

Chuck

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Date: Saturday, December 18, 2010 11:40 AM
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Subject: How to Photograph the Lunar Eclipse Dec 20 and 21

Lunar Eclipse Photos

How to Photograph the Lunar Eclipse—Dec 20 and 21



Weather permitting, a total eclipse of the Moon will be visible in most of North America on December 20 and 21. The eclipse will start in the early morning of December 21st for observers in the Eastern United States, and late the evening of Monday December 20 in the West. This total lunar eclipse will also be visible in western parts of South America, and northern Scandinavia. Most of Asia and Europe will see part of the eclipse as well. For the path of totality and local dates and times, consult this [handy summary](#). This is an exciting event for astronomers and it can provide great opportunities for photographers to take some stunning lunar eclipse photos as well. Photographing the moon is relatively easy compared to other celestial bodies, because it's relatively close to the earth.

We've waited almost three years for a total lunar eclipse — the last one was in February, 2008. We'll see two in 2011 — June 15 for South America, Europe, Africa, Asia and Australia, and December 10 for the eastern part of Africa, Asia, Australia and the Pacific. After that, we'll have to wait until April 15, 2014, when there will be another total eclipse for Australia, the Pacific, and the Americas, and U.S. citizens will be paying their 2013 income taxes. Details of eclipses — both lunar and solar - from 2001 to 2020 can be found at the enchanting [mreclipse.com](#), a site apparently run by one Fred Espenak, who seems to have made eclipses a big part of his life. The next total solar eclipse visible in the United States won't take place until August 21, 2017, as we learned poking around on mreclipse.

The tips that follow will show you how to photograph the moon under normal circumstances, or under eclipse conditions.

We'll start with how to photograph the full moon itself, and then give you specific tips for photographing a lunar eclipse. Hopefully the weather will cooperate.

Photographing the Full Moon

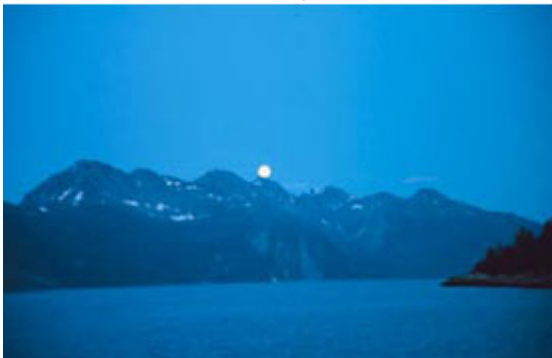
Let's start with the basics. The moon appears full when its orbit puts it in a position where the side of the moon facing us on earth is fully lit by the sun. Therefore, photographing the full moon on a clear night isn't much different than photographing any other sun-lit object — except that it's pretty far away — a little under 240,000 miles.

Because it is so far away, the moon is one subject where you'll get the best results with an SLR (single lens reflex) camera with a long lens rather than using a point-and-shoot or a single-use "disposable" film camera. In fact, with a point-and-shoot or single-use camera, you can get an image of the moon but it will likely be a tiny white point rather than anything that looks like the moon.

It is true that in many aspects of astrophotography, digital cameras face a host of different challenges than their film-based counterparts, including issues with the long exposure times necessary to photograph at night and noise issues in black areas of the sky. But, since the moon is a bright sunlit object, if it fills a good part of the frame, using a digital SLR will be easy. So, you can use either a digital SLR or a film SLR.

Exposure

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Since the moon is a sunlit object, the "sunny 16" rule applies. (This is an easy-to-remember trick for photographing any sunlit subject that photographers relied upon prior to the days of autoexposure.) Simply put, the correct exposure for an object lit by bright sun can be a shutter speed of 1/the ISO setting you're using, with an aperture of f/16. For example, if you're using an ISO of 400 (or an ISO 400 speed film), a good starting point for a correct exposure of the moon would be f/16 at 1/400. Since most cameras don't have a shutter speed setting of 1/400, we would suggest bracketing the exposure and making one at 1/250 at f/16, and one at 1/500 at f/16.

About Bracketing

While we're on the subject, let's discuss "bracketing" of your lunar eclipse photos for a moment.

