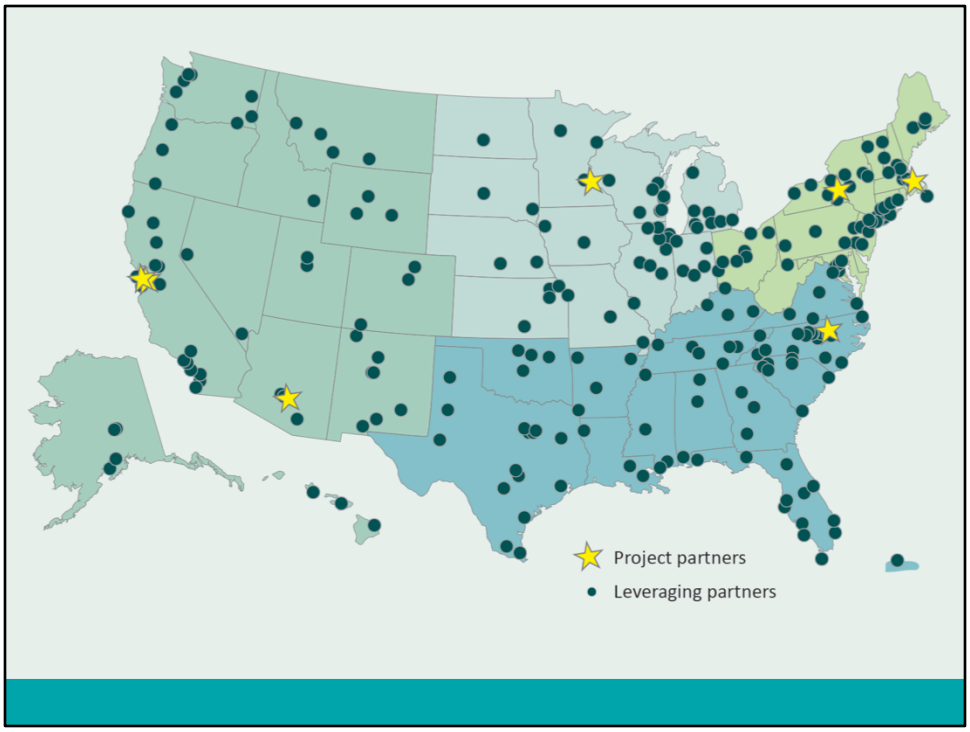
[This slide presentation provides an overview of the Explore Science: Earth and Space Toolkit, and can be used to introduce staff and volunteers to the project and its educational materials. You can customize this training presentation to fit your organization and programming.]

Welcome to the Explore Science: Earth & Space event training! In this presentation, we're going to go through quite a bit of information related to our local event and the national Explore Science: Earth & Space project.

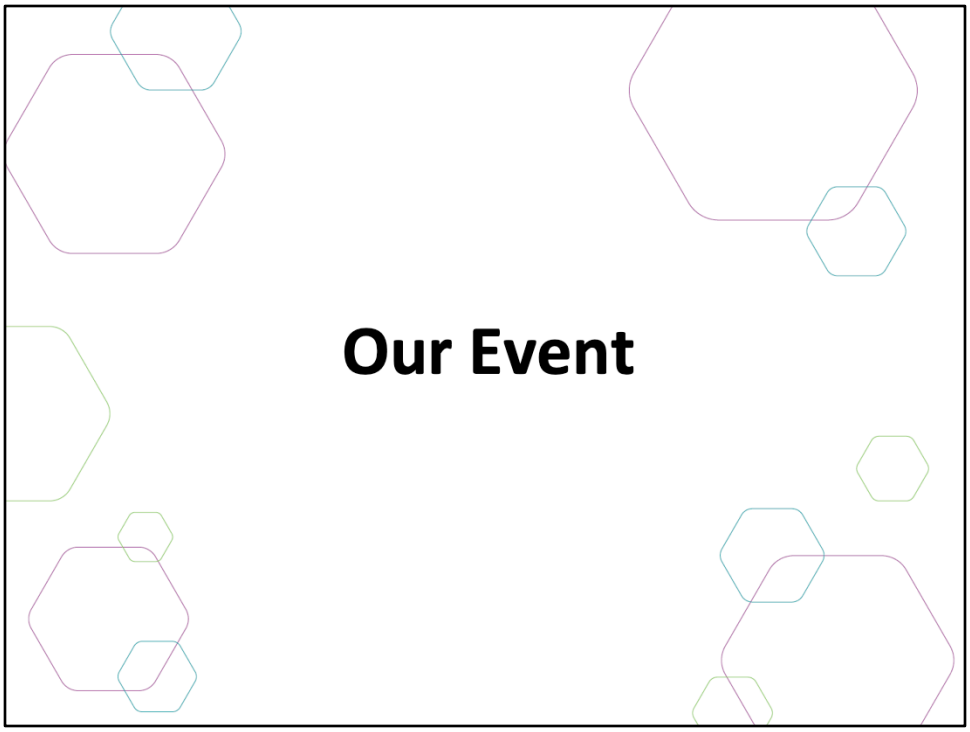
This training has three parts:
1. Quick introduction to the Explore Science: Earth & Space project and toolkit
2. Overview of the toolkit and the individual activities
3. Tips and training resources to help you lead the activities successfully

We'll have time at the end for questions, but feel free to ask for clarification throughout.

The Explore Science: Earth & Space project represents an effort by the National Informal STEM Education Network (NISE Network) in collaboration with NASA to engage museum visitors in Earth and space science hands-on activities and experiences with connections to science, technology, and society.



This year, the NISE Network shared 350 physical Explore Science: Earth & Space toolkits. Institutions (including, children's museums, science centers, NASA Visitor Centers, nature centers, natural history museums, and more!) all across the country are hosting events and engaging visitors through year-round programming!



Here are a few details about our event, today.

[This is for information specifically about your institution

Background

(Your institution's) mission and goals for this event

Who's here

Introduce collaborators, guest speakers, volunteer groups, and other educators and facilitators.

