

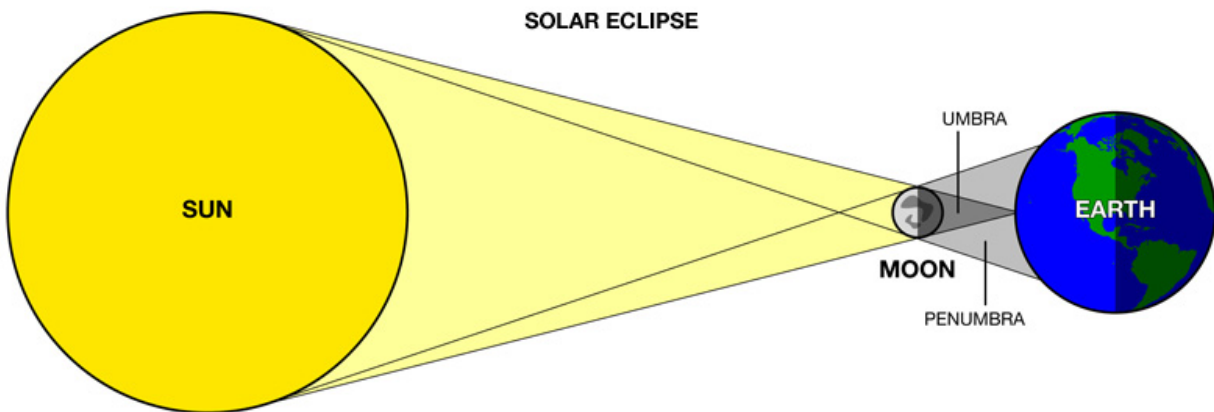
Umbraphile Journal

Prof. Patricia Reiff, Rice University

What's the big deal about eclipses? Seen one, seen 'em all? Why would you travel 30,000 km for two minutes of totality?

These are the questions that friends and family ask when they hear you just returned from an eclipse expedition (and are planning for the next one...). I just spent my spring break 2016 in Indonesia for the total eclipse, visiting Bali, Jogja, Krakatoa and other sites and viewing the eclipse March 8 from Ternate. Umbraphiles (shadow lovers) travel thousands of km over many days to get a few precious minutes in the Moon's shadow. If you are unlucky, the sky might be cloudy just at the wrong time... or even raining! But if all goes well, you are treated to one of the most amazing experiences that nature has to offer... a total solar eclipse!

A solar eclipse happens when the Earth, Moon and Sun *exactly* align. This happens during "new moon", but not all months have eclipses because the plane of the Moon's orbit around the Earth is tilted with respect to the plane of the Earth's orbit around the Sun.. Only near the "nodes" (the intersections of the two planes) can the Moon's shadow touch the earth. The Moon is about the same ANGULAR size as the Sun (a half degree in the sky), it can block it out entirely if you are in the exact right place at the exact right time. Since it is only 1/400th of the size of the Sun, it must be 400 times closer.



This diagram and other frequently asked questions is from http://space.rice.edu/eclipse/solar_eclipse_faq.html

So, what do folks see during a total solar eclipse? First, the Moon begins to cross the face of the Sun. The first moment that happens is called First Contact. Then the magical "diamond ring" occurs when the last piece of the Sun is still visible. This lasts just a moment and then totality occurs - Second Contact!

Diamond ring, Brian Verkaart, Australia 2012. From http://space.rice.edu/eclipse/solar_eclipse_faq.html



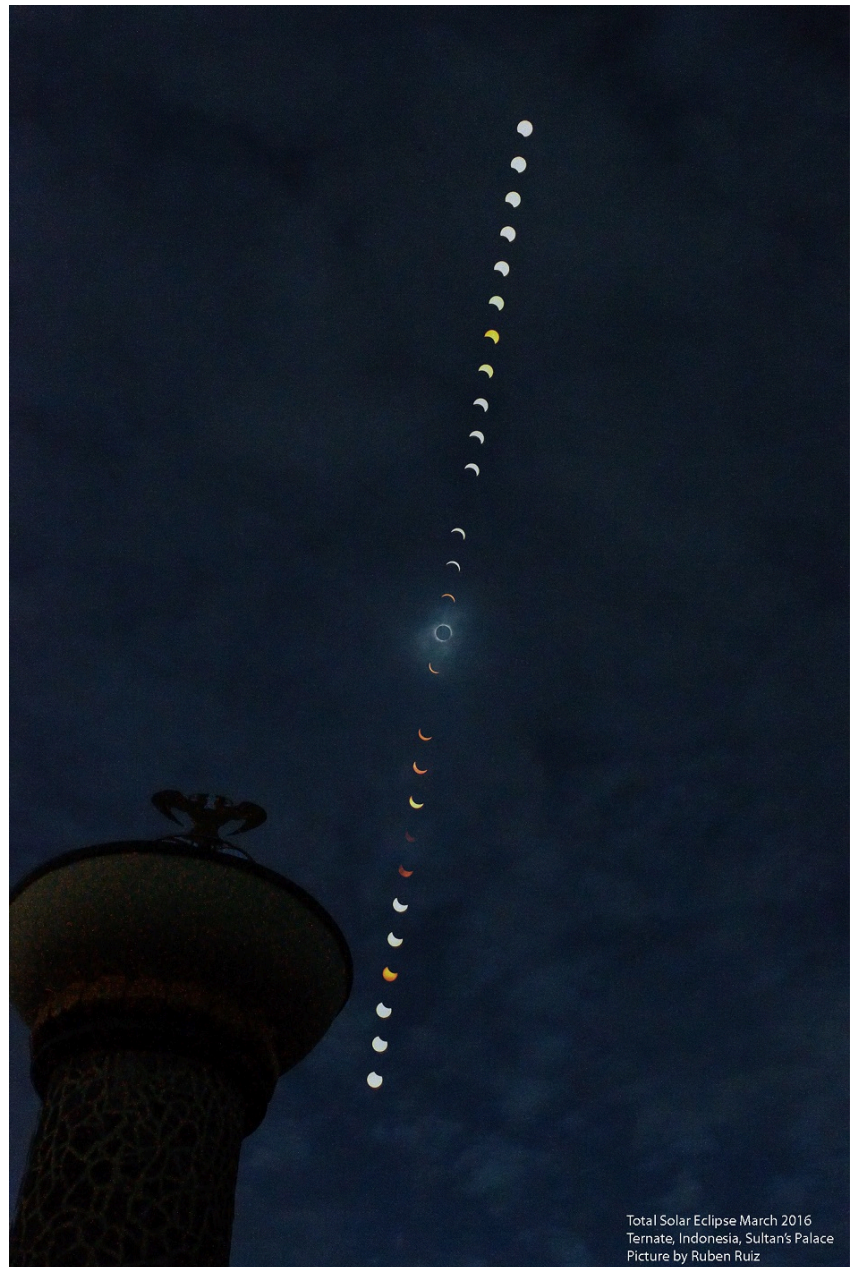
Only then can you take off the special filters and see the amazing total eclipse in its full glory, and only for the time that it is total at your location... which can be from one second to a maximum of nearly 8 minutes.

