



# SOLAR ECLIPSE OBSERVING GUIDE

THE COMPLETE GUIDE TO THE AMERICAN ECLIPSE

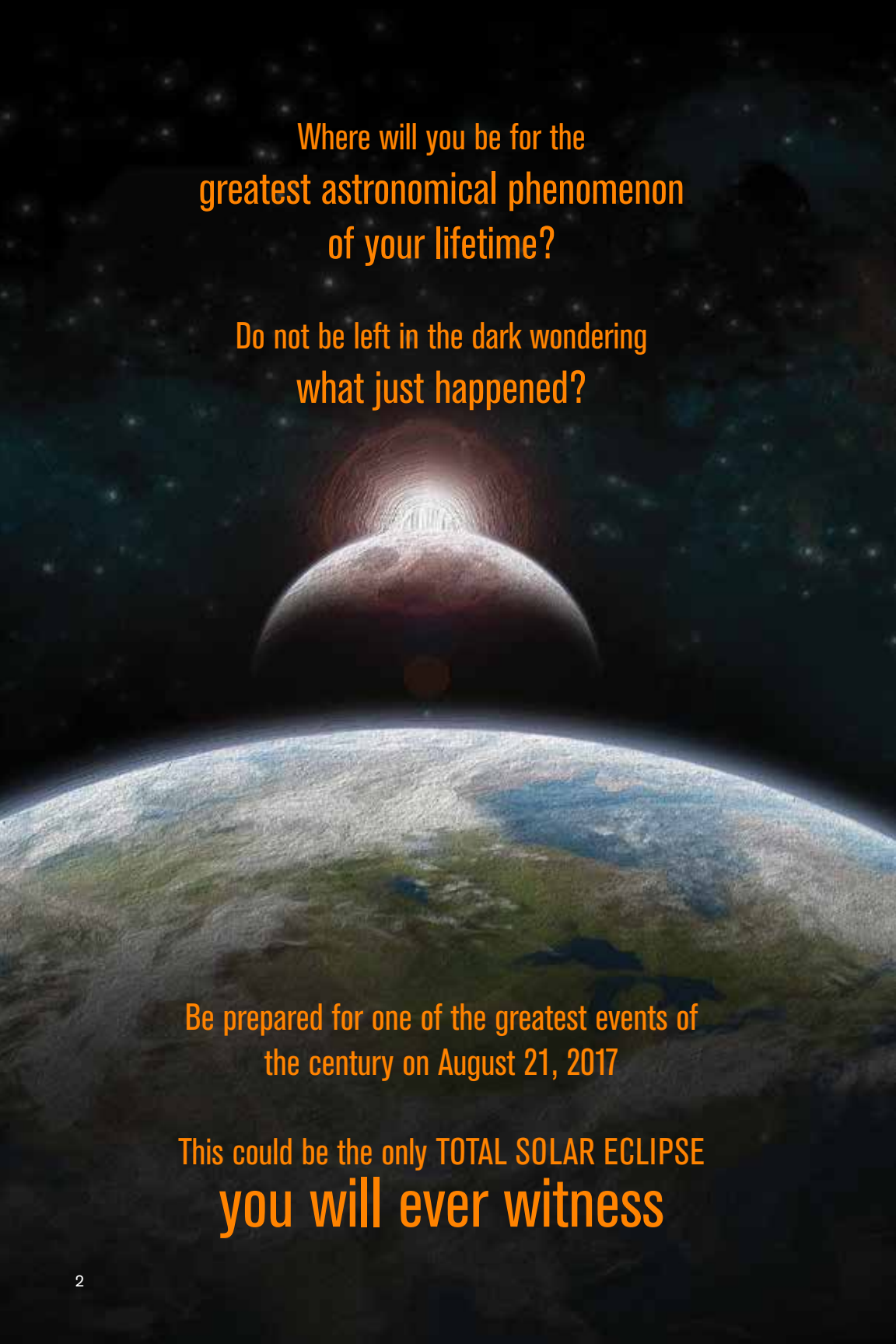


## AUGUST 21, 2017

By Fred and Patricia Espenak



by  **CELESTRON**



Where will you be for the  
greatest astronomical phenomenon  
of your lifetime?

Do not be left in the dark wondering  
what just happened?

Be prepared for one of the greatest events of  
the century on August 21, 2017

This could be the only TOTAL SOLAR ECLIPSE  
**you will ever witness**



By Fred and Patricia Espenak

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**AUGUST 21, 2017**

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**The Complete Guide For This Incredible Event Includes:**

- Science & History of Solar Eclipses
- Fun Facts for the Entire Family
- Helpful Hints and Safe Viewing Tips
- Maps and Diagrams
- Information for Partial Eclipses in the U.S., Canada, and Mexico
- And Much More





# WHAT IS A **TOTAL ECLIPSE** OF THE SUN?

On August 21, 2017 a total eclipse of the Sun will be seen by millions of people across the United States stretching from coast to coast. But first things first – what exactly is a total eclipse of the Sun? It is amazing, it can be scary, and it is like nothing you have ever seen before.

Day turns to an eerie twilight, there's a "hole in the sky," and bright stars and planets can be seen during the daytime. It is something that cannot be described – you just have to see it with your own eyes!

But what causes all of these things to happen?



2,160 MILES ACROSS



7,926 MILES ACROSS

The Sun is 100 times bigger than Earth and Earth is 4 times bigger than the Moon.

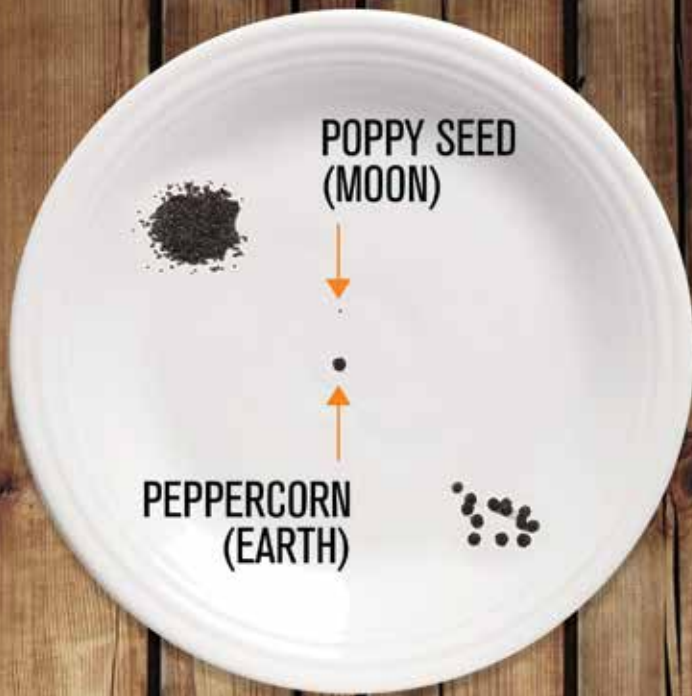
The Sun is 400 bigger than the Moon, but the Moon is 400 times closer to the Earth.

