



## IO - October 2023

Eugene Astronomical Society, PO Box 591, Lowell, OR 97452

[www.eugeneastro.org](http://www.eugeneastro.org)

Annual Club Dues \$25

President: Andrew Edelen 618-457-3331

Secretary: Randy Beiderwell 541-342-4686

Additional Board members:

Dan Beacham, Ken Martin, Robert Asumendi.

EAS is a proud member of The Astronomical League



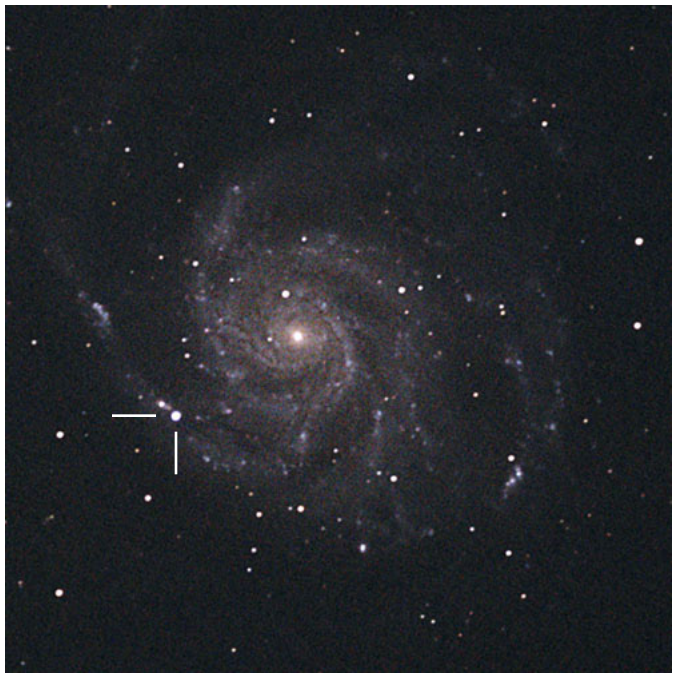
Next Meeting Thursday, October 19th, 7:00 p.m.

## Supernovae!

By Karmin Peterson

Inspired by last summer's supernova in M101, Karmin Peterson did some research on the phenomenon. Supernovae are some of the most violent explosions in the universe, marking the sudden death of a star. A supernova will often outshine the entire galaxy it's in — brighter than 200 billion stars! — for several months before it fades from sight. Supernovae enrich the interstellar medium with heavy elements that are too energy-demanding to be made in a normal star's lifetime, and are thus essential for our own existence. We often hear that we're made of star stuff, and that's true, but more to the point, we're made of *exploded* star stuff.

The above barely scratches the surface of all the cool things to know about supernovae. Karmin has agreed to share what he's learned about them at our October meeting. And bonus: What he learned further inspired him to write a song about them, which he will perform live for us at the end of his talk. This will be a meeting to remember, so don't miss it!



Supernova in M101, May 2023. Photo © by Karmin Peterson.

## Welcome New Members!

EAS welcomes two new members this month: Karmin Peterson and Kent Murley. Welcome to the club! We hope to get to know you and help you enjoy the night sky with us.

# September Meeting Report

## What's Up

By Robert Asumendi

## Exploring Jupiter's Icy Moons

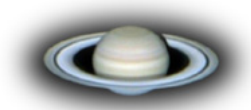
By Bernard Bopp

Our September 21st meeting began with Robert Asumendi's "What's Up" talk, featuring the ever-popular "Eyey" icon that designates which objects are visible to the naked eye. Robert gave us a full sweep of the sky from west to east, detailing dozens of objects to gaze at with naked eyes, binoculars, and telescopes.

After Robert's presentation, Bernie Bopp, retired professional astronomer, gave a talk on our search for life on the moons of Jupiter. He focused on the three outermost of the four large Galilean moons: Europa, Ganymede, and Callisto. All of those moons are larger than our own moon and are thought to contain liquid water oceans beneath their icy crusts. Europa's ocean may be fairly close to the surface, since that surface seems to be actively reformed by cracks, upwelling, and shifting of large icebergs. Europa also has sporadic geysers that shoot ice plumes many miles up into space, and we've been able to detect carbon dioxide, a compound necessary for life as we know it, on the surface.

Ganymede and Callisto have thicker ice and less recent resurfacing, but they still are thought to harbor deep oceans that could harbor life. Two space probes are heading out to Jupiter to examine these moons in more detail. JUICE (Jupiter Icy Moons Explorer), launched by the European Space Agency last April, will arrive at Jupiter in 2031, and Europa Clipper, a NASA mission scheduled for launch in October 2024, will arrive at Jupiter in 2030. When they do, we may find further evidence, perhaps even confirmation, of life beyond Earth. Stay tuned!

Many thanks to both Robert and Bernie for making this meeting one to remember. Bernie recorded his talk on Zoom before delivering it in person, so if you missed the meeting you can watch it on YouTube at [http://youtu.be/h\\_i4k3KBtIs](http://youtu.be/h_i4k3KBtIs).



## Next First Quarter Friday: October 20th

Our September 22nd star party was mostly clouded and smoked out, but the Moon and a few bright stars were visible, and MikeMcAdams was able to pull some good views out of the mist with his electronically assisted astronomy (EAA) setup. The Sheldon High astronomy club brought their scope, and several guests showed up as well, so it was a pretty decent star party despite the clouds and smoke.

Our next First Quarter Friday star party will be October 20th. First Quarter Fridays are laid-back opportunities to do some observing and promote astronomy at the same time. Mark your calendar and bring your scope to the College Hill Reservoir (24th and Lawrence in Eugene) and share the view with whoever shows up. Here's the schedule for the remainder of 2023. Star parties start at dusk or 6:00, whichever is later. (6:30 on 10/20)

October 20 (Moon 38% lit)

November 17 (Moon 24% lit)

December 22 (Moon 84% lit)

# Board Member Elections at October Meeting

Our October meeting is also our annual business meeting at which we vote for our board of directors. We have three positions coming up for renewal or replacement this year: Dan Beacham, Ken Martin, and Andy Edelen. Dan has agreed to serve another term if elected, but Ken is stepping down and Andy is moving soon, so those two positions need filling. Amy Baker and Sylvia Collazo have volunteered to fill them, pending a vote at our October meeting.

If anyone else wishes to toss their hat into the ring, we can have a multi-candidate election with the two candidates receiving the most votes winning the two board seats. If you would like to be nominated, contact one of the existing board members to learn more about the process and what will be expected of you.

After the general meeting, the board will meet to officially appoint officers for the next year. Robert Asumendi, who was elected to the board last year, has agreed to take on the president's job, and Randy Beiderwell has agreed to continue as secretary.

## That Time of Year for EAS Dues

By Randy Beiderwell

Hello everyone! Are you feeling a little fall in the air? Ready to fire up those awesome dew heaters? Just a reminder: EAS dues are still only \$25/yr! What a bargain!!!!

A HUGE THANK YOU to those of you who have already paid dues for 2023/2024! You all ROCK!

For those of us who have yet to pay, Dues are due and payable October 1, 2023 for the 2023/2024 season. My Astronomy Calendar says that is this Sunday!

**Renewing members, please send a check or money order to:**

Eugene Astronomical Society

P.O. Box 591

Lowell, OR 97452

New or prospective members, please fill out an EAS Membership form printable from our website in the "Join" section at the top of the Home Page at [eugeneastro.org](http://eugeneastro.org)

Prorated prices are for new members only! After you join EAS, dues are \$25.00 for an individual or 25.00 for an entire family per year. Once I process your check, you will get an EAS Dues Receipt via the most recent email address I have for you. Sorry, there is no way yet to pay your dues online. I still need a check, cash (not advised to send via mail) or money order.

Returning EAS members need not fill out a New Membership Application.

If you have a change of address, email or phone number, PLEASE let me know when you send in your check. Or, you can drop me a line anytime with any new information. If you have not been receiving your *Reflector* quarterly magazine from the Astronomical League, it is most likely due to a change of address that I am not aware of.

