

AOH Newsletter

Summer 2026



News and Notes

Observing at Kneeland

In June, after a long drought, we were finally able to hold a regular monthly observing session at Kneeland. The sky was clear, and we

set up a number of telescopes (some new, some old) and greeted some old friends—planets (Venus, Jupiter, and Mercury), galaxies, globulars, nebulae, and clusters.

There were 10 club members and 4 guests, and a good time was had by all.



Under the stars at Kneeland, June 2026. Photo by KY.



Jeff, Mark, & Ben getting set up. -KY.



Greg, Danielle, and Dan getting set up. -JW & AW & KY.



Allison getting set up. -JW.



Shannon setting up one of the library telescopes. -AW.



Russ' telescope setting itself up. -KY.



Looking for the first "star." –AW.



Venus, Jupiter, and, just barely, Mercury. (You may have to use averted vision!) –KY.



Zoom Meetings



Meetings were held on April 4, May 2, and May 30.

In attendance were Allison & Johann Waltberg, Ann Kilby, Arlo Reeves, Bernie Christen, Brent & Catrina Howatt, Chris McCown, Greg Deja, Ken Yanosko, Mark Wilson, Mary Kaufman, Roger Coy, Russ Owsley, and Yoon Kim.

The state of the Universe was discussed at length, and plans were laid for its continuing evolution.

Outreach: what we've been doing:

On April 26 we were invited to set up a station at the Humboldt Math Festival. Brent, Catrina, Mark, Ken, Greg, Allison, and Johann set up tables with a telescope demonstration, NASA astrophotos, and a gravity well. Around 300 K-12 kids, parents, and teachers showed up to look.

Johann demonstrates how a telescope gathers light. At far right Brent shows kids and parents how gravity works. Photos by Allison and Ken.



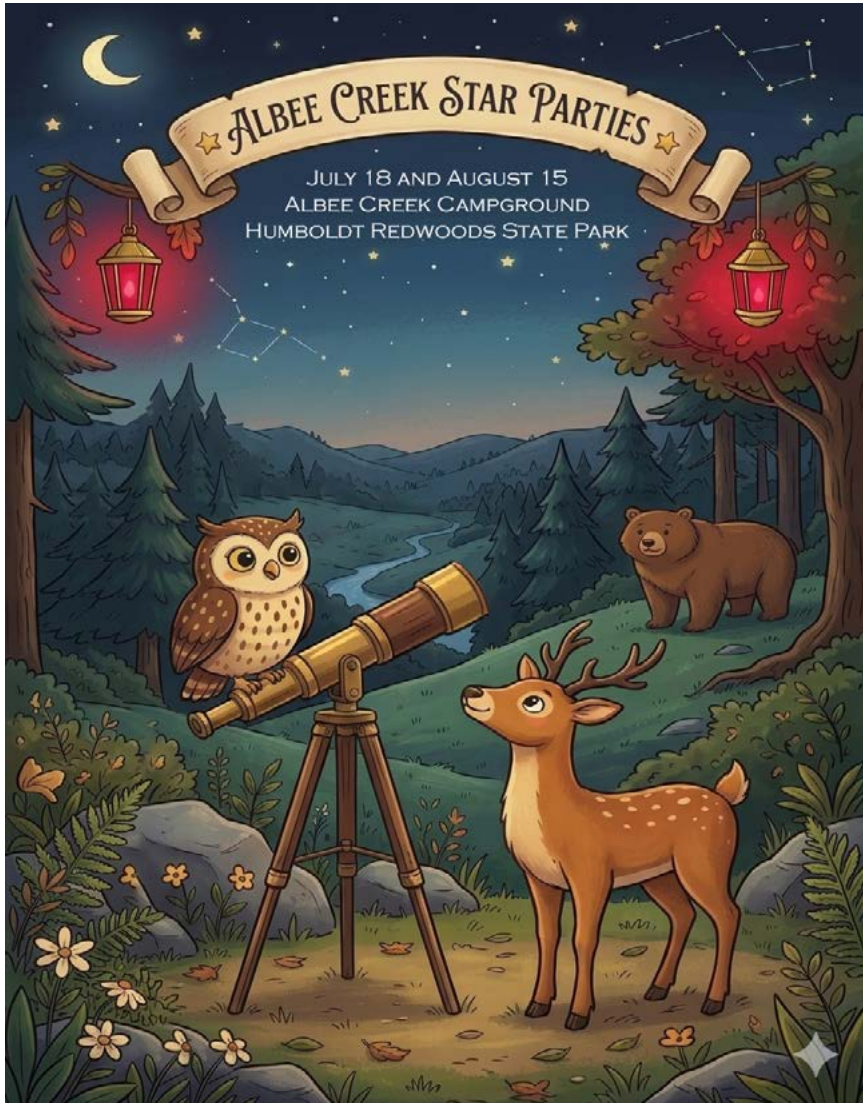
On June 6 we held a public workshop entitled "Star Maps and Star Apps" at the Eureka Library. Brent, Mark, Ken, Greg, Russ, Allison, and Johann talked about how to find and identify things in the night sky. We had 10 visitors.

