AOH Newsletter

Winter 2025

News and Notes

Recent Events

The Annual Pizza Party, Business Meeting, and Elections of the Board of Directors and Officers was held in November. Minutes of the meeting are posted online. Highlights of the minutes include the Treasurer's report that our current treasury balance is over $8500, the Secretary's report that the membership count is over 60 (an all-time high) and that the 2025 calendar of activities tentatively contains an Anniversary Potluck and three Albee Creek Star Parties. The President and Vice-President reported on the increase of club equipment, necessitating a move to a larger storage locker (the Board approved the additional expense) and requested ideas for the disbursement of unneeded stuff. Finally, the General Membership elected the Board of Directors for 2025 (see photo) and then the Board-Members-Elect elected the Officers (Brent Howatt, President; Mark Wilson, Vice-President; Ken Yanosko, Secretary; and Catrina Howatt and Bob Zigler, co-Treasurers).

The 2025 Board of Directors. Front: Mark Wilson, Ken Yanosko. Back: Bernie Christen, Catrina Howatt, Rick Gustafson, new member Allison Waltberg, Brent Howatt, new member Roger Coy, Bob Zigler. Photo by Grace Wheeler.

We had regular Zoom meetings in October and December. Participating were Allison, Ann, Bernie, Brent, Catrina, Frank, Grace, Johann, Ken, Maggie, Mark, Rick, Roger, Yoon, and guest Phyllis.

October was a busy outreach month (see the photos on pages 3-4). Roger and Susan Coy met with students, teachers, and parents at Skyfish School in Briceland for a sky lesson and some telescope observing. Catrina, Brent, Yoon, Mark W, Russ, Don, and Grace attended Science Night at College of the Redwoods and did some indoor hands-on activities as well as some lunar observing outdoors. And Brent, Catrina, Mark W, Allison, and Johann were on hand for Kneeland School's Trunk or Treat event, handing out astronomy-related goodies.

We had two clear nights (out of three) for observing at Kneeland (see pictures on pages 4-5). October 5 brought out 11 club members, a half dozen adult visitors, and a troop of girl scouts, who enjoyed seeing the Moon, Saturn, and the Andromeda Galaxy through a telescope and an impromptu Autumn star talk by Allison. On November 30 there were 14 Members, two former members (who promised to rejoin) and a couple of visitors. Grace gave a lesson on using the Seestar and did some non-Seestar photography. We were visited (interrupted?) by some Low-Earth-Orbit objects (first ISS and then a flock of newly-hatched Starlinks). An interesting sight was the appearance of the Starlinks an orbit later, now spread apart, popping up on the western horizon and then at no more than 20 degrees of altitude disappearing into the Earth's shadow. I haven't heard any UFO reports of this kind of phenomenon, but if anyone who didn't know what they were saw them, I imagine it would have been quite puzzling.

And in between our scheduled observing sessions Comet Tsuchinshan–ATLAS made an appearance (see pictures on page 6) and the aurora put on another spectacular show (see pictures on page 7 and Grace's article on pages 9-13).

Upcoming AOH Events

AOH will have Kneeland observing sessions on December 28, February 1, and March 1. Be sure to check the website and your email inbox in the days leading up to these dates for any weather-related changes in plans. We will also have Zoom meetings, rain or shine, on January 11, February 15, and March 15. The big event for the Winter months will be the Annual AOH Anniversary Potluck Dinner on February 22. Again the event will be at the Eureka Woman's Club, 1531 J Street in Eureka. Our featured speaker this year will be Dr. Susan Terebey of the Cal State LA Department of Physics and Astronomy. Dr. Terebey's field of specialization is Star and Planet Formation. Watch the Club Web Page for more details as that date approaches.

Upcoming Sky Events

Meanwhile, all five outer planets will be lining up for our inspection. On the night of January 1, Mars is rising in the east at 6 pm, while Saturn stays up in the west until its setting time at 10 pm. And Jupiter, Uranus, and Neptune will line up along the ecliptic in between them. In the meantime, all along, Venus is ruling the evening sky. On the night of March 1, the thin crescent Moon makes a nice appearance alongside. Then when the Moon moves out of the way, crescent-shaped Mercury pops up to take its place, fresh from its inferior conjunction with the Sun and reaching its greatest eastern elongation on March 7.

There will be a total lunar eclipse the night of March 13-14 beginning at 9 pm and ending at 3 am. The total phase lasts from 11:26 pm until 12:31 am. These are our Pacific Daylight Times; don't get fooled by civil calendars that might tell you that the eclipse is on March 14; the eclipse maximum occurs at 11:59 pm on the 13th, which is of course after midnight and therefore on the 14th for 2/3 of the globe and for most of the world's population.

Calendar

The 2025 AOH Calendar is now available for members to view and download at https://www.astrohum.org/members_only/calendar.php.

Dues

And don't forget that 2025 dues are due. If you haven't already done so please go to https://www.astrohum.org/membership.html and print and mail or submit your membership info and your $25.

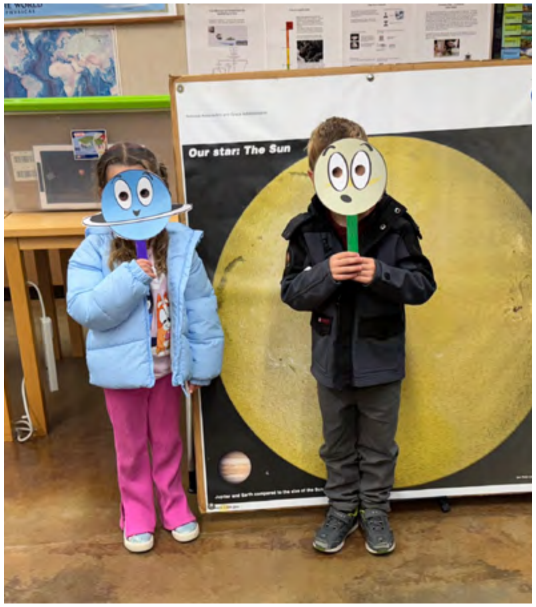
Thanks

As usual, thanks very much to all who helped put together the Newsletter, especially to Allison, Brent, Catrina, Diana, Frank, Grace, Joe, Johnny, Mark, Susan C, Susan F, and Susie.

—*Ken*

Photos


Roger with students at Skyfish School in Briceland, giving a telescope lesson in daylight and observing at night (note the auroral glow in the background). Photos by Susan Coy.

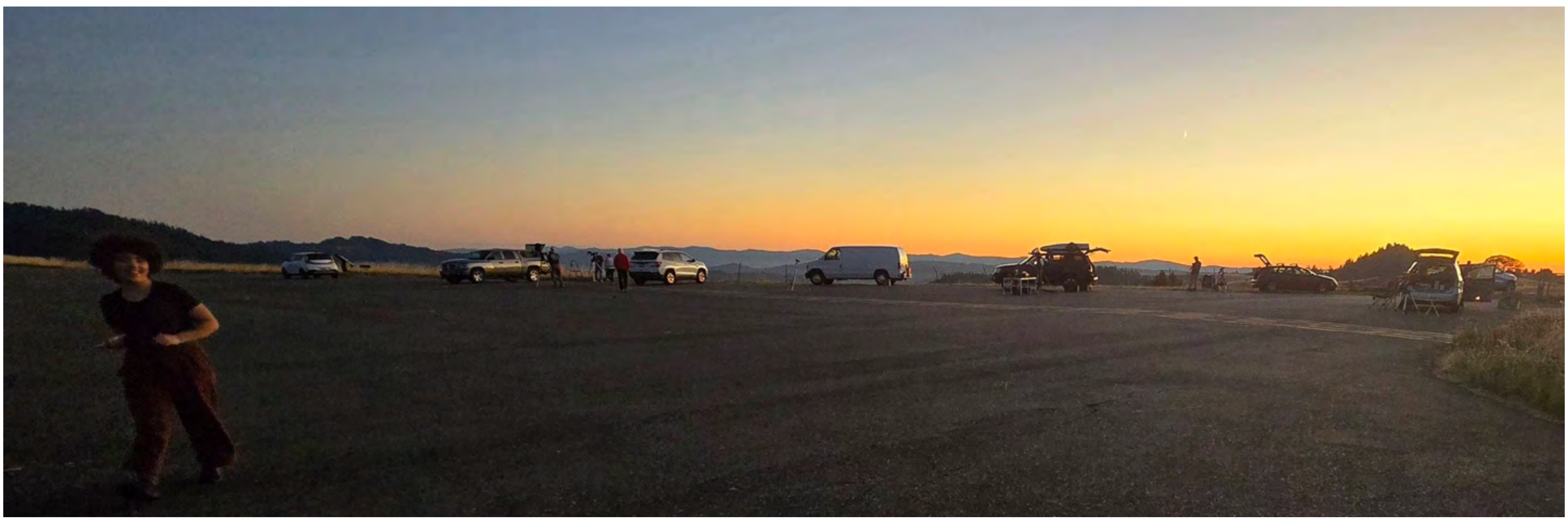
Russ explaining the Solar System, and kids enjoying their planet masks,

Catrina and Yoon at CR Science Night. This photo and those opposite by Grace Wheeler.