When you join EAS, you also join (behind the scenes) the Astronomical League. If you have never done so, I suggest poking around their website. There is a plethora of info, contests (yup, even for binoculars) and much more for your viewing pleasure. You also get a member discount on their books and more. NOTE: If you are not a paid-up member of EAS, you are not a member of the Astronomical League.

Thanks for your time, and happy fall to all! YEA for those sucker holes in the clouds!

Randy Beiderwell

EAS Secretary/Treasurer/Board Member

# Annular Eclipse October 14th (Early!)

Eugene will be right in the path of an annular eclipse on the morning of October 14th. Annular eclipses happen when the Moon moves between the Earth and the Sun but the Moon is near apogee in its orbit, so it's too small to completely cover the Sun. What we'll see is a dark bite taken out of the Sun at the beginning of the eclipse (called "first contact"), then the bite will get bigger and bigger until the entire moon fits within the blazing circle of sunlight ("second contact"). The Moon will take three minutes and fifty-four seconds to cross the face of the Sun, then it will touch the other side ("third contact") and begin to slip away until the last moment of eclipse ("fourth contact").

The eclipse will start early in the morning and be over by late morning. Here are times for Eugene:

**First contact: 8:04.** The Sun will be only 6° above the horizon at azimuth 107° (east-southeast).

**Second contact: 9:16.** The Sun will be 18° above the horizon at azimuth 121° (a little farther south).

**Third contact: 9:20.** The Sun will be at essentially the same altitude and azimuth.

**Fourth contact: 10:40.** The Sun will be 29° high at 140° azimuth (southeast).

The Eugene Science Center will be hosting an event, and EAS will be providing solar telescopes along with expert commentary and brilliant insights into the cosmic coolness of the eclipse. There will also undoubtedly be a fairly large crowd at the College Hill Reservoir, so we'll have some club members there as well. We can coordinate who goes where on our email list in the days before the event.

Note that Eugene is not on the centerline, so the ring of fire around the Moon during annularity will never look perfectly even. To see that, you need to travel south to the centerline, which is near Drain.

Weather records show that it's cloudy in Eugene on October 14th about 63% of the time, so it might pay to have a contingency plan in case we're unlucky. The eclipse path extends southeast from here, so Highway 58 is one option. Since the centerline is south of here, going south on I-5 is another option. Crater Lake would be a good site, although it's likely to be crowded at the rim (if it isn't snowed in already).

A note on safety: There will be no part of this eclipse that's safe to view without eye protection. Even during the annular phase of greatest eclipse, the Sun will be bright enough to damage unprotected eyes, and that damage will be permanent. Regular sunglasses are not enough to prevent damage, nor are any of the commonly espoused homemade filters made from candy wrappers, photographic film, old floppy disks, or the like. Nor can you use safe solar shades to look through binoculars or a telescope. The solar filter must go on the front of binoculars, telescopes, cameras, etc and let no unfiltered sunlight through whatsoever. Use only certified safe solar filters and safe viewing practices, or regret it for the rest of your life. Solar eclipses are totally cool even when they're just annular, and you should make every effort to see this one, but do it safely.



The annular eclipse of 2012. Photo courtesy of NASA.



# Constellation of the Month: Lacerta

By Andy Edelen

Hidden amidst the autumn Milky Way between Pegasus and Cepheus, Cygnus and Cassiopeia, is the faint zigzag pattern of Lacerta, the celestial Lizard. One of the Northern Hemisphere's most overlooked and obscure constellations, Lacerta and its member stars lie between two arms of the galaxy; the constellation's star-rich northern half contains a wealth of open clusters and planetary nebulae, while its southern reaches abound with small, faint galaxies — the shoreline of the great intergalactic sea in neighboring Pegasus, Pisces, and Andromeda.

Relatively few amateur astronomers bother to venture into Lacerta without a compelling reason to do so. Although it's teeming with deep-sky targets, none of these is a showpiece; as with many of our Constellations of the Month, the rewards here are subtle and understated. Yet for a constellation ranking 68th among the 88 constellations in size, and with its brightest star shining only at magnitude 3.8, Lacerta offers an entire season's worth of objects to examine and ponder. The challenge, among all of the similarly-bright potential guide stars, is to sort the wheat from the chaff.



Lacerta, as seen among its neighboring constellations. Image rendered in *Sky Safari 6*.

The Lizard, as with several of our other featured constellations, was created by the Polish astronomer Johannes Hevelius (although Hevelius's original renderings of the constellation were distinctly more mammalian in appearance, resembling a weasel more than a lizard). Attempts by German astronomer Johann Bode (of Bode's Nebulae fame) to make the stars of Lacerta into an homage to King Frederick of Prussia never took hold, although an asterism called Frederick's Glory — the last remnant of Bode's efforts — still exists in the constellation Andromeda.

The ancient Chinese referred to this region of the sky as *T'ang-Chie*, The Awakening Serpent, whose culmination in late January announced the end of winter. To the Chumash people of California, the stars of Lacerta represented an underworld ravine, through which a departed soul must travel to reach the Land of the Dead; here in the ravine, the soul would have its eyes plucked out by ravens, its eyes then replaced by poppy flowers. (A number of online sources claim that the Chumash also considered Lacerta to be a Lizard, but I don't find independent corroboration on this anywhere.)

Lacerta is short on both bright stars and an easily-recognizable pattern — it's one of three constellations (with Lynx and Camelopardalis) that always require me to look from the sky to a star atlas repeatedly during a night's deep-sky searching. There are few easy landmarks here, which makes Lacerta a challenging naked-eye target. (We'll cover some easier constellations over the next few months.) A dark sky is almost a necessity for tracing out the Lizard's meandering zigzag. It helps to start at the northwest corner of the readily-identifiable Great Square of Pegasus, starhopping from there to third-magnitude Eta Pegasi, and thence to fourth-magnitude 1 Lacertae, the southernmost star in the zigzag.



Lacerta, with the featured objects circled. North is to the right. Note that the double stars  $\Sigma 2894$  and  $\Sigma 2876$  are labelled as HR 8510 and HD 210772, respectively. Image rendered in *Sky Safari 6*.

