The Denver
OBSERVER
DECEMBER 2018

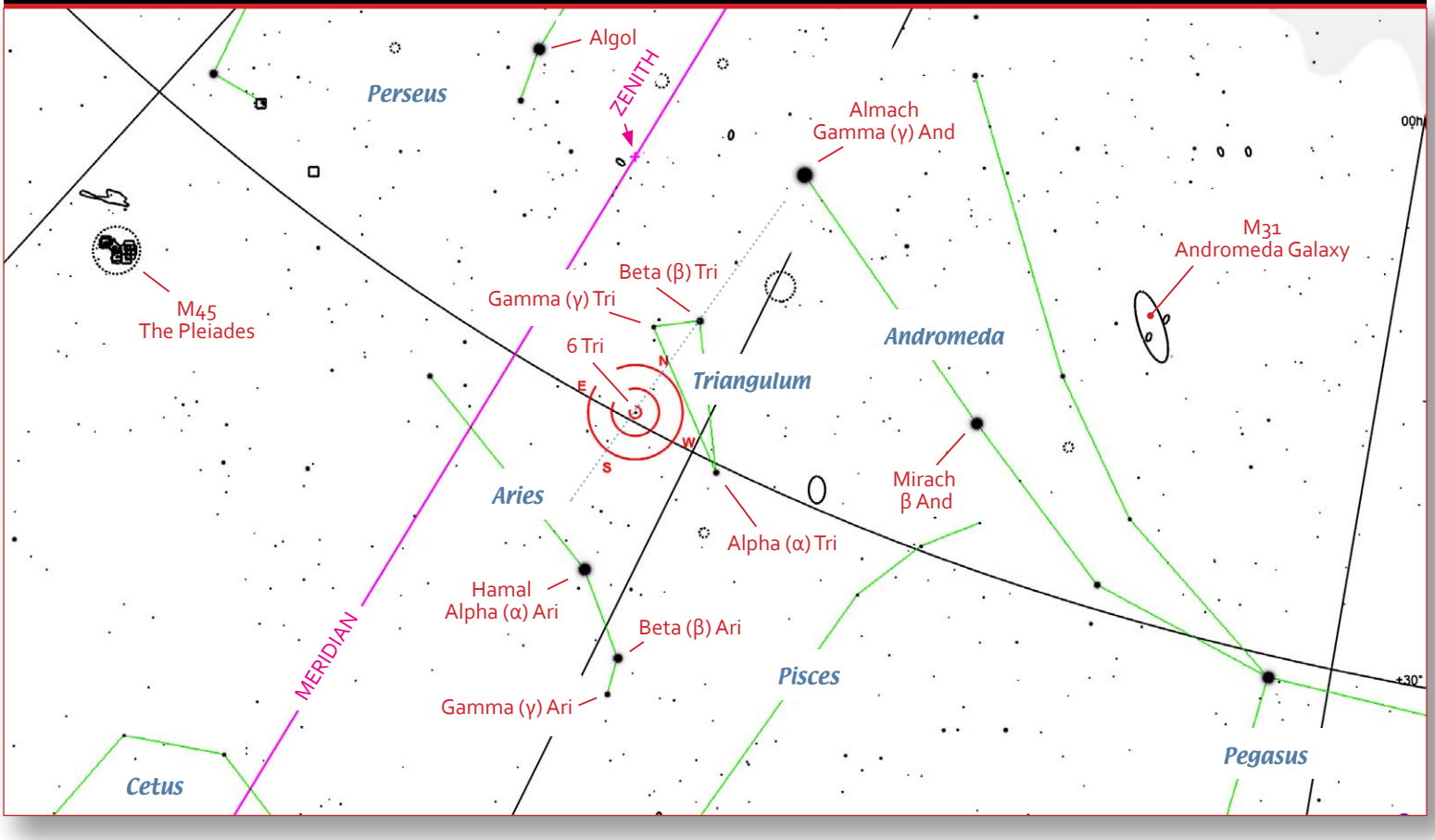

Chart of the area surrounding the constellations Andromeda, Triangulum, and Aries, as seen from Denver in mid-December at 9:00 PM, viewing just south of the zenith (nearly "straight up"). Telrad circles are shown centered on 6 Trianguli (6 Tri), one of this month's targets. As an aid to finding 6 Tri, note how the circles center on the imaginary line running from Almach to Beta Tri, and how the outermost circle touches another imaginary line running between Gamma and Alpha Tri.