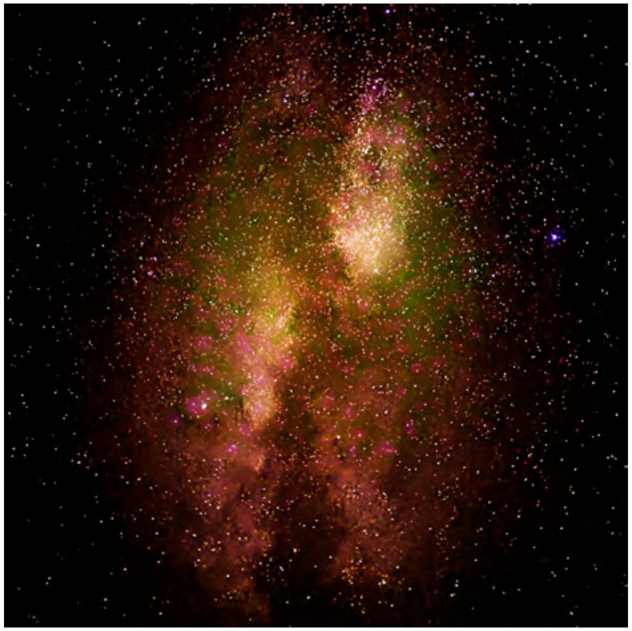
Outside at CR, the Moon came up just in time to get in some observing.

AOH participated in Kneeland School's Trunk or Treat event on October 26. Brent, Mark W, Allison, and Johann represented AOH and handed out astronomy-related trinkets. Photo by Brent Howatt.

Venus and the Moon at Kneeland on October 5. Photo by Catrina Howatt.



Setting up at dusk at Kneeland on October 5. Photo by Johnny Thomas.



Left: A piece of the Milky Way containing the "Great Rift" dark nebula. Center: IC5146, "The Cocoon." Right: M31, "The Andromeda Galaxy" with its satellite M110 at the top edge of the frame.
Photos taken at Kneeland on October 5 by Catrina Howatt using Grace Wheeler's Seestar.

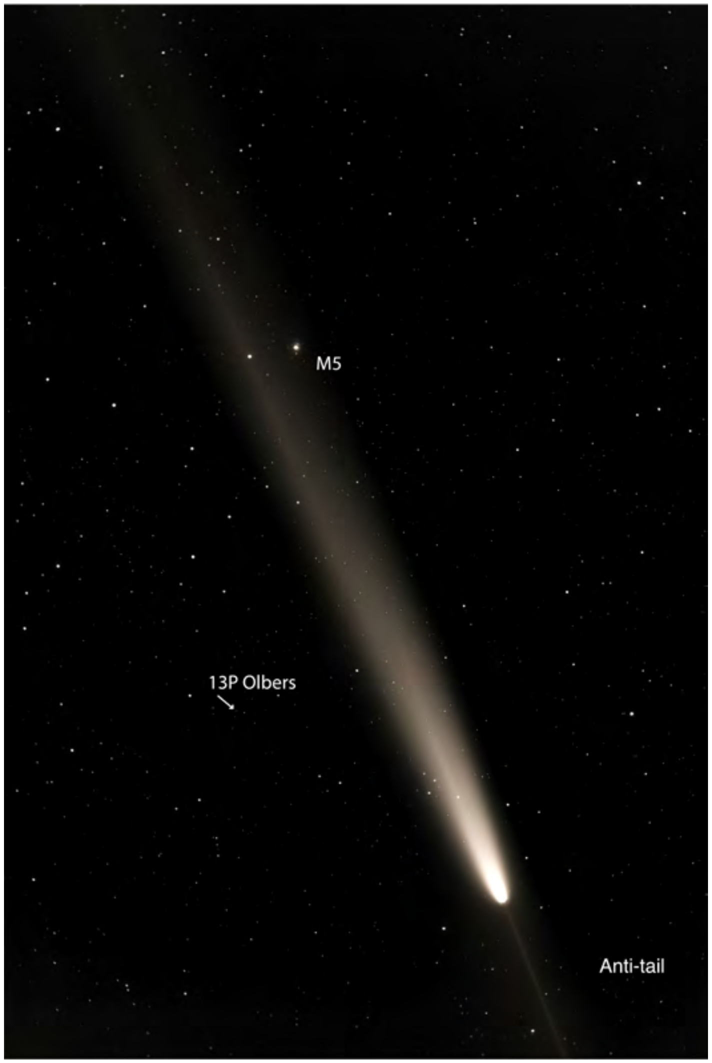
Left: Orion rising over the windsock and the Big Dipper hugging the northern horizon. Above: the usual suspects: Brent, Mark, and Ken.
Photos taken at Kneeland on November 30 by Catrina Howatt.

Comet A3 Tsuchinshan-ATLAS. Photos from Kneeland Road. Top: by Diana Minton on October 13; Bottom by Johnny Thomas on October 15.

Right: the comet on October 14 at Kneeland Airport by Grace Wheeler. The globular cluster M5 is visible in the tail of the comet, about 4 degrees from its nucleus. Also, to the left of Comet A3 is the faint comet 13P/ Olbers, with a magnitude of 11.5. (See the enlarged image below.)

The large image also shows the comet's anti-tail, which is directed toward the Sun. The anti-tail is composed of particles that the comet has deposited along its orbital path. When Earth passed through the orbital plane of the comet these cometary deposits were backlit by the Sun, creating the anti-tail (https://earthsky.org/space/comet-a3-has-an-anti-tail-can-you-see-it/).

The image was captured using a 71mm refractor and a Canon EOS Ra (ISO 640, 8-second exposure). The total integration time was 4.2 minutes.



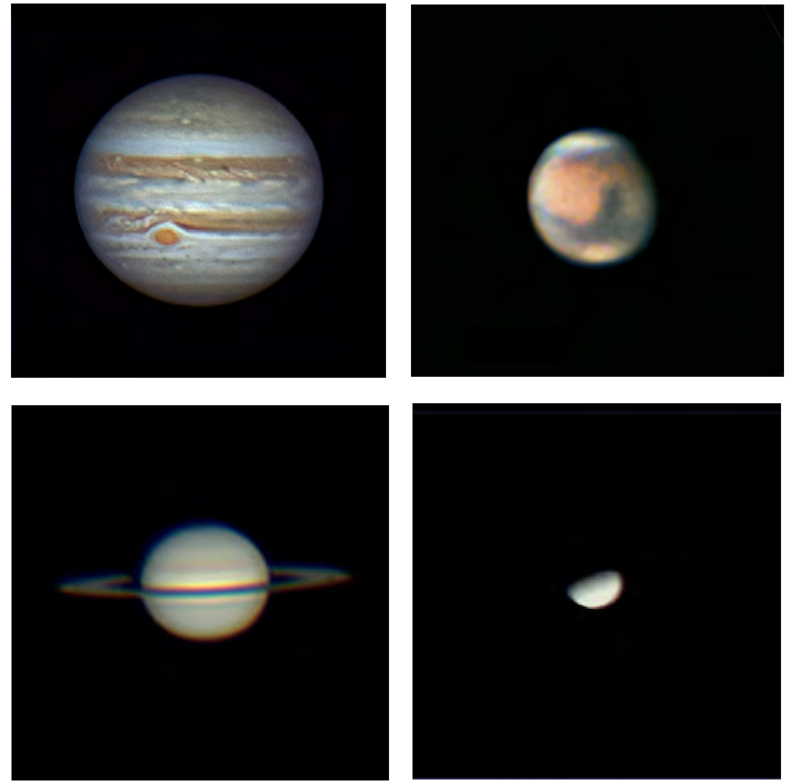
Left: Diana Minton caught the aurora from Kneeland on October 10.

