The Denver
OBSERVER
NOVEMBER 2016

NGC 7380 in Cepheus, a bright open cluster with associated nebula, as imaged during the Okie-Tex Star Party this past September.

Image © Joe Gafford.

NOVEMBER SKIES

by Zachary Singer

The Solar System

November will be a quiet month for the planets, and the biggest news for diehards is **Jupiter**. Already rising two hours ahead of the Sun at the beginning of the month, the banded planet breaks the horizon around 2:30 AM by December 1st. Since opposition is still about 5 months away, Jupiter remains relatively distant, at about 6 Astronomical Units (AU) from us. That's about half-again as far as it will be this April, so the planet's image is only 2/3 of the size it will be then. Still, it's more than 30 arc-seconds across, and detail in its equatorial bands should be readily apparent. (For comparison, Mars appeared just 18 arc-seconds wide at its best this past spring.)

Speaking of **Mars**, Earth-bound observers see a disk that's shrunk to just 7" now; while that's enough to clearly see that it *is* a disk, that's about it. Though Mars will be an increasingly uninteresting *telescopic* target, it will remain a presence in our western evening skies until next spring. After that, we can look forward to the summer of '18, when Mars will again come to opposition—it will be a good one!

Venus is still a bit low for sharp images, but it's quite bright and will become a better target for telescopes over the coming months. **Mercury**, meanwhile, spends the month climbing out of the solar glare.

Uranus approaches the Meridian around 9 PM, making observations very convenient! It has also moved westward a touch, relative to the stars, and now sits a little over a degree from Zeta (ζ) Piscium, a pretty, 5th-magnitude optical double—centering this star in your finderscope will include Uranus in the finder's view, making locating Uranus easy. (While too dim to be seen in the city, Zeta isn't too tough in the country.) If Zeta is a tough target for you, it's little over 2½° from Epsilon (ϵ) Piscium, much brighter and easier to find at magnitude 4—by finding Epsilon first, Uranus should be a quick star-hop away for anyone with a basic star chart or a smartphone app—and Uranus will be even closer to Zeta next month and into January.

Neptune has slowly moved westward of Hydor, or Lambda (λ) Aquarii, and now lies about 2½° to the southwest of the star. Still, if you put Hydor near the northeast edge of your finderscope's field,

Sky Calendar

7	First-Quarter Moon
14	Full Moon
21	Last-Quarter Moon
29	New Moon

In the Observer

The Observer is available in color PDF format from the DAS website: *http://www.denverastro.org/das/denver-observer/*

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The Executive Board conducts the business of the DAS at 7:30 PM, at Chamberlin Observatory. Please see the Schedule of Events for meeting dates. All members are welcome.

http://www.denverastro.org

PRESIDENT'S MESSAGE

by Ron Hranac

Answers to Some Common Questions

If you're like me (I'm a confirmed science geek), you like to follow astronomy and astrophysics-related news. For depth, I subscribe to a handful of print publications—*Astronomy*, *Science News*, and *Sky & Telescope*—as well as email-based updates and alerts from the likes of *spaceweather.com*. And of course, there's the newsletter you're reading now! I also receive alerts on my iPhone about solar activity from the app "Solar Monitor," and some of the science-related pages on Facebook provide useful updates, too.

All of that information can be overwhelming, and it's all too easy to miss a big story, so I've picked out a few of my favorites from the past 18 months or so for you.

Arguably, the biggest recent astronomy story was the New Horizons flyby of Pluto in 2015. In my opinion, *the pictures alone* were worth the entire mission. Textbooks are being rewritten, and the data will be studied for years. Can't get enough of New Horizons? See *http://pluto.jhuapl.edu/Mission/index.php*.

Lost and found: Remember the missing Philae lander that was deployed by the European Space Agency's Rosetta spacecraft to the surface of Comet 67P/Churyumov–Gerasimenko about a year ago? The lander was finally found in early September of this year, less than a month before the end of the Rosetta mission. Philae was supposed to touch down on the comet, anchor itself, and do a variety of tasks that included imaging and analysis of samples of the surface and subsurface (the lander was equipped with a drill). Well, during the landing attempt, Philae bounced (it was a roughly two-hour "bounce"), then got stuck in a somewhat hidden location on the comet where its solar panels could not receive adequate sunlight to keep the batteries charged. There was a silver lining to this cloud, though, as Philae was able to return a fair amount of data—at least until its batteries ran out of juice after about three days.

