STEM LEARNING ECOSYSTEMS

NASA Science resources for STEM engagement and learning

Video featuring 1 minute summaries of many of these NASA resources:

https://www.nisenet.org/nasa-resources-showcase
https://vimeo.com/nisenet/nasaresourceshowcase2022

OpenSpace/American Museum of Natural History

- Carter Emmart, American Museum of Natural History
- Rosamond Kinzler, American Museum of Natural History

Dive into craters to explore ancient ice on the Moon! Experience glowing blue sunsets on Mars! Observe the Sun's dynamic activity! Fly to the edge of the observable Universe!

Take your audiences on these and other cosmic explorations with OpenSpace, a freely available open-source data visualization tool designed for presenting astronomical, planetary, and space science data from NASA and other sources in a range of settings including exhibitions, immersive theaters, and planetarium domes. Funded as part of NASA's Science Mission Directorate's Science Activation Collective and led by the Science Visualization Group at the American Museum of Natural History in New York City, a growing number of informal science institutions are using OpenSpace to present complex data with clear, compelling, dynamic, and engaging visualizations.

This software is updated frequently with new data sets and can be used to provide live interactive programs about NASA's exploration of the Solar System, including current missions to Mars and Pluto and historical missions such as Apollo and Voyager. A brief guide will be available with information about downloading and installing the software, basic navigation, tips and tricks, and exciting program ideas that leverage the unique visualization capabilities of OpenSpace.

www.openspaceproject.com

Infiniscope/Arizona State University

- Ariel Anbar, Arizona State University
- Jessica Swann, Arizona State University
- Joseph Tamer, Arizona State University

The Infiniscope team empowers educators to bring dynamic digital learning experiences to their audiences. Through immersive 360-degree virtual environments, customized simulations, and real-time adaptive feedback, Infiniscope makes the wonders of Earth and space science accessible to learners of all ages. Our team includes educators, learning designers and NASA scientists working together to develop high-quality education materials that encourage exploration and discovery.

www.infiniscope.org

NASA's Night Sky Network

- Vivian White, Astronomical Society of the Pacific

Administered by the Astronomical Society of the Pacific (ASP), NASA's Night Sky Network is dedicated to supporting informal astronomy enthusiasts in astronomy clubs across the US. Find out how to partner with these local experts to bring the awe of the night sky to your museum. Invite members of a local club to bring their telescopes, knowledge, and hands-on activities to your museum for an out-of-this-world experience! Find a club near you:

https://nightsky.jpl.nasa.gov

www.nightsky.jpl.nasa.gov/clubs-and-events.cfm

www.astrosociety.org

NASA Earth Science Education Collaborative

- Theresa Schwerin, Institute for Global Environmental Strategies (IGES)
- Holli Kohl, NASA Goddard Space Flight Center (GSFC)
- Kristen Weaver, NASA Goddard Space Flight Center (GSFC)
- Tina Harte, NASA Langley Research Center (LaRC)

NASA Earth Science Educational Collaborative (NESEC) provides engaging and authentic NASA Earth STEM experiences and resources for life-long and life-wide learners that are delivered broadly through strategic collaborators and networks like NISEnet. The Institute for Global Environmental Strategies (IGES) leads NESEC in strong partnership with the world class Earth Sciences at three NASA Centers: Goddard Space Flight Center, Langley Research Center, and Jet Propulsion Laboratory. A specific focus is on citizen science using the GLOBE Observer mobile app, a data collection tool that allows volunteers to take Earth science observations with connections to NASA science and contribute to the Global Learning and Observations to Benefit the Environment (GLOBE) community. A toolkit for Informal Educators provides resources to help integrate GLOBE Observer into programming at a variety of settings.

https://nesec.strategies.org

https://observer.globe.gov

https://observer.globe.gov/toolkit

NASA Solar System Treks/ NASA JPL & NASA Ames

- Brian Day, NASA Solar System Exploration Research Virtual Institute
- Emily Law, NASA Jet Propulsion Laboratory

NASA's Solar System Treks Project (SSTP) produces web-based interactive visualization and analysis tools that enable mission planners, planetary scientists, students, and the public to explore the surfaces of a growing number of planetary bodies as seen through the eyes of many different instruments aboard a variety of spacecraft. Views can be stacked and blended. Users can interactively fly over peaks and down into valleys in 3D mode; measure distances, heights, and depths of landforms; mark areas for output to 3D printers; and create paths for immersive viewing experience using VR goggles.

