A Guide to the August 21, 2017 Total Solar Eclipse: When, Where and How to Shoot it

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Introduction

"There you are, outdoors, wearing some goofy special eclipse glasses to protect your eyes. You don't look very classy but, you know, the least you want to hear once you get back home is your Mom all pissed off yelling at you "I told yaaaa!".

Everything is in place. The tripod, the camera and the lens are perfectly aligned, anxiously waiting for the Moon to completely cover the Sun… for the show to begin.

Only the show is not how you imagined it would be…"

Suddenly, I noticed how the skin on **Daniel López**'s right arm was filled with bumps. "Are these goosebumps?" I asked myself.

The eyes of the astronomer stopped staring at me and got lost into his memories. Daniel wasn't with me anymore in that crowded assembly hall… He had been teleported to God knows where.

He continued speaking…

"It's hard to explain what you feel. The day becomes night without a warning. The Sun and the Moon merge into a black hole wrapped up in a crown of light and fire. Stars and planets flood the sky… Only the whispers of people surrounding you can break the spell.

I don't know. I've never lived anything like this. People become crazy, they do weird stuff… You are going to flip out.

Man, listen to me, as a friend and an astronomer, I know what I say. If you happen to be in the States this summer, you can't miss the August 21 total solar eclipse."

As I was returning from iNight, the most important Night Photography Congress in Spanish language, Daniel's words kept playing in my head over and over.

Call it destiny, and I know you're not going to believe this, but as soon as I got home… the screen of my iPhone lit up. It was a WhatsApp message from Germán Marquès, the Developer, the Architect, the brain behind **PhotoPills**. And he seemed extremely excited:

"I think we should add a tool to help PhotoPillers plan the total solar eclipse of next August 21… It's going to be big and I know how to do it! :P"

Eureka! I saw the light…

And here I am, just a few hours after landing in San Francisco, writing this article to help you plan and shoot your eclipse photo ideas.

If you happen to be in the United States (or plan to be there during the total solar eclipse) that's great news. This is going to be the eclipse of the century. It's the first time in 100 years that the total eclipse will be seen from coast to coast. All across the country!

So, If you use the **PhotoPills**' new Eclipse tool to choose your spot wisely, you'll be able to experience and photograph one of Nature's most amazing spectacles: a total solar eclipse.

If not? Well, don't give up. **PhotoPills** will tell you where is the closest place from which you can enjoy and capture the partial solar eclipse.

And, of course, I'll go through the equipment you need to shoot the total solar eclipse (**section 3**) and your gear setup (**section 5**).

Ready? Keep reading…

1

How to plan the 2017 total solar eclipse shooting session to nail it!

Would you like to photograph August 21 total solar eclipse?

If your answer is yes, then the United States of America are the place to go!

But be aware!

You'll have to pick the shooting spot and shooting time wisely since the total eclipse is only visible from certain locations. Most of the country will "only" see a partial eclipse.

The total eclipse will begin on a beach on the west coast of Oregon, and will end on a beach on the east coast of South Carolina, making a narrow diagonal track across the United States.

It will go through parts of Oregon, Idaho, Wyoming, Nebraska, a bit of Kansas, Missouri, the southern bit of Illinois, Kentucky, Tennessee, Georgia, North Carolina, and South Carolina.

You can see it from Nashville, TN and parts of the St. Louis, MO and Kansas City, MO metropolitan areas. Alternatively, you could go to a smaller town such as Salem OR, Saint Joseph MO, Carbondale IL, Hopkinsville KY, and Columbia SC where you'll get to see totality (the Moon covering the Sun completely)!

The total solar eclipse will take about 90 minutes to cross the U.S. and the Moon's shadow will move at an average speed of 2,335 kmh (1,450 mph). That's much faster than the speed of a regular commercial airplane.

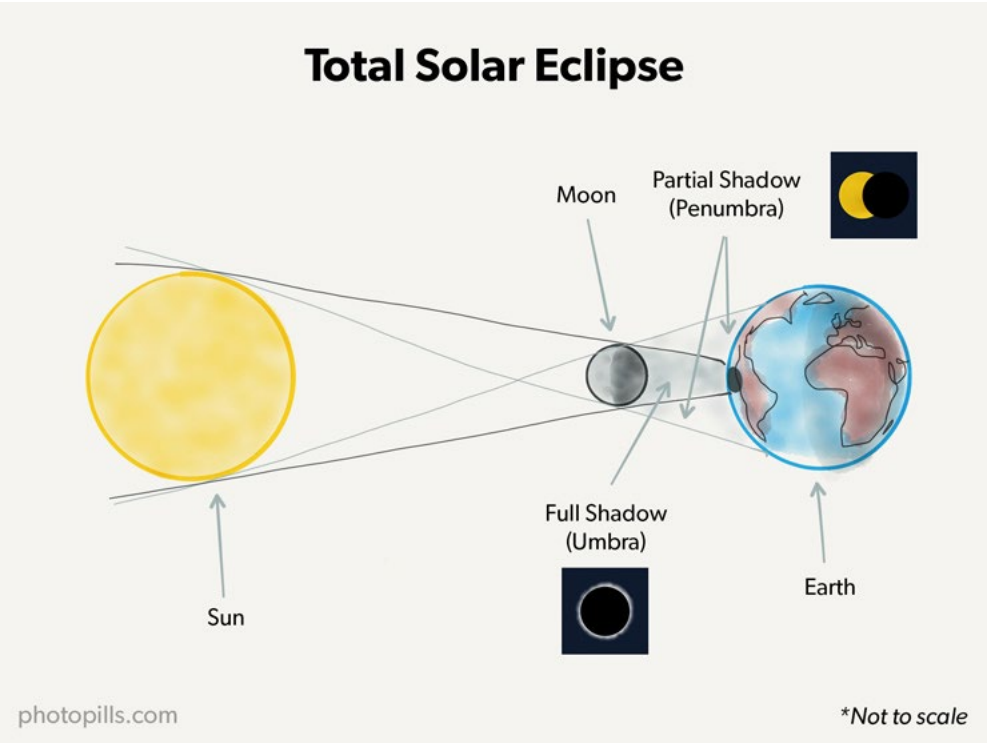
Getting excited?

I'll show you how to plan the Total Eclipse with **PhotoPills** in a second, but before...

First things first!

What is a solar eclipse?

A solar eclipse happens when the Moon moves between the Sun and Earth, blocking out the Sun's rays and casting a shadow on parts of Earth.



The Moon is 400 times smaller than the Sun, but it is also 400 times closer. Therefore the two celestial bodies appear nearly the same size, an extraordinary coincidence!

But, because the Moon's full shadow (also known as umbra) is not big enough to cover Earth completely, its shadow only covers a certain area. This area is called "the path of totality".

In other words, It's the area from where the total solar eclipse can be seen.

Let's find out where to go. :)

Where can you see the total solar eclipse (path of totality)?

Find the path of totality!

The path of totality is basically the area in which you are able to observe totality – the span of time during which the Moon completely covers the Sun.

So, if you are in the path of totality, you'll see a total solar eclipse!

That's, of course, if the weather is good and the sky is clear. Plan and pray!

PhotoPills iPad screenshot of the path of totality (dark band crossing the US).

The path of totality can be no more than 273 kilometres (170 miles) wide. On August 21 it will be no more than 115 kilometres (71 miles) wide.

And it will cross the entire United States!

12 million people live within the path of totality and 47 million (roughly 15% of the U.S. population) are just at a 2-hour drive!

So get to the spot well in advance… Traffic will be crazy!

Would you like to know where to go to see the total solar eclipse?

Let's use PhotoPills.

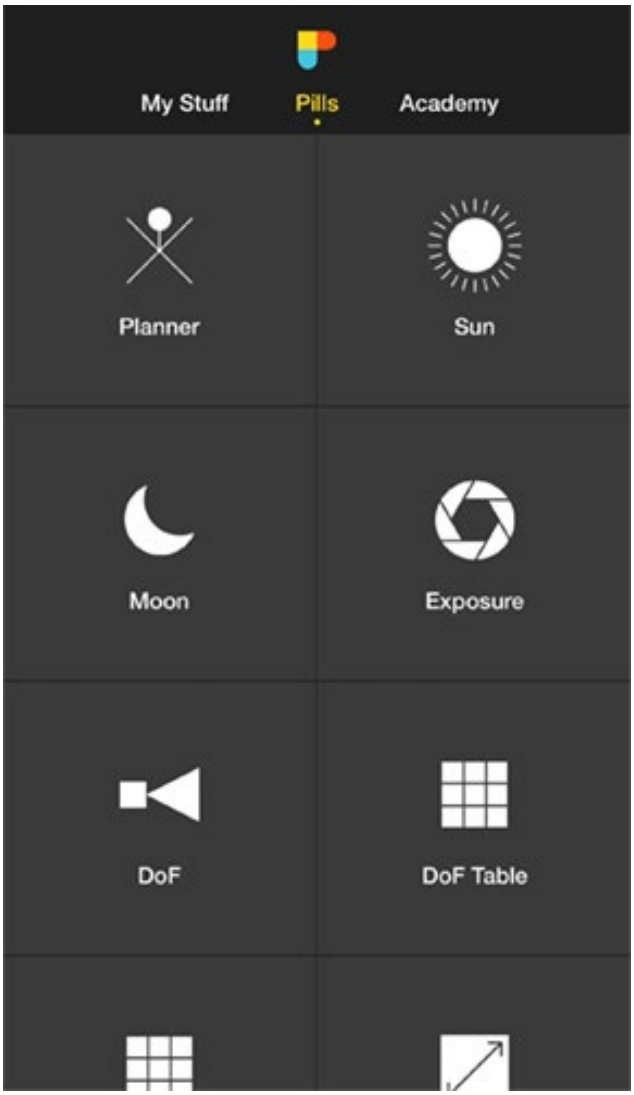
How to find where to go to see the total eclipse with PhotoPills

It will take you just a few seconds!

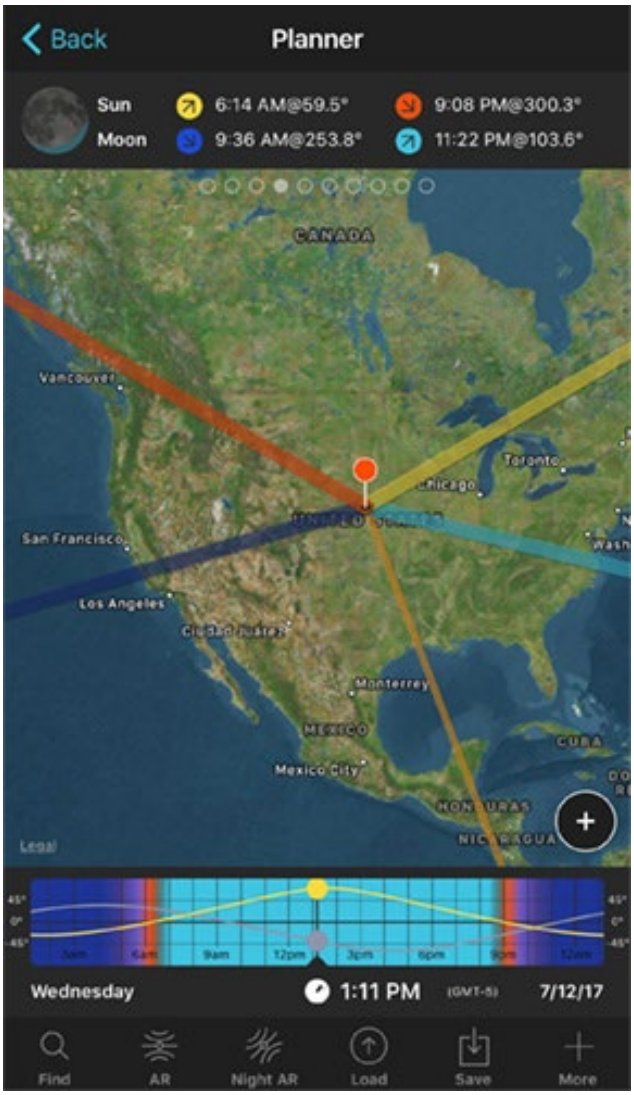
Ok, ok... Maybe a couple of minutes. :P

So, go to PhotoPills.

On the Pills menu, tap on the Planner. Then, swipe to the left the panels you see above the map until you find the two eclipse panels.



PhotoPills main Pills menu - Tap on Planner.



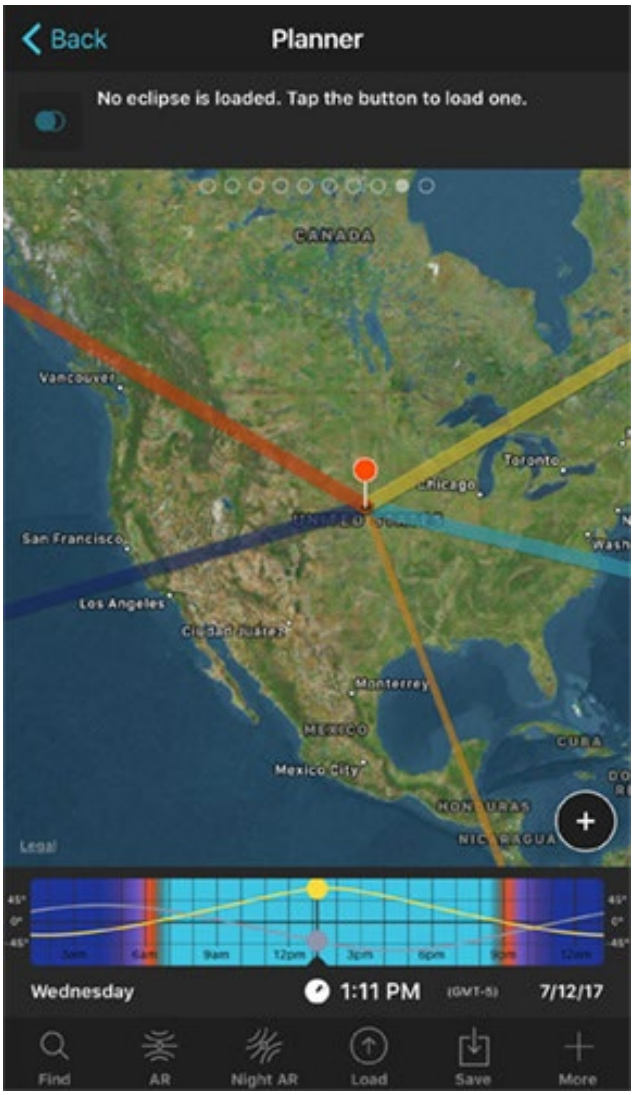
PhotoPills Planner - Swipe top map panels to the left to find eclipse panels.

On the first Eclipse panel, tap the button to see the Eclipse information on both the panels and the map.

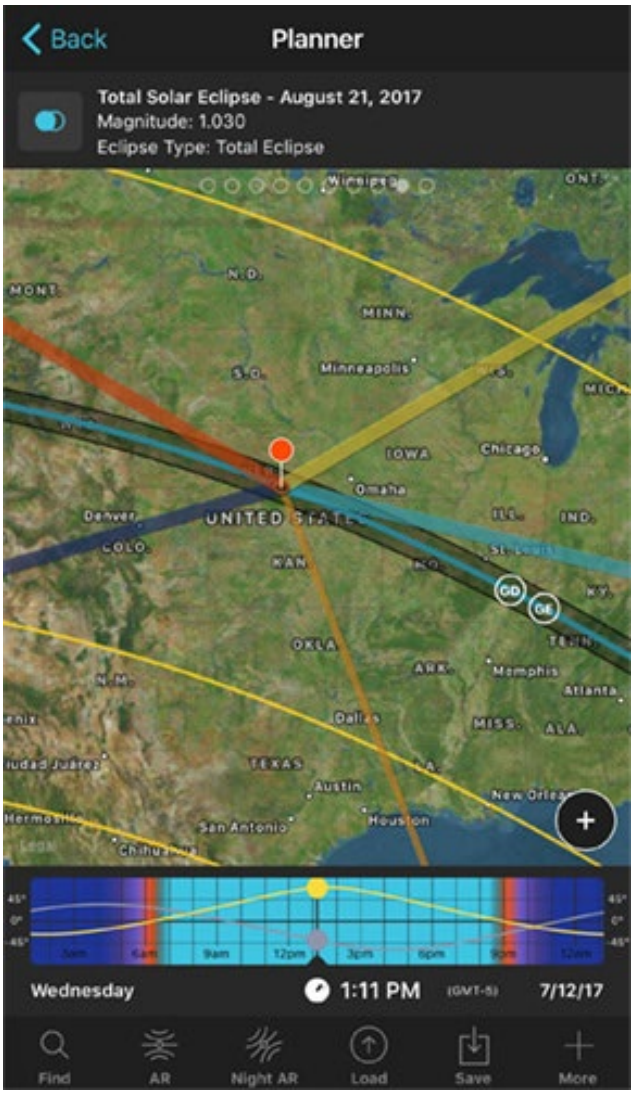
The path of totality is represented by a dark area that crosses the map from east to west. It points out the area where you have to go to see a total solar eclipse.

So now you know where to place the red pin (shooting spot) to start planning the total eclipse.

Remember that all the information displayed on the Planner is relative to the position of the red pin. This is particularly important in order to determine the exact local time the solar eclipse and the totality phase start and end.



Tap on the top panel button to switch on the Eclipse information.



Te red pin is located in the path of totality (dark central area).

Here is a summary of all the eclipse information you see on the map (lines, GD and GE) and top panel (magnitude):

- **Map central dark area:** It's the path of totality (the area of total darkness). In other words, the area where you can observe how the Moon will completely cover the Sun.
- **Map blue line within the path of totality:** It's the centerline. The farther away from the centerline you are (while being in the path), the shorter amount of time the Sun will be covered by the Moon. In other words, you will see a shorter totality duration.
- **Map yellow lines:** Outside the path of totality you'll be able to see a partial eclipse. The first yellow line on both sides of the path represents the locations where the Moon will cover 80% of the Sun. The next yellow line represents 60% and so on. The furthest from the path of totality, the more partial the eclipse will be.
- **Map Greatest Duration Point (GD):** The location where totality lasts longer, where the phase of total eclipse lasts longer. For the August 21 eclipse, the GD is located near Carbondale, IL where the duration of totality is 2 minutes and 41.6 seconds.
- **Map Greatest Eclipse Point (GE):** Don't confuse it with the Greatest Duration Point. The Greatest Eclipse Point is not where the total eclipse lasts longer. It is just a geometric point. GE wasn't a good name choice at all. It is actually the location where the shadow of the Moon is nearest to the center of the Earth. Sometimes, it falls very close to the GD point, but it's not always the case.
- **Eclipse Magnitude (top panel):** It represents how much of the solar diameter is covered by the Moon. It usually has a value between 0 and 1 inclusive, where 1 is totally eclipsed. But sometimes the apparent size of the Moon can be larger than the size of the Sun. In this case, the magnitude can be greater than 1.
- **Eclipse Type (top panel):** The eclipse type that can be seen from the red pin position (total, partial or not visible).

So, where to go?

It depends on the shot you have in mind.

Obviously, the ideal place to be is on the centerline near a town or park where the sky is

usually clear. And that's the key issue: the weather.

If the sky is partially cloudy or completely overcast during the time of the eclipse, I'm afraid you won't be able to see a thing...

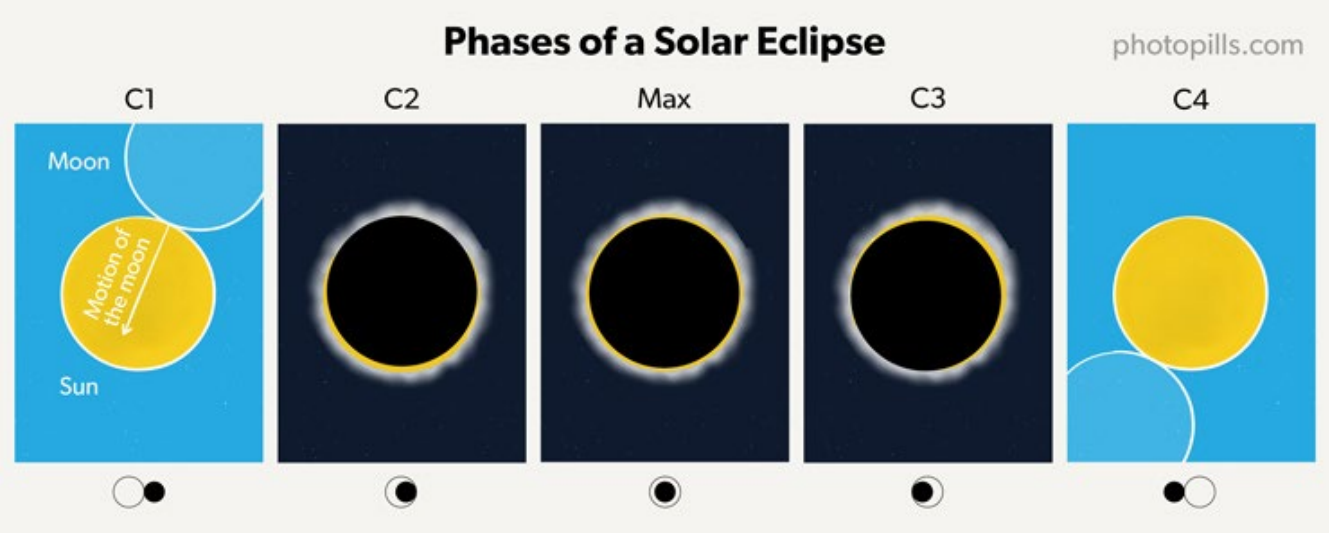
But, as you know from life experience, no one can predict the weather for sure.

In the meantime, I suggest you have a look at different sources such as the US National Weather Service, Dark Sky, Weather Underground, and WeatherSpark.

"Ok Rafa! Now I know where to go to see the total eclipse. But at what time is it happening? When should I get there? And what will I see?!"

Well, this leads us to the second PhotoPills eclipse panel!

The 5 total solar eclipse phases and when they happen



Imagine it's August 21 and you made it! You're in the path of totality waiting for the total eclipse to happen. These are the 5 eclipse phases you're about to see:

- **Partial eclipse begins (1st contact - C1):** The Moon starts to cover the Sun little by little. The Sun looks as if the Cookie Monster has bitten it.
- **Total eclipse begins (2nd contact - C2):** The Sun is almost entirely covered by the Moon. If you happen to be in the path of the Moon's umbra (its full shadow projected

on Earth) you might see Baily's beads and the diamond ring effect, just before totality.