Brent and Russ check their Star Apps. At far right Ken demos some online Star Maps. Photos by Ken and Allison.



Outreach: what we're gonna do:

We have two star parties on this summer's schedule at Albee Creek campground in Humboldt Redwoods State Park. Contact Brent (brent@astrohum.org) if you would like to volunteer to help out. No experience is necessary. We can also arrange carpooling if you would need a ride, and a complimentary campsite at the park is available if you want to spend the night.



International observe the Moon Night will be in September this year. We are planning to set up in-person observing stations at various locations. This will supplement our usual "virtual" event. Contact Mark (markw@astrohum.org) for more information on how you can participate. Again, no experience is necessary—we can always use help handing out flyers, keeping people in line, running out for coffee, doing "here, hold onto this while I do that," etc.



Following Up:

In March I challenged people to photograph the globular cluster Omega Centauri, which at the right time of year is just barely visible from our usual vantage point at Kneeland. With the bad weather we've been having, no one was able to, so I'll repeat the request again next spring. However, I did get these sets of photos, taken by AOH members, but not from Kneeland.

Arlo Reeves, who lives in Menocino, writes: "Although it was blowing pretty hard in Mendocino last night I haven't had many chances to image since acquiring some new kit so I thought I'd see what I could get. Taking on your newsletter challenge, here's a couple images of Omega Centauri from Mendocino, which at 39.30°N is 1.42°S of Kneeland at 40.72 °N. So Omega Centauri transited at an altitude of 3.30° here as opposed to 1.97° in Kneeland. What explains the 0.09° difference in altitude vis-a-vis the difference in latitude? I presume it's due to Sky Safari Pro taking atmospheric refraction into account. Indeed my raw images showed ample refraction effects on the stars (vertically elongated with blue above, red below), cleaned up in the image below with BlurXterminator. The red tint is also from high airmass....

"To give an idea of the angular size of Omega Centauri, I took



this untracked shot with my camera at 135mm (5sec, f1.8, ISO6400)."

"And this with my 85mm refractor, 10 frames of 120s each.

There's little to recommend imaging at these low altitudes. Guiding is difficult, and seeing is bad especially here on the coast. I spent the rest of the night on higher targets."



Meanwhile, Allison and Johann Waltberg were off on vacation in South Africa.



Here is Allison's report: "Without telescopes our options were a bit limited, but we did manage to get a few nice long exposures with our phones on one of the (surprisingly few) clear and dark nights, just a few minutes before the marine layer fog swallowed up everything...."



Omega is arrowed. You can see why it was given a Greek letter designation, Note that Crux, the Southern Cross, along with the Coalsack, is visible at the upper right. Below Crux are the Southern Pointers, Alpha and Beta Centauri. Allison & Johann Waltberg

"These were taken at Agulhas Rest Camp, about 3.5 miles from the southernmost point of Africa. Google Maps: <https://maps.app.goo.gl/HrjsSyaiZRTVyont9>.

"Also included [is] ... Johann's ingenious not-a-tripod setup to capture the long exposure using what we had handy."



Finally, from Australia, Jeff Schmitt got this Seestar picture. Read Jeff's account of his trip, and see more pictures, beginning on page 14.



Meteor Showers

The twin showers of the Southern Delta Aquariids and the Alpha Capricornids both, by a cosmic coincidence, have their peak activities occur on the night of July 30-31. The Moon is full, however, on July 29 so we don't expect a great show.

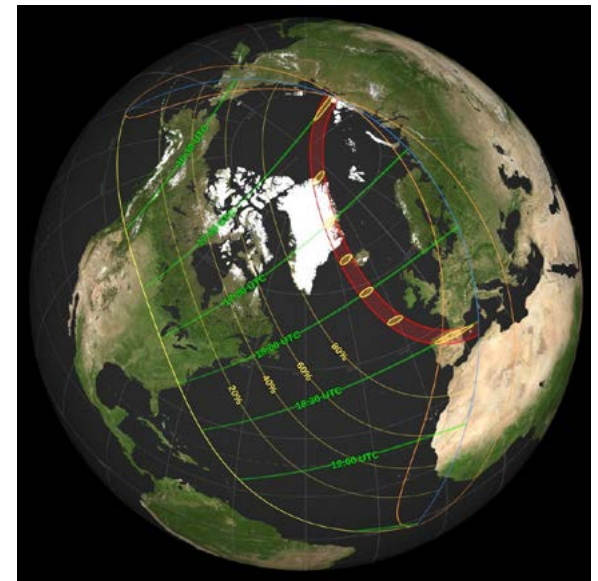
But on the night of August 12-13 the Perseids will peak in a moonless sky so it should be a very good Perseid year. Remember, too, that the Perseids may be seen up to two weeks before and after the peak night.

Photo Contest

It's not too late to enter the "Capture the Dark" photo contest run by DarkSky International: the deadline is June 30. Go to <https://capturethedark.darksky.org/contest2026> to get more information, or just go to look at their gallery of submissions and be inspired.

