Issue 3 | April 10, 2021

HELIUM FLASH

Macomb Community College Astronomy Newsletter

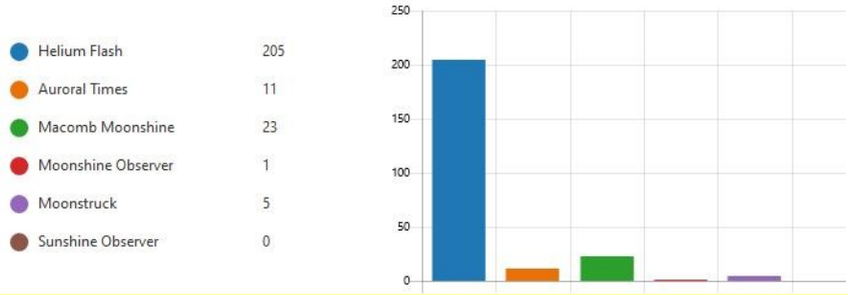
In this issue:

We Have a New Name!

In our last issue, we asked you to help us name our newsletter. You have spoken! Out of 245 responses, 205 of our readers voted for Helium Flash! The results are pictured below. As we promised, the person who submitted the winning name won the $50 gift card to the MCC bookstore. But the winner, Prof. Skonieczny, has decided that he will reward the student who earns the highest grade in his astronomy class this semester with the gift card. Lucky student!

1. Which is the best name for our newsletter?

More Details



Newsletter Naming Survey Results

What Does Helium Flash Mean?

A helium flash is a very interesting and very rarely photographed event that happens to some dying stars. It is a runaway thermal nuclear fusion process involving large amounts of helium and occurs very rapidly; in a flash! A helium flash will occur in the helium cores of low mass red giants (the first stage of a dying star) when temperatures of 100 million Kelvin are reached. They also occur on the surfaces of white dwarfs (the last stage of a dying low mass star) that have gravitationally attracted enough mass from a nearby star causing the dwarf to swell rapidly with a surface helium flash. The result is the star becomes a red giant again. Talk about second chances!

Image Credit: European Southern Observatory (ESO) The remnants of a helium flash are observed in the image as the red ring. For more information about the Sakurai Object (white dwarf that experienced a helium flash) in this image go here.

DOES ANYBODY REALLY KNOW WHAT TIME IT IS?

Part 1: My Sundial is Broken!

By Timothy Skonieczny

Of all the instruments that are both scientific and practical, the sundial is the most misunderstood and abused. Simplistic in theory and construction, the sundial belies its true complexity. It consists of a device that casts a shadow, called the gnomon, and something that the shadow is projected on that has a graphical representation of the passage of time. This may be a simple plate, called the dial plate, or something curved. It can be markers on the ground or a finely machined work of art. In any case, it tells time by the apparent movement of the sun across the sky caused by the rotation of the earth.

While the concept of the sundial is simple, the concept of time and how it is measured by humans is not. Location on the earth, the shape of the earth's orbit and its axial tilt, the need to standardize time for transportation, convenience of sleeping schedules, politics and even greed have influenced the measurement of time. Over the years, a disconnect between nature and humans resulted in the sundial being considered an anachronism; out of place and out of time, making it a cute garden ornament but of little practical value. In reality, it is the result of most people not understanding the difference between the motion of the sun across the sky and the motion of the hands of a timepiece that are adjusted to suit our whims.

My fascination with sundials began when I took a class called Spherical Astronomy. The class dealt mostly with using three-dimensional geometry to portray the locations of celestial objects. I don't remember sundials ever being mentioned in the class, but the concepts gave me an appreciation for their design. I started designing sundials and spent hours trying to understand their nuances. When people would find out that I had some knowledge of them, I would occasionally be told by someone who owns one that their sundial is broken and wondered how they could fix it. Some of my suggestions were simple, such as not placing the sundial underneath a tall oak tree or changing the orientation of the sundial. The gnomon must point accurately to the north and not some random direction, which I have seen even in public and school gardens. With those two out of the way, things get complicated.