That means the Sun and the Moon appear the same size to us here on Earth.

THAT INCREDIBLE COINCIDENCE  
IS WHY WE HAVE TOTAL  
SOLAR ECLIPSES.

865,000 MILES ACROSS





In order to better visualize the scale of these bodies, imagine this. Take an ordinary dinner plate, one that is about 10 inches in diameter. This represents the Sun.

On this scale, Earth would be  $\frac{1}{10}$  of an inch, about the size of a peppercorn. And the Moon would be even smaller, perhaps the size of a poppy seed.

Remember, the peppercorn represents the world in which we live. That's pretty small compared to the dinner plate Sun.



Every year or two, the Moon's orbit lines up perfectly with Earth and the Sun. The Moon passes directly in front of the Sun revealing its faint corona, the halo of plasma that surrounds the Sun.

That's when a total solar eclipse occurs somewhere on Earth. We say somewhere because the total eclipse is only visible from inside the path of the Moon's umbral shadow, the shadow in which the Moon blocks the entire Sun, as it sweeps across our planet. This is called the Path of Totality.





## PATH OF TOTALITY

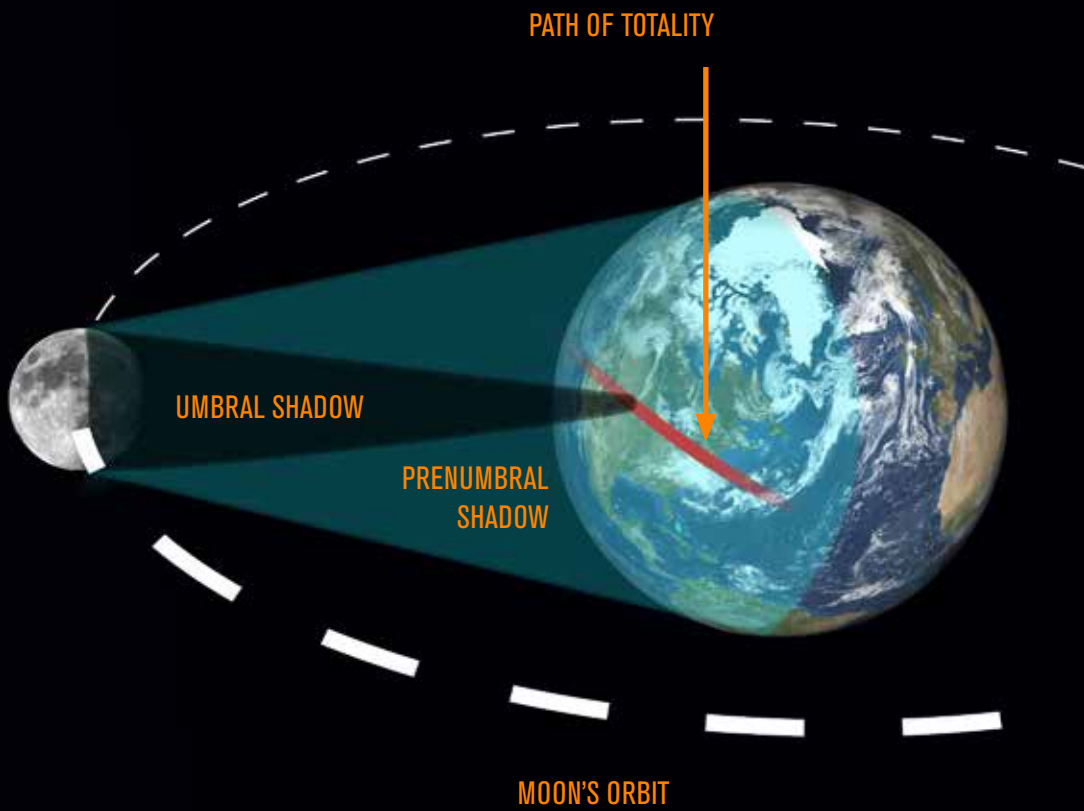
The Moon's umbral shadow crosses Earth during a total solar eclipse, creating the path of totality.

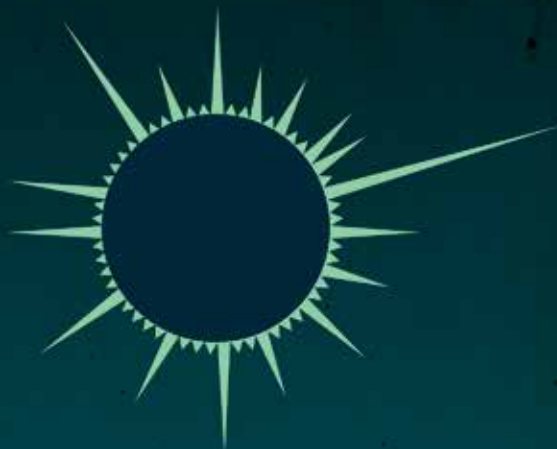
The umbral shadow is quite small when it reaches Earth, so the part of our planet that is typically treated to a total eclipse is very small – about 0.3% of the Earth's entire surface!

The Moon has a second shadow called the penumbra and it's much larger than the umbra. The penumbra is the shadow in which the Moon blocks only part of the Sun. People inside this larger shadow will experience a partial eclipse.

On average, a total eclipse is visible from any one spot on Earth about once every 375 years. So if you stay in one spot, your chance of seeing one of these astronomical wonders is pretty slim.







If you plan ahead or are lucky enough to be in the path of totality on August 21, 2017, you will never forget it, because it's not just something you see – it's something you experience. Daylight is replaced by a mysterious dusk, and bright planets and stars become visible. Plants and animals act as though it were night fall as flowers close up and birds return to roost. There's a chill in the air because the temperature drops a dozen degrees or more.