And Rosetta? Its mission concluded successfully at the end of September, following what ESA called a controlled impact on the surface of Comet 67P, returning some spectacular images on the way in. Rosetta was the first spacecraft to orbit a comet, and the first to deploy a lander on a comet. Scientists will be studying this mission's data for years to come, too. "Thanks to a huge international, decades-long endeavour, we have achieved our mission to take a world-class science laboratory to a comet to study its evolution over time, something that no other comet-chasing mission has attempted,"

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DAS SCHEDULE

NOVEMBER 2016

5	Open House—DU's Historic Chamberlin Observatory—Starts at 6:00 PM
11	General Meeting at DU's Olin Hall, Rm. 105, 7:30 PM
18	E-Board Meeting—At DU's Historic Chamberlin Observatory, 7:30 PM
24	Thanksgiving—No Public Night
26	Dark Sky Weekend—EGK Dark Site & Brooks Observatory

During Open House, volunteer members of the DAS bring their telescopes to the Chamberlin Observatory's front (south) lawn, so the public can enjoy views of the stars and planets, try out different telescope designs, and get advice from DAS members. The Observatory is open, too (costs listed below), and its historic 20-inch telescope is open for observing with no reservations necessary.

Open House costs (non-members): If the skies are clear, $2/person ($5/family), $1/person in inclement weather. DU students with ID, and DAS members free.

Public Nights feature a presentation on astronomical subjects and a small-group observing session on the historic 20-inch telescope (weather permitting), at Chamberlin Observatory on Tuesday and Thursday evenings (except holidays), beginning at the following times:

March 10 - September 30 at 8:30 PM

October 1 - March 9 at 7:30 PM

Public Night costs (non-members): $4/adult, $3/child and students with ID. DAS members and DU students with ID: free.

Members of the public (non-DAS/DU, as above), please make reservations via our website (*www.denverastro.org*) or call (303) 871-5172.

DAS NEWS

At This Month's Open House: How to Buy a New Telescope

If you've thought about buying a telescope, then please join us at Chamberlin Observatory, **Saturday, Nov. 5th, at 7:30 PM**. As part of our Open House, a highly informative talk on the basics of choosing and operating a telescope will be given (Open House itself starts at 6:00 PM).

Three types of telescopes will be displayed and discussed and your questions will be welcome. We'll give you an idea of what you can expect to spend for a new, entry level telescope and we'll cover the basic principles of telescope science, ownership and operation. You'll also have an opportunity for hands-on experience operating and observing with several popular telescopes.

This talk is presented by Denver Astronomical Society, *www.denver-astro.org*, a non-profit entity dedicated to the furtherance of amateur astronomy, in cooperation with Denver University, Department of Physics and Astronomy, Dr. Robert Stencel, Department Chair.

New DAS members and folks new to the hobby are especially encouraged to attend this talk. The people of the DAS really want to meet you, help you get involved in the hobby, and make you feel welcome!

Volunteer Opportunities

Thursday, November 17th, 5:30-7:00PM. Ponderosa Elementary, public school in Aurora. STEAM (Science, Technology, Engineering, Arts, Math) night. They would love if we could include some telescopes for the night. Their students spend time in a "Star-Lab" (portable planetarium) every year learning about different aspects of the night sky, and would really like to connect what they've seen in there to the real night sky. Ideally, we'd probably like three or four telescopes.

To volunteer, please contact Julie Candia at *external @ denverastro.org* —and thanks!

Colorado Astronomy Day at the Chamberlin Observatory

On Saturday, October 8, DAS members brought out solar telescopes for Colorado Astronomy Day on the Chamberlin Observatory's south lawn and manned the Observatory's 20-inch refractor, offering the public a chance to see sunspots and prominences safely and with expert guidance. Thanks to all the members who helped out!