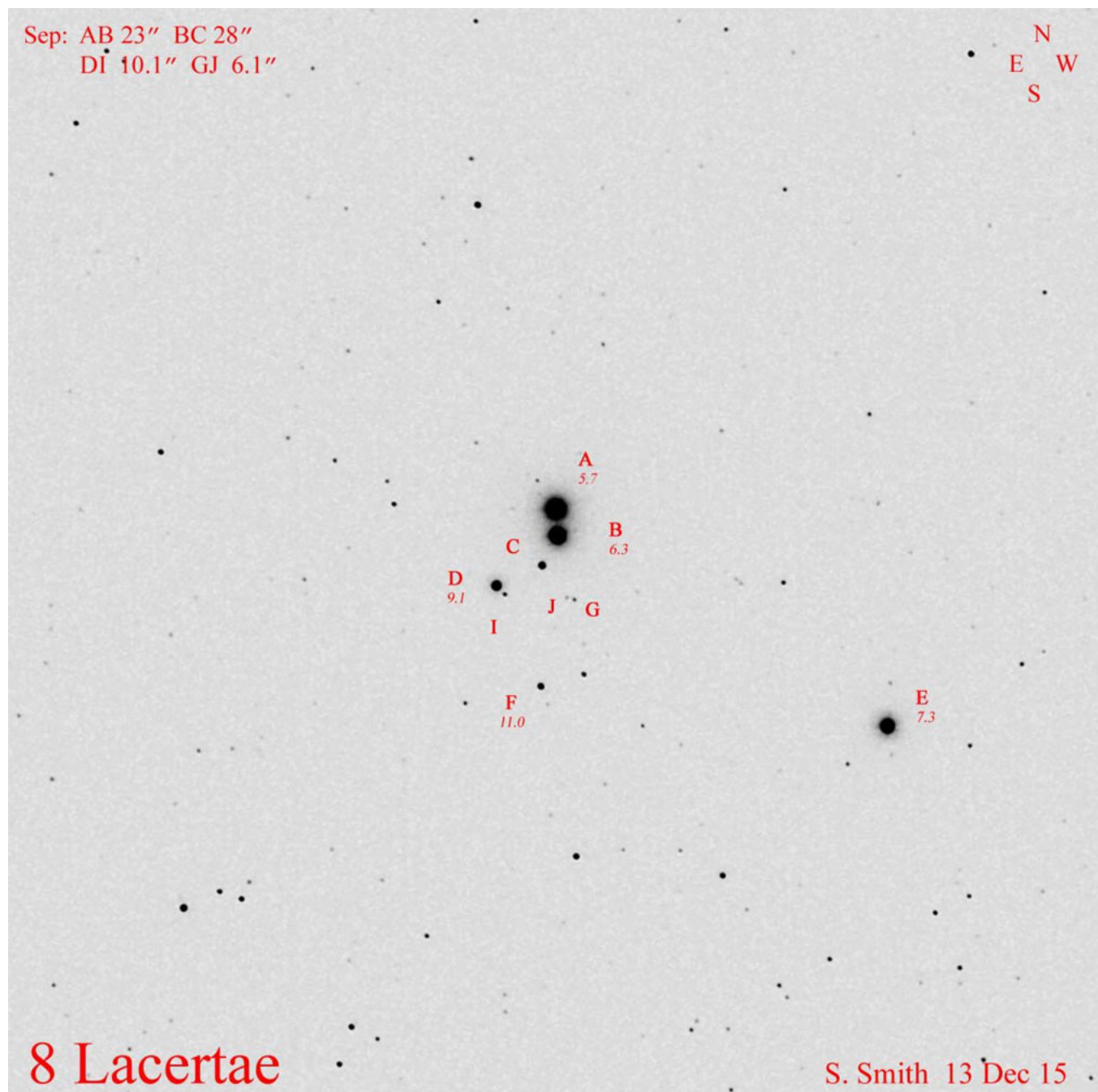
But our naked-eye challenge is not actually the constellation's pattern; it's to observe one of the constellation's individual stars. **10 Lacertae** looks like a basic 4.9-magnitude star, perhaps bluer than most to those with keen vision. The star's secret, though, is that it's a rare O-type dwarf star (O referring to its spectral type, which makes the star extremely blue), and the only one of naked-eye visibility. O stars are the hottest and rarest in the sky; only 0.00007% of stars are of this type. That 10 Lac is also a dwarf star — a Sun-sized star, in this case — makes it even rarer.

The distance to 10 Lac is poorly known, but our best estimate places it at about 1700 light years. At this distance and its apparent magnitude, 10 Lac would shine more than 2500 times as bright as the Sun.

And at this luminosity and mass, 10 Lac will live for only about 10 million years before destroying itself in a supernova explosion.

This stellar gem lies just under halfway between Eta Pegasi and 3.8-magnitude Alpha Lacertae. It's not an easy target for unaided eyes, but give it a try from one of EAS's dark sites. Binoculars may help locate the star, and telescopes of any size will reveal its brilliant blue hue, but be sure to try to spot it unaided if you use optical aid first! (10 Lac has a 10th-magnitude companion star an arcminute to the northeast; this will require a telescope.)

Our object for 6-inch telescopes lies just under a degree northwest of 10 Lac. **8 Lacertae** is a multiple star of so many components that it's sometimes referred to as a poor star cluster. The primary (brighter) star in 8 Lac is of magnitude 5.7, the secondary 6.3. These are known respectively as the "A" and "B" stars, the brightest in a multiple star almost always being the "A" star. Their separation distance would be written as



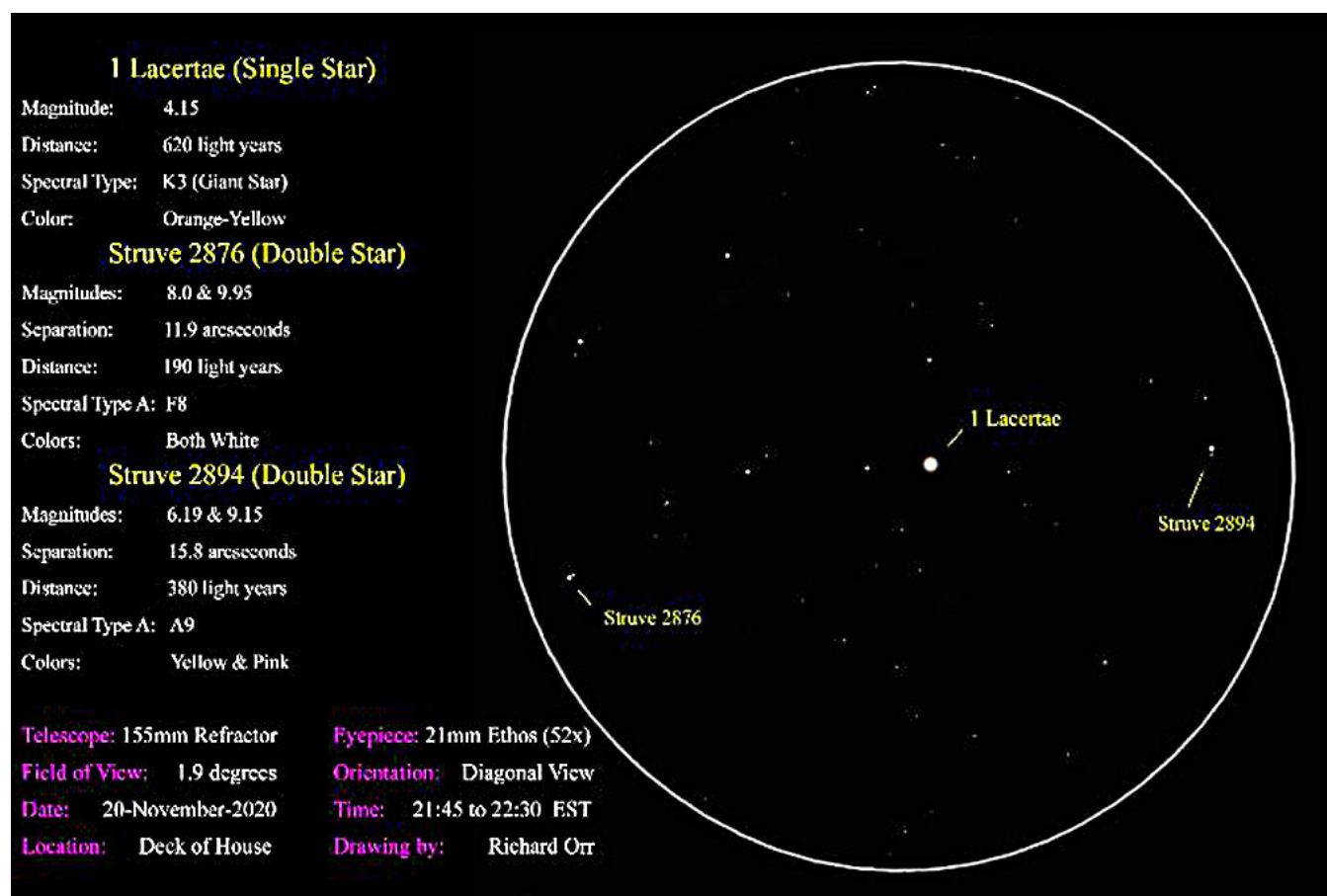
The components of 8 Lacertae. Photo by ssmith@cloudynights.com.

AB, in this case 22.4 arcseconds. (AB=22.4".) Further components would, ideally, be listed in descending alphabetical order by magnitude — “C” would be third-brightest, “D” fourth-brightest, and so on. However, this frequently isn’t the case, as additional components are often named in order of their discovery, even if they turn out to be brighter than any of the previously-named components. Confusing? It can be!

But back to 8 Lac. There are at least ten components in this multiple star system (A-J), almost all of them white or yellowish-white in the eyepiece. 8 Lac C is the dimmest of the major components at magnitude 10.4 (AC=49"); D shines at magnitude 9.1 (AD=82"), and E — which lies a whopping 5.5 full arcminutes away — is the third-brightest in the 8 Lacertae system at magnitude 7.3, implying that its “membership” in the group was only discovered after those of C and D. The other, fainter known components can be found on the photograph below, although there may still be further components listed in more-obscure scientific literature.

