Prescott Astronomy Club

Ephemeris

The Official Newsletter of the Prescott Astronomy Club (PAC)
e-phem-er-is: a time-based listing of future positions of solar system objects.

Original Photo: Lucas Pezeta

February 2023

Dr. Windhorst

Follow-Up on the JWST Mission

Dr. Rogier Windhorst is Regents' and Foundation Professor at Arizona State University and Interdisciplinary Scientist for the James Webb Space Telescope (JWST). Since 1987, he helped build up a world class group of astrophysicists and the ASU Cosmology Initiative, consisting of 16 faculty and numerous postdocs and students in the ASU School of Earth and Space Exploration.

Since 2002, Windhorst has been Interdisciplinary Scientist for JWST, with which he plans to make detailed a study of the epoch of First Light, when the universe was much less than one billion years old. He hopes to observe the First Stars directly during the first 500 Myr via so-called "cluster caustic transits", where gravitational lensing from foreground galaxy clusters can temporarily produce extreme magnifications of these individual early stars that happen be in exactly the right location behind the cluster. His JWST GTO team also plans to monitor the best survey field at the North Ecliptic Pole (NEP) to find the earliest supernovae with JWST in the first billion years, faint variable brown dwarf stars in our Galaxy, faint variable Active Galactic Nuclei, and to study the host galaxies of the first quasars seen less than one billion years after the Big Bang.

This summary is a combination from ASU and NASA sources. If all are included, the result would be too long for an introduction and take up too many pages of the Newsletter.

General Meeting of the Prescott Astronomy Club

Wednesday, March 1, 2023 6pm
Prescott Public Library - Founders Room

Speaker: Dr. Moskovitz

Topic: Earth strikes back: NASA's first planetary defense experiment (DART followup)

Background: Late 2022 NASA's DART spacecraft deliberately crashed into an asteroid at a speed of more than 13,000 mph. Given this dramatic end, ground based telescopes, including several at Lowell Observatory, will be tasked with witnessing the aftermath. I will discuss background to the DART mission, what is expected to happen, and why smashing into things in outer space can be fun.

Bio: Nick Moskovitz is an astronomer at Lowell Observatory in Flagstaff, Arizona. He has degrees from the University of California at Santa Barbara (BS Physics) and the University of Hawaii (PhD Astronomy). His research is related to small bodies in the Solar System with active projects involving video observations of meteors, curation of an asteroid database (asteroid.lowell.edu), and observations of near-Earth asteroids.

Original Photo: unknown from NASA.org

Spot the Messenger: Observe Mercury

Most planets are easy to spot in the night sky, but have you spotted Mercury? Nicknamed the Messenger for its speed across the sky, Mercury is also the closest planet to the Sun. Its swift movements close to our Sun accorded it special importance to ancient observers, while also making detailed study difficult. However, recent missions to Mercury have resulted in amazing discoveries, with more to come.

