

NASA SCIENCE ACTIVATION

Presentation to Committee on
Astrobiology and Planetary Sciences
24-26 October 2023

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Agenda

- Introduction to Science Activation
 - Metrics of Success
 - Learning/Logic Model
 - History
- Benefits to Planetary Science and Astrobiology
- Meeting Future Needs - 2024 Solar Eclipse, Science Activation 3.0
- Discussion



What is Science Activation?

A rigorous, scientifically-driven, nationwide program to connect learners of all ages with NASA Science most effectively and efficiently

Our Collective Vision:

By 2025, to increase learners' (of all ages) active participation in the advancement of human knowledge

National Aeronautics and
Space Administration



2022 | NASA SCIENCE ACTIVATION

IMPACT REPORT



<https://science.nasa.gov/learners>

Relationships Lead to Results

Science Activation by the Numbers - 2023



We
Collaborate

50

active teams

We Leverage

525

partnerships

We Connect

745

scientists
involved

We Innovate

121

papers published

We Provide

1133

learning
resources

We Engage

52 M

learner
interactions

We Reach

55

states &
territories

We Empower

100%

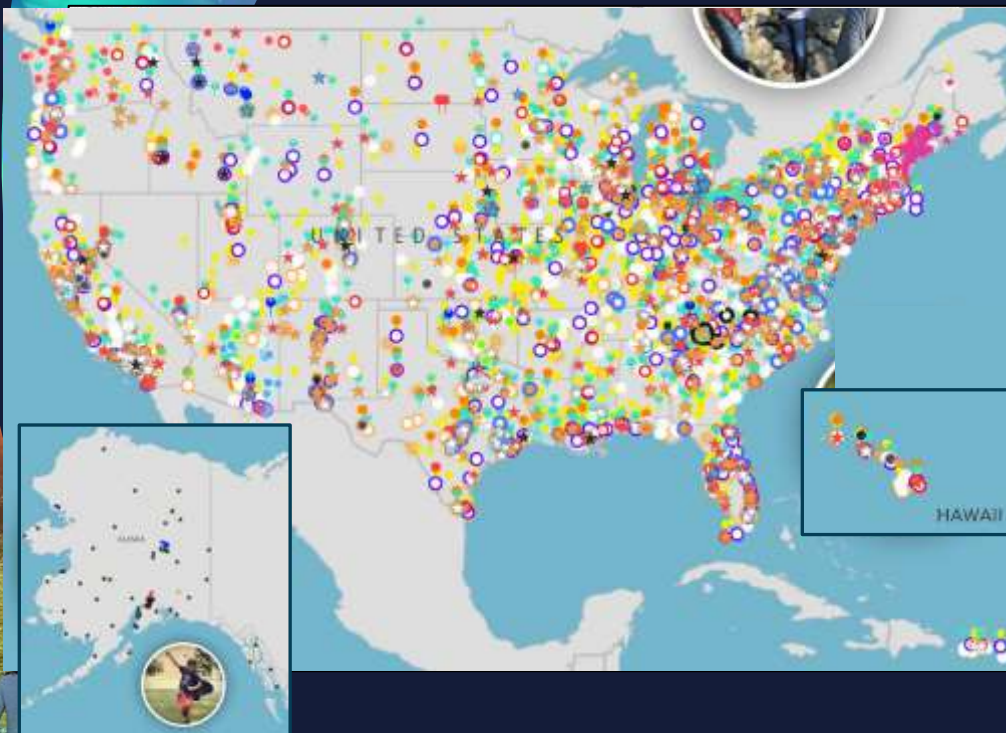
communities



Science Activation (SciAct)

Involving Learners of All Ages Across the Nation in the Active Participation in the Advancement of Human Knowledge

Figure illustrates the US reach of the SciAct program in 2022



<https://science.nasa.gov/learn>

Strategic Objective - Enable NASA science experts and content to engage more effectively and efficiently with learners of all ages

Major Activities

- 50 community-based, competitively selected teams and infrastructure activities develop audience-focused learning resources
- Half of portfolio focuses on particular underserved audiences:
 - Native American nations in OK, AK, NM, NC, ME
 - Learners on the Autism Spectrum
 - People who are blind or have low vision
 - Community college students (48 in the network)
- 10 projects with a Climate, Earth systems, and/or Earth data focus
- 6 projects with a Planetary science focus
- 4 projects focused on Subject Matter Expert (SME) engagement
- 121 publications so far, cited over 1000 times to date
- Vast and growing collection of resources for learning.

