Science AMA Series: We're NASA scientists. Ask us anything about the Aug. 21 total solar eclipse!

NASA-Sun-Earth [1] and r/Science AMAs[1]

[1]Affiliation not available

April 17, 2023

Abstract

Edit, 4:31 PM ET We're signing off. Thanks for all of your questions! Some of us will try to answer more questions throughout the next couple of days. And remember, all our eclipse info is at eclipse2017.nasa.gov Edit, 3:03 PM ET We're live! We'll be online answering questions starting at 3 PM ET! On Monday, August 21, 2017, daylight will fade to the level of a moonlit night as millions of Americans experience a total solar eclipse. For the first time in nearly 100 years (since 1918), the moon's shadow will sweep coast-to-coast across the US, putting 14 states in the path of totality, and providing a view of a partial eclipse across all 50 states. A solar eclipse happens when a rare alignment of the sun and moon casts a shadow on Earth. Eclipses provide an unparalleled opportunity for us to see the sun's faint outer atmosphere, the corona, in a way that can't be replicated by human-made instruments. We believe this region of the sun is the main driver for the sun's constant outpouring of radiation, known as the solar wind, as well as powerful bursts of solar material that can be harmful to satellites, orbiting astronauts and power grids on the ground. We're here to talk about * What you'll see on August 21st & how to watch it safely * Why we're excited to study the sun during this eclipse & our upcoming mission to the sun * How eclipses can help us learn about Earth, the solar system, and exoplanets More info at https://eclipse2017.nasa.gov/ Mitzi Adams I am a solar scientist for NASA's Marshall Space Flight Center (MSFC), where I study the magnetic field of the Sun and how it affects the upper layer of the solar atmosphere, the corona. With a professional interest in sunspot magnetic fields and coronal bright points, friends have labelled me a "solar dermatologist". Alexa Halford I am a contractor at NASA Goddard. Throughout my education I have been lucky to work at JPL NASA looking at Uranus's moons and study Saturn on the Cassini mission at the South West Research Institute. Today I stick a bit closer to home studying the Earth's magnetic field and its space weather phenomena. Michael Kirk I am currently a fellow with the NASA Postdoctoral Program (NPP). This two-year program allows me to pursue my research interests here at Goddard and collaborate with other scientists. My research interests include automated solar image processing, anatomy of chromospheric flares and associated ephemeral brightenings, solar cycle variations in polar coronal holes, and helioinformatics (the way we scientists interact with and make use of solar data Debra Needham I am a planetary scientist at NASA Marshall with a focus on geomorphology, surface processes, and volcanology on the Earth, the Moon, Mars, and Venus. I am also involved with efforts to integrate science into future robotic and human exploration. Cécile Rousseaux I graduated from the University of Namur (Belgium) and received a Masters Degree in Biology of Organisms (University of Namur) and another one in Oceanography (University of Liege). I then did my PhD in Environmental Engineering at the University of Western Australia. In 2011, I started working at the NASA Goddard Space Flight Center as a Research Scientist. My research focuses on the effects of climate variability on the oceans using earth system models and satellite ocean color through data assimilation. Jesse-Lee Dimech My name is Dr. Jesse-Lee Dimech, I'm a lunar seismologist and NASA postdoctoral fellow at MSFC. I research "moonquakes" using seismic data recorded during the Apollo moon missions. I'm also helping operate an H-alpha solar telescope on eclipse day in Hopkinsville, Kentucky, which will live feed to NASA TV. Dr. Alphonse Sterling I am a solar scientist at NASA Marshall where I study the magnetic field of the Sun and how it affects the solar atmosphere, including the chromosphere and the corona. I have attended several eclipses. Chris Blair I am a communications professional at NASA Marshall specializing in planetary and solar sciences and the International Space Station.

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REDDIT

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NASA-SUN-EARTH R/SCIENCE

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We're here to talk about
• What you'll see on August 21st & how to watch it safely
• Why we're excited to study the sun during this eclipse & our upcoming mission to the sun
• How eclipses can help us learn about Earth, the solar system, and exoplanets
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READ REVIEWS

WRITE A REVIEW

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What recommendations do you suggest to viewers of the eclipse to get the best experience?

hnglmkrnglbrry

Plan ahead! Many people will be traveling to the path of totality, which stretches SE through the US, from Portland, Oregon and Charleston, South Carolina, so expect crowds, especially along major roadways. Most of the continental US will see 75% of totality though, so you don't have to travel to see it!

Bring safe eye-wear and solar filters if you plan to look directly at the sun (see http://eclipse2017.nasa.gov/safety for more details). Be very careful not to look directly at the Sun without the safety glasses!

If you bring a camera or telescope, make sure to use proper solar filters to protect your optics. For the best experience, try to automate your cameras so you look around you during the eclipse.