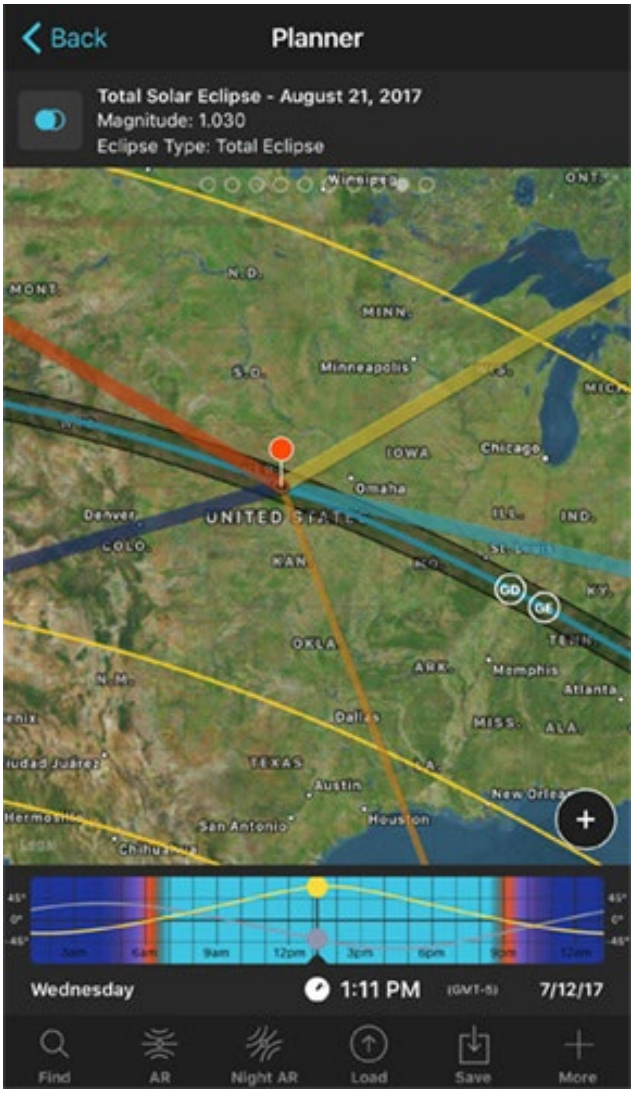
- **Totality and maximum eclipse:** The Moon covers the Sun completely. Only the Sun's corona (the outer atmosphere of the Sun) is visible. Aren't you excited? The sky is now dark! You also experience a fall in the temperatures and notice how animals go quiet. Again, if you happen to be in the path of the Moon's umbra you may be able to see Baily's beads and the diamond ring effect, just after totality ends.
- **Total eclipse ends (3rd contact - C3):** The Moon starts to move away from the Sun, allowing it to reappear.
- **Partial eclipse ends (4th contact - C4):** The Moon stops overlapping the Sun. The eclipse ends at this stage in this specific location.

The time each phase happens depends on the location (latitude/longitude). But don't panic! You can use PhotoPills to figure it out.

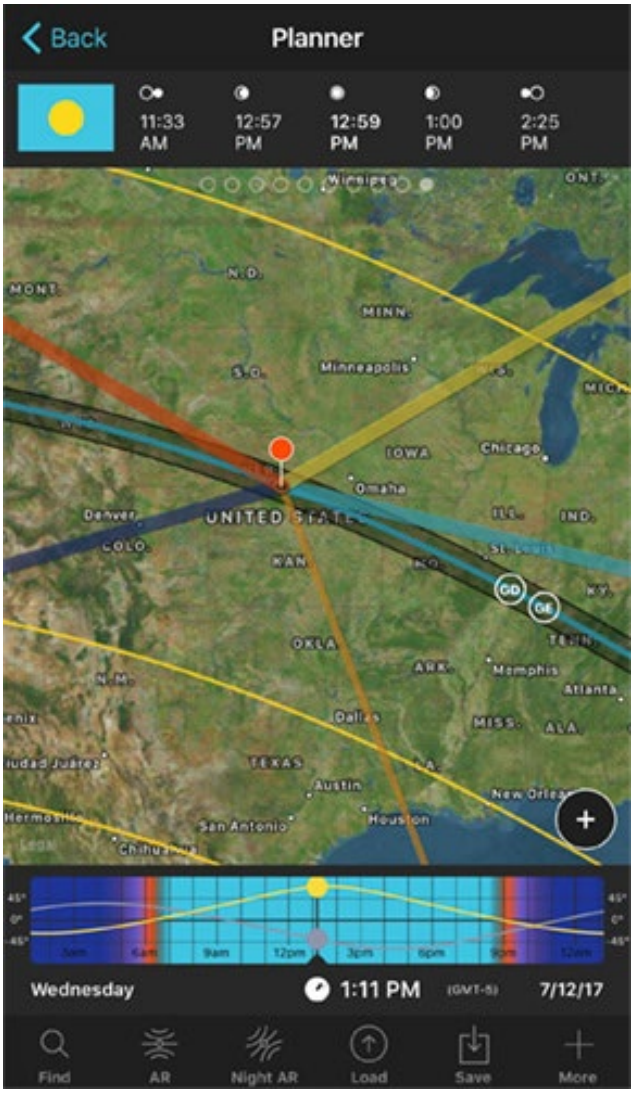
How?

First, go to the PhotoPills' Planner and place the red pin on the desired shooting spot within the path of totality (dark area). Then, swipe left on the top map panels until you find the second eclipse panel.

On this second eclipse panel, you can read the time each phase of the total solar eclipse begins on August 21.



PhotoPills Planner - Read eclipse magnitude and type on the first eclipse panel.



PhotoPills Planner - Read the times of total eclipse phases on the second eclipse panel.

According to the second eclipse panel of the screenshots above, if you go right where the red pin is on August 21, you learn that:

- The partial eclipse begins at 11:33am (local time according to the red pin position).
- The total eclipse begins at 12:57pm (local time).
- Totality and maximum eclipse happens at 12:59pm (local time).
- The total eclipse ends at 1:00pm (local time).
- The partial eclipse ends at 2:25pm (local time).

Therefore you'll only have a few minutes to photograph the total eclipse! Be ready, be fast!

"Fantastic Rafa! Now I just need to know where to frame the camera. Where will the Sun be during the eclipse? How do I see it on the map?"

Good questions!

Let's figure it out!

Where to frame the camera to capture the total eclipse

Now that you know where to go and at what time, you need to know where the eclipse will happen in the sky. You need to know the position of the Sun during the duration of the eclipse.

In other words, you need to know the **azimuth (direction) and the elevation** of the Sun at all times.

So, go back to **PhotoPills** and set the date to August 21 and the time at 11:33am, when the eclipse begins. And see how the Sun moves from that time onwards.

If you do it, you'll see the direction (azimuth) of the Sun on the map and the elevation on one of the top panels. I'll show you how to find this information in a moment.

How to set the date and time on the Planner?

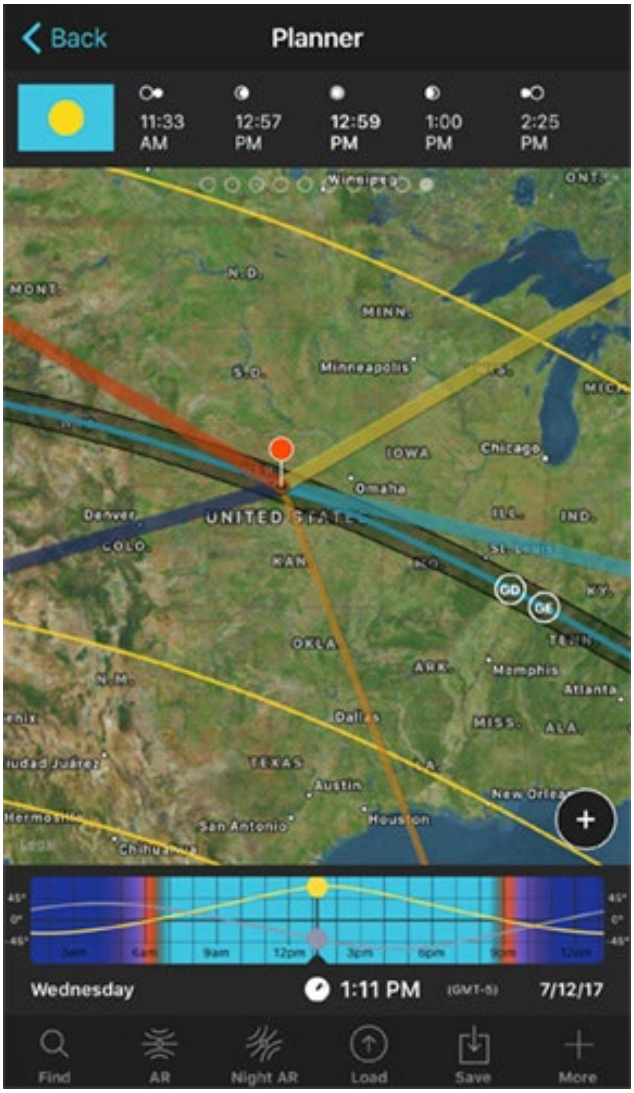
You could obviously do it by **changing the date and time using the time bar**. But there is a better way to do it.

Work smarter, not harder! ;)

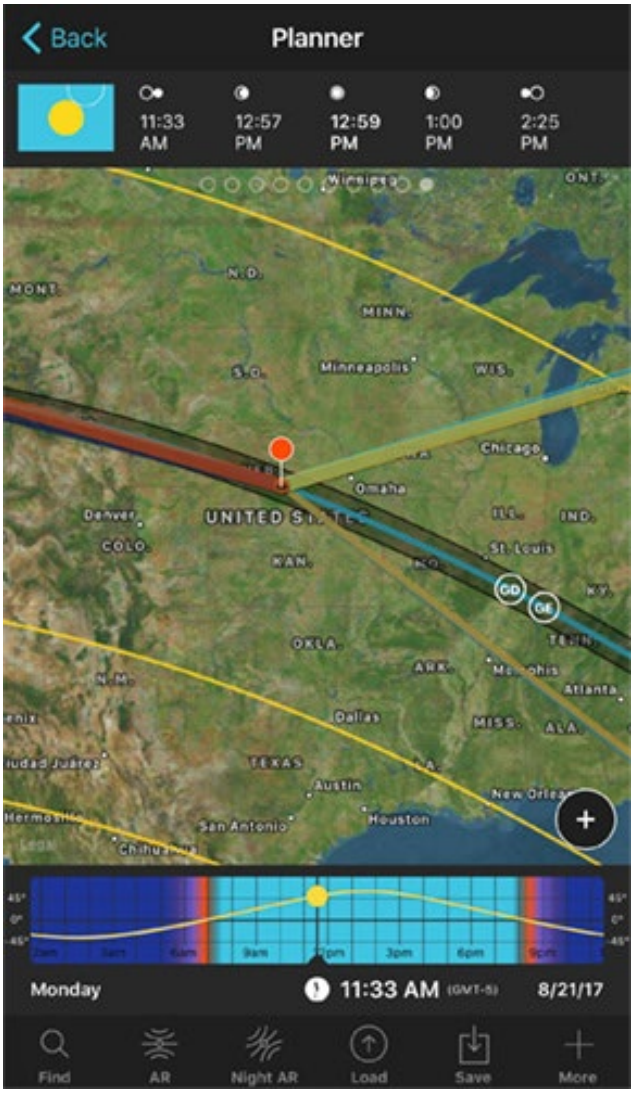
Go to the PhotoPills' Planner and tap on the eclipse button you see on the second eclipse panel. You'll find it on the left side of the panel. It has a picture of the Sun (a yellow circle).

When you tap on the eclipse button the date will be set to August 21, 2017 and the time when the eclipse begins (11:33am in this example).

Notice that the icon of the button has changed. It is now showing you the phase of the eclipse for the selected time (at the beginning of the eclipse).



PhotoPills Planner - Tap on the Sun button on the top panel.

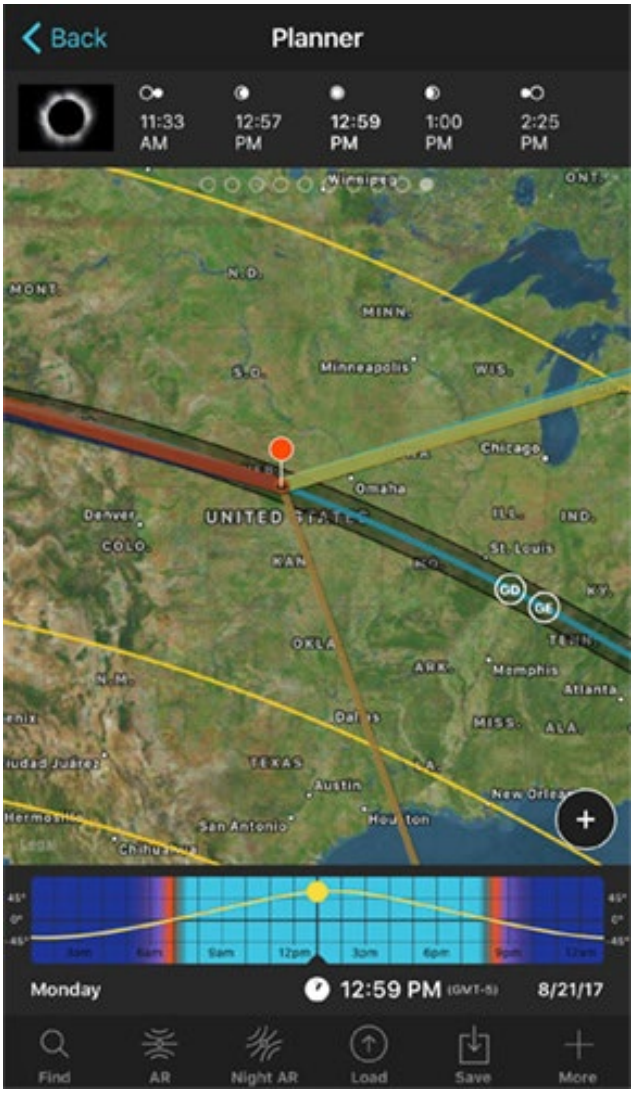


PhotoPills Planner - The date has been set to August 21, 2017 and the time to 11:33am.

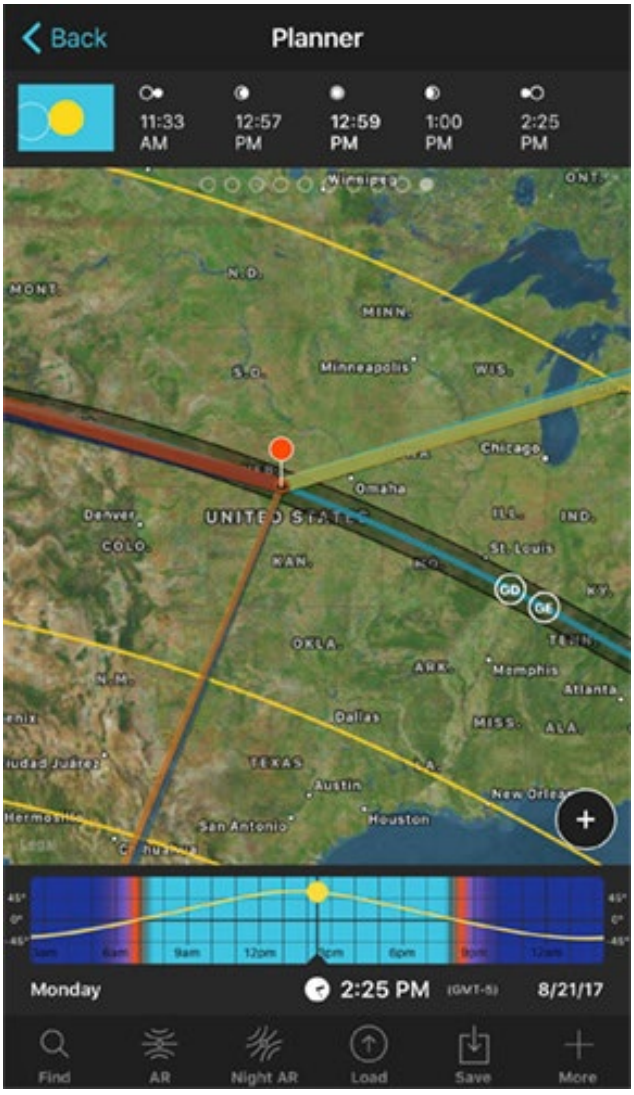
But there is more!

If you tap the eclipse button again, the time will be set at totality, when the maximum eclipse happens (12:59pm). See how the icon of the button is showing you a picture of the total eclipse?

Tap the button again to set the time when the eclipse ends (2:25pm). Again, the icon of the button changes according to the eclipse phase.



PhotoPills Planner - Time set to totality (12:59pm).



PhotoPills Planner - Time set to when the eclipse ends (2:25pm).

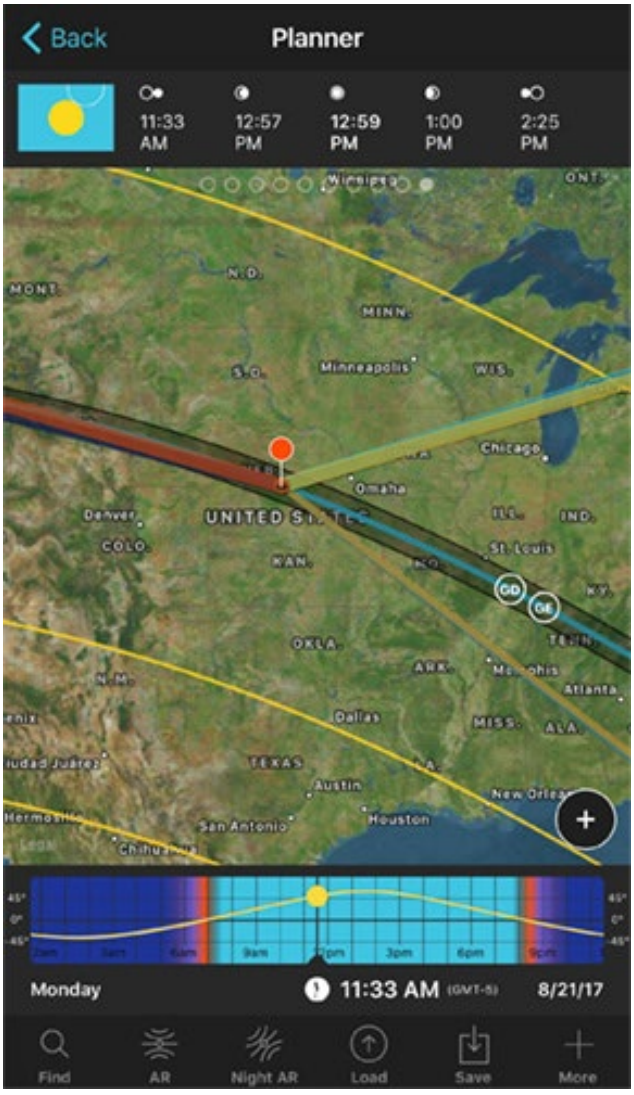
Now, pay attention to the map.

The thin orange line that begins at the red pin is showing you the direction of the Sun for the selected date and time. So you know the direction (azimuth) of the Sun at all times.

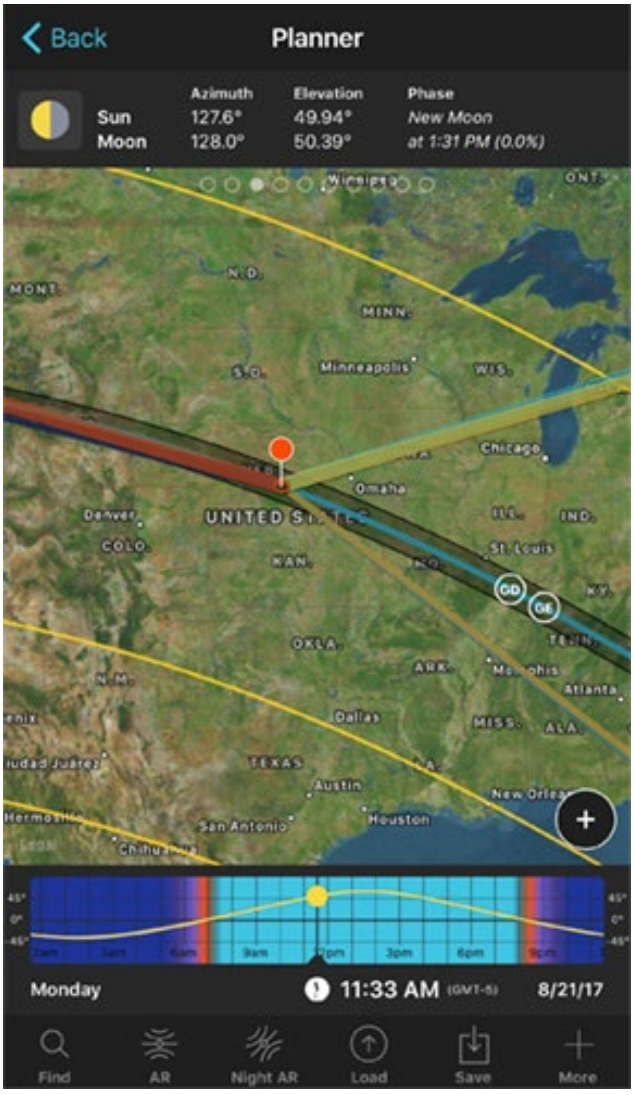
And the elevation?

Swipe the top panels to the right until you find the Sun/Moon azimuth and elevation panel.

According to the top panel, the Sun will have an elevation of 49.94º at the beginning of the eclipse (11:33am). And its azimuth will be exactly 127.6º (south-east). This is the angle, measured clockwise around the observer's horizon, between the Sun and the north. It's represented on the map by the thin orange line.



PhotoPills Planner - View of the second eclipse panel.

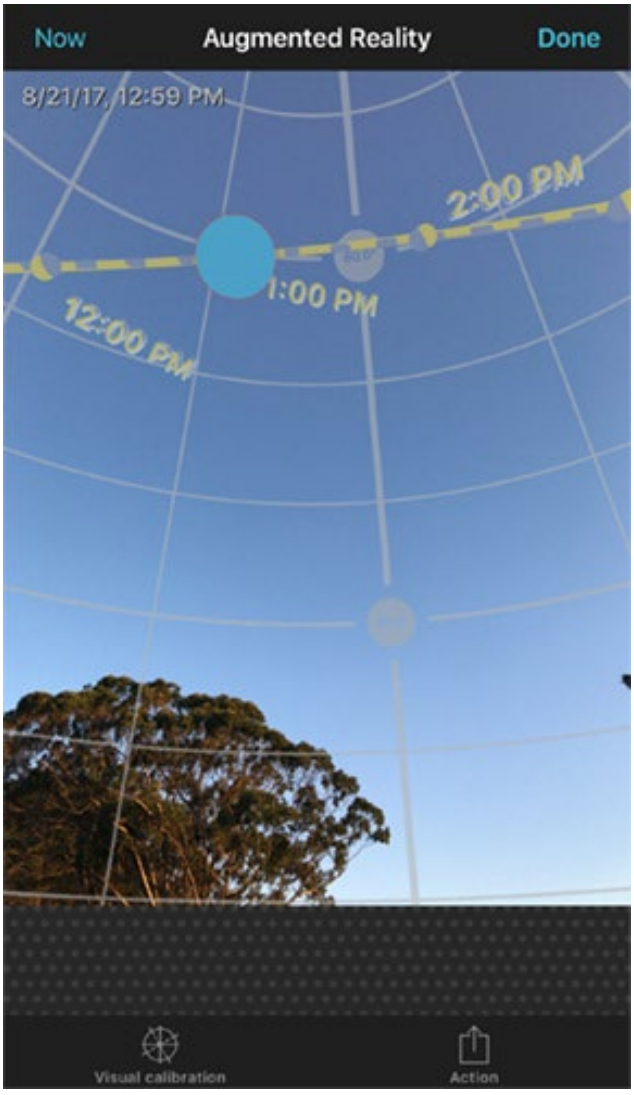


PhotoPills Planner - View of the Sun/Moon azimuth and elevation panel.