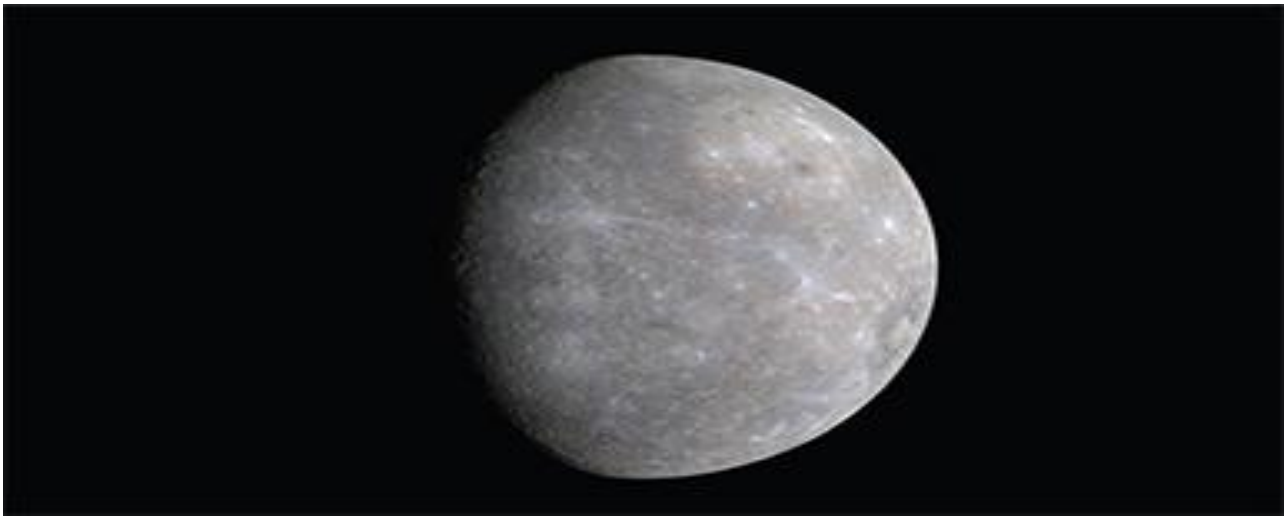


Photo: NASA/Johns Hopkins University Applied Physics Laboratory/Carnegie.

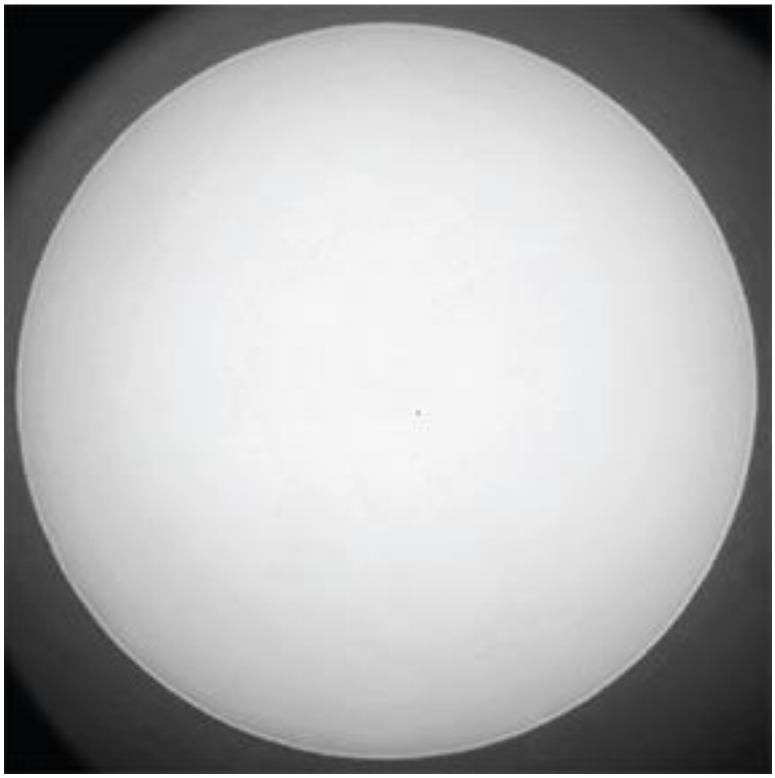
Mercury is hot, small, and heavily cratered across its gray surface, as seen in this image from NASA MESSENGER. Mercury is the most heavily cratered planet in our solar system, since it lacks either a substantial atmosphere or geologic activity to erode surface features like craters, similar in certain aspects to the surface of our own Moon.