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

DECEMBER SKIES

by Zachary Singer

The Solar System

Mercury ended November lost in the solar glare, but as it sweeps rapidly through its orbit, it will become increasingly visible as a pre-dawn target. After about the first week of December, the planet will sit almost 10° above the southeastern horizon at 6:30 AM, roughly 40 minutes before dawn. (By then, it will look like a fat crescent in telescopic views.) A week later, Mercury reaches its widest angle, as we see it, from the Sun (known as "greatest elongation"), and sits slightly higher at the same hour, brightening by about a half-magnitude as well. After that, the planet will appear closer to the Sun each day. Look for a **close conjunction with Jupiter on the morning of the 21st,** when the two planets will lie within a degree of each other.

Late-November views of **Venus** were spectacular, even with the naked eye—the planet's sheer brilliance in a dark sky made a 5:30 AM rise worthwhile. (Venus was so bright, it made it hard to recognize a nearby, seemingly wan star for what it really was: 1st-magnitude Spica.)

Happily, the views continue in December—though the planet's brightness diminishes slightly and the disk appears a bit smaller, it still presents a terrific target, for naked eyes and telescopes alike. In the latter, you'll still see a "fat crescent" through about mid-month, broadening to a half-disk or "lemon wedge" by month's end. You can also sleep a bit later than last month, because of the later sunrise—and the planet will be higher, more than 25° up at 6:30 AM.

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Sky Calendar

7	New Moon
15	First-Quarter Moon
22	Full Moon
29	Last-Quarter Moon

In the Observer

The Observer is available in color PDF format from the DAS website: https://www.denverastro.org/das/?page_id=13

Society Directory

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PRESIDENT'S MESSAGE

by Ron Hranac

Sign In to the DAS Member Portal

Our new Member Portal has been up and operational for over a month, and initial feedback is positive. While there has been a small number of people who asked for a little extra help, those cases have largely been limited to getting through the initial log-in and setup ("click *that* button…").

Most members are finding the portal easy to use. One remarked that both the membership renewal process and the process for signing up for the upcoming Holiday Party were much easier than before. *Important note: If you plan to attend any paid DAS events—including this month's Holiday Party—you will need to use your Member Portal account to sign up for those events.*

The portal's forums are picking up steam as more folks are using them. Many members are still using the Yahoo Groups general membership listserv, which is okay for now. Keep in mind, though, that we'll be pulling the plug on the listserv in the not too distant future (not to worry, we'll provide plenty of advance notice). So, please feel free to migrate your on-line discussions to the forums. Like the rest of the Member Portal, the forums are easy to use.

The on-line member directory has become a very interesting place: People are posting their mug shots, bios about themselves and summaries of their astronomical interests. Some are posting links to their own websites.

If you've read this far and are wondering what the heck this Member Portal stuff is all about, I encourage you to take a look at the "President's Message" in November's *Observer* for more information. (The *Observer* is moving on-line as well! Editor Zach Singer discussed this on page 5 of last month's newsletter.) Here's a link to the November issue: https://www.denverastro.org/xobserver/november2018_denverobserver.pdf

Indeed, if you're one of those who has yet to log in to the Member Portal for the first time, you need to do so *sooner rather than later*. E-mails have been sent to everyone who hasn't logged in, so check your e-mail in-box—if you don't see it, look in your spam folder just in case it's hiding there.

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DAS SCHEDULE

December 2018

8	Dark Sky Weekend—EGK Dark Site & Brooks Observatory
15	Open House—DU's Historic Chamberlin Observatory—Starts at 5:00 PM
16	DAS Holiday Party—Embassy Suites Denver Tech Center—Starts at 6:00 PM
28	E-Board Meeting—DU's Historic Chamberlin Observatory, 7:30 PM. All members welcome.

(January 2019)

5	Dark Sky Weekend—EGK Dark Site & Brooks Observatory
12	Open House—DU's Historic Chamberlin Observatory—Starts at 5:00 PM

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.

President's Message

Continued from Page 2

Here are the essentials from a recent e-mail reminder sent to those who have not yet logged in to the Member Portal for the first time:

The Denver Astronomical Society has added a Member Portal to our website, and we'd like to invite you again to log in and begin using it. The Member Portal will enable you to control the information you share with the club and its members, and make your annual membership renewal much easier. There are other benefits that will be rolled out on the portal over time.

Please take a little time to make your initial login and check it out. **Your e-mail address in the portal is the same one at which you received this e-mail.** To log in for the first time, please use the link provided in the e-mail we sent you to reset your DAS Member Portal password.