Also, to visualize how high the Sun will be in the sky, you can use the PhotoPills Augmented Reality tool. To do so, on the Planner tap on the AR button (bottom) and you'll see through your phone the exact position and path of the Sun.

Remember! that what you're seeing in the Augmented Reality view is what you'd see from the position of the red pin on the selected date and time.

PhotoPills Planner - Augmented Reality view of the position of the Sun at the beginning of the total solar eclipse (11:33 am).



PhotoPills Planner - Augmented Reality view of the position of the Sun at the moment of maximum solar eclipse (12:59 pm).

And that's it!

This is how you can figure out how the Sun is moving across the sky during the eclipse.

Now, from the photography point of view, there are a few eclipse phenomenons you can't miss.

Let's have a look at them!

The different phenomena that you can observe as totality approaches

As totality approaches, you can see certain unique sights. Make sure you don't miss them!

Here is the chronological order in which they occur.

Shadow bands

About 1 or 2 minutes before totality, you may notice eerie bands of undulating shadow racing across the ground, along the sides of buildings or across other light–colored surfaces.

Photo by Cantavestrella

Diamond ring

About 10 to 15 seconds before and after totality, the solar corona (the outer atmosphere of the Sun) becomes visible. As the last bits of sunlight pass through the valleys on the Moon's surface, and the faint corona around the Sun is just becoming visible, it looks like a ring with glittering diamonds on it.

Photo by **Skyseeker**

The Sun’s corona

As the diamond ring fades away, you are now able to see the Sun’s corona. Can you spot the faint rays that surround the silhouette of the Moon?

Photo by **Morten Ross**

Baily's beads

Approximately 5 seconds before totality, get ready to see the Baily's beads. They are an ensemble of brilliant beads of sunlight caused by the Sun shining through valleys and depressions on the Moon's surface.

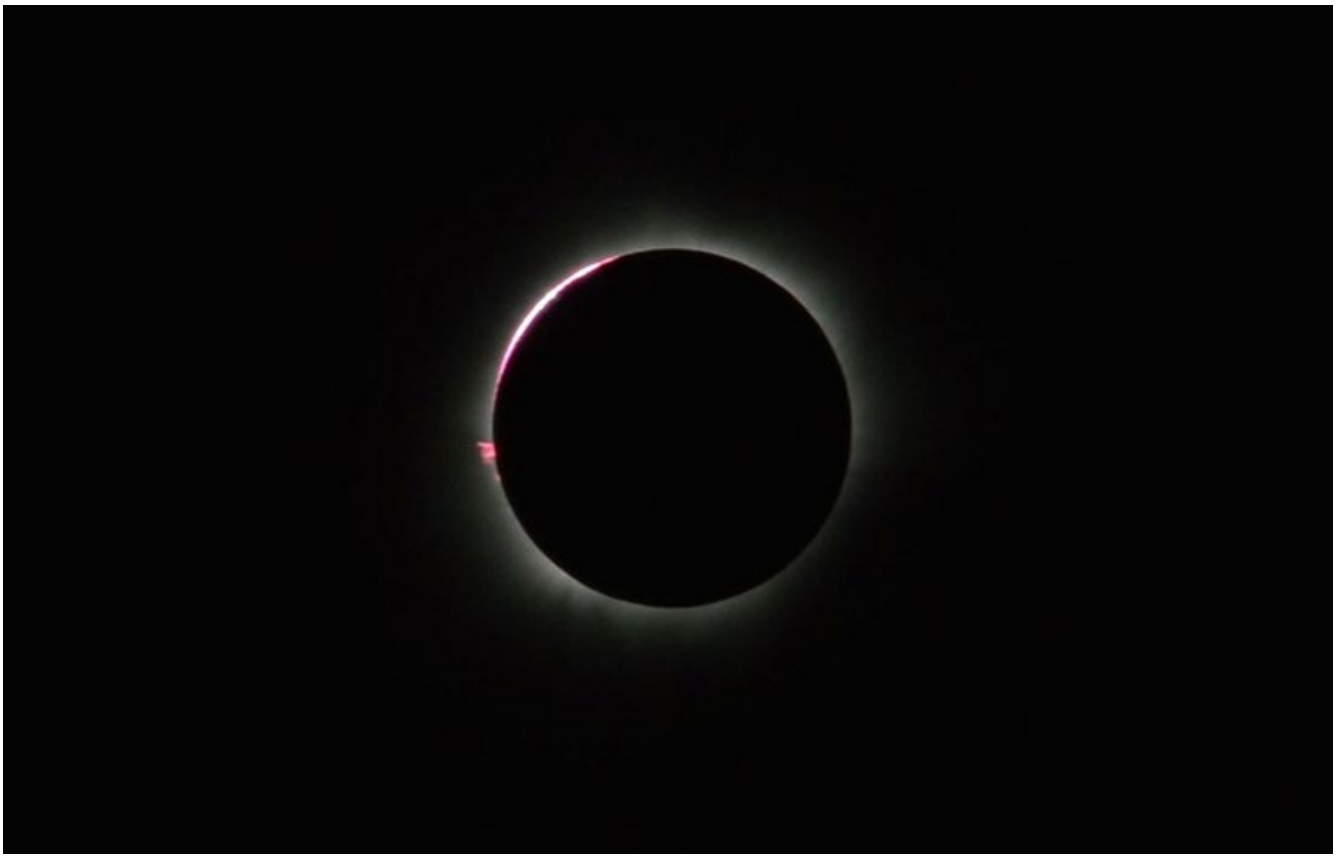


Photo by **Arief R. Sandan** (Ezagren)

The Sun’s chromosphere

The chromosphere is a low layer of the Sun’s atmosphere. Just a few seconds after totality ends, you can notice a reddish glow – it’s the chromosphere.

Photo by **Nicholas Jones**

These sights then repeat in reverse order too!

Great!

Now you know everything you need to start brainstorming and come up with a great photo for the total eclipse.

Use **PhotoPills** to explore a few great locations you know and find the shot you're looking for.

Don't know what location to choose? These are my final thoughts!

What makes a great location to photograph the total solar eclipse

One of the most important tasks while planning your eclipse shooting session will be to determine the location from which you will be taking pictures.

In order to choose the best possible location according to the pictures you have imagined, here are some things you should definitely take into account.

Try to be in the centerline of the path of totality

As I have explained earlier in this section, the path of totality is the area where you can observe how the Moon will completely cover the Sun.

Within the path of totality there is a line called the centerline. This is a very thin area where the Moon covers the Sun for the longest time.

Therefore, if you set your shooting spot there, you will have more time to experience and capture totality. This is particularly important because while totality can last between 2 and 7.5 minutes, on August 21, 2017 the maximum duration of totality will be a mere 2 minutes and 41 seconds.

Find a spot with lots of space to move around

You want to look for a place that has lots of space.

And that's for a very simple reason. Don't even think for a minute that you will experience the eclipse on your own. There will be dozens of people there too!

Considering the setup preparation and the gear you plan to use, the last thing you want is someone (or even you!) tripping with your tripod or backpack!

Therefore, look for a wide space.

Additionally, try to avoid dusty or sandy sites. As totality approaches and temperatures cool, the so called "eclipse winds" can start out.

That's something you definitely want to avoid at all costs.

First, because your tripod can suffer from these winds and your framing could change. Secondly, because dust and sand are a camera's worst enemy. Finally, because it's really uncomfortable to take pictures under these conditions.

Look for an interesting subject

In other articles of the Academy about pictures of the Moon, the Milky Way or even Star Trails, we always recommend to include part of the landscape and a powerful subject.

In the case of the 2017 total solar eclipse you will, on the contrary, have a hard time to work on a complex composition.

Why?

The reason is very simple. During the eclipse and in the path of totality, the Sun will be positioned at an altitude between 40º and 65º from the horizon.

And that's very very high...

In other words, you will have to make a choice.

Option 1. You want to include part of the landscape and, if possible, an interesting

subject. In this case, you have no choice but to use a wide-angle lens resulting in a very small Sun (see section 5).

Photo by Gry Berntzen

Option 2. You don't want to give up shooting a big Sun. Well, you must use a super telezoom that won't allow you to capture any landscape at all (see section 6).

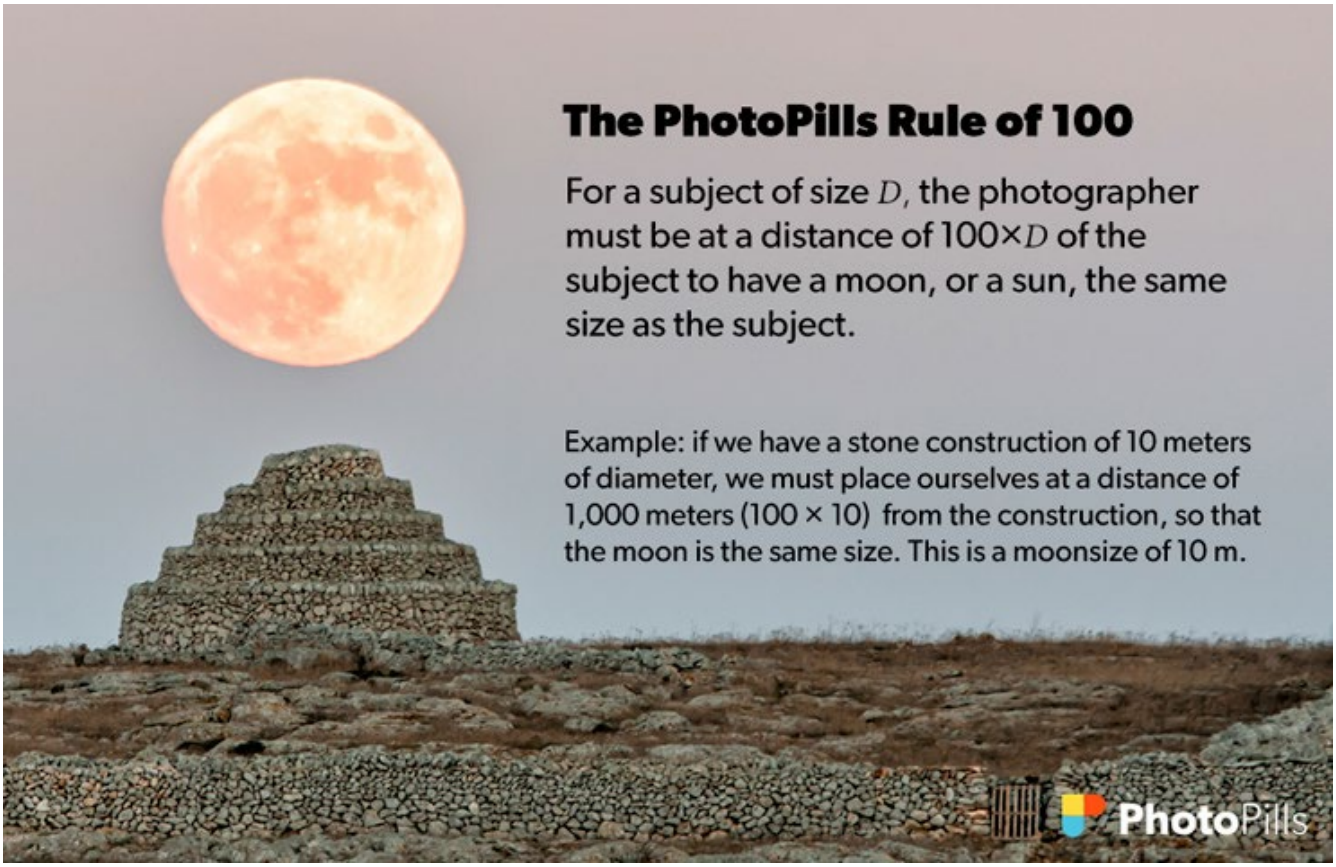
Photo by **Morten Ross**

Your spot will determine the size of the Sun compared to the subject

If you're planning to use a long focal length to capture a big Sun with your subject, look for a location that allows you to shoot far away from the subject.

How far?

It depends on the size of the Sun you need compared to your subject. To get the shooting distance, the rule of thumb is to multiply by 100 the diameter of the Sun you want.



You can learn more about this topic in the following article: 7 Tips to make the next SuperMoon shine in your photos.

Some final recommendations to enjoy the show!

Total solar eclipses are extremely unique events. They're literally magical!

Tons of people might never experience it in their lifetime. So if you are a lucky one (probably one a million!), well, you might not be alone that day.

Expect a big crowd and be prepared for it, especially if you plan to shoot the eclipse. My recommendation is that you should arrive to the shooting location well in advance. Scout the area and look for an ideal spot to view and capture de eclipse.

In addition to this, bring drinks and snacks with you. Note that you will spend several hours in the field (the eclipse alone lasts more than 2 hours) so bring a folding chair, a hat and sunscreen as well.

If you are going to be accompanied by children, bring something to keep them occupied while waiting. And if older people are also going to be with you, bring folding chairs and a sun umbrella so they can wait comfortably.

And remember! Use eclipse glasses to watch all the partial phases. Never ever look at the partially-eclipsed Sun without eye protection. (For more details, see section 8).

2

Want to plan the partial eclipse?
This is how to do it!

“Hey Rafa! I won’t be able to shoot the total solar eclipse… Can I use PhotoPills to plan the partial eclipse instead?”

Of course!

The partial eclipse will be visible all over North America, Central America, a large portion of South America, and a bit of West Europe (including a part of Spain) and Northwest Africa, weather permitting.

Millions of people will be able to see a big bite taken out of the Sun as the Moon moves in front of it.

Planning the partial eclipse with PhotoPills is very similar to planning the total eclipse.

Let me show you how it works.

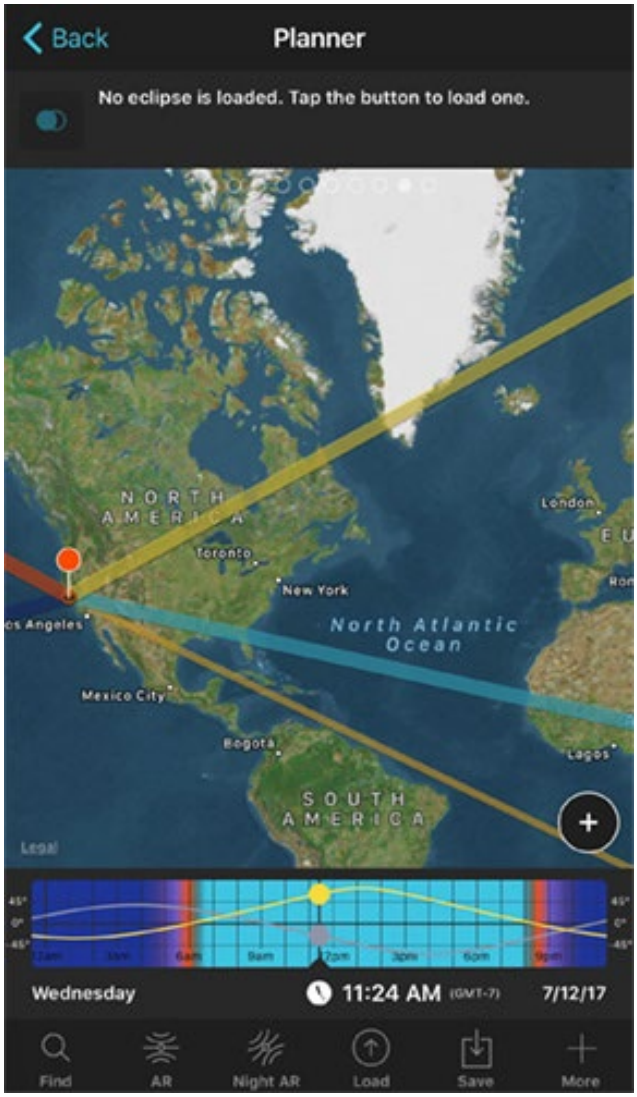
Where can I see the 2017 partial solar eclipse?

Go to the PhotoPills’ Planner tool, swipe the top panels to the left until you reach the first eclipse panel. Then, tap on the button to see the eclipse information both on the panels and the map.

Do you see the yellow lines on the map?

Well, to see the partial eclipse you need to go to a location that falls within the sector determined by the outer yellow lines… and outside the path of totality (dark central area).

Therefore, place the red pin on the location you wish to go and get the key eclipse information on the map and top panels.



PhotoPills Planner - View of first eclipse panel.

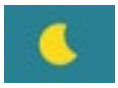
PhotoPills Planner - View of the eclipse information on the map and the panel.

Notice that on the screenshots the red pin is placed where I am now, in San Francisco. And by reading the eclipse panel, if I'm still here on August 21 (though I won't), I'll be able to enjoy a partial eclipse of magnitude 0.802.

This means that the Moon will cover 80.2% of the diameter of the Sun. Not too bad!

In fact, you'll be able to enjoy a partial eclipse of large magnitude in the major cities in the U.S., Canada, Central and South America. Check the magnitude and times in the following table:

City	Eclipse Starts	Max Eclipse	Eclipse Ends	Magni-tude	Eclipse at Max
New York City	1:23 pm	2:45 pm	4:01 pm	0.77	
Los Angeles	9:06 am	10:21 am	11:45 am	0.69	
Chicago	11:54 am	1:20 pm	2:43 pm	0.89	
Houston	11:47 am	1:17 pm	2:46 pm	0.73	
Philadelphia	1:21 pm	2:44 pm	4:01pm	0.8	
Phoenix	9:14 am	10:34 am	12:00 pm	0.7	
San Antonio	11:41 am	1:09 pm	2:38 pm	0.69	
San Diego	9:07 am	10:23 am	11:47 am	0.66	
Dallas	11:40 am	1:10 pm	2:39 pm	0.8	
San Francisco	9:01 am	10:15 am	11:37 am	0.8	
Indianapolis	12:58 pm	2:25 pm	3:49 pm	0.93	
Washington DC	1:18 pm	2:43 pm	4:02 pm	0.84	

Miami	1:27 pm	2:58 pm	4:21 pm	0.82	
Toronto (Canada)	1:11 pm	2:32 pm	3:49 pm	0.76	
Vancouver (Canada)	9:10 am	10:21 am	11:38 am	0.88	
Ciudad de México (México)	12:02 pm	1:20 pm	2.28 pm	0.38	
San José (Costa Rica)	12:05 pm	1:17 pm	2:23 pm	0.33	
Bogotá (Colombia)	1:38 pm	2:44 pm	3:43 pm	0.35	
Belém (Brasil)	4:14 pm	5:11 pm	6:03 pm	0.49	
A Coruña (Spain)*	8:43 pm	9:19 pm	9:53 pm	0.23	

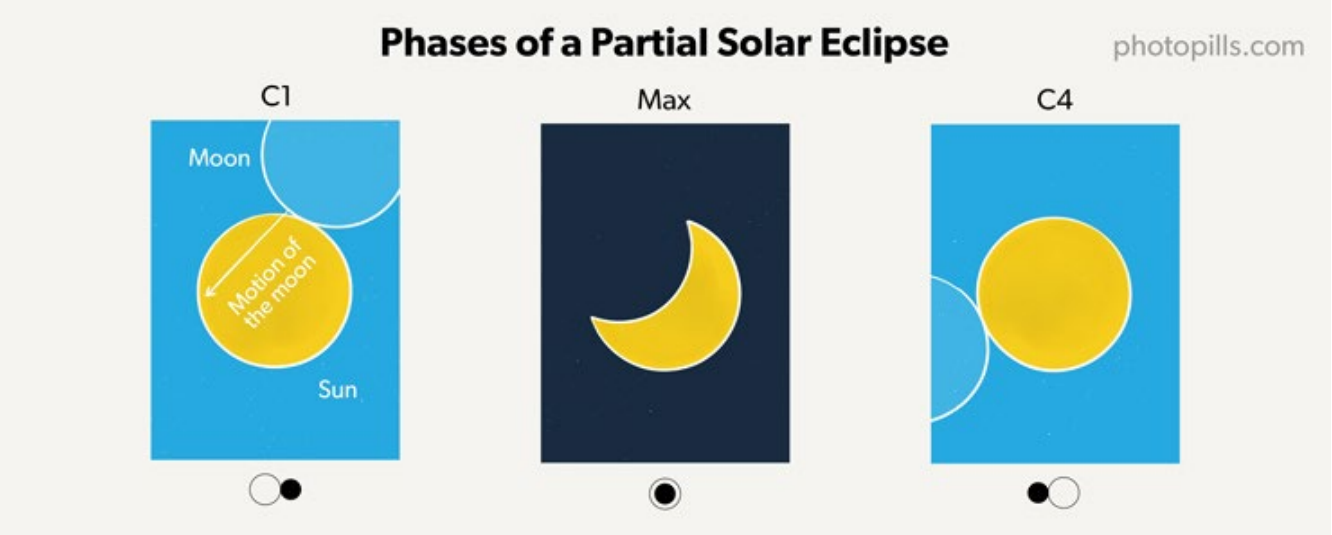
** In A Coruña (Spain) sunset is at 9:27pm. Part of the eclipse will happen below the horizon.*

Great, now you know where you can see the partial eclipse.

The next step is to figure out for a given location (red pin position), when you need to get there and what you'll see.

Let's find answers. Let's have a look at the second eclipse panel on PhotoPills!

The 3 partial solar eclipse phases and when they happen



The partial eclipse goes through three main phases. Follow these steps to figure out when each phase happens for the selected location (red pin position).

On the PhotoPills' Planner, swipe the top panel to the left to get to the second eclipse panel. On this panel you can read the time of the three phases of the partial eclipse of August 21:

- **Partial eclipse begins:** The Moon starts becoming visible over the Sun. The Sun looks as if the Cookie Monster has bitten it. In the example below, this happens at 9:01am.
- **Maximum eclipse:** The eclipse reaches its maximum magnitude. The Moon covers more of the Sun's disk than at any other instant during the eclipse. It occurs at 10:15am in this example.
- **Partial eclipse ends:** The Moon stops overlapping the Sun. The eclipse ends at this stage in this specific location. So in the example, it ends at 11:37am.

Have a look at the first screenshot below, the date of the Planner is set to July 12, 2017. To set the date of the eclipse (August 21, 2017) tap on the Sun icon you see on the panel.

If you do so, the time will be also set to 9:01am, when the partial eclipse begins. Notice that the icon of the button adapts to the eclipse phase.

PhotoPills Planner - View of the second eclipse panel.

PhotoPills Planner - After taping the Sun icon, the date has been set to August 21, 2017 and the time at 9:01am, the beginning of the partial eclipse.

