# Watchgr™

A publication of Celestial Products

Guide to accompany the World's Most Beautiful Moon Calendars' MoonLight<sup>™</sup>, MoonShine<sup>™</sup>, MoonDazzle<sup>™</sup>, Moons and Blooms<sup>™</sup>, MoonDance

Phases of the Moon 2019

All times shown in Universal Time (UT hh:mm) – Eclipses are marked with "E" and number for reference under "Eclipses"												
	( NE	w)		FULL								
New Moon				First Quarter			Full Moon			Last Quarter		
<u>Month</u>	Day	<u>Time</u>	Mor	<u>th Day</u>	<u>Time</u>	<u>Month</u>	<u>Day</u>	<u>Time</u>		<u>Month</u>	<u>Day</u>	<u>Time</u>
Jan	6	01:28 E	1 Jan	14	06:46	Jan	21	05:16 E	E2	Jan	27	21:10
Feb	4	21:04	Feb	12	22:26	Feb	19	15:53		Feb	26	11:28
Mar	6	16:04	Mar	14	10:27	Mar	21	01:43		Mar	28	04:10
Apr	5	08:50	Apr	12	19:06	Apr	19	11:12		Apr	26	22:18
May	4	22:45	May	12	01:12	May	18	21:11		May	26	16:33
Jun	3	10:02	Jun	10	05:59	Jun	17	08:31		Jun	25	09:46
Jul	2	19:16 E	3 Jul	9	10:55	Jul	16	21:38 E	E4	Jul	25	01:18
Aug	1	03:12	Aug	7	17:31	Aug	15	12:29		Aug	23	14:56
Aug	30	10:37	Sep	6	03:10	Sep	14	04:33		Sep	22	02:41
Sep	28	18:26	Oct	5	16:47	Oct	13	21:08		Oct	21	12:39
Oct	28	03:38	Nov	4	10:23	Nov	12	13:34		Nov	19	21:11
Nov	26	15:06	Dec	4	06:58	Dec	12	05:12		Dec	19	04:57
Dec	26	05:13 E	5									

Basic data shown here and in other tables credit to Fred Espenak and Sumit Dutta, NASA Goddard Space Flight Center

#### 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 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 more relation of the other completes information 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 a more relation of the other completes information 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 the participant language that the term was information and waning to receding illumination and waning to receding 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 the participant language through and the participant language through and the participant language through the recedent and the participant language through and the receding the recedent and the participant language through and the re on many variables: location, date, altitude, localized terrain, and additional sun/earth/moon geometric information. Hence, any more specific moonrise/moonset almanac information must be generated ed on those variables. Refer to our mooncalendar.com website for more information on resources for moon watchers

Age of Moon									
in Days	0	5		10 1 1 1 1	15	<b>20</b>		25	30
Moon Phase Cycle	NEW	) $)$ $)$	First Quarter		FULL		Quarter		
29.53 days	I	- Waxing Crescent -	>	– Waxing Gibbous –	>	— Waning Gibbous —	>I	- Waning Crescent	<b>→</b>
Rises	s with Sun	Rises mid-morning	Rises about noon	Rises mid-afternoon	Rises at sunset	Rises before midnight	Rises about midnight	Rises after midnight	Rises with Sun
Sets	s with Sun	Sets after sunset	Sets about midnight	Sets after midnight	Sets at sunrise	Sets after sunrise	Sets about noon	Sets after noon	Sets with Sun
Sets	s with Sun	Sets after sunset	Sets about midnight	Sets after midnight	Sets at sunrise	Sets after sunrise	Sets about noon	Sets after noon	Sets with Sun

### Eclipses 2019

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.)

- $E1-January\,5-6-Partial\,E clipse\,of\,the\,Sun.\,Visible\,from$ northeast Asia, north Pacific Ocean, Aleutian Islands
- E2 January 20-21 Total Eclipse of the Moon. Visible from central Pacific Ocean, Americas, Europe, Africa
- E3 July 2 Total Eclipse of the Sun. Visible from South Pacific Ocean, Chile, Argentina
- E4 July 16-17 Partial Eclipse of the Moon. Visible from SouthAmerica, Europe, Africa, Asia, Australia
- E5 December 26 Annular Eclipse of the Sun visible from Saudi Arabia, India, Sumatra, Borneo, but Partial from Asia, Australia

Eclipse predictions by Fred Espenak, NASA's Goddard Space Flight Center.

See Eclipsewise.com for details and map

#### 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 29.5 day moon phase cycle. To help you understand this kind of phenomenon, 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. Eventually, your cup will be under for 30 seconds and catch two drips 29 seconds apart instead of the usual one drip. 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 Moon under this definition occurs October 31, 2020.