Things to look for:

About a minute before totality look at the ground for shadow bands on lighter surfaces such as on a car - they'll look like snakes wriggling on the ground.

Right before and after totality, look for "Baily's Beads" and the Diamond Ring effect, where there will be a point or balls of light on one side of the mostly eclipsed Sun. Make sure you're wearing your safety glasses at this point!

During totality, you might be able to see coronal bands surrounding the Sun. During totality you can look at the Sun without eye protection, but as soon as it starts to get bright put them on again!

-DN

What kind of data might NASA be getting from studying the suns corona during this eclipse? and what could this data mean for our understanding of the sun?

Altvra

The sun's corona is the source of all of the energetic particles that bathe the Earth (this is called the solar wind). One unsolved question about the corona is how it gets accelerated off of the sun and into space. Our best instruments to study the corona are not good enough (yet) to block the sun's bright surface completely and see the solar atmosphere down to its surface. During a total solar eclipse, we get an exact alignment and have the opportunity to see from the solar chromosphere through the transition region and into the corona. This will hopefully help us understand where the solar wind originates and how it is accelerated. -MK

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Altvra

We will be studying the visible-light inner corona, which can only be seen during a total solar eclipse. With these observations, we can stitch together multiple wavelengths of the corona and follow phenomena from the photosphere (the surface of the Sun) to the chromosphere to the corona. -- MA

I've got a trip booked to see it with my family. We've got young kids (6, 4, 1). How do we keep everyone's eyes safe? Also, anything special I need to take good pictures and video? I've got a DSLR and a gopro.

shadfc

It is important to never look directly at the sun without proper eye protection. You can seriously injure your eyes. We suggest to purchase ISO 12312-2 compliant and CE certified pair of glasses. You can find more information on this at https://eclipse2017.nasa.gov/safety C.R.

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shadfc

During the partial phases, be sure to have eclipse glasses (ISO rated 12312-2) for everyone. When you see the Diamond Ring, totality begins and you will see nothing through your eclipse glasses; at that time you can take off the eclipse glasses and look at the amazing eclipsed Sun. BEFORE the next Diamond Ring, and you will see the edge of the Moon begin to brighten a bit, put your eclipse glasses back on. Also, I don't recommend staring with eclipse glasses for a long period of time. A minute or two is probably all you need anyway to keep track of the progression of the eclipse. -- MA

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shadfc

Only view the sun directly through eclipse glasses, or #14 welders glass if you have it. The only exception is during totality, when the photosphere of the sun is fully covered by the moon, and you can see the corona surrounding the moon. At this point, you can look directly at the sun without eye protection. But the moment it starts to get brighter, you must put them back on.

Check out this page for safety tips:http://eclipse2017.nasa.gov/safety

Don't try and take a picture of the eclipse on a camera without an appropriate eclipse filter, or it might damage the sensor in your camera.

- JLD

With the area underneath the totality not receiving the infrared energy from the sun, how much of a temperature drop should we expect?

Also since pressure is related to temperature, will there be a wind pattern that follows the totality?

Jafuba

There will be a drop of temperature of between five and ten degrees fahrenheit. -- MA

I've heard something about snakes on the ground being a possibility with this solar eclipse - can you explain this?

Edit: I am referring to the Smarter Every Day video. Are we going to experience shadow bands?

Viixo

Shadow bands are tricky! If you are going to see them, they will show up about a minute before and a minute after totality - you must be in the path of totality to see the shadow bands. However, we don't really know why shadow bands form yet, so we can't predict whether or not you will see them in this event. We might know more after we analyze data collected during this eclipse!

-DN

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Viixo

We will be looking for Shadow Bands -- the Doctor featured on the Smarter Every Day video is a friend of mine...But, we cannot predict whether we will see shadow bands. I have experienced five eclipses, but have seen shadow bands only once.

Any plans to have a time lapse camera on a high mountain pointing west to watch the shadow approach at supersonic speed?

kkehoe5

I don't know of any mountain top cameras, but I do know there are going to be several high altitude balloons watching the shadow come racing across the landscape.
https://eclipse2017.nasa.gov/balloon-observations -MK

How rare do you think it is to have a moon and sun to have the same size as seen from the planet's surface? And how close is the perceived similarity?

liarandathief

It is extremely rare in our solar system. In fact, our moon is the only one that exactly blocks out the disk of the sun while leaving the outer corona exposed. There are transits (eclipses) on other planet-moon systems in the solar system, but they are not nearly as amazing as on Earth. They would block the sun so much that you wouldn't be able to see any solar features, it would just get dark - like a really dark cloud was passing.