If you tap the Sun icon again, time will be set at the maximum eclipse phase (10:15am).

Tap it again to set time to when the partial eclipse ends (11:37am). Notice how the eclipse icone adapts.

PhotoPills Planner - Time set to the maximum eclipse.

PhotoPills Planner - Time set to the end of the partial eclipse.

Easy, isn't it?

Let's move on! Let's figure out where to frame the camera!

Where to frame the camera to capture the partial eclipse

Easy! It works the same way that with the total eclipse (see section 1).

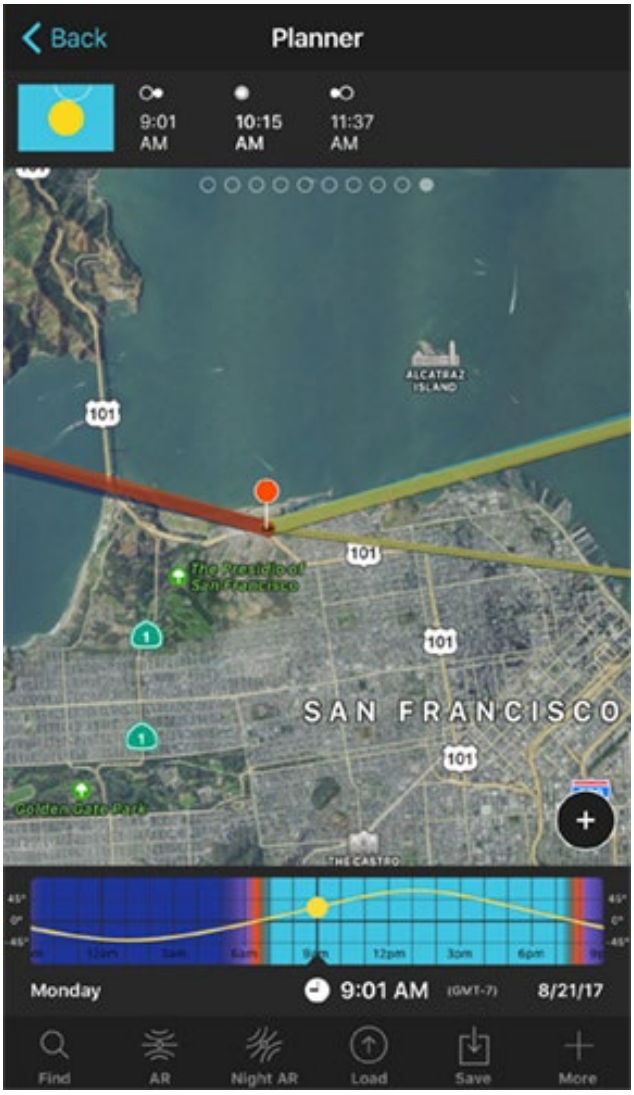
To frame the camera you need to know the position of the Sun in the sky during the eclipse.

So, let's zoom in on the location of the red pin and see where the Sun will be (azimuth and elevation) at the beginning of the partial eclipse.

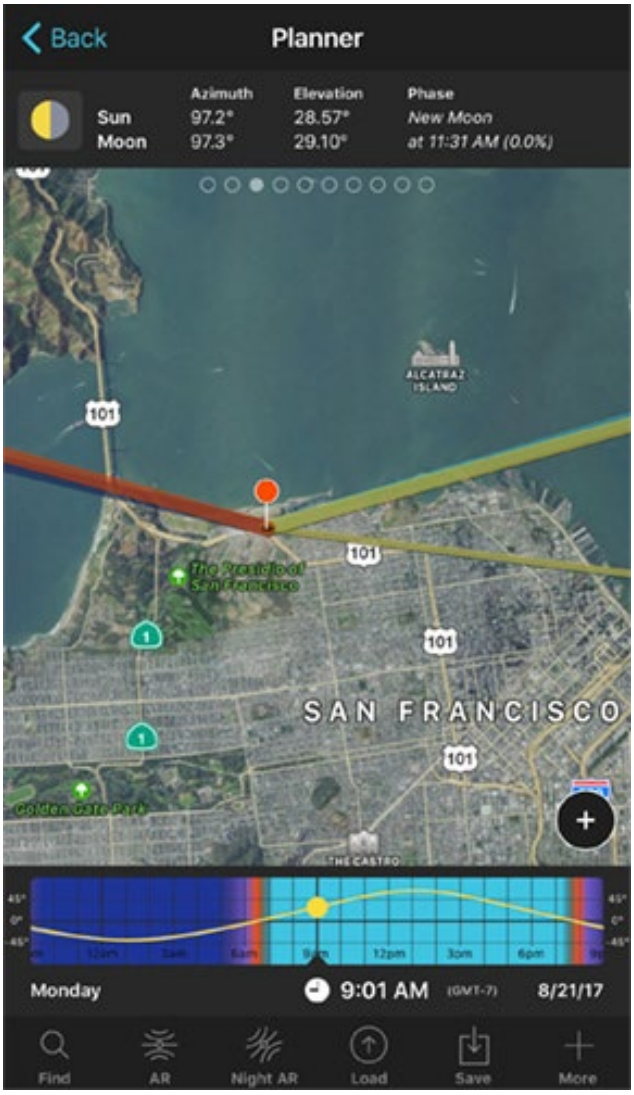
Tap the Sun icon on the eclipse panel until the time is set to 9:01am, when the eclipse begins.

On the map, the orange thin line that begins at the red pin is telling you where the Sun is (the direction or azimuth).

To get the elevation of the Sun, swipe the top panel to the right until you reach the Sun/Moon azimuth and elevation panel. There you can read that the Sun is at an elevation of 28.57° and at an azimuth of 97.2°.



PhotoPills Planner - The orange thin line points out the position of the Sun at 9:01am, when the eclipse begins.



PhotoPills Planner - Read the azimuth and elevation of the Sun at 9:01am, when the eclipse begins

Follow the same steps to figure out the position of the Sun at the moment of maximum eclipse and when the eclipse ends. Just tap the icon of the Sun on the eclipse panel and read the position of the Sun both on the map and the Sun/Moon azimuth and elevation panel.

What makes a great location to photograph the partial solar eclipse

The cool thing about the partial eclipse is that you have many more options of places to go.

So do your research and find a spot where:

- The eclipse has a large magnitude (above 0.6 if possible). The location includes an interesting background and subject for the shot.
- The easter you go the lower in the sky the eclipse will be. And the more opportunities to include the landscape in the frame you'll have. For example, in Galicia (Spain), the eclipse will happen around sunset.
- If you're planning to capture a big Sun together with your subject, you'll better go to a place that allows you to be far away from your subject (e.g. tree or building on top of a mountain).

Use **PhotoPills** in your research to find the perfect spot!

Are you still here? Yes?

You're a heroe!

Now you're more than capable of planning your eclipse photo ideas.

It's time to learn how to photograph the eclipse!

It all begins with the right equipment. :)

3

All the gear you need to shoot the 2017 total solar eclipse

In this section, my goal is to describe everything you need to photograph the eclipse.

Everything!

From solar filters, camera and lens to tripod, intervalometer and more...

Actually, I will tell you the equipment Antoni Cladera (the Photographer, the Animal of the PhotoPills team) will bring to the U.S. to shoot the eclipse.

Oh! I didn't tell you? The whole PhotoPills team will be at the States for the eclipse... It's going to be epic!

Our equipment for the eclipse

In addition to our Total Eclipse PhotoPills special edition t-shirts... this is the gear will bring to the US.

Solar Filters

A 77mm Solar Filter "White light" by Thousand Oaks Optical and a Baader Solar Filter to be used on the telephoto lens.

To shoot the eclipse sequence and video

Nikon D500 + Nikon 200-500mm f/5.6 + Gitzo 4542 systematic tripod.

Also Olympus OM-D E-M1 + Olympus Zuiko 300mm f/4 + Manfrotto aluminium tripod.

To capture the foreground and the eclipse

Nikon D4s + Nikon 70-200mm f/2.8 + Manfrotto 055 XPROB tripod. Depending on the shooting spot, we might use the 35mm f/1.4 lens.

To shoot the full path of the elipse

Nikon D7000 + Tokina 11-16 f/2.8mm + Gitzo 1241 tripod.

To shoot the making of timelapse

A Panasonic Lumix GX8 + Panasonic 14-140mm f/3.5-5.6 + Benro FTA18AB0 Travel Angel tripod.

And also a GoPro + Gorillapod tripod.

To capture details, shadows and making of

A Fuji X100 + Vanguard VEO 235AB tripod.

And a Pinhole camera. Medium format, Holga 120mm wide angle.

But this is just our gear. Let me give you a more general view of the equipment you'll need.

First, you need a solar filter

“Do I Rafa?”

Yes! And it has to be one made for this specific purpose: to photograph a solar eclipse!

Do not risk damaging your eyesight and equipment by using some cheap filter or one not designed for looking directly into the Sun.

Your filter must also block infrared (IR) and ultraviolet (UV) light as well which, though invisible, can also damage your eyes.

What are the different types of solar filters?

The are three types of solar filters for photography:

- Aluminized Mylar®
- Metal-coated
- Black-polymer (usually hand-held)

All the filters can be:

- Screw-on types, just like a regular neutral density (ND) circular filter.
- Mounted in a metal cell, making it very easy for you to clamp them over your lens and adjustable to different diameters.

How are you going to see the Sun through a solar filter?

Aluminized Mylar® filters are the most expensive ones. However, they provide a white Sun which is true to the Sun’s real color (surprise! It’s not yellow).

Do not be deterred by their wrinkled surface. This surface tends to scatter light a little bit, but these filters are actually very sharp! They are particularly good for highly magnified images.

Metal-coated glass filters and black polymer filters result in a Sun with a saturated yellow. Any of them will work fine, since you can always change the Sun color later on, in post-processing.

Finally, metal-coated glass filters offer you a sharper picture than black polymer filters which are more appropriate for naked eye observation and wide-angle images.

Do not use homemade filters!

According to NASA, the following materials should never be used to view a solar eclipse:

- Photographic neutral density filters, no matter how dense they are
- Photographic polarizing filters
- Sunglasses of any kind
- Negative film (exposed or not)
- Smoked glass
- Space blankets and other forms of household Mylar, or silvery CD/DVD disks
- Medical X-ray film
- Floppy disks

You must avoid them because, while they dim visible light, they do not block infrared (IR) and ultraviolet (UV) light that can damage your retinas.

Where can you buy your solar filter?

Most telescope stores will sell solar filters to fit a variety of lenses and telescopes.

However, if you prefer to order yours online here are a few alternatives:

- Amazon
- B&H
- Orion Telescopes
- Baader Astro Solar (Europe)
- Kendrick Astro Systems (Canada)
- Seymour Solar Filters
- Thousand Oaks Optical

The Camera

Just about any camera will work to capture the 2017 total solar eclipse, but some will produce better pictures depending on your expectations.

Can you capture the solar eclipse with your smartphone?

Yes!

Nevertheless, since the camera on your smartphone has a wide-angle lens, don't photograph the eclipse itself. Focus on what people around you are doing while including the eclipsing Sun in the frame.

And while you are taking photos here and there, don't forget to wear eclipse glasses. Grab a second pair to use one of the glasses' filters in front of your smartphone's camera as well!

Point-and-shoot cameras

In general, point-and-shoot type cameras all have great image quality and are very cost efficient. Unfortunately, because of their limited zoom range, it'll be hard to capture a large Sun disk in the Photo.

When shooting, use the LCD of your camera, put a **solar sheet** in front of the lens and wear the special eclipse glasses. Safety first!

And please, don't try to tape or attach in any fancy manner some sort of filter to these type cameras. Chances are the filter will be ripped off, breaking your camera sensor and harming your retinas.

Low-end cameras

The following cameras allow full manual basic exposure:

- Cameras with **APS-C** sensor: **Nikon D3400**, **D5300**; **Canon 1200D**, **Canon 1300D**; **Sony a3000**, **SLT-A37**, **SLT-A58**; **Pentax K-5**
- Camera with **Four Thirds System**: **Olympus E-PL5**
- Compact camera (1'' sensor): **Sony RX100 III**

Mid-range cameras

These cameras deal acceptably in terms of noise at a reasonable price.

For eclipses it's less critical as the scene will never get very dark (the sky will be like at twilight) and even the eclipsed Sun and corona will be quite bright. However, the lesser noise, the better quality you get.

- APS-C cameras: Nikon D7200, D7500, Canon 700D and 7D Mark II, Fuji XT-1, Pentax K-5 II and the Sony a6500
- Cameras with a 4/3 sensor: Olympus OM-D E-M1 and OM-D E-M5 Mark II
- Full Frame cameras: Nikon D610 and D750, Sony a7 and a7r

High-end cameras

On the higher price range (and higher quality), I recommend you these cameras:

APS-C cameras: Nikon D500, Fuji XT-2 and Fuji X-Pro2

Cameras with a 4/3 sensor: Olympus OM-D E-M1 Mark II

Full Frame cameras: Nikon D800, Nikon D810, Nikon D4S, Nikon Df, Nikon D5, Pentax K1, Canon 6D (which outperforms the Canon 5D Mark III in terms of noise, high ISO, etc.), Canon 6D Mark II, Canon 1D X, Canon 1D X Mark II, Canon 5D Mark IV, Canon 5DS, Canon 5DS R, Sony a7s Mark II, Sony a7 Mark II, Sony a7r Mark II and Sony a9.

The lens

Your choice of lens and its focal length will depend on how big you want the Sun to appear on your photos.

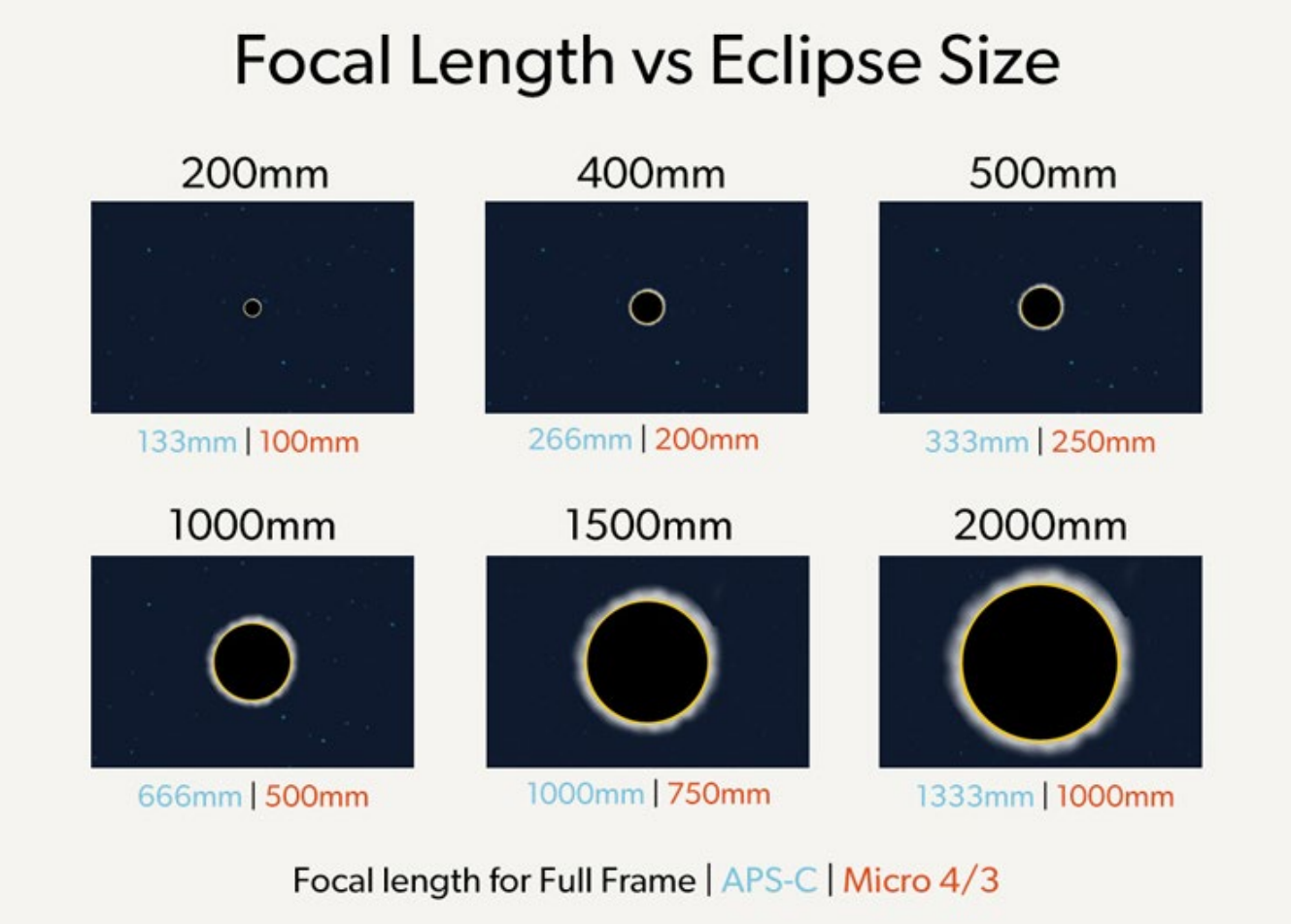
Are you looking to include part of the landscape and don't mind having the Sun as a dot? Use a wide-angle lens, like the Nikon 14-24mm f/2.8, Toni's favorite.

You don't worry about the landscape and it's ok to get a small Sun? Take a standard-

length telephoto lens, like the Nikon 70-200mm f/2.8 or the Canon 70-200mm f/2.8.

Would you like to capture a big (or huge) Sun? Use a super telephoto lens. For example, the Nikon 200-500mm f/5.6, the Canon 100-400mm f/3.5-5.6, the Fujifilm 100-400mm f/4.5-5.6, the Olympus Zuiko 300mm f/4 PRO and the Sigma 150-600mm f/5-6.3 for Nikon and Canon.

For the total eclipse, crop sensor cameras can play in your favor when trying to capture a big Sun in the photo!



Alternatively, you can also use a catadioptric lens. It is smaller, cheaper and lighter than a regular super telezoom lens. In addition to this, diffraction is almost insignificant.

However, it doesn't come without its inconveniences...

Not only it has a fixed focal length, you won't be able to change the aperture either. In addition to this, the out of focus areas of the picture can result into a doughnut-shaped bokeh.

You can't expect to have everything!

The tripod and the head

For starters, you need a sturdy and solid tripod. In other words, a heavy tripod!

This is particularly important if you plan to shoot composites (section 7) because you must make sure that your framing doesn't change from one capture to the next.

In any case, you need to keep your camera steady in order to prevent vibrations that could blur your photos.

Do you have a basic tripod?

Basic tripods usually don't weigh too much, which makes them pretty unstable.

Use these easy but efficient tricks to prevent vibrations:

- Hang a bag filled with stones or even your camera bag from the hook located at the bottom of your tripod's center column. But don't do it when it's windy, you'll get the opposite effect!
- Don't raise the center column of the tripod if it has one, it will make it more unstable.

Are you looking for a great tripod at a reasonable price?

Get the Manfrotto 055XPRO3. Probably the best seller tripod among advanced amateur photographers!

If want to spend a little bit more, have a look at the carbon fiber tripods.

These tripods are robust and weigh less than the aluminium ones. They allow loads from 5 kg to over 25 kg (11-56 lb) depending on the model.

Brands like Gitzo, Manfrotto, Benro, Induro or Really Right Stuff offer tripods of great quality in both materials, carbon and aluminum.

Should you get a specific tripod head?

Choosing your tripod head will depend on your taste, but make sure that it can bear at least 5/7 kg (11/16 lb) of weight and that includes a removable plate.

In my opinion, the tripod's best friend is a good ball head. The **Kirk Enterprises BH-1** is the one Toni uses. Supporting up to 23 kg (50 lb), it bears the weight of his gear with no problem. It allows him to work comfortably and with great precision.

Other heads we like are the **Gitzo GH2780QD**, the **Really Right Stuff BH-55** and the **Arca Swiss Monoball Z1 SP**, all robust and with very high endurance (minimum 13.5 kg or 30 lbs).

Additionally, if you are using a super telephoto lens you may want to use a gimbal head, such as the one I use, the **Benro GH2**.

Is a shutter release or an intervalometer necessary?

While shooting a solar eclipse, you should avoid vibrations. Otherwise, you risk ending up with a whole bunch of blurred photos. In order to do so, you need a way to trigger your camera without having to touch it.

Shutter releases and intervalometers will do the job. But, in my opinion, you should forget about the remote shutter release and get a good intervalometer.

Why?

Because remote releases are not programmable. You cannot shoot at regular intervals automatically.

The intervalometer is programmable. You can set the exposure time, the time interval between photos, the total number of photos to be taken and even the time delay of the first picture.

These are all great intervalometers:

- Brand intervalometers: Canon TC-80N3 Timer Remote Controller, Nikon MC-36A Multi-Function Remote Cord and Phottix TR90.
- For cheap intervalometers check the brand Yongnuo.
- Wireless intervalometer: Phottix AION.

Use some lightning gear during totality

All the fun of a total solar eclipse is the (brief) moment in which everything becomes dark!

Since our eyes take 20 minutes to get used to being in the dark, I recommend you to use a headlamp with included RED Night Vision Light just in case you need to check your camera settings.

When using your headlamp, make sure you're not annoying the photographers around you. This is key!

Headlamps with Red Night Vision Light are best – they allow to avoid white flash lights that ruin your night vision. A few good ones are: PETZL TIKKA XP, PELICAN 2750 and PELICAN 2760.

Other powerful LED headlamps are the Led Lenser SEOS, H14R or H7R.

Alternatively, you can use a flashlight such as the Coast TX-10, the Led Lenser L7 and the Maglite Mini Xenon.

What type of memory cards should you use?

There are many different types of SD cards (Secure Digital) depending on capacity and data transfer speed.

Depending on the capacity of the card, you can get:

- SD cards: capacity up to 2GB
- **SDHC cards** (SD High Capacity): capacity between 2GB and 32GB
- **SDXC cards** (SD Extended Capacity): capacity between 32GB and 2TB

Besides capacity, it's important to pay attention to **transfer speed**:

- Speed class 2: 2MB/s
- Speed class 4: 4MB/s
- Speed class 6: 6MB/s
- Speed class 10: 10MB/s
- UHS speed class U1: speed between 10MB/S and 104MB/s
- UHS speed class U3: speed between 30MB/S and 312MB/s

For beginners, 32GB SD cards Class 4 or 6 (from $15) are enough. They are great, cheap and the amount of photos stored is fine.

The main drawback is speed. Transfer speed of a camera memory card refers to how quickly data can be written to it. If you're going to take photography seriously, you'll need to purchase a memory card with a high transfer rate, because it allows each picture to be saved into the memory card quicker, providing a shorter delay between two consecutive shots.

Nowadays, the price of SD cards has dropped so much and it's so cheap to purchase a SDHC speed class 10 16GB card that you shouldn't purchase anything with less specifications.

Finally, I recommend you to use several small capacity cards rather than a few large capacity ones. That way, if you lose a card or spoil it, fewer pictures will be lost. By using several small capacity cards you decrease the risk of losing your photos.