When you bracket your exposure, it simply means that you take a photograph at the setting you think is correct, but you also photograph the same subject several more times, making slight changes in either the shutter speed setting or aperture. For most situations, we suggest that you make one or two images giving the image less exposure, and one or two that give the image more exposure.

You can't bracket fast-moving subjects — a breaking news photo or sports action shot won't wait long enough for you to make multiple exposures. But the moon (or a landscape or scenic subject for that matter) isn't moving so fast relative to your camera. Therefore, it's always a good idea to bracket your exposure. For our full moon shot, in addition to 1/250 and 1/500 at f/16, you could give a little less exposure by making a photo at 1/1000 at f/16, and a little more by shooting at 1/125 at f/16. You can achieve the same bracket of exposure by keeping your shutter speed at 1/250 but using different aperture openings, such as one exposure each at f/16, f/22, f/11 and f/8.

Use Manual Exposure

There are several reasons for turning off your auto exposure and setting your exposure manually when you photograph the moon. The main reason is that when you point your camera at the full moon, the moon is a little bright spot in a sea of darkness. In lunar eclipse photos, therefore, chances are that your automatic metering system will give too much emphasis to the vast area of dark sky surrounding the moon and therefore call for too much exposure — the result is that the moon will be overexposed. All you'll get is a clear, white circle.

Another reason to expose manually and to bracket your exposure is that the exact amount of light coming from the moon will depend in part on how clear the sky is when you make your photograph. Water vapor is a factor if humidity is high, and there might be dust in the air if it is windy. If you're at a high altitude, such as Denver, you'll likely need a little less exposure than if you're at sea level in New York or San Francisco. These factors will require small exposure changes. By using the manual exposure settings we suggest a little later in this article and by bracketing your exposure you'll guarantee that one of your exposures will give the best possible image.

Choice of Lens

© National Oceanic & Atmospheric Administration



Charles Schott with Davidson meridian instrument eclipse expedition of 1870.

We've established that you should treat the moon as a sunlit object and bracket your exposures.

Your next key question is what lens to use for capturing lunar eclipse photos? When the moon is low in the horizon, it will be much smaller in a photo than it may appear to your eye. The simple rule of thumb is to use the longest lens you have, and join it with a tele-extender if you have one. Shooting the moon with a 50mm lens will produce an image that looks like a dot. You'll be a little better at 200mm, but a 500mm lens will do a good job. If you have a small telescope, you can make a close-up photo of the moon with great detail.

Here's one place where the smaller sensors in the less expensive DSLRs give a real benefit. That 300mm lens will act more like a 400+mm lens if it's mounted on a digital SLR with a smaller-than-full-

size chip.

The full moon occupies about 1/2 of 1 degree of our field of view as you look up into the heavens. A rough guide is that if you divide the length of your lens by 100, you'll get an approximate idea of how big the image of the moon you record. That means if you use a 50mm lens, you'll record the full moon as 1/2-millimeter in diameter. However, if you use a 300mm lens you'll get a 3mm moon, and if you add a 2x tele-extender to your 300mm lens the moon will be 6mm in diameter. If you can get your hands on an 8-inch telescope, you can have a moon that's about 20mm in diameter, which will nicely fill the frame. These calculations presume that you're using a 35mm film camera or a full-size sensor that is equivalent to a 35mm film frame.

If you're unfamiliar with tele-extendors (also sometimes called teleconverters), they're worthy of an article unto themselves. In short, a tele-extender is a device that effectively increases the focal length of your lens, usually by a factor of 1.4 or 2. A 1.4x tele-extender increases a 100mm lens to 140mm, a 2x extender increases the 100mm lens to 200mm. This boost comes with a price — the effective f-stop decreases and you may need to use manual focus. However, buying a good 300mm lens and a 2x tele-extender can be lot cheaper and more practical than buying a 600mm lens.

Whatever lens you use when taking lunar eclipse photos, it's probably a good idea to use your tripod to steady your camera. Even with a short lens, if you're holding your camera pointed toward the sky it is easy to sway a bit and that will cause camera shake and a soft image. With a long lens, a tripod is essential.

ISO Settings.

ISO 400 or 800 is a good choice. If you're using a film-based camera, color negative, or, since your subject is primarily black-and-white, 400 speed black-and-white film will be fine as well. If you bracket a lot, you could even use slide film, but there's a greater danger of losing detail because of overexposure if you do.