Now, let's look at a less familiar definition of a seasonal 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 18, 2019 is the next Blue Moon using this definition since there are four full moons in the season period between the March equinox and the June 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 that has four full moons.

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The World's	MostR	between the Marc season. Since the full moon in the s	h equinox and the June sol seasons have beginning an season that has four full me	stice. Remem d ending dates ons.	per, this partial	type of Blue Mo ly into a calenda	oon is the fu r month, the	ll moon of the last full mor Blue Moon will always be	1th in that e the third
Inc	Science + Art	The name Bl particles that scat	ue Moon may otherwise ap ter more of the yellow-red	ply to the rare wavelengths l	occurr eaving	ence of seeing a the green-blue v	blue colored vavelengths	moon filtered through atm that can give it that color.	nospheric
21st CENTURY	LUNA	41 MOOD C		(5	- E See Uni	quinoxes a	and Sols	sion to your time zone)	
		2020 On Ca	llendars	Month	Day	<u>Time (UT)</u>	Event		
				Mar	20	21:58	March (S	pring/Vernal) Equinox	
A HAAAAA		A DECEMBER OF	The Shee She	Jun	21	15:54	June (Su	mmer) Solstice	
	- 1 M	2020		Dec	23 22	07:50	Decembe	r (Winter) Solstice	
					Р	erihelion a	nd Aph	elion 2019 🛛 🗌	
Moon Calendars • N	lote Cards • Persona	l Maps of the Sky		Month	Day	Time (UT)	Event		
21st Century Luna™	MoonBeams™	Heaven's View™		Jan	3	09:59	Perihelior	n (Earth closest to Sun)	
MoonShine™ MoonLight™ MoonDaggless	Heavenly Reflections™	Printed or engraved to commemorate a wedding, birth, first		Jul	4	18:59	Aphelion	(Earth farthest from Sur	ו)
MoonMaggy™ Moons and Blooms™	Hubble Telescope Deen Space Images	date, etc.	100	Celes	tiall	Products	.com	LEST)	
			1	Мо	onCa	alendar.c	om	PRODUCTS	

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# **Full Moon Names**

The following names for full Moons come to us from American Indian and folklore sources. Take your pick!

\*Usually, the full moon closest to the autumnal equinox is called the Harvest Moon, but for some, the assignment of 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.



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#### **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 to long 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.

Precessio	n Period = 8 yr. 10 mo.
Perigee Moon Average distance 363,396 km (m) (225,804 miles) from Earth	Hoon Slower Earth Hoon Slower Hot Slower Hot Slower Hot Slower Hot Slower Hot Slower Hot Slower Hot Hot Slower Hot Hot Slower Hot Hot Hot Hot Hot Hot Hot Hot Hot Hot
	2019
These dates are also m Look for "P" Perigee, "A" A	arked directly on most of our moon calendars. Apogee. Data credit to Fred Espenak, NASA GSFC.
Perigee	Apogee
Date Time(UT) km	Date Time(UT) km
-	Jan 09 04:29 406116
Jan 21 19:58 35734	5* Feb 05 09:26 406556
Feb 19 09:06 35676	2** Mar 04 11:25 406391
Mar 19 19:47 35938	1 Apr 01 00:14 405577
Apr 16 22:02 36420	9 Apr 28 18:20 404577
May 13 21:53 36901	7 May 26 13:27 404134
Jun 07 23:21 36850	8 Jun 23 07:50 404549
Jul 05 04:54 36372	9 Jul 21 00:01 405480
Aug 02 07:08 35939	8 Aug 17 10:50 406244
Aug 30 15:57 35717	7 Sep 13 13:32 406378
Sep 28 02:27 35780	3 Oct 10 18:29 405902
Oct 26 10:41 36131	6 Nov 07 08:37 405060
Nov 23 07:54 36672	1 Dec 05 04:09 404447
Dec 18 20:30 37026	0 –

\*January 21 is a perigee full moon, known in popular culture as a supermoon, appearing larger and brighter than a normal full moon at less than average perigee distances. \*\*February 19 is the shortest distance perigee (356,762 km or 221,682 miles) of 2019 and coincident with the full moon of that date. Hence, this one will be the biggest and brightest of the full moons in 2019. New moons coincident with perigee are by the supermoon definition also "super." In August, September and October, the new moon dates are coincident or nearly coincident with perigee. There is more hype than substance attached with the aspects to these events. It is more important knowing that every perigee coincident with either a full or new moon has its greatest influence in higher and lower tide height/depth values. Coastal flooding can be more extensive with storms on those dates.

# 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.