Entire portfolio involved in Broadening Participation

Science Activation – Summary



What It Is - Rigorous

- Guided by NASEM Decadals, NASA Science Plan, and NASEM 2020 Assessment
- Learner and community-centric, based on evidence of need, e.g., how can NASA Science support them?
- Network of 37 competitively-selected cooperative agreements plus 13 NASA infrastructure teams and their corresponding partners to connect science content, SMEs with learners
- Both a Collaborative and Innovation Model that encourages scaling and room for adaptation. This philosophy served us well over the pandemic
- All have independent evaluators! Teams must meet established metrics of success. Also a Portfolio-level evaluator

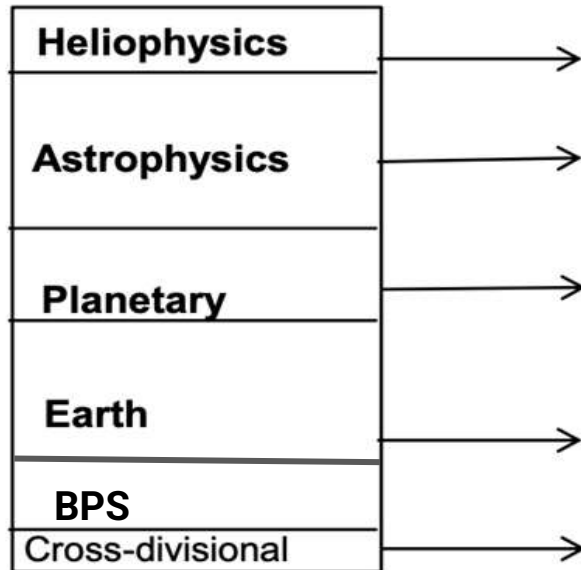
What It Is Not -

- Not the Department of Education- formal “education”, e.g., curriculum, education research/ technology
- Not NASA mission-centric- 1% of mission funded anymore. However, can still fund outreach per SPD 26B
- Not NSF - fundamental educational research
- Not “best efforts” grants

SMD Science Activation Model



SMD Assets (Content, SME's, etc) *



Science Activation Provider(s)



Outcomes to Meet these SMD Science Activation Objectives

Enable STEM Education

Improve U.S. Science Literacy

Advance National Education Goals

Leverage Through Partnerships

Evaluation

Partnering Opportunities

Kania, J., & Kramer, M. (2011). Collective impact. Stanford Social Innovation Review, 9: 36–41. Retrieved from https://ssir.org/articles/entry/collective_impact



2023-2024 Conferences At-a-Glance

As of Sep 21, 2023
Yellow = Deadlines
Approaching

Sep	Oct		Nov	Dec	Jan	Feb	March		April	May
Annual National Historically Black Colleges & Univ Week Sep 24-28 Arlington, VA	55th AAS Division of Planetary Science Oct1-6 San Antonio, TX	School Science and Mathematics Association Oct 18-21 Colorado Springs, CO	National Association for Interpretation Nov 7-11 Little Rock, AR	American Geophysical Union Dec 11-15 San Francisco, CA	American Assoc of Physics Teachers Winter Meeting Jan 6-9 New Orleans, LA	American Camp Association National Conf Feb 6-9 New Orleans, LA	SXSW EDU Mar 4-7 Austin, TX	Nat'l Science Teaching Assoc Conf on Science Educ Mar 20-23 Denver, CO	American Educational Research Assoc April 11-14 Philadelphia, PA	Astrobiology Science Conference May 5-10 Providence, RI
AAS Solar Eclipse Planning Workshop Sep 29-30 San Antonio, TX	Association of Science and Technology Centers Oct 7-10 Charlotte, NC	Inclusive SciComm Symposium Oct 19-21 Kingston, RI	Out in STEM Nov 9-12 Anaheim, CA		AAS 243 Jan 7-11 New Orleans, LA	National Council of Teachers of Mathematics Feb 7-9 Seattle, WA	Internat'l Tech & Engineering Educators Assoc Mar 6-9 Memphis, TN	Nat'l Society of Black Engineers Mar 20-24 Atlanta, GA		Assoc of Children's Museums Interactivity May 15-17 Madison, WI
	9th Annual HBCU Climate Change Oct 11-15 New Orleans, LA	National Council of Teachers of Mathematics Oct 25-28 Washington DC	National Society of Black Physicists Annual Nov 9-12 Knoxville, TN		YouCubed Mathematics Leadership Summit Jan 23-24 Stanford, CA	Space Center Houston's Space Exploration Educators Conf. Feb 8-10 Houston, TX	Tri-State CAMP Conference Mar 12-14 Atlantic City, NJ			American Alliance of Museums May 16-19 Baltimore, MD
	Geological Society of America Connects Oct 15-18 Pittsburgh, PA	Society for Adv. of Chicanos & Native Americans in Science - Diversity in STEM Oct 26-28 Portland, OR	NASA Science Activation Nov 13-17 Leesburg, VA		104th American Meteorological Society Jan 28 - Feb 1 Baltimore, MD	American Assoc for the Adv of Science Feb 15-17 Denver, CO	Nat'l Assoc for Research in Science Teaching Mar 17-20 Denver, CO			
	National Indian Education Association & Educator Day Oct 18-21 Albuquerque, NM	Connected Learning Summit Oct 26-28 Virtual	American Society for Gravitational & Space Research Nov 14-18 Washington DC				Nat'l Afterschool Assoc Annual Convention Mar 17-20 Dallas, TX			



