

Total solar eclipses provide an opportunity to engage with science, culture and history

March 14 2024, by Nikhil Arora and Mark Richardson



The Baily's Beads effect occurs when gaps in the moon's rugged terrain allow sunlight to pass through in some places just before the total phase of the eclipse. Credit: Aubrey Gemignani/NASA

On April 8, 2024, there will be a total solar eclipse in Canada. This is an opportunity to experience, learn from and participate in the excitement

and wonder. And rather than hiding inside, researchers have been communicating how people can safely enjoy this unique opportunity.

Roughly every 18 months, the sun, moon and Earth come into perfect alignment and somewhere on Earth [experiences a solar eclipse](#). During this phenomenon, the moon casts a roughly 250 km wide shadow onto Earth.

This ephemeral daytime darkness can be a once-in-a-lifetime experience. The last time Toronto experienced a total solar eclipse was on [Jan. 24, 1925](#); the next total solar eclipse will occur in 120 years, on [Oct. 26, 2144](#).

Our interpretation of, and response to, total solar eclipses has advanced enormously. Eclipses were once considered cosmic omens that predicted dying kings, good harvests or the need for new territorial treaties. Today, they provide a unique opportunity to consider the physical nature of the universe, and the cosmic privilege of witnessing the alignment of the moon and sun.

Eclipses and knowledge creation

Due to their sudden darkness, solar eclipses have been perceived [through history as catastrophic events](#). Many societies developed stories to [explain these unusual events](#), often filled with fear and violence.

Indian myths tell of an [immortal demon seeking revenge on Vishnu by trying to eat the sun and moon](#). The Pomo, Indigenous people of Northern California, describe [a huge angry bear trying to eat the sun](#). In other mythologies, eclipses were thought to be heavenly forces removing our source of warmth and life.

Beliefs about eclipses motivated ancient Greek astronomers to create the

[antikythera mechanism](#), a complex analog computer that predicted the timing of future eclipses with a precision of 30 minutes. These predictions were critical for Greek society as a solar eclipse could mean an upcoming death of the king, requiring the appointment of a pseudo-emperor to be killed instead.

Our reactions to eclipses have evolved, driving us to better understand the solar system and the universe at large.

During the eclipse on Aug. 18, 1868, astronomers Norman Lockyer and Pierre Janssen each studied the light from the solar corona to [discover a new chemical element](#). This chemical element was named helium, after the Greek word for the sun.

On May 29, 1919, Frank Watson Dyson and Arthur Stanley Eddington studied the [bent path of starlight](#) during a total solar eclipse for the first experimental "[triumph of Einstein's theory](#)" of general relativity.

Eclipse experiences

Unlike many other cosmic events, such as [meteor showers](#) or comets, which require expensive telescopes or [dark sky places](#), eclipses are a barrier-free celestial event. To safely enjoy the eclipse, one simply needs eclipse viewing glasses or [a cardboard box](#).

Many universities across Canada are using the opportunity of the total solar eclipse to engage with people to safely experience this astronomical phenomenon. For example, Queen's University in Kingston, Canada is making [120,000 eclipse glasses available](#) to make safe eclipse viewing possible for anyone.

In the spirit of education, hundreds of [eclipse ambassadors](#) are heading to schools to engage with students about having a profound and safe

experience during the eclipse. These ambassadors lead workshops on building inexpensive pinhole cameras to project the sun during the eclipse, explaining unique features that can be seen during eclipses, such as [Bailey's beads](#) and the [diamond ring effect](#), and helping everyone appreciate the vastness of the solar system.

These efforts demonstrate the universal value of science, and promote science engagement beyond classrooms and institutions.

Not only is the upcoming eclipse being leveraged as an opportunity to inspire the next generation of scientists, but it is also being used for the advancement of scientific knowledge. Unlike the experiments of Dyson, Eddington and Lockyer that were limited to the academy, today's institutions are mobilizing the public to conduct citizen science experiments.

Initiated by NASA, the [Eclipse Megamovie project](#) will use photos taken during totality of the solar eclipse to study the solar corona. In 2017, photos collected during the total eclipse helped researchers identify a plasma plume in the [solar corona](#). The 2024 eclipse will help researchers study this plume in greater detail.

Anyone with a DSLR camera and a tripod can submit a picture of the total solar eclipse to the Eclipse Megamovie project. The public data collected for the 2024 eclipse will far exceed what could be accomplished by any one experiment or location.

April's [total solar eclipse](#), and others to come, will remind people that science is exciting and inspiring, and that scientific expertise is of profound universal value. Such a celestial coincidence is an opportunity to engage with local communities and discuss the origin and mechanics of our solar system, all while including the public in scientific discovery through crowd-sourcing images of their experience.

All that's left is to hope for clear skies and marvel once more at the cosmos.

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