A pair of merely-double stars is our target for 4-inch telescopes this month. Sharing the same low-power field of view as the 4.15-magnitude star 1 Lacertae,  $\Sigma 2876$  and  $\Sigma 2894$  are among the Lizard’s finest binary systems.  $\Sigma 2876$  consists of a white 8.0-magnitude star with a bluish-white 9.8-magnitude companion (AB=12");  $\Sigma 2894$  has a yellow 6th-magnitude primary with a blue 8.9-magnitude secondary (AB=16"). Seen in the field with orange 1 Lac, these two doubles provide a wide range of color and spectral type. Note, however, that the colors of stars — particularly in close proximity to each other — can be highly subjective; one source describes  $\Sigma 2894$  as “yellow and pink.” These two doubles are  $1.3^\circ$  apart, so be sure to use an eyepiece that allows for that large a field of view in order to see them together.

The “ $\Sigma$ ” at the beginning of the stars’ names is the prefix for the catalogue of Friedrich Georg Wilhelm von Struve, the patriarch of the Struve family of double-star observers. (His son Otto had two catalogues of doubles, labelled “O $\Sigma$ ” and “O $\Sigma\Sigma$ .” Other members of the family used no prefixes.)



The field of 1 Lacertae, with  $\Sigma 2876$  and  $\Sigma 2894$  both visible. Field of view  $1.9^\circ$ ; magnification 52x with a 6-inch refractor. Sketch by Richard Orr, orrastradrawing.com.

If 8 Lac is a “star cluster” of sorts, most of our remaining objects this month are true clusters, lurking amid the intangible glow of the Milky Way. Our binocular object for this month, **NGC 7209**, is the southernmost of our target clusters in Lacerta, lying just under 3° west of 4.5-magnitude 2 Lacertae. NGC 7209’s location, south of the denser band of the visible Milky Way, makes it easier to spot in binoculars and easier to identify.

One of several larger clusters in the Lizard, NGC 7209 spans 1/3 of a degree. It’s not particularly rich in stars, with about 25 members. Only two of these (a pair of 8.5-magnitude stars) are bright enough to resolve in standard binoculars; the remainder form an indeterminate circular background glow. Still, this is a bright, obvious object in even the old “opera glass” style binoculars used by so many of the popular astronomy writers of the early 20th Century.

Similar to NGC 7209, but a brighter object overall, is **NGC 7243**, which lies about 4° north-northeast of NGC 7209 (or 1.5° roughly west of 4.6-magnitude 4 Lacertae). NGC 7243 is very slightly larger than NGC 7209 and somewhat richer in stars. This makes it a better object for a 2-inch telescope, as there’s more detail that can be seen here with small optics.

NGC 7243 reveals eight stars to binoculars, but about twice that many to a small refractor. Its brighter stars are more evenly spread out than those of NGC 7209, so there’s less unresolved glow behind the brighter stars. The cluster was one of William Herschel’s discoveries (Sept. 1788), and is also included in the Caldwell Catalogue, a list of interesting deep-sky objects hand-selected by British astronomer Patrick Moore.

Farther north in Lacerta lie our targets for 8- and 12-inch telescopes. **NGC 7245** is a smaller cluster, just under 5' in diameter, embedded in a denser portion of the Lacerta Milky Way. The stars in NGC 7245 are of two primary brightness “levels”: there is a sprinkle of 11th-magnitude stars along the cluster’s west side and a 9th-magnitude star on the east-northeast just outside the cluster’s periphery, and these are overlaid upon a field of predominantly 13th-magnitude stars. My notes on the cluster (with a 12.5-inch scope) indicate that it’s extremely rich, small, and bounded by a triangle of brighter stars... “not a cluster for easy resolution.”

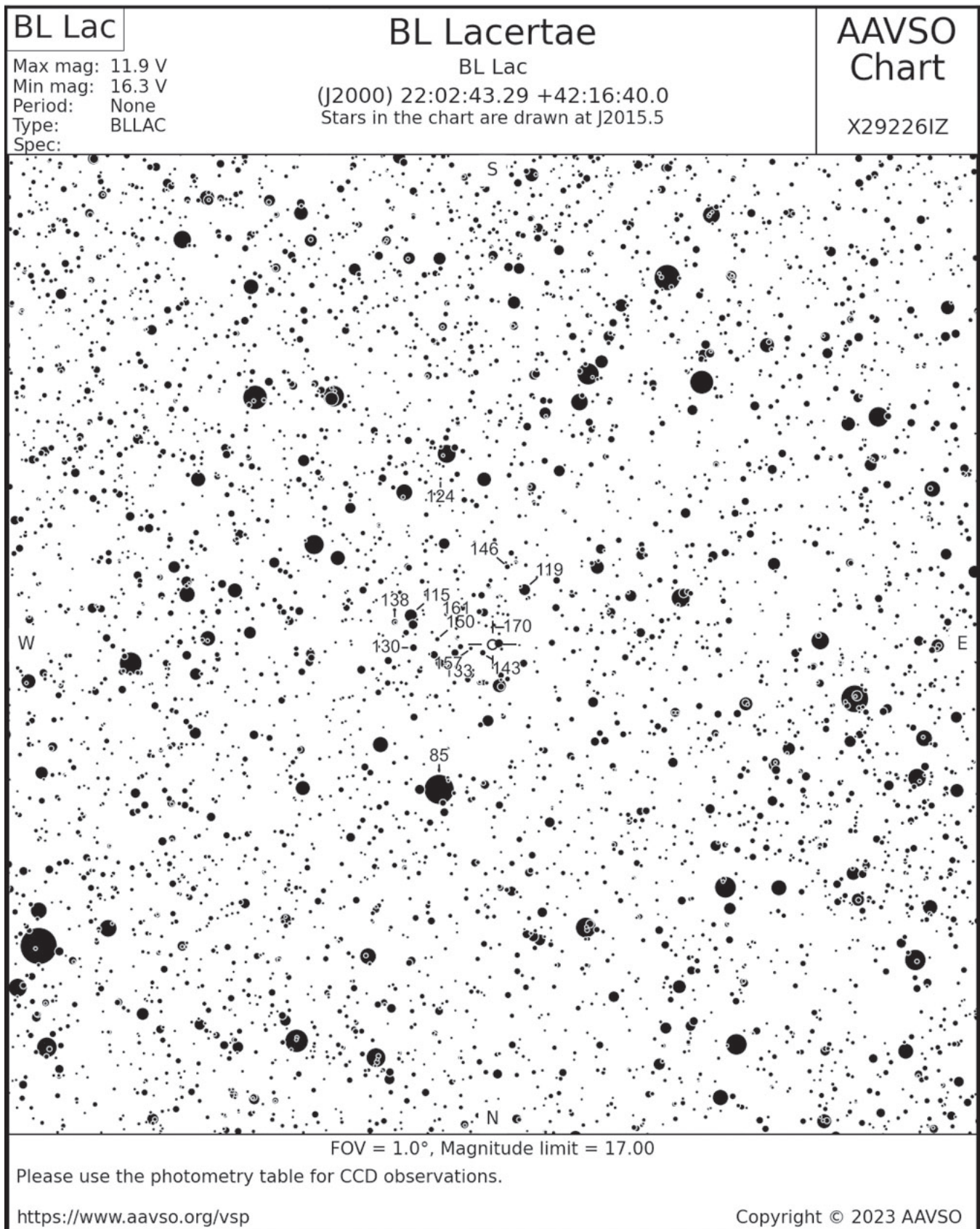
To find NGC 7245, draw a line through Alpha Lac through Beta Lac and extend it that same distance.

In the same low-power field of view, 5' northeast of NGC 7245, is a barely discernible 3' glow, more apparent in photographs even than NGC 7245 but vanishingly faint in the eyepiece. This is **King 9**, an exceedingly-rich but very challenging open cluster that’s 2-1/2 times farther away than NGC 7245 (26,000 light-years vs. 11,000). For those who don’t think of open clusters as visual challenges, King 9 is certainly proof otherwise; it’s as tough as any of the Palomar globulars.