Right: Also on October 10 Ken was on the cruise ship Viking Octantis *on the St. Lawrence River when the aurora appeared overhead. This photo is courtesy of the ship's photographer.*

More of he aurora from Kneeland on October 10: composite of photos by Brent Howatt, who was enjoying his very first aurora.

See more aurora photos in Grace Wheeler's article on pages 9-13.

Above: Grace Wheeler captured this aurora video from the Kneeland Sky Cam. Click on the picture to view. If your browser/pdf viewer doesn't show the animation, go [here](#) to download or view the clip.



Grace Wheeler also got some planet shots. Above are Jupiter on November 29 with its Great Red Spot; Mars on November 16 showing its Northern Ice Cap, Hellas Basin, and Syrtis Major; Saturn on November 30 with its rings looking narrow and dark because of the angle of the ring plane to us and to the Sun; Venus on November 30, 68% full (Or is it 32% empty?).

Left: Frank Simpson sends this clip from Novato of the sunrise over "Mt. Diablo-Henge" on Tuesday morning, October 29th, 2024. Click on the picture to view. If your browser/ pdf viewer doesn't show the animation, go [here](#) to download or view the clip.

Seestar in McKinleyville. Mark Wilson, after a lesson from Grace, got the Orion Nebula from his light-polluted yard.

Solar Cycle 25: The Twin Auroras of October

by Grace Wheeler

The October 7th Aurora

The first 10 days of October were an exciting time for aurora chasers. It began with Sunspot 3842 (Fig. 1) releasing an X7.1 solar flare on October 1, followed by an X9.0 flare on October 3. The X9.0 was the strongest solar flare observed so far in Solar Cycle 25.

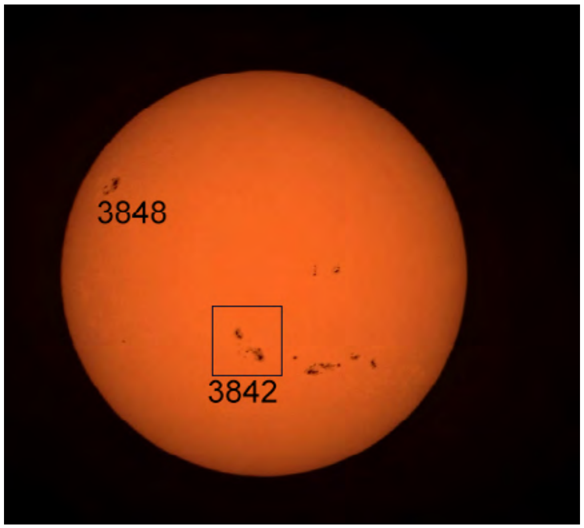


Figure 1: An image of the Sun taken on October 3rd. Sunspot 3842 is visible on the solar disk and was the source of the X9.0 solar flare that caused the auroral storm of October 6-7. On the eastern limb, Sunspot 3848 is rotating into view. In a few days, this sunspot would also become active, and erupt with an X-class solar flare.

The solar disk was captured using a Seestar 50. (Image credit: GDW.)

The coronal mass ejection (CME) from the X7.1 solar flare was relatively faint, and when it reached Earth, it caused only a minor G1 storm. As a result, the aurora was visible only at high latitudes. The CME from the X9.0 flare, however, was more substantial, prompting the NOAA Space Weather Prediction Center (SWPC) to issue an alert for a strong G3 storm on Saturday, October 5. Many of us in the lower mid-latitude areas of the U.S. had hoped for a Saturday night aurora, especially since it would coincide with the new moon. However, the CME didn't reach Earth until Sunday morning, and the solar winds were weaker than expected which caused the geomagnetic storm to be downgraded to a moderate G2 storm. Despite the weakening of the auroral substorm, the event still produced an auroral display visible from the northern border states to as far south as Ohio, Indiana, and New York (Fig. 2). I also followed these developments on the Facebook group Northern Lights Alerts; I was heartened that the aurora had been seen in Virginia and Missouri. I hoped the storm would last long enough for nightfall on the West Coast so we might see the aurora in Northern California. Unfortunately, by the time it got dark on the West Coast, the storm had weakened, and aurora sightings were limited to Idaho, Washington, and Oregon. By late Sunday night, I had given up on seeing the aurora. Little did I know, the storm was still active, and I would get a second chance on the evening of October 7th.

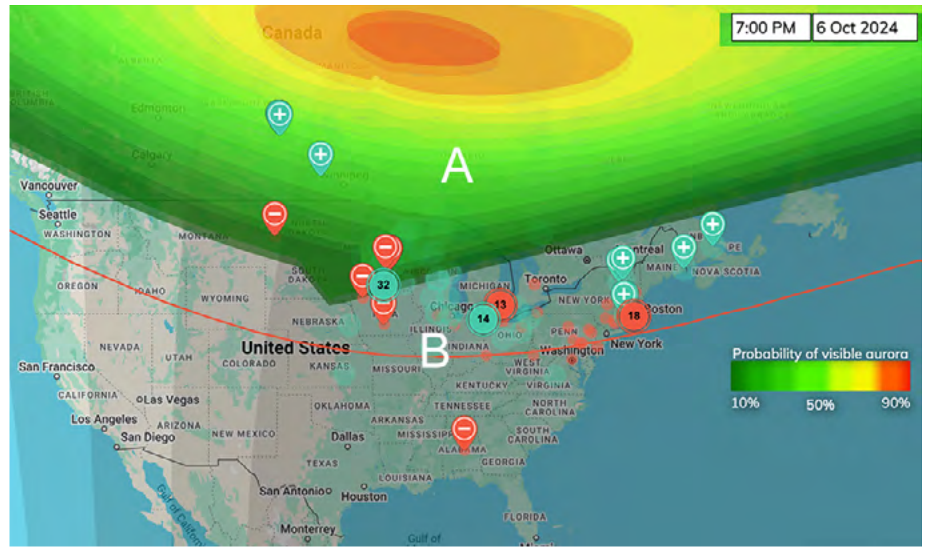


Figure 2. The Aurora forecast for October 6th at 7 p.m. PDT/10 p.m. EDT. (A) The auroral oval is color-coded to show the probability of an aurora in areas contained within the oval. There was a 90% probability in the high latitude of Canada and 10% in the northern U.S. border states. (B) The red line shows the southernmost extent of the view line for the aurora. (C) The plus and minus signs are the respective positive and negative sightings that were reported. (Image credit: aurorasaurus.org with modifications by GDW.)

I was fortunate that night to be at the Kneeland Airport doing astrophotography. During the imaging session, I noticed a faint haze to the north, so I checked my phone for the tell-tale signs of an aurora. I saw sensor noise and dismissed it as just haze and wishful thinking. Had I looked at the long exposure pictures (Fig. 3AB), my impression would have been different as the aurora could be seen in these images.

Figure 3. The aurora on October 7-8, as observed from Kneeland Airport. Early in the evening (8:15 p.m. and 9:30 p.m.), the auroral lights were not visible to the naked eye or on a cell phone screen. However, they appeared in images captured with a 3-second exposure. As the evening progressed, the aurora became visible to the unaided eye, with distinct pillars observed at 10:30 p.m. and 1:30 a.m. The active auroras (C, D) were predominantly red, with some green visible beneath. (Image credit: GDW).

As the storm intensified, two photographers, Diane and Rob, arrived at the airport and joined me on the runway. They had been down the hill photographing the Draconid meteor shower and watching the aurora. For the next 45 minutes, we watched a spectacular display of towering rays against the backdrop of stars (Fig. 3C). The storm subsided at 11:15 p.m., and the haze returned. Diane and Rob left, but I stayed, hoping for more aurora activity. At 1:30 a.m., as I was packing up, I witnessed one final intense display of lights (Fig. 3D). I later learned that the aurora was caused by a strong G3 storm with a Kp index of 8. It turned out to be a prolonged and widespread event that had surprised many aurora forecasters (Fig. 4).