Also, if your camera can work with **CompactFlash** (CF) cards, take advantage of it.

And the PhotoPills Total Eclipse T-shirt!

Ah! This is the most important thing! Get ready for TOTAL EPICNESS! :P

Get your t-shirt here!

4

General advice when shooting the 2017 total solar eclipse

You have spent weeks preparing for the total solar eclipse shooting session. You brainstormed several ideas, you found a location and a shooting spot thanks to PhotoPills, and you are ready for the adventure!

But first, let me tell you some general advice that is useful regardless of the type of pictures you plan capturing.

When to remove and replace your solar filter

This is THE question you may have as a first-time total solar eclipse photographer.

"You are right Rafa... How will I know when to remove the filter? And then, when do I have to replace it on my lens?"

Just to remind you, if for any reason you plan to view (not shoot) the eclipse using a telescope or a pair of binoculars, do not remove the solar filter until the last bit of the Sun is completely covered.

You risk damaging your retinas severely if you don't do so.

Now, If you want to capture the diamond rings and the Sun's corona you must remove the solar filter.

Contrary to your eyes, your camera is safe for the few seconds or even a minute before totality, and again afterwards for a short time.

When should you remove the solar filter?

Easy. When the Sun's crescent is an extremely thin line.

Once you've done so, do not look through the viewfinder of your camera while the solar filter is off!

Look at the image on the camera's Live View LCD screen instead.

Later on, when should you place again the solar filter on your lens?

This is even easier because you will see the edge of the Moon becoming brighter. So, once the diamond ring ends, put your filter back in place.

Avoid the curse of new gear and get familiar with it

The 2017 total solar eclipse approaches… Only a few weeks left!

And you are thinking about purchasing new gear (a camera, a lens, a telescope, a tripod, etc.) to capture it. Why not? After all, it's a once in a lifetime opportunity, isn't it?

If you decide to do so, try out the gear at home. Not once, not twice, but as much as you need to know it by heart and master it.

Rehearse the actions of setting up the tripod and the camera, aiming it high and adjusting exposures.

Trust me, during totality you'd be so surprised that you can get easily distracted… So much so that you can even forget to take pictures!

Use the following cheat sheet

What you should test at home:

- Can you easily remove and replace your solar filter?
- How many frames per second (fps) can your camera shoot on Burst mode?
- How does the Auto Bracketing function of your camera works?
- Is your complete setup (body+lens+tripod) solid when aimed up high?
- Can you access all controls and the LCD screen with the camera aimed up high?
- Practice operating the camera and adjusting your settings on Manual.
- How long do your batteries last?

What you should test shooting at the Sun (during the partial phases the Sun will have the same brightness):

- Practice finding the Sun with the solar filter on.

- Practice focusing on the Sun's edge in bright daylight.
- Figure out the best exposure settings with your solar filter on.
- Check possible framings on a date and time in which the Sun will be at the same elevation as during the eclipse.

What you should test shooting in twilight (during totality the sky will be as dark as twilight):

- Figure out the best exposure settings (no solar filter here!)
- How do your photos come up in case you have to increase ISO?

What you should test shooting in Full Moon (it has the same brightness as the inner corona):

- Practice focusing on the Moon's edge.
- Figure out the best exposure settings.
- Check how fast the Moon moves across your frame.

What you should test shooting at the Crescent Moon (it has a similar brightness to the corona):

- Figure out the best exposure settings.
- Practice taking pictures while rapidly adjusting the exposure settings.
- Are your images sharp focused? No vibrations?

Practice with the Sun and the Moon!

I won't stress it enough. You may have only one (yes, one) opportunity to shoot a total solar eclipse in your life.

Do you really want to improvise on the shooting day?

If you mess it up you'll have to wait until July 2nd, 2019 and travel all the way down to Chile or Argentina!

First, practice shooting the Moon

As a first approach, practice shooting the Moon. It's there for you almost every day (hmm... night!).

Aim to capture extremely sharp and well exposed photos of the Moon and you'd have done the hardest part!

Shoot during the Crescent Moon (Waxing or Waning)

First things first...

The Waxing Crescent Moon is an intermediate Moon phase that comes after new Moon. During this period, the lit up portion of the Moon increases from 0.1% to 49.9%.

Photo by David Steele

Waxing is a synonym of growing, while crescent refers to the curved shape the Moon has. It's similar to a banana, don't you agree?

As a rule of thumb, the Waxing Crescent Moon rises in the daytime before noon. You can easily spot it in the day sky, although it's easier to do so around sunset. Later on, it usually sets before midnight.

The Waning Crescent Moon is an intermediate Moon phase that comes right before the following new Moon. During this period, the lit up portion of the Moon decreases from 49.9% to 0.1%.

Waning is a synonym of decreasing. Again, crescent refers to the curved shape of the Moon. The banana I was talking about a couple of paragraphs above, remember?

As a rule of thumb, the Waning Crescent Moon rises after midnight. You can still see it in the morning before it sets in the afternoon.

Photo by **Thomas Bresson**

Now, let's talk about your test shots.

As you can see from the pictures, the (Waxing or Waning) Crescent Moon has a bright sunlit side, similar to the prominences and inner corona. Since it's really bright, you'll need a fast exposure (just a fraction of a second).

The dark side, lit by the sunlight reflected off the Earth (known as Earthshine), is similar to the outer corona and nearby stars during totality. To expose for it, you will need a shutter speed of more than a second.

Shoot during the period in which the Waxing Gibbous Moon turns into Full Moon

"Rafa, what's the Waxing Gibbous Moon?"

Again, Waxing means that the Moon gets bigger. Gibbous refers to the shape, and in this case it is less than the full circle (that would be Full Moon), but larger than the semicircle shape of the Moon at Third Quarter.

As a rule of thumb, the Waxing Gibbous Moon rises after noon. So you can see it during the afternoon and in the evening as it sets after midnight. During this period, the lit up portion of the Moon increases from 50.1% to 99.9%.

Photo by **Eric Kilby**

So, what about your test shots?

During twilight the Waxing Gibbous Moon has a similar brightness and size to the eclipsed Sun and its inner corona. So it's great to practice on your focusing using the Live View function on your LCD screen, and your exposure settings.

Additionally, it will also help you to establish how much the Moon's motion will affect your images.

Nevertheless, keep in mind how high the Sun will be during the August 21, 2017 total eclipse compared to the Waxing Gibbous Moon. The latter will be much lower in summertime.

Then, shoot the Sun as well

Practice shooting the Sun as well to make sure that your filter works properly, you are able to focus sharply, and to expose correctly.

Take into account that the Sun will be very bright during most of the eclipse phases. So the idea here is to shoot at the same local time as the eclipse will take place.

For example, if you plan to be in Carbondale, IL on August 21, the eclipse will last 2 hours and 55 minutes starting at 11:52am (local time) and ending at 2:47pm.

Ideally, you should get to your shooting spot at least one of two days in advance. This extra time will allow you to scout the area, look for the best spot and practice some shots.

As I explained in **section 1**, use **PhotoPills** to find out about the azimuth and elevation of the Sun in that location on the previous days (August 19 and 20).

If you can't make it, practice at home!

How?

Easy, schedule a shooting session during the same frame of time in which the total solar eclipse will take place.

Let's use the example above. You know that in Carbondale, IL (your preferred eclipse shooting location) the eclipse will start at 11:52am (local time) and will end at 2:47pm.

Imagine you are in Menorca. The idea is that you should plan your test shooting session between 11:52am and 2:47pm (Menorca local time). That way you will be in the same conditions as on the eclipse day.

What I mean by same conditions is:

- A very strong Sun, forcing you to play with short exposures.
- A very high elevation (at least more than 45º), so you can have an idea of the composition you can work with.

Let's say that you shoot in Menorca on August 2, 2017. At 12:16pm for example, the Sun will have an elevation of 59.71º and an azimuth of 130.6º, similar to the one you will have in Carbondale on August 21, 2017 (elevation of 62.61º and azimuth of 156.8º).

Don't forget to remove the solar filter!

How long does it take you? Try to do it as securely and as fast as you can.

Time yourself, and rehearse the procedure over and over until you master it.

Take into account the excitement you will have during eclipse day. So you may well be slower than the times you achieve at home.

However the most important thing is not speed. It's not forgetting to remove the filter a few seconds before totality starts!

If you don't do it and you keep shooting, your camera won't capture anything. It will be too dark and all your pictures will be underexposed.

The best trick to remember removing the solar filter is to set up an alarm on your smartphone to buzz a couple of minutes before the start of totality.

PhotoPills tells you exactly when totality will start at the location you are (section 1).

As soon as you figure it out, set the alarm. Don't procrastinate it or you will forget!

What type of pictures can you produce of the 2017 total solar eclipse?

The type of photos you can get will depend on how much time you want to invest during the eclipse and how experienced you are as a photographer.

Here are the different types classified by level of difficulty:

- Easy: grab shots and wide-angle stills
- Moderate: close-up stills and tracked images
- Hard: close-up and wide-angle composites

Now that you know what type of photos of the solar eclipse you can imagine, let's see how you can actually take them!

5

How to shot a grab shot or wide-angle stills of the 2017 total solar eclipse

Photo by Gry Berntzen

If you plan to include a surrounding scenery in the foreground of your eclipse images, you can do so using your smartphone, a point and shoot camera or a camera with a wide-angle lens.

Your shoots will be particularly cool if you consider shooting the Sun before a nice mountain range, a rock formation or a man-made landmark.

A few considerations

In the specific case of the 2017 total solar eclipse, to capture both the eclipse and the surrounding landscape you will face some challenges.

Both the Sun and the Moon will be high in the sky (e.g. an elevation of 40° in the coast of Oregon and 65° in Kentucky).

Therefore, if you are looking to capture both the horizon and the eclipsed Sun you will

need a wide-lens. This means that the eclipsed Sun will appear very very small in your frame.

For example, with a focal length of 24mm and shooting with a Full Frame camera in landscape mode, you have a vertical angle of view of almost 53º, so you can capture the sun high in the sky. Another example, with a focal length of 14mm, your angle of view is now more or less 81º, so you can capture it even higher.

Obviously, if you point your lens in portrait mode using the same focal lengths of the previous example you will capture the Sun at a much higher elevation... ;)

Of course, you may find a shooting spot near a mountain, a canyon or a wind turbine where you will observe the Sun above the skyline. This is a great option to capture awesome photos during the partial phases (section 1).

However, you may not capture the twilight, and during totality the landscape may be as dark as the sky...

Shooting with a smartphone or a point-and-shoot camera

These type of cameras produce remarkably good images, even in Auto mode.

The only difficulty might be dealing with autofocus. That's why practicing is so important. Not only a few days before the eclipse, but also during the eclipse. For example, while the Moon still hasn't covered the Sun.

In terms of composition, the issue here is that because of the wide-angle lens and the height of the Sun, you will have problems to include both the Sun and the ground in your frame.

My recommendation is that you can use these type of cameras to capture the site, the people enjoying the eclipse or even recording a video of the experience.

Photo by National Park Service

You can also work on close ups of gear, shots of people with funny filters on... The idea is to convey the excitement that you, and the rest of the people there, lived and experienced.

It's supposed to be a huge event!

Shooting with a DSLR or a mirrorless

The necessary equipment is composed by a DSLR or mirrorless camera, a wide-angle lens, the solar filter, a sturdy tripod, a tripod and a head, and an intervalometer.

Place your tripod

As soon as you get to the location and you are at your shooting spot, place your tripod and make sure it is stable and balanced.

Disable lens stabilization

If your lens includes a function to stabilize vibrations (VR/IS/OIS) when shooting handheld, disable it. Since you'll be using a tripod, this function might try to compensate vibrations that don't exist and blur your images.

You don't want to get a blurred Sun after all the planning, right?

Also, use an intervalometer or any other device to avoid any camera shake caused by your hands.

In the same way, I recommend you to turn on the Exposure Delay/Mirror Lock Up function to avoid a possible camera shake caused by the mirror slap before the exposure.

Finally, if you don't have an intervalometer or you left it at home, set the camera to a timer. This way, you'll also prevent camera shake caused by both your hands and the mirror slap.

Remove UV filter (if you have one!)

Ultraviolet filters (UV) are great to protect your lens, but you don't need an extra glass on your lens for this shot. Remove it!

Shoot in RAW

In the shooting menu, select the RAW option as the resulting file. This image file format allows you to use image data recorded by the camera sensor to produce higher quality images than JPEG. Additionally, this data can be used to improve the image and correct problems that wouldn't be recoverable in JPEG format otherwise.

Shoot in Manual

That way you have total control over exposure by adjusting shutter speed, aperture and ISO as you wish.

Use a Solar Filter

Yes, you need to use a solar filter (see section 3). But don't forget to remove it when shooting during totality and place it back again afterwards.

Focal length

Your desired composition determines the focal length to use. If you wish to capture as much landscape as possible, while getting a tiny Sun, go for a short focal length (8-35mm).

If you have a foreground subject to which you want to give importance, get closer to it.

Exposure: Aperture, Shutter speed and ISO

The good news is that light really won't change dramatically until the eclipse approaches totality, so you will be able to keep the same camera settings during most of the event.

However, when the eclipse show is at its most exciting moment (totality), the light will be changing quickly, and you must be ready to adapt your camera settings.

Again... don't forget to remove the Solar filter during totality!

During totality settings for a well-exposed image are similar to what's needed during twilight after sunset. The sky is deep blue, not dark as night.

In terms of aperture, try to use the largest possible one (f/2.8, f/4, f/5.6). The Moon will be moving much faster than what you imagine so you want to keep exposures very short.

As for the shutter speed, keep it between 1/125 and 1/4000 during the eclipse and slow it during totality (1-2 seconds).

Regarding sensibility, set your camera to its native ISO – the lowest available ISO setting. For most cameras, this is ISO 100 or 200.

Alternatively, you can use this **exposure guide**.

At totality, bracket, bracket and bracket some more

When the eclipse reaches totality and you have removed your solar filter from your camera, bracket your shots.

According to experts, there is a vast 12-stop dynamic range from the corona at the Sun's surface to the outer edges of the corona. Shoot lots of shots at different exposures. When you post-process later, you can choose the one that looks best.

Focusing

Most photographers worry about the “best” exposure to capture the eclipse when, actually, it’s the focus that you should worry about!

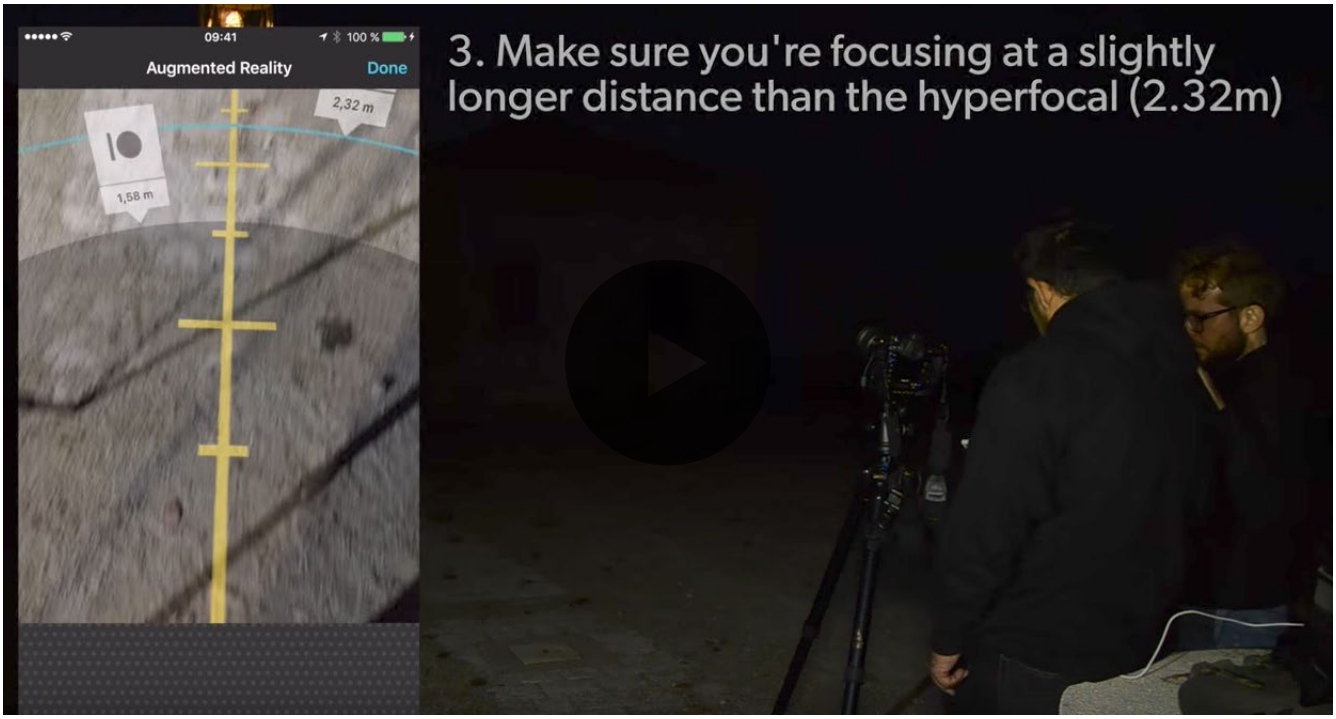
First, take your time (as long as necessary) to focus carefully.

As we are using a wide angle lens for this type of photo, we can focus at the **hyperfocal distance**.

When focusing the lens at the hyperfocal distance, always make sure that you’re not falling short. It’s better to focus a little bit further (1 meter is fine) than the hyperfocal distance. This will ensure that everything at the horizon is in focus. Falling short will blur all the elements at the horizon (mountains, the Sun).

You can calculate the hyperfocal distance using our **depth of field calculator** for a given focal length, aperture and camera model.

It’s very easy, just watch this video and you’ll learn how to do it in less than 1 minute!



Then, you can either use the autofocus or focus manually using the Peaking Focus and/or the Focus Magnifier tools if your camera has them.

Once you're done using the autofocus, switch to Manual Focus and make sure you touch the ring or change the focus mode during the shooting.

Use a Manual White Balance

Since you are shooting in RAW, you can always adjust the white balance in post-processing.

But, if you want to capture the real colors of the Sun and the scene right in your camera, I recommend you try a fixed 5200K and adjust from there.

6

How to shot a close-up or tracked images of the 2017 total solar eclipse

These are the type of shots most photographers will want to capture, but be ware because it can be challenging. After all, you are shooting a slowly moving target!

The simplest way to get close-ups is with a telephoto lens, using focal lengths up to 400mm to 600mm if you can. The obvious challenge is focusing the image and then following the moving Sun as Earth's rotation takes it from east to west across the sky.

Place your tripod

Once in the field, place the tripod on the planned shooting spot and make it stable and balanced.

Turn off lens stabilization

You're using a tripod. So, disable vibration reduction/image stabilization on your lens (VR/IS/OIS). This will prevent the blur caused by the lens when trying to correct inexistent vibrations.

You don't want to get a blurred Sun after all the planning, right?

Also, use an intervalometer or any other device to avoid any camera shake caused by your hands. Alternatively, set the camera to a timer.

Remove UV filter (if you have one!)

Having the UV filter on the lens is useless in here. It can cause halos, flares and annoying reflections!

Shoot in RAW

Always shoot in RAW!

The RAW file allows you to make the most of the data recorded by the sensor. Take advantage of it, use it in post-processing to produce better images.

Set the shooting mode in Manual

By using the manual mode you get full control over exposure. Set the exposure time, ISO and aperture to capture the exposure you wish.

Use a Solar Filter

Yes, you need to use a solar filter (see section 3). But don't forget to remove it when shooting during totality and place it back again afterwards.

Focal length

If you want to capture a big Sun compared with the frame, use a focal length of 400mm, 500mm (or more, use a teleconverter if necessary) and go far away from the subject.

What distance exactly? It depends on the size of the Sun you want.

You can find more details in section 1.

Exposure: Aperture, Shutter speed and ISO

As I explained in section 1, the eclipse will last on average 3 hours. So during that time the light really won't change dramatically. Keep the same camera settings during most of the event.

- Aperture. Use the largest aperture your lens allows you (f/2.8, f/4, f/5.6). The Moon moves faster than what you think!
- Shutter speed. Set it to a range between 1/125 and 1/4000 during the eclipse and slow it during totality (1-2 seconds).
- ISO. Use the lowest available ISO setting (ISO 100 or 200).

However, before, during, and after totality, the light will be changing quickly. So, you'll have to change your camera settings.

Alternatively, you can use this exposure guide.

At totality, use bracketing to nail your shots

At totality light goes off! Remove the solar filter a few seconds before it starts and consider bracketing your shots.

Up until now, your camera has been dealing with scenes where the Sun was illuminating enough. So your exposure speeds were (very) fast.

Nevertheless, as the Moon covers the Sun, the light will be less and less, and at totality the dynamic range of the scene can go up to 12 stops from the corona at the Sun's surface to the outer edges of the corona.

The inner corona is far brighter than the outer corona thus, no single exposure can capture its full dynamic range. The best strategy is to choose one aperture and bracket the exposures over a range of shutter speeds from 1/1000 second to 1 second.

Focusing

When preparing your total eclipse shooting don't worry about the "best" exposure to capture the eclipse. It's much better if you pay attention to focusing. You don't want to end up with all your photos of this once in a lifetime event blurred!

So, take your time (as long as necessary) to focus carefully at the edge of the eclipsed Sun.

- Use the autofocus or focus manually using the Peaking Focus and/or the Focus Magnifier tools if your camera has them.
- Lock the focus! After using the automatic focus mode to make focus, set it back to manual focus.
- Always take a test image and use the Live View function to make sure the Sun is in focus before starting the shooting.

Use a Manual White Balance

Now that you know how powerful a RAW can be, shooting in RAW allows you to adjust the white balance in post-processing.

But, if you want to have more accurate colors, start with a fixed 5200K and adjust from there.

7

How to create close-up and wide-angle composites of the 2017 total solar eclipse

Photo by Thanakrit Santikunaporn

Tell the complete story in one image!

Close-up and wide-angle composites are a great way to show how the eclipse changes over time.

To create a composite image you need:

- To take as many photos as possible to capture the evolution of the whole eclipse. Use the techniques explained in section 5 and section 6 depending on the focal length you want to use.
- To merge the photos in one image in post-processing.

You can create many composites, but the most spectacular are the multi-photo composites and the layered composites.