While originally initiated for mission planning and science, this technology has demonstrated great benefits for STEM engagement and inspiration. As a component of NASA's STEM Activation Infrastructure, Treks are available as resources for NASA STEM Activation partners, and to the greater outreach and education community. As new missions are being planned to a variety of planetary bodies (including upcoming human and robotic missions to the Moon beginning this year), these tools are facilitating the public's understanding of the missions and engaging the public in the process of identifying and selecting where these missions will land.

trek.nasa.gov

trek.nasa.gov/moon

trek.nasa.gov/mars

NASA Heliophysics Education Activation Team

- Carolyn Ng, NASA Goddard Space Flight Center
- Shannon Reed, NASA Goddard Space Flight Center

NASA Heliophysics Education Activation Team (NASA HEAT) is bringing heliophysics and NASA discoveries to learning spaces across the US by engaging audiences in the 2023 and 2024 solar eclipses and making heliophysics discoveries more accessible to educators through the Next Generation Science Standards (NGSS). NASA HEAT does this by partnering with scientists, educators, and communicators to provide authentic science-based content and experiences based on identified audience needs and refined by rigorous evaluation.

science.gsfc.nasa.gov/heliophysics/

NASA's Museum & Informal Education Alliance

- Amelia Chapman, NASA Jet Propulsion Laboratory
- Jeff Nee, NASA Jet Propulsion Laboratory

NASA's Museum & Informal Education Alliance is a free, active community of practice that provides informal educators access to NASA and its resources via: a member website of searchable resources, including a calendar of mission events, deadlines, and anniversaries; live and archived professional development teleconferences with NASA experts; and personal assistance navigating NASA's extensive resources and events. Over two thousand professionals at more than a thousand museums, science centers, planetariums, Challenger Centers, observatories, parks, libraries, and youth-serving organizations are members of the MIE Alliance.

The Alliance provides a platform for sharing events and exhibits with NASA and its audiences, and advocates for informal education within NASA by providing a venue for feedback, requests, and communication between NASA content developers and informal educators.

informal.jpl.nasa.gov/museum

Solar System Ambassadors

- Kay Ferrari, NASA Jet Propulsion Laboratory

The Solar System Ambassadors (SSA) program is a nationwide volunteer public engagement effort sponsored by NASA's Science Mission Directorate and managed by NASA's Jet Propulsion Laboratory. SSAs are space enthusiasts from all walks of life who are asked to conduct and report four events annually where they share NASA's story in ways meaningful to their communities. Ambassadors are chosen based on their exceptional communication skills and community connections. SSA training involves connecting Ambassadors with NASA scientists and engineers via webinars, providing them with the most up-to-date information and materials possible to share at their events. Currently, there are 1,150 SSA volunteers in all 50 states, US territories, and US military bases and consulates overseas. Over the past 21 years, Solar System Ambassadors have reached more than 11 million people directly and almost 570 million people indirectly.

solarsystem1.jpl.nasa.gov/ssa/home.cfm

https://solarsystem.nasa.gov/solar-system-ambassadors/directory/

NASA's Eyes

- John Nelson, NASA/Jet Propulsion Laboratory
- Jason Craig, NASA/Jet Propulsion Laboratory

