Observing Total Lunar Eclipses

Calendar in the Sky
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Imagine a night...
... when a new partner joins the stately dance of moon around Earth and Earth around Sun.

Image Credit: Rob Gonsalves, Imagine a Night
Types of Eclipses

LUNAR ECLIPSES
- When the Earth blocks the Sun’s light from reaching the Moon
- [When the Moon moves through the Earth’s shadow]
- Different classifications of lunar eclipses: total, partial, penumbral

SOLAR ECLIPSES
- When the Moon blocks the Sun’s light from reaching the Earth
- [When the Moon’s shadow falls onto the Earth]
- Different classifications of solar eclipses: total, partial, annular

Image Credits: Fred Espenak, www.MrEclipse.com
What Causes Eclipses

Eclipses occur because of a geometrical coincidence:

– The Moon is 400x closer to the Earth than the Sun
– But the Sun is 400x bigger than the Moon

Lunar eclipses can ONLY occur when:
1. The Moon is in full moon position AND
2. The Moon is located at or near the lunar nodes
Lunar Eclipses

NOTE: Diagram is not to scale!
Lunar Nodes

Lunar Nodes Animation: [http://astro.unl.edu/classaction/](http://astro.unl.edu/classaction/)
(click on “Lunar Cycles”, then “Animations”, then “Moon Inclination”)

Image Credit: University of Nebraska Lincoln
Facts About Lunar Eclipses

• There can be between 0-3 lunar eclipses per year
• When a lunar eclipse takes place, everyone on the nighttime side of the Earth can see it
• Lunar eclipses can only happen at full moon
• But lunar eclipses do not happen EVERY full moon
Total Lunar Eclipse

http://www.youtube.com/watch?v=2dk--IPAi04
Total Lunar Eclipse
July 16, 2000, Lahaina
Penumbral Lunar Eclipse

(when the moon passes through the Earth’s penumbral shadow)
Partial Lunar Eclipse

(when part of the moon passes though the Earth’s umbral shadow)
Upcoming Total Lunar Eclipse: April 14-15, 2014


Eclipse Durations

Penumbral = 05h44m00s
Umbral = 03h34m44s
Total = 01h17m48s

ΔT = 67 s
Rule = CdT (Danjon)
Eph. = VSOP87/ELP2000-85

Eclipse Contacts

P1 = 04:53:37 UT
U1 = 05:58:19 UT
U2 = 07:06:47 UT
U3 = 08:24:35 UT
U4 = 09:33:04 UT
P4 = 10:37:37 UT

Total Eclipse of the Moon

April 15, 2014

Mid-Eclipse - 12:46 am PDT

Earth's Umbra

South

East

West

10:58 pm*  
Moon's Motion Relative to Earth's Shadows

01:25 am  
Total Eclipse Begins

12:07 am  
Mid-Eclipse

01:25 am  
Total Eclipse Ends

02:33 am  
Partial Eclipse Ends

Partial Eclipse Begins

10:58 pm*  
Eclipse begins on night of April 14

All times are in Pacific Daylight Time

Courtesy of Fred Espenak
www.MrEclipse.com
Total Lunar Eclipse – April 15, 2014

NOTE:
All times listed are UT. Depending on the observer’s time zone, the eclipse may begin on April 14. Use online tool such as http://www.timeanddate.com/worldclock/ to convert to your local time.

04:52 – penumbral eclipse begins (first content of Moon with Earth’s shadow)
07:06 – partial eclipse begins (first contact of Moon with Earth’s umbra)
07:42 – Full Moon
07:46 – middle of eclipse (Moon nearest to center of Earth’s shadow)
08:25 – total eclipse ends (Moon touches farher edge of Earth’s umbra)
09:33 – partial eclipse ends (last contact of Moon with Earth’s umbra)
10:39 – penumbral eclipse ends (last contact of Moon with Earth’s shadow)