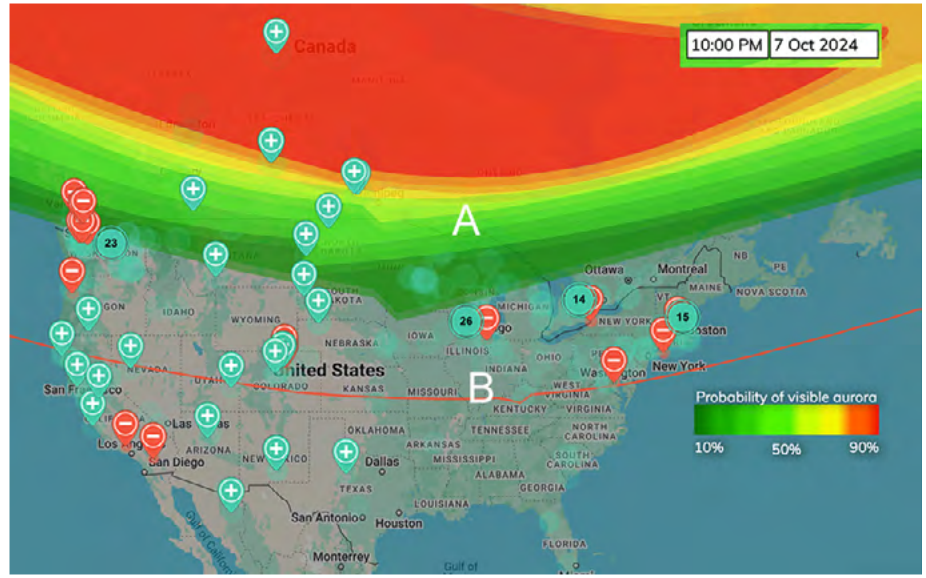


Figure 4. The aurora forecast for October 7 at 10 p.m. PDT. (A) The color code for the areas contained within the oval showed that there was a 10% probability of an aurora in the northern border states of the U.S. and an increased chance in the higher latitude areas of Canada. (B) The southernmost extent of the view line ran through the middle of the U.S. and included northern California. (3) The plus and minus symbols correspond to the respective positive and negative sightings that were reported. (Image credit: aurorasaurus.org with modifications by GDW.)

The October 10th Aurora

If aurora chasing couldn't get more exciting, on the morning of October 8, an X1.8 flare erupted from sunspot region 3848 (Fig. 5). The sunspot had been quiet but had recently developed a complex and volatile magnetic field. Located just north of the Sun's equator, it was in the direct line of sight with Earth. When the flare erupted, it produced a sizable, fast-moving CME directed toward Earth. The next day, NOAA issued a severe G4 storm alert for October 10th. The storm had a Kp index of 8, with a forecast that the aurora would be visible in southern

Oregon and northern California. The CME arrived on the morning of October 10 (U.S. EDT). It was nighttime in Europe, so I knew observers there would be the first to see the aurora. Social media quickly lit up with reports of a strong auroral storm in Europe, visible as far south as the UK and France. For us West Coasters, we would have to wait another 12 hours to see if the storm would last.

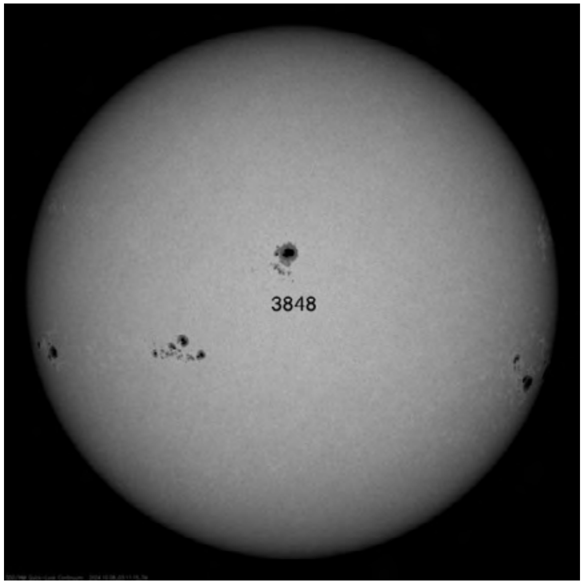


Figure 5. Sunspot Region 3848 was nearly in the center of the Sun on October 7 when an X1.8 solar flare erupted. The CME that followed was directed towards Earth. The image of the solar disk is from the HMI intensitygram (gray) of the NASA Solar Dynamic Observatory (https://sdo.gsfc.nasa.gov).

We were fortunate that the auroral storm persisted, allowing us to view the aurora for several hours. Don and I arrived at the Kneeland Airport at 8 p.m., joining AOH members Brent, Catrina, Mark Wilson, and Joe Eiers on the tarmac. Observing conditions were not ideal due to partly cloudy skies to the north and a quarter moon overhead. I suspect that the moonlight diminished the aurora's visibility somewhat—the green hue often seen at the lower part of the aurora was muted. Early in the evening, the aurora was in its "quiet arc" phase (Fig. 6D). While occasional rays were visible (Fig. 6A), the lights were mostly diffuse and dim (Fig. 6B). At this stage, the aurora was difficult to see without the aid of a cell phone.

As the evening progressed, the storm became more active, and the aurora became visible to the naked eye. The active aurora displayed deep red hues, with bright pillars appearing more frequently (Fig. 6C). This increased activity was likely due to our location rotating towards the "midnight" sector of the auroral oval (Fig. 6D), where auroral activity peaks. This region is where most of the auroral electrons enter the atmosphere from the magnetotail (https://www.swpc.noaa.gov/content/aurora-tutorial).

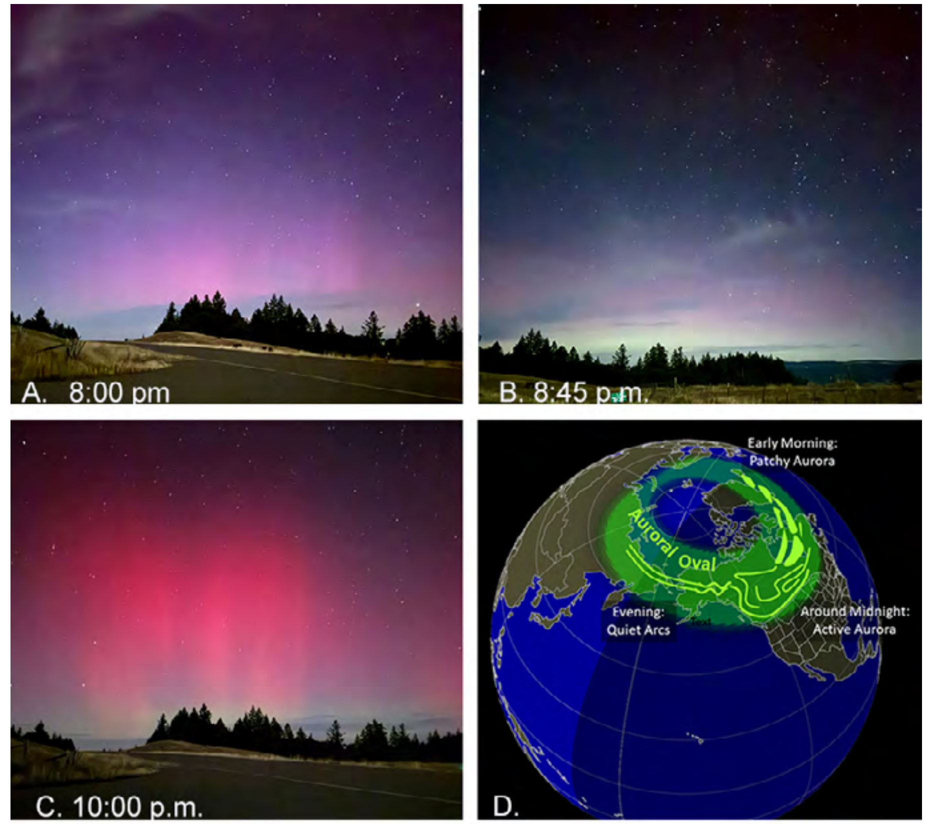


Figure 6. Images of the aurora from 8 p.m. to 10:00 p.m. Images A (8 p.m.) and B (8:45 p.m.) represent "quiet arcs" that are seen in the early evening auroral oval. Image C (10 p.m.) represents the transition to "active aurora" as our location rotates into the midnight section of the auroral oval. Image D shows the auroral oval with the three different phases: evening, midnight, and early morning.
(Image Credit: Images of the aurora were taken by GDW. The diagram of the aurora oval is from https://www.swpc.noaa.gov/content/aurora-tutorial.)