Above: In a solar-safety demonstration, participants "burned eyeballs" with unfiltered sunlight focused through a telescope eyepiece.

Left: Solar observing on the Chamberlin's south lawn.

Images © Z. Singer

President's Message

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notes Alvaro Giménez, ESA's Director of Science in a late September press release.

Proxima Centauri—part of a triple system known as Alpha Centauri—is a little over 4 light years away from us and is the nearest star outside of our solar system. A few months ago scientists discovered evidence for a planet orbiting Proxima Centauri. They named the planet Proxima b, which completes one orbit in just 11.2 days. Proxima b is also very close to its star: about 5% of the distance from Earth to the Sun.

Radial-velocity measurements suggest that Proxima b is at least 1.3 times as massive as Earth. The real surprise? The planet is *potentially* habitable, because of Proxima Centauri's tiny size and much cooler temperature than our Sun. Still, conditions are likely to be iffy: Proxima Centauri emits mostly infrared radiation, and is known for "exuberant" flares. Stay tuned on this one.

One mission that has perhaps been overshadowed by the aforementioned news (not to mention the discovery of gravitational waves a little over a year ago, see *https://www.ligo.caltech.edu/page/about*) is the Dawn mission to asteroid Vesta in 2011-2102, and now the dwarf planet Ceres. The spacecraft entered orbit around Ceres in March, and continues doing some pretty impressive science there. More information is available at *http://dawn.jpl.nasa.gov/mission/*.

While not specifically related to astronomy, the October 9th issue of Parade (a small magazine that accompanies the Sunday *Denver Post*) had an article about the emotion of awe, and Project Awe, a three-year research program at UC Berkeley. The article discussed awe and astronauts (they "feel this in the extreme"), and also mentioned "that spine-tingling feeling you get gazing at the Milky Way." Those of us who enjoy amateur astronomy can certainly relate to the latter, and the stories I shared here definitely fall under the awe umbrella for me. I told you I'm a science geek.

OKIE-TEX 2016

Clear Skies and Interesting Discussions on the Great Plains

By Jack Eastman

As September, 2016, drew to a close, the desolate outback of the Oklahoma Panhandle once again beckoned for an excursion to the Okie-Tex Star Party and the promise of unparalleled dark-sky astronomy… I headed to Villanueva Restaurant in Lamar for a healthy dose of Enchiladas de Taos, and then on to Boise City, where I spent the night. Next morning, on to help with the camp setup. At the site, we were surprised by a bit of a T-storm and fish-drowning rain. Radar showed only a tiny green pimple left after the storm, but it evolved into another fish-drowner, with a third a while later.

After that, skies were very good, SQM ~21.7-ish, and pretty much stayed that way—it was a great week of observation, camaraderie and commiseration with friends old and new! As in times past, the event was very laid back; there was plenty of time to wander around, engage in discussions of all possible things astronomical and optical—Okie-Tex is definitely one of the best star parties around.

On a couple of the nights, the seeing was especially good, and Saturn was a treat. Just following the Milky Way with binoculars was magnificent, beginning the journey at the boundaries of Scorpius and Sagittarius and working one's way along our galaxy. Later, poking through Auriga, we started with M38, and following the line of open clusters, hit M36 and M37, ending with M35 in Gemini—it was neat to see the differences in texture in these clusters.

One thing I noticed was the Milky Way in and around Sagittarius seemed somewhat washed out. I have noticed this at previous Okies; it's annoying until you realize it's the *Zodiacal Light*, scatter from dust in the plane of the Solar System (ironically, it takes very clear and dark skies to see it). The Zodiacal Light is interesting enough in the evening sky, but it's spectacular, an almost vertical cone of light, when seen before dawn.

The formal part of things started on Tuesday afternoon, with a series of talks on archeoastronomy, particularly solar alignments and inscriptions. Carl Lehrburger talked about a site in California, Mojave North, then Scott Monahan gave his talk, "Sacred Equinox," describing alignments relating to equinox events. Finally, Phil Leonard talked about the inscriptions at nearby Anubis Caves.

