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MCC ASTRONOMY

Macomb Community College Astronomy Newsletter

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The Great Conjunction

When two celestial objects in the night sky appear at their closest positions to each other when viewed from Earth this is known as a conjunction. (Technically they will share the same right ascension. This is the celestial equivalent to longitude on Earth.) For the inner planets it's not a rare event. But, for Jupiter and Saturn these conjunctions occur around every 20 years and are known as Great Conjunctions for their rarer occurrences.

On December 21, 2020, for those fortunate enough to have clear evening skies, they were treated to a grand celestial event involving Jupiter and Saturn. During the great conjunction, Jupiter and Saturn appeared so close to each other in the sky that they appeared as a single bright star (to the naked eye), dubbed the *Christmas Star*. The nickname comes from the possibility that Jesus was born during a great conjunction and this could be the star to which many biblical stories refer. Locally, the skies were too cloudy to see the Great Conjunction. But, Prof. Fey's sister in law, Lisa Jenkins, was able to capture the celestial event in Riverside, California as seen in the images provided. Below, Jupiter is the bright star on the left and Saturn is on the right. The little dimmer dots aligned with Jupiter are three of the Moons of Jupiter. Notice that Saturn appears elongated because of its rings. The next time Jupiter and Saturn will be so close together in the sky again will be March 15, 2080, There will be other conjunctions before 2080 but they will not appear so close to each other.

Credit: Lisa Jenkins, Riverside CA
Jupiter and Saturn in great conjunction
Image taken using an iPhone X 12/21/20

"The next time Jupiter and Saturn will be so close together in the sky again will be March 15, 2080. There will be other conjunctions before 2080 but they will not appear so close to each other."

Credit: Lisa Jenkins, Riverside CA
Jupiter with moons, and Saturn
Image taken using a Sony 7iii with a 200 mm f2.8 12/21/20.

By Timothy Skonieczny

The Solar Eclipse of June 10th, 2021

If the universe can be thought of as a living entity, then it must have a dual personality. In some ways, especially in the long term, it is chaotic and unpredictable. In other ways, it functions like a clock and follows repeated patterns that can be complicated but predictable. Calculating these cycles became the obsessions of great astronomers like Johannes Kepler, Isaac Newton, and Edmond Halley. Newton once wrote to Halley that calculating the motion of the moon gave him a headache and kept him awake at night. He also pondered that the orbits of the planets were so complicated that the total effort of all human beings at the time could not determine them.

One of the earliest known patterns of celestial movement is the Saros Cycle. Discovered by the ancient Chaldeans, the Saros Cycle is a repeated pattern of eclipses. During a lengthy series that typically lasts 12 to 13 centuries involving more than 70 solar eclipses, eclipses repeat every 18 years, 11 days, and 8 hours. Therefore, if one was fortunate to observe the total solar eclipse on August 21st, 2017, one will also occur on September 2nd, 2035. That does not imply that the path of totality will cross the same location. The 8-hour difference is 1/3rd of a day, so the path is shifted 1/3rd of the way around the earth. The 11-day difference means the path will be shifted northward or southward due to the orbital tilt of the earth affecting the seasons. While the center of the path of the 2017 eclipse passed over southern Indiana, the one in 2035 will be located east of Japan. Approximately every 54 years and 1 month, or 3 complete cycles, eclipses come back to the same general location on earth. On September 23rd, 2071, a total eclipse will occur again in the Western Hemisphere, but the center of the path will be located in the Caribbean Sea.

On October 23rd, 2014, a partial solar eclipse occurred at sunset. ASTR 1030 students viewed the eclipse from Eastwood Beach, Stony Creek Metropark.