We left the airport at 10 p.m., but Mark and Joe stayed until after 1 a.m. Joe later sent me this report along with some pictures (Fig. 7).

> "Last night, after you left, it was just Mark and I out there watching the northern sky build up a white glow. Around 11:15, we started seeing beautiful white pillars form across the northern sky, reaching about 30 degrees high. This continued steadily for an hour, and at its peak, we saw green, red, and white sheets of light with the pillars moving back and forth. Unlike in May, the activity was confined to the north and didn't get higher than about 45 degrees at most. However, it was incredibly active, constantly changing, and didn't wind down until around 1 a.m. Thought you might enjoy our report."

Figure 7. Images of an active aurora taken from the Kneeland Airport on Oct. 10-11. (Image credit: Joe Eiers.)

How strong was the October 10th storm? NOAA reported that this was a G4 storm with a KP of 8.75. While it was not as strong as the G5 magnetic storm of May 10th, it came close. The October 10th storm was long-lasting and seen throughout the U.S. Figure 8 is the Aurorasaurus map showing the forecast for the southern extent of the view line. Based on ground sightings, the view line went much farther south.

SAR Arcs

In addition to the aurora, we observed two deep red plumes of light to the northwest and southeast of the airport (Fig. 9). I later learned these were SAR (Stable Auroral Red) arcs. SAR arcs are distinguished

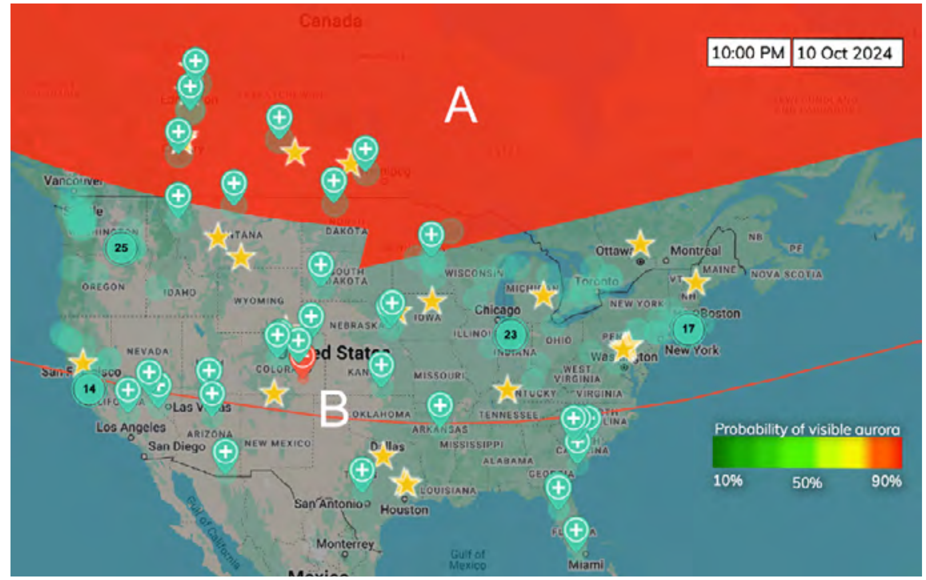


Figure 8. The aurora forecast for October 10th at 10 p.m. PDT (Aurorasaurus.org.) (A) The probability of an aurora in the areas contained within the oval was 90% in Canada. The high probability was also seen in some of the northern border states of the U.S. (B) The southernmost extent of the view line reached into the lower mid-latitude states. (C) The plus and negative signs are the respective positive and negative sightings that were reported. (Image credit: aurorasaurus.org with modifications by GDW.)

by their deep red color (6300 nm), consistent intensity, and stationary appearance. This sets them apart from auroras, which can appear green, red, or purple and are dynamic, changing in intensity and movement within seconds. SAR arcs are typically oriented east to west and occur at higher altitudes than auroras. When observed together, the SAR arc often positioned high above the aurora (Fig.10.) Additionally, while auroras are generally high-latitude phenomena, SAR arcs can appear at lower latitudes, sometimes without an accompanying aurora.

Both auroras and SAR arcs are driven by geomagnetic storms, though the mechanisms behind them differ. Auroral substorms occur when the magnetic fields of solar winds interact with Earth's magnetosphere. This interaction energizes electrons within the magnetosphere, which then enter the atmosphere near the magnetic poles and excite gas molecules. In contrast, SAR arcs are formed when particles in the ring current—a belt of protons and electrons encircling Earth's equator—heat

Figure 9. SAR arcs were observed to the northwest (far left) and southeast (far right) of Kneeland Airport. A composite view of the SAR arcs in relation to the auroral arc was created by "stitching" together five images taken between 8:45 and 9:15 p.m. This composite image illustrates the positions of the SAR arcs relative to the auroral arc. The following stars/DSOs were identified, and their azimuths were used to approximate the compass headings of the SAR arcs and the auroral arc: 1. Alphecca (286°); 2. Dubhe (345°); 3. Capella (37°); 4. Pleiades (65°); 5. Hamal (81°) (Image Credit: GDW.)

Figure 10. Aurora, SAR, and the Milky Way (Astronomy Picture of the Day). A screenshot of a timelapse video of the May 11th aurora. The pink and purple auroral arc sits near the horizon. Above the aurora is the red SAR arc. The Milky Way is to the left. The timelapse video can seen here: https://www.youtube.com/watch?v=fisAZYNwDgk
(Credit: Jeff Dai (TWAN). CC BY)

up during strong geomagnetic storms. The heat is transferred to the top of the ionosphere, where it excites oxygen atoms, producing the characteristic red glow. A more detailed explanation of SAR arcs can be found here: https://www.sfgate.com/bayarea/article/sar-arc-red-glow-california-geomagnetic-storm-18476121.php.

Although SAR arcs are considered rare, the high solar activity during Solar Cycle 25 may be increasing their frequency. Social media posts have reported sightings of SAR arcs during the auroras of May 11, October 7, and October 10. I'll be searching for them during my next aurora encounter.

The Peak of Solar Cycle 25

On Oct. 16, NOAA and NASA issued a press release announcing that the peak of Solar Cycle 25 had been reached. They anticipate high solar activity in 2025, potentially extending into 2026. If you've missed recent auroras, keep an eye out for announcements from NOAA SWPC, social media (Facebook and X host several groups dedicated to aurora chasing), astronomy news websites such as Space.com, and EarthSky.org, or solar activity monitoring websites like SolarHam.com and SpaceWeatherLive.com.

You can also report your aurora observations on Aurorasaurus.org, a citizen science program that brings aurora scientists and chasers together. The website also provides real-time aurora sighting updates.