Summer Eclipses

August will bring a total solar eclipse on the 12th of the month, but the limited path of totality crosses over the Arctic Ocean, eastern Greenland, and the north Atlantic and ends in northern Spain. Alaska and Canada get a partial eclipse, as do parts of the US (not including us) and parts of Siberia, Europe, and eastern Africa.



Two weeks later on August 27 a deep partial lunar eclipse will unfold. The table below shows what we'll see from Humboldt County:

From NASA. The red band shows where a total solar eclipse can be seen. Yellow curves across the map show where a partial eclipse will be visible. See <https://science.nasa.gov/eclipses/future-eclipses/total-solar-eclipse-on-august-12-2026/>.

Time	Event
7:48 pm	moonrise, Moon already partially eclipsed
9:13 pm	maximum eclipse, 96% of the Moon covered
10:32 pm	end of partial phase
12:02 am	end of penumbral phase

Thanks

... to Allison, Johann, Arlo, Barry, Jeff, Oliver, and Susan, who helped put the Newsletter together.

Ken

Questions I Ask Myself

by Oliver Smith

There are a few steps that I have to take before setting up to take a picture: a few important questions that I have to ask myself in order to ensure a decent photo.

Do I have clear skies in order to dedicate hours of imaging?

Of course, where we live the weather is known to change on the flip of a dime, and the weather report can only be used as an educated guess most times. One minute you're cruising right along with your subframes of the image; next thing you know you're autoguide numbers go through the roof, you take a look outside and the clouds are here for the night. (This happened to me last night!) That's why I have 3 or 4 weather apps and try to get a basic understanding of the upcoming weather. And sometimes you get caught by surprise.

Will I be shooting in the right location?

Another way that I ask myself this question is, "How dark does the sky need to be for me to take these subframes?" I use the Bortle scale to find the darkest skies possible. The scale is from 1 to 10 with respect to how dark an area is. For instance Los Angeles is Bortle 10, and if you're there you may want to go for a drive in order to get out of its light dome (the bubble of light pollution above your head). The Kneeland airport is on the border between B2 and B3, and Eureka is a strong B6. And if you live in Eureka or Arcata, it is very nice to have Kneeland such a short drive away. There are some targets that you don't need a dark sky to shoot in, like the moon, but my favorite targets are very dim, and a dark sky is very helpful.

Do I have the right light filtration?

If you use the right filter you can cut out a lot of light pollution or glare. There are a few targets that are not emission type targets, meaning that star radiation is not charging up any surrounding gases—hydrogen alpha, sulfur 2, oxygen 3 (HA, Sii, Oiii). Sometimes they are reflection type targets, like star shine on stellar dust, or the moon and planets; sometimes it's better to use the UVIR cut filter instead of a light cut filter (more on filters in a different note). For instance

you would not be doing yourself any help shooting the Pleiades star cluster in hydrogen alpha. You would want to use a UVIR cut filter in order to allow all of the reflected light to shine through, at the same time minimizing star-bloat which occurs during lengthy exposure times. And in the same respect to light magnitude, you would never shoot the moon using a UVIR cut filter. Instead, you would use a variable polarizing filter which would cut back on some (or all) of the brightness of the moon. (The reflected sunlight from the moon can really hurt your eyes. Please be careful.)

Do I have the right scope?

What is the target that I'm going for this evening? Is it very small and dim? Is it very large and bright? Is it very large and dim?

I use a few different apps that showcase NASA photos, ESA photos, and amateur and professional photos as well. Stellarium, Astro Bin, and Telescopius are my three go-to apps. And believe me when I say, you can lose a lot of time in these apps because of the amazing photos that are displayed!

I will do a search on the target to find out what other photographers have used as equipment, how much time was spent on the target, and in what filter, and how they framed up the target in the camera's field of view.

Do I want to shoot the Orion Nebula by itself? I would use anything over an 80mm scope. Do I want to include the Horsehead Nebula? I need to use something under a 70mm scope. Shooting a tiny little galaxy? You might want to grab something with over 1000mm!

I have quite a few different scopes and camera lenses. Lately I've really enjoyed shooting emission/reflection nebulae, so for me it's all about very wide angle scopes and lenses: 24mm – 700mm. For the last few targets, I have been using (and really falling in love with) two particular scopes: my Svbnony SV555 54mm Petzval scope which has a 243mm focal length, and my Askar 103 Apo. The latter is a modular scope, used in tandem with different focal reducers; it can be used from 420mm to 700mm. These two scopes mean the difference between shooting the Orion nebula complex, or zooming in on the Orion nebula itself.



Svobony SV555

With these questions answered to the best of my understanding, I will drag all of my equipment to the location—including charging units, scopes with accessories, mounts and tripods, an unbelievable amount of wiring, and a computer. Once I get polar aligned and challenge the scope for accuracy, I can begin my imaging sequence. I will monitor the auto guiding numbers, at the same time watching the night sky in all of its magnificence!