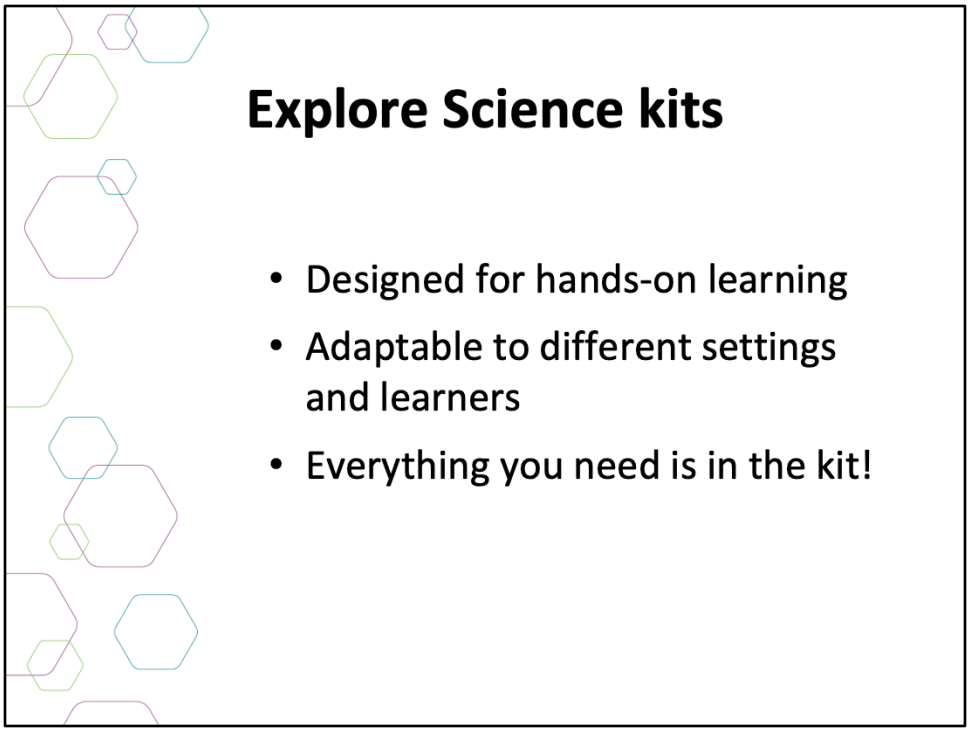
Orientation, Safety, and Policies

Where are restrooms, lunchrooms, and other places?
Where are the emergency exits?
Who should be contacted in case of emergency?
What do volunteers do if they have a problem? Who should be contacted?
Does your institution have procedures for fire alarms, lost children, and other emergencies?

Schedule

Highlight the schedule for the day.
Are there special presentations? If so, where will they be held and at what time?
When does the event begin and end?

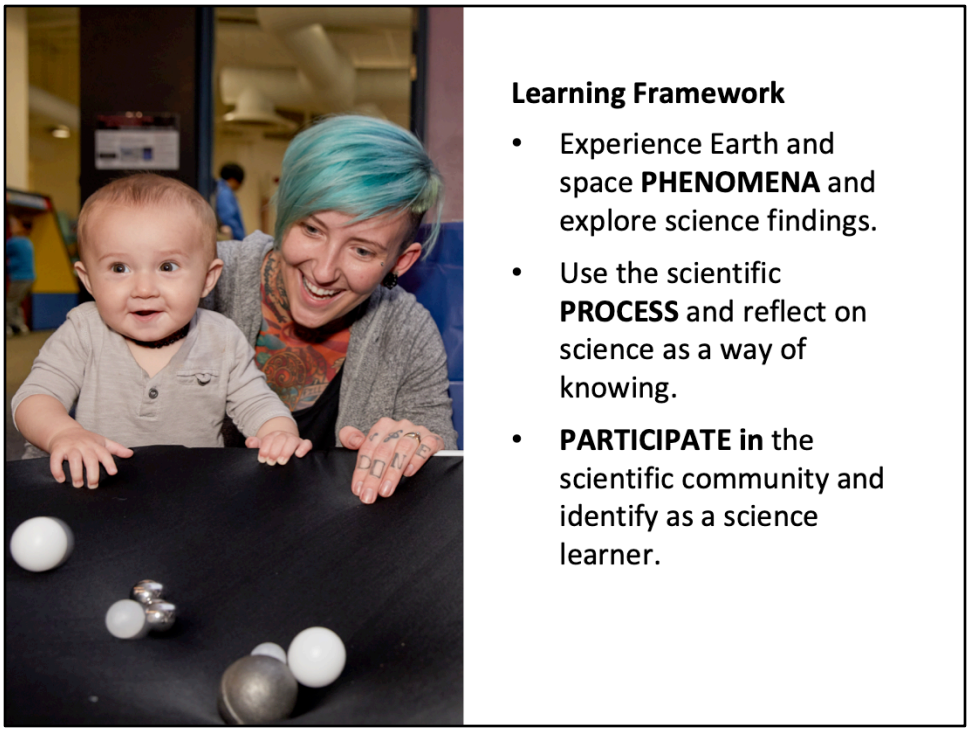
Now, we'll quickly review the Explore Science: Earth & Space Toolkit.



The Explore Science: Earth & Space toolkit materials have been designed to engage visitors in Earth and space phenomena, to help visitors reflect on science as a way of knowing, and to encourage them to identify as science learners.