NASA's Eyes is a publicly available visualization system created by NASA JPL. Eyes allows users to virtually ride along with NASA missions, view and zoom in to realistic simulations of planets, moons, stars, and space objects studied by NASA scientists. The system is a downloadable program with daily self- updating content from NASA featuring three museum-friendly versions: Eyes on Earth, Eyes on the Solar System, and Eyes on Exoplanets. In addition, the Eyes team is now creating web browser–based simulations that work on your mobile phone. Each and every planet, moon, comet, asteroid and spacecraft is directly embeddable through an iFrame on any website. Just go directly to the object in question and use the direct URL link. Example: JWST can be live in real-time on your website by embedding this link: https://eyes.nasa.gov/apps/orrery/#/sc_jwst For Earth data, any and all confirmed exoplanets, and all Near-Earth Objects, please see Eyes on the Earth, Eyes on Exoplanets, and Eyes on Asteroids.

eyes.nasa.gov

NASA eClipsTM/National Institute of Aerospace

- Shelley Spears, National Institute of Aerospace
- Sharon Bowers, National Institute of Aerospace
- Joan Harper-Neely, National Institute of Aerospace

NASA eClips resources support standards-based instruction by increasing STEM literacy in formal and nonformal settings. The free video segments inform and engage students, through NASA-inspired, real-world connections. NASA Spotlites are short (90–120 second), student-produced videos designed to debunk nationally recognized science misconceptions. From research to script, to screen, students build their own understanding of the science concept through creative video representations. The NASA Spotlite Design Challenge offers campers opportunities to collaborate creatively to produce science videos for other students. NASA eClips Guide Lites focus on activities pulled from Educator Guides and are well suited for phenomenon-based science inquiry in nonformal educational settings. All Guide Lites are organized using the 5E learning model.

nasaeclips.arc.nasa.gov

NASA's Universe of Learning

- Denise Smith, Space Telescope Science Institute (STScI)

- Tim Rhue II, Space Telescope Science Institute (STScI)
- Yesenia Perez, Space Telescope Science Institute (STScI)
- Erika Wright, Center for Astrophysics | Harvard & Smithsonian Center
- Mary Dussault, Center for Astrophysics | Harvard & Smithsonian Center
- Brandon Lawton, Space Telescope Science Institute (STScI)

NASA's Universe of Learning creates a wide range of resources for museums and informal learning environments. Made of organizations embedded within NASA missions that produce some of the most iconic science and imagery in the world, NASA's Universe of Learning uses its direct connection to the wonders of the cosmos and the experts behind the science to enable learning for people of all ages. Some of those include data tools and participatory experiences like the Astrophoto Challenge where people can process real NASA data and submit their images for feedback from professional astronomers. Explore multimedia and immersive experiences like ViewSpace which has videos and digital interactives that are used as components of exhibits and programs in museums across the country. Connect with community programs and exhibits like the Accessible Learning Resources where the team creates 3D models, tactile resources, and sonification resources to provide multimodal methods to learn. Participate with some of NASA's Universe Learning professional learning experiences like the Informal Learning Network, which is finding new ways to use these resources with underserved communities across the country. These experiences and more enable lifelong learners to make a personal connection to our universe.

www.universe-of-learning.org

https://www.universe-of-learning.org/resources/projects/informal-learning-network

https://www.universe-of-learning.org/resources/projects/accessible-learning-resources

www.viewspace.org

mo-www.cfa.harvard.edu/MicroObservatory

James Webb Space Telescope Resources

- Chris Britt, Space Telescope Science Institute (STScI)
- Yesenia Perez, Space Telescope Science Institute (STScI)

The launch and commissioning of the James Webb Space Telescope are monumental achievements that have taken the skill and perseverance of devoted professionals across the globe to accomplish. With this new observatory, we seek to answer questions of our common origin: the beginnings of stars, planets, and galaxies themselves. Webb will study every phase in the history of our Universe, ranging from the first luminous glows after the Big Bang, to the formation of solar systems capable of supporting life on planets like Earth, to the evolution of our own Solar System.

