The Astronomical Event of the Decade

A solar eclipse double-header in 2023 and 2024 offers the perfect experience to excite early learners.

By Anna Hurst, Julia Plummer, Suzanne Gurton, and Dennis Schatz

On Saturday, October 14, 2023, and then again on Monday, April 8, 2024, sky gazers all across North America will experience what is arguably the most breathtaking of astronomical phenomena: a solar eclipse. During the October eclipse, everyone in North America will experience a partial eclipse, but if you are lucky enough to be in the 125-mile-wide “path of annularity,” you will see the Moon slowly pass in front of the Sun, until only a “ring of fire” (a ring or annulus of the Sun’s surface) is visible. The eclipse is not total because the Moon is approaching its farthest point from the Earth, so appears too small to cover the entire Sun.

The April event will be a repeat of what everyone saw in 2017 but even better. Everyone in North America will experience a partial eclipse, but those lucky enough to be in the 100-mile-wide path of totality will see the Moon completely cover up the Sun. When only a sliver of the Sun is visible, your surroundings start to get dark as if the Sun is setting, the temperature drops, and birds go to roost, as they think night is coming. Finally, the Sun is totally covered, and the beautiful solar atmosphere (the corona) becomes visible.

Totality will last up to four minutes, making it much longer than the 2017 eclipse. While only those people in the narrow 100-mile-wide band will see a total eclipse, everyone in the United States will see a partial eclipse and will need to be prepared to safely observe the event and enjoy its beauty.

See NSTA’s Solar Eclipse Observing Guide for Educators (see Online Resources) for more details regarding the eclipses, including their path across North America, when and where to observe them, and how to use safe viewing strategies.
A Perfect Event for Early Learners

The two eclipses are ideal astronomical events to observe with young children because they allow them to observe a powerful yet easily accessible astronomical phenomenon. Observing scientific phenomena is the first step toward engaging in scientific inquiry for young children (Plummer and Ricketts 2023). Most astronomical phenomena are a challenge to observe because they occur over long periods of time, you need telescopes to observe them, or they happen at night when young children are sleeping. A solar eclipse, however, happens during the daytime and can be observed using simple equipment, such as solar-viewing glasses or a pinhole projector (see safe viewing strategies in the NSTA Solar Eclipse Observing Guide for Educators).

A solar eclipse is also a relatively simple phenomenon—one that children can model using familiar concepts and materials. During the eclipse, the Moon blocks the Sun’s light, producing a shadow that falls on the Earth. Shadows are a phenomenon that children encounter in their everyday lives. Thus, observing the phenomenon of the Sun going dark during the day can begin a conversation involving explanations that use models of astronomical objects.

Eclipses can be powerful social events that may stimulate conversations about science for weeks and even years to come. A social experience such as this one has the potential to be a catalyst for further science exploration for a young child and may foster children’s further interest in science.

A Pathway to the Skies

Educators and researchers working on the “My Sky Tonight: Early Childhood Pathways to Astronomy” project have researched methods that support young children’s observations of astronomical phenomena (e.g., Plummer and Ricketts 2023). My Sky Tonight (MST) is an NSF-funded program from the Astronomical Society of the Pacific, in partnership with three universities and four museums. The MST team created a set of research-based, developmentally appropriate, hands-on astronomy activities for preK children, which are distributed to children’s museums and science centers across the United States and are freely available online, accessible to any interested educator (see Online Resources). Many of the activities focus on phenomena that children this age can experience directly, including phenomena related to the Sun, Moon, and Earth (three objects essential to understanding a solar eclipse).

Getting the Most out of the Eclipse

Investigating Shadows

To understand what causes a solar eclipse, one must first have some basic understanding of shadows. One of the MST activities, Bear’s Shadow, focuses on the shadow phenomenon (see Figure 1 for materials lists for these activities). Prior to formal instruction, young children often have many ideas about shadows, such as “Everyone can see their shadow,” “It follows you,” and “The sunlight makes it happen because [the Sun is] so bright” (Worth and Grollman 2003, p. 131). Yet understanding how shadows form often requires the support of hands-on instruction that helps children connect the relative position of the light source, the object, and the shadow (Hadjigeorgiou 2015).

The activity begins with reading Moonbear’s Shadow (Asch 2000), a story in which a bear tries to run away from his shadow. The book’s illustrations show the positions of the Sun and the shadow changing throughout the day. The story prompts the children to wonder, “How can shadows appear long or short and in different directions?”