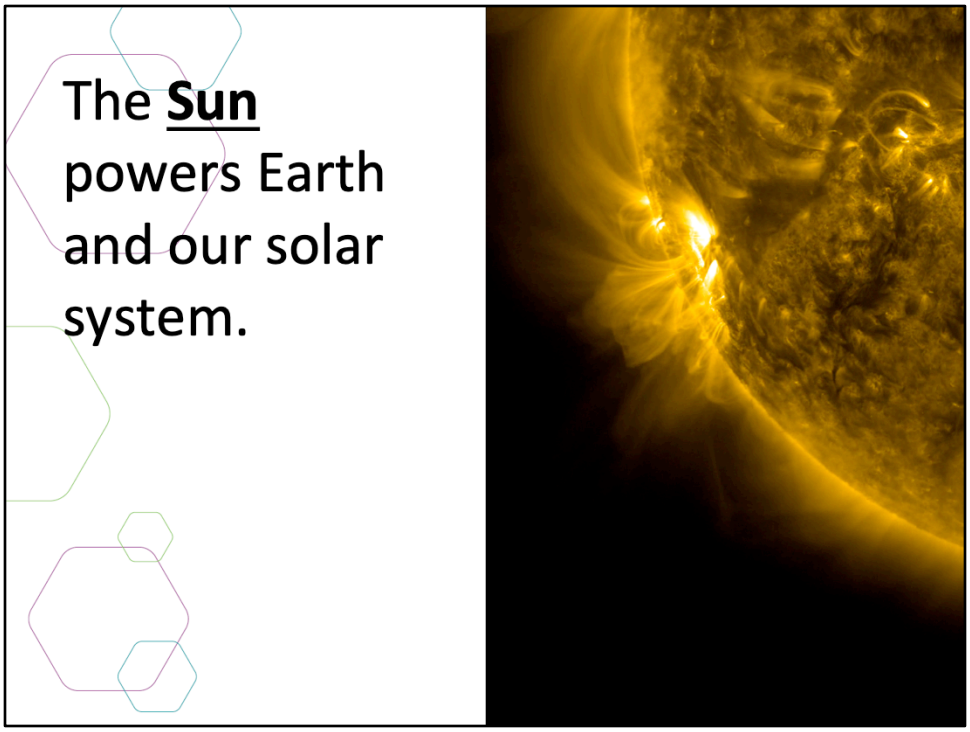
The toolkits focus on hands-on space and earth science activities. They are adaptable to different settings and different kinds of learners.

Each toolkit includes everything you need for all the activities, with supplies for about 100 people.



The Toolkit activities were developed around a learning framework that has three main parts: PHENOMENA, PROCESS, and PARTICIPATE.

- Experience Earth and space **PHENOMENA** and explore science findings.
- Use the scientific **PROCESS** and reflect on science as a way of knowing.
- **PARTICIPATE in** the scientific community and identify as a science learner.



Some of the BIG questions NASA scientists are asking about the Sun include:

1. What causes features on the Sun—like sunspots—to vary?
2. How do Earth and our solar system respond to the dynamic Sun?

Image
Active Region Conga Line
A series of active regions on the Sun were all lined up one after the other as they rotated into view over three days (Sept. 22-24, 2012)
https://sdo.gsfc.nasa.gov/gallery/ultrahd/
Image credit: NASA/SDO

Some of the BIG questions NASA scientists are asking about the Earth include:

1. How is the Earth changing?
2. What cause changes on Earth?
3. How will the Earth change in the future?

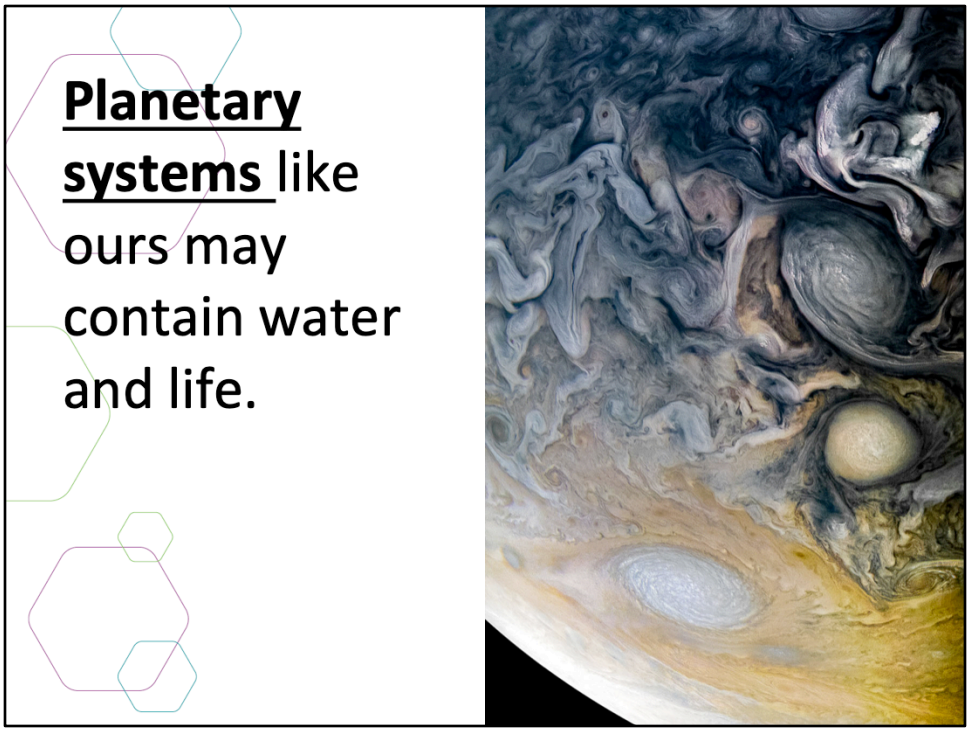
Image

Hurricane Florence as it was making landfall

Hurricane Florence is pictured from the International Space Station as a category 1 storm as it was making landfall near Wrightsville Beach, North Carolina.

https://www.nasa.gov/image-feature/hurricane-florence-as-it-was-making-landfall-0

Image credit: NASA



Some of the BIG questions NASA scientists are asking about our solar system and other planetary systems include:

1. How did our solar system form?
2. How did life begin on Earth?
3. Could life exist elsewhere?

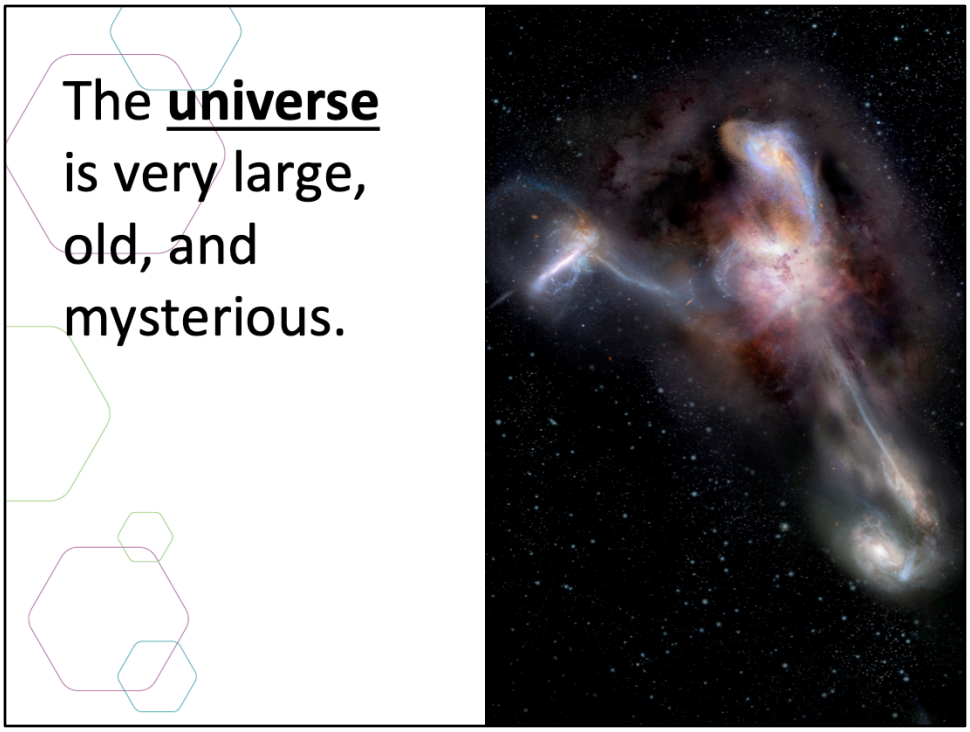
Image

Intricate Clouds of Jupiter

See intricate cloud patterns in the northern hemisphere of Jupiter in this new view taken by NASA's Juno spacecraft.

https://www.jpl.nasa.gov/spaceimages/details.php?id=PIA21984

Image credit: NASA/JPL-Caltech/SwRI/MSSS/Kevin M. Gill



Some of the BIG questions NASA scientists are asking about astrophysics include:

1. How did the universe begin?
2. How is the universe changing?
3. Are we alone in the universe?

Image

The Most Luminous Known Galaxy

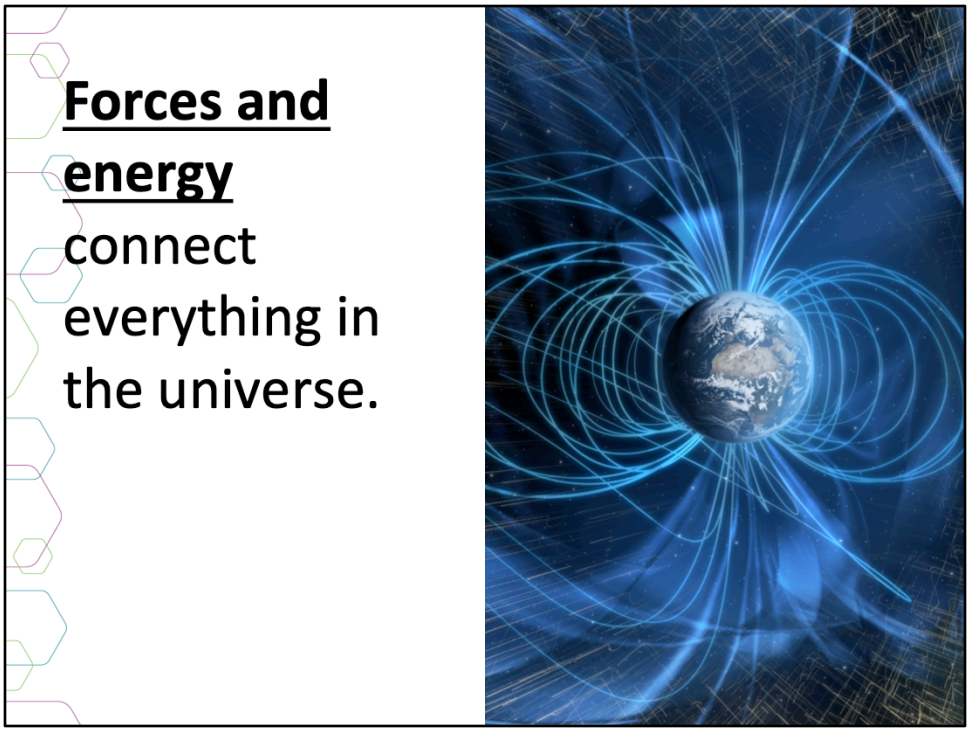
Artist impression of W2246-0526, the most luminous known galaxy, and three companion galaxies. https://astropix.ipac.caltech.edu/image/nrao/NRAO_Gallery_nrao18ch26_artimp_Final

Image credit: NRAO/AUI/NSF, S. Dagnello

The relationship between Earth & space science and our society is a cross-cutting topic to all NASA science research and missions. Some questions include:

1. How do our values influence science questions about Earth and space?
2. What inspiration does society draw from new NASA technology and discoveries?
3. How do teamwork and specialized tools contribute to NASA research?
4. What impacts do the dynamic processes of the Sun, Earth, and universe have on human society?

Image
The Mars Science Laboratory Team
The Mars Science Laboratory (MSL) team in the MSL Mission Support Area react after learning the the Curiosity rove has landed safely on Mars and images start coming in at the Jet Propulsion Laboratory on Mars, Sunday, Aug. 5, 2012 in Pasadena, Calif
https://mars.nasa.gov/resources/4208/the-mars-science-laboratory-team/
Image credit: NASA/Bill Ingalls



Force and energy are common threads of the universe and how NASA scientists learn about nearby and far-away space objects. Some topics include:

1. The Electromagnetic spectrum
2. Gravity
3. Magnetism

Image
Earth's Magnetic Field
The solar wind is deflected past Earth by a global magnetic field (artist's concept).
https://svs.gsfc.nasa.gov/4370
Image credit: NASA/GSFC

The Explore Science: Earth & Space toolkit includes 10 hands-on activities. Each activity comes in a box and includes all the physical materials you'll need plus the activity and facilitator guides and additional information sheets.

[The following slides include the activities from the Explore Science: Earth & Space 2020 toolkit Part A. You may choose to augment your kit with additional activities from the 2017, 2018 & 2019 toolkits or other educational resources. The 2017, 2018 & 2019 digital toolkits are available for download from nisenet.org. The NISE Network also has a curated list of programs, media, and professional development that directly relate to the toolkits. These resources can be viewed and downloaded from http://www.nisenet.org/earthspacekitextensions.]

The Bear's Shadow and Investigating Clouds activities help participants **Explore Earth**.