Space Telescope Science Institute's (STScI's) Office of Public Outreach and NASA have partnered to share this achievement with the public and to meet them where they are in their own exploration of the universe. We are working with communities across the country to support celebrations of Webb's launch and first images through the Webb Community Events initiative. We want to empower all people to look up and explore with Webb.

www.jwst.nasa.gov/

www.webbtelescope.org

Scientific Visualization Studio/NASA Goddard Space Flight Center

- Mark SubbaRao & Lori Perkins NASA Goddard Space Flight Center

The NASA Scientific Visualization Studio (SVS) works with NASA-affiliated programs and researchers to visualize their data for the purpose of communicating their goals and results in an exciting and accurate manner. All of the 10,000+ visual products created by the SVS and its partner groups are made available at https://svs.gsfc.nasa.gov and are completely free for use by the public. Although not strictly created for STEM education, SVS visualizations dramatically illustrate scientific concepts and discoveries in a way that bridges the gap between scientific knowledge and the real-world application of that knowledge. The SVS is also always looking for new visualization ideas so feel free to contact them if you have a great idea or would like an existing visualization modified to better fit the needs of external users.

https://svs.gsfc.nasa.gov

NASA Astromaterials

- Paige Graff, Jacobs/JETS at the NASA Johnson Space Center
- Kim Willis, Jacobs/JETS at the NASA Johnson Space Center

NASA's Astromaterials team aims to share unique NASA assets with students, formal and informal educators, the public, and the scientific community in order to generate excitement, knowledge, and awareness of NASA Science Mission Directorate (SMD) Science and Exploration. We enable access to our assets and Earth and planetary science content through in-person and virtual connections as well as through hands-on activities and resources that promote and encourage the development of skills for STEAM (Science, Technology, Engineering, the Arts, and Mathematics) careers for individuals from all backgrounds.

Our unique assets include:

- Astromaterials Collections: Apollo lunar samples, Antarctic meteorites, cometary and interstellar dust, solar wind, microparticle impacts, and asteroid samples from Itokawa, Ryugu, and Bennu (anticipated arrival in September 2023)
- Astronaut Photography of Earth taken by crew in space
- Subject Matter Experts (SMEs)
- Specialized Research and Curation Laboratories

https://ares.jsc.nasa.gov/

https://ares.jsc.nasa.gov/astromaterials3d/

https://ares.jsc.nasa.gov/engagement/

Eclipse Soundscapes: Citizen Science Project

- Trae Winter, ARISA Lab
- MaryKay Severino, ARISA Lab

With the help of citizen scientists, NASA subject matter experts (SMEs) will collect audio recordings from eclipses and analyze acoustic data to determine how disruptions in light and circadian rhythms may affect ecosystems. The data will include soundscapes recorded by the National Park Service and Brigham Young University during the 2017 total solar eclipse, as well as recordings to be taken during the 2023 annular eclipse and 2024 total solar eclipse. The analysis of these recordings will be central to ARISA Lab's informal learning objective, which is focused on fostering self-efficacy in under-represented learners, specifically members of the Blind and Low-Vision community (BLV). Citizen scientists, both sighted and BLV, will participate in eclipse experiences together. Under the guidance of NASA SMEs, citizen scientists will participate in workshops, and collect and analyze eclipse acoustic data. We invite your museum community in future to utilize the free eclipse learning materials, become citizen scientists who collect eclipse data during the 2023 annular eclipse or the 2024 total solar eclipse, and/or analyze the eclipse sound data in 2024 and 2025.

https://eclipsesoundscapes.org/citizen-science-project

Navigating the Path of Totality/Exploratorium

- Rob Semper, Exploratorium

- Robyn Higdon, Exploratorium

Navigating the Path of Totality is a public education program using the opportunity of the annular solar eclipse of 2023 and the total solar eclipse of 2024 as platforms for sparking public engagement and learning about the Sun, heliophysics, and the STEM content related to both. Working with NASA Subject Matter Experts (SME) and with other NASA Science Activation partners, the Exploratorium's team of scientists, educators and media producers leverage the dramatic experience of solar eclipse events to engage students, educators, and the public at large in the excitement of scientific discovery.

