WHAT'S UP IN NOVEMBER

By Bernie Reim

The month of November can be a little bleak with the fall foliage fading out and the snows of winter not here yet, but there will be plenty of exciting celestial highlights to make up for any terrestrial shortfalls. These include three bright planets perfectly placed in our evening sky, Saturn, Jupiter, and Mars in that order, another comet that could become visible to the naked eye by early next year, a potentially better-than-average Leonid Meteor shower, and the second total lunar eclipse for our country this year during the early morning hours of November 8.

NASA just had a great success with its DART (Double Asteroid Redirection Test) mission hitting the tiny moon, Dimorphos, of an asteroid named Didymos, which means "twin" in Greek. This is the first time we ever changed the orbit of a natural body in our solar system in a planned and measurable way. This is part of our new planetary defense system using a kinetic impactor. DART weighed about half a ton and was only 6 feet long. It was like smashing a golf cart into the Great Pyramid of Giza.

This happened at 4 miles per second and 7 million miles away. After traveling for almost a year, it scored a near perfect bulls eye only 17 meters off dead center of this tiny 500-foot in diameter moonlet. The main asteroid is about 5 times that large. It made a crater about 50 feet in diameter, one tenth the size of the moonlet, and forced out a plume of dust and debris 6,000 miles long and visible from earth-based telescopes.

They already calculated that its orbit was shortened by 32 minutes from the roughly 12 hours it used to be. Anything over 1 minute shorter would have been a success. They are still working on some details, but now we know for sure that we can use this method with great success to save our precious planet from a deadly asteroid impact if we need to. DART was just a test on an asteroid's moon that was never in any danger of actually hitting the earth.

NASA has not been so successful yet with getting its Artemis mission off the ground, but it has been officially rescheduled for November 14, so that is also good news.

Three bright planets now rule our evening skies. Just this past summer none of the planets were visible in the evening sky since they were all morning planets, which is very unusual. Saturn is still in Capricorn since it spends over two years in each constellation. It will set first, around 10:30 pm by the end of the month. It dims a little more this month since we are getting farther ahead of it in our faster orbit around the sun. Its rings are tilted at only 15 degrees and are getting thinner to our line of sight, which happens once every 29 years, which is the time it takes Saturn to orbit the sun. They will disappear entirely by 2025, as they last did in 1996.

Jupiter rises before sunset and is still up for most of the night since it is only a little over a month past its best opposition in 59 years which happened on September 26. Jupiter will also fade a little more this month as we race farther ahead of it around the sun, but it is still much brighter than usual and about 20 times brighter than Saturn.

Mars will be the real "star" of the evening sky this month and next. The red planet is getting closer and brighter every night this month as we rapidly catch up with it in our faster orbit around the sun. It already started its retrograde or westward motion against the fixed background of stars and it will reach opposition early next month on the 8th. It now rises by 9 pm in Taurus and it will rise two hours earlier by the end of the month as it will also get considerably brighter and larger. It starts the month at minus 1.2 magnitude, a little fainter than our brightest star, Sirius, which always shines at minus 1.4 magnitude in Canis Major. Then it

ends this month at a dazzling minus 1.8 magnitude, just one magnitude or 2.5 times fainter than Jupiter.

Notice how Mars forms an ever-changing triangle of orange objects in the Winter Hexagon. The orange giant star named Aldebaran in Taurus is about 15 degrees to its right and the red supergiant star, Betelgeuse in Orion, is about 20 degrees below it. Now is a good time to start looking at it through a telescope because you can see some great features on it like dark markings, both polar ice caps, and a little of its thin atmosphere. All of this makes it a much more real place, and we should learn much more about our neighboring planet soon since we will most likely be walking around on it by 2037.

Another comet was discovered in March of this year by the Zwicky Transient Facility at Mt.Palomar, which is a new wide field survey camera using the 48 inch Schmidt Telescope which also performed the original Mt. Palomar Sky Survey over 50 years ago . This is Comet C/2022 (ZTF) and is expected to peak at 5th magnitude by February, which makes it easily visible to the unaided eye. It only glows at 10th magnitude in Serpens Caput below Corona Borealis now, but it should get 100 times brighter over the next 3 months or so. It is on a parabolic path like all the comets in our solar system, originating in the Oort's cloud, which extends from 2000 to 100,000 astronomical units out, or 50 to 2500 times the distance to Pluto, which is about 40 A.U.

The annual Leonid Meteor shower is usually one of the 5 best meteor showers each year after the Geminids and Perseids. Even though a last quarter moon will rise around midnight this year to spoil much of the show, you can expect up to 250 meteors per hour during the morning of Saturday the 19th from a debris stream shed by its parent comet, 55P/Tempel-Tuttle back in 1733.