Bear's Shadow appeals to preschool-aged visitors, as well as accompanying adults and older children. It explores the following ideas:

- A shadow is created when an object blocks light from falling on a surface.
- An object's shadow always appears on the opposite side from the light source.
- Shadow's change when the relative positions of the light source and the object change.

Investigating Clouds explores the following ideas:

- Clouds influence Earth's weather and climate.
- Clouds form when individual water molecules combine into droplets.
- NASA researchers study clouds in order to better understand and predict how Earth's climate is changing.
- *Particular to the information sheet, worksheet, and Globe postcard that come in the activity:* Citizen science programs collect and share the data with researchers that collaborate with NASA.

Asteroid Mining, Mission to Space, and Design, Build, Test all help participants **Explore the Solar System**.

The Mission to Space board game explores the following ideas:

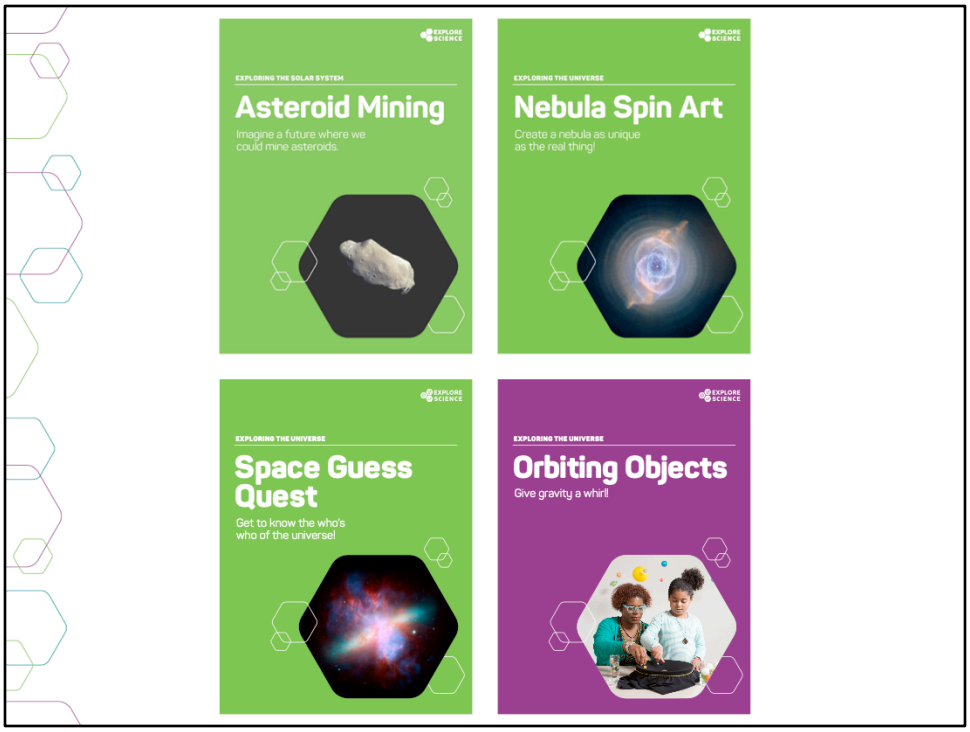
- A successful mission to space take a lot of planning, research, and curiosity.
- Developing, planning, and completing a mission to space is a complex process with many steps.
- Missions to space are full of surprises and challenges.

The Asteroid Mining activity explores three main ideas:

- Asteroids are small, rocky objects—some contain previous metals or water ice.
- It's exciting to imagine what our lives might be like in a future filled with more space exploration—and it's also important.
- NASA missions are helping researchers learn more about asteroids and the resources they might contain.

The Design, Build, Test engineering activity explores the following ideas:

- Scientists use spacecraft to explore Earth and space.
- Missions to space require large teams to design, build, and test spacecraft.
- Preparing to launch a spacecraft into space take a lot of time.



These activities are about **Exploring the Universe**.

The Star Formation challenge explores the following ideas:

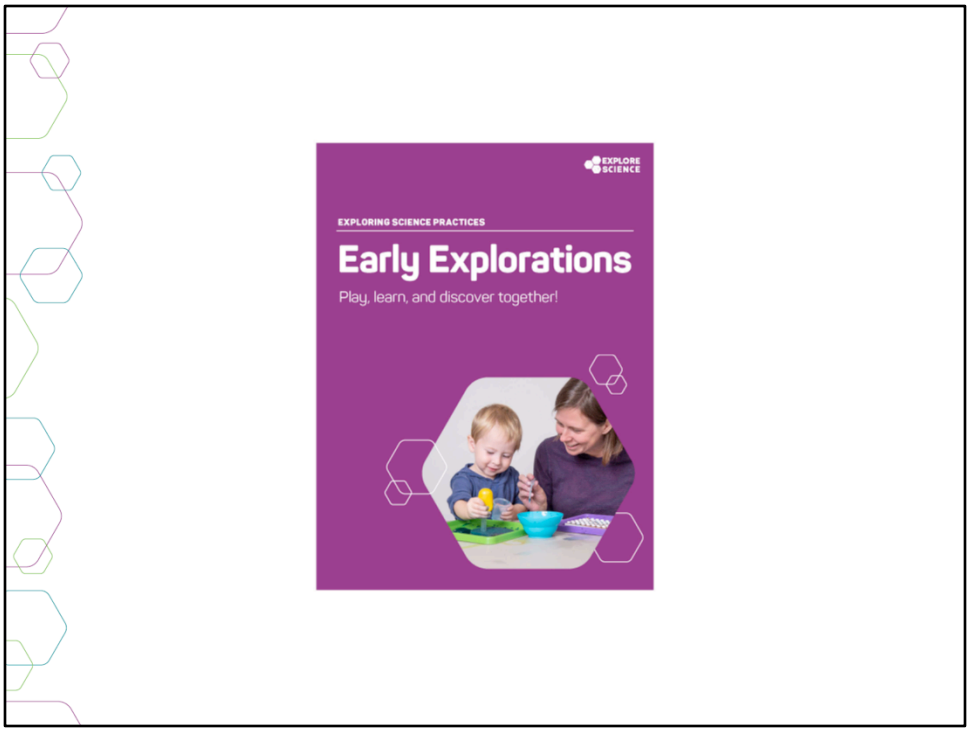
- The space between stars, planets, and other large objects is not empty—it contains gas and dust.
- Stars are born when huge amounts of gas and dust clump together.
- The more gas and dust that clump together, the higher the new star's mass.
- NASA scientists use telescopes to learn more about how stars form.