One problem that arises with commercial sundials purchased at a garden store or online is that they violate the aphorism that "form follows function." While often stated for architecture and engineering applications, it applies to sundials as well. In other words, the first priority is to design it to work and the second priority is to make it look pretty. Commercial sundials are often designed to look pretty but not to portray time accurately. The gnomon not only needs to point toward the north but also must to be parallel to the axis of rotation of the earth. To do that, it must be slanted to the same angle as the latitude where the sundial is located. Most commercial sundial gnomons have a fixed angle because they are mass-produced, and little attention is paid to accuracy. The sundial shown has a gnomon angled at 40.5°, which is better suited for Columbus, Ohio, than Macomb Community College.

This commercial sundial reads the time as 12:00 p.m. on March 14th, 2021. On the next page is a timepiece. Compare the times of the two.

It seemed logical to divide the earth into 24 separate zones, but what would be the reference longitude that all time zones would begin at? That question would be resolved in 1884. At the request of President Chester Arthur, 41 mostly old bearded men from 26 countries met in Washington D. C. for the International Meridian Conference and established the reference longitude as the one that passes through the

Royal Observatory in Greenwich, England, which became known as the Prime Meridian. Later, the Eastern Time Zone would be centered 75 degrees west in longitude from that. Most of Michigan logically belongs in the Central Time Zone and adopted that from 1885 until 1931, but then switched to the Eastern Time Zone. Perhaps being associated with New York and Washington, D.C., seemed more desirable than Chicago and Dubuque, Iowa. Since Macomb Community College has a longitude close to 83 degrees west of the Prime Meridian and not 75 degrees, it results in a 32-minute difference in time when the sun is highest here compared to the center of our time zone. Hence, sundials used here are different by 32 minutes compared to a timepiece using Eastern Standard Time.

While things may seem complicated as a result of human intervention, nature also has a say. A third discrepancy between clock time and sun time is the result of the nature of the solar system and the laws of physics. If the earth was not tilted on its axis and if it orbited the sun in a perfect c0ircle, the two corrections already discussed would suffice. But the earth is tiled on its axis and orbits in a slightly elliptical orbit. The combination of these two causes the sun to speed up and slow down slightly as it moves across the sky during the course of a year compared to a timepiece that moves at a uniform rate. This third discrepancy is referred to as the Equation of Time. The use of the word equation is misleading because it does not refer to an equation in the normal mathematical sense, but how it was used in the Middle Ages as an expression of the difference between values. The Equation of Time is simply a correction between when the sun is highest in the sky and when it would be highest if these two effects did not occur. The time discrepancy depends on the date, so there is no one value to use. On four dates that vary depending on if it happens to be a Leap Year, the Equation of Time is zero. On average, they occur on April 15th, June 13th, September 1st, and December 25th. On these dates, no correction needs to be made. But what about the others?

The timepiece, which uses a radio signal to adjust the hands based on a time defined by the National Institute of Standards and Technology, indicates a different time than the sundial on the previous page. Which one is correct?

To know what adjustment to make for other dates of the year, the Equation of Time can be shown as a chart or a graph. On a sundial that I am working on now, a small brass plaque affixed to the dial plate shows the correction for 83 days of the year. At certain times, the correction is nearly the same for many days, so there is no reason to show all 365 days. Many sundials represent the correction with a graphic called the analemma. It resembles a figure 8 and, in the past, could be found on many earth globes, but is now rarely seen. I once asked a representative of one of the largest makers of globes as to why they no longer display that. I was told that they believed most Americans did not understand its importance, so it served no purpose. I thought that was a sad commentary on how Americans have lost touch with the rhythms of the heavens. If you have a globe produced many years ago, you will likely find it along the Equator in the Pacific Ocean.

The Equation of Time has two extreme values. On February 11th, a timepiece will read time 14 minutes and 15 seconds faster than a sundial. On November 3rd, it will read slower by 16 minutes and 25 seconds. If Daylight Savings Time and the longitude correction are added to list, the result is that on March 14th, a sundial will read 12:00 p.m. when a timepiece reads 1:40 p.m. but on December 25th, the timepiece will read 12:32 p.m. and be different by only 32 minutes. The best advice is that when giving a commercial sundial as a gift, do it on Christmas. The recipient will think it is “broken” by only 32 minutes.

Obviously, the sundial is a useful timekeeping device only when the sun is shining. If it is and with the three time corrections discussed, it can be a reliable and fascinating way to keep track of time. But how accurate is it? The next installment of this series will examine how the sundial compares to other methods of timekeeping. Does it hold up to a fine Shinola watch? Is it as accurate as the atomic clocks of the United States Naval Observatory? Does anybody really care?