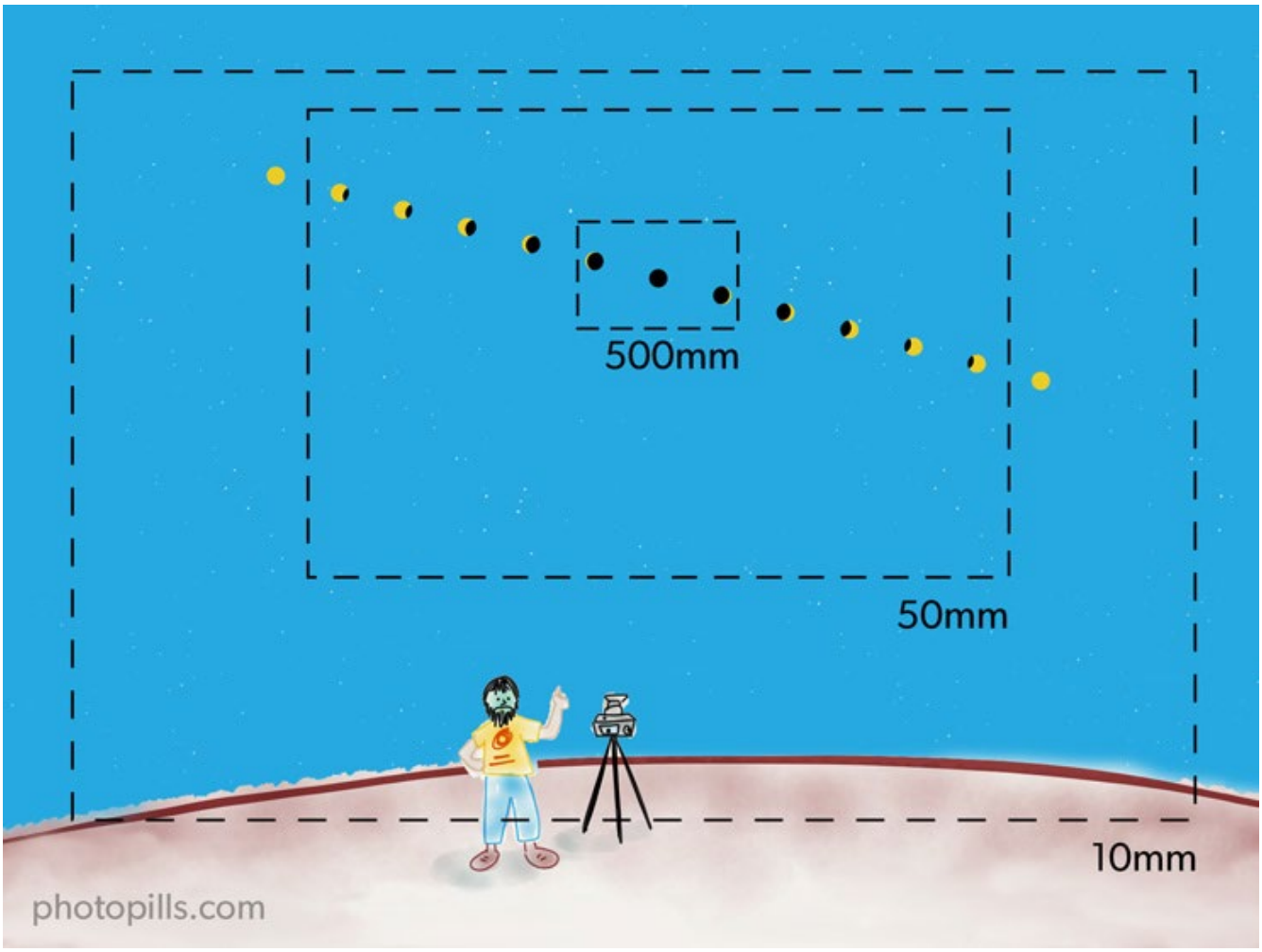
Multi-photo composites

A multi-photo composite shows the Sun moving naturally along a static frame. So you won't need to move your camera during the entire eclipse.

Whether you are planning a close-up or a wide-angle image, make sure you follow this pieces of advice:

- Determine how the Sun will be drifting across your sensor at your shooting spot (use PhotoPills!).
- Compose your picture according to it.
- Determine the interval between shots.

Obviously, your goal is to orient your lens' field of view according to the Sun's movement and get the image of totality close to the center.



Before you frame the shot use the PhotoPills Augmented Reality tool to see where the Sun and the Moon will be during the eclipse according to your position.

Depending on the focal length you use, you can also add an interesting foreground or landscape into your frame.

Remember to shoot all the partial phases with you solar filter on and the total phases without it.

As for the time intervals, you can shoot as often as you like (especially if you are looking to produce a time-lapse). As a rule of thumb, a composite still image looks best with frames taken no less than 5 minutes apart.

Again, your main concern should be framing the scene so the Sun moves nicely across the frame and ends up centered at totality.

Later on, in post-processing, merge your exposures into a single frame.

Layered composites

A layered composite is a combination of several shots during the eclipse that you realistically merge but that do not represent what actually happened.

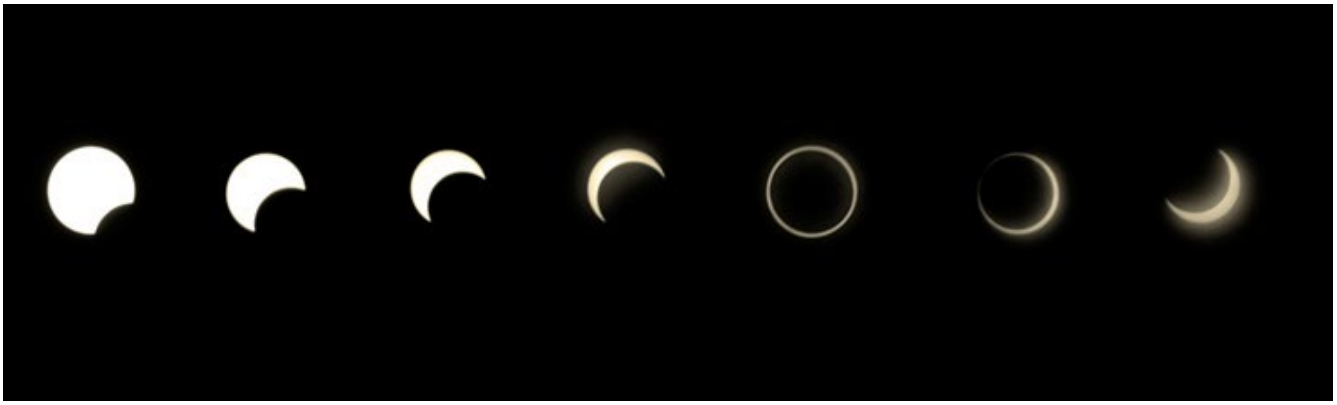


Photo by Kyle Greenberg

This type of composite is much easier to produce because you don't need to worry much about composition. You will only need a portion of the image and no landscape or foreground to appear in the frame.

In this case, all you have to do is use the images you already have shot and display them in a natural way to show the eclipse evolution.

Align and center each individual frame. Make sure that all the images are symmetric and that there is a constant distance between each one.

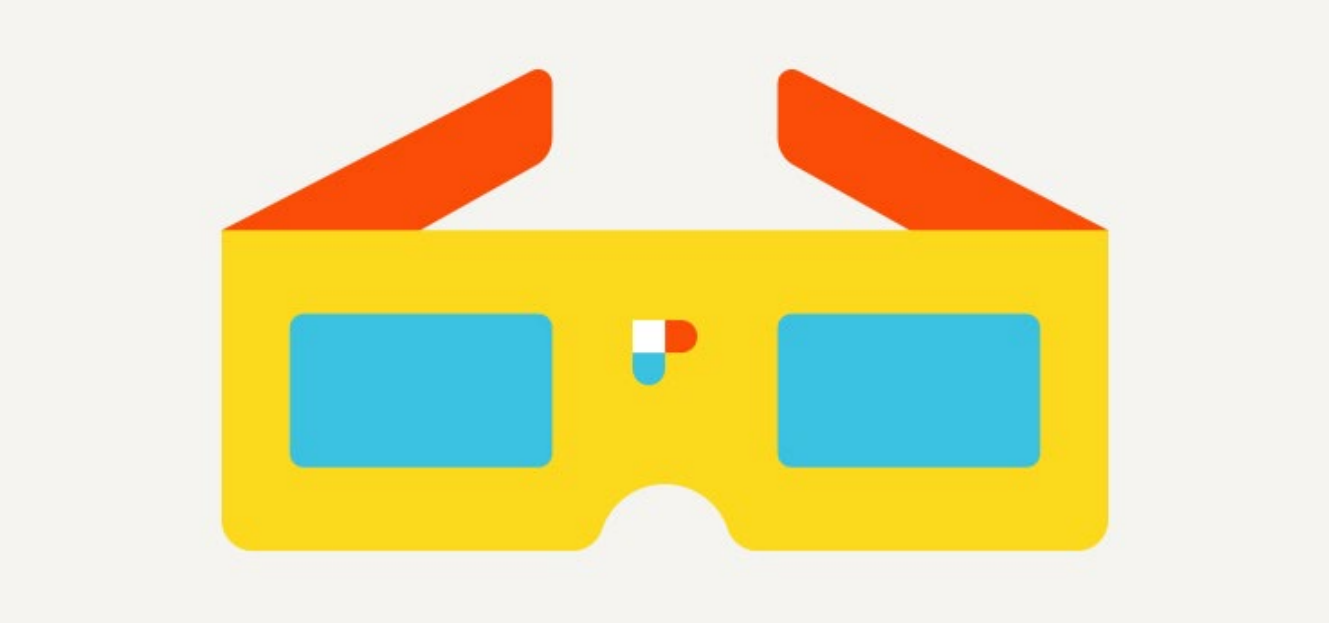
Why is this type of composite considered a "realistic fake"?

Because you could decide, like in the example above, to place all your exposures along a straight line.

Does this represent the Sun's real trajectory? Surely no, but it's still looks real, doesn't it?

8

Don’t forget to use special eye protection!



Never ever forget to protect your eyes during the whole solar eclipse with an approved ISO protection (e.g. eclipse glasses).

You must use them throughout the whole eclipse, except when totality occurs. A few seconds before it happens, take you eclipse glasses off and enjoy the views! Once it's done, put them on again.

Avoid looking directly at the Sun

On regular day you don't happen to look directly at the Sun.

That's for two reasons.

First, because since you were a kid you've had the instinct not to look directly at it. It hurts and it's annoying. This instinct is called "aversion reflex".

Secondly, because there's nothing to see after all! The Sun is so bright and its light is so powerful that you are blinded.

So if that's what you do on a regular day, why would you expose your sight to potential damage looking at the Sun during the 2017 total solar eclipse?

Because it's a unique event and you don't want to miss it. I get it.

In fact, you could be able to override your aversion reflex since your willpower can be extremely powerful (pun intended) and take you beyond the usual boundaries. After all, you could be thinking that "it's just going to be a couple of minutes".

To make things worse, you could look straight into the Sun with some comfort while it's partially covered by the Moon...

However, the consequences are fatal. You would suffer eclipse blindness, an eye damage that would negatively affect your sight forever and from which you might never recover.

The fatal consequence: eclipse blindness

As soon as you start looking at the Sun during an eclipse you are exposing yourself to suffer from eclipse blindness.

What is eclipse blindness exactly?

Well, your eyeballs get burned and your retinas can suffer a permanent damage. In other words, you can lose sight (partially or globally, depending on how much you expose your eyes).

Think about an excess of light applied to your retinas. They just can't bear it and this huge light destroys the retina's photoreceptors.

These photoreceptors are the cells allowing you to see in the dark, to view in color and to have sharp vision.

The problem with eclipse blindness is that you won't feel its effects until the next morning or even later. Some of the symptoms, affecting mainly your central vision, could be seeing blurry or not seeing at all (black image or black spots). Your peripheral vision is generally spared, but it really depends.

Nevertheless, once you suffer from eclipse blindness, you are considered a visually impaired person.

And to make things worse, your healing process is a mystery. According to the statistics, 50% of the people affected recover full vision in the next 6 months. The other 50% recover it only partially or are impaired for the rest of their lives.

So, please avoid any risk and view the eclipse taking some basic precautions!

How can you view the eclipse without going blind?

I can't stress it enough. Looking directly into the Sun during an eclipse can cause you blindness.

Avoid:

- Looking repeatedly at the Sun without any protection.
- Staring at the Sun for an extended time.
- Glancing through a camera, binoculars or telescope without solar filters.
- Using regular sunglasses as they will not provide enough protection.

I've repeated the word "protection" several times. So, what are the different tools that you can use to protect your retinas?

- Approved solar eclipse glasses.
- Specially designed solar telescopes or solar binoculars.
- Cameras, binoculars and telescopes with approved solar filters (section 3).
- A pinhole projector.

Wear a pair of approved solar eclipse glasses

Probably, the best and cheapest piece of protection that you can get is a pair of solar eclipse glasses or handheld views. Before purchasing yours, make sure that it complies with all the safety requirements.

Just because "it looks good", it doesn't mean it will serve its purpose. So check that yours are ISO-approved solar eclipse glasses. Look for an ISO (International Organization of Standardization) label; ISO 12312-2 is the U.S. standard, while ISO 12312-2:2015 is the UE standard.

In addition to this, make sure that the glasses' filters are pristine (no defects, such as scratches, bubbles and dents), and that they cover both eyes perfectly.

Finally, put the filters in front of your eyes before looking up at the Sun, not after.

Don't even think about viewing the eclipse with your eclipse glasses between your eyes and optics (e.g. camera, binoculars). You risk from damaging you retinas severely!

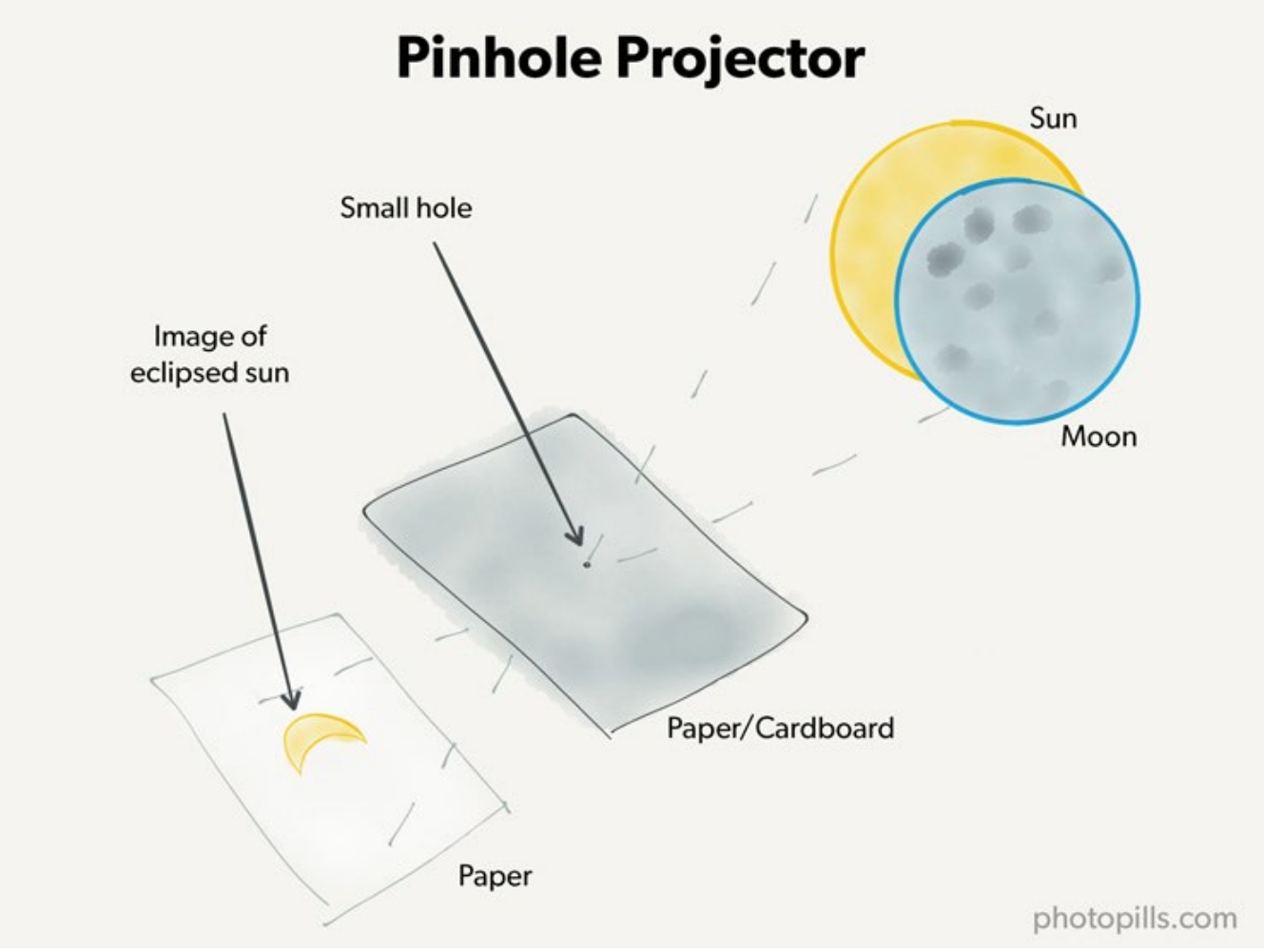
You can get your approved pair of solar eclipse glasses of American Paper Optics, Rainbow Symphony or Thousand Oaks Optical on Amazon.com.

How do you make a pinhole projector?

You only need two white cards or pieces of cardboard.

First of all, use a needle to punch a small hole in one of the cards. Then, use this card to get the light through it and project it onto the second card, the blank one.

You will be able to see the eclipse perfectly.



Don't use anything else as a protection!

According to NASA, the following materials should never be used to view a solar eclipse:

- Photographic neutral density filters, no matter how dense they are
- Photographic polarizing filters
- Sunglasses of any kind
- Negative film (exposed or not)
- Smoked glass
- Space blankets and other forms of household Mylar, or silvery CD/DVD disks
- Medical X-ray film
- Floppy disks

You must avoid them because, while they dim visible light, they do not block infrared (IR) and ultraviolet (UV) light that can damage your retinas.

This warning is very important in the case of regular sunglasses.

According to the experts, sunglasses typically let in between 10% and 20% of daylight. This is still too bright for your retinas.

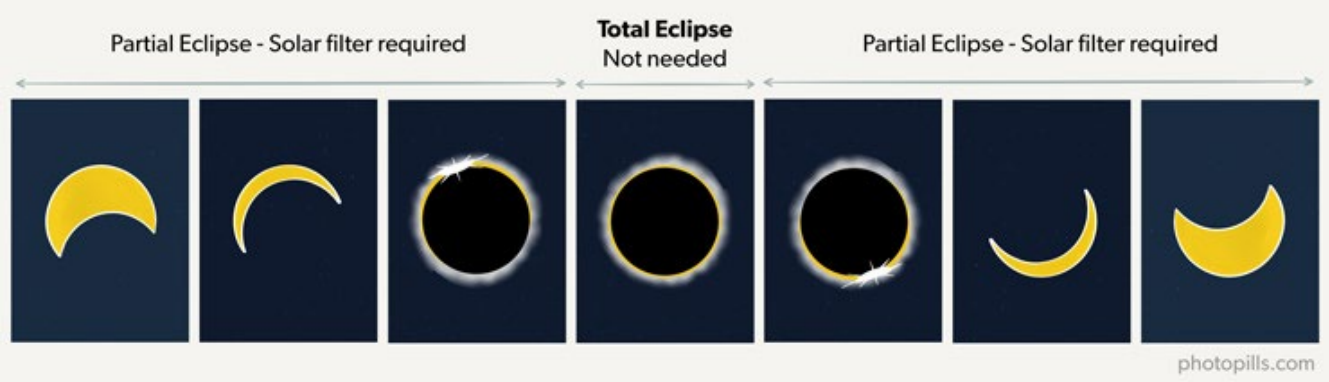
The filters used on any approved solar eclipse glasses are generally 100,000 times darker.

Now that you know what to use to protect your eyes, let's see when it is safe to look.

When is it safe to look?

There is only one phase in which it is safe to look at the Sun and that's during totality, when the Sun is completely covered (100%) by the Moon.

At that moment, the Moon is blocking the Sun's rays and only the corona (the outer atmosphere of the sun) is visible.



So, yes, remove your protection. Otherwise you won't see anything at all!

However, be extremely cautious because even when the Sun is almost completely covered (98-99%), this tiny crescent that remains is still bright enough to cause you eclipse blindness.

This is only valid if you are in a location from which you will see a total solar eclipse. If you are watching the partial solar eclipse from other parts of the U.S. or the rest of the world, you must keep your protection on the entire time.

Remember that you must use proper eye protection while viewing the total solar eclipse to prevent your eyes from suffering partial or total blindness.

And as soon as you have everything ready, practice using your protection and equipment before the eclipse actually happens.

Practice before the eclipse

Considering that the 2017 total solar eclipse is a unique event, make sure you are sufficiently prepared.

Now that you have a proper eye protection, your gear is ready and you know where you will be admiring this amazing phenomenon, don't improvise!

First, make sure that you know exactly when and how it is safe to look.

Then, depending on the tool you plan to use to observe the eclipse (camera, binoculars or telescope), practice in advance how you will be using it.

In other words, don't play around with the solar filters during the eclipse. You should know exactly what to do and how to do it before it actually happens.

Please, take all the necessary precautions (especially if you will be accompanied by children) and enjoy the eclipse without having to regret it later on!

9

The 12 mistakes you should avoid when shooting the 2017 total solar eclipse

You forget to remove the solar filter at totality (1)

This is the most common mistake.

You are so focused on the eclipse, setting your gear correctly, nailing the perfect shot... that you forget to remove the solar filter from the lens!

If you want to capture the Sun as the Moon covers it completely, you must remove the solar filter.

Remember that it will be almost dark and that a solar filter is much darker than a regular big stopper (10-stop neutral density filter). It only transmits 1/100,000th of the light while a big stopper transmits 1/1,024th.

To avoid forgetting the solar filter removal you can do a couple of things.

The first one is setting an alarm on your smartphone. Thanks to **PhotoPills** you are able to predict exactly when totality will start at the location you are (**section 1**).

Take advantage of this and set an alarm on your smartphone to buzz a couple of minutes before totality happens.

And while you are at it, set another one to buzz before the end of totality so you don't forget to put the solar filter back!

The second is to ask people around you (you won't be alone, I'm sure) to remind you. It's probably less effective, but it's always good to have a backup.

Someone (or even you!) steps on your camera or trips over your tripod (2)

The first advice to try to avoid this problem is to find a shooting spot in which you have enough space around you.

On eclipse day you will be dealing with a lot of people moving around you and your gear. And most of them won't be photographers so they might not be very careful with your tripod.

So, get to the shooting spot as early as possible.

Ideally, you would have scouted the area in advance (the day before, for example) so you already know the location and the exact spot from where you will be shooting.

Once you are there on eclipse day, my second advice is to try to spread your gear around you and your tripod. That way, people will more likely step on your backpack or trip over your folding chair, not over your camera or your tripod.

Your tripod moves resulting in a different frame, and you can't get back to the original one (3)

In this case, I have good news and bad news.

First, the good news.

If you are shooting a single shoot with a telephoto lens, chances are you will have enough negative space around both the Sun and the Moon to fix it in post-processing cropping the frame.

Even if you are shooting with a huge telezoom (or a telescope!), you might have a frame large enough for you to crop and adjust the Sun's position.

Now the bad news.

