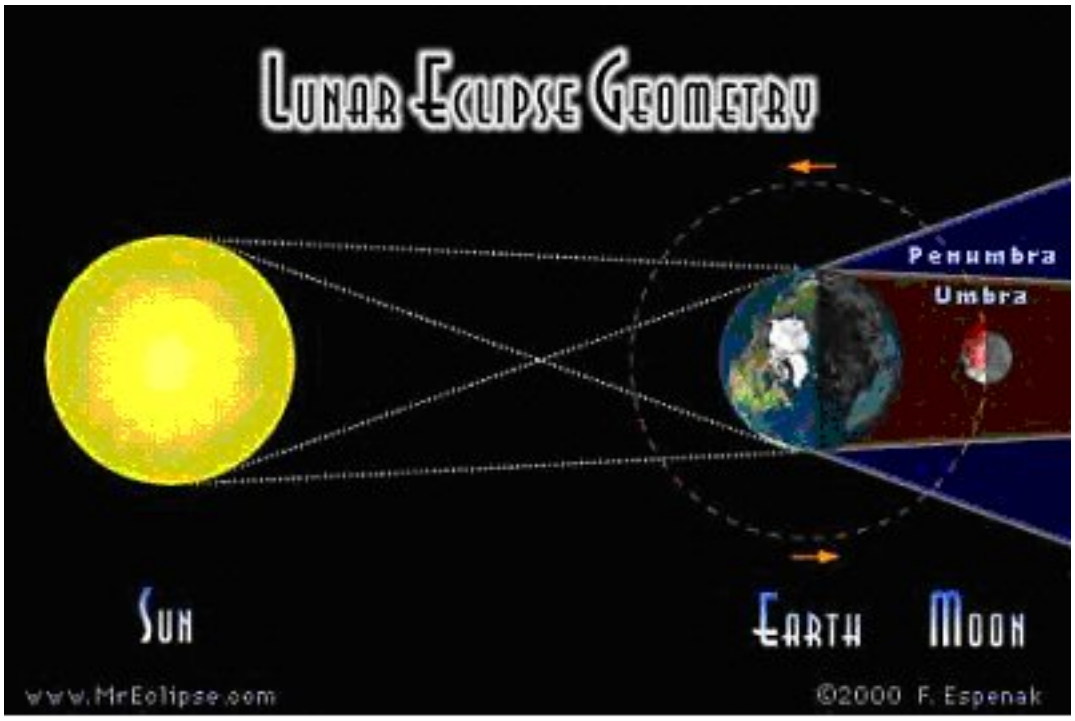
The Great Total Lunar Eclipse of 2008

An Observers' Guide

By A.P. Witzgall

The wait is over – a total lunar eclipse is coming! After nearly a year, on February 20, 2008, the Moon will rise and go into total eclipse with observers on the East Coast of the United States and Canada in a ringside seat, and the entire totality will last over 50 minutes. We haven't had a total lunar eclipse visible from start to finish for quite a few years, as in March of 2007 the Moon rose in eclipse, while in August of 2007 early risers saw the setting Moon pass into the shadow of the Earth. For the newcomers to astronomy and to AAI, this is a potentially grand event. This article will tell you what to expect, how to observe it and with the proper equipment, and how to document what you will see.



Above is an excellent diagram from Fred Espenak's Mr.Eclipse.com website at:
http://www.mreclipse.com/MrEclipse.html
It tells of the geometry that allows eclipses of the Moon to occur, albeit a simplified explanation.

