

*“How faint the tune. Somewhere there's heaven.
How high the moon?” (Ella Fitzgerald)*

One of the joys of Amateur Astronomy is the sense of wonder one can feel from exploring and understanding the nature that surrounds us. On Christmas day, while we were driving east on I-85, my wife and my mother-in-law noticed that the moon appeared red in color and much larger than normal as it passed the horizon. Then, as we continued, the moon seemed to return to its normal color and size as it rose into the sky. What was going on?

50 years ago last Christmas, Apollo 8 flew humans around the far side of the moon for the first time. This year, on Jan 2, China landed a probe on the far side of the moon. And, on Jan 20-21, we will witness a Total Lunar Eclipse!

In honor of these events (and at Debbie's request), I am devoting this month's newsletter to the Earth's moon.

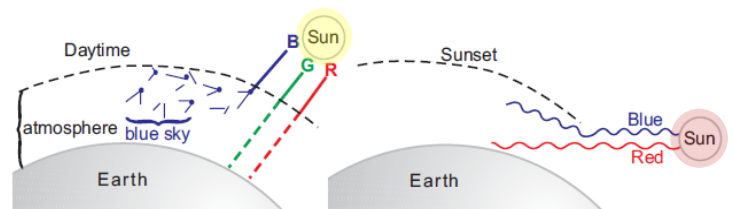
The moon is the earth's largest natural satellite. It is 1/6 the size of the Earth and subtends an arc of about ½ degree from our vantage point. It revolves around the earth on an elliptical orbit once every 27.3 days (or 29.5 days relative to the sun), with an average distance of about 240,000 miles. When it is closest to the earth, it is at perigee, and when it is farthest from the earth, it is at apogee. The moon is called new when it is between the earth and the sun and therefore not visible at night. It is called full when it is opposite the sun from the earth and fully visible throughout the night. **This month, the moon will be NEW on Jan 5 and FULL on Jan 21.**



Why does the moon sometimes look red? In fact, the moon never actually changes color. What changes is how the earth's atmosphere affects the light through a process known as "Rayleigh Scattering:" Air molecules and microscopic particles in the earth's atmosphere scatter shorter

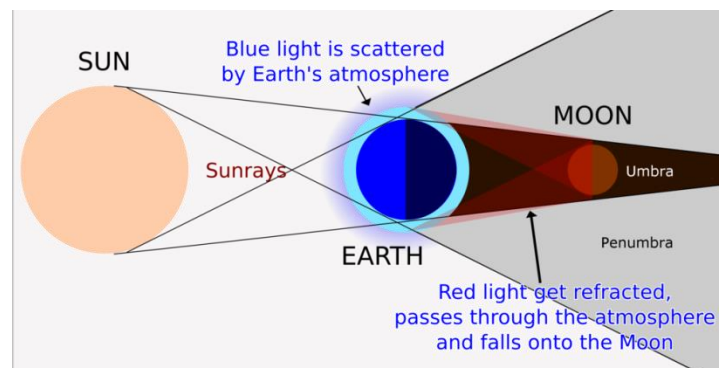
wavelengths of light (yellow, green and blue) more than longer wavelengths (orange and red). The more atmosphere that light has to pass through, the redder the light will appear.

During the day, when the sun is high overhead, the scattered light makes the sun appear yellow and the sky appear blue. However, when the sun is low on the horizon, light passes through more of earth's atmosphere and scatters more, making the sun appear orange and the sky appear red. (As my father-in-law, a Navy vet, used to say: "Red sky at night: a sailor's delight!")



Likewise, at night, the moon appears white high in the sky, but red on the horizon when the reflected sunlight is scattered through more atmosphere. Since moonlight is significantly dimmer than sunlight, our eyes can't detect the same yellow and blue colors that we see during the day.

The situation is slightly different during a Lunar Eclipse: Instead of reflecting white light from the sun, the moon is hidden from the sun by the earth. This time, the direct rays of the sun pass through and are scattered by the earth's atmosphere, producing a red shadow behind the earth, called the Umbra. The moon reflects this red light back to earth, making the moon look red. We call the moon at this moment a "**Blood Red Moon.**"



Why does the moon sometimes look larger than normal? In fact, the moon's size doesn't change – it is always about ½ degree in size. The apparent larger size of the full moon near the horizon is actually an optical illusion. Next time you see

it looming large on the horizon, test it yourself: “Cover” it with a small object like an aspirin tablet. Then when it is high in the sky, do it again. You’ll see that it is the same size! There are many theories why it seems bigger – perhaps our brains are just comparing it to the surrounding landscape and drawing a false conclusion.

The moon DOES appear SLIGHTLY (only about 15%) larger when it is full during perigee. This is called a Supermoon.



Are there more birth, emergency room visits, or car accidents during Full Moons? Nope. While many medical and lay people still believe this, studies have shown that the full moon has no effect on human behavior. Perhaps we are just more aware of significant events during full moons.

The Total Lunar Eclipse: On Jan 20, the moon will be FULL, at PERIGEE, and ECLIPSED by the earth, and therefore known as a **BLOOD RED SUPERMOON**. At **9:37pm on Jan 20**, the moon will enter the penumbra and begin to darken. Then, at **10:35pm**, the moon will begin to disappear into the earth’s shadow (the umbra). By **11:42pm** the moon will be completely eclipsed *and it will begin to glow red*. The midpoint of the total eclipse will be at **12:13am on Jan 21**. The moon will begin to emerge from umbra at **12:44am**, and will be fully visible again at **1:51am**. However, the moon will remain dim, still in the penumbra, until **2:48am**. See *in-the-sky.org* for a great animation and timetable of these events.

Solar System: Mars (now in Pisces) continues to keep pace with the Earth and is bright red in the southwestern sky at night. Neptune (in Aquarius) will set later this month for the season, followed closely by Uranus (in Pisces). Venus and Jupiter are bright in the early morning sky; on Jan 22 they will be in conjunction (same right ascension), appearing within 2.5 degrees of each other.

Deep-Sky: During the wintertime, the earth’s night sky faces away from the center of our galaxy, and the outer rim of the Milky Way glows from north to south. Within the

plane of the milky way, stars form in gas clouds called “nebulae,” then stay in “open clusters” as the slowly move away from each other to become “mature stars.”

This month’s deep sky challenge is to observe a beautiful line of open clusters between Auriga and Orion, high overhead. From north to south, **M38, 36, 37** and **M35** are easily visible with binoculars as small fuzzy clouds amidst the rich star field of the Milky Way. In larger telescopes, the bright, jewel-like individual stars are easily seen. Nearby, in Auriga, look for dimmer clusters **NGC 1931, IC 417, NGC 1893,** and **IC 405 (The Flaming Star Nebula)**. These beautiful clusters are still surrounded by the nebula in which they were born only a few million years ago. Similarly, the bright cluster **NGC 2244**, surrounded by its nebula **NGC 2237 (The Rosette Nebula)** shines in Monoceros, just east of Orion.

- Jim Feiste, January 2019

Deep Sky Challenge Map (from SkySafari) – FACING SOUTHEAST