Much of the reason for this is, as mentioned, King 9’s distance. Of its forty member stars, the brightest are of 18th (!) magnitude. The stars you see in the eyepiece (and in photos) that look like member stars of King 9 are merely superimposed, line-of-sight objects having no relation to the cluster at all. It’ll take excellent sky conditions and a large telescope to pull King 9’s feeble gossamer glow out of the starry background, especially with those overlaid foreground stars causing your eye to be distracted from the task.

There are 27 clusters in the King catalogue, five of them with superseding designations (King 3 is better known as NGC 609, and four other King clusters have more-common names from the Berkeley or Czerwik catalogues). This is common with open clusters; there are a great many catalogues of such clusters in use, and they often overlap. The majority are named after their discoverer (in this case, American astronomer Ivan King) or place of discovery (Harvard, Berkeley, Biurakan, etc.). These less-familiar catalogues of open clusters are often a good source of observing targets beyond the usual Messier and NGC objects, but it pays to know ahead of time what you’re getting into — some open-cluster catalogues contain only dim, difficult objects, while others contain bright objects that are hardly recognizable as unified, discrete entities. The King clusters are a mixed bag; I had assumed King 9 would be a fine sight in my 12.5-inch scope, without realizing that even larger optics would be needed to see more than a barely-perceptible glow.

Our final object for Lacerta is the constellation’s most unusual. **BL Lacertae** is, on first glance, an ordinary star; after repeated observations, it may be discerned to vary in brightness over time. But even this



Finder chart for BL Lacertae; north is at bottom, west at left. Field of view is 1°. Comparison star magnitudes have decimals removed; e.g. “124” = magnitude 12.4. The brightest star at lower left is 7.6-magnitude HD 209125.

Image courtesy AAVSO.org.

is hardly indicative of the object’s true nature — BL Lac is actually the extremely variable active nucleus of a distant galaxy, and the namesake of the object class known as BL Lacertae Objects.

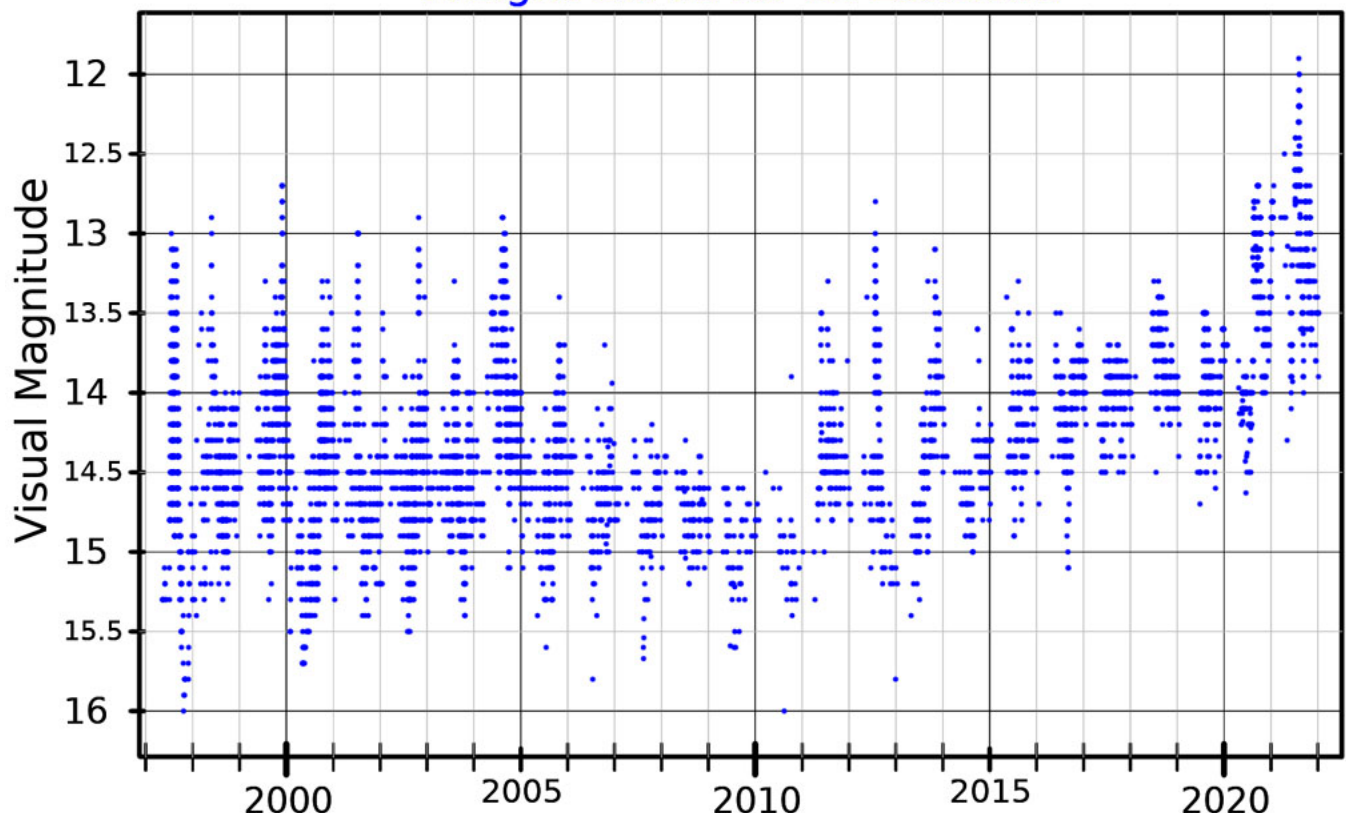
The mechanics of BL Lac objects aren’t fully understood. They seem to be the result of relativistic jets — massive outpourings of plasma ejected from supermassive black holes — being aimed roughly in our direction. The irregularity of these jet outbursts is what causes the variations in brightness that we see. In the case of the BL Lac Objects, these differ from standard quasars in large part by the frequency of the variation and the lack of emission lines in the spectra of the two types of object. The BL Lac Objects are “lower-power” radio galaxies than other such types.

Observing BL Lac generally requires a 10-inch telescope or larger. It lies exactly halfway between 4.5-magnitude 6 Lac and magnitude 5.0 77 Cygni; this is not an easy task to find. The object’s magnitude usually ranges between magnitudes 14 and 17, so under good conditions, a 10-inch scope would be able to follow the object down to about magnitude 14.5. Recently, however, BL Lac has become even more energetic than usual, and is brightening into the 12th-magnitude range — within range of even an 8-inch scope on a good night. The best time to catch this unusual object is this fall! Use the finder chart below, a clear dark sky, and the largest optics you have.

The celestial Lizard is one of the most challenging constellations in the Northern Hemisphere, its faint zig-zag almost invisible in the riches of the autumn Milky Way. And yet its own riches are well worth tracking down; there are unusual stars, open clusters of all kinds, and a host of planetary nebulae and galaxies which we didn’t even cover this month. Once you’ve gotten familiar with the more-famous constellations around it, test yourself with Lacerta — you may find this forgotten corner of the cosmos to be as rewarding as its glamorous neighbors.

(Next month: something a lot easier!)