Once you've logged in, you will be prompted to accept the terms and conditions. Then, you can go into your profile to update and verify your contact information (and choose which information can be seen by other members). After you have logged in the first time and set your password, you can return to your profile at https://members.denverastro.org. (Note: Click on "Log in" in the very upper right corner of the page.)

** If you're *still* stuck, contact our DAS Secretary, Ed Ladner, at secretary@denverastro.org.

Annual Elections

Have you thought about a leadership role with DAS? Our annual elections are just around the corner. If you're interested in running for an officer or trustee position on the E-Board or would like to nominate someone, be sure to attend next month's General Membership Meeting at DU's Olin Hall on Friday, January 18th. Nominations will open at the January meeting, and continue until our Annual Membership Meeting on Friday, February 15th. (Tim Pimentel has agreed to be the Election Chairperson.) Starting January 18th, any member can submit nominations for officers and trustees to the Election Chairperson at nominations@denverastro.org.

ABOUT THE DENVER ASTRONOMICAL SOCIETY

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 DU's 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.

ASTRO UPDATE

Selected Summaries of Space News

by Don Lynn

Planet Around Barnard's Star

A probable planet has been discovered, using the radial-velocity method, orbiting Barnard's Star, the second-nearest star system to our solar system. This would make it the second-nearest known exo-planet, after the one orbiting Proxima Centauri. It still needs to be confirmed, but the discoverers claim 99% certainty that it is a planet. (There have been previous claims of detecting a planet at Barnard's Star, but they proved mistaken.)

This probable planet takes 233 Earth days to complete an orbit. Since Barnard's Star is a dim red dwarf, at this size of orbit, the planet receives only 2% the light that our Earth does. The average surface temperature is estimated at about -240°F. The planet's mass is at least three times that of Earth. It could therefore be rocky, or rocky and icy, or a mini-Neptune gas giant. Barnard's Star gained fame when it was found in 1916 to have the fastest known motion across the sky, due to it being so close (about six light-years away).

Probable Neutron Star Merger

Study of observations by both ground-based and space telescopes of the object that gave off a gamma-ray burst in 2015 (known as GRB150101B) shows that it had the characteristics expected of a merger of two neutron stars. It was quite like the observations of the neutron star merger that was detected by the LIGO gravitational wave detectors in 2017 and then observed in everything from radio waves to gamma rays.

Both events produced an unexpectedly faint gamma-ray burst, strong blue light, and long-lasting X-ray emission. The faintness of the gamma-ray bursts is thought to be because they were observed off the axis of the jet produced. The differences between the events are that no gravitational wave data exists from the 2015 event, and it was 13 times as far away. (This distance probably would have prevented gravitational detection if LIGO had been running then.) It is possible that the 2015 event was the merger of a neutron star with a black hole, but the best bet seems to be merging neutron stars.

Strange Supernova Explained

An unusual supernova, dubbed iPTF14gqr, was seen in late 2014: It brightened too rapidly (less than a week), it did not expel enough mass, and the exploding star's mass was too low. A new study of the evidence concluded that these characteristics matched what is expected if a massive, closely-orbiting companion gravitationally stripped off much of the exploding star's gas before the explosion.

The massive companion was likely a neutron star; the observed explosion would produce another neutron star, leaving the pair of neutron stars in a very close orbit. Unfortunately, the supernova was too far away (nearly a billion light-years) to be able to detect X-rays from these neutron stars, which could have confirmed this explanation of the unusual properties of this event.

Quenching

It has long been known that many galaxies are not currently forming any new stars, even though they had to have gone through huge amounts of star formation in the past, perhaps billions of years ago. What causes star formation to stop (known as quenching) has long been debated. New observations of a galaxy known as SDSS J1341-0321, using the ALMA radio telescope array in Chile, show that it is in the process of quenching star formation. It recently (in astronomical time scales) merged with another galaxy, which caused a burst of star formation. It is now undergoing a huge outflow of gas—in other words, the newly formed stars appear to be blowing away the fuel for future stars. Further observations of similar galaxies are needed to confirm this explanation for quenching, and to see if it is the only such explanation.

Ancient Star Discovered

Astronomers have found the oldest known star, roughly 13.5 billion years old. The first generation of stars that formed after the Big Bang contained only hydrogen, helium, and a touch of lithium, because that was what the Big Bang produced. The newly found star has such a low metallicity (abundance of elements heavier than helium) that it may be a *second-generation* star—no first-generation star has ever been found.