To investigate this question, children are invited to recreate scenes from the book by using a scientific model. In this case, we use a flashlight to represent the Sun and a figurine representing the bear. We challenge children to make Bear’s shadow long, short, in front of him, behind him, and so on, so they can use their own observations to make claims about how the Sun’s location is related to shadow length and direction. We have found that young children often use more than verbal descriptions to make their claims. They often include gestures and manipulations of the model to communicate their ideas about light and shadows (Plummer and Ricketts 2023). Encourage children to compare the flashlight’s position and the shadow’s length and direction. Giving children interesting prompts and tasks to try out with the materials often leads to
fun and unexpected responses. For example, when asked if they could make Bear’s shadow disappear (this happens at noon in the book), some children simply turned off the flashlight or put it under the table! This gave the educator the opportunity to try to clarify the challenge; she referred to the book and the scene at noon. Children then attempted to use the models to make Bear’s shadow disappear following the ideas from the book. These simple representations of the Sun and the bear engage children in the scientific practice of modeling as they test their ideas to understand and explain shadows.

Modeling a Solar Eclipse

Talking to children about what to observe and experience during the eclipses can help them understand the objects that are involved in this phenomenon. Show children photographs of solar eclipses and ask if they have any ideas about what causes eclipses. Some guiding questions for this discussion could include:

- What do you notice in the photograph?
- If the Sun is in the sky, does the eclipse of the Sun happen during the day or the night?
- What do you think causes a solar eclipse?
- What could cause something bright to become dark? Have you ever experienced anything like that?

Create a model using the children’s own bodies to represent the Earth, a ball to represent the Moon, and a lamp to represent the Sun. Begin by kinesthetically modeling day and night on Earth. For example, tell the children: “Let’s all pretend that we are the Earth. Imagine we live on the tip of

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**For the Bear’s Shadow activity:**
- Book: *Moonbear’s Shadow* by Frank Asch
- For each station:
  - Green mat with blue pond and fish
  - Bear figure
  - Tree (small model or stand-up paper cutout)
  - Flashlight with Sun cutout attached
- Set of challenge cards (available for download at [https://astrosociety.org/file_download/inline/16c059d4-27c3-49b2-8178-c1f1f291ba68](https://astrosociety.org/file_download/inline/16c059d4-27c3-49b2-8178-c1f1f291ba68))

**For modeling eclipses:**
- Photographs of solar eclipses
- Ball
- Lamp

Drawings can assess children’s understanding of how shadows form. For young children, it is helpful to provide a sheet of paper with a picture or silhouette of a cartoon bear already photocopied onto the center of the page. Ask the child to draw Bear’s shadow and to draw where the Sun would be to make that shadow. A child that is beginning to understand how shadows are formed will be able to draw the Sun on the opposite side of the Bear’s shadow. Through conversation, a child may reveal whether he or she understands the relationship between the height of the Sun in the drawing and the length of the shadow.

The story shows the Sun’s changing position throughout the day and the resulting change in the position of Bear’s shadow. The story isn’t specific about where Bear lives and makes a general statement about the shadow disappearing at noon when the Sun is directly overhead. This doesn’t actually happen anywhere in the United States, except Hawaii—it only happens in the tropics. A more useful generalization of this is to notice when the shadow is at its shortest, rather than looking for it to disappear. As children investigate how shadows form, they start to understand the relationship between the Sun’s position in the sky and length and direction of shadows. They will build on this in future investigations, during which they track shadows throughout the day to learn about the Sun’s apparent motion.

Understanding shadows is a first step toward understanding the phenomenon of a solar eclipse and prepares young learners to understand disciplinary core ideas (DCIs) in the *Next Generation Science Standards*. For lesson plans and videos of Bear’s Shadow and the other My Sky Tonight activities, as well as additional related resources, visit the My Sky Tonight website (see Online Resources).
our noses, Mt. Nose! Can you face the Sun (lamp) so that it’s
daytime on Mt. Nose? Now slowly turn so that it is night-
time on Mt. Nose, facing away from the Sun.” This activity
is outlined in more detail in the Day & Night activity from
My Sky Tonight (see Online Resources).

Next, model the solar eclipse. Have each child hold a large
ball between his or her face and the lamp so that it blocks
the light. Ask children, “Can you see the Sun now? This is
what it will be like during the eclipse!” This activity is not
for young children to fully understand the details of a solar
eclipse; rather, it provides them with initial exposure to the
ideas. This will provide a foundation for additional learning
through their real-world observations of the eclipses.