Saros Cycles have a beginning and ending. They also overlap, so other eclipses will occur during these years, but they are part of a different sequence. The 2017 eclipse was part of Saros Cycle #145. This summer, we will experience an eclipse from Cycle #147. The eclipse will also be very different in nature. Solar eclipses can be categorized as being either central or non-central. A central eclipse implies that the center of the moon's disk crosses directly in front of the center of the sun's disk. Like the 2017 eclipse, the eclipse on June 10th, 2021, will be a central eclipse when viewed along a narrow path of land. Unfortunately, the moon will be farther from the earth in its elliptical orbit than in 2017 and will not completely obscure the photosphere of the sun, which is the bright yellow disk we see in the sky. The result is that a bright ring of sunlight will surround the sun. This type of eclipse, statistically more common than total eclipses, is referred to as an annular eclipse. The name comes from the Latin word for "little ring," or annulus. If the eclipse is viewed from a location that does not lie along this narrow path, it is considered non-central, or partial.

While annular eclipses lack the grandeur of totality, they are fascinating to observe. Many of the same effects leading up to a total eclipse can still be seen. The sky noticeably dims, although not as dramatically. Bright planets, such as Jupiter and Venus, can be observed. The sky takes on a strange appearance and shadows on the ground become sharper. The temperature drops as the amount of sunlight is reduced to a small fraction of what it is normally. The duration of annularity, the time the moon lies within the sun's disk, can range from a few seconds to over 12 minutes, although that is extremely rare. Of the three annular eclipses I have observed, the shortest lasted a mere 14 seconds and was very close to being total. In 1994, an annular eclipse was visible from Macomb Community College and had a duration of over 4 minutes.

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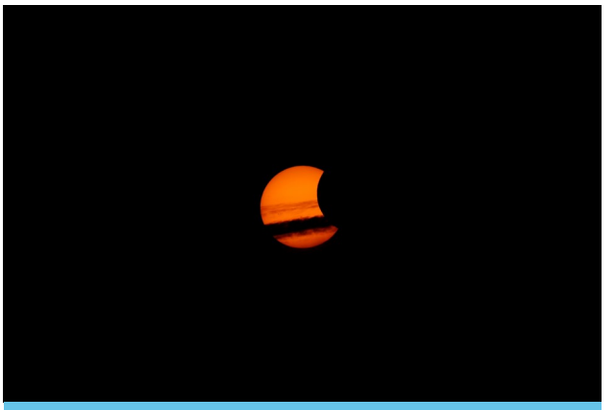

Although clouds impaired the view, the eclipse was still a memorable event.

Unfortunately, the path of this summer's eclipse does not pass over our area. It begins at sunrise east of Thunder Bay, Ontario, continues over northern Greenland, and finally ends at sunset in Russia. What makes this a particularly challenging eclipse to observe is that the closest part of the path is just north of Lake Superior but there are few roads leading into the path.

Occurring at sunrise, a clear horizon is needed, which means a long and arduous trip to the Hudson Bay along gravel roads that provide few services. Weather prospects are also not favorable, so only the most dedicated eclipse chasers are likely to experience the annular phase. But don't despair! Observers in this area can look forward to a special treat; a sunrise partial solar eclipse.

On Thursday, June 10th, the sun will rise with about 57% of its disk covered by the moon. Sunrise will occur just before 6:00 a.m. and as the sun climbs higher, less of the sun will be covered until the eclipse ends about 40 minutes after sunrise. Weather permitting, observing the sun on the horizon during an eclipse can be a memorable event. Celestial objects tend to look much larger on the horizon than when high in the sky, so the sun's image may appear magnified. Experienced photographers will find potential for great aesthetic pictures if equipped with a long telephoto lens. The most exciting part will occur at the moment of sunrise and it will be imperative to have clear horizon. Viewing over an open farm field will help, but the best views will be over open water, such as over Lake Huron. Sunrise will occur in the northeast since this date is close to the Summer Solstice. Viewing further to the east and north than at MCC also means a slightly longer eclipse and a greater percentage of the sun obstructed.

