MoonWatcher™

a publication of Celestial Products

Guide to accompany the world's most beautiful moon calendars: MoonLight™, MoonShine™, MoonDazzle™, Moons and Blooms™

Phases of the Moon 2015

All times shown in Universal Time (UT hh:mm) – Eclipses are marked with "E" and number for reference under "Eclipses"

New Moon

Month	Day	Time	
Jan	20	13:14	
Feb	18	23:47	
Mar	20	9:36	E1
Apr	18	18:57	
May	18	4:13	
Jun	16	14:05	
Jul	16	1:24	
Aug	14	14:53	
Sep	13	6:41	E3
Oct	13	0:06	
Nov	11	17:47	
Dec	11	10:29	

First Quarter

Month	Day	Time
Jan	27	4:48
Feb	25	17:14
Mar	27	7:43
Apr	25	23:55
May	25	17:19
Jun	24	11:02
Jul	24	4:04
Aug	22	19:31
Sep	21	8:59
Oct	20	20:31
Nov	19	6:27
Dec	18	15:14

Full Moon

Month	Day	Time	
Jan	5	4:53	
Feb	3	23:09	
Mar	5	18:05	
Apr	4	12:05	E2
May	4	3:42	
Jun	2	16:19	
Jul	2	2:20	
Jul	31	10:43	
Aug	29	18:35	
Sep	28	2:50	E4
Oct	27	12:05	
Nov	25	22:44	
Dec	25	11:11	

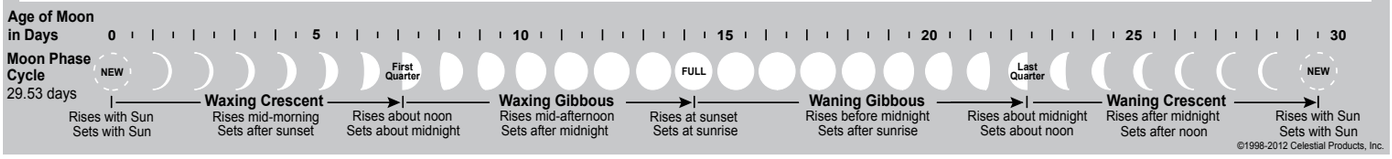
Last Quarter

Month	Day	Time
Jan	13	9:46
Feb	12	3:50
Mar	13	17:48
Apr	12	3:44
May	11	10:36
Jun	9	15:42
Jul	8	20:24
Aug	7	2:03
Sep	5	9:54
Oct	4	21:06
Nov	3	12:24
Dec	3	7:40

Basic data shown here and in other tables provided by the U.S. Naval Observatory, Washington, D.C.

Daily Phase Changes and Rise/Set Times

The period of time in which the moon moves through one complete change of phases represents a synodic month - an average of 29.53 days. A lunation generally refers to the period between consecutive new moons - again, an average of 29.53 days. It is common to refer to the age of the moon in units of days. At about 7 days after New, the moon has passed through one fourth of its journey through a complete lunation, hence the name of First Quarter. About halfway through the cycle (14-15 days), the moon is seen in its Full illumination. At about 22 days of age, it is three-quarters through the cycle - the Last Quarter (sometimes called Third Quarter) phase. Finally, the moon comes back to New Moon after 29+ days. In the diagram below, the various phase appearances of the moon are illustrated along the days of age ruler. Names for the moon's illuminated growth/phases between the quarter phases is show immediately below the illustrations. Just remember that the term waxing refers to the moon's increasing illumination and waning to receding illumination. Also shown are mid-latitude rules of thumb for the rise and set times of the moon. More specific times of moonrise and moonset are dependent on many variables: location, date, altitude, localized terrain, and additional sun/earth/moon geometric information. Refer to our mooncalendar.com website for more information on resources for moon watchers.



Eclipses 2015

Eclipse dates are marked on the Phases of the Moon table. Times shown in that table are close to "mid-eclipse" values. (See Universal Time for discussion on conversion of Universal Time to other zone times.)

E1 – March 20 – Total Eclipse of the Sun. Visible from Iceland, Europe, north Africa, north Asia, north Atlantic.

E2 – April 4 – Total Eclipse of the Moon. Visible from Americas, Asia, Australia, Pacific. (In the U.S., this eclipse starts as the moon is setting in the early morning twilight. West coast viewers will have the best chance of seeing it in a dark sky.)

E3 – September 13 – Partial Eclipse of the Sun. Visible from south Africa, south Indian, Antartica.