Mercury can be one of the brightest planets in the sky – but also easy to miss! Why is that? Since it orbits so close to the Sun, observing Mercury is trickier than the rest of the "bright planets" in our solar system: Venus, Mars, Jupiter, and Saturn. Mercury always appears near our Sun from our Earth-bound point of view, making it easy to miss in the glare of the Sun or behind small obstructions along the horizon. That's why prime Mercury viewing happens either right before sunrise or right after sunset; when the Sun is blocked by the horizon, Mercury's shine can then briefly pierce the glow of twilight. Mercury often appears similar to a "tiny Moon" in a telescope since, like fellow inner planet Venus, it shows distinct phases when viewed from Earth! Mercury's small size means a telescope is needed to observe its phases since they can't be discerned with your unaided eye. Safety warning: If you want to observe Mercury with your telescope during daytime or before sunrise, be extremely careful: you don't want the Sun to accidentally enter your telescope's field of view. As you may already well understand, this is extremely dangerous and can not only destroy your equipment, but permanently blind you as well! That risk is why NASA does not allow space telescopes like Hubble or the JWST to view Mercury or other objects close to the Sun, since even the tiniest error could destroy billions of dollars of irreplaceable equipment.

Image: with the Assistance of Stellarium.

Mercury reaches maximum western elongation on the morning of January 30, which means that your best chance to spot it is right before sunrise that day! Look for Mercury towards the southeast and find the clearest horizon you can. Observers located in more southern latitudes of the Northern Hemisphere have an advantage when observing Mercury as it will be a bit higher in the sky from their location, but it's worth a try no matter where you live. Binoculars will help pick out Mercury's elusive light from the pre-dawn glow of the Sun.

Despite being a small and seemingly barren world, Mercury is full of interesting features. It's one of the four rocky (or terrestrial) planets in our solar system, along with Earth, Venus, and Mars. Mercury is the smallest planet in our solar system and also possesses the most eccentric, or non-circular, orbit of any planet as well: during a Mercurian year of 88 Earth days, the planet orbits between 29 million and 43 million miles from our Sun – a 14-million-mile difference! Surprisingly, Mercury is not the hottest planet in our solar system, despite being closest to the Sun; that honor goes to Venus, courtesy its thick greenhouse shroud of carbon dioxide. Since Mercury lacks a substantial atmosphere and the insulating properties a layer of thick air brings to a planet, its temperature swings wildly between a daytime temperature of 800 degrees Fahrenheit (427 degrees Celsius) and -290 degrees Fahrenheit (-179 degrees Celsius) at night. Similar to our Moon, evidence of water ice is present at Mercury's poles, possibly hiding in the frigid permanent shadows cast inside a few craters. Evidence for ice on Mercury was first detected by radar observations from Earth, and followup observations from NASA's MESSENGER mission added additional strong evidence for its presence. Mercury sports a comet-like tail made primarily of sodium which has been photographed by skilled astrophotographers. The tail results from neutral atoms in its thin atmosphere being pushed away from Mercury by pressure from the nearby Sun's radiation.



On rare occasion, Earthbound observers can observe Mercury, like Venus, transiting the Sun. Mercury frequently travels between Earth and the Sun, but only rarely does the geometry of all three bodies line up to allow observers from Earth to view Mercury's tiny shadow as it crosses our star's massive disc. You can see one such event in this photo taken by Laurie Ansorge of the Westminster Astronomical Society on November 11, 2019. If you missed it, set a reminder for Mercury's next transit: November 13, 2032.

NASA's Mariner 10 was Mercury's first robotic explorer, flying by three times between 1974-1975. Decades later, NASA's MESSENGER first visited Mercury in 2008, flying by three times before settling into an orbit in 2011. MESSENGER thoroughly studied and mapped the planet before smashing into Mercury at mission's end in 2015. Since MESSENGER, Mercury was briefly visited by BepiColombo, a joint ESA/JAXA probe, which first flew by in 2021 and is expected to enter orbit in 2025 - after completing six flybys. Need more Mercury in your life? Check out NASA's discoveries and science about Mercury at solarsystem.nasa.gov/mercury/, and visit the rest of the universe at nasa.gov.