Most importantly, observing the eclipse must be done SAFELY. Unlike a total solar eclipse which can be viewed directly by the eye, partial and annular eclipses require reasonable caution. Glancing directly at the sun even for a quick look can cause serious and irreversible eye damage. Fortunately, there are numerous ways to do that. The projection method in which the sun's image is projected onto a screen by a pinhole or lens is a time-honored method but is not ideal for a sunrise eclipse. Using a dedicated filter will give a better view. These filters are sold through popular online sources and are often called "eclipse glasses." They are relatively inexpensive and cheaper when bought even in small quantities. Personally, I find "eclipse cards" easier to use and can double as a filter to place in front of a camera lens. Do not try to make your own filter or use sunglasses to observe the sun. The filter must be designed for this purpose. Make sure that they are CE and ISO certified. Special binoculars with built in filters sold by reputable companies may also work well for this eclipse. Also, do not try to photograph the eclipse by pointing the camera directly at the sun. Place an appropriate filter in front of the lens.

Eclipse glasses that are certified for quality can be an inexpensive and safe method for viewing solar eclipses.

Eclipse viewers or cards that use the same filter material as eclipse glasses are sometimes more convenient and can also be used in front of a camera lens.

Karen (left) and Sara (right) Skonieczny demonstrating eclipse viewers on a rare sunny Michigan winter day.

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Those that miss this eclipse will find solace in the fact that the eclipse will repeat on June 21st, 2039, which is 18 years and 11 days from this eclipse. With the path shifted westward, Anchorage and Fairbanks in Alaska will make great travel destinations to view it. Closer to Michigan, an annular eclipse will occur on October 14th, 2023. This is part of Saros Cycle #134. The path crosses the southwestern U.S. and passes over Albuquerque and San Antonio. This is just 6 months before the April 8th, 2024, total solar eclipse of Cycle #139 that can be seen in northern Ohio.

In the distant future, total eclipses will end as seen from earth. This is due to the slowly increasing distance between the earth and moon. Tidal effects are causing the moon to gradually spiral away from the earth. The distance is currently increasing by only 3.8 cm per year, but over millions of years, those centimeters add up. The current estimate is that this will happen sometime between 650 million years into the future to possibly 1.4 billion years. Annular and partial eclipses will still occur, although the Saros Cycle will be much longer than it is now because the moon will take longer to orbit the earth. ★

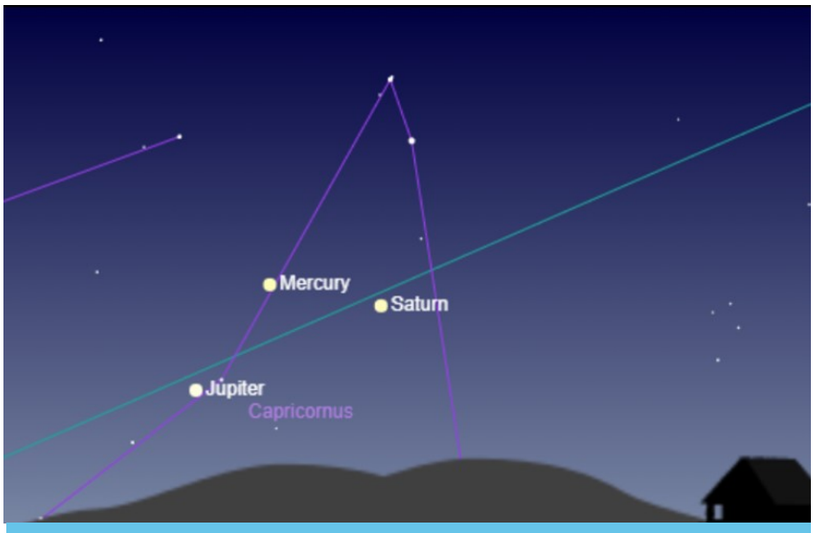
FEBRUARY SKY

By Jonathan Schemke

Winter continues, but by February spring is in sight. How close, depends on a ground hog's ability to see its shadow for some reason. For those of you looking to brave the night's cold there are a few points of interest this month.

Planets

For early risers late in the month, Mercury, Saturn, and Jupiter will all be visible grouped in a small triangle right before sunrise. They will appear near the East-Southeastern horizon briefly before the sun makes its appearance.



February 22, 2021 at 7:15 am Eastern Time
Source Sky and Telescope Interactive Sky Chart

Mars will be visible high in the evening sky throughout the month and setting in the west around 1 am. The crescent moon makes a close approach with the red planet on February 18th.