If you are shooting a single shoot with a wide angle lens, chances are your photo will be either ruined (let's hope not!) or different from what you initially composed.

If the former happens, who knows, you might end up with a nice result anyway. The problem is that you may not be able to create a multiple exposure composite.

So, I won't say it enough, make sure you have enough space around your setup so that you can move freely and no one else disturbs your shooting session.

You could even cause this yourself while removing the solar filter, especially if it's a screw one.

First, practice, practice and practice before eclipse day.

Then, remove it very carefully and slowly.

Oh, oh… You forgot something (e.g. memory card, shutter release, battery, etc.) (4)

It's so disappointing when you are in the field excited about the shooting only to realize that you forgot something of capital importance…

The best solution to prevent this?

A checklist! (See section 3)

The more complete and detailed your checklist is, the more helpful you will find it.

And don't write it on a piece of paper, put it on your smartphone so it's always with you.

Your memory card, shutter release, battery (you name it) fails (5)

This type of problem can be easily avoided and solved.

A few days before eclipse day, test all your gear and make sure that everything works.

While doing so you might find handy to write and go through a complete checklist like the one I suggested you in section 3.

When possible, bring two (or more like memory cards or batteries) of each. That way, if something goes wrong in spite of your previous check, you can always use your spare shutter release, another battery or a different memory card.

Be prepared for everything!

You accidentally shifted focus and the Sun and the Moon are blurry (6)

Again, you can face two different situations depending on the type of shot you plan.

You are shooting with a wide angle lens

Therefore, you are including part of the landscape in you frame. Here, you clearly failed to focus at the hyperfocal distance.

Refocus again and make sure that you are focusing the lens at a slightly larger distance than the hyperfocal distance (e.g. 1 meter). But most importantly, make sure not fall short again!

You'll find how to focus at the hyperfocal distance in this video.

You are shooting with a telephoto lens

In this case, most of your photo is covered by both the Sun and the Moon. Here, you failed when focusing manually.

To refocus again accurately use the Live View option on your LCD screen and, if your camera has them, both the Focus Peaking and the Focus Magnifier.

You'll find how to use these tools in section 6.

All your images are blurred! Why? (7)

If your photo is completely blurred despite having focused correctly, it's either because you are getting vibrations in your camera and/or your lens.

- Use a sturdy tripod and make sure it's completely stable.
- Turn off the lens stabilisation system. You're using a tripod, and there is no need to use this function. Despite the absence of vibrations, it may try to correct inexistent movements causing the opposite effect!
- Use an intervalometer or a shutter release. Don't touch the camera unless it's strictly necessary.
- Check the lens autofocus is disabled.
- Double check the focal length is the right one. Make sure you don't touch the ring of the lens.
- Always take a test shot to double check that everything is in focus.

You forget it will get dark so you can't see anything (8)

Remember the checklist I told you about in section 3?

Well, include a flashlight or a headlamp!

And, of course, don't forget it at home on eclipse day. You will need one during totality. It will get almost dark...

It's cloudy so you don't shoot at all (9)

Obviously, your best strategy is to move and change your location and shooting spot if the clouds appear.

Does that mean that if the clouds appear too late and it's too late for you to move you shouldn't shoot?

No way!

A few clouds can become an interesting element in your scene.

And yes, it is possible to shoot the eclipsed Sun through some clouds. Sometimes the camera sees things your eye cannot.

You can shoot the partial phases of the eclipse and totality through clouds.

If the clouds are too dense, remove the solar filter (otherwise it would be too dark for the camera to capture anything) and start shooting.

If they're not, try the best you can while the solar filter is on.

Worst case scenario, if the Sun is completely blocked by clouds, you can always capture the lighting changes and the shadow of the Moon on the clouds...

Second contact (C2) comes too soon. You aren't ready, and blow the exposures (10)

Your pictures are blown because you continued shooting without replacing the solar filter on your lens.

When should you do this? As soon as you see the edge of the Moon becoming brighter. Put your filter back in place once the diamond ring ends.

Never look through the viewfinder of your camera while the solar filter is off! Look at the image on the camera's Live View LCD screen instead.

You just stare up during the eclipse and forget to do anything! (11)

That's a cool option too!

But weren't you the one who was asking how to shoot the 2017 total solar eclipse?

Come on! Mooooooove!!

You shoot in JPG and now you cannot edit! (12)

Always shoot in RAW, and edit the RAW file in Lightroom (or your preferred post-processing software).

The RAW file contains all the information captured by the sensor of your camera. So it's much easier to make adjustments later on in the image without risking losing of quality.

The JPEG format is a compression of the image. So a lot of information gets lost in this compression.

10

The 10 final eclipse curiosities and facts you can’t miss

I know it's a long article, but there is so much to cover!

Here you have 10 interesting things about this year solar eclipse and eclipses in general.

The action happens in the sky and in the shadows (1)

Photo by David~O

Do you wish to see the eclipse projected on the ground?

Pay attention to the shadows cast by trees!

Yes! During the eclipse, when light goes through the small gaps between the leaves, it casts shadows with the shape of the eclipse.

This amazing effect is produced because the small gaps between leaves act as pinhole cameras.

Actually, any small hole will create the same effect. Try it! Take a piece of paper, make a hole in it and enjoy the eclipse not in the sky, but in the shadows.

How will the 2017 total solar eclipse move across the U.S.? (2)

The total eclipse will begin at 8:46am Pacific Time over the Pacific Ocean. From there, it will be moving to the west to reach the coast of Oregon in Lincoln City at 9:04am Pacific Time (totality will be at 10:17am over the span of 1 minute and 55 seconds).

From there on, it will move inland to reach the western border of Idaho (e.g. Boise at 10:10am local time), Wyoming at (e.g. Jackson at 10:16am local time), and Nebraska at (e.g. Scottsbluff at 10:25am local time).

Then, the 2017 total solar eclipse will move across northeastern Kansas (e.g. Saint Joseph at 11:36am local time), Missouri (e.g. Jefferson City at 11:46am local time), southern Illinois (e.g. Carbondale at 11:52am local time), western Kentucky (e.g. Hopkinsville at 11:56am local time), Tennessee (e.g. Nashville at 11:58am local time), northeastern Georgia (e.g. Tallulah Falls at 1:07pm local time), and South Carolina (e.g. Columbia at 1:13pm local time).

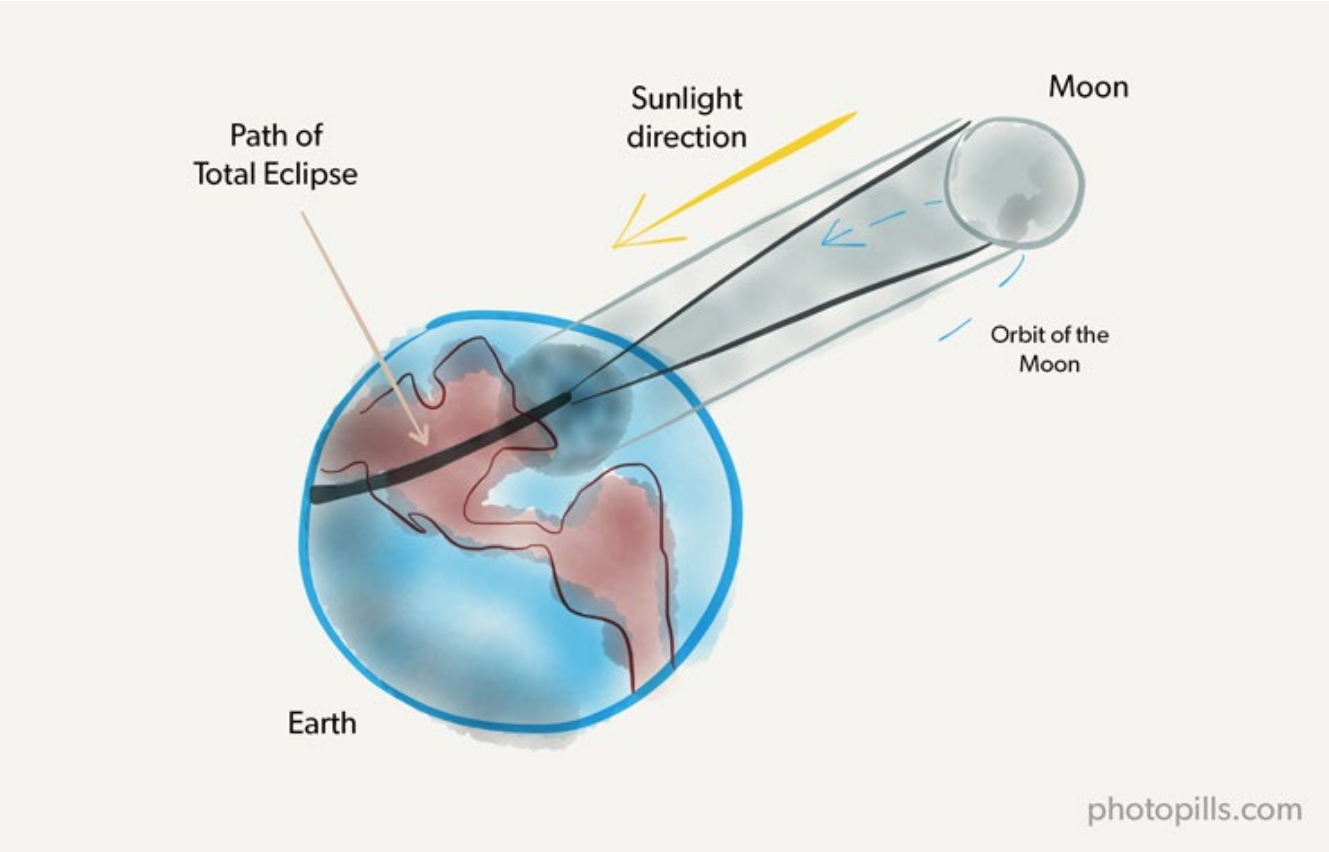
Finally, it will end on the easternmost cape in South Carolina (e.g. Charleston at 2:48pm Eastern Time).

It will take about 90 minutes to cross the U.S. and the shadow will move at an average speed of 2,335 kmh (1,450 mph). That's much faster than the speed of a regular commercial airplane.

When checking the local time at which the eclipse will occur at a given location, keep in mind that the eclipse will move across the four time zones of the continental U.S. (excluding Alaska).

How fast does the 2017 total solar eclipse moves across the U.S.? (3)

As the Moon moves in its orbit around the Earth, its shadow is projected on the surface.



Because of the geometry of the Earth's shape, the Moon's shadow (umbra) will travel faster across its surface at the beginning of the eclipse path (e.g. Oregon), and will slow down progressively as it crosses the country (e.g. Nebraska, Kentucky), only to speed up a little bit as it leaves the U.S. (e.g. North Carolina).

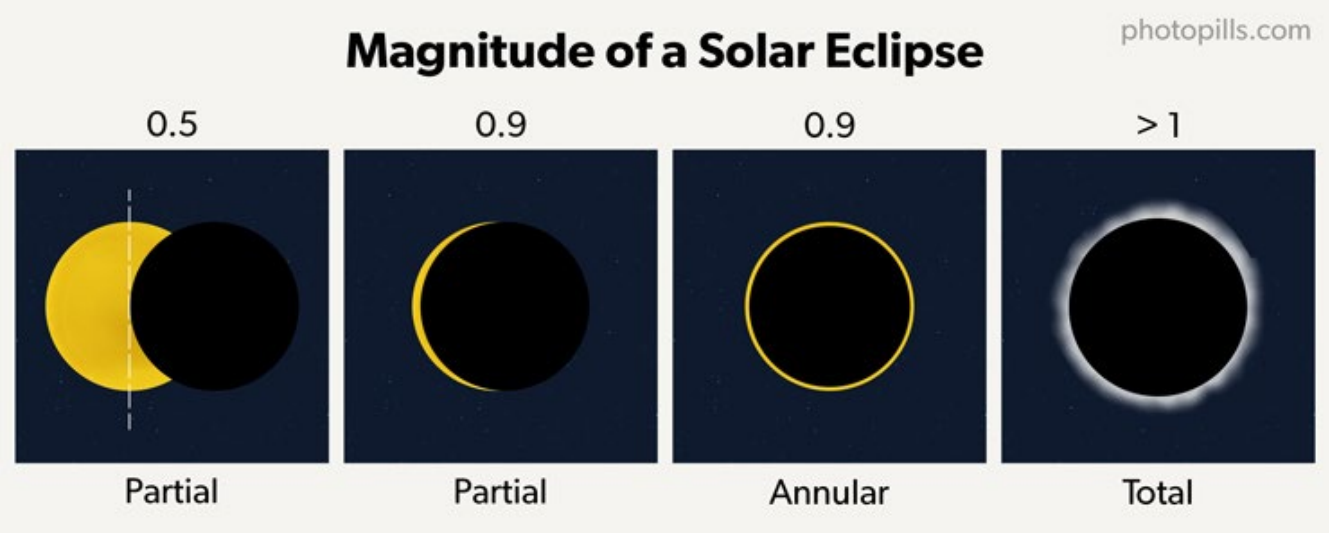
One of the best eclipse calculators (thanks Xavier Jubier!) allows you to note that the Moon's shadow (also called umbra) is moving at:

- 1,405 kmh (2,400 mph) in western Oregon
- 700 kmh (1,575 mph) in central Nebraska
- 650 kmh (1,455 mph) in south Illinois
- 665 kmh (1,490 mph) in western South Carolina

What is the difference between magnitude and obscuration? (4)

The magnitude is a number astronomers use to define how much of the Sun is covered by the Moon in a solar eclipse.

The magnitude represents the fraction of the solar diameter that is covered by the Moon. It has a value between 0 and 1 inclusive, where 1 is totally eclipsed.



Sometimes, the eclipse magnitude can have a value greater than 1. This happens when the apparent size of the Moon is larger that the diameter of the Sun.

The eclipse magnitude is frequently confused with the eclipse obscuration.

The obscuration represents how much of the solar area (not the diameter), is covered by the Moon.

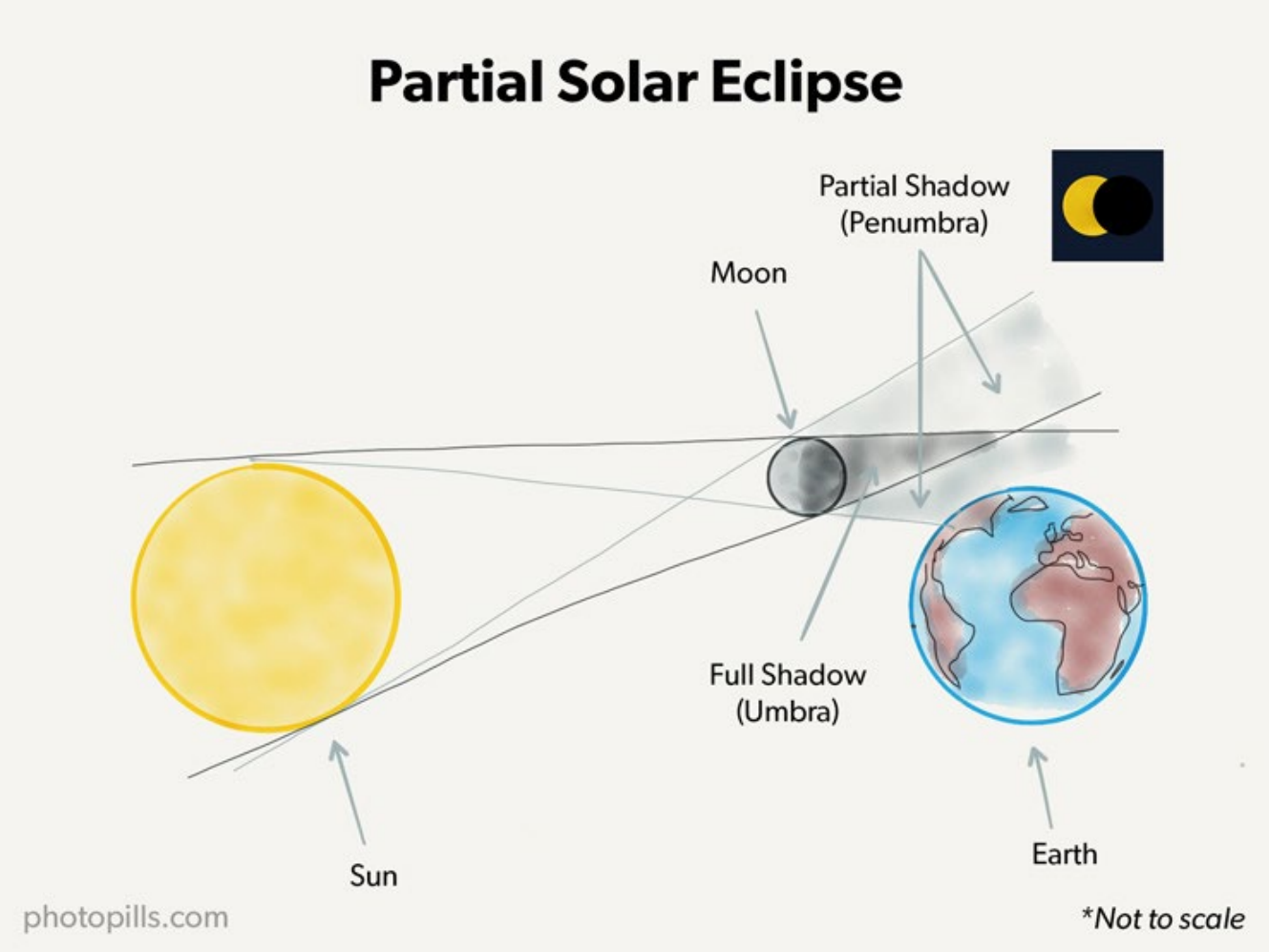
What are the different types of eclipses? (5)

Each eclipse is defined by how big is the Sun covered by the Moon. As I have just explained you, this measure is called magnitude and it depends on which part of the Moon's shadow falls on Earth.

There are 4 different types of solar eclipses.

The partial solar eclipse

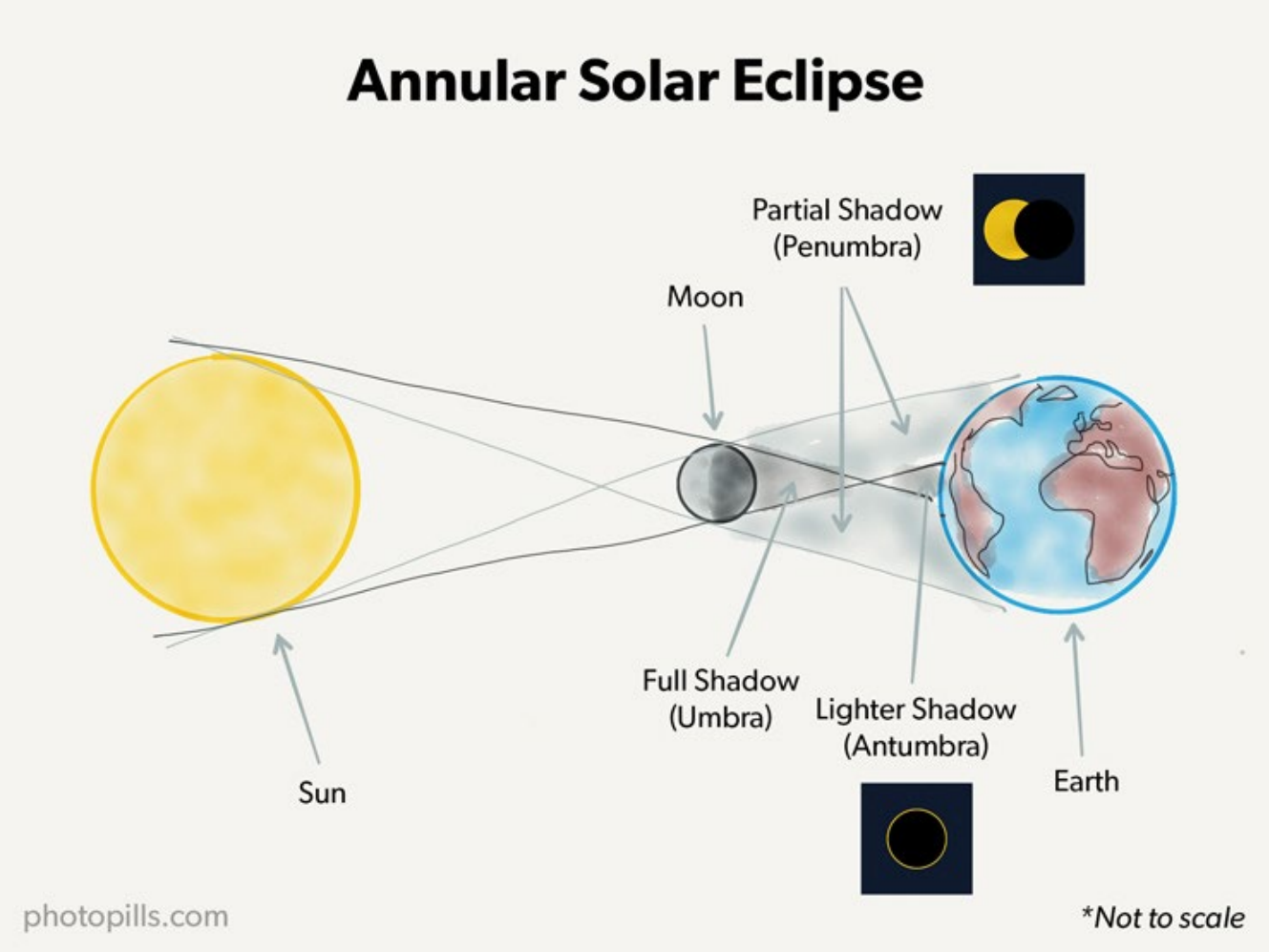
A partial solar eclipse occurs when the Moon partially covers the Sun and casts only its penumbra shadow onto Earth.



The annular solar eclipse

An annular solar eclipse takes place when the Moon is not big enough to cover the Sun completely.