What makes this star different from most other known stars with extremely low metallicity is that it is tiny (14% the mass of our Sun); almost all the others are more like the mass of our Sun. Also, this star is orbiting within the thin disk of the Milky Way, while other very-low-metallicity stars orbit in the halo.

It has been proposed that only higher-mass stars formed in the early Universe. If this is so, it would explain why no first-generation stars have been found, since higher-mass stars end their lives sooner than low-mass stars.

Lucy

NASA approved building the Lucy spacecraft, scheduled for launch in October 2021. Its mission is to visit several Trojan asteroids on a 12-year flight, as well as a main-belt asteroid.

The Trojan asteroids share Jupiter's orbit. They occupy two groups, at a 60-degree angle ahead or behind the planet, in the Lagrange stable zones. (They became known as Trojans after many of those asteroids were named after heroes in the Trojan War, of Helen of Troy fame.) Lucy will use ion propulsion for its interplanetary voyage.

DAS NEWS

DAS Holiday Banquet

Our 2018 Holiday Banquet is set for **Sunday, December 16th**, at the Embassy Suites Denver Tech Center. **Cocktail hour starts at 6:00 PM**, with dinner at 7:00 PM. (The DAS Holiday Banquet is a members-and-guests-only event that replaces the December General Meeting.)

Though we have greater capacity than last year, seating is still limited—***as of this writing, tickets are almost sold out (sales end Dec. 9th, regardless).*** For full details, and to purchase tickets online, go to https://members.denverastro.org/event-3106082

DAS Astronomy Minute

Laura Rothstine, one of our youngest members, presented the DAS Astronomy Minute at the November General Membership Meeting on the 30th, with her talk about quantum gravity.

If you're interested in presenting an Astronomy Minute, contact Ron Hranac at president@denverastro.org.

DAS member Laura Rothstine gives her Astronomy Minute talk.

DAS Treasurer Scott Perrin and DAS Secretary Ed Ladner.

Donation for VNH Scholarships

Ed Ladner recently presented a check for $500 made out to the Denver Astronomical Society's Van Nattan-Hansen Scholarship Fund. The check is from his employer, RSM, a company handling audit, tax, and consulting services. Ed tracked his hours working on the creation and ongoing operation of our new Member Portal, and RSM's charitable arm donated the amount of pay Ed would have earned for the same number of hours at work.

The Observer Moves Online

As a DAS member, you've probably heard that **after this issue, the *Observer* will move to an *online* platform, while phasing out both the black-and-white paper copies and the related color PDF files you're used to receiving.** Instead, you'll find the *Observer's* content in a section of the DAS website.

DAS is currently working through logistics to bring you the best online *Observer*; among the last areas requiring polishing are its links and placement within the DAS main website and/or our Member Portal. We'll keep you posted on new developments through e-mail, so stay tuned.

Speaking personally, I will miss this old, paper *Observer*, with its familiar typesetting and layout. At the same time, we're already at work with the new online format, and it has so many advantages that I'm sure you'll be pleased.

As always, you can send your comments and questions to me at editor@denverastro.org.

—Zach Singer, Editor

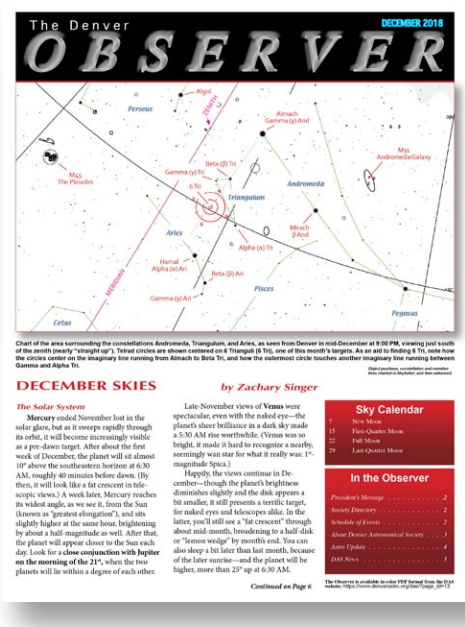
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Chart of the area surrounding the constellations Andromeda, Triangulum, and Aries, as seen from Denver in mid-December at 9:00 PM, viewing just south of the zenith (nearly "straight up"). Tetrad circles are shown centered on 6 Trianguli (6 Tri), one of this month's targets. As an aid to finding 6 Tri, note how the circles center on the imaginary line running from Almach to Beta Tri, and how the outermost circle touches another imaginary line running between Gamma and Alpha Tri.