The brilliant Sun is replaced by a black orb surrounded by a ghostly halo. The colors of sunset ring the horizon, and the hair on the back of your neck stands up as those around you scream in amazement at the totally eclipsed Sun.





© F. Espenak

All total eclipses begin and end with a partial eclipse and the entire event can take nearly three hours. But the total part of a solar eclipse usually lasts only about 2 to 3 minutes, so there is very little time to absorb this spectacular sight. This is what looks like that “hole in the sky” – the black disk of the Moon with the Sun’s feathery corona spreading out around it in all directions. Because the Sun is so bright, unless that fiery disk is blocked, the corona is too faint to be seen.



As totality ends, a brilliant burst of sunlight appears along the edge of the Sun. This is the “diamond ring effect” since the corona and sunburst look like a celestial engagement ring.



If you simply can't get into the path of totality, you'll still see an interesting show. The partial eclipse will be visible from everywhere in the U.S. (see Table 2), Canada (see Table 3), and Mexico (see Table:4).

For example, in New York City you will be treated to a 72% partial solar eclipse, and if you are in Memphis, TN you will get a whopping 94% partial solar eclipse. If you happen to be lucky enough to be in a totality city such as Charleston, SC, you will get the mother lode – 100% of the Sun completely covered during the total solar eclipse. AWESOME! So if you can get to totality (see Table 1 on page 29), you will be glad you did.

If you can't, you will still see an amazing sight. You just need to make sure you have a pair of EclipSmart™ Solar Safe Shades with you.

Image Credit: Actual partial eclipse image taken by Celestron's own, Kevin Kawai. Bledsoe, TX , May 20, 2012



# HISTORY OF ECLIPSES

Although people have been watching eclipses for thousands of years, they haven't always understood what was happening. Many years ago they were surprised and terrified when an eclipse occurred.



Can you imagine how you might feel if, right in the middle of the day, the sky slowly got darker and darker until the Sun suddenly went out? You might think it would never come back or that the world was coming to an end.



That's what people thought in ancient times. They didn't want to live forever in darkness, so they would do all kinds of things to make the Sun return.



In China, they would light fires or shoot arrows at the Sun to try to make it catch fire again.

In Europe, India, and Indonesia, it was thought that a monster, perhaps a dragon, was trying to eat the Sun. People would bang on pots and pans or drums and make all kinds of noise to try to scare the monster away.

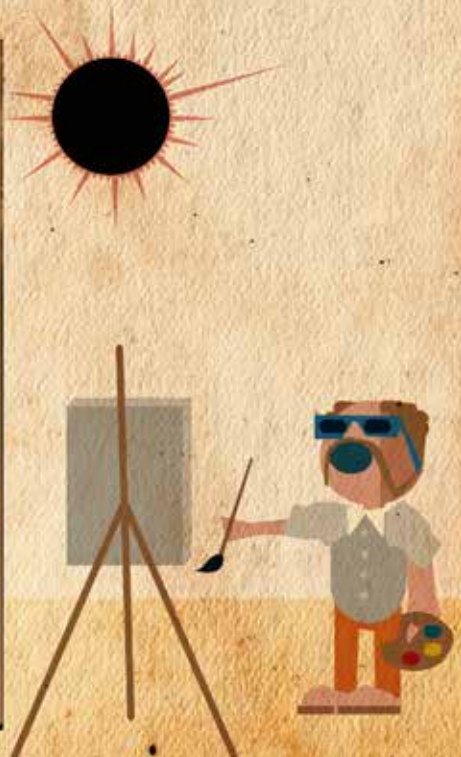






Eclipses were often seen as important omens. In 585 BC, a total eclipse occurred during a war in Turkey. The two battling armies believed the eclipse was a sign to lay down their weapons and make peace.

Once they could predict accurately, people started paying much more attention to eclipses. By the mid 1800's, astronomers were traveling many miles just to see one. Before the camera was invented, artists would travel along with the scientists to try to capture what they had seen in a drawing or painting.



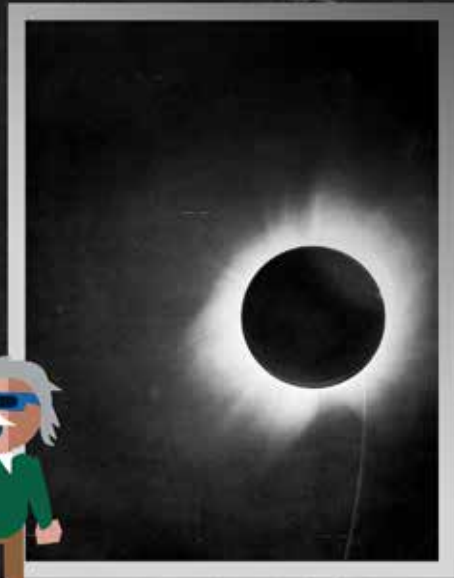


# 1800

By the late 1800s, photographs could be made of the corona, and those who hadn't seen a total eclipse could finally believe what astronomers had been telling them. But no picture can compare to experiencing the real thing.

# 1919

Sir Arthur Eddington used images of the 1919 total solar eclipse to confirm the bending of starlight by the gravity of the Sun, first predicted by Einstein.



# 1926

By 1926, scientists proposed that the Sun and stars derive their energy from nuclear reactions at their core. This was based in part on the accumulation of evidence from solar eclipse observations.



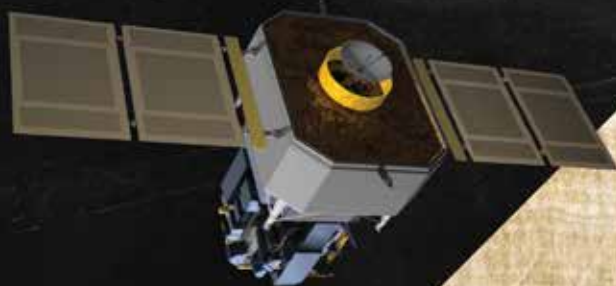
# 1973

In 1973, scientists used a Concorde supersonic jet flying at 1,250 miles per hour to stay inside the Moon's shadow during an eclipse over Africa and to extend the duration of totality to 74 minutes - 10 times longer than can ever be observed from the ground.