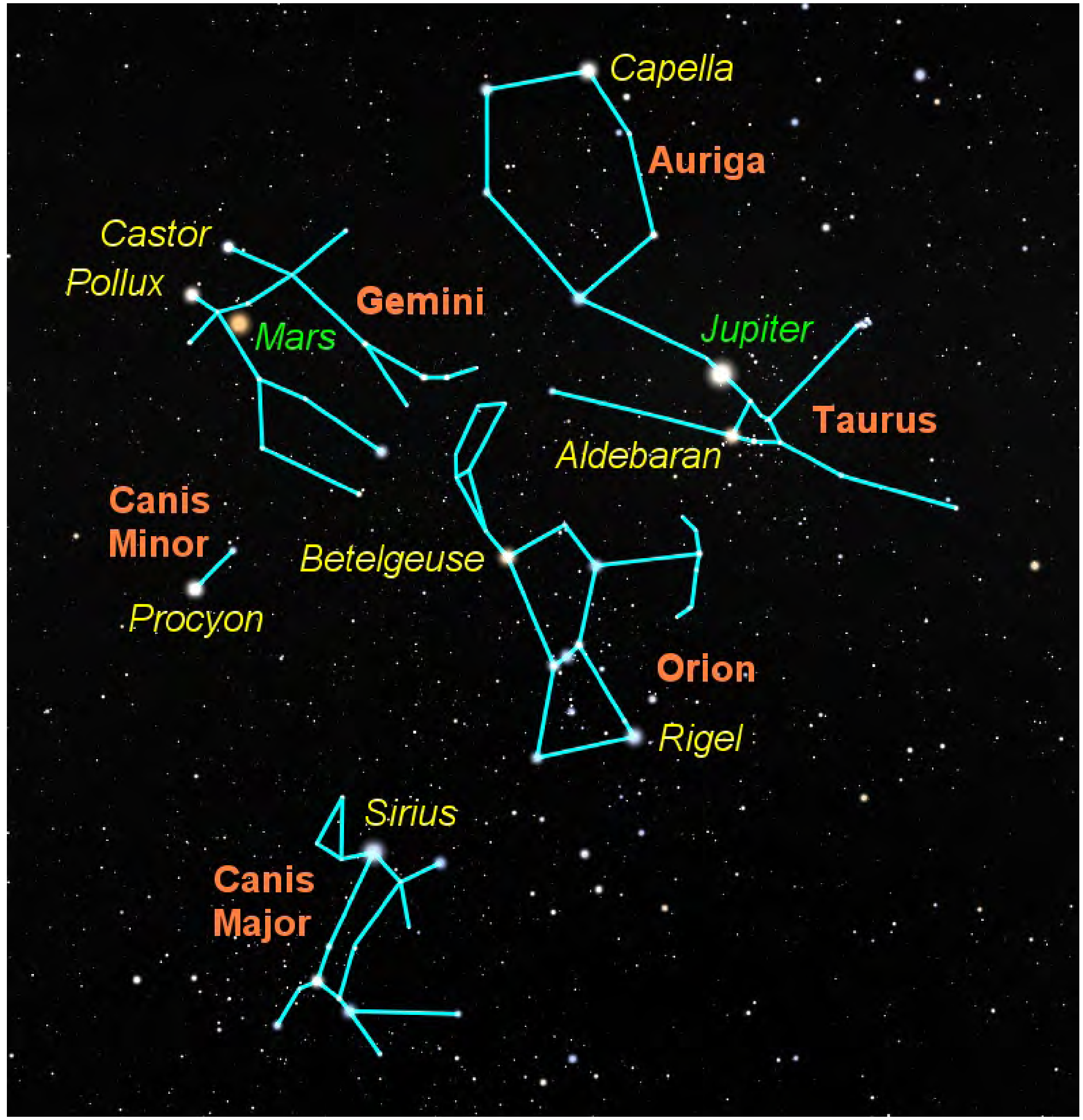
Happy aurora hunting!

The Winter Constellations

by Allison Waltberg

The king of the winter constellations is Orion, whose brightest stars form an obvious hourglass shape recognized by many cultures all over the world as a human figure with broad shoulders and a belt with a sword. It's easy to imagine an arc to the right as a shield or bow defending against the charging bull Taurus, and he's also often drawn holding a club poised to strike with the other arm above his head. In Greek mythology Orion was identified as the greatest of hunters, who boasted to Artemis, goddess of the hunt, that he could kill every animal on Earth. Gaia (the Earth herself) feared for her children and sent a scorpion to kill Orion before he could follow through with his threat. Artemis, in recognition of his skill, placed him in the sky, along with Scorpius, the scorpion who brought him down; the two were placed on opposite sides of the sky so that Orion would never have to face his mortal enemy again.

Orion's brightest stars are the orange Betelgeuse at his shoulder and the blue Rigel at his foot, both supergiant stars that are expected to become supernovas at the end of their lives hundreds of thousands of years in the future. Orion is also home to the Orion complex, an enormous group of star-forming dust and gas clouds spanning the entire constellation, containing a wealth of nebulas visible as separate objects. The largest and brightest is the Orion Nebula, which is visible to the naked eye as the middle portion of Orion's sword. Charles Messier divided its two brighter regions into M42 and M43, which are separated by a darker dust lane. The lowest star in his sword is the open cluster NGC 1980, and just above the sword is another cluster, NGC 1981, accompanied by several additional nebulous areas with their own NGC designations. Meanwhile, the region around Alnitak (the leftmost star in the belt) touts its own group of nebulas including IC 434, glowing background to the dark Horsehead Nebula (B33), and the Flame Nebula (NGC 2024). [See detailed maps of



The Winter Hexagon, as seen from Humboldt County at 10 pm on February 1, 2025. From Stellarium.

the Orion Molecular Cloud Complex at these websites: https://en.wikipedia.org/wiki/File:Orion_Head_to_Toe.jpg and https://apod.nasa.gov/apod/ap101023.html.]

Because Orion spans the celestial equator and is made of particularly bright stars, he is visible from almost the entirety of both terrestrial hemispheres; in the tropics he passes through the zenith in the December and January skies, and his lower half can even be seen grazing the horizon during the all-day darkness of June Antarctic winters. I have a particularly vivid memory of spotting the familiar hourglass shape appearing "upside down" high in the north and surrounded by mostly-alien constellations in the spring pre-dawn sky in South Africa, which was an unmistakable reminder we weren't in Kansas (or the Northern Hemisphere) anymore.

Surrounding Orion are the bright stars of the Winter Hexagon. With Betelgeuse at the center, we can start from Rigel and work clockwise to find Sirius the southernmost, then Procyon, the twins Castor and Pollux, Capella at the northern end, and finally Aldebaran (which you of course already read about in the previous newsletter). Currently Mars and Jupiter are both disrupting the hexagon, outshining the stars; Mars is in Gemini near Castor and Pollux, while Jupiter is still in Taurus near Aldebaran.

Sirius is the brightest star in the night sky and known as the "Dog Star" due to its location in the constellation Canis Major, the great dog. Its brightness is largely due to its nearness, at only about 8.6 light years from Earth. The ancient Egyptians built their 365-day calendar to begin each new year in mid-summer when Sirius first reappeared in the morning twilight sky just before sunrise, which heralded the annual flooding of the Nile that made their land fertile and was celebrated with festivals. Across the Mediterranean, the Greeks saw the rising of the Dog Star in the morning sky as bringing about the hot and dry part of summer whose heat caused plants and people to wilt, which became known as "the dog days of summer". Just before Sirius rises above the horizon, it is preceded by Procyon, the brightest star in Canis Minor, the small dog constellation which is drawn just as a line between two stars. The two dogs are depicted as hunting dogs that follow Orion across the sky.

Next are Castor and Pollux, the Gemini twins. The Greeks said they were half-brothers; Pollux was fathered by Zeus and thus immortal, while Castor's father was the mortal husband of their mother Leda. They were great sailors who crewed the Argo on adventures with the legendary hero Jason. When Castor eventually died, Pollux asked to share his own immortality with his brother and Zeus agreed to place them both in the sky, where they were revered by Greek sailors seeking fair winds. The constellation looks very much like two stick figures holding hands with the bright stars at their heads.

Above them is Capella, the "Goat Star" of Auriga the charioteer, itself roughly hexagonal in shape. Auriga is associated with any number of mythological chariot-driving figures, but Capella is identified with the mythological goat Amalthea, who suckled the infant Zeus. Two dimmer stars below Capella are called the Kids, who are portrayed as two baby goats being held under Auriga's arm. The goat and kids were previously a separate constellation from the charioteer; but Ptolemy merged the two, leaving future generations to wonder why exactly this chariot is full of goats.

Early winter sunsets help the bright planets stand out in twilight from background stars which don't appear until later. Looking to the southwest just after sunset, Venus will be shining brightly with Saturn nearby. Venus is getting higher in the sky each night into February, and at its closest will pass within 1/2 degree of Saturn in the hours after sunset around January 18. Saturn's rings are also thinning as we approach the ring plane crossing in March 2025, but unfortunately Saturn will be close to conjunction with the sun at that time and won't be visible from Earth. Meanwhile to the southeast in the early evening sky Jupiter and Mars are standouts. Jupiter has just passed its opposition in early December and will be visible for the entire night most of the winter, while Mars reaches opposition on January 16. This makes January a particularly great time to view planets, with 4 naked-eye planets easily visible in the early evening hours, assuming you can find a rare clear sky in the rainy Humboldt wintertime.