I once came across a sundial

that gave me a reason to smile.

But it turned to a frown

when I bent to look down.

The clouds made me wait for a while.

STUDENT HIGHLIGHT

BY ANDREW LAPEER

Image Credit: Andrew Lapeer
The Pleiades
The image is 30 minutes of integration at f/6.9. The data was collected the night of March 14.

Messier 45, commonly referred to as the Pleiades or the Seven Sisters is located in the Milky Way approximately 400 light-years from Earth. This data was collected using a Williams Optics Zenithstar 81 doublet refractor paired with a Sky Watcher EQ6-R Pro equatorial mount, Canon Rebel T7i, and a Williams Optics FLAT 6A III field reducer.

As for the photographer, my name is Andrew Lapeer. I am a recently accepted Astronomy and Astrophysics student at the University of Michigan Ann Arbor. There isn't anything I enjoy more than the cosmos, being able to take photos of cosmological objects that are an incomprehensible distance away and share them with the people around me is a feeling comparable to no other.

Image Credit: Andrew Lapeer
Equipment used to image the Pleiades shown above.

FREEING TRADE IS A SIMPLE MATTER OF PHYSICS

By Christopher Zin

In 1859, construction of the 120-mile-long artificial waterway known as the Suez Canal began. Over the course of ten years, workers carved through the Isthmus of Suez, like a worm through an apple, connecting the Mediterranean and Red seas. Its main purpose was to shorten trade routes that would otherwise have to travel around the southern tip of Africa. As this can cut weeks off a voyage, it is easy to see why a ship would want to worm its way through the canal. This is also why a stranded container ship blocking the canal was a global issue.

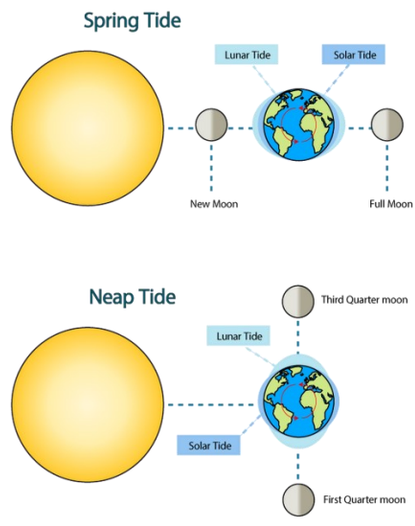
Location of the Ever Given. Source: New York Times and Airbus satellite imaging

On March 23rd, the Ever Given ran aground near the entrance at Suez and held up hundreds of ships, affecting roughly 13% of international trade. As this created a nearly $10 billion per day shipping delay, you can imagine how greatly the stuck crew wanted to worm their way out of that situation!

So, what does this have to do with astronomy and, more importantly, what's with all the talk about worms? Well, the heroine of our story is the greatest worm of all! Her name: The Worm Moon.

After nearly a week trying to dig the ship out and an assortment of other efforts, the solution was simple. Just add water. For mere humans, this is no easy task as the Suez Canal is connected to the world's oceans. The Moon though? She'll do it for free as she's passing by.

Tides are caused by the gravitational effects of the Moon. Earth's oceans will bulge outward when the Moon is directly overhead, as this is where the Moon's gravity is strongest. At the same time, another bulge will occur on the opposite side of Earth, where the Moon's gravity is weakest. This is known as high tide, as the local water levels will generally rise during the event. In between the bulges is low tide, where water levels are lower than average, a result of all the water gravitating to the high tide regions.



Orientations of the Earth, Moon, and Sun causing the tides. Source

By the same token, the Sun gets into the game too. While the effect is not as strong as that of the Moon, the Sun can serve to amplify or weaken the tides, depending on the alignment of the three celestial bodies. In particular, when there is a full moon in the sky, the high tides are at their highest. This is exactly the turn of events that occurred on March 29th. With water levels a foot-and-a-half higher than during normal high tide, workers freed the Ever Given and tugboats were able to pull it to safety.

So why worms? Well, the full moon that occurs during March is named the Worm Moon. This is likely a reference to the earthworms that emerge from the soil as spring begins or, as they are freed from the earth, as it were. Alternatively, Jonathan Carver, an 18th century sea captain, posits that the name comes from beetle larvae that surface around this time. Either way, it is a fitting name to end the story of how, through the combined efforts of the Earth, Moon, and Sun, the Ever Given was freed and global maritime trade was saved.