First, the nuts-and-bolts. On February 20th, 2008 the Sun will set at 5:36 pm EST. The Moon, at almost Full phase, will rise at 5:18 pm. The schedule of events for the eclipse is as follows

event	**time (EST)**
Moon enters penumbra	7:35 pm February 20th
partial eclipse begins	8:43 pm
total phase begins	10:00 pm
Total phase ends	10:52 pm
Partial phase ends	12:09 am February 21st
Moon exits penumbra	1:17 am

This means that the totally eclipsed Moon will be well up in the southeastern sky, and very convenient to observe, for a duration of about 52 minutes of totality. The Moon is south of the center of the umbra, or dark shadow of the Earth, and we see the event in a dark sky. Although the entry of our satellite into the ***penumbra*** (the outer part of Earth's shadow) is visually a non-event, if it's really clear, we may begin to see the action start as early as 8 pm as the Moon approaches the edge of the ***umbra*** (or darkest part of the Earth's shadow).

But remember that "dark" is a relative term. Look at the geometry of a total lunar eclipse in the diagram above. The Earth's atmosphere transmits the red end of the solar spectrum (all the sunsets and sunrises combined) and projects that coloration onto the surface of the Moon. Since the Moon is south of the centerline of totality, the bottom half of our satellite should be a bright orange, dimming to a dusky red as we go north on the disc. You will notice the bright star, ***Regulus*** in Leo about 2 degrees north and above the eclipsed Moon, and ***Saturn***, 4 days before opposition (best time to see the planet) about 4 degrees east of our satellite. (If you can drag yourself away from this event for a while, move your telescope to the ringed planet where you'll see that Saturn's rings are beginning to narrow for an edge-on appearance in about a year or so.)

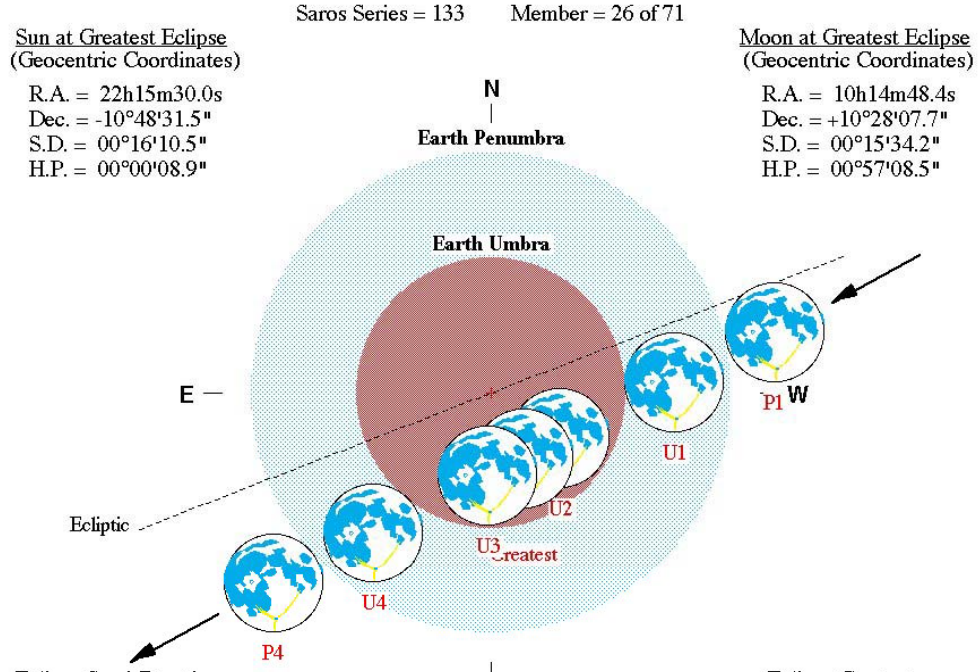
On the next page, is the detailed report for those interested, again from Mr.Eclipse.com: Note that this is written for Universal time and date, so 7 pm is zero hours UT, and is the 21st of February, 2008 at Greenwich, England, where this time standard is reckoned.