E4 – September 27/28 – Total Eclipse of the Moon. Visible from Americas, Europe, western Asia, Africa, eastern Pacific. (From the U.S. the umbral portion begins about 9:07 pm EDT the evening of September 27 as the moon rises.)

Eclipse Predictions by Fred Espenak, NASA's GSFC. The next total solar eclipse in the U.S. is August 21, 2017. For a detailed explanation of eclipses refer to the book, *The Under-Standing of Eclipses,* by Guy Ottewell.

Blue Moons

Should you get excited about seeing a Blue Moon? No, but this popular term has hopefully led to more interest in astronomy. Unlike other astronomical events - an eclipse, occultation, transit of Mercury, etc. - there is nothing to witness in the way of motion or change. Blue Moon definitions (yes, there is more than one!) are just human inventions to put a name on a counting fluctuation that occurs when one puts the grid of our calendar system on the natural moon phase cycle. Imagine two systems: the first a spigot that drips once every 29 seconds and the other your hand-held cup that repeatedly moves in and out under the spigot - 30 seconds under and 30 seconds out. In time, your cup will be under for 30 seconds and catch two drips instead of the usual one. So it is with our calendar system of months, season changeover dates, and the moon's phase cycle. Both of the following definitions are the result of looking for an extra count of a full moon inside one of our calendar cycles.

The widely known definition that has permeated western culture since the mid-20th century relates to the occurrence of a second full moon in a calendar month. Since the average lunation takes just over 29.5 days, it is possible to have two full moons within the 30 or 31 day calendar months as long as the first full moon occurs within the first day(s) of the month. One can find one of these Blue Moon months roughly every 2+ years, but this average is hardly a rule that can be used to predict future occurrences. This is due to the varying number of days in each calendar month, leap year, and the variance from the 29.5 day average lunation period. The next Blue Moons under this definition occur July 31, 2015 and January 31, 2018.

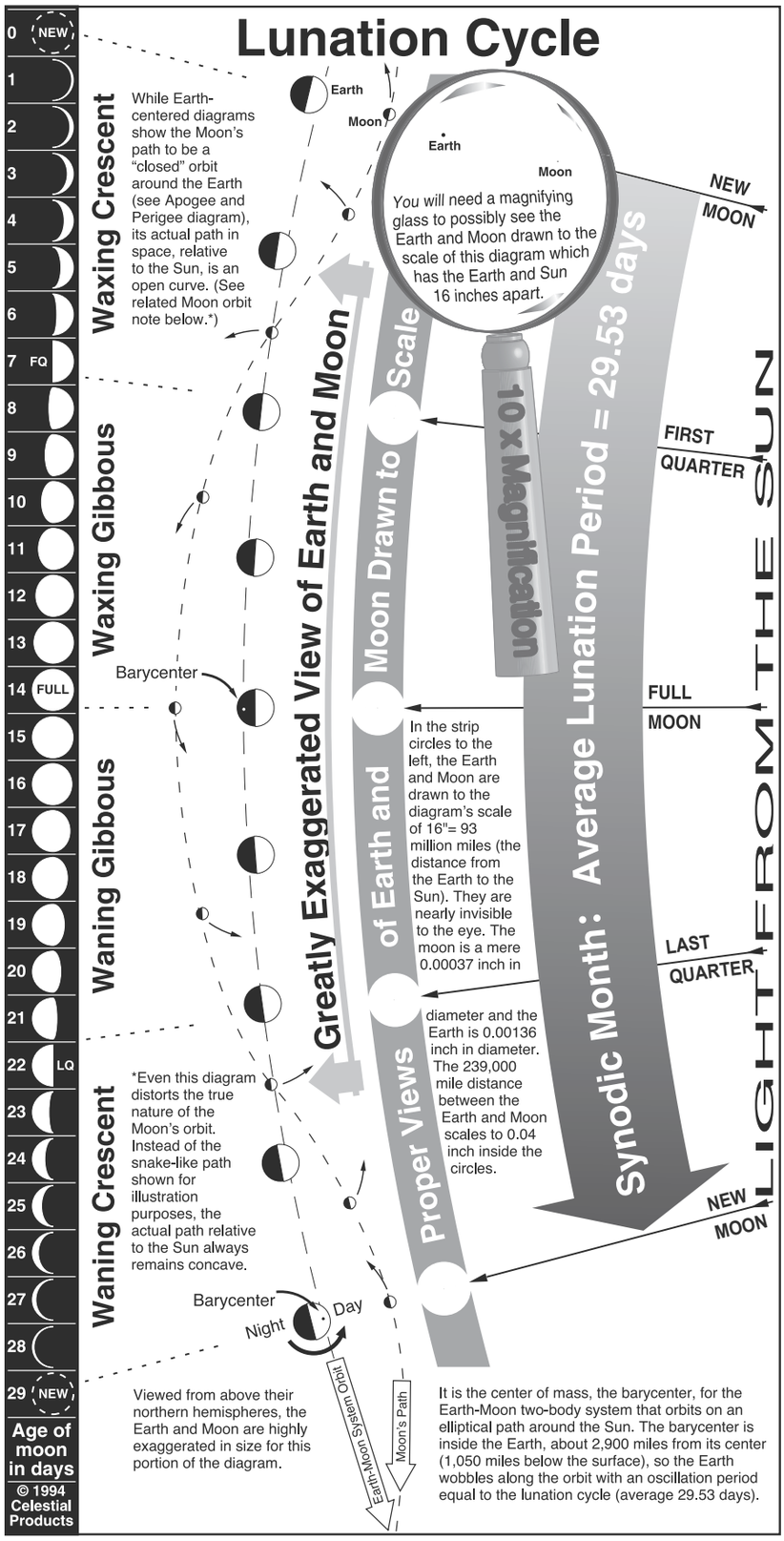
Now, let's look at a less familiar definition of a Blue Moon that evolved many decades ago. It refers to the third full moon within a season (astronomical Winter, Spring, Summer, Fall) having four full moons. Normally a season will have only three full moons, but occasionally, the lunation cycle meshes with a season so that it is possible to get in four full moons. Thus, February, May, August, and November are the only months in which one could have one of these "extra" seasonal full moons. The full moon of May 21, 2016 is the next Blue Moon using this definition since there are four full moons in the season period between the March 20 equinox and the June 20 solstice. Remember, this type of Blue Moon is the full moon of the last full month in that season. Since the seasons have beginning and ending dates partially into a calendar month, the Blue Moon will always be the third full moon in the season of four.