# PRESENT

At present, some satellites (SOHO, SDO, and STEREO) observe the Sun's corona continuously by producing artificial eclipses. But eclipse observations from the ground still play an important role in understanding the Sun. Perhaps one of the biggest unsolved mysteries is why the Sun's corona is so incredibly hot. Future eclipse observations may help solve this puzzle.



60%



70%



80%



90%



100%



90%



80%



70%



60%



# PATH OF TOTALITY

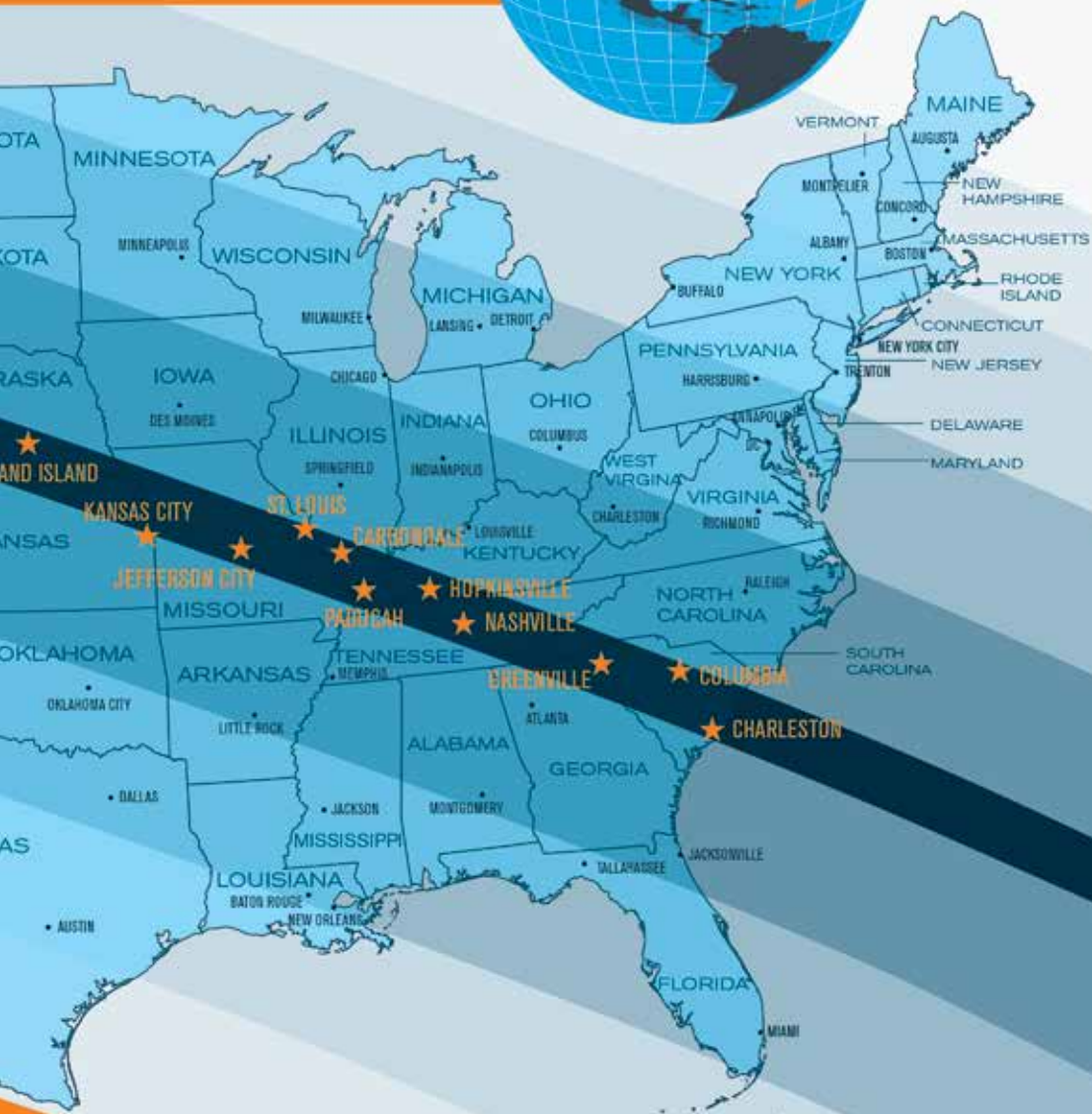
**REMEMBER** You must be in the PATH OF TOTALITY in order to see a total solar eclipse.



The path is about 70 miles wide and runs from west to east through parts of the following states: Oregon, Idaho, Wyoming, Nebraska, Kansas, Missouri, Illinois, Kentucky, Tennessee, Georgia, North Carolina, and South Carolina.

**TY**

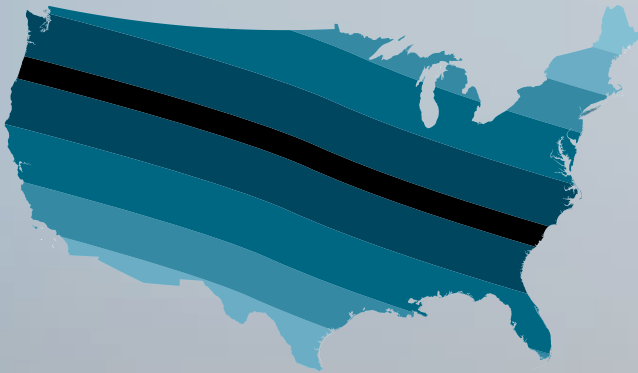
order to see the TOTAL ECLIPSE





# WHY SEEING TOTALITY *IS A MUST!*

Words alone cannot describe the magnitude and excitement of this rare, once-in-a-lifetime event. There has not been a total solar eclipse in the lower 48 states since 1979, and that one only passed through a small area in the western United States.



The entire United States will get a partial solar eclipse on August 21, 2017. But to see the total eclipse, you must be inside the 70-mile-wide path of totality that stretches across the country from Oregon to South Carolina.



Viewing the partial solar eclipse will be a phenomenal event – but if you can see the total solar eclipse, there is little comparison.

When rating natural wonders on a scale of 1-10, a partial solar eclipse might be a 7, but a total solar eclipse is 1,000,000! It's just off the charts. It's something to remember for the rest of your life. When the Moon's shadow sweeps over you, the sight of the Sun's glorious corona is indescribably beautiful.