Original Photo: George Desipris

A Chance to see a Comet

Art Arnold-Roksandich

Comet C/2022 E3 (ZTF) may be the most visible Comet since NeoWise in 2020. As you can see in the chart, the relative position of the comet heads east across the northern sky and becomes circumpolar on Jan. 21 until about Feb. 4th. During this time, it will transit times (above the pole) will be between 10pm and midnight, where it will be visible well above the horizon. It will reach its closest approach to earth on Feb. 1, around 27 million miles. At that time its brightness is projected to be as bright as magnitude 5 but could only be around 6 or 6.5. Comet brightness is hard to predict. On Feb. 10, the comet will appear very near Mars. Not many opportunities come where we can casually see a comet, so get out. Look up!

Sky and Telescope has an excellent article on this comet and its viewing possibilities. The Sky Chart below is from this article. https://skyandtelescope.org/astronomy-news/spot-circumpolar-comet-ztf-c-2022-e3-in-binoculars/.

Photos from the PAC

Original Photo: Zukiman Mohamad

Please submit photos for use here to Hilary Legacy at ed@prescottastronomyclub.org.

Backyard Astronomer

Original Photo: Eberhard Grossgasteiger

The Backyard Astronomer – February 2023

An Ancient Visitor from The Outer Solar System

By Adam England, The Backyard Astronomer

Photo: Chaco Canyon Crescent and Supernova, Courtesy EarthSky.org, imaged by Rob Pettengill. **Photo:** Ida Ou Kazzo Moracco petroglyphs, Courtesy American Meteor Society, imaged by Abderrahmane Ighi.

The Upper Paleolithic is a segment of human prehistory starting around 50,000 to 12,000 years ago, and is characterized by the first known organized settlements, advancements in tools and weapons, and artistic work. These early petroglyphs (carved or etched) and pictographs (painted) started with simple lines and dots, and soon evolved to include traced hands, animals, people, and boats. While we cannot presume to know the full intent of the respective artists, some of these appear to have been purely artistic, while others seem to relay information on game animals, locations, and even seasons and the passage of time. Lunar cycles, constellations, and unique astronomical events have been found worldwide, documented in these cave walls.

Photo: Stars of Orion's Belt? Courtesy Museum of Indigenous People.

These ancient people certainly looked to the skies, as we know similar stories behind constellations carry across continents and millennia. Archaeoastronomers study how these cultures understood the heavens and the impact it had on their civilizations. From Chaco Canyon, New Mexico, to the dense jungles of Borneo, to caves across Europe, we find repeated patterns of stars, crescent moons, seasonal equinoxes and solstices, supernovas, eclipses, and the sudden appearance and retreat of comets.

Comets became some of the first objects to be predicted, as short-period comets make their return in cycles of less than 200 years. Well before the invention of the telescope in the early 17th century, astronomers measured these long-tailed visitors against historical records and saw patterns in their return. However, some of these comets never matched up to historical records. Using modern technology, we now identify these as long-period comets coming from the distant Oort Cloud, a bubble of icy bodies well beyond the orbits of Neptune and Pluto. These comets are extremely difficult to predict how much they will brighten as they approach the Sun, with some visible during the day, and others only seen through binoculars.

Photo: Comet C/2022 E3 (ZTF) courtesy NASA.gov, imaged by Dan Bartlett.

Comet C/2022 E3 (TZF) is one of these long-period comets currently making its way through the inner Solar System. Discovered at the Palomar Observatory in California on March 2nd, 2022, it reached perihelion – it's closets approach to the Sun – on January 12th, became visible to the naked eye on January 17th, and will be closest to Earth on February 1st. Clear skies permitting, step outside and look toward Polaris, the North Star. Draw a line to the moon, and about a third of the way from Polaris, in the constellation Camelopardalis, you may be able to see this ancient interloper. Grab a pair of binoculars or a telescope and you will certainly be able to resolve the fuzzy green tail of this comet, which last graced our skies and was seen by our ancestors nearly 50,000 years ago.

Photo: Comet C/2022 E3 (ZTF) location on 2/1/23 via SkySafari.