For me there is no other feeling quite like leaning against the hood of my car in the middle of the dark while looking up, relaxing

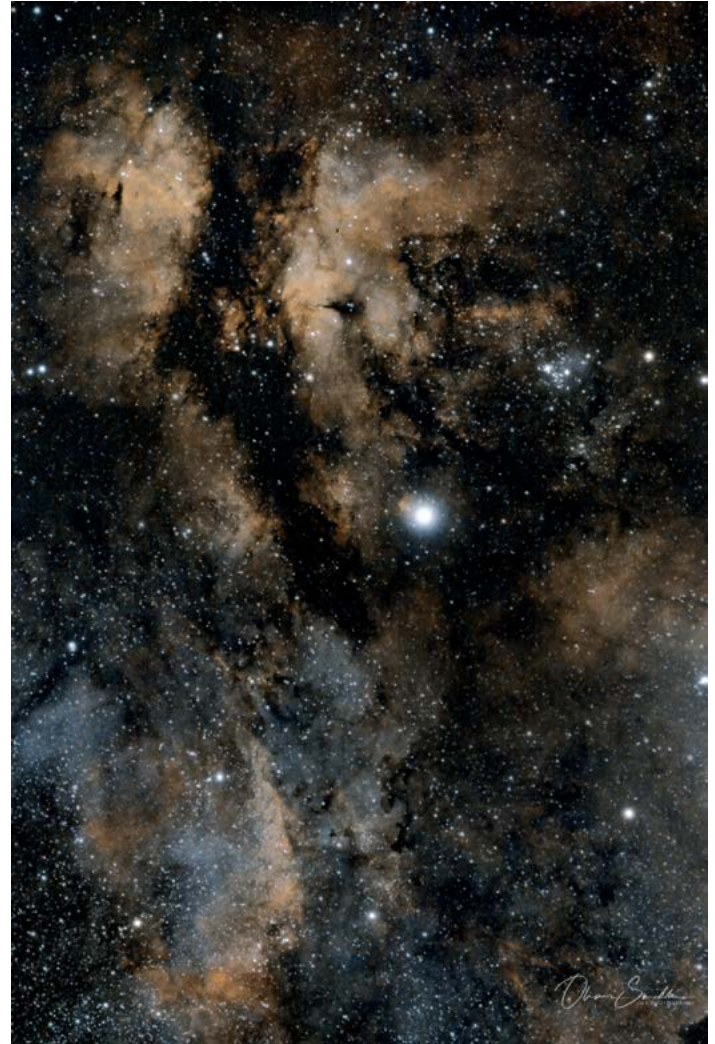


Askar 103

my eyes to recover my night vision, seeing nebulae take shape, catching meteors in my peripheral vision as they streak across the sky, and resolving faint star clusters while my rig does its thing. For me, it just really melts my heart and stimulates my mind.

Clear skies everybody!

Oliver Smith is a fixture at Kneeland whenever sky conditions permit. See some of his work on the following pages as well as in the Spring Newsletter on pages 7-11.



Clockwise from upper left:

NGC 2170, the Angel Nebula, a reflection nebula located in the constellation Monoceros;

the Butterfly Nebula in the Cygnus region with an unrelated star, Sadr, in the foreground;

Caldwell 4, the Iris Nebula, a beautiful reflection nebula located in the constellation Cepheus.



*Clockwise from above:
the Elephant's Trunk Nebula in Cepheus, a picturesque
star-forming region within the IC 1396 complex;
globular cluster Messier 3 with 6th magnitude star
Hiparchus 66725 in Canes Venatici;
Markarian's Chain, a stretch of more than eight gal-
axies located in the heart of the famous Virgo Cluster.*



Clockwise from upper left:
IC 4604, part of the Rho Ophiuchi Cloud Complex, surrounding the multiple star system Rho Ophiuchi;
Messier 51, the Whirlpool Galaxy in Canes Venatici;
Messier 101, the Pinwheel Galaxy in Ursa Major.

Australia is a Tough Assignment

by Jeff Schmitt

I've got to say, traveling to Australia is a tough assignment; but being backed up by my best observing buddies, Jon & Kim, made a huge difference. We left Arcata about 2pm on Sunday, and arrived in Sydney about 10:30 am on Tuesday. It was a 15 hour flight, plus 1.5 hours to SFO, a 5 hour layover, and a crossing of the International Date Line. Arriving in Sydney, we were exhausted, but exhilarated! We stayed at the oldest hotel in Sydney, the Lord Nelson Brewery Hotel.



Sydney Harbor.



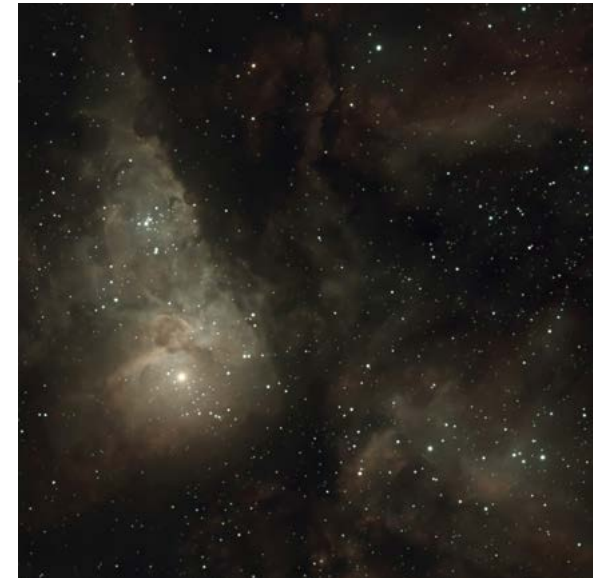
The Lord Nelson Brewery Hotel.