The Nebula Spin Art activity explores the following ideas:

- A nebula is a large cloud of gas and dust in space that can be created by a dying star.
- Nebulas are responsible for mixing up and spreading out elements in space.
- NASA scientists can assign colors in nebula images to represent different elements and other characteristics we can't see with our eyes.

The Space Guess Quest game explore the following main ideas:

- Humans are exploring a wide variety of objects, like nebulas, galaxies, stars, and worlds throughout the universe (and now the universe even includes human-made spacecraft!)
- Scientists often use visual clues to identify objects in space.



And this year, we have added an additional toolkit category: **Exploring Science Practices**.

The Early Explorations activity is designed to engage early learners (ages 0-4) and their caregivers in the development of science process skills. Through doing this activity with their young child, caregivers will explore 3 main ideas:

- Exploring materials, using tools, and making observations are important skills for doing science.
- Very young children (ages 0-4) use science process skills (like exploring, categorizing, measuring, observing, predicting, problem-solving, and using tools) to learn about the world around them.
- Practicing science process skills early and often is important for children's brain development.

Throughout this exploration, the facilitator should model strategies for fostering, guiding, and building on basic science practices. The activity has the following goals:

- To help adults understand that *doing science* looks different at different developmental stages;
- To model facilitation strategies that encourage the use of *science process skills* by early learners;
- And to thereby increase caregivers' ability and confidence to engage the very

Now, we'll review some tips for leading these activities with participants

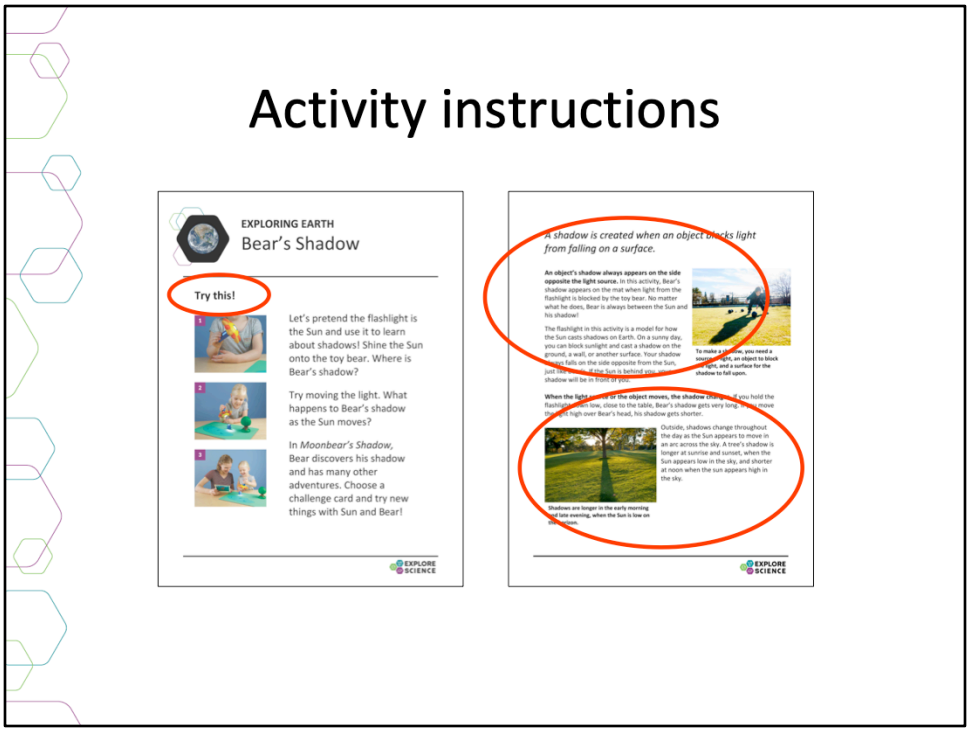
We've just taken a very quick look at all 10 activities in the Explore Science: Earth & Space toolkit.

Here is an example of just one activity, Bear's Shadow. Each activity box includes all the physical materials needed to do the activity.

Some of these materials are intended for the learners to use. These include the supplies they need to do the activity—like the flashlight "sun," toy bear, toy tree, and landscape mat with pond and fish—shown in this image. You'll also want to share the colorful activity guide and sign, and any additional information sheets, worksheets, or other graphics. These things should all be out and accessible for learners.

The box also includes some materials for you, the facilitator, to use. These include the more plain-looking facilitator guide with some notes about things like set-up and safety, and some tips to help you do a great job leading the activity, as well as any materials you'll need for advance preparation. These are just for you and are not meant to be shared with participants.

Finally, please note that there are both activity and content training videos for each activity, which you can watch to help you learn the activity before you do it with participants.