The name Blue Moon may otherwise apply to the rare occurrence of seeing a blue colored moon filtered through atmospheric particles that scatter more of the yellow-red wavelengths than the green-blue wavelengths that give it the color.

Equinoxes and Solstices 2015

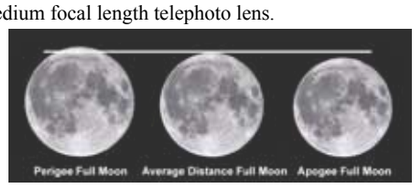
(See **Universal Time** article for conversion to your time zone)

Month	Day	Time (UT)	Event
Mar	20	22:45	March (Spring) Equinox
Jun	21	16:38	June (Summer) Solstice
Sep	23	8:20	September (Autumnal) Equinox
Dec	22	4:48	December (Winter) Solstice



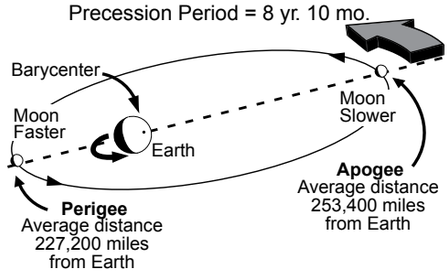
Perigee and Apogee

Like most orbits, the path of the Moon around the Earth is an ellipse with a closest approach, perigee, and farthest point called apogee. (More accurately stated, this path is an ellipse with a focus on the barycenter. See note on the barycenter in diagram at left.) It is possible to visually detect the Moon's larger apparent size at perigee to that at apogee. While perigee and apogee can occur at any phase of the moon, try to capture a full moon at or near perigee and apogee using a medium focal length telephoto lens.



The additional increase in lunar gravitational force on the Earth at perigee can lead to higher high tides (and lower low tides) than would normally occur. Couple this increased lunar gravitational component with the Sun's gravitational force at a time when both the Moon and Sun are aligned with the Earth (New or Full Moon) and you have the ingredients for higher than normal tides–tides that are dreaded for their potential shore damage when a storm is present.

As a further complication to the Moon's orbit, the elliptical figure itself turns (precesses) forward relative to the background stars, taking nearly 9 years to complete one circuit.



2015

(These dates are also marked directly on our moon calendars. Look for Perigee, Apogee, P, or A.)

