



Interpreting the Eclipse – Some Thoughts to Get You Started

Science is happening in America's conserved sites.

Science is an important endeavor.

You can be a part of it.

The total solar eclipse of August 21, 2017 presents a unique opportunity to engage visitors about our planet, our Sun and Moon, the Solar System and our place in the universe. Total solar eclipses are powerful emotional experiences that also can be used to help connect visitors with the scientific process, science results, human endeavors, and cultural history.

As interpreters contemplate how best to engage visitors about the total solar eclipse, many will be looking for ways to connect the eclipse with the themes of their site. Below are a few notions of Tangibles, Intangibles and Universals to get people started in thinking as they plan for this event:

Tangibles	Intangibles	Universals
Heat and Cold	Our place in the Universe/Earth and Solar System	Scale
Light and Dark	Movement	Fear
Shadow	Fear	Power
Orbit	Awe	Awe
Phases	Discovery	Time
Gravity	Exploration	Movement
Energy	Sense of profound shared experience, joined by	Exploration
Stars	millions	Discovery
Moon		
Earth		
Sun		
Animals		
Plants		
Sound		

Some topics related to the solar eclipse that may readily link to park/site themes

Human exploration and settlement of North America

Native people's belief systems tied to Sun, Moon, etc.

Earth is within the Solar System and is itself a system of systems – link to ecosystems and other systems in evidence at your site

Dark sky preservation

Natural sounds preservation

Scientific inquiry

History of science and of our understanding of natural phenomena

The total solar eclipse of August 21, 2017 presents an opportunity to inform people about:

Eclipses

- Solar eclipses occur when the Moon passes directly between the Earth and the Sun, casting a shadow on the Earth's surface. You can observe a total solar eclipse when the Moon passes directly between the Sun – and you.
- Very few people can observe a solar eclipse when it occurs, because the Moon is very small relative to the Earth, and very far away, so the shadow it casts only falls on a small area of the Earth's surface.
- Lunar eclipses occur when the Moon travels into the Earth's shadow. During a lunar eclipse, the Earth is directly in between the Moon and the Sun.
- Lunar eclipses occur about as often as solar eclipses, but we can observe them more often because everyone on the night side of the Earth can see a lunar eclipse when it occurs.
- Eclipses do not occur every month because the Moon's orbit around the Earth is tilted relative to Earth's orbit around the Sun. Sometimes the Moon makes a direct line with the Earth and the Sun (and then we get an eclipse), and sometimes it does not.
- NASA resources for the August 21, 2017 total solar eclipse (note: content continually growing):
 - <https://eclipse2017.nasa.gov>
 - <https://svs.gsfc.nasa.gov/Gallery/suneclipse2017.html>
 - <https://eclipse.gsfc.nasa.gov/solar.html>

Eclipse Science

- Einstein's General Theory of Relativity was first tested during a total solar eclipse in 1919. (It accurately predicted the deflection of starlight seen in photographs from stars that were near the Sun's dark disk during the eclipse, caused by gravitational lensing).
- Lunar eclipses provide an opportunity for scientists to better understand the uppermost layer of the Moon's surface (scientists use a thermal radiometer onboard the Lunar Reconnaissance Orbiter to see how the Moon's uppermost surface responds to the rapid change in temperature during a lunar eclipse. The thermal properties of the surface help scientists better understand its composition and physical properties.)
- Many exoplanets and binary stars are discovered because of eclipses.
- Total solar eclipses are the only times scientists can currently see deep down into the Sun's corona. You can capture images during totality to help scientists better understand this layer of the Sun's atmosphere.
 - <http://eclipsemegamovie.org>
- You can participate in a number of other eclipse-related science investigations, such as:
 - <http://eclipse2017.nasa.gov/citizen-explorers>

The Sun

- We are learning more about the Sun every day, due to a fleet of spacecraft that observe and monitor the Sun.
- We know a lot about the star in the center of our Solar System – but there is still a great deal that we do not know.
- For more information about solar science, visit:
 - <https://solarsystem.nasa.gov/planets/sun>
 - https://www.nasa.gov/mission_pages/sdo/main/index.html

The Moon

- We are learning more about the Moon every day, because of spacecraft collecting data at the Moon right now.
- Learning about the Moon helps us better understand the Earth, as well as all of the other planets and moons in our Solar System. The same processes that shape and affect the Moon are active throughout the Solar System, and beyond.
- The Moon is of particular importance to us because it holds a record of Earth's early years – a record that Earth has erased (through plate tectonics and weathering and erosion). If we want to know what the early Earth was like, and what it experienced, we need to study the Moon.
- Data from current and recent missions have revolutionized our understanding of Earth's nearest neighbor. Recent discoveries include: there is water on the Moon! (in several places – some of them unexpected, and which we don't yet understand); there has been recent geologic activity on the Moon (volcanoes and faults active within the past few million years); the Moon might still be shrinking!
- You can learn more about these and other discoveries about the Moon here:
 - <http://moon.nasa.gov/>
 - https://www.nasa.gov/mission_pages/LRO/main/index.html

The Process of science – and the Predictive Power of Science

- We know exactly where and when we will be able to see the eclipse - and we know where and when eclipses will (or did) occur hundreds of years in the future and in the past. This is pretty remarkable.
- Everyone observing the eclipse (total or partial) will be testing a hypothesis made by scientists decades ago, who used their knowledge of the patterns of in our Solar System to predict that there would be a solar eclipse on August 21, 2017 – and that you would be able to see it at a certain time and a certain place on our planet. If you do, you have found additional support for this hypothesis. You are a part of the scientific process.
- Native groups had the opportunity to witness solar eclipses, and records of these observations may be preserved in stories and rock art (e.g. a petroglyph in Chaco Culture National Historical Park).

Additional Topics:

- Scale of our Solar System
- Motions in our Solar System
- The scale of exploration
 - Example: All of the tracks made by the first astronauts to walk on the Moon would fit inside a baseball diamond. If you were only to walk that far/explore an area that small inside this park, how much would you have seen of the whole park? The country? The planet? – Can extend this to the distances traveled during the other Apollo missions, and by rovers on Mars. (Take home message: there is still a lot left to explore.)
- Daytime astronomy
- Solar energy
- Exploring the Earth/exploring the Solar System
- Idea of systems: solar system, ecosystem, Earth systems, systems in your body
- Navigation