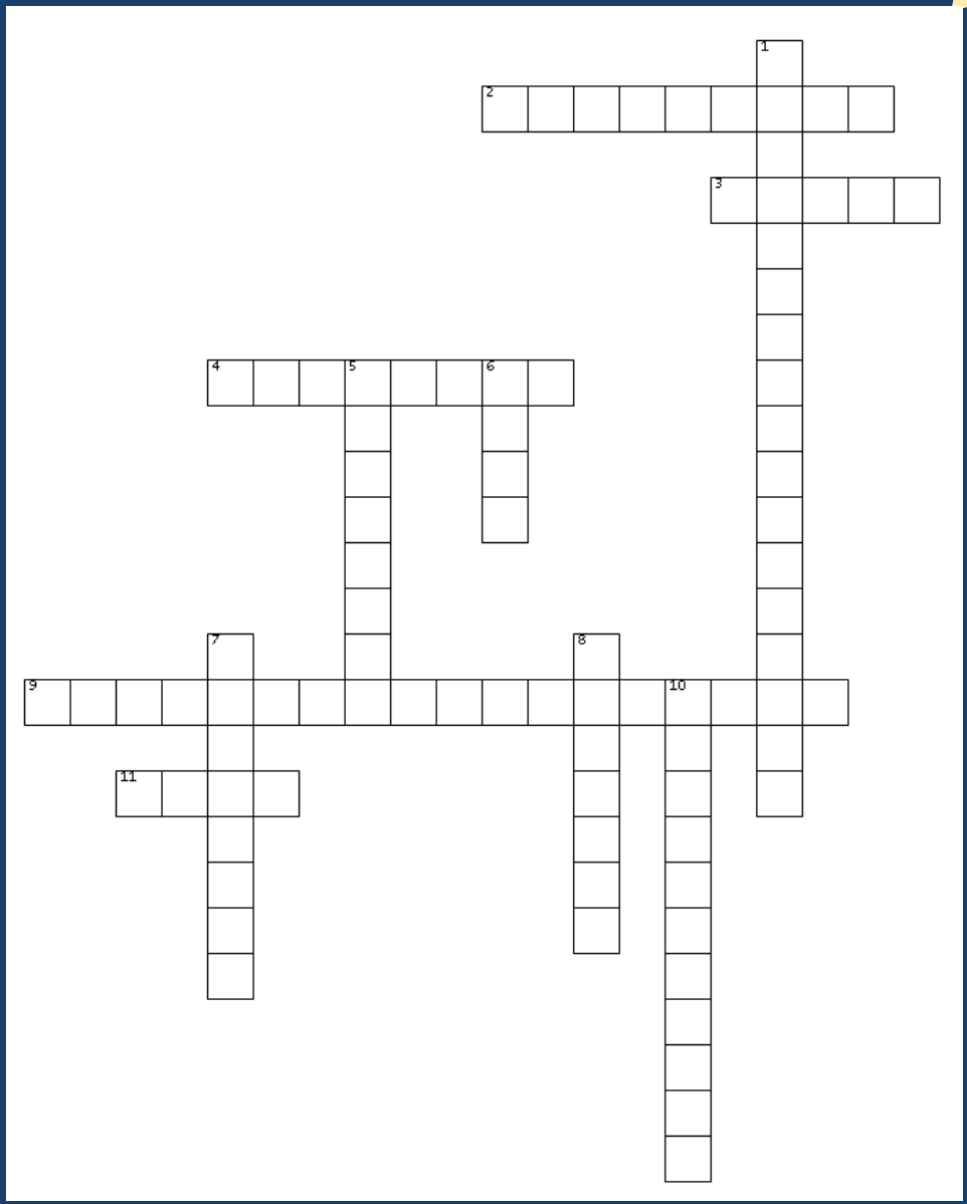

ACROSS

2. in charge of monthly initiatives
3. stream-of-conscious
4. get a refresher through peer instruction
9. work with mentors under a research program
11. in collaboration with