Learning Standards Alignments

- Earth and Space Science
- Physical Science
- Life Science



Astrophysics Standards Alignments



Heliophysics Standards Alignments



Earth Science Standards Alignments



Planetary Science Standards Alignments



Biological and Physical Science Standards
Alignments
(Coming Soon)



Astrobiology Standards Alignments

Big Picture Context: How we got here



- 1990s: Culture shift to 1% Mission EPO policy
- 2013: OMB budget action **exposes duplication and lack of impact**
- 2014: SMD AA+DDs re-envision approach ⇔ **Science Activation**
- 2015: Initial CAN competition
- 2016: SciAct 1.0 kickoff – 27 projects competitively selected
- 2017: Total Solar Eclipse across North America ⇔ **>88% of US adults engaged**
- 2019: National Academies assessment ⇔ **Model validated**
- 2020: SciAct delivers ⇔ **> 23M learning interactions/112 countries**
- 2021: SciAct 2.0 begins; ROSES-20,21 gap-filling Call (SME's, DEIA, Eclipse, Data)
- 2022: **52M learning interactions/153 countries**
- 2023/2024: Solar Eclipses across US
- FY 2024: Next National Academies Assessment
- 2025: 10-year mark. Assessment of next steps.



Progress on 2020 NASEM Recommendations – All Green – Either Completed or Ongoing Efforts



Progress on NASEM Recommendations

1. **Visioning process:** PI meetings held Dec. 2019; and April 2020 to engage in visioning. Revisiting at annual meetings to continually factor in new advances and changes. ONGOING
2. **Measurable outcomes:** Agreed upon set of Mid-Level Objectives finalized May 2021. COMPLETED
3. **Coordinated learning network:** Workshop at Nov. 2020 annual meeting continued network development begun in 2017. Fall 2021 award to MIT Media Lab providing additional best practices, insights, and “glue” for the network. COMPLETED
4. **Critically review and guide existing projects, be explicit about the rationale and criteria for including new projects:** Implemented in ROSES-20/21 and 2.0 extension processes. **Underserved communities:** Major focus of ROSES-20/21 solicitation and awards. 1/3 of portfolio now addressing this challenge. Goal to increase by 2024. COMPLETED
5. **Broadening participation [...] beyond counting numbers of individuals:** Focused awards from ROSES-20, and additional selections planned from ROSES-21 to deeply and intentionally reach underserved communities. ONGOING
6. **Dialogue with NASA Science Mission Directorate’s missions and scientists:** 4 ROSES-20 awards focused on SME audience. Processes in place to develop and improve internal SMD communication products and processes, external website and social. ONGOING
7. **Independent mechanism to obtain ongoing, real-time advice:** Regular check-ins with NASEM to periodically update our understanding of the education ecosystem, including through support of new equity study. Meet quarterly and NASEM presents at annual meeting. ONGOING
- 7a. **Portfolio-level evaluation:** Competitively-selected Pacific Research & Evaluation Fall 2020 through “simplified” acquisition process. Tremendous value add in bringing fresh perspective on portfolio, challenges, and opportunities. COMPLETED