Wednesday afternoon began with Mike Lockwood, of Lockwood Custom Optics, on "A Modern Guide to Mirror Support," telling us how important a proper mirror cell and support system can be to the performance of your telescope, especially for large mirrors. This was followed by his talk on thermal control (that is, fans and the like) to reduce or eliminate the nasty effects of thermal currents in and around the telescope. Then John Bozeman showed us how we can add our images to the ones in the Palomar Observatory Sky Survey (POSS-II) images. The evening talk was Val Germann describing the 2017 eclipse path near his home in Missouri and some of the better sites from which to observe the event.

Thursday's talks were oriented toward the imaging community; John Bozeman repeated his session, and then father-and-son team Craig and Josh Smith went over the use of Sequence Generator Pro. That evening, Mike Simonsen offered "Stand Back! I'm Going to Try Science," describing the various research-oriented topics where the amateur can provide cutting-edge results, like variable stars, meteor showers (discovering new ones), planetary observations, asteroid light curves, and many more. The glaring omission, however, was double stars: Dave Cottrell took care of that with Friday's beginning talk, showing how us amateurs are using advanced approaches, such as autocorrelation techniques and even true speckle interferometry, to eke out the data from crummy images.

Tim Havens and Jack Eastman with the biggest (twin 6-inch, f/8 Takahashis) and smallest (6x15, inset) binoculars at Okie-Tex.

Image © D. Thomas / T. Havens

Dave also mentioned that we can contribute to the database in the Washington Double Star Catalog by observing "neglected doubles." He and Ed Wiley added that in this field, a person can make the observations and produce a published, peer-reviewed paper on one's own. After Jonathan Talbot's "Imaging from the Suburbs," was Val Germann again with a discussion of "The Santa Fe Trail and Astronomy in Missouri," which talked about how the folks out there founded the Morrison Observatory in the city of Fayette, with a 12.25-inch Clark refractor in 1875, and a year later, a 6-inch meridian transit from London. The Morrison Observatory's primary duty was the sale of the precise time to the Chicago & Alton Railroad and various

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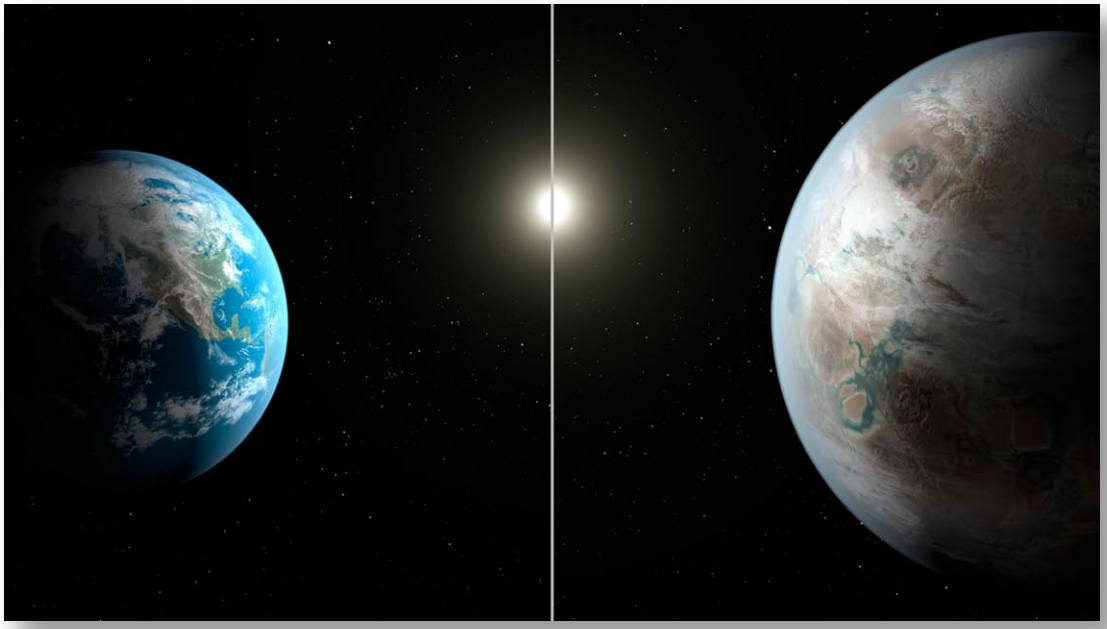
IS PROXIMA CENTAURI'S "EARTH-LIKE" PLANET ACTUALLY LIKE EARTH AT ALL?