If you are outside the path of totality, you will still see an incredible partial solar eclipse, which shows a crescent Sun and must be viewed with EclipSmart™ Solar Safe Shades. If you are inside the path, you will also see these partial phases, but once the Moon completely covers the Sun you can view totality and the Sun's corona without the EclipSmart™ Solar Safe Shades – and what a sight it is. It may leave you speechless or shouting with excitement.

**DON'T  
MISS IT!**



# FUN FACTS

## ABOUT SOLAR ECLIPSES



A total solar eclipse is the only time the Sun's faint corona is visible from Earth.

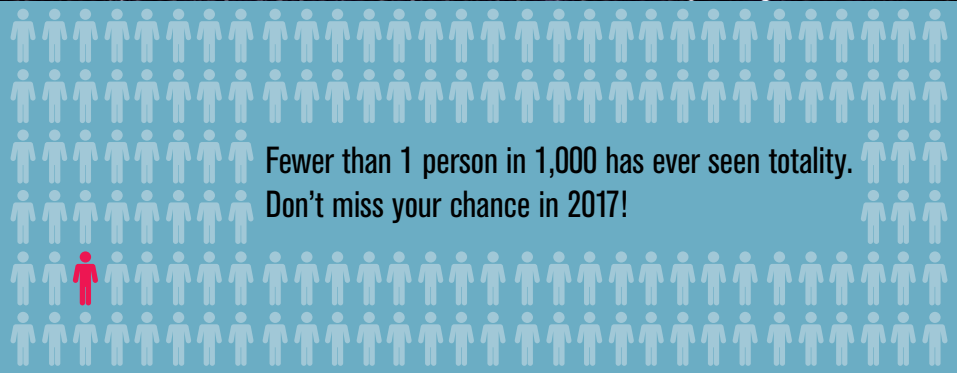
In 1973, a supersonic airplane chased the Moon's shadow during an eclipse. This extended totality to those on board to 74 minutes as the airplane kept pace with the shadow.



On June 16, 1806, in Cooperstown, New York, convicted criminal, Stephen Arnold, was taken out of his windowless cell in shackles to view an eclipse.

Planets can be seen in the daytime with the naked eye during a total solar eclipse.





The glowing halo surrounding the Sun during a total eclipse is called the solar corona. It is the Sun's outer atmosphere consisting of a super hot 2-million-degree (C) plasma.



Emperor Louis of Bavaria witnessed a total solar eclipse on May 5, 840. He was so terrified by the event that he died shortly afterwards. A quarrel between his three sons over Louis' succession led to the Treaty of Verdun, dividing Europe into France, Germany, and Italy.

During the total solar eclipse in 1878, the American inventor Thomas Edison observed the eclipse from a chicken coop. He used a new invention, the tasimeter, in a failed attempt to measure the temperature of the Sun's corona.



# FUN FACTS...

1979

The last time totality occurred anywhere in the 48 states was on February 26, 1979, nearly 40 years ago.

Everyone in the U.S. (including Alaska and Hawaii) will see some part of the Sun eclipsed by the Moon on August 21, 2017.

To see the 2017 TOTAL SOLAR ECLIPSE you must be inside the narrow path of the Moon's dark shadow, the umbra. This path of totality will cross parts of the 12 states: Oregon, Idaho, Wyoming, Nebraska, Kansas, Missouri, Illinois, Kentucky, Tennessee, Georgia, North Carolina and South Carolina.







# About the 2017 Total Solar Eclipse!



It will take just 90 minutes for the Moon's shadow to cross the United States from Oregon to South Carolina.

The average speed of the Moon's shadow as it crosses the United States is nearly 1,700 miles per hour. This is more than twice as fast as a supersonic jet.



# SAFE VIEWING



EclipSmart™ Solar Safe Shades block the harmful ultraviolet and infrared rays of the light that comes from the Sun and are essential for viewing the partial phases that precede and follow totality. You can follow the Moon's progression across the Sun by looking through these glasses every few minutes during the partial phases. EclipSmart™ Solar Safe Shades are lab tested and meet the new ISO 12312-2 requirements (Filters for Direct Observation of the Sun).

The initial partial phases will last about 90 minutes, but the last 20 minutes before totality you will start to notice that the temperature is dropping and the sky is beginning to look odd.

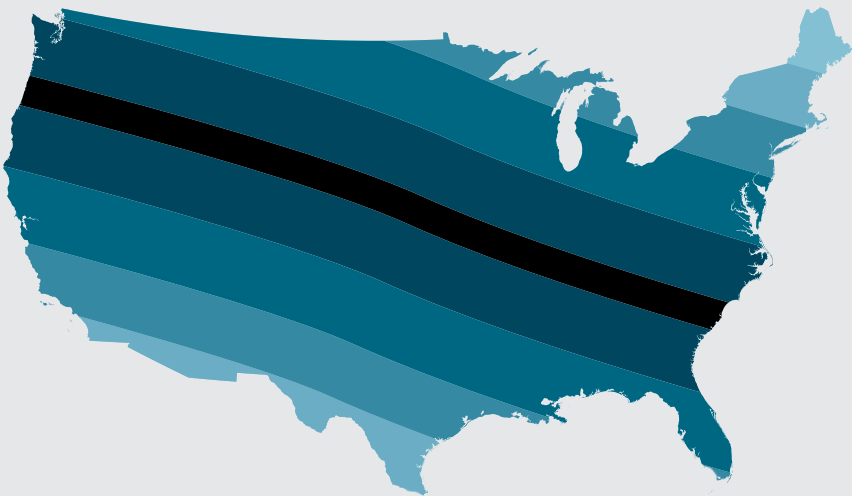
A rapid decrease in the brightness of the sky will alert you that totality is near. Once the darkness descends, you will know it is safe to take your glasses off and view totality.

**It is extremely important to remember that only during complete totality may you look at the Sun without EclipSmart™ Solar Safe Shades. Never look directly at the partial phases of the eclipse without EclipSmart™ Solar Safe Shades.**

Even though the total part of the eclipse will last about 2 minutes, it will seem to go by much faster. Before you know it, the Sun will peek around the Moon again and it will be time to put those EclipSmart™ Solar Safe Shades back on.

So when does the eclipse begin and end? That depends on where you are. The eclipse occurs in mid-morning in the western U.S. In the middle of the country, the eclipse happens around noon. Finally, if you're in the eastern U.S., watch for the eclipse in the early afternoon.