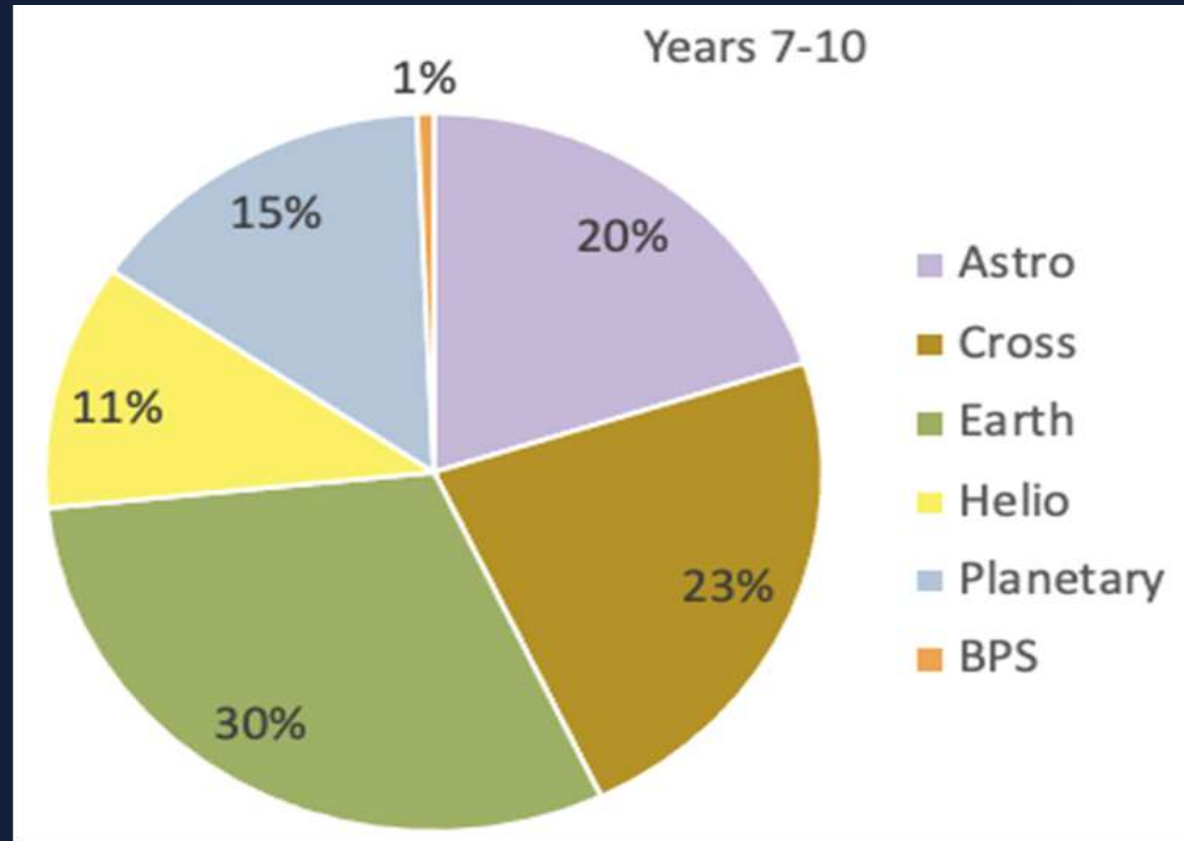
Planetary Science and Astrobiology Focus



The 2020 NASEM Assessment observed SciAct should better connect to NASA missions - e.g., mission scientists are generally unaware of SciAct and what it is/could do to convey mission science. Planetary Science Decadal also identified the need. SciAct issued ROSES Call and in response awarded/augmented:

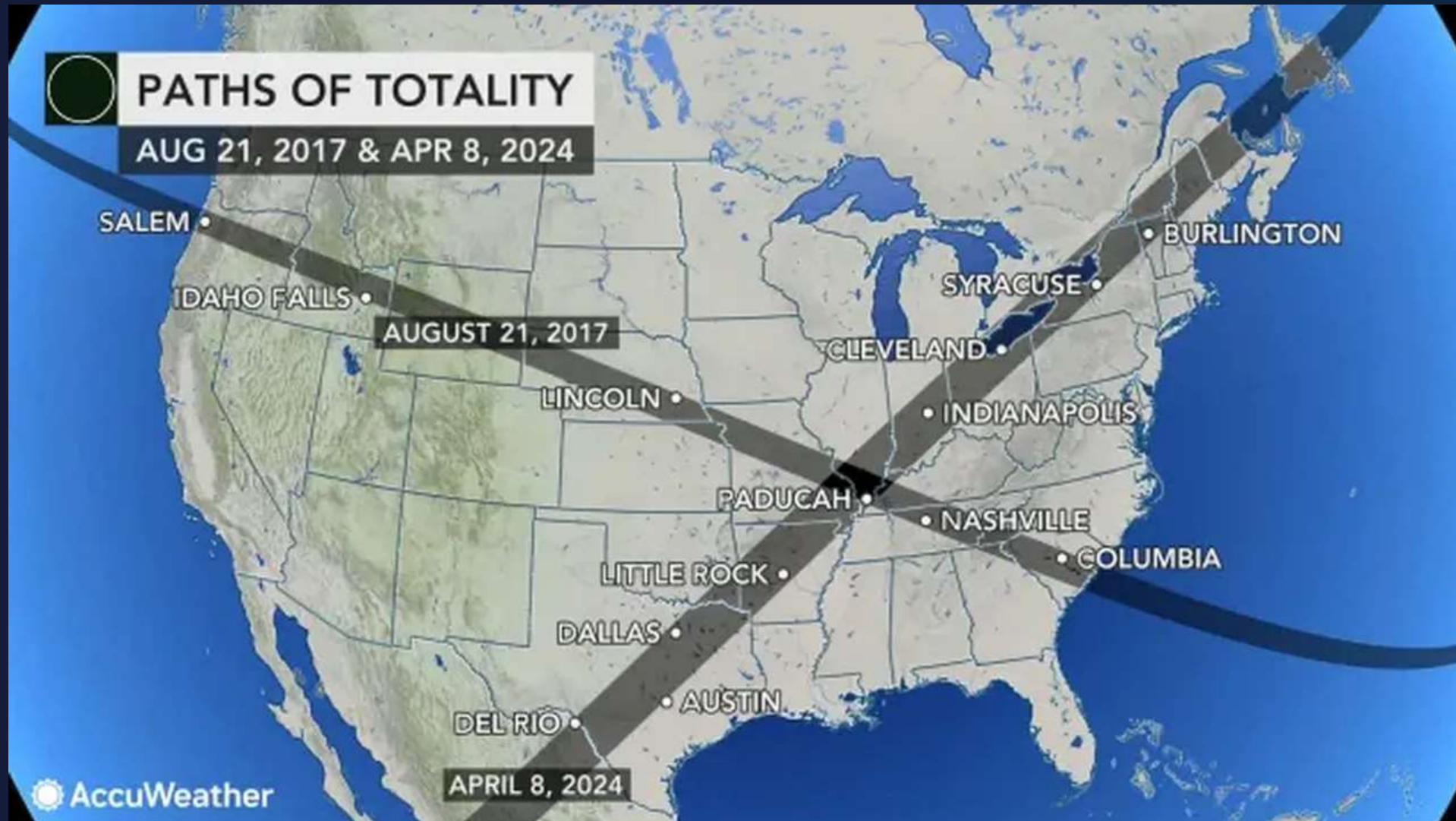
- [Infiniscope](#) (ASU) - Infiniscope produces web-deliverable, digital experiences that tie to NASA science to promote active learning at the middle school/high school/intro college level. See pages 50-51 of ([2022 Impact Report](#)). New suite, launching mid-2024, targets Mars exploration and Europa exploration
- [SCoPE](#) (ASU) - Connecting science/engineering subject matter experts with NASA education experts. (See pages 48-49 of [2022 Impact Report](#)) 7 New Grantees just awarded!
- [Planetary ReaCH](#) (LPI) -Empowering planetary experts (content heroes) to better engage Black & Latinx audiences (See pages 74-75 of [2022 Impact Report](#)) Will be in Puerto Rico in Nov!
- [PLANETS](#) - Integrating NASA planetary science/engineering into out-of-school time learning. (See pages 72-73 of [2022 Impact Report](#))
- [Treks](#) - Enabling learners to explore planetary surfaces in an interactive online platform