Sydney Observatory.

We toured the iconic Harbor Bridge, and the infamous Sydney Opera House, and then the oldest observatory in Sydney, the Sydney Observatory, a block from our hotel, where we were honored to raise the eclipse flag.

After a couple of days in Sydney, we took a 6 hour train ride to a town called Dubbo, rented cars, and drove a couple



NGC 3372, The Great Carina Nebula.



Active Galaxy Centaurus A.

of hours to Coonabarabran, in the Warunbungle mountains, site of the OzSky Star Safari. The hotel is very basic, but adjacent to the observing site, and very attuned to the needs all of us amateur astronomers. The staff was very accommodating, and the Sky Safari volunteers were excellent, and their knowledge of the southern skies phenomenal.

The first few nights were very good, and we were amazed at how close some of these stars and objects are to some of our normal constellations like Scorpius and Sagittarius, just a thumb's distance, okay a thumb and a half's distance, below our horizon. One of the



The Australia Telescope Compact Array.



Siding Spring Observatory.

most amazing things was that most of our northern constellations were upside down. We had trouble recognizing them, even Leo, even when we knew where it was!

We were rained out a couple of nights, so Jon & Kim drove 6+ hours to the Opal Capital of Australia, while Lisa & I took a day off, then drove 1.5 hours to the Australia Telescope Compact Array. I am sorry to say that we were not overly impressed, but they are coordinated with the Parks, Mopra, & Molonglo Radio Observatories. We also toured Siding Spring Observatory, about 15 minutes from OzSky. It houses the Anglo-Australian Telescope (AAT), the largest telescope in Australia, a 150" reflector, and is in the middle of a Dark Sky Area. Everyone in the area is proud that they are considered one of the premier Dark Sky Areas in the world.

When our time in "Coona" was up, we traveled back to Sydney, and took a flight to Cairns (Cans) near the Great Barrier



Jeff and Lisa, at right, with Jon and Kim, center, and another pair of visitors at the AAT.

Reef. Unfortunately for us, a cyclone (hurricane) passed just north of Cairns a few days earlier, so the waters were a bit murky, or so we were told, so we skipped the snorkeling. There is an excellent aquarium in Cairns, and they had an exhibit from Egypt called “The Tombs of the Pharoes.” The aquarium and the “Tombs” were certainly one of the highlights of our trip, and totally unexpected. The re-creations were very well done (in Egypt), and sanctioned by the Egyptian government. What a treat!

We also went to Kuranda, the rain forest east of Cairns. We took a train ride up, toured the town, and took the Sky Tram back. Another spectacular day!

We flew back to Sydney the next day, and spent our last day taking a ferry across the Sydney Harbor to Manly and Manly Beach. It was a nice relaxing day to end a long trip, but, ironically, not long enough! There were many other excursions that I did not mention, or sped past, but those will need to wait until a future Newsletter!

Jeff Schmitt is a longtime member and past president of AOH.

This article first appeared in the [North Coast Journal](#) on May 7, 2026. It is reprinted here with the permission of the author.

Canals on Mars by Barry Evans

“Lowell always said that the regularity of the [Martian] canals was an unmistakable sign that they were of intelligent origin. The only unresolved question was which side of the telescope the intelligence was on.”

— Carl Sagan, *Cosmos*

“Canals on the Planet Mars,” read the headline of *The Times of London* of April 13, 1882, in response to an announcement by the director of Milan’s Brera Observatory, Giovanni Schiaparelli, that he’d seen a network of stripes on the surface of the planet Mars. He called them canali, Italian for channels, but journalists saw an opportunity to pique the public’s interest with the mistranslation “canals.” Schiaparelli’s claim prompted European and American astronomers to aim their telescopes at Mars’ tiny disc to see the markings for themselves. Most said they saw no lines. Even with the best telescopes of the age, Mars usually appeared blurry and indistinct. That changed when a close approach of the planet in summer of 1892 gave Frenchman Camille Flammarion an opportunity to check Schiaparelli’s map.

Flammarion was something of a Renaissance man: astronomer, philosopher, writer and lecturer. If intelligent beings on Mars had built a vast network of canals, he was just the man to confirm it. His obsession with alien life started at age 20 with his first book, *The Plurality of Inhabited Worlds*. Later, *The New York Herald* ran his op-ed, “How to Talk with the Folks on Mars.” Thus primed, in 1892, Flammarion said that he could see Schiaparelli’s lines, which, he mused, might be a gigantic semaphore — Martians signaling to us across millions of miles of empty space. (He presumably discounted the canal hypothesis, since Martian engineers would presumably

This article is reprinted from the NASA website at <https://science.nasa.gov/mission/dragonfly/>. Use of this material is permitted for educational or informational purposes.