Adam England is the owner of Manzanita Insurance and Accounting and moonlights as an amateur astronomer, writer, and interplanetary conquest consultant. Follow him @ Facebook.com/BackyardAstronomerAZ and Instagram.com/TheBackyardAstronomerAZ.

Original Photo: Camille Cox

February 2023:

This calendar is put together from several sources & shows the objects & events available for viewing during February 2023.

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
			1 C/2022 E3 (ZTF) at Perigee C/2022 (ZTF) Reaches its Brightest	2	3	4 Moon at Apogee
5 Full Moon (Snow Moon)	6	7 Moon at Aphelion	8 a-Centaurid Meteor Shower 2023 NGC 2808 is Well Placed	9	10 Mercury & Pluto in Conjunction	11

12	13 Last Quarter Moon Lunar Occultation of Delta Scorpii	14	15 Venus & Neptune in Conjunction Mercury at Aphelion	16 Sun & Saturn in Conjunction	17	18 C/2022 A2 (PANSTARRRS) at Perihelion Moon at Perihelion Moon & Mercury in Conjunction
19 Moon at Perigee Messier 81 is Well Placed	20 New Moon	21 Cluster NGC 3114 is Well Placed	22 Moon & Venus in Conjunction Moon & Venus in Close Approach Moon & Jupiter in Conjunction Moon & Jupiter in Close Approach Lunar Occultation of Jupiter	23	24	25 Moon & Uranus in Close Approach
26	27 First Quarter Moon Cluster IC 2581 is Well Placed Moon & Mars in Conjunction Moon & Mars in Close Approach Lunar Occultation of Mars	28				

Original Photo: Unknown

Our club webmaster, E. J. Van Horne, shares tips on how to get the most out of our website.

Our club webmaster, E. J. Van Horne, shares tips on how to get the most out of our website.

Shall get out my telescope and find a dark site for observing or enjoy a warm cocoa in front of the fireplace?

For me, that depends on the viewing conditions. Not what I can find on Accuweather or the Weather Channel, but critical measures of sky conditions - **cloud cover**, **transparency**, **seeing**, and **darkness**.

Cloud cover is measured in the percent of the sky covered by clouds. 100% is overcast with the sky completely covered. 0% is clear with not a cloud in the sky. Of course, the actual cloud cover is likely somewhere in between.

Let's say the clouds are not in my way. Next, I check the **transparency**. Even without clouds, that pesky water vapor can cause trouble, even if it is not the form of clouds. The more water vapor, the harder it is to see through the haze. The type of objects matter because some objects (global clusters) are high contrast, which don't require good transparency, while others, like galaxies, are not.

If the transparency is good enough for what I am viewing, next up is **seeing**. When the air is still, I can crank up the magnification and see fine detail on my targets. If the air is in motion due to turbulence, then trying to zoom in just results in a blurry mess in my eyepiece. Think of the mirages you can see over a hot road in the desert. Imagine looking though that with a telescope.

Finally, the **darkness** tells how much (or little) light will interfere with my viewing. This number includes time of day and bright astronomical objects, such as the Moon, but not light pollution, weather, or whether I forgot and left the lens cap on my scope. If you decide to set up in front of the Yavapai Courthouse, you are on your own.

Okay, where can I find the forecast values for these measures? The club website has you covered.

On the main menu, choose Resources and select Astronomy Websites. You will find a list of sites, each with an icon and a link underneath. Find the entry for the Prescott Clear Sky Chart and click on the link (not the icon). Pro tip - the sites are sorted by name to make them easier to find.

The chart can be overwhelming at first, but the site has good documentation. The Page Contents on the left side of the page (the heading has a lime green background) has information on Sky conditions, which I summarized above, and more. Spend some time with the chart and documents. Soon you, too, will be able to find out whether to roll out your scope or spend the evening on the Cloudy Nights website (whose link is also on the Astronomy Websites page).

I hope that this site helps you to find the best time to schedule your viewing.