Planetary Science and Cross-Divisional is 38% of Portfolio



**Budget Comparison: By
Major Content**

Solar Eclipse April 8, 2024: Where Will YOU Be?





NASA Priorities for 2024 Total Solar Eclipse

- Safety
- Broadening Participation
- Science
- Public Engagement
- Science Activation
- Citizen Science





ECLIPSE SOUNDING ROCKETS

Three instrumented rockets are launching during both the annular and total solar eclipses.

Launch Sequence

- **Rocket 1:** launching ~35 minutes before peak eclipse
- **Rocket 2:** launching at peak eclipse
- **Rocket 3:** launching ~35 minutes after peak eclipse

Objectives

- Explore how the eclipse shadow promotes irregularities in the ionosphere
- Understand how the ionosphere responds to local changes in density, temperature, and conductivity
- Assess how lower atmosphere cooling due to the eclipse impacts ionospheric dynamics

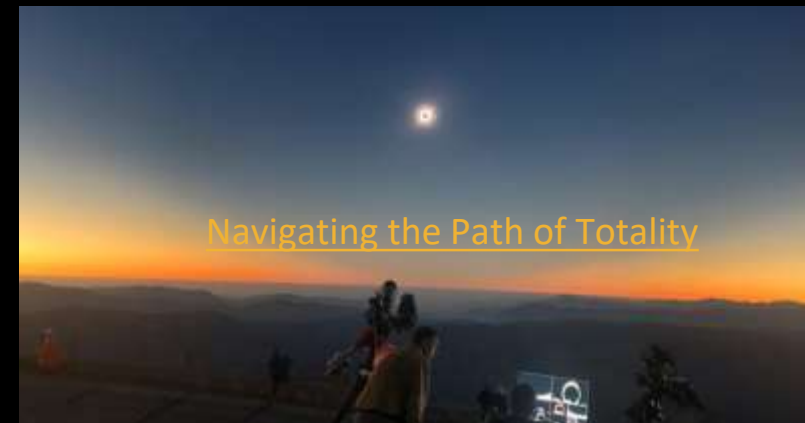
Eclipse-Focused NASA Science Activation Projects



Heliophysics Education Activation Team
(NASA HEAT)