Dragonfly: An Airborne Science Mission Like No Other

by Zibi Turtle

Never before have humans planned an airborne science mission to another world like Dragonfly.

The Dragonfly rotorcraft will break the barriers for exploration of other planetary bodies. Instead of being limited to just the region around its landing site, Dragonfly's rotors will carry it for miles across [Saturn's moon] Titan during its planned 3.3-year mission, stopping to explore a variety of geologically interesting areas along the way, including dunes and Selk Crater.



Artist's concept of Dragonfly on the surface of Titan.
NASA/Johns Hopkins APL.



Artist's concept of Dragonfly lifting off from the surface of Titan.
NASA/Johns Hopkins APL. Click on the picture for animation;
if the animation does not display in your PDF viewer, click [here](#) instead.

Dragonfly is expected to make one flight every 1-2 Titan days, which is called a Tsol and lasts about 16 Earth days.

Sampling the Surface

Flying several miles each flight through the yellowish, smoggy haze of Titan's nitrogen-rich atmosphere, Dragonfly will stop at a variety of geologic sites, where it will collect samples of surface material for analysis inside the rotorcraft by a suite of scientific instruments.

The exploration of these diverse locations will help to characterize the habitability of Titan's environment, investigate how far pre-biotic chemistry has progressed, identify compounds of astrobiological interest, and even search for chemical indicators of water-based or hydrocarbon-based life.

Keep up with news about the Dragonfly Mission at
<https://science.nasa.gov/mission/dragonfly/dragonfly-news/>.

Elizabeth "Zibi" Turtle is the Dragonfly Senior Scientist and a planetary scientist at the Johns Hopkins University.

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



The Summer Triangle's Hidden Treasures

by David Prosper

Mid-summer skies bring the lovely Summer Triangle asterism into prime position after nightfall for observers in the Northern Hemisphere. Its position high in the sky may make it difficult for some to observe its member stars comfortably, since looking straight up while standing can be hard on one's neck! While that isn't much of a problem for those that just want to quickly spot its brightest stars and member constellations, this difficulty can prevent folks from seeing some of the lesser known and dimmer star patterns scattered around its informal borders. The solution? Lie down on the ground with a comfortable blanket or mat, or grab a lawn or gravity chair and sit luxuriously while facing up. You'll quickly spot the major constellations about the Summer Triangle's three corner stars: Lyra with bright star Vega, Cygnus with brilliant star Deneb, and Aquila with its blazing star, Altair. As you get comfortable and your eyes adjust, you'll soon find yourself able to spot a few constellations hidden in plain sight in the region around the Summer Triangle: Vulpecula the Fox, Sagitta the Arrow, and Delphinus the Dolphin!

You could call these the Summer Triangle's "hidden treasures"—and they are hidden in plain sight for those that know where to look!

Vulpecula the Fox is located near the middle of the Summer Triangle, and is relatively small, like its namesake. Despite its size,



Search around the Summer Triangle to spot some of its hidden treasures! To improve readability, the lines for the constellations of Aquilla, Lyra, and Cygnus have been removed. These aren't the only wonderful celestial sights found around its borders; since the Milky Way passes through this region, it's littered with many incredible deep-sky objects for those using binoculars or a telescope to scan the heavens. Image created with assistance from Stellarium

it features the largest planetary nebula in our skies: M27, aka the Dumbbell Nebula! It's visible in binoculars as a fuzzy "star" and when seen through telescopes, its distinctive shape can be observed more readily—especially with larger telescopes. Planetary nebulae, named such because their round fuzzy appearances were initially thought to resemble the disc of a planet by early telescopic observers, form when stars similar to our Sun begin to die. The star will expand into a massive red giant, and its gases drift off into space, forming a nebula. Eventually the star collapses into a white dwarf—as seen with M27—and eventually the colorful shell of gases will dissipate throughout the galaxy, leaving behind a solitary, tiny, dense, white dwarf star. You are getting a peek into our Sun's far-distant future when you observe this object!

Sagitta the Arrow is even smaller than Vulpecula—it's the



M71 as seen by Hubble. Your own views very likely won't be as sharp or close as this. However, this photo does show the cluster's lack of a bright, concentrated core, which led astronomers until fairly recently to classify this unusual cluster as an "open cluster" rather than as a "globular cluster." Studies in the 1970s proved it to be a globular cluster after all – though an unusually young and small one! Credit [ESA/Hubble and NASA](#).

third smallest constellation in the sky! Located between the stars of Vulpecula and Aquila the Eagle, Sagitta's stars resemble its namesake arrow. It too contains an interesting deep-sky object: M71, an unusually small and young globular cluster whose lack of a strong central core has long confused and intrigued astronomers. It's visible in binoculars, and a larger telescope will enable you to separate its stars a bit more easily than most globulars; you'll certainly see why it was thought to be an open cluster!