The Exploratorium will provide three live streams of the eclipse for you to use with your audiences on Saturday, Oct 14, 2023, of the Annular Eclipse from the Southwestern U.S.; and on Monday. April 8, 2024, of the total solar eclipse from Texas. These streams include:

- A three-hour broadcast of views from our telescopes in the path of totality
- A one-hour educational program in English that will include Exploratorium educators, NASA SMEs, and others sharing the excitement of the day and a review of what people are seeing, related solar science, and highlighting the Parker Solar Probe mission
- A one-hour educational program in Spanish that will include Exploratorium educators, Kira Villanova (a morning show anchor from Univision), NASA SMEs, and others sharing the excitement of the day and a review of what people are seeing, related solar science, and highlighting the Parker Solar Probe mission

The team will also produce a series of videos on eye safety, 'eclipse 101', etc. In partnership with the Indigenous Education Institute, they will be making videos in Diné (Navajo).

www.exploratorium.edu/eclipse

NASA Space Place

- Jessica R. Stoller-Conrad, NASA Jet Propulsion Laboratory
- Heather Doyle, NASA Jet Propulsion Laboratory

NASA Space Place is an award-winning website that engages upper-elementary-aged children in space and Earth science through interactive games, hands-on activities, fun articles and short videos. Most of NASA Space Place's content is available in both English and Spanish. As of 2021, the program's robust online presence includes more than 35 million pageviews each year and more than 800,000 combined followers across three social media platforms. The Space Place team also produces NASA's climate science website for kids, NASA Climate Kids.

Spaceplace.nasa.gov

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https://climatekids.nasa.gov/

NASA Artemis

- Patricia Moore, Artemis Communications patricia.l.moore@nasa.gov 281-636-2919

NASA will send the first woman and first person of color to the lunar surface on Artemis missions and safely return to Earth. Together with commercial and international partners, NASA will establish a sustainable presence on the Moon to prepare for missions to Mars.

NASA will use the most powerful rocket ever built, the Space Launch System, to launch the Artemis I mission to send an uncrewed Orion spacecraft thousands of miles beyond the Moon – farther than any spacecraft built for humans as ever flown. The Artemis I Launch and Splashdown Event Planning Guide can be used to help plan Artemis I watch parties and STEM events.

Additional NASA's Artemis multimedia resources may be found in the Artemis Outreach Resource Box Folder and our featured resources may be found in the Artemis Resources PDF.

STARnet Library Network

The STAR Library Network (STAR Net) is a hands-on learning network for libraries and their communities across the country. STAR Net focuses on helping library professionals build their STEM skills by providing "science-technology activities and resources" (STAR) and training to use those resources.

STAR Net is built upon a strong network of collaborators and partners, led by the Space Science Institute's (SSI) National Center for Interactive Learning (NCIL).

https://www.starnetlibraries.org

NASA ASTRO CAMP® Collaborative Partner Program

NASA's ASTRO CAMP Collaborative Partners Program provides opportunities for youth service organizations, museums, libraries, schools, and universities to present NASA's ASTRO CAMP activities in their community with training and resources provided by NASA ACCP specialists.

https://www.nasa.gov/centers/stennis/education/students/astrocamp.html

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NASA Citizen Science Projects

NASA's citizen science projects are collaborations between scientists and interested members of the public. Through these collaborations, volunteers (known as citizen scientists) have helped make thousands of important scientific discoveries. Want to work on some real NASA science? Click on one of the 28 projects below to get started. NASA citizen science projects are open to everyone around the world, not limited to U.S. citizens or residents.

https://science.nasa.gov/citizenscience

National Informal STEM Education Network (NISE Network)

The National Informal STEM Education Network (NISE Network) is a community of informal educators and scientists dedicated to supporting learning about science, technology, engineering, and math (STEM) across the United States. NISE Network brings people together to engage in STEM, understand our world, and build a better future for everyone.

Browse by Themes and Topics: https://www.nisenet.org/browse-topic

Solar Eclipses: https://www.nisenet.org/solareclipse

James Webb Space Telescope: https://www.nisenet.org/webb

Moon - Artemis Missions: https://www.nisenet.org/moon

Mars: https://www.nisenet.org/mars