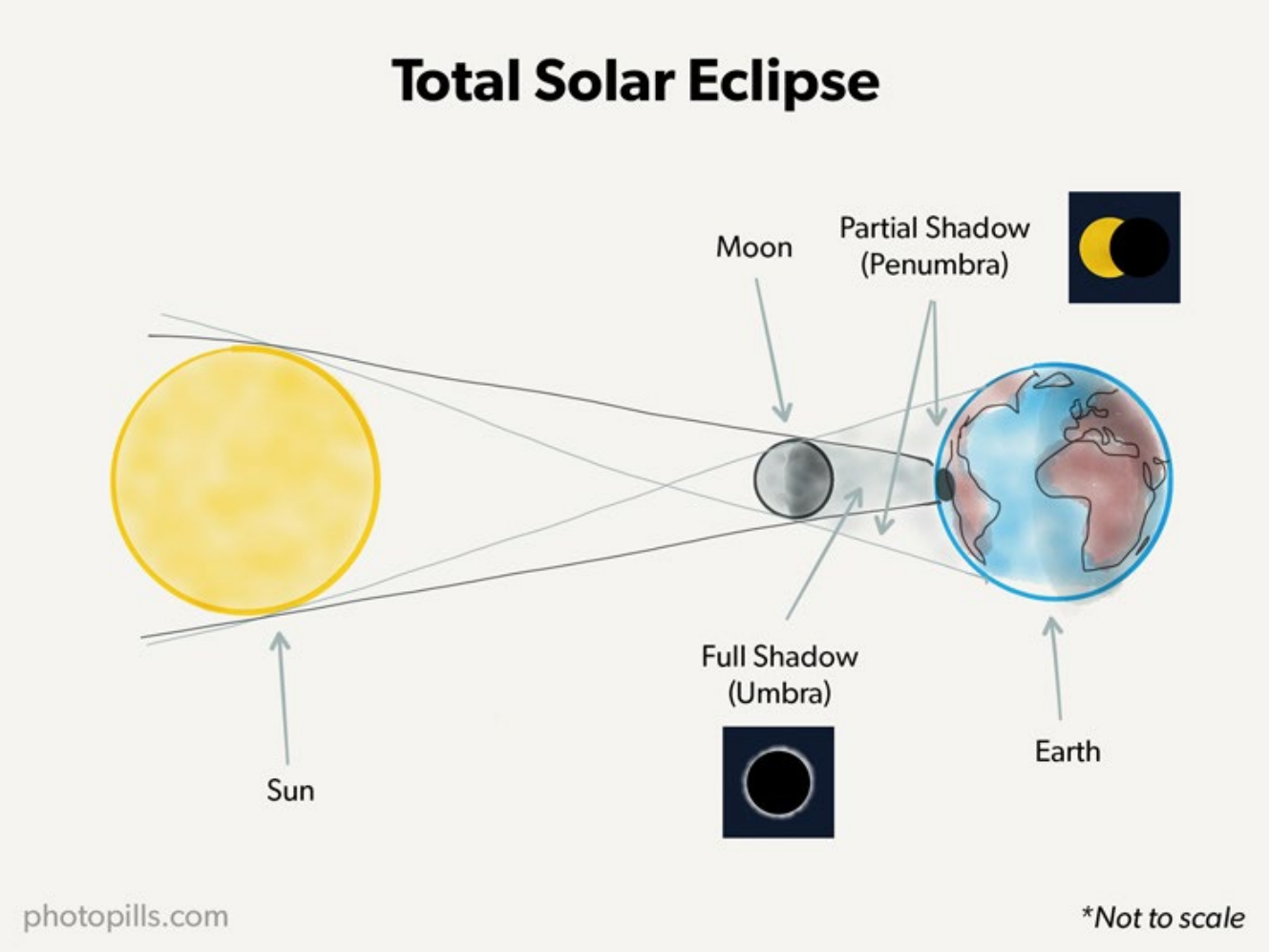
In this case, the Sun's outer edges remain visible to form a ring of fire in the sky. An annular eclipse of the Sun takes place when the Moon is near apogee (the point of the Moon's orbit farthest from Earth), and the Moon's antumbra (its lightest shadow) falls onto the Earth.



The total solar eclipse

A total solar eclipse happens when the Moon completely covers the Sun.

This event can only take place when the Moon is near perigee, the point of the Moon's orbit closest to Earth. A total solar eclipse is only visible if you're in the path of totality, the area where the Moon's casts its darkest shadow, the umbra.



The hybrid (or annular-total) solar eclipse

Finally, a hybrid solar (or annular-total) eclipse is extremely rare. It occurs when the same eclipse changes from an annular to a total solar eclipse (and/or vice versa) along the eclipse's path.

What are the types of shadows of the Moon? (6)

The type of eclipse you can experience depends on the type of shadow that is involved.

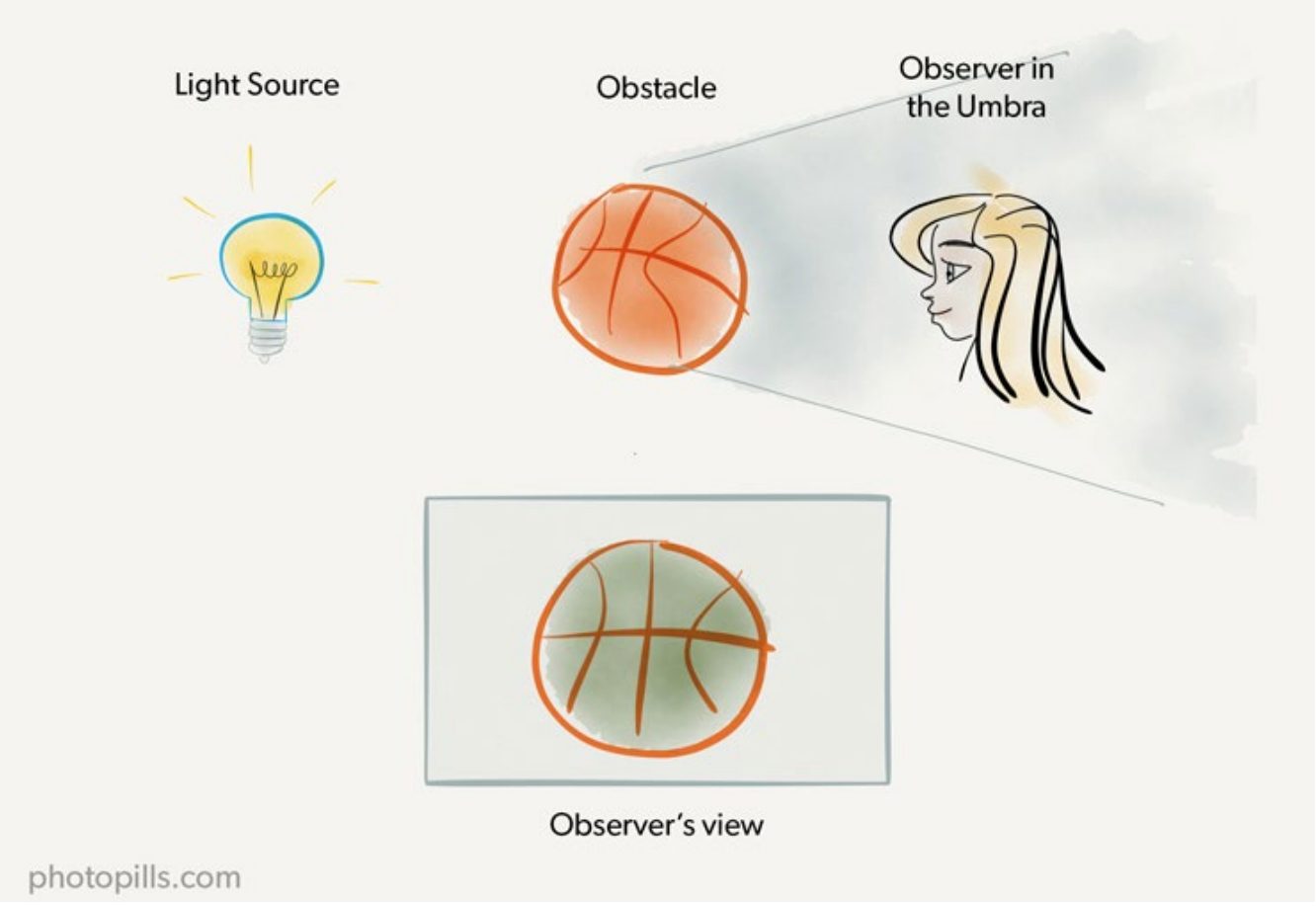
Both the Moon and Earth cast 3 shadows:

- An umbra
- A penumbra
- And an antumbra

The umbra is the shadow's dark center portion, while the penumbra and the antumbra are different types of half-shadows.

What is the umbra?

In physics, the umbra refers to the darkest part of the shadow. If you aim a light source directly at an object, the blackest portion of the shadow directly behind the object is the umbra of the shadow.



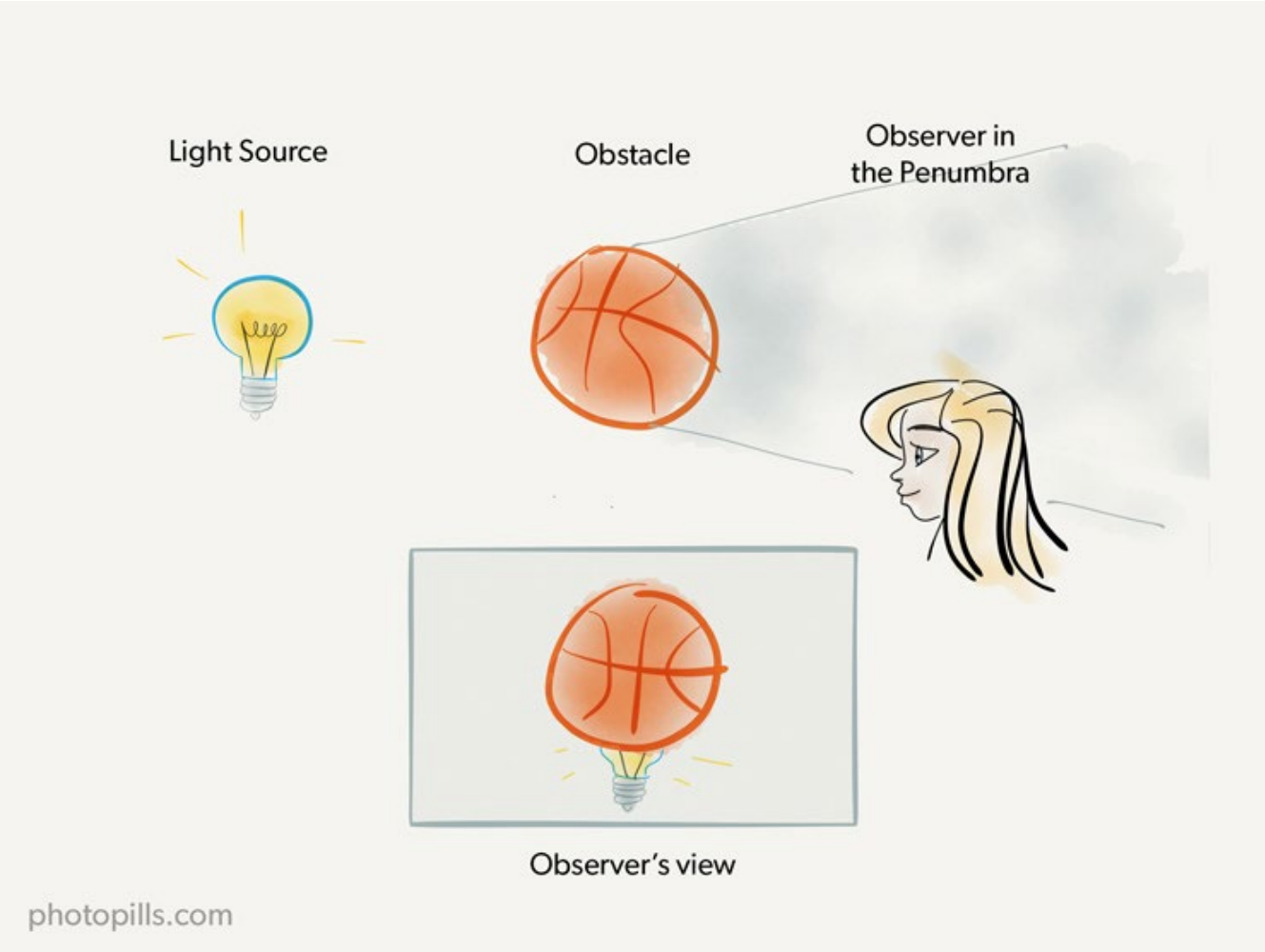
If you are in a spot located in the Moon's umbra and look into the direction of the Sun, you will see a total solar eclipse.

During a total solar eclipse, the area on the Earth's surface covered by the Moon's umbra is called path of totality as I explained you in section 1.

The size of the path of totality depends on the Moon's current distance from Earth. So the smaller the distance, the larger the umbra.

What is the penumbra?

When a light source is only partly covered by an object, you get a half-shadow called penumbra.



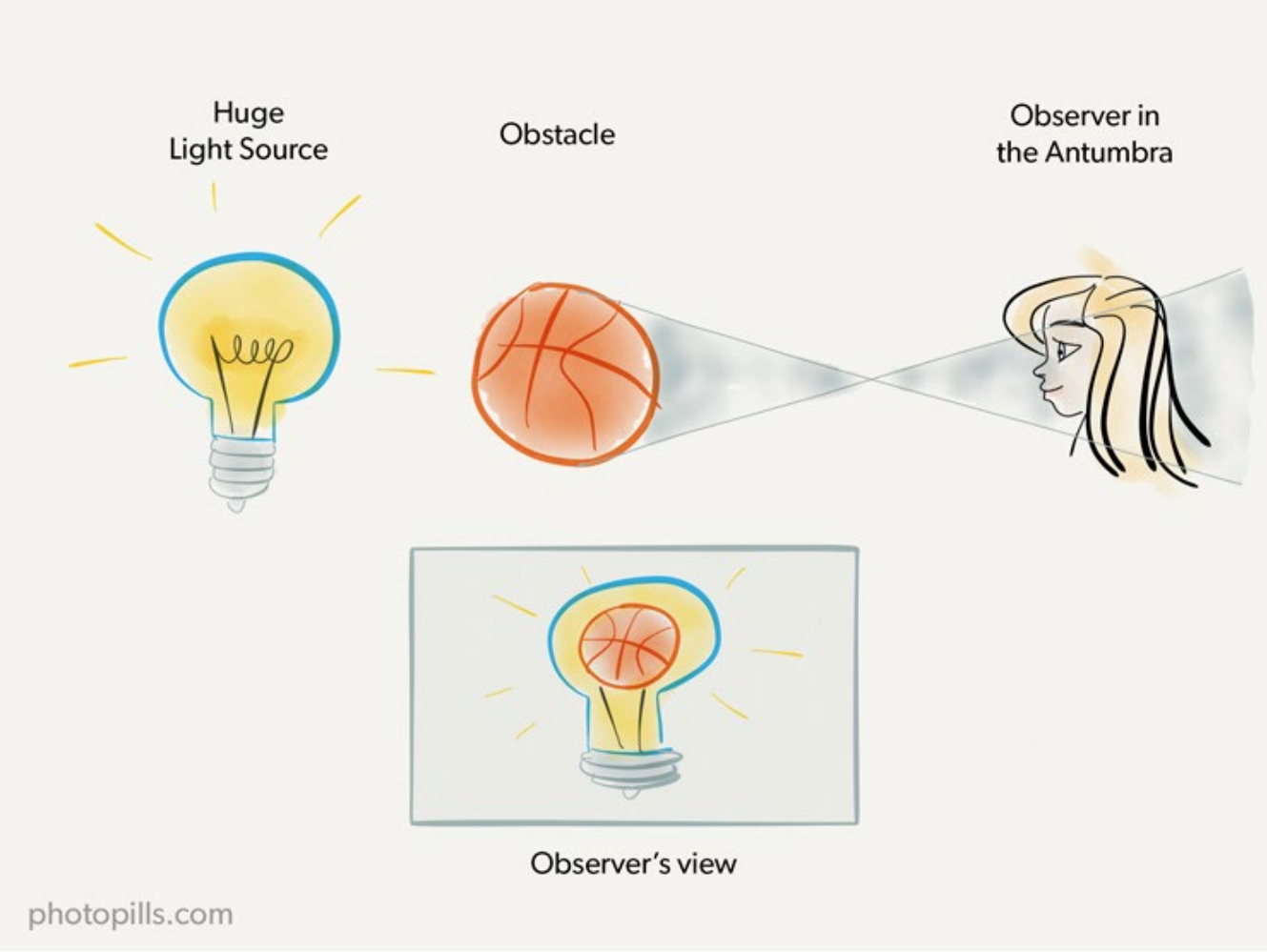
If you are in a spot located in the Moon's penumbra and look at the Sun, you will see a partial solar eclipse.

Because of its size, the penumbra can cover whole continents and oceans whereas the Moon's umbra only shadows a very small area of Earth at most. That's why partial solar eclipses occur much more often in any one location than total solar eclipses.

In addition to this, the penumbra's darkness is not uniform. This shadow is much darker in the areas adjacent to the umbra than at the edges.

What is the antumbra?

The antumbra is the lighter area of a shadow beyond the point of the umbra. It only occurs when the Sun has a larger diameter than the Moon.



What happens is that the Moon is completely in front of the Sun but doesn't cover it completely. In fact, you can see the outline of the Sun around the shadow of the Moon.

Why does a solar eclipse only happen during new Moon? (7)

Have you heard about an event astronomers call "syzygy"?

No?

This peculiar name comes from the ancient Greek word suzugos, meaning to be yoked together or conjoined. It defines the exact span of time during which the Sun, the Moon, and the Earth are aligned in a perfect (or near perfect) straight line. This happens around new Moon every lunar month.

Remember that the new Moon is the moment when the Sun and the Moon are aligned, and on opposite sides of the Moon. So, a solar eclipse happens when the shadow cast by the Moon falls on Earth.

However, there isn't an eclipse every new Moon. Why is that?

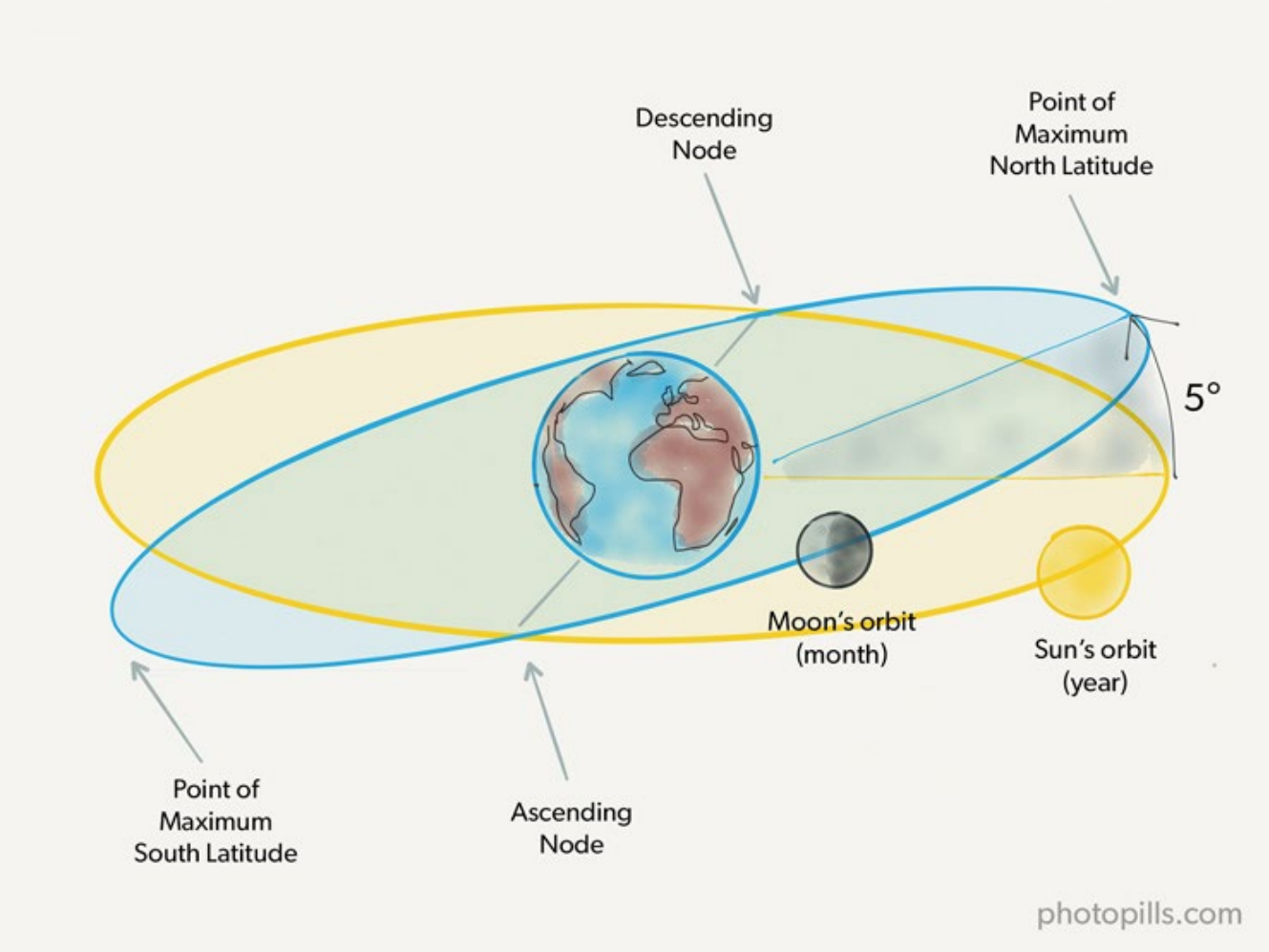
Why doesn't it happen every new Moon? (8)

A solar eclipse doesn't happen every new Moon because of 2 reasons.

The first one is that the new Moon has to be near a lunar node.

A lunar node is one of the two points where the plane of the Moon's orbital path around Earth meets Earth's orbital plane around the Sun. This plane is named the ecliptic.

Both paths (Earth's and Moon's) meet because the plane of the Moon's path around Earth is inclined at an angle of around 5° to the ecliptic.



The second one is that Sun must also be close to a lunar node in order to form a perfect or almost perfect line with the Earth and the Moon. This alignment occurs a little less than 6 months apart, and it lasts 34.5 days more or less.

Therefore, it is only during this time that eclipses can take place.

So, how often does a solar eclipse occur? (9)

Most calendar years have 2 solar eclipses, but remember that not all are total.

Up to 5 solar eclipses can occur in the same year, but this is rare. According to NASA calculations, in the past 5,000 years only about 25 years have had 5 solar eclipses. The last time this happened was in 1935, and the next time will be in 2206!

How long does an eclipse last? (10)

It takes hours for the Moon to move completely between the Sun and Earth. From beginning to end, a solar eclipse will be approximately less than 3 hours.

But the time when the Sun is completely covered lasts no more than a few minutes for any given location. As a matter of fact, totality can last between 2 to 7.5 minutes and it depends on the relative positions of the Moon and Earth in their orbits.

Remember that the duration of the totality phase varies from one location to the other. In the case of the August 21, 2017 eclipse the longest totality phase will last a maximum of 2 minutes 41.6 seconds.

11

Will the World end after the 2017 total solar eclipse?

Phew! I'm always up for a challenge and putting up this guide for you has definitely being a massive one.

But now that I'm finishing the article, I can't stop thinking again about Daniel López words…

"I've never lived anything like this. People become crazy, they do weird stuff… You are going to flip out."

I want to experience what he has. And I want to flip out as he says I will.

Wouldn't you?

Yes? Then tell me where do you plan to be on August 21, 2017.

Or even better.

Let's do it… Together!

Join me as **I will be touring the United States this summer** to help you plan a legendary shot of the 2017 total solar eclipse.

And yes, we will also be together to tell the rest that the world hasn't ended after the eclipse…

Author: **Rafael Pons (The Bard)**

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