The alignment of sizes is extremely exact. Since the moon doesn't have an exactly circular orbit, sometimes the moon doesn't even completely cover the sun - this is called an annular eclipse. Other times when the moon is closer to the earth, it more than covers the sun, but not by more than a couple percent. -MK

Hi there! I've been counting down to this eclipse for 15 years and I'm taking my kids over 100 miles to view the totality. We're planning to

- Buy eclipse glasses to view the partially eclipsed sun
- make a pinhole viewer
- view eclipse shadows made by leaves
- make eclipse shadows with our fingers
- use binoculars to project the eclipse

What other activities, experiences, or experiments should we be sure to do to take full advantage of our eclipse experience?!

freeschooler

If you have a pasta strainer (colander) with holes in it, and you hold it so it makes a shadow on the ground, during the eclipse you will see lots of crescent shapes where the light passes through the holes. -JLD

Around what time does the event take place?

EnglandFairy

It depends where you are. The lunar shadow enters the United States on August 21st near Lincoln City, Oregon, at 9:05am PDT, and leaves the United States at 4:09pm EDT. All of the United States will see at least a partial eclipse. But totality (full obstruction of the sun by the moon) is only visible in some parts of the country. For more information on the path of totality, and the amount of the sun which is blocked out based on your location, check out this page: https://svs.gsfc.nasa.gov/4518 -JLD

Around what time does the event take place?

EnglandFairy

The eclipse enters the U.S. at 10:15 am PDT off the coast of Oregon and exits the U.S. at approximately 2:50 pm EDT in South Carolina. C.R.

I live approximately 6 miles from the edge of the path of totality. Do you think that there will be a noticeable difference in viewing this from my backyard vs. driving the 6 miles to be directly in the path of totality?

j1e2f3f

Yes! 6 miles makes a big difference. You will not see a total eclipse if you are 6 miles from the edge of the path of totality, and if you are right on the edge, you will see it only for a very short time. I would

suggest positioning yourself so that you are in the middle of the path of totality, especially if you are so close. Here are some maps that might help you: https://eclipse2017.nasa.gov/eclipse-maps

But be careful with traffic, lots of people will probably be doing the same thing. -JLD

I've been told its safe to take off the glasses at the totality and gaze in awe. Is this correct? Thanks for the Q&A!

jevchance

Yes it is safe to look at the sun when it is in totality. Safety is critical, but you won't be able to see the amazing beauty of the solar corona if you keep your eclipse glasses on. So check your location for exact times of totality and be sure to put your glasses back on before totality ends. I would recommend setting a timer so you know when the totality is ending and it is time to look away. -MK

Aside from the light darkening aspect, are there any other physical effects a Total Solar Eclipse can have on an environment? For example, a change in weather or drop in air temperature?

Archer2408

Yes there can be other effects. This is one of the reason why such an eclipse is a great opportunity for us to understand some of the feedback between the energy from the sun and the earth. These uncommon conditions reduce the light and change the temperature on the ground. These changes in conditions can affect weather and life on earth. NASA will follow these changes in conditions through several observing systems including spacecrafts, sub-orbital balloons, ground-based observations, and citizen scientist. C.R.

Many historical battles mention an eclipse and it is conjectured that the sophisticated manual computer the Antikythera Mechanism was designed and built to predict them ... were there more total eclipses over civilisation for a time than today?

radii314

In general, no. We can have an eclipse roughly every 180 days, but because the shadow of the Moon is so small, relatively little of Earth sees it, and most of the time, the shadow will fall on water, we are a water planet. Lunar eclipses *seem* to occur more frequently because when they happen, the entire night side of Earth can see them. -- MA

So I'm going to have my telescope (Celestron 5SE, i know, it's a noob scope) w/ a solar filter, and my camera (Canon T6i). What settings should I use on my camera to take video this awesome event?

hobby_scientist

Nothing wrong with a C-5. I have one. Practice with the full Moon, which is approximately the same brightness as the visible-light corona, but during totality, use different exposures, because by doing so, you will bring out different details in the corona, and you will be able to see the prominences. -- MA

What specific data will NASA be studying during the eclipse that they can't under normal conditions?

glittaknitta

We will be studying the visible light inner corona - with SOHO we look at the corona all the time but because of internal reflections, the disc they use to make the eclipse causes internal reflections so they have to make it oversized and it's way bigger than the size of the sun. During the eclipse, we can look at the inner corona and connect it with the outer corona. - MA

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glittaknitta

Astronauts aboard the International Space Station will gather imagery data, NASA's Lunar Reconnaissance Orbiter will also turn its instrument to face the Earth and attempt to track the shadow of the moon on our planet. Additionally several space and aircraft instruments will observe how the eclipse affects Earth's atmosphere. This will allow us to use these uncommon conditions to understand how the light and heat from the sun can affect life on earth for example. C.R.

How does a solar eclipse affect the weather and temperature of the area in earth in its shade?