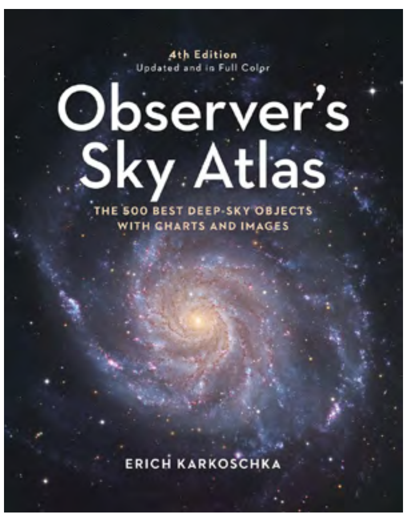
Observer's Sky Atlas: a Book Review

by Mark Wilson

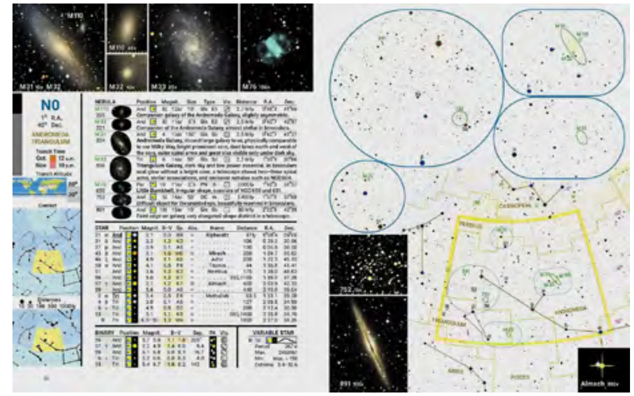
Last September I read a review of the above titled book. I like books and star atlases, of which I have too many, but this one sounded intriguing.

This is a fourth edition, published in 2023. Some of you may have an older edition, but I had not heard of it. The atlas is written by Erich Karkoschka who is professional astronomer at the Lunar and Planetary Laboratory in Tuscon, Arizona. The previous editions of the atlas were black and white, but this 4th edition is 148 pages of blazing color and lavishly illustrated. It is 7.5x9.5 inches with a hard paste-board cover.

There are 500 deep sky objects with photos for each. There are also lots of interesting single and multiple star systems. The author says he has observed most of the 500 objects with 10x50 binoculars or a 6 inch scope. My first impression after flipping through the book was that there is a ton of information. The introductory text of several pages is used to explain the information about each object in the data tables, such as spectral type and color index of stars. Each chart is accompanied with an adjacent page of tables with information about the various objects on the charts. The charts and adjacent data tables are arranged in three broad categories staring with northern constellations, designated with an N, equatorial constellations designated with an E, and finally southern constellations designated with an S. Each category is then arranged by Right Ascension going from 0 hr to 24 hr.



There is a heavy emphasis on individual and double stars. Not every star is shown down to a certain magnitude. The charts illustrate sections of the sky, not individual constellations. A problem with this is that some constellations are not whole in some charts. For example, Scorpio is in two separate charts designated E18 for the upper part and S21 for the lower part. On the other hand some charts have several whole constellations or parts of constellations. Each chart has what the author calls a main chart with the areas of interest having enlarged "finder" charts. This is explained in the introductory pages but it still takes some getting used to. The author lumps all deep sky objects together as "nebulae." On the charts all deep sky objects are identified by the same symbol. This is a bit annoying as I am used to seeing specific symbols for different types of objects. The information in the adjacent table identifies the type of object, e.g. galaxy, planetary nebula, globular cluster, etc. Each "nebula" has a photograph of the object. Another annoying thing with the charts is that some objects are identified by the number symbol (hash tag) then a number, but there is no hash tag number or information in the adjacent data table about the object. It took me a while to figure this out. I had to go back to several pages of photographs before the charts began. One of the nice aspects of the charts and tables is that they are easy to read with a red light.



There is a main chart with many smaller charts, tables, and photographs for each section of the sky,

The atlas was designed to be used in the field, but a major drawback to this use is that it does not lie flat. It needs to have a spiral binding.

Despite the drawbacks I mentioned above, I think this atlas is a valuable tool. Having such extensive data tables adjacent to the charts is something none of my other atlases have. The extensive use of photographs is also a distinct plus. The photos that are next to the "nebulae" descriptions are intended to give the observer an idea of what to see in the eyepiece. This atlas will be accompanying me on all my future observing outings, and I recommend it to our night sky observers. The cover price is about $40, but I found it at Thrift Books for about $30.

More on Saturn's Rings

by Ken Yanosko

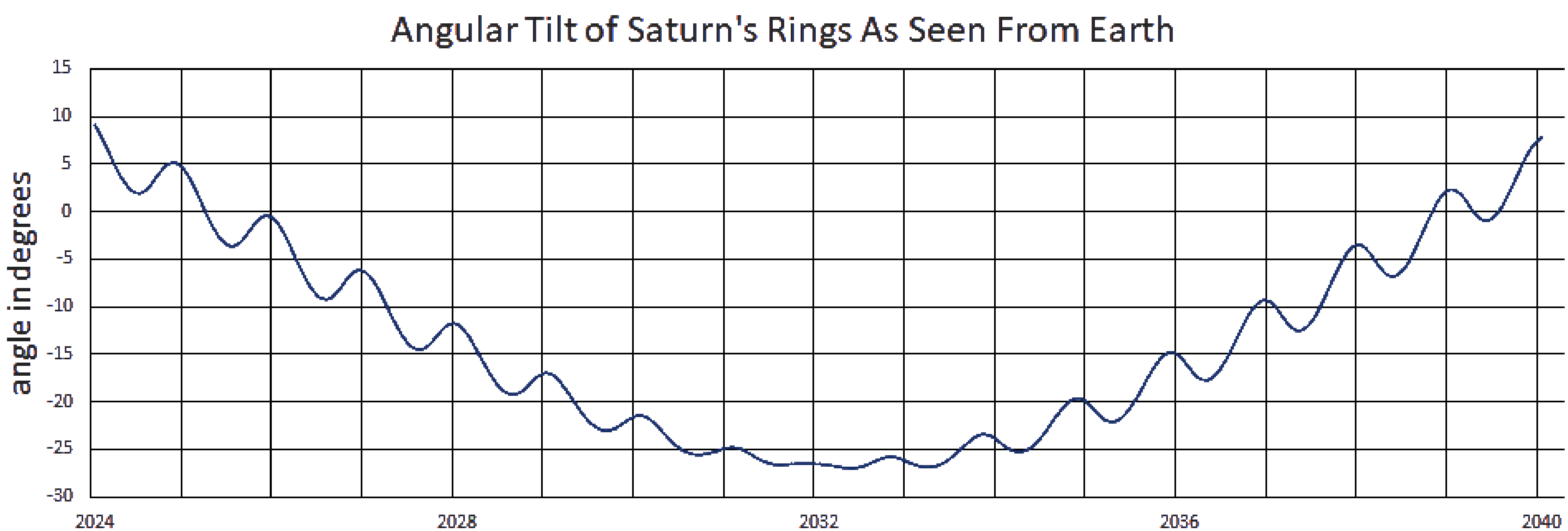
In the Autumn issue Grace had an article about Saturn's rings, which at that time were tilted three degrees to our line of sight. We were told that this angle would increase to five degrees right about now, and then plummet to zero next March, when the rings will appear edge on from Earth. (Actually this will be hard to see, because at that time Saturn will be too close to the Sun—as seen from Earth—to observe.) But I was intrigued by this back-and-forth "wobble" of the rings, so I tried to figure out what is going on.

There's a thing called the Saturn Ephemeris Generator at https://pds-rings.seti.org/tools/ephem3_sat.shtml which will give you a table showing the ring angle for any period of time. I downloaded such a table from the beginning of 2024 to the end of 2039, and used it to construct the graph below. If you ignore the small oscillations, it depicts a little over half of one period of a sine curve. The whole curve would run for approximately 30 years and then repeat; that's how long one Saturnian year is. A stationary observer at the Sun would experience two "ring plane crossings" during this time; these would correspond to Saturn's equinoxes, i.e. the times when a Saturnian would see the Sun crossing Saturn's equator. That's the same as crossing Saturn's ring plane.

Now what about the smaller wobbles? Note that they are each one Earth year long. Since the orbital planes of Earth and Saturn differ by about 2½ degrees, as the Earth goes through one year we see the rings appear to "wobble" by plus or minus that amount. The curve below is clearly the sum of these two effects.

At the left edge we see that at the beginning of 2024 the angle was almost 10 degrees; by midyear it was down to two degrees, and then went back up to five degrees. Next year we go through a ring plane crossing as the angle plummets to minus three degrees, and the returns back to nearly zero at the end of 2025. (The minus sign means we are seeing the southern side of the rings.)

Now look forward to 2038-39. Because of this compound motion, Earth will experience *three* ring plane crossings, one at the end of 2038 and two in the middle of 2039. Be sure to mark that down on your calendars.