Table 1 lists eclipse times and duration for the lucky cities inside the path of totality. The listed eclipse times are in local time, and include daylight savings time. Table 2 lists the eclipse times and magnitude (percent of the Sun's diameter covered by the Moon) for major U.S. cities outside the path of totality.



# HOW TO PREPARE



If you travel into the path of totality on eclipse day, the one thing that can still prevent you from seeing the “big show” is the weather. Weather forecasts are very good these days so keep an eye on them. Note whether any fronts with heavy cloud cover will be passing through your destination on eclipse day.



Hotel rooms are already being booked for 2017. There will be many more people in the path of totality on eclipse day than the millions who actually live there, so plan ahead and bring necessities with you. It's difficult to predict traffic for an unusual event such as this, especially in cities, so get to your destination at least a day early.



If the weather doesn't cooperate, you will have to be prepared to literally chase the eclipse. You probably won't know if you've picked a good spot, weather wise, until the day before, so have your car packed with some food, lots of water, sunscreen, a full tank of gas, and some maps of the eclipse path with local times indicated. If you arrive at your chosen destination and the weather is not promising, then you can head out the night before and drive, drive, drive until you find clear skies. Whatever you do, don't resign yourself to sitting under a cloudy sky while this once-in-a-lifetime event passes you by.

So, once you're sitting under a clear blue sky, waiting for the eclipse to begin, what else should you have with you for the perfect eclipse experience? The first thing you need is a pair of EclipSmart™ Solar Safe Shades. They are the safest, easiest, and most fun way to watch a solar eclipse, and the special lenses have been designed to protect your eyes during the partial phases of the eclipse. The glasses will also allow you to easily monitor the progress of the eclipse leading up to totality. These glasses can be obtained exclusively from [www.celestron.com/eclipsmart](http://www.celestron.com/eclipsmart).

### List of Eclipse Day Essentials:

- Plenty of EclipSmart™ Solar Safe Shades
- EclipSmart™ Photo Filter for your smartphone
- Map of the eclipse path with local times
- Sun screen for before and after the eclipse
- A hat to shade your head and keep you cool
- Plenty of food and drinks!







Now you have all of the information needed to enjoy and be prepared for the

## **AUGUST 21, 2017** U.S.A. TOTAL SOLAR ECLIPSE

This will be the event of a lifetime, and if you have the opportunity to view the solar eclipse in an area of the United States that will experience totality, **TAKE IT! Spread the word so that no one misses this incredible event.** And most importantly, make sure you have plenty of EclipSmart™ Solar Safe Shades in advance of this event for you, your family, and friends. Share a pair and get eclipsed!!!

## WHERE WILL YOU BE?



# TOTAL SOLAR ECLIPSE TIMES FOR CITIES IN THE PATH OF TOTALITY (USA)

TABLE: 1

City/State	Partial Eclipse Begins	Total Eclipse Begins	Total Eclipse Ends	Partial Eclipse Ends	Duration of Totality
Albany, OR	9:05 AM	10:17 AM	10:19 AM	11:38 AM	01m51s
Anderson, SC	1:09 PM	2:38 PM	2:40 PM	4:03 PM	02m34s
Ballwin, MO	11:49 AM	1:17 PM	1:19 PM	2:44 PM	01m45s
Blue Springs, MO	11:42 AM	1:09 PM	1:10 PM	2:37 PM	00m51s
Bowling Green, KY	11:59 AM	1:28 PM	1:28 PM	2:53 PM	00m55s
Cape Girardeau, MO	11:52 AM	1:20 PM	1:22 PM	2:48 PM	01m47s
Carbondale, IL	11:52 AM	1:20 PM	1:23 PM	2:47 PM	02m37s
Casper, WY*	10:22 AM	11:43 AM	11:45 AM	1:09 PM	02m26s
Charleston, SC	1:17 PM	2:46 PM	2:48 PM	4:10 PM	01m29s
Chesterfield, MO	11:49 AM	1:17 PM	1:18 PM	2:44 PM	01m22s
Clarksville, TN	11:57 AM	1:26 PM	1:28 PM	2:53 PM	02m19s
Cleveland, TN	1:03 PM	2:33 PM	2:34 PM	3:59 PM	01m06s
Columbia, MO	11:46 AM	1:12 PM	1:15 PM	2:40 PM	02m37s
Columbia, SC	1:13 PM	2:42 PM	2:44 PM	4:06 PM	02m30s
Cookeville, TN	12:01 PM	1:30 PM	1:32 PM	2:56 PM	02m33s
Corvallis, OR	9:05 AM	10:17 AM	10:19 AM	11:37 AM	01m40s
Gladstone, MO	11:41 AM	1:08 PM	1:10 PM	2:36 PM	01m40s
Goose Creek, SC	1:17 PM	2:46 PM	2:48 PM	4:10 PM	02m10s
Grand Island, NE	11:34 AM	12:59 PM	1:01 PM	2:27 PM	02m34s
Greenville, SC	1:09 PM	2:38 PM	2:40 PM	4:03 PM	02m11s
Hendersonville, TN	11:59 AM	1:27 PM	1:30 PM	2:54 PM	02m30s
Hendersonville, TN	11:59 AM	1:27 PM	1:30 PM	2:54 PM	02m30s
Hoover, MO	11:41 AM	1:07 PM	1:10 PM	2:35 PM	02m12s
Hopkinsville, KY	11:57 AM	1:25 PM	1:27 PM	2:52 PM	02m40s
Idaho Falls, ID	10:15 AM	11:33 AM	11:35 AM	12:58 PM	01m49s
Independence, MO	11:42 AM	1:09 PM	1:10 PM	2:36 PM	01m15s
Jefferson City, MO	11:46 AM	1:13 PM	1:16 PM	2:41 PM	02m28s
Kansas City, KS	11:41 AM	1:09 PM	1:09 PM	2:36 PM	00m26s
Kansas City, MO	11:41 AM	1:09 PM	1:09 PM	2:36 PM	00m27s
Kearney, NE	11:33 AM	12:58 PM	12:59 PM	2:26 PM	01m54s
Keizer, OR	9:06 AM	10:17 AM	10:19 AM	11:38 AM	01m48s
Kirkwood, MO	11:50 AM	1:17 PM	1:19 PM	2:44 PM	01m27s
Leavenworth, KS	11:41 AM	1:07 PM	1:09 PM	2:35 PM	01m34s
Liberty, MO	11:42 AM	1:08 PM	1:10 PM	2:36 PM	02m06s
Lincoln, NE	11:37 AM	1:03 PM	1:04 PM	2:30 PM	01m17s
Mount Pleasant, SC	1:17 PM	2:46 PM	2:48 PM	4:10 PM	01m45s
Murfreesboro, TN	12:00 PM	1:29 PM	1:30 PM	2:55 PM	00m56s
Nashville, TN*	11:59 AM	1:27 PM	1:29 PM	2:54 PM	01m56s
North Charleston, SC	1:17 PM	2:46 PM	2:48 PM	4:10 PM	01m53s
Oak Ridge, TN	1:04 PM	2:34 PM	2:34 PM	3:58 PM	00m17s
Paducah, KY	11:54 AM	1:22 PM	1:25 PM	2:50 PM	02m20s
Salem, OR	9:05 AM	10:17 AM	10:19 AM	11:38 AM	01m55s
St. Joseph, MO	11:41 AM	1:06 PM	1:09 PM	2:35 PM	02m38s
Sumter, SC	1:15 PM	2:44 PM	2:45 PM	4:07 PM	01m48s