Perigee			Apogee		
Date	Hr(UT)	Miles	Date	Hr(UT)	Miles
			Jan 9	18	251,909
Jan 21	20	232,473	Feb 6	6	252,370
Feb 19	7	221,826	Mar 5	8	252,516
Mar 19	20	222,192	Apr 1	13	252,284
Apr 17	4	224,329	Apr 29	4	251,707
May 15	0	227,437	May 26	22	251,186
Jun 10	5	229,728	Jun 23	17	251,116
Jul 5	19	228,101	Jul 21	11	251,553
Aug 2	10	225,023	Aug 18	3	252,182
Aug 30	15	222,631	Sep 14	11	252,565
Sep 28	2	221,753*	Oct 11	13	252,518
Oct 26	13	222,739	Nov 7	22	252,103
Nov 23	20	225,444	Dec 5	15	251,531
Dec 21	9	228,924			

Data derived from astronomical algorithms by Jean Meeus.

*September 27-28 is the shortest distance perigee of the year (221,753 miles) and coincident with the full moon. This leads to a slightly larger than normal looking moon on that date. Astronomers have known about these coinciding events for hundreds of years and call them perigee full moons, but they got dubbed by an astrologer as a "Supermoon." There is more hype than substance attached with the visual aspects to this event. More important is knowing that every perigee coincident with either a full or new moon has its greatest influence in higher and lower tide height/depth values.

Full Moon Names

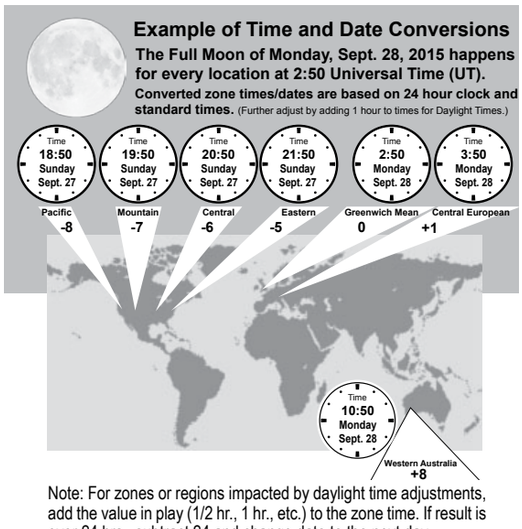
The following names for full Moons come to us from American Indian and folklore sources. For commentary regarding these names, consult the *Astronomical Calendar* available at CelestialProducts.com.

January ..... Moon After Yule, Old Moon
February ..... Snow Moon, Hunger Moon, Wolf Moon
March ..... Sap Moon, Crow Moon, Lenten Moon
April ..... Grass Moon, Egg Moon
May ..... Planting Moon, Milk Moon
June ..... Rose Moon, Flower Moon, Strawberry Moon
July ..... Thunder Moon, Hay Moon
August ..... Green Corn Moon, Grain Moon
September ..... Fruit Moon, Harvest Moon*
October ..... Hunter's Moon
November ..... Frosty Moon, Beaver Moon
December ..... Moon Before Yule, Long Night Moon

*Usually, the full moon closest to the autumnal equinox is called the Harvest Moon, but for some, the Harvest Moon is that which occurs only on or after the autumnal equinox. In either case, this means that there are years when the October full moon may end up being called the Harvest Moon.

Universal Time

All our publication event times are reported in Universal Time (UT). This is simply understood as the local time on the prime meridian (0 degrees longitude) which passes through Greenwich, England, hence the familiarity you may have with Greenwich Mean Time (GMT). Universal Time uses a 24 hour period with 0 hours representing midnight; 12:00 is noontime; 14:00 is 2 pm; 18:00 is 6 pm, and so forth.



Note: For zones or regions impacted by daylight time adjustments, add the value in play (1/2 hr., 1 hr., etc.) to the zone time. If result is over 24 hrs., subtract 24 and change date to the next day.

To convert Universal Time to your zone time (e.g., Eastern Standard Time), subtract an hour for each time zone west of Greenwich needed. (Add an hour for each zone east of Greenwich). Examples are shown in the Time Conversion Example diagram at left. Note that when the subtraction results in a value less than 0, the date reverts to the **previous** day and the hour value is adjusted by adding 24 hours to the negative value.

For users in the U.S., we have used a star to mark dates of Full and New Moons that may shift depending on your time zone. Thus, you should always check for a "star" and know your time zone affect on whether the event date will shift to the previous day.