Local Skies: April

By Jonathan Schemke

The weather is warming, and the outdoor nights are becoming more palatable. This is a perfect time to go out and see the stars when you can. Michigan weather might make clear nights rare in spring, but evenings are generally pleasant, and the summer heat and haze hasn't yet set in.

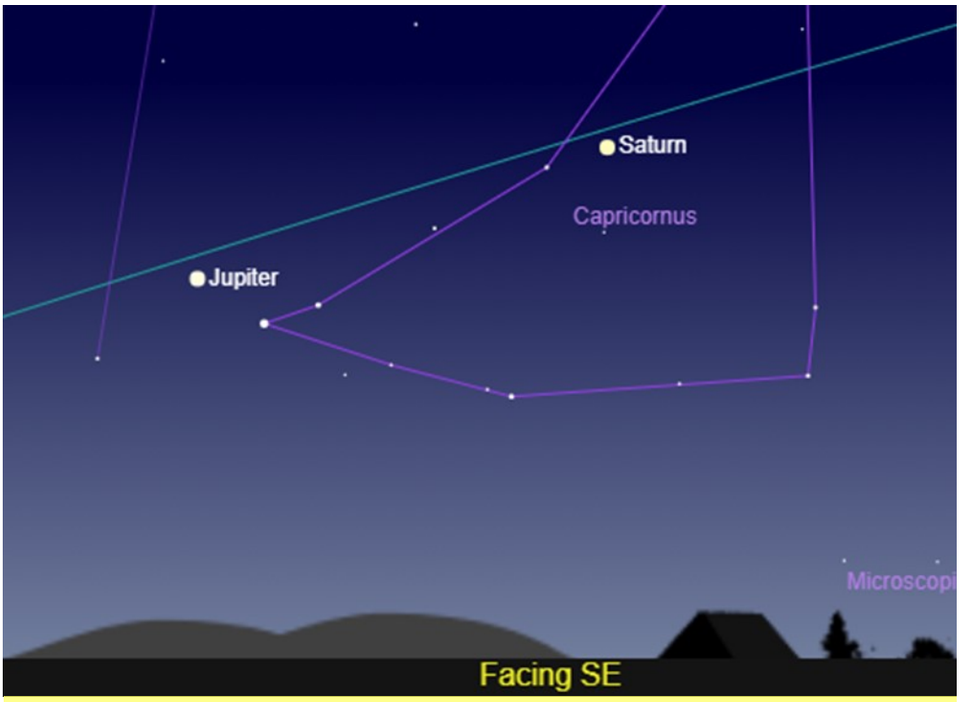
Planets

If you look to the west just after sunset you might catch red Mars right before it passes below the horizon.

April 9th, 2021 at 10:00 pm Eastern Time: Made using Sky and Telescope Interactive Sky Chart

If you catch a glimpse, keep in mind that a new NASA rover is in its second month on the red planet. As part of this mission a helicopter is planned to take the first flight on another world this month.

If mornings are better for you, Jupiter and Saturn are still visible just before sunrise above the southeastern horizon.



April 12th, 2021 at 6:15 am Eastern Time: Made using Sky and Telescope Interactive Sky Chart

The Moon

We have a *moonless* night on April 12th while the moon passes through its new phase. Our full moon this month is also a *supermoon*. This means that the full phase occurs while the moon is closer to Earth making it look slightly larger in the sky. This occurs on April 27th. The April full moon is sometimes referred to as the *Sprouting Grass* moon since it ushers in the growing season.

Meteor Shower

The Lyrids occur in April, peaking on the 22nd and 23rd. This means an increase in shooting stars visible throughout the end of the month. Although not the largest of showers traditionally, it does occur as the weather warms in the northern hemisphere making it a perfect time to just lay out and look at the sky.

I hope we all get to enjoy some beautiful skies in the coming months.

Student and Faculty Highlights

We want your submission!

Have you done, written, 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.

May Eclipse

Watch for the Moon to take on a reddish rust color during the Total Solar Eclipse on May 26. You will have to live stream it or plan to take a vacation in the path of the ecliptic in Eastern Asia, Japan, western North American, and Australia. You could also take a cruise on the Pacific Ocean for a great view, assuming the weather is cooperative.