E. J. Van Horn

Original Photo: Adrian Lang

Radio Astronomy

By Susanne and James Vaughan

When we think of astronomy, we usually think of the visual part of the electromagnetic spectrum. After all, the first sensors to train upon the skies were human eyes. But visible light is just a small slice of the electromagnetic spectrum. Radio waves are a much larger slice, about 10x larger. Radio astronomy collects the radio waves of the universe and assembles a different map. This non-visual data can show us the gas clouds leftover from exploding supernovae, the event horizon of black holes no longer emitting light, and the locations of pulsars. These radio emissions are collected from radio telescopes, digitized, and processed to show the images. The National Radio Astronomy Observatory has a web site with more information: www.nrao.edu

Radio telescopes arrays are all over the world. Recently, the Atacama Large Millimeter/Submillimeter Array (ALMA in Chile) released an article about discovering two supermassive black holes at the center of two merging galaxies. The binary black holes were found 500 million light years from Earth, with a mere 750 light years between them.

The good news is that a radio telescope can "see" through some clouds, so most of the time, a dark clear night is not required for observing. Even people in light polluted areas can use radio telescopes. Also, building a radio telescope can be done cheaply. One PAC member built one for 21cm wavelengths which shows the distribution of neutral hydrogen in space for about $200. If you are interested, contact a Prescott Astronomy Club board member, who can put you in touch with a member that builds and tests radio telescopes.

Original Photo: Egil Sjøholt

We'd Love Your Photos & Ideas for the Newsletter!

I am requesting any & all photographer members of PAC to submit astronomical &/or sky photographs to share with all the members by their inclusion in Ephemeris. Images can be sent to Hilary Legacy at ed@prescottastronomyclub.org. Please include descriptions of equipment, cameras, image capture parameters & processing, as well as what's in the image & when & where you took it. Or, for anyone who likes to photo edit or make their own images, I'd love to hear from you too. Thanks!

I'm also asking for anyone with ideas of things we could put in our newsletter or those willing to write articles to contact me. If there's something you'd like to see here, then tell me about it. Email Hilary Legacy at ed@prescottastronomyclub.org.

Original Photo: Joonas Kääriäinen

Observing lists are available in PDF format on the PAC website to provide guidance & goals for visual & astrophotography programs. This list These lists graciously provided by Past President David Viscio to assist in planning your observation activities. The lists are in PDF format and may be viewed, downloaded or printed with the permission of David Viscio.

Astroleague Lunar 100
Bright Nebulae Dunlop 100.
Globular Clusters
Messier
Planet Maps
Binocular Showpieces Caldwell
Face-On Spiral Galaxies
Herschel II
Herschel 400
Royal Astronomical Society of Canada Finest NGC Saguaro Astronomy Club Best NGC S&T

SCAVENGER HUNTS IN THE SKY

Lists for Any Occasion

Need ideas for your visual or astrophotography program? We have you covered with observing lists for your personal exploration or use at a star party.

Click on the links below to open an observation list in another window to view or print it.

Astroleague Lunar 100
Astroleague Urban
Binocular Showpieces
Bright Nebulae
Caldwell Objects
Double Stars
Dunlop 100 (Southern Hemisphere)
Face-On Spiral Galaxies
Globular Clusters
Herschel 400
Herschel II
Hidden Treasures

Messier Objects
Open Clusters
Planet Maps
Planetary Nebulae
RAS of Canada Finest NGC
Saguaro Astronomy Club Best NGC
Secret Deep
Space & Telescope Lunar 100
Telescope Showpieces by Month

Original Photo: Rajesh S. Balouria

What You Need to Know About Astronomy Apps

By Hilary Legacy

I hope last month's review of the app **X**. There are many astronomy apps available on both the Apple & Android platforms, but not all are created equal. Each offers different functions & information, each with a different design & style. Some focus on constellations & stars, others on the moon, yet others on education. I'll begin with the ones I myself have, one per month, & then other apps will follow in the next issue.