Most of today's digital cameras do well at ISO speeds even higher than 800, while other models have either too much noise or overly aggressive noise-reduction that reduces detail.

What should you look for in the test shots? Look at any area with deep shadow, and if you see specks of red, blue and green color you are seeing "chrominance noise." Compare a shot of the same subject at ISO 100, ISO 200, ISO 400 and ISO 800 and decide what is an acceptable level of noise for your personal tastes. If your camera performs well enough at ISO 400 or ISO 800, those will work very well. Since you're going to have your camera mounted on a tripod, the slower shutter speed required by a lower ISO won't be a problem.

If you follow these simple tips, you'll have no problem if you attempt to "Shoot the Moon!"

Now, let's turn to photographing a lunar eclipse.

The Lure of a Total Eclipse

© NASA



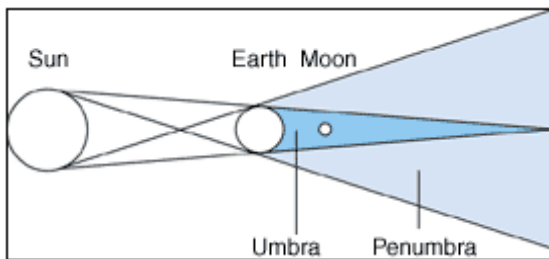
Photo of Moon taken from Apollo 11

Eclipses of the sun and the moon have been a fascination to earthlings since the dawn of our time. The upcoming lunar eclipse, which, weather permitting, will be visible throughout the North America, may not receive much advance publicity, but as it lends an opportunity for great lunar eclipse photos it deserves considering.

Astrologers have always gotten riled up about eclipses. Having a bad hair day? Consider this as a source for excuses taken from a Web astrology site: "During a lunar eclipse the light of the Full Moon is temporarily hidden to our view, blocking our self-awareness, crashing our emotional-defense systems, and over-sensitizing our emotional reactions. The effects of a Lunar Eclipse usually last for about 6 months or until the next Lunar Eclipse." No wonder after the February 2008 total eclipse the market tanked, Lehman Brothers went under and we suffered the Great Recession!

Forget about "The dog ate my homework." Try this: "I did it because my emotional defense system crashed during the 2008 Lunar Eclipse." Or, "I'm sorry I said that, but the Eclipse blocked my self-awareness and over-sensitized my emotional reactions." And now there's another one on the way. What next?

What is a Lunar Eclipse?

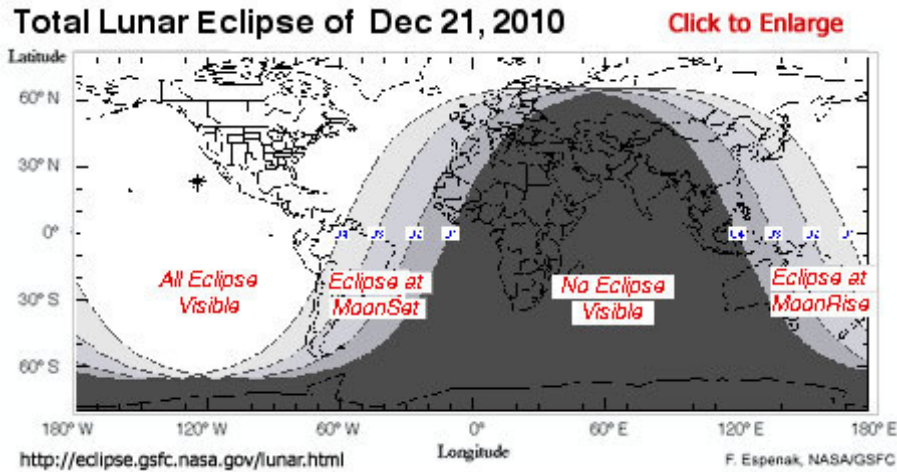


A lunar eclipse occurs when the moon is covered by the shadow of the earth — that is, the earth comes between the sun and the moon, casting the earth's shadow on the surface of the moon. A partial eclipse happens when only a portion of the moon is obscured by shadow. When the entire moon is covered for a period of time, we call that a "total eclipse."