### A Light Curve for BL Lacertae



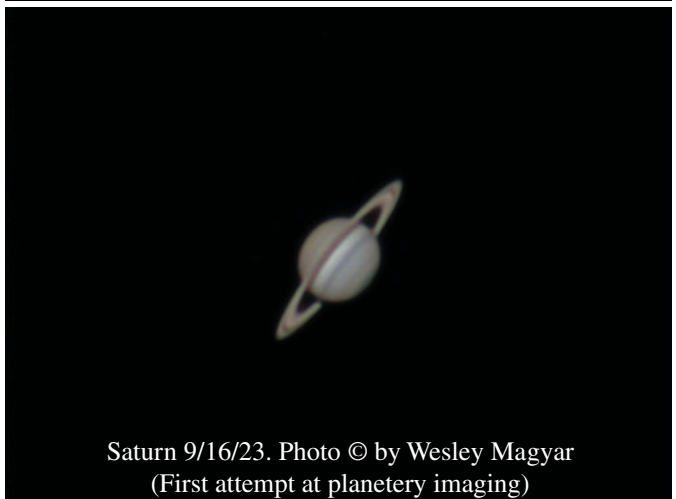
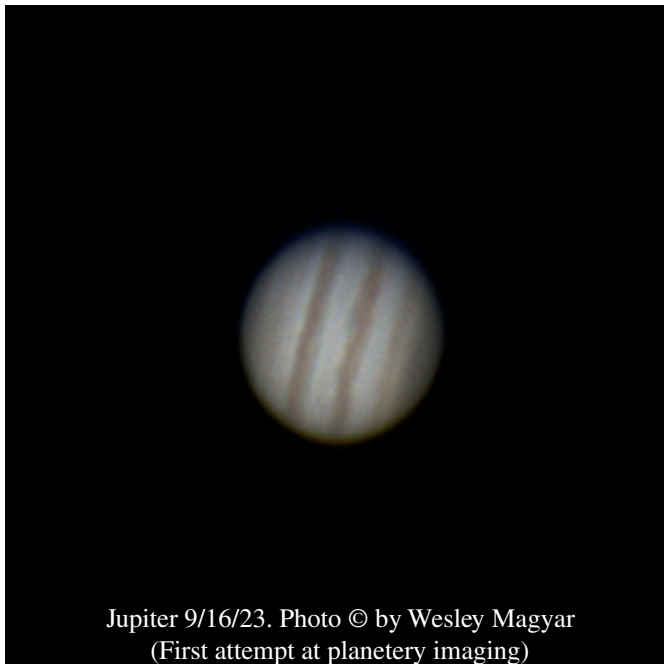
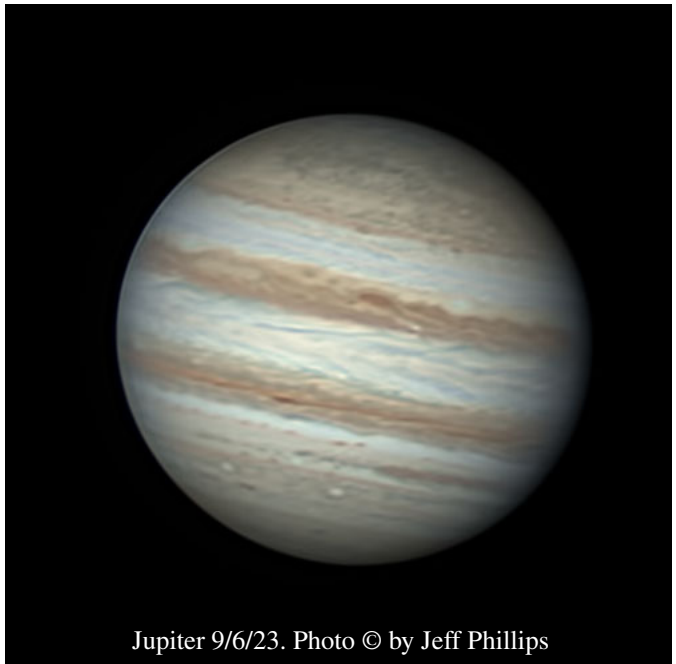
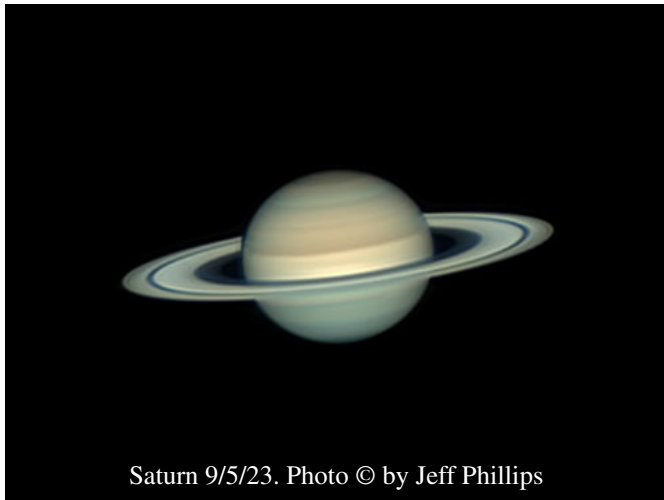
Light curve for BL Lacertae. Note the spike in brightness since 2020. Image courtesy AAVSO.org.

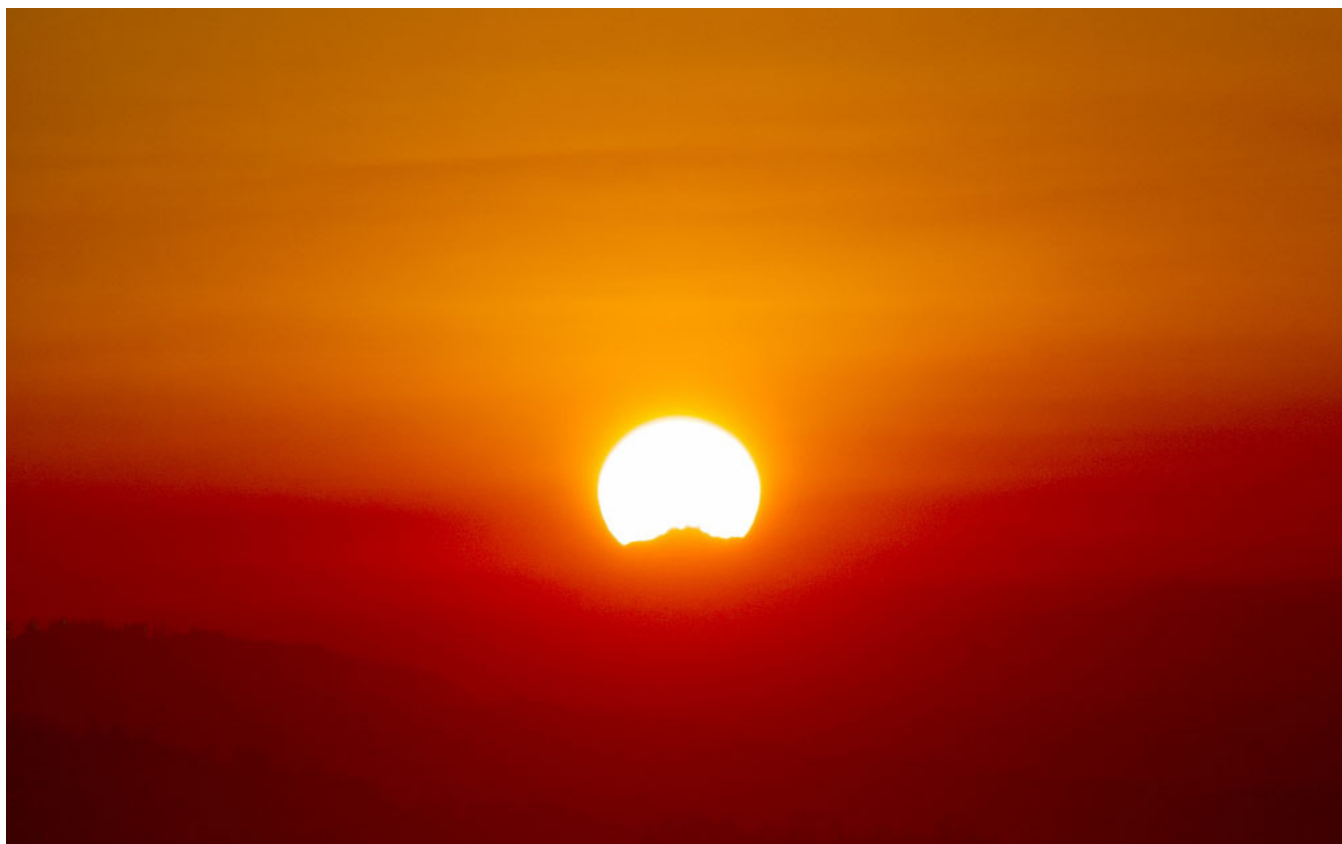
# Fun Fact: The Moon on Two Holidays

Did you know that we get almost the same phase of the Moon on Halloween as we did on the 4th of July? It happens that way every year, though people seldom notice. Why? Well, there are 119 days between Independence Day and Halloween, and the Moon takes 29.5 days (on average) from one full Moon to the next. If you divide 29.5 into 119 you get 4.03, which is awfully close to four complete lunar phases. The repetition would be perfect if the span were 118 days....except it wouldn't necessarily. The Moon takes 29.5 days *on average*, but at certain times of year it can be slower or faster because its orbit isn't a perfect circle. So the recurrence is seldom exact, but it's always close.