February 18, 2021 8:00 pm Eastern Time
Source Sky and Telescope Interactive Sky Chart

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This will be fairly high in the sky after sunset and moving down to west as night progresses. Look for the moon, and the reddish-orange object next to it is Mars.

The Moon

Speaking of the moon, our companion in space reaches full on February 27th. The February full moon was often referred to as the Snow Moon for obvious reasons, since the snow is often heavy this month. However, it was also called the Hunger Moon by some native northern tribes due to the lack of good foraging and poor hunting during this time of year.

February is the lone month that can never have a Blue Moon (second full moon in the month). Due to the full moons coming every 29.5 days, even a leap year February can not have two full moons.

Online Sky Chart

For anyone looking to get a more specific map of the full sky at their location at time this link has a list of some available resources.

I hope everyone gets a chance to go out at least a couple times this month, but in any case, I hope you enjoy your February. ★

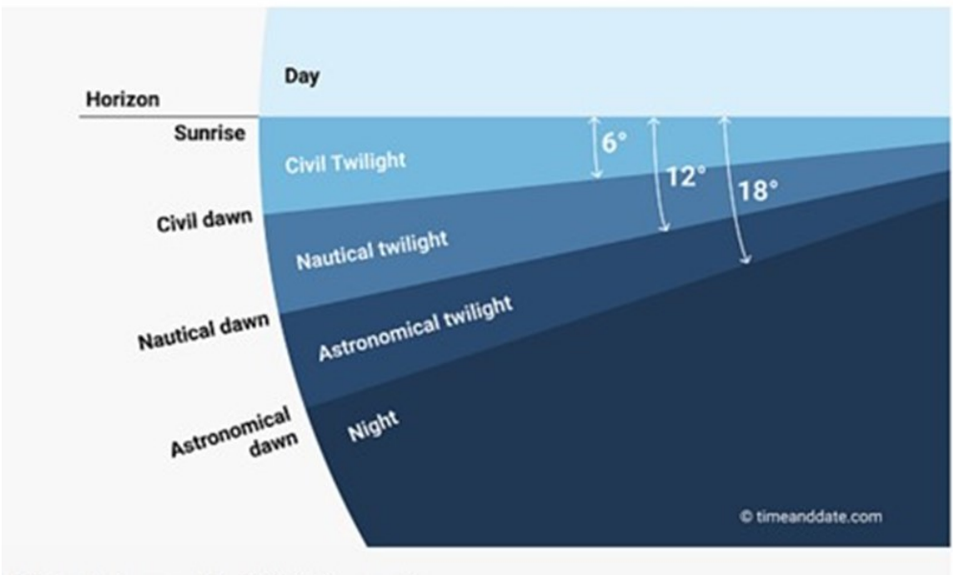
EQUINOX AND TWILIGHT

By Dr. Dale Partin

The word *equinox* is derived from two Latin words *aequi* (equal) and *nox* (night). Thus, on the equinox, the night and day are equal in length, or each 12 hours long. So, on the Fall or Autumnal Equinox and the Spring or Vernal Equinox, it is approximately correct that the Sun will be above the horizon for 12 hours on those days, and then below the horizon for 12 hours. This is actually off by a few minutes, as atmospheric refraction bends sunlight when the Sun is near the horizon, making it appear that the Sun is just above the horizon when it is actually just below the horizon.

But really, it is pretty bright for a while before *sunrise* and after *sundown* or *sunset*. At those times, we enter into the *Twilight Zone* (recalling a popular science fiction program from the 1960s by that name – you can still watch them on youtube). As we all know, there is a lot of light for at least half an hour before sunrise (dawn) and for at least half an hour after sundown (dusk). Even though the Sun is not visible at these times, the Sun's light is hitting the clouds and air above us, and being scattered down to the ground, making it pretty bright. So, it is rather imprecise to say that the length of the day and night are equal on the equinoxes, but it is roughly true!