Any cast shadow has a partial area called a penumbra and completely dark area called an umbra. The penumbra has some illumination and some shade, the umbra is complete full shading of an object from a source of illumination.

Where can you see this eclipse?

As we've noted, the December 21st total lunar eclipse will be visible in virtually all of the Americas as well as portions of Europe, Australia and eastern Asia, so many of our readers will be able to try their hand at lunar eclipse photos. The moon will remain in total eclipse for almost an hour in those areas lucky enough to see all of the eclipse.



When is it going to happen?

Since this is a total eclipse, the moon will enter the penumbra, which is not visible to the naked eye, then the umbra, then there will be a period of totality, followed by the moon leaving the umbra back to the penumbra, and finally exiting the penumbra, ending the event. So you don't miss your opportunity to take lunar eclipse photos, here are the times of the event in the U.S.

	Eastern Standard Time	Central Standard Time	Mountain Standard Time	Pacific Standard Time
Partial eclipse begins	1:33am	12:33	11:33pm	10:33
Total eclipse begins	2:41am	1:41	12:41	11:41pm
Middle of eclipse	3:17am	2:17	1:17	12:17
Total eclipse ends	3:53am	2:53	1:53	12:53
Partial eclipse ends	5:01am	4:01	3:01	2:01

You can use the above listed times to calculate the approximate duration of the eclipse depending on where you live in the United States. NASA's online [Lunar Eclipse Explorer Program](#) will calculate

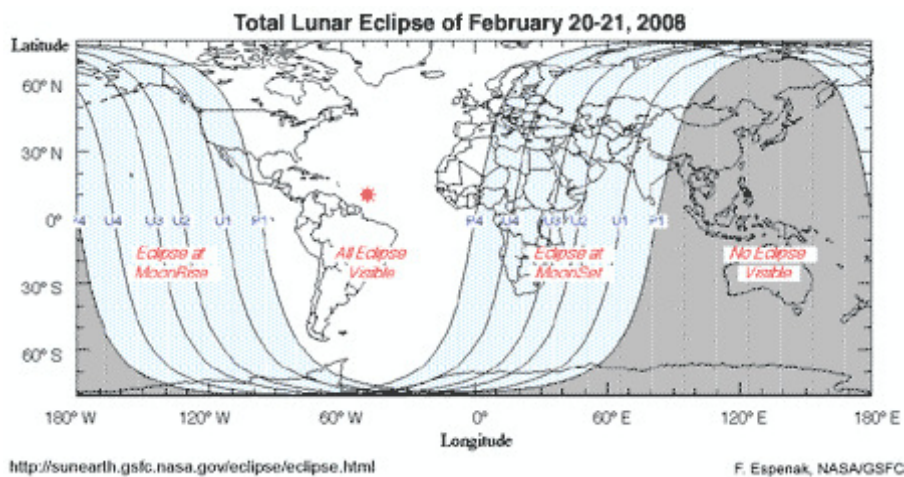
what you will see based on where you live. Realize that the times vary not only with regard to location, but also the relative latitude and longitude of your location. The timing and duration of the event also vary because while the eclipse takes place everything continues to move: the earth around the sun, the moon around the earth, and things continue to rotate.

Chances are your local newspaper will give the times for your location. However, if you want to check it out for yourself, there's a really cool site maintained by the [US Naval Observatory](#) that lists these times (and for you techies, the moon's Azimuth and Altitude) for thousands of places in the US and for foreign locations based on latitude and longitude. By the way, there is a lot of other interesting stuff on the US Naval Observatory site regarding data for moon phases, sunrise and sunset and the like.

Lens, tripod and exposure:

Unlike photographing the full moon, when the moon enters the earth's shadow you will need a longer exposure, because it will no longer be a sun-lit object. That means you'll want to use a fast ISO (400, 800 or higher) and definitely have your camera mounted on a tripod.

Some serious astrophotographers still use film-based cameras, and for many of those the film of choice is Fuji's 800 speed color negative, although any fast color-negative film will do. Unlike the full moon, where we suggested that black-and-white film would work, one of the characteristics of a total lunar eclipse is that the moon appears to be reddish in color during totality. This is an illusion caused by atmosphere having a different effect on the longer waves of red and infrared light than the shorter waves of blue light. You'll want to capture that color.