By Ethan Siegel

NASA Space Place

Just 25 years ago, scientists didn't know if any stars—other than our own sun, of course—had planets orbiting around them. Yet they knew with certainty that gravity from massive planets caused the sun to move around our solar system's center of mass. Therefore, they reasoned that other stars would have periodic changes to their motions if they, too, had planets.

This change in motion first led to the detection of planets around pulsars in 1991, thanks to the change in pulsar timing it caused. Then, finally, in 1995 the first exoplanet around a normal star, 51 Pegasi b, was discovered via the "stellar wobble" of its parent star. Since that time, over 3000 exoplanets have been confirmed, most of which were first discovered by NASA's Kepler mission using the transit method. These transits only work if a solar system is fortuitously aligned to our perspective; nevertheless, we now know that planets—even rocky planets at the right distance for liquid water on their surface—are quite common in the Milky Way.



An artist's conception of the exoplanet Kepler-452b (R), a possible candidate for Earth 2.0, as compared with Earth (L). *Image credit: NASA/Ames/JPL-Caltech/T. Pyle.*

On August 24, 2016, scientists announced that the stellar wobble of Proxima Centauri, the closest star to our sun, indicated the existence of an exoplanet. At just 4.24 light years away, this planet orbits its red dwarf star in just 11 days, with a lower limit to its mass of just 1.3 Earths. If verified, this would bring the number of Earth-like planets found in their star's habitable zones up to 22, with 'Proxima b' being the closest one. Just based on what we've seen so far, if this planet is real and has 130 percent the mass of Earth, we can already infer the following:

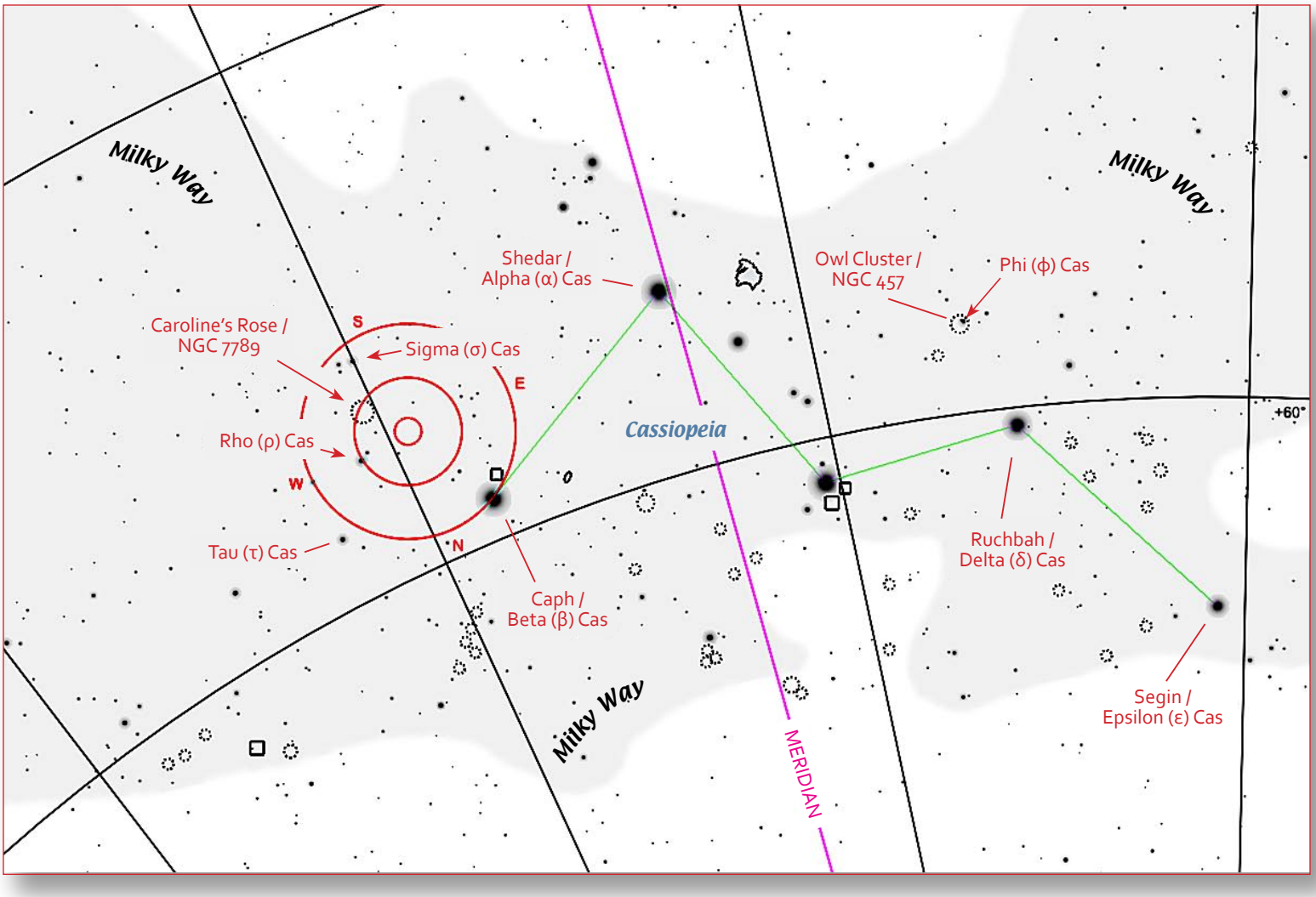
- It receives 70 percent of the sunlight incident on Earth, giving it the right temperature for liquid water on its surface, assuming an Earth-like atmosphere.
- It should have a radius approximately 10 percent larger than our own planet's, assuming it is made of similar elements.
- It is plausible that the planet would be tidally locked to its star, implying a permanent 'light side' and a permanent 'dark side.'
- And if so, then seasons on this world are determined by the orbit's ellipticity, not by axial tilt.

Yet the unknowns are tremendous. Proxima Centauri emits considerably less ultraviolet light than a star like the sun; can life begin without that? Solar flares and winds are much greater around this world; have they stripped away the atmosphere entirely? Is the far side permanently frozen, or do winds allow possible life there? Is the near side baked and barren, leaving only the 'ring' at the edge potentially habitable?

Proxima b is a vastly different world from Earth, and could range anywhere from actually inhabited to completely unsuitable for any form of life. As 30m-class telescopes and the next generation of space observatories come online, we just may find out!

Looking to teach kids about exoplanet discovery? NASA Space Place explains stellar wobble and how this phenomenon can help scientists find exoplanets: *http://spaceplace.nasa.gov/barycenter/en/*

This article is provided by NASA Space Place. With articles, activities, crafts, games, and lesson plans, NASA Space Place encourages everyone to get excited about science and technology. Visit *spaceplace.nasa.gov* to explore space and Earth science!



Viewing *north*, and about 70° up in Denver at 9:00 PM in mid-November. Note Telrad position relative to Caph, or Beta (β) Cas; placing it as shown, with Caph on the edge, and the Telrad's center 90° from the Caph-Shedar line, will include Sigma (σ) Cas and NGC 7789 just inside a 9x50 finderscope field.

Object positions, constellation and meridian lines charted in SkySafari, and then enhanced.

November Skies

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Neptune will be a blue-gray "star" near the opposite side. The planet crosses the Meridian around 7 PM mid-month.

If you've observed **Saturn** at all these last few days, then you already know that it's an increasingly blurry mess. At the beginning of November, it still appears more than 30° from the Sun, but that angle shrinks to a mere 8° by the end of the month, and the ringed planet achieves superior conjunction (when it lines up behind the Sun and is lost in its glare) on December 10th. In short, "Bye, Saturn; see you next year."