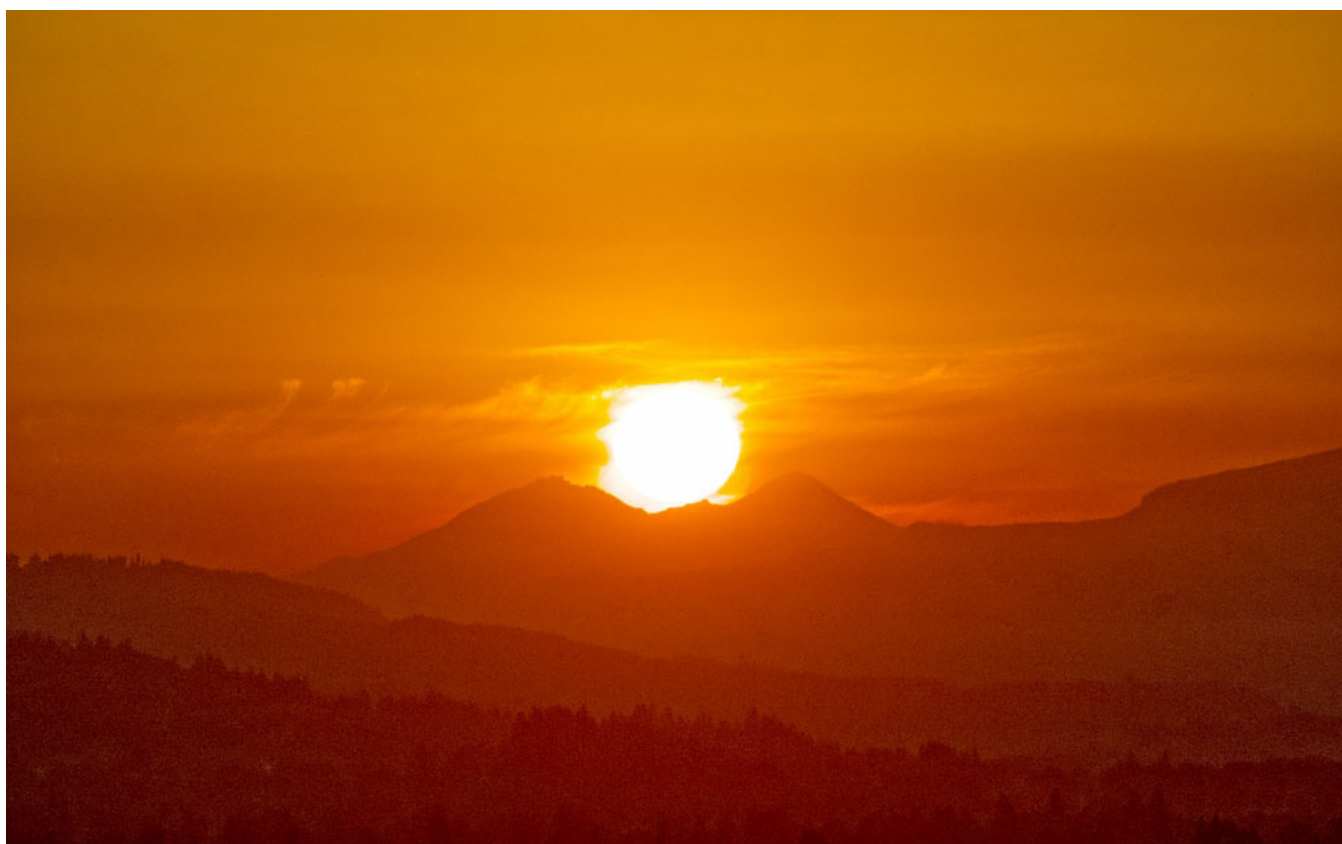
## Gallery

September started out clear and provided many great opportunities for astrophotography, then clouded up and rained for the last half of the month. All the same, club members took some great photos when they could. Zoom in a bit; they'll still be pixel-sharp at 200%.

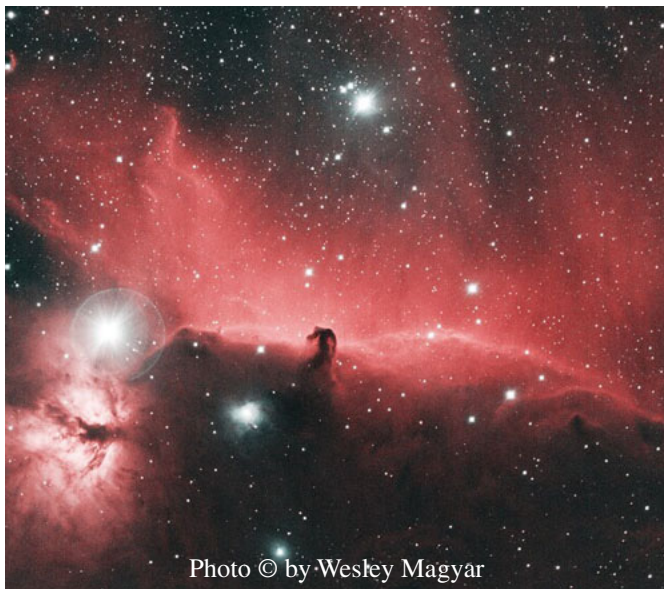




Sunrise over North Sister 9/8/23. Photo © by Alan Gillespie.



Sunrise over North and Middle Sister 9/9/23. Note how much farther south it rose just one day later. The days get shorter quickly in September! Photo © by Alan Gillespie.