Every meteor shower is always better when its parent comet has just returned to shed much more debris into its permanent debris trail. Tempel-Tuttle orbits the sun every 33 years. Back in 1966 over 100,000 meteors per hour where seen from parts of our southwest and there were many great shows from 1999 through 2002. I well remember seeing nearly 1000 meteors per hour, classified as a true meteor STORM during the morning of November 18, 2001. It was right after 9/11 and there were almost no planes in the sky for the whole night. I saw an average of one meteor every 4 seconds and there was not a single lull of over 10 seconds, so it was basically raining meteors the entire night right up to the dawn. I saw up to 7 meteors in one single second all emanating from Leo the Lion, the radiant of this great shower.

There were about 30 of us at our new observatory in Kennebunk that we had just built the summer before. We also saw about 50 fireballs or bolides that night, which are caused by a pebble sized piece of this comet instead of just the dust that causes most of the meteors in any shower. Some of them were so bright that they would light up the whole sky as they exploded about 60 miles above us, right at the edge of space where the sky turns a permanent black as there are no more air molecules to turn the sky blue and let us breathe. Some of the twisting fiery trails lasted so long that many shorter meteors would streak right through those trails, truly a wonderful display of nature's awesome power, FAR more impressive than any human fireworks!

Usually you could expect something that magnificent out of the Leonids every 33 years, but that particularly spectacular show was caused by a much denser part of its trail that we will only pass through once every 99 years, so we have a long wait.

The last good highlight this month is another total lunar eclipse. That will start at 3 in the morning of Tuesday, Nov. 8, which also happens to be Sir Edmund Halley's birthday, just 366 years earlier. If he were around today, I am sure he would be impressed with how much more we know now than we did during his time, but maybe not with what we are doing with all that knowledge.

The umbral part of this lunar eclipse doesn't start until 4:09 am EST, when the moon starts to pass into the denser part of Earth' shadow. You won't really notice any darkening on the moon until that time. Then the total part begins at 5:16 and ends at 6:41 am when the whole moon will be completely immersed in our shadow. However, the sun will rise at 6:30 that morning and the full moon will set before it completely exits our shadow. That will be quite a sight to see the eclipsed moon setting as twilight dawns and the sun rises. I have seen dozens of lunar eclipses, but never one like this into sunrise.

The moon will be in Aries the Ram, near the Pleiades and Mars in Taurus. Watch how other celestial objects will become brighter as the moon gets darker. Jupiter will be just one constellation to the west in Pisces the Fish, but it will set soon after the eclipse starts. Our shadow always stretches nearly a million miles into space, but only when the sun, Earth, and moon are in perfect alignment can we see our shadow projected onto the moon or stand at the very bottom of the moon's shadow cone as it just brushes across the earth, barely reaching us at all since it only extends about 250,000 miles into space at all times.

The exact color that the moon will take on during a total eclipse is always a mystery. It can range from dark gray, almost invisible, to a bright copper orange with a bluish rim. That is called the Danjon scale, which goes from 0 to 4, dark to bright. It depends on the exact composition of our atmosphere at the time and how many particulates are floating around in it. The only reason the moon does not disappear completely is that our life-giving atmosphere acts as a giant lens and bends a little reddened sunlight around Earth and onto the moon to give it that great three-dimensional appearance, as if you could just reach out and touch it, only 1.3 seconds away at the speed of light. A more dramatic way to look at this effect is that what you are really seeing reflected back to you from our only natural satellite is the combined effect of all of the sunrises and sunsets seen simultaneously. The opposite of that is true when you are in the moon's shadow far a few fleeting moments and you can see a 360 degree sunrise/sunset all around you at once, thereby becoming aware of the entire atmosphere of Earth instead of just the sunrise or sunset part.

Nov.1. First quarter moon is at 2:37 a.m.EDT.

Nov.3. On this day in 1957 the Soviets launched Sputnik 2, sending the first creature into space, a dog named Laika.

Nov.4. The moon passes near Neptune and Jupiter today.

Nov.6. On this day in 1572 Tycho Brahe found a supernova in Cassiopeia before the telescope was invented.

Nov.8. Full moon is at 6:02 a.m.EST. This is the Beaver or Frosty Moon. It will also be fully eclipsed by the earth this morning. Look for the planet Uranus just to the left and above the moon while it is in our shadow. Edmund Halley was born on this day in 1656. I first saw his comet on his birthday in 1985.

Nov.9. Carl Sagan was born on this day in 1934. Uranus is at opposition today in Aries.

Nov.11. The moon passes 2 degrees north of Mars today.

Nov.16. Last quarter moon is at 8:27 a.m. EST.
Nov.17. The Leonid meteor shower will peak this morning.
Nov.19. The American astronomer Eleanor Helin was born on this day in 1932. She was the lead investigator on NEAT (Near Earth Asteroid Tracking) and discovered several comets and asteroids.
Nov. 20. Edwin Hubble was born on this day in 1889.
Nov.23. New moon is at 5:57 p.m.
Nov. 24. Jupiter is stationary today, ending its retrograde motion.
Nov.28. The moon passes 4 degrees south of Saturn tonight.
Nov.30 First quarter moon is at 9:37 a.m. Mars comes closest to Earth today at 50.6 million miles away, but it will not reach opposition until December 8.