Stars and Deep Sky

Our targets this month are way up north, in Cassiopeia, the Queen—two open clusters, one of which is quite well-known, and one tight binary star. Before we get going, let me note that the shape of this constellation is one of the easiest to find, because it makes a pronounced "W" that long ago was supposed to represent a side view of Queen Cassiopeia's throne—so each section of the W is in turn, the chair's back, seat, legs and floor. The one catch is that because Cas is so high in declination (essentially, celestial "latitude"), we'll turn around and *face north* to observe there—so the W shape seen on sky charts will rotate 180°, appearing more like a flattened "M" than a W. Around 9 PM mid-month, you'll find the M waiting for you about 70° up and about 30° above Polaris, the North Star. (Look for it a little to the right earlier in the month, and a bit to the left later.)

Our first stop, then is the well-known **Owl Cluster, NGC 457,** at **1h 21m, +58° 22'.** (Some folks also call it the "ET Cluster.") Though I've included this one for beginners, it's a frequent target for experienced observers, because it's lovely to look at and easy to find. The cluster gets its name from its "eyes," two bright stars noticeable even in finderscopes, and its somewhat symmetrical "owl" shape—including streamers of stars that seem to illustrate cartoonish wings. (Ironically, the brighter of the "eye" stars, Phi [φ] Cassiopeiae, isn't actually part of the cluster—it's a line-of-sight interloper lying significantly closer to us.)

The Owl is very bright and easy to see, even in the city. In a 10- or 12-inch 'scope, it's lovely at about 60x, with a field wide enough to show even the outlying stars with plenty of room; out in the country, the Milky Way's stars form a rich background. At 120x, it's a little tight, but very good, too—and the extra magnification will help you see the central part of the cluster more clearly. At 200x, you'll see the dimmer cluster members very well, but the narrow field will require you to sweep around to get a complete view.

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November Skies

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With more moderate instruments, 60x is still a great place to start and 100-120x should give you great views; the "best" magnification will depend on seeing conditions, whether you're in the city or country, and so forth—let your eye be your guide.

Finding the Owl is easy—imagining Cas as an "M," look for the two stars that make up the letter's right side, Segin, aka Epsilon (ϵ) Cas, and Ruchbah, or Delta (δ) Cas. Put the center of your Telrad on the imaginary line between these two stars and slide it toward Ruchbah; keep going until the Telrad's center has passed Ruchbah and the *trailing* part of the outer (4°) circle rests on it. If you look through your finderscope, you'll now see Phi Cas, the "bright eye," glowing just a little to the side of the finderscope's center; put it in the middle, and a quick tweak in a moderate-power eyepiece will get you the whole cluster.

In contrast to the flamboyant Owl, whose brightest members are about 8.5-magnitude, the open cluster **Caroline's Rose, NGC 7789** (located at **23h 58m, +56° 48'**), seems dimmer, and at first glance, less spectacular. The cluster, though, is a fascinating object—its stars appear in swirling regions of light and dark, and folks who have never seen it before are often struck by its resemblance to a white rose, especially when viewed away from city lights. There are far more stars here than in the Owl, and they're more consistent in their appearance—that's because this is an unusually *old* cluster, with an age in the range of 1.5 billion years, so its massive, bright blue stars died off long ago, leaving the long-lived, cooler (and less ostentatious) stars to carry on. You don't need a big telescope for this cluster—a 5-inch (or even smaller) 'scope will do well under dark skies.

To find NGC 7789, find the stars that make up the *left* side of the "M" this time—Shedar, or Alpha (α) Cas at the "top" of the M, and Caph, or Beta (β) Cas, at the "bottom." Align your Telrad so that it makes a right angle to the line between these two stars, with Caph at the vertex and the Telrad's center making up the third "star"—*the chart illustrates this Telrad position*. If you have it right, Rho (ρ) Cas and Sigma (σ) Cas will lie on the opposite end of the finderscope from Caph—in a 9x50 finderscope under dark skies, NGC 7789 is a large, dim glow midway between them (remember the whole field will likely be inverted in the finder's view). Don't get too sloppy with your initial Telrad position, or you'll pick up Tau (τ) Cas in your finderscope—it's similar in appearance to Rho and Sigma, and it's easy to get confused then. With smaller finders or in the city, you'll likely be out of luck visually—in that case, just center your crosshairs between Rho and Sigma, and you should pick up a section of the Rose.