SuperpoweredNutball

The uncommon conditions produced by the total solar eclipse reduce the light and change the temperature on the ground. These changes in conditions can affect weather and life on earth. Many organisms and plants rely on light and or heat for their survival. In the oceans for example phytoplankton take up light and convert them into organic carbon that can be used by higher trophic levels as food. NASA will follow these changes in conditions through several observing systems including spacecrafts, sub-orbital balloons, ground-based observations, and citizen scientist. C.R.

Will any parts of Canada be in the path of totality?

TheVentril

A few parts of Canada will be in totality in the total solar eclipse of 2024. https://eclipse.gsfc.nasa.gov/SEgoogle/SEgoogle2001/SE2024Apr08Tgoogle.html You will just have to travel or wait until then. -MK

If all the planets and moons orbited on a perfectly flat plane (2D), like you often see in school textbooks, would there be a Total Solar Eclipse every 29.5 days?

Flight714

If the moon, sun, and earth were all on the same plane, there would be a solar eclipse and a lunar eclipse every lunar orbit. But the same place on Earth would always see the solar eclipse. - AS

Who is being chosen for the sacrifice?

On a more serious note, is there a particular reason why the USA/Northern Hemisphere gets to witness so many galactic(?) events? Aurora Borealis/Perseid Meteor Shower/All manner of eclipses.

Down here in the Southern Hemisphere, our sky tv seems to be missing a few channels.

Edit: Just to be clear I am aware of the Aurora Australis.

Sco0bySnax

There was a total eclipse in Indonesia last year and in Australia in 2012 as well as one in 2010 in The Cook Islands. This is actually the first total eclipse to hit the continental US in 99 years! - AS

I've been told this is the largest solar eclipse I will see in my lifetime. Is there any truth to this? When will the next eclipse of this magnitude occur on earth?

Thick_and_4orty

Solar eclipses occur fairly regularly (https://eclipse.gsfc.nasa.gov/solar.html), but this one is special to us because it stretches across such a broad area of the US. Fingers cross for good weather! The next solar eclipse over the continental US will occur April 8, 2024, and will stretch across only half of the US (though totality will last almost a minute longer!).

There are other solar eclipses that will occur in 2018, though they'll only be partial eclipses. The next total solar eclipse on Earth will occur July 2, 2019 - in South America.

How impressive will the eclipse be for someone outside the total eclipse area? For example, I live in Vancouver BC, will it be worth seeing here?

rdrum

That's a great question! First of all, if you are outside the total eclipse path, it is imperative that you use eye protection during the entire duration of the eclipse. If you are outside the path, you will only see a partial eclipse. If you have never seen a partial eclipse, it will be impressive to see much of the sun covered up by the moon through your filters. Even if you have seen one before, this one may be deeper, i.e. more of the sun covered, than others you may have seen - and that's fun to see! But a total eclipse is, frankly speaking, much more spectacular. But if you miss it this time, try again in 2024! - AS

Is there anything specifically spectacular about this eclipse that makes it stand out?

callumlikesfood

It's been almost 100 years (99) since a total solar eclipse has hit the entire continental US. - DN

Hi there! I am a Mechanical Engineering student with a special love for Astrophysics. Are there any fun at home experiments I can run during the eclipse. I know scientists around the world will be using that window to do collect some cool data. But I wanna have fun too!!!

jambocroop

You could check out the Megamovie, citizen scientists are still being recruited. Also Globe is looking for temperature measurements. -- MA

Which 14 states will be on the path of totality?

SweetCheeksJhony

See the maps on https://eclipse2017.nasa.gov. -- MA

Over on your twitter, you stated that it is unsafe to view the Solar Eclipse with the naked eye, as it is the same thing as the sun. But I've heard from nearby scientific communities that it is safe as long as it is during totality, and not when the sun is only partially covered by the sun.

Which is true here?

pianoboy8

It is unsafe to look at the sun during the partial phases with the naked eye. But, it is safe to look at the totally eclipsed sun with the naked eye, which is called totality. During partial phases, use protection such as eclipse glasses. During totality, take off the eclipse glasses and enjoy the fantastic view. More info: https://eclipse2017.nasa.gov/safety. - MA

Which scientific observations can only be made during totality, and what might they help us learn that we haven't already?

toasters_are_great

We can observe the inner corona during totality, which cannot be seen with our current coronagraphs because the blocking disk has to be much larger than the visible surface (photosphere) of the Sun. The Moon makes a perfect coronagraph --MA

Is it worth it to travel to the point of totality or would it be almost the same watching from a different location?

CrookedKeith

There is a very big difference in watching at the point of totality versus seeing the partial eclipse. For example, you may not see the corona bands or the diamond ring effect. But the crescent is very cool to see if you aren't able to travel. - DN