Eclipse
Ambassadors



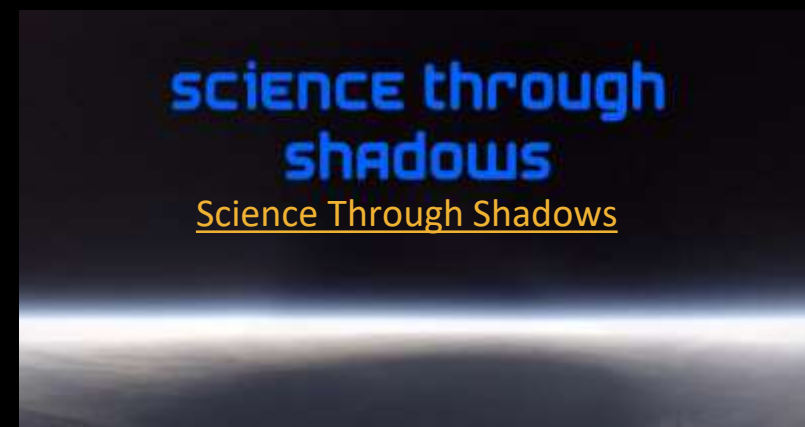
Navigating the Path of Totality



The Eclipse Soundscapes Citizen Science Project



Earth to Sky (ETS)



**science through
shadows**

Science Through Shadows



Eclipse Ballooning



Aurorasaurus



GLOBE Observer



Early Results and Images - Annular



(Balloon Fiesta Credit H. Hanson)



Exploratorium telescope feed!!!

Over 6 million views!

AND featured on the digital version of the New York Times! Among many other locations!

https://www.youtube.com/watch?v=_juWnYZoruU

Solar System Treks and SSERVI!



Credit: B. Day

Annular Solar Eclipse: Oct 14, 2023 – NASA Solar System Treks and SSERVI
Petroglyph National Monument

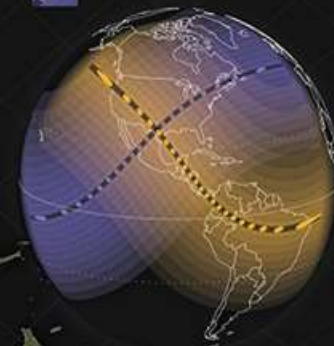


Eclipse Images by Brian Day



Earth to Sky enabled NASA representation at the following National Parks:

- Mesa Verde National Park
- Hovenweep National Monument
- Bears Ears National Monument
- Canyonlands National Park
- Natural Bridges National Monument
- Great Basin National Park





A Perspective:

“The goal is getting students into STEM, not to market NASA missions.”

Grace Hu/OMB

HIGH SCHOOL

- ∞ GL4HS: GeneLab for High School Students
- ∞ STEM Enhancement in Earth Science (SEES) High School Summer Intern Program

GRADUATE

- ∞ International Astronautical Congress
- ∞ Future Investigators in NASA Earth & Space Science & Technology (FINESST)
- ∞ NASA Space Technology Graduate Research Opportunities
- ∞ National Space Grant College & Fellowship Project
- ∞ NASA Fellowship Activity
- ∞ NASA Internships
- ∞ NASA International Internships
- ∞ NASA JPL Internships
- ∞ NASA Science Mission Design Schools
- ∞ Pathways Recent Grad Program

NASA SCIENCE CONTINUING OPPORTUNITIES

- ∞ NASA JPL/CalTech
- ∞ NASA Job Opportunities
- ∞ Presidential Management Fellows
- ∞ NASA's STAR Program
- ∞ NASA DEVELOP Program
- ∞ NASA Citizen Science

UNDERGRADUATE

- ∞ Blue Marble Young Scientist Program
- ∞ National Space Grant College & Fellowship Project
- ∞ NASA Internships
- ∞ NASA International Internships
- ∞ NASA JPL Internships
- ∞ Space Life Sciences Training Program (SLSTP)
- ∞ Pathways Internship Program
- ∞ L'SPACE Academy
- ∞ USRA Scholarship Awards
- ∞ NASA Student Airborne Research Program (SARP)
- ∞ Summer Undergraduate Program for Planetary Research (SUPPR)
- ∞ SETI Research Experience for Undergraduates (REU)
- ∞ Lunar and Planetary Science Summer Intern Program

POSTDOCTORAL

- ∞ NASA Postdoctoral Program (NPP)
- ∞ NASA Hubble Fellowship Program
- ∞ Roman Tech Fellowship in Astrophysics
- ∞ Jack Eddy Postdoctoral Fellowships
- ∞ NASA JPL Postdoc Program
- ∞ Space Radiation Studies
- ∞ NASA Science Mission Design Schools

Last update 11/4/22

<https://science.nasa.gov/learn/learner-opportunities>



What is Next Step towards Science Activation 3.0?

The 2024 National Academies Assessment will help inform prioritized collective impacts, guide new areas of community and learner-based efforts, and target new audiences and areas of collaboration—all while ensuring broad participation equitably



Late-Breaking - People

- Quanzhi Ye Wins Prestigious DPS Harold C. Urey Prize
- Carolina Carnalla-Martinez - New Ciencia Coordinator for NASA Science

Questions? Discussion?