Finally, there's Sigma Cas, the star we just used to find NGC 7789. It's a tight binary, with two blue-white B-class components 3.1" apart—in a 6-inch 'scope, you might need 200x or more to split them on a decent night. Many listings for this system describe the colors as "yellow and blue," but when I've observed it this past few months, Sigma has instead appeared "white and light gray." (Such discrepancies are common, and in this case, our ongoing haziness could be the problem.)

With current conditions, Sigma Cas strikes me as a more-brilliant stand-in for half of the Double-Double in Lyra, and it's a little easier to split. When you observe Sigma, keep in mind that it's thought to lie about 4,500 light-years from us, an impressive distance for a star you can see naked-eye in the country—if our Sun were equally far, it would be too dim to see in a 10-inch 'scope. Sigma's distance also means that the "tight split" you see in your eyepiece corresponds to a physical separation of more than 4,000 AU, or at least 100 times farther than Pluto's average distance from the Sun.

If you followed the directions for Caroline's Rose, of course, you've already found Sigma Cas. They're only a degree or so apart, so if you've got one object, you've got the other—as long as you're in the neighborhood, give Sigma a look!

—See you next month.

Okie-Tex 2016

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time balls in St. Louis and Kansas City (see *https://en.wikipedia.org/wiki/Morrison_Observatory*). Then the evening talk was presented by Amy Estelle on the subject of cultural astronomy: How the various cultures over time regarded astronomy and how astronomy affected these cultures.

Saturday's final round of presentations started off with our own Mike Hotka's "Visual Observing 101," his techniques for getting the most out of an observing session. (He is very much "list-oriented," having lists for the objects to be observed as well as other lists, such as stuff to take on the observing trip!) Tom Trusok then presented "Tools, Technology and Software for Amateur Astronomers," an in-depth discussion of what's out there for us enthusiasts. The final talk, "Our Roots in Cosmology," with Dr. Jeff Hester, was a terrific examination of what we think we know about modern cosmology—a review of both the science and philosophy of our universe. All in all, it was a great roundup of speakers and subjects.

There was the traditional two-part swap meet as well. (Yes, I bit big this time, and grabbed a Super Polaris mount for my 6-inch.) One true highlight for us here was the appearance of a table of items from S&S Optika! Yes, S&S lives as a star party attendee—Tim and Cathie are keeping it alive; they say they'll do the star party circuit and sell stuff as they always have, but no "brick and mortar" store. It was great to see them there! They are thoroughly enjoying retirement under the pristine skies of west Central New Mexico.

All in all, a terrific time was had by all. I'm totally addicted to this one and definitely plan to go again in 2017 and years following.

ABOUT THE DAS

Membership in the Denver Astronomical Society is open to anyone wishing to join. The DAS provides trained volunteers who host educational and public outreach events at the University of Denver's Historic Chamberlin Observatory, which the DAS helped place on the National Register of Historic Places. First light at Chamberlin in 1894 was a public night of viewing, a tradition the DAS has helped maintain since its founding in 1952.

The DAS's mission is to provide its members a forum for increasing and sharing their knowledge of astronomy, to promote astronomical education to the public, and to preserve Historic Chamberlin Observatory and its telescope in cooperation with the University of Denver. The DAS is a long-time member in good standing of the Astronomical League and the International Dark Sky Association.

The DAS is a 501 (c)(3) tax-exempt corporation and has established three tax-deductible funds: the Van Nattan-Hansen Scholarship Fund, the DAS General Fund, and the Edmund G. Kline Dark Site Fund.

*****JOIN US!** More information about DAS activities and membership benefits is available on the DAS website at *www.denverastro.org*.

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