Total Lunar Eclipse of 2008 Feb 21

Geocentric Conjunction = 03:48:27.4 UT J.D. = 2454517.65865
Greatest Eclipse = 03:26:04.8 UT J.D. = 2454517.64311

Penumbral Magnitude = 2.1707 P. Radius = 1.2473° Gamma = -0.3993
Umbral Magnitude = 1.1110 U. Radius = 0.6973° Axis = 0.3802°

Saros Series = 133 Member = 26 of 71



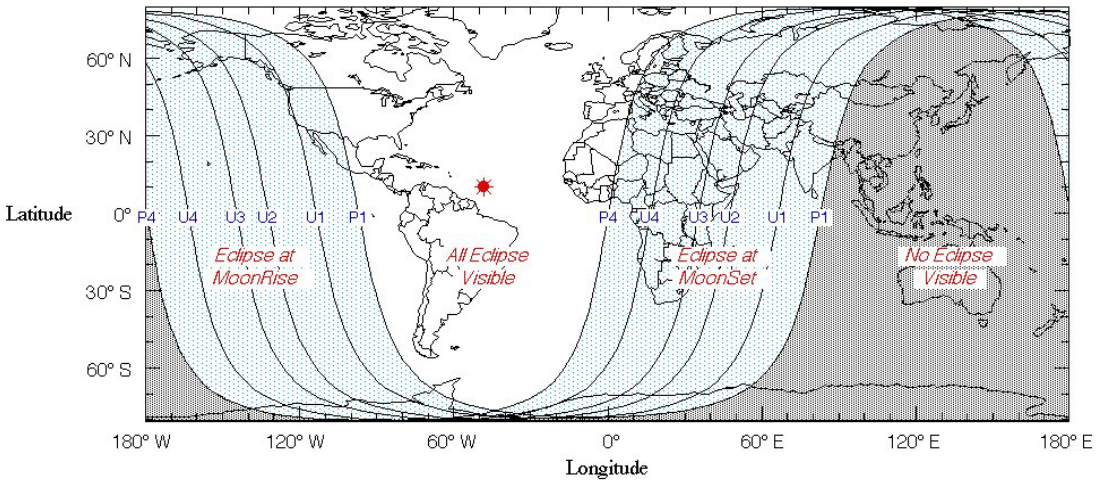
Eclipse Semi-Durations
Penumbral = 02h51m09s
Umbral = 01h43m04s
Total = 00h25m29s

Eph. = Newcomb/ILE
ΔT = 65.2 s

Eclipse Contacts
P1 = 00:34:59 UT
U1 = 01:42:59 UT
U2 = 03:00:34 UT
U3 = 03:51:32 UT
U4 = 05:09:07 UT
P4 = 06:17:16 UT

F. Espenak, NASA's GSFC - 2004 Jul 07

http://sunearth.gsfc.nasa.gov/eclipse/eclipse.html



The diagram above gives us the detailed geometry of totality, and where it is best seen on Earth for this event. Here in North America, and especially on the East Coast, we have the best view.

Now, how do you observe a total eclipse of the Moon? Actually rather casually! You've got some 52 minutes for this eclipse's total phase to watch the changing colors of shades of gray and red as the Moon crosses the shadow of the Earth. Dress warmly, as though it were 20 degrees colder than the Weather Channel will predict. *Remember to keep your head covered*! Layer your sweater under a good heavy coat. Wear insulated boots, or at least a thick wool sock with a thin cotton sock over it in ordinary boots. This is no time for fashion! We want to be comfortable as we observe, not frozen and shivering! Shivering means blurred photos!!

Your equipment for viewing can be as simple as your unaided eyes, or as complex as a full scale astrophotographic array! Binoculars are a favorite by most visual observers, as you get a good view of the Moon with some background stars. Use a tripod for best results. Even a small telescope can yield a spectacular view. Larger telescopes at low power can see fine detail on the lunar surface that is usually drowned out at Full phase.