This table gives the times for the eclipse for cities inside the path of totality. These times are local and include Daylight Savings Time.

# PARTIAL SOLAR ECLIPSE TIMES FOR CITIES NOT IN THE PATH OF TOTALITY (USA)

TABLE: 2

CITY/STATE	PARTIAL ECLIPSE BEGINS	MAXIMUM PARTIAL ECLIPSE	PARTIAL ECLIPSE ENDS	ECLIPSE MAGNITUDE
Akron, OH	01:07 pm	02:32 pm	03:52 pm	84%
Albany, NY	01:23 pm	02:42 pm	03:57 pm	72%
Allentown, PA	01:20 pm	02:43 pm	04:00 pm	79%
Atlanta, GA	01:06 pm	02:37 pm	04:02 pm	97%
Austin, TX	11:41 am	01:10 pm	02:39 pm	72%
Baltimore, MD	01:19 pm	02:43 pm	04:01 pm	83%
Baton Rouge, LA	11:55 am	01:26 pm	02:54 pm	80%
Birmingham, AL	12:01 pm	01:32 pm	02:58 pm	94%
Boise, ID	10:11 am	11:27 am	12:50 pm	99%
Boston, MA	01:28 pm	02:47 pm	04:00 pm	70%
Buffalo, NY	01:12 pm	02:34 pm	03:51 pm	77%
Charleston, WV	01:08 pm	02:36 pm	03:57 pm	91%
Chicago, IL	11:54 am	01:20 pm	02:43 pm	89%
Cincinnati, OH	01:02 pm	02:29 pm	03:52 pm	92%
Cleveland, OH	01:07 pm	02:31 pm	03:51 pm	84%
Columbus, OH	01:04 pm	02:31 pm	03:53 pm	89%
Dallas, TX	11:40 am	01:10 pm	02:39 pm	80%
Dayton, OH	01:02 pm	02:29 pm	03:51 pm	91%
Denver, CO	10:23 am	11:47 am	01:15 pm	93%
Des Moines, IA	11:43 am	01:09 pm	02:34 pm	95%
Detroit, MI	01:03 pm	02:28 pm	03:48 pm	83%
El Paso, TX	10:24 am	11:47 am	01:16 pm	68%
Flint, MI	01:02 pm	02:26 pm	03:46 pm	82%
Grand Rapids, MI	12:58 pm	02:22 pm	03:43 pm	84%
Harrisburg, PA	01:17 pm	02:41 pm	03:59 pm	81%
Hartford, CT	01:25 pm	02:45 pm	04:00 pm	73%
Honolulu, HI	–	06:36 am	07:25 am	39%
Houston, TX	11:47 am	01:17 pm	02:46 pm	73%
Indianapolis, IN	11:58 am	01:25 pm	02:49 pm	93%
Jackson, MS	11:55 am	01:26 pm	02:54 pm	86%
Jacksonville, FL	01:16 pm	02:48 pm	04:12 pm	92%
Kansas City, MO	11:41 am	01:09 pm	02:36 pm	100%*
Lansing, MI	01:00 pm	02:24 pm	03:45 pm	84%
Little Rock, AR	11:48 am	01:18 pm	02:47 pm	90%
Los Angeles, CA	09:06 am	10:21 am	11:45 am	69%
Louisville, KY	12:59 pm	02:28 pm	03:52 pm	96%
Madison, WI	11:51 am	01:15 pm	02:38 pm	88%
Memphis, TN	11:52 am	01:23 pm	02:50 pm	94%

This table gives the local times for the partial eclipse for cities outside the path of totality. The listed times are local times and include Daylight Savings Time. The “Eclipse Magnitude” is the percent of the Sun’s diameter covered by the Moon at maximum eclipse.