But this raises the issue of *twilight*. What exactly does twilight mean? There are three actual definitions or degrees of twilight: civil twilight, nautical twilight, and astronomical twilight, depending on how far below the horizon the Sun is.



Different degrees of twilight in the morning.

Source

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Civil twilight is when the Sun is 0 to 6 degrees below the horizon in the morning or evening. When the Sun drops 6 degrees below the horizon in the evening, it is legally *dark* or *night*. Thus, in some jurisdictions, one must have one's headlights on when driving a car before morning civil twilight or after evening civil twilight. Only the brightest astronomical objects (the Moon, Venus and Jupiter) are easy to see at civil twilight (civil dawn or civil dusk). Nautical twilight happens when the Sun is 12 degrees below the horizon. At that point, it is pretty dark, so that ancient mariners could navigate their ships by the stars. Although the sky is not super dark at that point, the major, bright stars are easy to see. Finally, astronomical twilight happens when the Sun is 18 degrees below the horizon. At that point, the sky is as dark as it is going to get, so that astronomers can see very faint things in the sky, like distant galaxies. This of course is when there are no bright city lights nearby to cause light pollution.

Some weather websites give twilight times. The chart below is from Weather Underground for February 12, 2021. From it, you can see that sunset will occur at 6:00 pm, and civil twilight will occur 29 minutes later at 6:29 pm. Astronomical twilight will not occur until 7:35 pm, an hour and 35 minutes after sundown. I often use this web site to plan my astronomical observing. Cheers!

ASTRONOMY *Source*

SUN	RISE	SET
Actual Time	**7:34** AM	**6:00** PM
Civil Twilight	**7:05** AM	**6:29** PM
Nautical Twilight	**6:31** AM	**7:03** PM
Astronomical Twilight	**5:59** AM	**7:35** PM
Length of Visible Light	**11** h **24** m	
Length of Day	**10** h **26** m	

Tomorrow will be **2** minutes **39** seconds longer

Moon	**8:26** AM	**6:59** PM

Waxing Crescent
1% of the Moon is Illuminated

Feb 19	Feb 27	Mar 5	Mar 13
Waxing Half	Full Moon	Waning Half	New Moon
First Qtr		Last Qtr	

STUDENT HIGHLIGHTS

Provided by MCC student Nicholas Bradley

Nicholas is a current student at Macomb Community College. Beginning the Winter 2021 semester he plans to study cybersecurity. On the next page you will see a couple of fantastic images that Nicholas took from his driveway of the Rosette and Heart nebulas using the telescope pictured on the right. He's been a lover of astronomy ever since he was a kid and has since acquired a deep sky astronomy set up that he uses whenever he can. See more of his work on Instagram @highonspxce.

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Rosette Nebula
Credit: Nicholas Bradley 6 hours of narrowband data on 11/23/20
Processed in Pixinsight and Photoshop cc2019

> *“I want to keep astronomy as a hobby since I don't want to look up at the stars and be reminded of work.“*
>
> *~Nicholas Bradley*

Heart Nebula
Credit: Nicholas Bradley

Students, Faculty, & Readers

We want your submissions!

Have you done, created, or photographed anything interesting relating to astronomy? We would love to read about it. Send submissions to SkoniecznyT@macomb.edu or FeyF@macomb.edu with permission for us to publish it.

In our last issue we asked you for a catchy name with the potential to win a $50 gift card for the Macomb Community College bookstore or Amazon.com (your choice). We received some great suggestions. Now we need your help to decide! Go here or scan the QR code to make your selection (There are no ads and you are not asked to provide any information.) The choices you will see are:

Helium Flash
Auroral Times
Sunshine Observer
Moonstruck
Macomb Moonshine
Moonshine Observer

SPRING EQUINOX

The spring equinox will occur in Detroit at 5:37 am EDT on Saturday March 20. What does this mean? At 5:37 am the Sun will appear to cross the celestial equator (projection of the Earth's equator on the sky) as viewed from Earth. During an equinox the length of day and night are almost equal. The length of day light will continue to increase until the Summer Solstice.

Happy Spring!