One great thing about lunar eclipses (as opposed to solar events) is that you can look at most of the entire event with your naked eye. You don't need filters for your camera — just some preparation, patience, and luck.

What if I don't have a telephoto lens?

If your camera has just a regular zoom lens, let's say an 18-55mm or 18-70mm, you can try one other type of eclipse photo by recording the stages of the eclipse on a single frame. Set your camera on a tripod, and watch how the moon is moving relative to your location during the period from moon rise to the start of the penumbra. Set your camera so that the moon, as it starts into the penumbra, is on one side of your frame so you can anticipate the moon moving through the frame. (If you have a technical

mind, this is where the Altitude and Azimuth information will come in handy.) You just lock your shutter open (setting it on "B" or "T") and record the different phases of the eclipse all on one frame. When you're not making an exposure, just cover your lens with your lens cap. Warning: This sounds easy, but it's not. However, unless you buy or rent a long lens, it will give you an excuse to be outdoors and observe the entire event and use your camera.

Exposure:

Everything listed above with regard to bracketing is true here. In fact, plan to shoot lots of pictures and bracket all over the place. After all, there's a full moon every month, but total lunar eclipses in good weather are rare. In addition, when the moon is in the earth's shadow, there will be less light over all, so the degree to which atmospheric haze and humidity affect your exposure will be greater.

Your exposure will vary as the moon enters the penumbra and then continues into the umbra and totality. At each step, as it grows darker, you will need to give your image more exposure. By shooting lots of images and bracketing, you can be sure of two things: You'll have lots of images to throw away, and you'll greatly increase your odds of getting a good photograph.

When the moon is in the penumbra, you won't see much difference between that illumination and the regular full moon. When the discernable shadow line of the umbra is visible on the moon, that's when the subject gets interesting and it's time to start photographing.

Here are some rough departure points for exposure, but don't forget to **bracket**:

Eclipse event	ISO 100	ISO 200	ISO 400	ISO 800
Full Moon in clear sky	1/250 <i>f/11</i>	1/250 <i>f/16</i>	1/250 <i>f/22</i> or 1/500 <i>f/16</i>	1/500 <i>f/22</i> or 1/1000 <i>f/16</i>
Moon in penumbra, and Shadow line of umbra visible On moon's surface	1/60 <i>f/5.6</i>	1/60 <i>f/8</i>	1/125 <i>f/8</i>	1/250 <i>f/8</i>
Moon completely in umbra (totality)	4 seconds at <i>f/2.8</i>	2 seconds at <i>f/2.8</i>	1 second at <i>f/2.8</i>	1/2 second at <i>f/2.8</i>

We've included exposure figures for ISO 100 speed because that's the true effective speed for most digital camera chips. However, you should bear in mind that if you use exposures longer than two seconds for your lunar eclipse photos, you start to run up against problems of blurring because of the rotation of the earth, unless you use a telescope with a tracking mount. If you have tracking equipment, you can try using longer exposures that may allow you to capture other, more distant and therefore dimmer celestial objects in your frame. However if you don't have that type of equipment, in addition to making a 4-second exposure we suggest that — if your digital SLR offers that option — you select a faster ISO, 200, 400 or 800. This may increase noise somewhat, but it will enable you to avoid any blur.

Total eclipses that are visible in many areas of the world don't happen very often. If you're lucky

enough to be in an area where it will be visible, then you won't want to miss the opportunity to photograph this eclipse!

Two final tips and we know you'll thank us for if them you don't do a lot of photography at night — first, bring along a flashlight to check your camera's settings as you proceed. When the moonlight disappears, it gets very dim out there! Second, after a while you'll start to feel the night chill, so bring along a jacket or windbreaker of some sort.

For further reading:

The astronomy buffs at NYI love *Sky and Telescope Magazine* and fortunately they have a very informative Web site at www.skyandtelescope.com.

If you are interested in learning more about using digital cameras with telescopes, read *Sky and Telescope Magazine's* article, "[Astro Imaging with Digital Cameras](#)."

If you are curious about what a total lunar eclipse looks like, there are some great videos on YouTube. Just do a search for "Lunar Eclipse."

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