TABLE 3

LUNAR ECLIPSE EXPOSURE GUIDE

ISO		f/Number								
25		1.4	2	2.8	4	5.6	8	11	16	22
50		2	2.8	4	5.6	8	11	16	22	32
100		2.8	4	5.6	8	11	16	22	32	44
200		4	5.6	8	11	16	22	32	44	64
400		5.6	8	11	16	22	32	44	64	88
800		8	11	16	22	32	44	64	88	128
1600		11	16	22	32	44	64	88	128	176

Subject	Q	Shutter Speed								
Lunar Eclipse										
Full Moon	**8**	1/4000	1/2000	1/1000	1/500	1/250	1/125	1/60	1/30	1/15
Umbral Contact	**7**	1/2000	1/1000	1/500	1/250	1/125	1/60	1/30	1/15	1/8
Umbra: Mag=0.25	**6**	1/1000	1/500	1/250	1/125	1/60	1/30	1/15	1/8	1/4
Umbra: Mag=0.50	**5**	1/500	1/250	1/125	1/60	1/30	1/15	1/8	1/4	1/2
Umbra: Mag=0.75	**4**	1/250	1/125	1/60	1/30	1/15	1/8	1/4	1/2	1 sec
Totality: L=4	**-3**	1/2	1 sec	2 sec	4 sec	8 sec	15 sec	30 sec	1 min	2 min
Totality: L=3	**-5**	2 sec	4 sec	8 sec	15 sec	30 sec	1 min	2 min	4 min	8 min
Totality: L=2	**-7**	8 sec	15 sec	30 sec	1 min	2 min	4 min	8 min	15 min	30 min
Totality: L=1	**-8**	30 sec	1 min	2 min	4 min	8 min	15 min	30 min	—	—
Totality: L=0	**-11**	2 min	4 min	8 min	15 min	30 min	—	—	—	—

Exposure Formula: $t = f^2 / (I \times 2^Q)$

where: t = exposure time (sec)
f = f/number or focal ratio
I = ISO film speed
Q = brightness exponent

F. Espenak – 1996 March

The table above of suggested exposures is from the ubiquitous MrEclipse.com. The brightness of the Moon in totality can strongly affect your exposures. For this eclipse, I suggest you use the middle ground as denoted by the table, and bracket your exposures.

For the astrophoto crowd, a few suggestions: I like to use a C-8 with a telecompressor to get a focal ratio of f/6.3, which gives me a disc on the negative or slide of about 11 mm diameter; this is a nice size to fit onto a slide or print. I use ISO 400 to 800 Fujicolor for prints, and ISO 400 Ektachrome for slides. As each eclipse is unique in lighting and therefore brightness (the 'inconstant Moon' of Shakespeare applies!), the best I can tell you on exposures is simply to bracket them. During a dark totality, at ISO 800, start from ½ second and work up to 8 seconds. If it's a bright red disc that rises, start at 1/8 second at the same speed, and go up to 4 seconds.

Here's a bit of telescope math to calculate the size of the lunar image on your film/detector. Multiply the focal length of your telescope or lens in millimeters by the constant 1860 (the size of the average Full Moon in arc-seconds), then divide that number by 206,265 (the number of arc-seconds in 1 radian). This will give you the size of the Full Moon in millimeters with your system.

For those with the new digital SLRs (lucky guys/gals!), this is a great opportunity to break new ground. I can tell how new a technology is just by researching its use for a given purpose through the current literature. Believe me, there's still very little in print at this time when it comes to lunar eclipse photos and digital SLRs! (Ditto for webcams, which will have to be coupled to camera lenses of 50 to 135 mm focal length to fit the entire lunar disc onto the CCD chip.) See what your camera meter says for exposure, and give it a try. If you keep getting underexposures, increase the ISO rating (or go up and down several steps from the 'nominal' exposure it suggests). Remember, you'll have at least 50 minutes to capture any number of good and bad exposures, so if some don't work, you can delete them and go for a longer or shorter exposure. One caveat: stock up on batteries, or use an external power supply if your DSLR has one! Remember, it's gonna get cold that night, and the temperature will eat power!!

The next total lunar eclipse will take place on December 12th , 2010, when we once again have a great evening view of that entire event from the East Coast. For *this* upcoming event, on February 20th, I wish all of us clear skies and good seeing that Wednesday night!