# PARTIAL SOLAR ECLIPSE TIMES FOR CITIES NOT IN THE PATH OF TOTALITY (USA)

CITY/STATE	PARTIAL ECLIPSE BEGINS	MAXIMUM PARTIAL ECLIPSE	PARTIAL ECLIPSE ENDS	ECLIPSE MAGNITUDE
Miami, FL	01:27 pm	02:58 pm	04:21 pm	82%
Milwaukee, WI	11:54 am	01:18 pm	02:40 pm	86%
Minneapolis, MN	12:44 pm	02:07 pm	03:29 pm	86%
Montgomery, AL	12:03 pm	01:35 pm	03:01 pm	91%
New Haven, CT	01:25 pm	02:46 pm	04:00 pm	74%
New Orleans, LA	11:58 am	01:30 pm	02:57 pm	80%
New York, NY	01:23 pm	02:45 pm	04:01 pm	77%
Norfolk, VA	01:21 pm	02:47 pm	04:07 pm	88%
Oklahoma City, OK	11:37 am	01:06 pm	02:35 pm	87%
Omaha, NE	11:39 am	01:04 pm	02:31 pm	98%
Orlando, FL	01:19 pm	02:51 pm	04:15 pm	88%
Philadelphia, PA	01:21 pm	02:44 pm	04:01 pm	80%
Phoenix, AZ	09:14 am	10:34 am	12:00 pm	70%
Pittsburgh, PA	01:11 pm	02:35 pm	03:55 pm	84%
Portland, OR	09:06 am	10:19 am	11:38 am	99%
Providence, RI	01:28 pm	02:47 pm	04:00 pm	72%
Raleigh, NC	01:17 pm	02:45 pm	04:06 pm	94%
Richmond, VA	01:18 pm	02:44 pm	04:04 pm	88%
Riverside, CA	09:07 am	10:23 am	11:47 am	69%
Rochester, NY	01:14 pm	02:36 pm	03:52 pm	75%
Sacramento, CA	09:03 am	10:17 am	11:39 am	83%
St. Paul, MN	11:44 am	01:07 pm	02:29 pm	86%
St. Louis, MO	11:50 am	01:18 pm	02:44 pm	100%**
St. Petersburg, FL	01:18 pm	02:50 pm	04:14 pm	84%
Salt Lake City, UT	10:14 am	11:34 am	01:00 pm	92%
San Antonio, TX	11:41 am	01:09 pm	02:38 pm	68%
San Diego, CA	09:07 am	10:23 am	11:47 am	65%
San Francisco, CA	09:02 am	10:15 am	11:37 am	80%
San Jose, CA	09:02 am	10:16 am	11:38 am	79%
Seattle, WA	09:09 am	10:21 am	11:39 am	93%
Springfield, IL	11:51 am	01:18 pm	02:43 pm	96%
Syracuse, NY	01:18 pm	02:38 pm	03:54 pm	74%
Tallahassee, FL	01:10 pm	02:42 pm	04:07 pm	89%
Tampa, FL	01:18 pm	02:50 pm	04:14 pm	85%
Toledo, OH	01:03 pm	02:28 pm	03:49 pm	85%
Topeka, KS	11:39 am	01:07 pm	02:34 pm	99%
Tulsa, OK	11:40 am	01:09 pm	02:37 pm	90%
Washington, DC	01:18 pm	02:43 pm	04:02 pm	85%

\* The southern edge of the path of totality crosses through Kansas City. To see totality you must be on the North side.

\*\* The northern edge of the path of totality crosses through St. Louis. To see totality you must be on the South side.

# PARTIAL SOLAR ECLIPSE TIMES (CANADA)

TABLE: 3

CITY, PROVIDENCE	PARTIAL ECLIPSE BEGINS	MAXIMUM PARTIAL ECLIPSE	PARTIAL ECLIPSE ENDS	ECLIPSE MAGNITUDE
Calgary, AB	10:20 am	11:33 am	12:50 pm	81%
Edmonton, AB	10:24 am	11:35 am	12:49 pm	74%
Richmond, BC	09:10 am	10:21 am	11:38 am	89%
Vancouver, BC	09:10 am	10:21 am	11:38 am	88%
Victoria, BC	09:09 am	10:20 am	11:37 am	91%
Winnipeg, MB	11:40 am	12:58 pm	02:16 pm	76%
Saint John's, NF	03:30 pm	04:29 pm	05:25 pm	43%
Halifax, NS	02:42 pm	03:53 pm	04:59 pm	58%
Brampton, ON	01:10 pm	02:31 pm	03:49 pm	76%
Burlington, ON	01:10 pm	02:32 pm	03:50 pm	77%
Hamilton, ON	01:10 pm	02:32 pm	03:50 pm	78%
London, ON	01:07 pm	02:30 pm	03:49 pm	80%
Ottawa, ON	01:18 pm	02:35 pm	03:49 pm	69%
Toronto, ON	01:11 pm	02:32 pm	03:49 pm	76%
Montréal, QC	01:22 pm	02:38 pm	03:50 pm	66%

# PARTIAL SOLAR ECLIPSE TIMES (MEXICO)

TABLE: 4

CITY	PARTIAL ECLIPSE BEGINS	MAXIMUM PARTIAL ECLIPSE	PARTIAL ECLIPSE ENDS	ECLIPSE MAGNITUDE
Chihuahua	10:28 AM	11:50 AM	1:17 PM	59%
Ecatepec	12:01 PM	1:20 PM	2:38 PM	39%
Guadalajara	11:49 AM	1:05 PM	2:23 PM	37%
Juarez	10:24 AM	11:47 AM	1:16 PM	68%
Leon	11:51 AM	1:10 PM	2:30 PM	40%
Mexico City	12:02 PM	1:20 PM	2:38 PM	38%
Monterrey	11:43 AM	1:09 PM	2:35 PM	55%
Nezahualcoyotl	12:02 PM	1:21 PM	2:38 PM	38%
Puebla	12:05 PM	1:24 PM	2:41 PM	38%
Queretaro	11:55 AM	1:15 PM	2:34 PM	40%
San Luis Potosi	11:50 AM	1:11 PM	2:33 PM	44%
Tijuana	9:08 AM	10:23 AM	11:47 AM	65%
Toluca	12:01 PM	1:19 PM	2:36 PM	37%
Torreon	11:37 AM	1:00 PM	2:25 PM	52%
Zapopan	11:49 AM	1:05 PM	2:23 PM	37%

These tables gives the local times for the partial eclipse from cities in Canada and Mexico. The listed times are local times and include Daylight Savings Time, if applicable. The "Eclipse Magnitude" is the percent of the Sun's diameter covered by the Moon at maximum eclipse.



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# SOLAR ECLIPSE OBSERVING GUIDE

By Fred and Patricia Espenak



## The Complete Guide For This Incredible Event Includes:

- Science & History of Solar Eclipses
- Fun Facts for the Entire Family
- Helpful Hints and Safe Viewing Tips
- Maps and Diagrams
- Information for Partial Eclipses in the U.S., Canada, and Mexico
- And Much More!



Fred Espenak is a retired astrophysicist from NASA's Goddard Space Flight Center and was the agency's expert on eclipses. Known as "Mr. Eclipse," he is the author of numerous eclipse books including "Totality - Eclipses of the Sun" and "Thousand Year Canon of Solar Eclipses: 1501 to 2500". An avid eclipse chaser, he has participated in dozens of eclipse expeditions around the world.



Patricia Totten Espenak is a retired chemistry teacher and amateur astronomer who has traveled widely with her husband, Fred, to view various celestial events. She has experienced 16 total solar eclipses.

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