Delicate **Delphinus the Dolphin** appears to dive in and out of the Milky Way near Aquilla and Sagitta! Many stargazers identify



M27, the Dumbbell Nebula, imaged with a Seestar S50 by Brent and Catrina Howatt from their backyard in Eureka.

Delphinus as a herald of the fainter water constellations, rising in the east after sunset as fall approaches. The starry dolphin appears to leap out of the great celestial ocean, announcing the arrival of more wonderful sights later in the evening.

Want to hunt for more treasures? You'll need a treasure map, and the Night Sky Network's "Trip Around the Triangle" handout is the perfect guide for your quest! Download one before your observing session at bit.ly/TriangleTrip. And of course, while you wait for the Sun to set—or skies to clear—you can always find out more about the objects and science hidden inside these treasures by checking out NASA's latest at nasa.gov.

David Prosper, formerly with the Astronomical Society of the Pacific, now does his observing from Ursa Major Sugar Farms in upstate New York.

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World's biggest astronomy camera seeks to answer pressing questions about the universe

by Joshua Weston

The Vera C. Rubin Observatory has started releasing its first discoveries: including supernovae, variable stars and asteroids, which will from now on be discovered at an astonishing rate as it begins its Legacy Survey of Space and Time, a ten-year survey probing the deepest reaches of the universe.

During the course of this survey, astronomers around the globe will seek to answer some of the most pressing questions about the nature of our world.

To the naked eye, the night sky seems like a static and unchanging firmament, with the occasional planet or comet or shooting star visible.

But with a larger, more sophisticated telescope or camera we are able to discover hundreds of new phenomena every night, from dying stars to near-Earth asteroids.

The camera that allows this exploration—attached to a telescope over eight metres wide atop Cerro Pachón in Chile—is the largest in the world, weighing almost three tonnes and built over ten years.

The Rubin Observatory's giant camera can probe the faintest reaches of our existence, capturing light emitted as much as 12 billion years ago. But the Rubin camera will capture new events much closer to our Solar System.

By taking multiple photographs of the sky every night—and



[RubinObs/NSF/DOE/NOIRLab/SLAC/AURA/T. Lange](https://www.noirlab.si.edu/news/2019/08/rubin-obs-nsf-doe-noirlab-slac-aura-t-lange)

tracking any differences between them, scientists will be able to capture objects moving through space such as the tens of millions of asteroids and comets hurtling through the Solar System.

Outer reaches

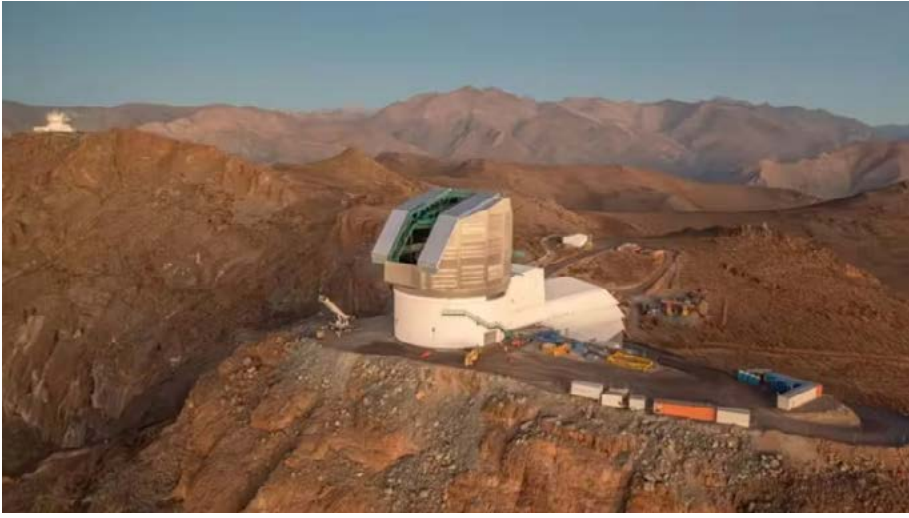
Increasing the number of known asteroids in the belt between Mars and Jupiter can help us to understand the formation history of the Solar System.

Beyond Neptune in the faint and distant Kuiper Belt—a population of icy objects in the outer reaches of the Solar System—astronomers will be able to study an environment similar to our Solar System in its infancy, to better understand how we came to be.

It has been theorised before that disturbances to the orbits of Kuiper Belt objects indicates the existence of a hypothesised “planet nine”—Rubin may even be able to build more evidence for this as-yet undiscovered world.

Beyond the solar system, astronomers seek to identify stellar streams of stars leftover from smaller galaxies merging with our own, which help us understand the history of the Milky Way.

What Rubin will capture more than any previous telescope



The Vera C. Rubin Observatory will carry out a ten-year survey of the Universe. [Rubin Observatory](#)

are optical transients—stars brightening and dimming, and those that eventually explode as a supernova.

These explosions produce elements essential to life, from oxygen to iron, and scatter across the universe the materials required for forming stars and planets.