Reference Information



NASA Core Values + Science Activation Application

January 2023 Update

- **Safety/Health** - We recognize this as NASA's number one core value
- **Excellence**
 - **Rigor** – We use evidence and work toward audience-based solutions
 - **Innovation** – We look for novel ideas to improve our practices
- **Integrity**
 - **Public Value** – We seek to add value in all our activities
- **Teamwork**
 - **Partnerships** – We leverage connections to amplify our impact
- **Inclusion**
 - **Broadening Participation** – We strive to share NASA science for the benefit of all



Science Activation Group Norms

March 2022 Update

- **Mutual Respect** – We respect each other and value each others' perspective
- **Reciprocity** – We take care of ourselves so we can also care for others
- **Openness** – We listen first and assume positive intent from others
- **Accountability** – We take full responsibility for our words/actions
- **Humility** – We own our limitations of perspective and seek others' viewpoints
- **Kindness** – We are kind to each other, even when we disagree
- **Collaboration** – We work together to achieve common goals and objectives

KEY SCIENCE THEMES*



**PROTECT AND
IMPROVE LIFE ON
EARTH AND IN SPACE**

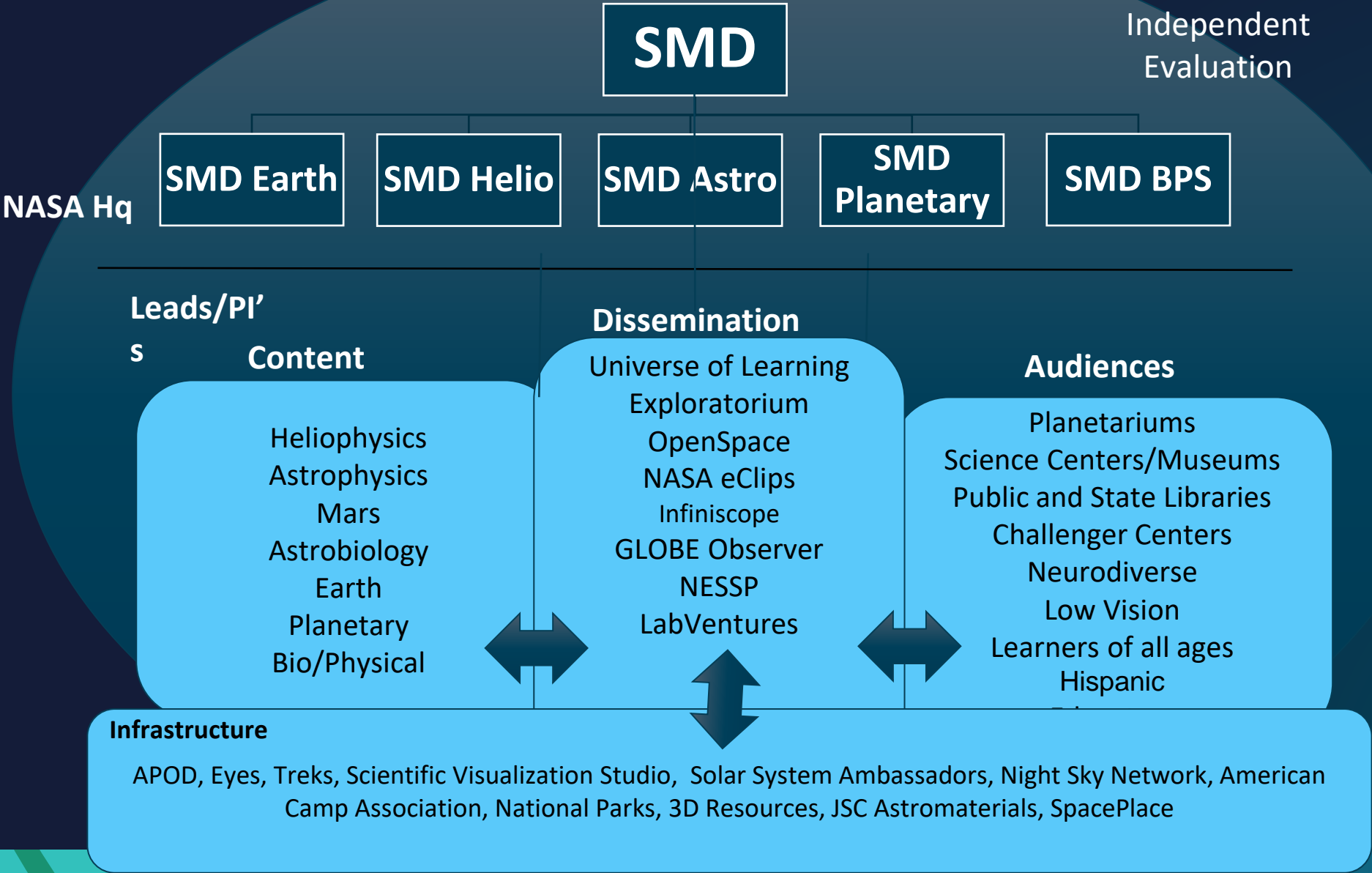
**DISCOVER SECRETS
OF THE UNIVERSE**



**SEARCH FOR LIFE
ELSEWHERE**

*See [2020-2024 Science Plan](#)