Sky Tonight

This app's home page shows both the Northern & Southern Hemispheres' stars & constellations as you hold it up (or down). On the top of the page is the exact date & time, & the bottom there are four buttons in order from left to right): a search button that also suggests things you can look at now or in the near future; a telescope-shaped button that tells you the current GPS coordinates, lists the stargazing index (when the sun's down, what phase the moon's in, how much current light pollution there is & the percent of cloud cover at the moment), the current weather where you are, then lists the objects that are visible (lists them by object type, alphabetical, date(s) they are visible & their magnitude); a button that calls up a calendar that lists each of the visible objects that day; & a button with three horizontal lines that gets you to the menu. The menu lists: Helpful Tips (obvious), Stargazing News (again, obvious), My Reminders where you set an alarm to look at a particular object, Favorites shows you're the favorite objects you've marked as such, Premium Access (the paid version, which I do not yet have), Calibration lets you reset your phone, & then lists "sister" apps. The one that looks the most interesting is called Solar Walk 2, which is a 3D encyclopedia of the entire solar system in real-time. Not a bad app with some different options.

In the next issue, I'll review X. I hope this column gives you a good look at some of the astronomical apps out there!

Original Photo: Samer Daboul

These are photographs from non-PAC members that you might enjoy.

Photo Credit: Tobais Bjørlii

Photo Credit: Eberhard Grossgasteiger

Original Photo: Tobias Bjørkli

PAC Board of Directors:

President: Art Arnold-Roksandich
Vice-President: Brian Blau
Secretary: Jack Evans
Treasurer: Roland Albers

PAC Directors-at-Large:

E.J. Van Horn Vice
Dave Covey
Ken Olson
Pat Bledsoe

PAC Coordinators:

Astronomical League Coordinator: Ken Olson
Club Equipment: Open
Facebook: Open
Membership: Roland Albers
METASIG: John Dwan
Newsletter: Hilary Legacy
Night Sky Network: Open
Outreach Coordinator: Brian Blau
Refreshments: Open
Schools & Camps Outreach: Joel Cohen
Starry Nights Coordinator: Brian Blau
Webmaster: E.J. Van Horn

Here are job descriptions of the open positions:

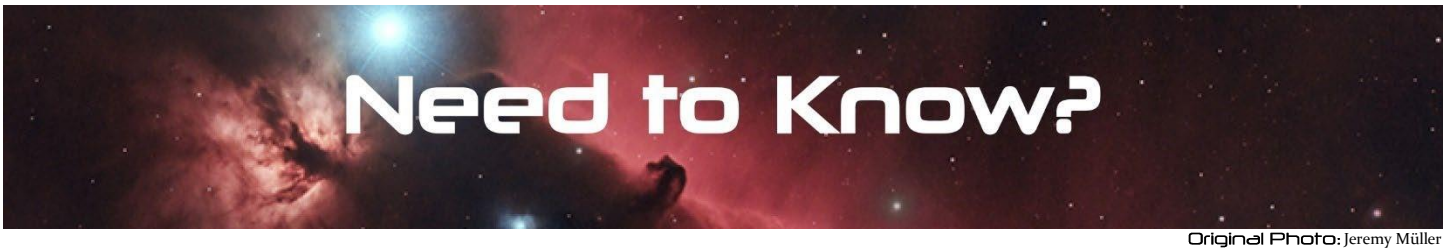
PAC Contact Information:

Website: http://www.prescottastronomyclub.org
Email: info@prescottastronomyclub.org

PAC Mentors:

If you need advice on the purchase of astronomy equipment, setting up equipment, astrophotography, etc., contact a PAC mentor.

Astrophotography: Open
General & Astrophotography: David Viscio
Visual Observation: Greg Lutes



Original Photo: Jeremy Müller

Ask a Member!

A 15-minute segment is being added to the regular general meetings where members can have their burning questions answered by other knowledgeable members. If you have an astronomy-related question you would like answered, submit it to Art Arnold-Roksandich at p@prescottastronomyclub.org. You can also bring up the question at the meeting.