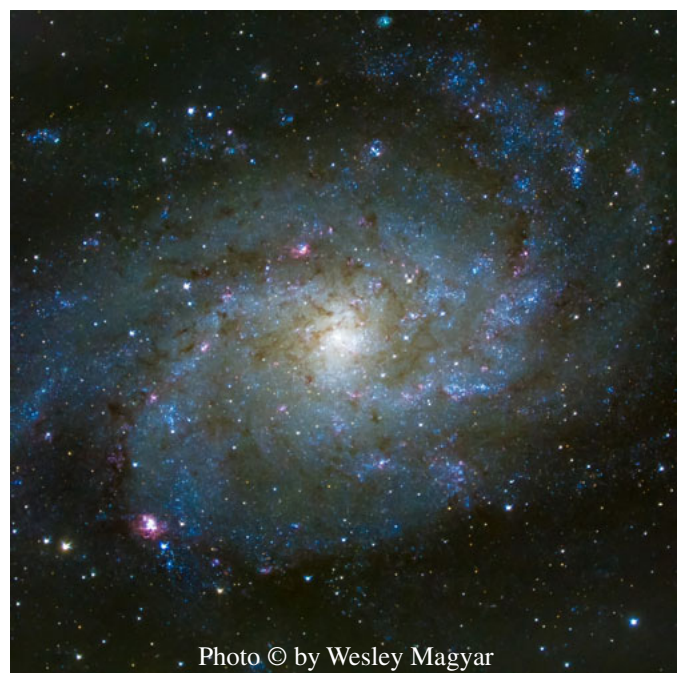
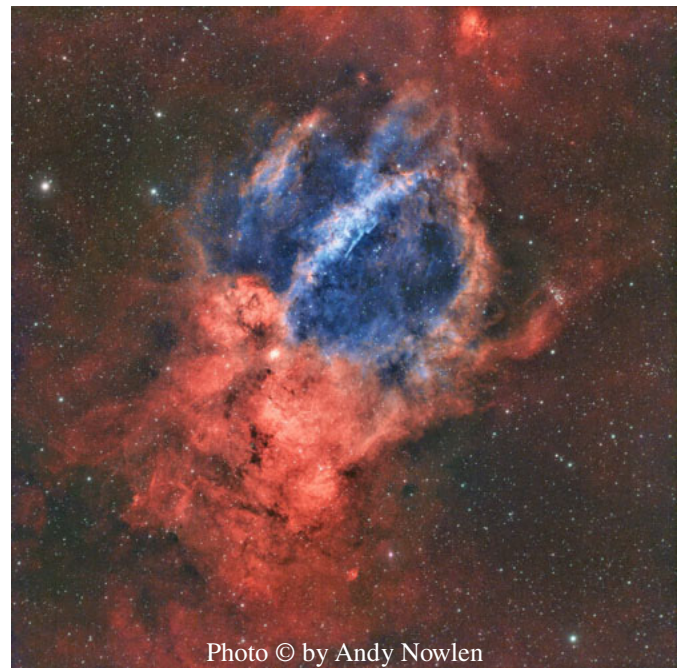
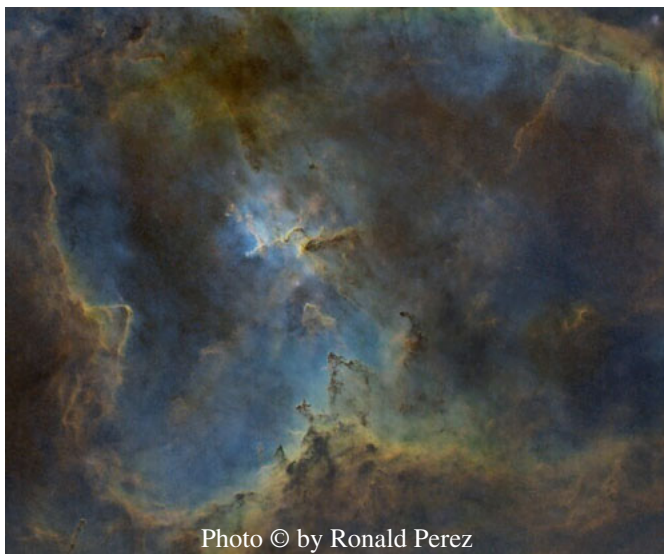
Left: Wes Magyar caught the Flame Nebula and the Horsehead Nebula in this great wide-angle shot.

Mid-left: Ron Perez captured the emission nebula in the middle of IC 1805, the Heart Nebula.

Lower left: Wes Magyar zoomed in for a close-up of M31, the Andromeda Galaxy.

Below: Andy Nowlen caught both an emission and reflection nebula in Sh2-157, the Lobster Claw Nebula.

Bottom right: Wes Magyar's image of M33, the Triangulum Galaxy, shows its spiral arms and many star-forming regions.





# Observing in October 2023



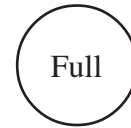
Last Q



New



1st Q



Full

Oct 6, 6:48 AM	Oct 14, 10:56 AM	Oct 21, 8:29 PM	Oct 28, 1:24 PM
Mercury Rise: 6:20 AM	Mercury lost in sun	Mercury lost in Sun	Mercury Set: 6:20 PM
Venus Rise: 3:27 AM	Venus Rise: 3:29 AM	Venus Rise: 3:34 AM	Venus Rise: 3:42 AM
Mars Set: 7:14 PM	Mars Set: 6:55 PM	Mars Set: 6:38 PM	Mars Set: 6:23 PM
Jupiter Rise: 7:56 PM	Jupiter Rise: 7:22 PM	Jupiter Rise: 6:52 PM	Jupiter Rise: 6:22 PM
Saturn Set: 3:42 AM	Saturn Set: 3:08 AM	Saturn Set: 2:40 AM	Saturn Set: 2:12 AM
Uranus Rise: 8:14 PM	Uranus Rise: 7:42 PM	Uranus Rise: 7:13 PM	Uranus Rise: 6:45 PM
Neptune Set: 5:52 AM	Neptune Set: 5:19 AM	Neptune Set: 4:51 AM	Neptune Set: 4:22 AM
Pluto Set: 00:41 AM	Pluto Set: 00:10 AM	Pluto Set: 11:39 PM	Pluto Set: 11:11 PM

All times Pacific Daylight Time (March 12 – Nov 4, 2023 = UT -7 hours) or Pacific Standard Time (November 5, 2023 – March 9, 2024 = UT -8 hours)

Date	Moon Rise	Moon Set	Twilight Begin	Sun Rise	Sun Set	Twilight End
10/1/2023	20:06	10:01	05:34	07:10	18:53	20:29
10/2/2023	20:36	11:19	05:35	07:11	18:52	20:27
10/3/2023	21:12	12:34	05:36	07:12	18:50	20:26
10/4/2023	21:57	13:42	05:37	07:14	18:48	20:24
10/5/2023	22:50	14:42	05:39	07:15	18:46	20:22
10/6/2023	23:50	15:30	05:40	07:16	18:44	20:20
10/7/2023		16:08	05:41	07:17	18:43	20:18
10/8/2023	00:55	16:39	05:42	07:18	18:41	20:17
10/9/2023	02:00	17:03	05:44	07:20	18:39	20:15
10/10/2023	03:05	17:24	05:45	07:21	18:37	20:13
10/11/2023	04:09	17:42	05:46	07:22	18:36	20:11
10/12/2023	05:12	17:59	05:47	07:23	18:34	20:10
10/13/2023	06:16	18:15	05:49	07:24	18:32	20:08
10/14/2023	07:21	18:33	05:50	07:26	18:30	20:06
10/15/2023	08:28	18:53	05:51	07:27	18:29	20:05
10/16/2023	09:38	19:18	05:52	07:28	18:27	20:03
10/17/2023	10:50	19:48	05:53	07:29	18:25	20:01
10/18/2023	12:02	20:27	05:55	07:31	18:24	20:00
10/19/2023	13:11	21:19	05:56	07:32	18:22	19:58
10/20/2023	14:11	22:22	05:57	07:33	18:20	19:57
10/21/2023	15:00	23:36	05:58	07:35	18:19	19:55
10/22/2023	15:39		05:59	07:36	18:17	19:54
10/23/2023	16:10	00:55	06:00	07:37	18:16	19:52
10/24/2023	16:36	02:16	06:02	07:38	18:14	19:51
10/25/2023	16:58	03:36	06:03	07:40	18:13	19:49
10/26/2023	17:19	04:55	06:04	07:41	18:11	19:48
10/27/2023	17:41	06:13	06:05	07:42	18:10	19:47
10/28/2023	18:04	07:32	06:06	07:44	18:08	19:45
10/29/2023	18:32	08:51	06:08	07:45	18:07	19:44
10/30/2023	19:05	10:09	06:09	07:46	18:05	19:43
10/31/2023	19:47	11:23	06:10	07:48	18:04	19:41

All times are for Eugene, Oregon Latitude 44° 3' Longitude 123° 06'

## Items of Interest This Month

- 10/3 Callisto passes over Jupiter's N. pole.
- 10/4 Red Spot transits 10:30 PM.
- 10/5 Io shadow transit 6:50 – 9:00 PM.
- 10/9 Europa shadow transit 9:10 – 11:31 PM.
- Red Spot transits 9:38 PM.
- 10/12 Ganymede skims along Jupiter's S. pole 9:30 – 10:25 PM.
- 10/14 Annular solar eclipse!** (See p.4)
- 10/16 Europa shadow transit 11:46 PM – 2:06 AM.
- 10/19 Double shadow transit on Jupiter.
- Io shadow 10:39 PM – 00:49 AM,
- Ganymede shadow 10:56 PM – 00:41 AM
- 10/20 First Quarter Friday star party.**
- Mercury in superior conjunction
- 10/21-10/22 Orionid meteor shower. Red Spot transits 9:30 PM.
- 10/23 Venus at greatest western elongation (visible in morning before sunrise).
- 10/27 Extra "moon" (7th magnitude star HD16150) in Jupiter system.
- 10/28 Callisto crosses below Jupiter's S. pole (closest at 7:00 PM). Io shadow transit 7:12 – 9:13 PM.
- 10/29 Callisto and Ganymede pass one another 9:00 PM.