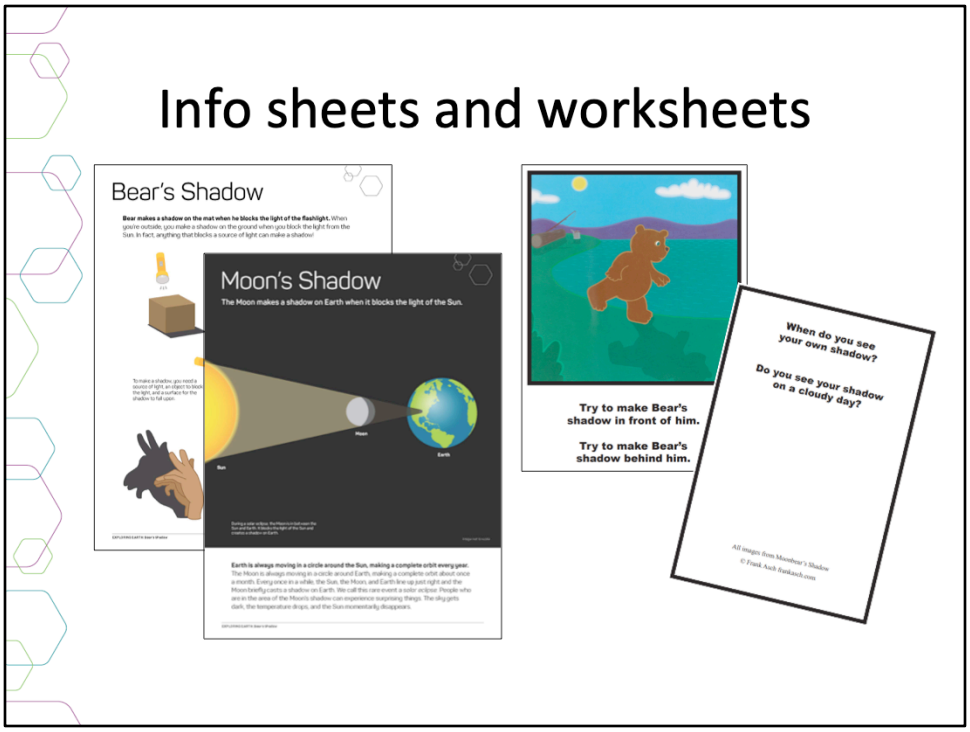


UPDATE

Now let's look at some of these materials a bit more closely. Here is an example of an activity guide, for the Bear's Shadow activity.

The activity guides are structured to help you lead learners through hands-on science activities.
The front side includes step-by-step instructions in the section called "Try this!"
The back side describes what learners observe—and explains why it happens. Finally, the guide relates the activity to current space or Earth related science, NASA research, or information on childhood development.
You can leave these guides out on the table both to help you explain the activity and so that learners can read them and look at the pictures.

(They're available in both English and Spanish versions.)



Many activities include additional information sheets or other graphic assets (in this case, challenge cards). Depending on your event or setting you may choose to use these more or less. They provide additional related content about the hands-on activity for participants and facilitators alike.

Each activity in the toolkit comes with an activity training video and a science content training: https://vimeopro.com/nisenet/explore-science-earth-space. Facilitators can watch these before the event (or even last minute, online!)

[This year, we have also included a a training video about facilitation techniques titled ***Educathalon*** *and a set of training videos on* ***Strategies for Approaching Difficult Scientific Concepts*** *in space and Earth science. Part one describes various strategies you can use and provides an annotated example. Part two provides a scripted example of a visitor interaction and invites you to notice which strategies are employed. You can watch these videos together as a group and discuss what you see and notice and how this might change the ways you interact with visitors.]*

Notes and tips


FACILITATOR GUIDE
Bear's Shadow

Learning objectives

This activity explores these ideas:

- A shadow is created when an object blocks light from falling on a surface.
- An object's shadow always appears on the opposite side from the light source.
- Shadows change when the relative positions of the light source and the object change.

The activity can also be connected to the 2017 solar eclipse event, with the following additional learning objective:

- A solar eclipse occurs when the Moon passes directly between the Sun and the Earth, blocking the Sun's light and casting a shadow on Earth.

Materials

- Flashlight "sun"
- Toy bear
- Toy tree
- Landscape mat with pond and fish
- Challenge cards
- Bear's Shadow information sheet
- Activity and facilitator guides
- Optional: Moonbear's Shadow storybook by Frank Asch
- Optional: Moon's Shadow information sheet (for 2017 solar eclipse connections)

The Explore Science toolkit comes complete with all necessary materials for this activity. Materials are also readily available to create or restock activity kits. Graphic files (including the landscape mat) can be downloaded from www.nisenet.org. The toy bear is available through www.learningresources.com. The sun and tree toys in this activity can be bulk ordered through qualitylogoproduct.com. The squishy sun toy has been modified to fit onto a small LED flashlight (available at discount stores). Moonbear's Shadow by Frank Asch can be ordered from online booksellers, or found in bookstores or your local library.

Safety

Remind participants not to shine the flashlight in anyone's eyes. Do not allow a child to place the toys in his or her mouth, and clean the toys promptly and appropriately if they come into contact with a

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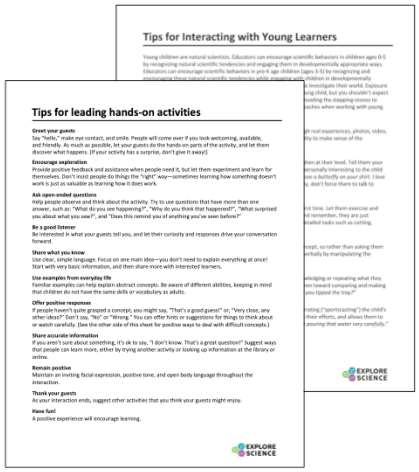
Tips for Interacting with Young Learners

Tips for leading hands-on activities

Greet your guests
Say "hello," make eye contact, and smile. People will come over if you look welcoming, available, and friendly. As much as possible, let your guests do the hands-on parts of the activity, and let them discover what happens. (If your activity has a surprise, don't give it away!)

Encourage exploration
Provide positive feedback and assistance when people need it, but let them experiment and learn for themselves. Don't insist people do things the "right" way—sometimes learning how something doesn't work is just as valuable as learning how it does work.

Ask open-ended questions
Help people observe and think about the activity. Try to use questions that have more than one answer, such as: "What do you see happening?", "Why do you think that happened?", "What surprised you about what you saw?", and "Does this remind you of anything you've seen before?"

Be a good listener
Be interested in what your guests tell you, and let their curiosity and responses drive your conversation forward.

Share what you know
Use clear, simple language. Focus on one main idea—you don't need to explain everything at once! Start with very basic information, and then share more with interested learners.

Use examples from everyday life
Familiar examples can help explain abstract concepts. Be aware of different abilities, keeping in mind that children do not have the same skills or vocabulary as adults.

Offer positive responses
If people haven't quite grasped a concept, you might say, "That's a good guess!" or, "Very close, any other ideas?" Don't say, "No" or "Wrong." You can offer hints or suggestions for things to think about or watch carefully. (See the other side of this sheet for positive ways to deal with difficult concepts.)

Share accurate information
If you aren't sure about something, it's ok to say, "I don't know. That's a great question!" Suggest ways that people can learn more, either by trying another activity or looking up information at the library or online.

Remain positive
Maintain an inviting facial expression, positive tone, and open-body language throughout the interaction.

Thank your guests
As your interaction ends, suggest other activities that you think your guests might enjoy.

Have fun!
A positive experience will encourage learning.