DOWN

1. planning ahead and/or polishing current education
5. how'd you hear about us
6. stay up to date
7. seasonal publishing
8. listen in on our thoughts
10. initiative for academic review through video lectures

VOLUME 1

EXPLORE THE COSMOS CROSSWORD

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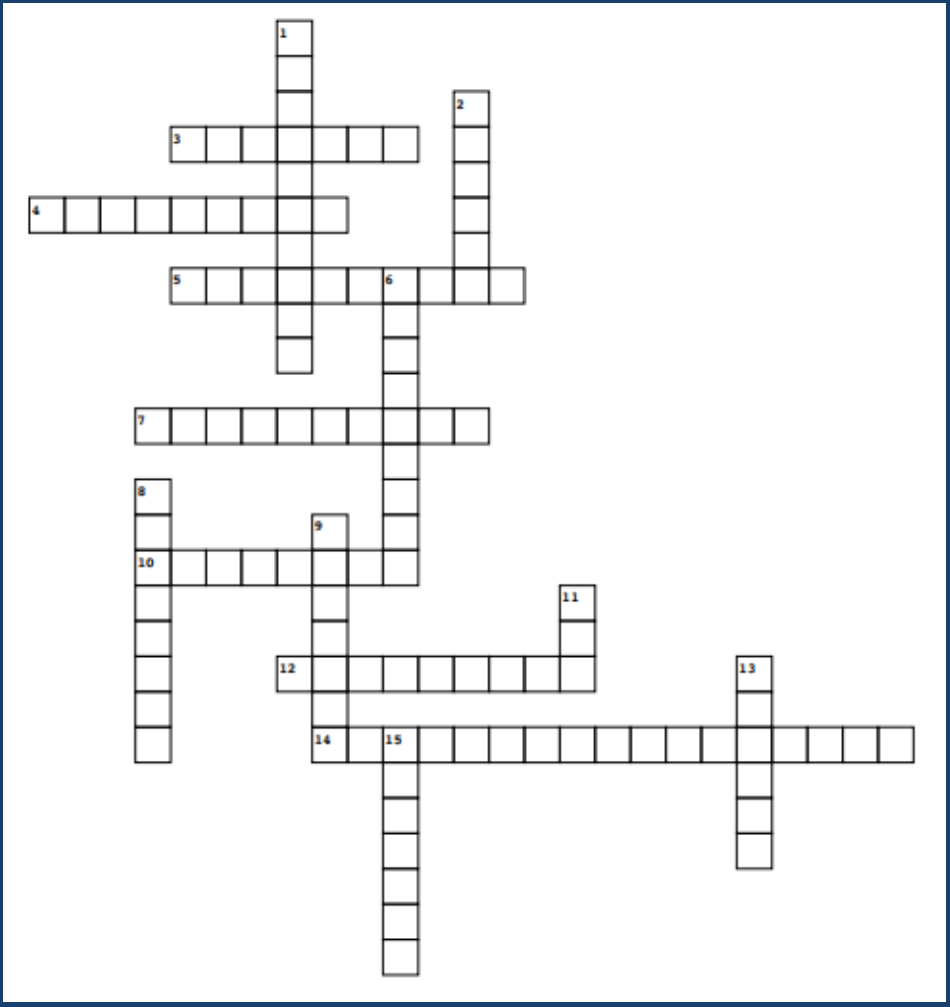

Across

3. Theoretical physicist who discovered that black holes emit radiation

4. Distance light travels in a year

5. Alternate universes

7. Law that states the universe is expanding

10. Galaxies moving away from us

12. Space telescope launched in 2021 taking infrared images

14. Ripples caused by warps in the fabric of spacetime

Down

1. Material postulated to make up 85% of the universe; holds galaxies together

2. Brightest star in the sky

6. Planet outside the Solar System

8. Theoretical structure connecting two points in spacetime

9. It all started with the _____

11. Background radiation in the universe (abbreviation)

13. Rotating neutron star

15. Mission to the Moon with the first woman and person of color

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ASTROPHYSICS

STEM & ART

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