Totality is a full-body experience, so although there are many excellent photos of totality, the experience is much more. As totality approaches, the sky gets darker. It's really hard to notice the difference until the sun is 90% covered. Then you notice the sky seems gray, not blue, and the shadows all seem very sharp. The birds may start to roost. The temperature may fall by 5 or even 10C, and the wind may pick up. Street lights come on. It is definitely an eerie feeling, and for many a spiritual experience. The eclipse looks huge in the sky, because the corona adds up to several times the Sun's diameter. Some folks stare so intently they forget to use their binoculars!

Looking at the eclipsed sun through a pair of binoculars, you can see the prominences which leap up from the edge of the Sun, the bright inner corona and the wispy outer corona, all

at the same time - a magical sight! However, it's just not the same in photos! Photographs that show the detail in the prominences are short exposure and can't show the outer corona. Longer time exposures that show the outer corona overexpose the prominences. So the eye (preferably aided by binoculars) is the best tool!

All too soon the totality is over - Third Contact. The chromosphere flashes, then perhaps "Bailey's beads" (pieces of the Sun peeking up behind mountains on the edge of the Moon).



Eclipse sequence by R. Ruiz. This and other great photos can be found at our eclipse report site

<http://www.eclipsetours.com/completed-tours/2016-indonesia-total-solar-eclipse-results/>

Then the diamond ring as the Sun reappears. Is it really over so quickly? Tears of joy are common. Those who want to capture the whole sequence (as in the photo here) stay for that last hour that the Moon finishes its travel across the face of the Sun, ending at Fourth Contact. Others embrace and take selfies with the still-partially-eclipsed sun on their faces.



Bailey's beads. Jacques Guertin photo from
<http://www.eclipsetours.com/completed-tours/2016-indonesia-total-solar-eclipse-results/>

And the discussion begins... which one are you going to see next? For Americans, it's been a long dry spell since the last total eclipse crossed the US in 1979 but a great one is coming next year! August 21, 2017, a total eclipse will cross the continental US from Oregon to South Carolina, and folks are already picking their observing spots! Hotel space is already gone at many great sites.

Because of the ellipticity of the Moon's orbit around the Earth and the Earth's orbit around the Sun, some times the Moon appears larger than the Sun, leading to a very long eclipse. Other times the Moon appears smaller than the Sun, and even if you are in the right place, the Sun is not completely covered, leading to a glowing ring of sunlight around the Moon. In those cases (annular eclipses), it is never safe to take off your special solar filters and you don't get to see the corona. So I don't travel to those really any more... I save my eclipse travel funds to see totality!



And no, they are not all alike. At

Comparison of solar max eclipse (left) with solar min eclipse (right). From Ken Offit, in http://space.rice.edu/eclipse/solar_eclipse_faq.html

solar maximum, the corona is symmetric around the Sun. At solar minimum, the corona is extended along the Sun's equator. Eclipses that occur near sunrise or sunset can have

lovely reflections along the water or placement near interesting objects. Eclipses that occur near noon are best to see the Moon's shadow racing towards you at 1000 miles per hour like a black tornado. Clear skies can show "shadow bands". Cloudy skies can often thin just at totality enough to see through a bit... or it can be raining. Even in cloudy conditions you can experience the change in the wind, the darkness of the sky, the change in temperature, and the creatures heading for bed.

So, if you haven't ever seen a total solar eclipse, make your plans! The 2017 will be one of the easiest to see in a long time! The Houston Museum of Natural Science is reserving hotel space in Casper Wyoming, plus many other operators have tours planned. I frequently am a guide for <http://eclipsetours.com>. Or just find a good spot on the center line, but be SURE to be inside the path of totality! There's an interactive map of the eclipse at: <http://www.eclipse2017.org> and other sites.

I take my traveling companion Trigger MMS with me on my journeys. He has also traveled to space in two high altitude balloon flights and went 2/3 of the way up Mt Everest with one of our alumni! You can see a video of totality from this past Indonesian eclipse at Trigger's Facebook page: <https://www.facebook.com/Trigger.MMS/>



Trigger is never far from me during an eclipse!! Here we are celebrating after having a great view of one of the world's most special events.. We were rock stars - everyone wanted a "selfie" with us!

Clear skies!!

"Doctor Pat"