Capturing more of these supernovae and understanding how they happen is vital for understanding the evolution of the universe. While these are some of the more common “flashes” Rubin will find in its game of spot-the-difference, other rarer objects such as black holes will also be detected and studied to improve our understanding of cosmology.

Some supernovae can be used to determine how far away the galaxy they inhabit is, letting us discover new environments from the earliest years of the universe. Why is it important to capture data about these ancient galaxies?

Scientists believe that the universe after the Big Bang was uniform in all directions. How then did galaxies form? Astronomers believe the answer lies in small clumps of dark matter, which gas and

dust gravitated around until galaxies could be born.

The issue with dark matter is that we cannot observe it directly, though it makes up 80% of matter in the universe. The dark matter is responsible for galaxies—and everything within them—developing, but it also forms even larger-scale filaments of galaxies.

How these structures form is dependent on what dark matter is—which requires us to know how it influenced the formation of galaxies big and small, old and young.

Understanding existence

The Legacy Survey of Space and Time seeks to answer one question – what is the universe? It also prompts another – why does it matter? By understanding where our existence comes from, we can predict the nature and eventual evolution of the universe: a complete picture of cosmic evolution from start to finish.

Humanity has turned to a number of answers for its own existence over the course of its existence, with Rubin another step in the direction of finally getting the full picture.

Understanding the fundamental forces at work in our universe is a path to answering many of the spiritual questions of society (what are we here for?) but also the practical ones (what steps do we take now?).

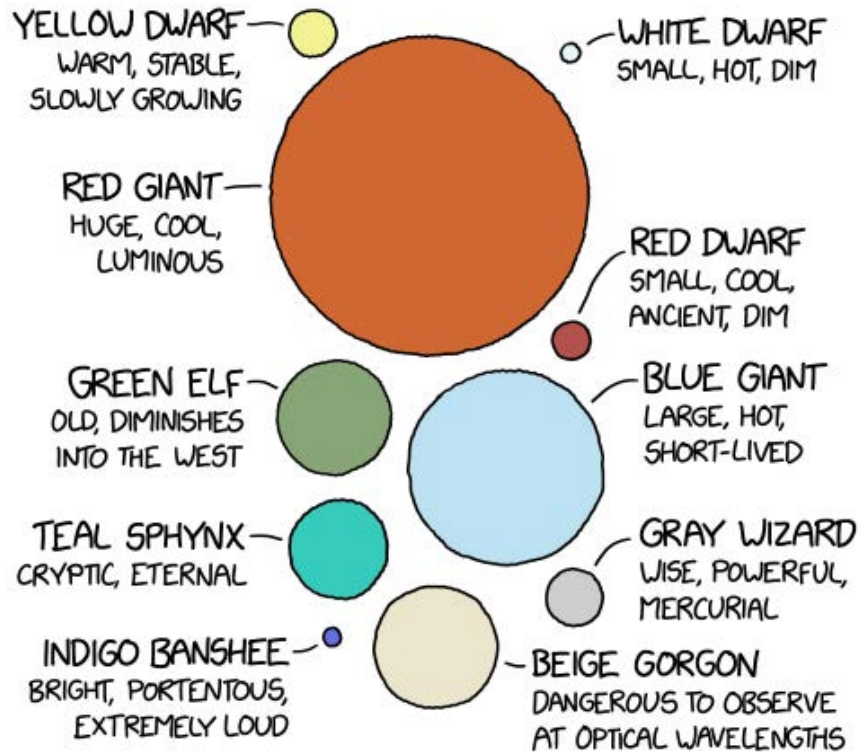
The Legacy Survey of Space and Time has inspired collaboration from scientists across the world based in countries such as Chile, the US, France, Germany, Australia, Japan, Brazil and the UK.

Techniques in machine learning and AI to analyse the huge amounts of data generated by Rubin will have uses in industries such as finance, medicine and engineering.

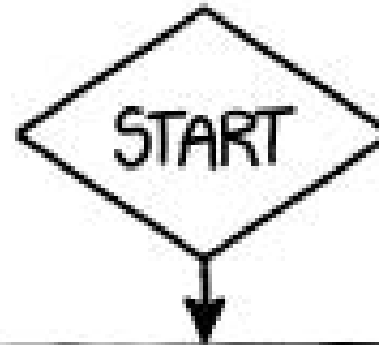
Regardless of how Rubin furthers our understanding of the universe, it will still enable technological innovations and international collaboration.

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COMMON STAR TYPES



HOW TO IDENTIFY A POSSIBLE METEORITE:



SUN MERCURY
(NOT TO SCALE) VENUS EARTH MARS

JUPITER

Optimistic aliens measure space typographically

← 1 AU →

SPACE TIP: IF YOU'RE EVER LOST IN THE INNER SOLAR SYSTEM, YOU CAN JUST TYPE OUT THE PHRASE "OPTIMISTIC ALIENS MEASURE SPACE TYPOGRAPHICALLY" IN TIMES NEW ROMAN AND USE THE DOTS AS A MAP.

[xkcd](#), by Randall Munroe.

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