This article is distributed by the NASA Night Sky Network, a coalition of hundreds of astronomy clubs across the US dedicated to astronomy outreach.

Spot the King of Planets

by Dave Prosper and Kat Troche

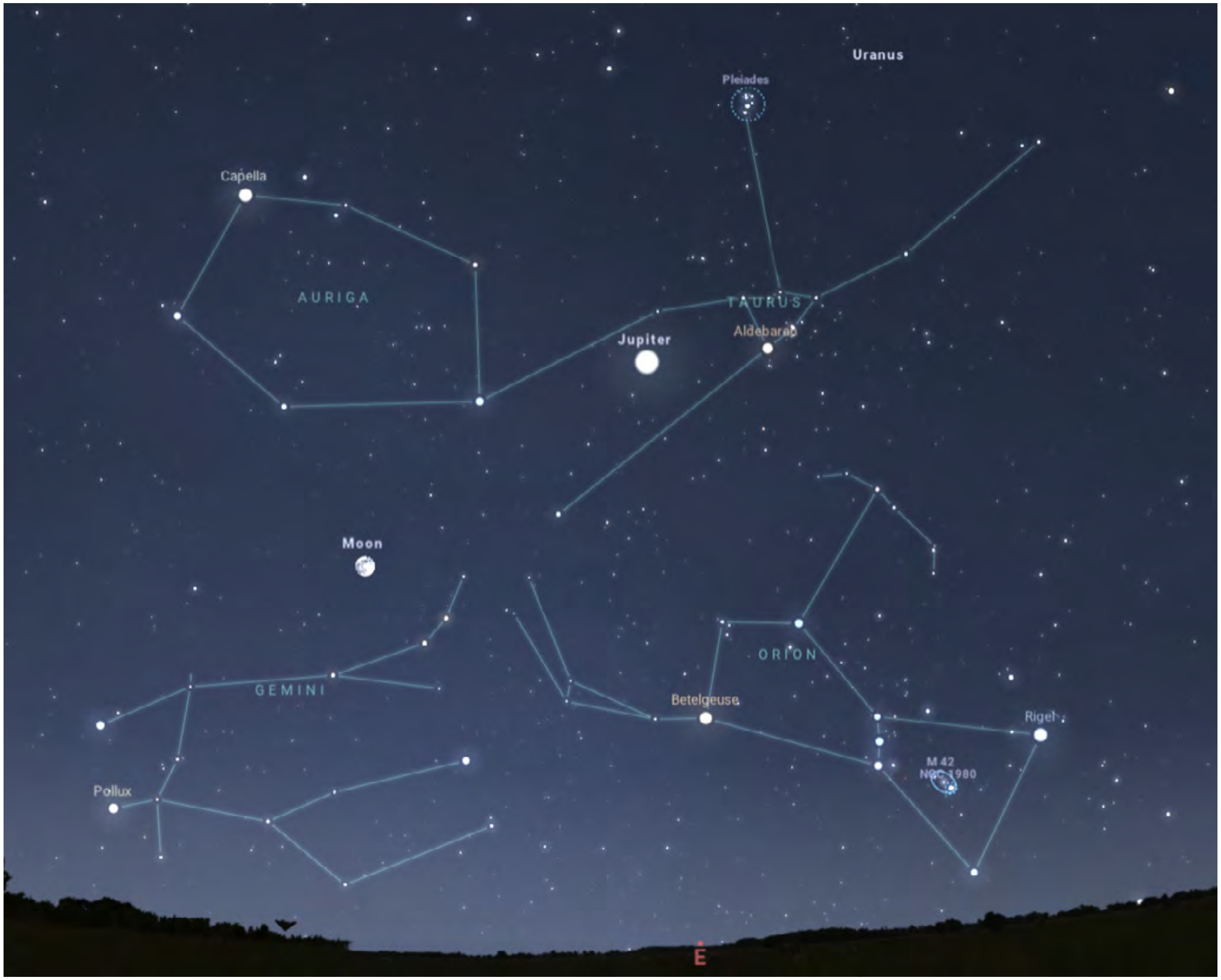
Jupiter is our solar system's undisputed king of the planets! Jupiter is bright and easy to spot from our vantage point on Earth, helped by its massive size and banded, reflective cloud tops. Jupiter even possesses moons the size of planets: Ganymede, its largest, is bigger than the planet Mercury. What's more, you can easily observe Jupiter and its moons with a modest instrument, just like Galileo did over 400 years ago.

NASA's Juno mission captured this look at the southern hemisphere of Jupiter on Feb. 17, 2020, during one of the spacecraft's close approaches to the giant planet. This high-resolution view is a composite of four images captured by the JunoCam imager and assembled by citizen scientist Kevin M. Gill. Credit: NASA, JPL-Caltech, SwRI, MSSS | Image processing by Kevin M. Gill, © CC BY

Jupiter's position as our solar system's largest planet is truly earned; you could fit 11 Earths along Jupiter's diameter, and in case you were looking to fill up Jupiter with some Earth-size marbles, you would need over 1300 Earths to fill it up—and that would still not be quite enough! However, despite its formidable size, Jupiter's true rule over the outer solar system comes from its enormous mass. If you took all of the planets in our solar system and put them together, they would still only be half as massive as Jupiter all by itself. Jupiter's mighty mass has shaped the orbits of countless comets and asteroids. Its gravity can fling these tiny objects towards our inner solar system and also draw them into itself, as famously observed in 1994 when Comet Shoemaker-Levy 9, drawn towards Jupiter in previous orbits, smashed into the gas giant's atmosphere. Its multiple fragments slammed into Jupiter's cloud tops with such violence that the fireballs and dark impact spots were not only seen by NASA's orbiting Galileo probe but also by observers back on Earth!

Jupiter is easy to observe at night with our unaided eyes, as well-documented by the ancient astronomers who carefully recorded its slow movements from night to night. It can be one of the brightest objects in our nighttime skies, bested only by the Moon, Venus, and occasionally Mars, when the red planet is at opposition. That's impressive for a planet that, at its closest to Earth, is still over 365 million miles (587 million km) away. It's even more impressive that the giant world remains very bright to Earthbound observers at its furthest distance: 600 million miles (968 million km)! While the King of Planets has a coterie of 95 known moons, only the four large moons that Galileo originally observed in 1610—Io, Europa, Ganymede, and Callisto—can be easily observed by Earth-based observers with very modest equipment. These are called, appropriately enough, the Galilean moons. Most telescopes will show the moons as faint star-like objects neatly lined up close to bright Jupiter. Most binoculars will show at least one or two moons orbiting the planet.

Small telescopes will show all four of the Galilean moons if they are all visible, but sometimes they can pass behind or in front of Jupiter or even each other. Telescopes will also show details like Jupiter's cloud bands and, if powerful enough, large storms like its famous Great Red Spot, and the shadows of the Galilean moons passing between the Sun and Jupiter. Sketching the positions of Jupiter's moons during the course of an evening—and night to night—can be a rewarding project! You can download an activity guide from the Astronomical Society of the Pacific at [https://astrosociety.org/file_download/inline/1689e781-3f4a-4178-8f7a-7bc581986242.](https://astrosociety.org/file_download/inline/1689e781-3f4a-4178-8f7a-7bc581986242)



Look for Jupiter near the Eye of the Bull, Aldebaran, in the Taurus constellation on the evening of December 15, 2024. Binoculars may help you spot Jupiter's moons as small bright star-like objects on either side of the planet. A small telescope will show them easily, along with Jupiter's famed cloud bands. How many can you count? Credit: Stellarium Web

Now in its eighth year, NASA's Juno mission is one of just nine spacecraft to have visited this impressive world. Juno entered Jupiter's orbit in 2016 to begin its initial mission to study this giant world's mysterious interior. The years have proven Juno's mission a success, with data from the probe revolutionizing our understanding of this gassy world's guts. Juno's mission has since been extended to include the study of its large moons, and since 2021 the plucky probe, increasingly battered by Jupiter's powerful radiation belts, has made close flybys of the icy moons Ganymede and Europa, along with volcanic Io. What else will we potentially learn in 2030 with the Europa Clipper mission?

Find the latest discoveries from Juno and NASA's missions to Jupiter at https://science.nasa.gov/jupiter/.

Originally posted by Dave Prosper:
February 2023
Last Updated by Kat Troche:
November 2024

Heavenly Bodies by Susie Christian

An AOH Christmas