2023 SMD Science Activation Collective Relationships



SciAct's Collective Impact Approach: Model Applied for 2.0

Core Values and Group Norms

- SMD Leadership
- PI's and Team Leads
- Science POCs
- Einstein Fellows

- Annual/Monthly Meetings
- Collaboration support (Slack, etc.)
- Google Folders
- SMD Learners Website
- Digital communications



- Vision Statement
- Top Level Outcomes
- Mid-Level Objectives

- Independent Evaluators
- Collective Impact
- Common Tools
- Data Dashboard

- Cross-collaborations (internal)
- Leveraged External Partnerships
- Action and Affinity Groups

Kania, J., & Kramer, M. (2011). Collective impact. Stanford Social Innovation Review, 9: 36–41.
Retrieved from https://ssir.org/articles/entry/collective_impact

SCIENCE ACTIVATION DESIRED OUTCOME/VISION STATEMENT:

Increasing learners' active participation in the advancement of knowledge

OBJECTIVES:

Mid Level Objectives:

Enable STEM Education

Inspire participants' interest in **STEM** and the development of their identities as science learners.

Provide opportunities for participants to engage with the disciplinary content related to **NASA science and engineering**.

Increase number of and frequency with which **NASA SMD assets** are used by learners across the US.

Improve U.S. Scientific Literacy

Advance participants' understanding of the process of science using **NASA SMD assets**.

Advance National Education Goals

Increase participation in learner-centered experiences based on **NASA SMD assets**.

Increase the diversity of participants reached by **Science Activation** through intentional, inclusive programming.

Engage participants in learning experiences that promote development of skills for **STEM** careers.

Leverage Efforts through Partnerships

Leverage internal mechanisms to support sharing and learning across the **Science Activation** portfolio.

Utilize external partners to leverage reach and effectiveness of the **Science Activation** portfolio.

NASA SMD assets = science content and data, space and airborne platforms, and scientific and technical personnel.

NASA's Neurodiversity Network

Eclipse Guide

Remember:
These tips are helpful for
all populations, not just
neurodiverse learners!

What is Neurodiversity?

Neurodiversity refers to the range of differences in individual brain function and behavioral traits.

Someone who is neurodivergent has a brain that functions differently from the neurotypical population, leading to unique strengths, challenges and perspectives.

Autism is one form of neurodivergence. Autistic people may respond differently to sensations that others may not think twice about. Here are some strategies to help neurodivergent learners feel safe and ready to enjoy eclipse experience.

Embed interests

Prior to the eclipse, learn about the learner's special interests and then find ways in which these interests relate to the eclipse event. Use these interests to assist in your teaching and support.

Setting expectations

Explain the physical changes that the learner will experience during a total solar eclipse including visible changes in light intensity, changes in ambient sound levels and sudden changes in temperature. The "What to Expect" videos listed through the QR code below are useful for setting expectations around the level of light at totality, how others may react and how long totality is expected to last.

Be safe!

Make sure participants know when and how to use special eclipse glasses. Demonstrate the use and provide a visual schedule that shows when and how long to wear the glasses during the event.

Provide visuals

Provide your learner with pictures of what the Sun will look like at each stage of the eclipse. There is a video in the resources below that you may use to visualize what the level of light will be, as well as how other people around you may react (laughing, cheering, clapping). Allow the learner to spend as much time with each visual as they need.

- Pictures of the Sun at various stages of the eclipse
- What the sky will look like before/after/during totality
- Any schedule specific to your group: when to arrive at the viewing location, duration of totality, etc.

Prime the learner and establish clear expectations

Priming supports executive function. Ask the learner what they expect to experience, so you can support their interests and identify any potential concerns. Demystify the experience, and be sure to include verbal check-ins through the various stages of the eclipse. If someone has never experienced a total solar eclipse before, the arrival of totality can be very jarring!

- Clapping and cheering
- Temperature drops
- Light level drops
- Eclipse glasses may be removed ONLY during totality. If they remain on it may be too dark to see the eclipse.

For more info:

Scan the QR code to learn more about supporting neurodiverse learners and access the online content mentioned in this flyer.



A composite image of a mountain landscape at sunset. In the foreground, two children are walking away from the viewer on a dirt path that leads towards a bright sunset on the horizon. The sky is filled with a vibrant aurora borealis in shades of green and blue. A large, crescent moon is visible in the upper left portion of the sky. The landscape features rolling green hills, a small body of water, and distant mountain peaks.

EXPLORE

With Us

<https://science.nasa.gov/learn>

<https://science.nasa.gov/citizen-science>