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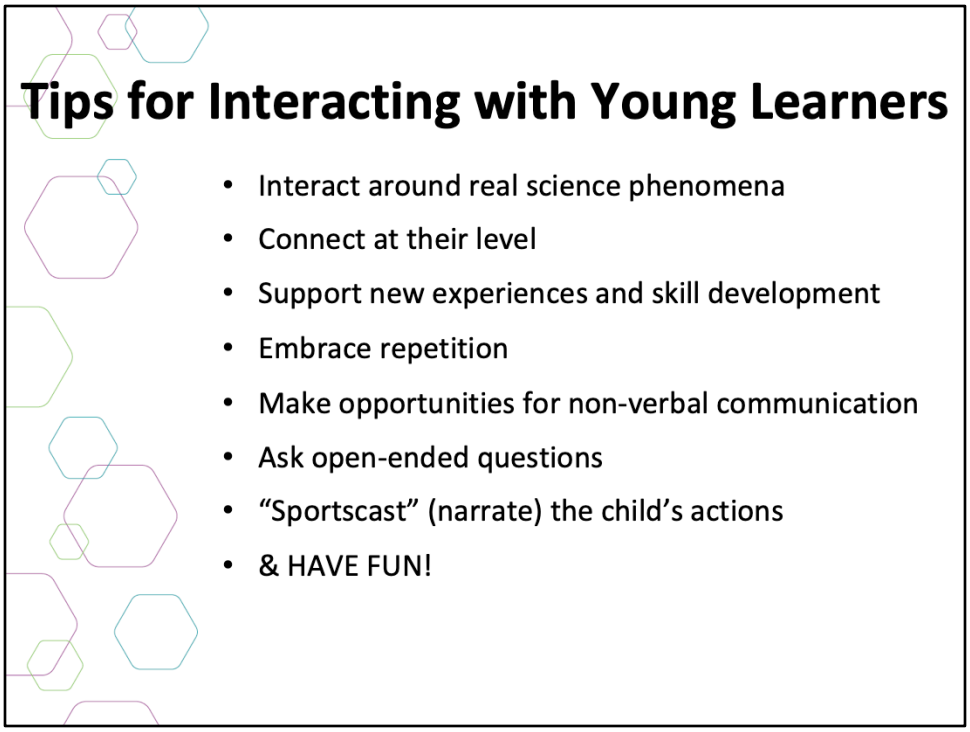
The facilitator guide is for you, the activity leader.

The first few pages list the learning objectives, activity materials, and includes important notes related to set-up, safety, presentation, difficult concepts and other aspects of the activity.

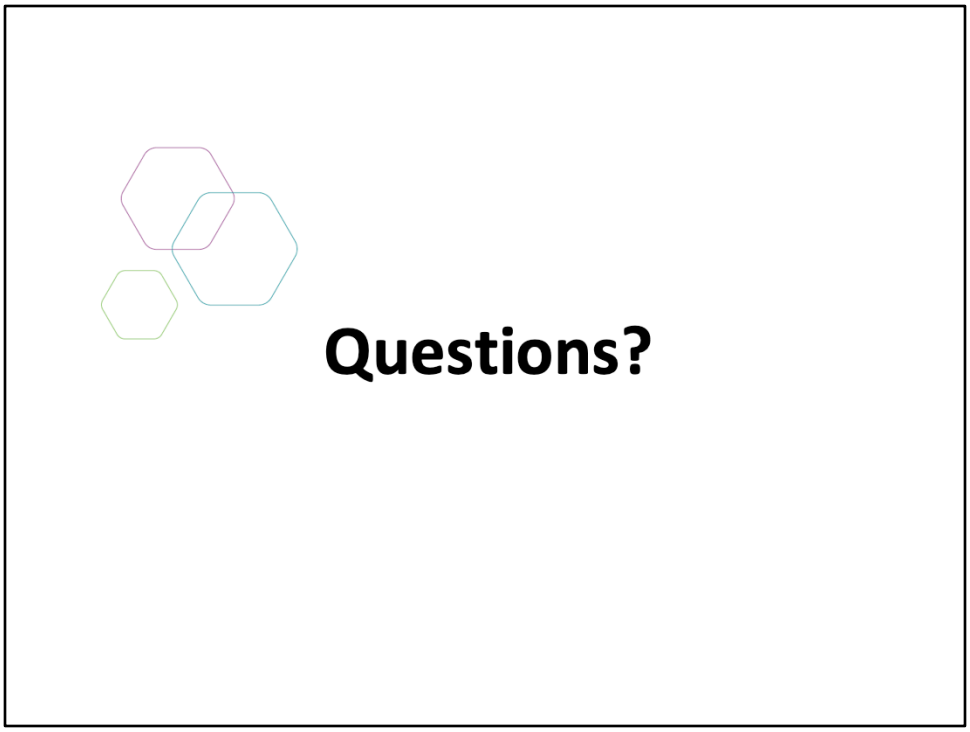
Additionally, each activity contains a useful reference sheet with tips for leading hands–on science activities or tips for interacting with young learners, as well as notes about how to talk to visitors about misconceptions and other difficult concepts.

Tips for leading hands-on activities include:

- Greet your guests
- Encourage exploration
- Ask open-ended questions
- Be a good listener
- Share what you know
- Offer positive responses
- Share accurate information
- Remain positive
- Thank your guests
- & HAVE FUN!



These tips are especially useful for facilitators leading the "Early Explorations" activity. However, they can be used with young participants for any of the toolkit activities.



Questions?

Thank you

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Activity photos by Emily Maletz and Dave Burbank for the NISE Network. Training video screen capture by Museum of Life and Science. Living with the Sun image: composite image of 25 separate images of the Sun from the Solar Dynamics Observatory (SDO) spanning the period of April 16, 2012, to April 15, 2013, courtesy NASA Goddard Space Flight Center/SDO/AIA/S. Wiessinger. The Changing Earth image: Late winter storms dropped a fresh coating of snow across the Alps in mid-March 2016, courtesy NASA image by Jeff Schmaltz, LANCE/EOSDIS Rapid Response. Our Solar System and Planets Around Other Stars image: Artistic concept of water plumes on Jupiter's moon Europa courtesy NASA/ESA/K. Retherford/SWRI. Galaxies and Beyond image: Eagle Nebula's "Pillars of Creation" courtesy NASA.

THANK YOU!