**Observing the Solar Eclipse**

The eclipses will be visible as a partial eclipse from all loca-
tions in North America as long as the sky is clear of clouds,
with the Moon blocking part of the Sun. The October 2023
annular eclipse will be visible only along a narrow path ex-
tending from the Oregon coast to the southeast coast of Tex-
as. The April 2024 total eclipse will only be visible along a
narrow path extending from the western coast of Mexico to
the eastern coast of Canada.

It is only safe to look directly at the Sun during the few
minutes of total eclipse (when the Sun is completely covered).
Any time that even a small piece of the bright Sun shows, it
is essential to use eye protection. See safe viewing strategies
in the NSTA Solar Eclipse Observing Guide for Educators.

**Safe Viewing Options**

Be sure that you have a safe solar-viewing option when ob-
serving the eclipse. Safe-viewing strategies include observ-
ing through a telescope with a solar filter, using solar-view-
ing glasses, or making a projection of the partially eclipsed
Sun with a telescope or binoculars, or a simple pinhole. Solar
glasses should be modified with elastic or tape around the
back so they stay put on young children’s small faces. Re-
mind children and adults that they should never look directly
at the Sun with their unaided eyes, except during totality.
Ask the other adults present to remind the children of this
as needed.

**Before the Eclipse**

Well in advance of the time of the eclipse, make sure your
youth have already safely observed the Sun using the same
observing options you will be using during the event. There
are two reasons for this. First, it is important for children to
gain experience in using these observing aids safely when
there is no rush to observe the eclipse. Second, this will pro-
vide children with experience observing the Sun when it is not
eclipsed; making comparisons of observations is an important
part of doing science. The partial eclipse is visible over hours
as the Moon slowly covers the Sun, but the total eclipse only lasts one to four minutes! Therefore, viewing the Sun safely can start during the partial eclipse, which provides a useful comparison to later observations. Be sure you have enough adult supervision to ensure children follow safety procedures. We recommend one adult for every three to four children.

**During the Eclipse**

As the Moon begins to cover the Sun and the eclipse event begins, you might encourage students to talk about what they are observing by asking questions:

- Do you notice anything different about the Sun yet?
- What is covering the Sun?

Once totality begins—if you are lucky enough to be in the path of totality: Is the Sun completely dark? Is there any light at all around the Moon? (Don’t forget that only during totality can you directly observe the Sun without protection.)

In addition to directly observing the eclipse, encourage the children to notice what happens to the environment around them. You might ask questions such as: *Does it get any darker when the Sun is partially covered?* If the children are lucky enough to see the total eclipse, have them not only notice how dark the surroundings get, but what happens to wildlife (e.g., birds) and to the temperature. *Did you notice what the birds are doing? How does it feel now? Is it warmer or colder?*

**After the Eclipse**

Encourage children to draw what they observed and share their observations verbally with each other and the teacher. We have found that conversations around children’s drawings are important opportunities to reveal children's conceptual understanding when their ideas are not easily conveyed by their verbal abilities or the details of their drawings alone (Brooks 2009). Their drawings may not be accurate and they may vary greatly, sometimes showing just the Sun and other times showing the child observing the eclipse, or a drawing of the model you demonstrated earlier.

**Assessment**

Although it is not appropriate to assess the drawings for accuracy or specific details, the act of recording observations is a valuable scientific exercise that can be a first step toward more sophisticated scientific representations as children get older. We suggest that assessment instead focus on considering how children use elements of their drawings to support their explanation of the event. Look for evidence of children conveying details of the experience in their drawings that help them convey a sense of the phenomenon. Edson (2013) provides suggestions for assessment guidelines for children’s science notebook entries, including observational drawings. This includes assessing for accurate colors, inclusion of key details, and (for older children) use of written notes such as scientific vocabulary. If observational drawings are a regular part of your classroom curriculum, look for ways your children’s drawings of the eclipse show they are improving their skills in recording their observations.

**Conclusion**

Young children are natural explorers, learning about their world by experiencing it. Although most astronomical phenomena require special equipment to observe, the solar eclipse and changing shadows from the Sun are phenomena that children can
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observe directly and explore through models. The annular solar eclipse on October 14, 2023, and the total solar eclipse on April 8, 2024, are must-see opportunities, whether you are in the path of totality or in a location where you will see a partial eclipse. These are astronomical phenomena that children can observe, record, and model. This can inspire many science conversations and experiences in the following weeks and months.

ONLINE RESOURCES

My Sky Tonight
www.astrosociety.org/MySkyTonight
NSTA Eclipse Guides, Resources, and More
www.nsta.org/eclipse
Science 101: Do You Have an Activity for Daily and Seasonal Patterns and Motions of Earth?
Solar Science: Exploring Sunspots, Seasons, Eclipses, and More

REFERENCES


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