DECEMBER SKIES by Zachary Singer

The Solar System

Mercury ended November lost in the solar glare, but as it sweeps rapidly through its orbit, it will become increasingly visible as a pre-dawn target. After about the first week of December, the planet will sit almost 10° above the southeastern horizon at 6:30 AM, roughly 40 minutes before dawn. (By then, it will look like a fat crescent in telescopic views.) A week later, Mercury reaches its widest angle, as we see it, from the Sun (known as "greatest elongation"), and sits slightly higher at the same hour, brightening by about a half-magnitude as well. After that, the planet will appear closer to the Sun each day. Look for a **close conjunction with Jupiter on the morning of the 21st**, when the two planets will lie within a degree of each other.

Late-November views of **Venus** were spectacular, even with the naked eye—the planet's sheer brilliance in a dark sky made a 5:30 AM rise worthwhile. (Venus was so bright, it made it hard to recognize a nearby, seemingly wan star for what it really was: 1st-magnitude Spica.)

Happily, the views continue in December—though the planet's brightness diminishes slightly and the disk appears a bit smaller, it still presents a terrific target, for naked eyes and telescopes alike. In the latter, you'll still see a "fat crescent" through about mid-month, broadening to a half-disk or "lemon wedge" by month's end. You can also sleep a bit later than last month, because of the later sunrise—and the planet will be higher, more than 25° up at 6:30 AM.

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Sky Calendar
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In the Observer

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December Skies

Continued from Page 1

Mars remains with us as December begins, transiting in a dark sky just after 6:00 PM. It's still fairly large and bright, at about 9" across and magnitude 0. By New Year's, though, Mars will shrink to just 7" and dim by about a half-magnitude…. We'll have Mars in our sky for quite a while yet, but the best of this apparition is now behind us—*well*, except for one thing: **On December 6th and 7th, Mars and Neptune have a very close conjunction.**

The two planets will appear just 2.1 arc-minutes apart on the morning of the 7th, an astonishingly close pairing, around 7 AM Mountain Standard. Here in Denver, though, the two planets will be well below the horizon at that time, but before you think of shooting the messenger, here's what we get in return—not one, but *two* opportunities for what are still very close conjunctions. On the night of the 6th (i.e., the night *before* the "official" event), the planets are just over 20 arc-minutes apart, or a third of a degree, around 6 PM. The sky at that time will be dark, and our targets more than 40° up in the south. Neptune will appear to the east of Mars (to our left, in unreversed views); if you don't see Neptune at first, center Mars in a low-power eyepiece and let your telescope drift a while (i.e., turn off your 'scope's tracking if you're using it); look for a tiny, pale bluish dot—there won't be many other stars in the eyepiece field, so Neptune should be noticeable.

By 9 PM, Mars and Neptune will have drawn noticeably closer, to 16½ arc-minutes, or just over ¼° apart; they'll still sit almost 27° above the southwestern horizon then. By 10 PM, they're less than ¼° apart, though only 17° above the horizon; the two will draw ever closer until they set just after 11:30 PM our time.

The situation reverses on December 7th—at 6 PM, you'll find Neptune to the *southwest*, instead of the east, and less than 18 arc-minutes from Mars. As the evening progresses, the gap between the two planets will *widen*, so best viewing will come early rather than late—by 10 PM, they'll be almost 24 arc-minutes apart.

Depending on your eyepiece's angle of view, it's possible that you may not have enough power to really appreciate Neptune *as a disk* (that is, as a *planet,* with a visible diameter) when you view it together with Mars. If that happens, take a moment to "zoom in" on Neptune using a higher-powered eyepiece (200x should do it), and when you've really *seen* Neptune, go back to the lower-powered eyepiece and enjoy the pairing with Mars (the color contrast should be great).

Like Mercury, **Jupiter** was lost in sunlight in late November, and will remain so for much of December—but it will become a noticeable pre-dawn object by mid-month. By the end of December, Jupiter will sit 12° above the horizon, 45 minutes before sunrise—it's not a great telescopic target yet, but it will become one early next year. (In the meantime, don't forget the conjunction with Mercury on the 21st!)

So long for now, **Saturn!** The ringed planet starts December low in the southwest, only about 10° up, just 45 minutes after sunset. By the end of the month, it's lost in the sun's glow, and we'll see it again as a pre-dawn object early next year.

Uranus is a lovely and *convenient* target. By 6:30 PM in early December, it's at least 45° up, and crosses the meridian (i.e., it's highest in the south) at that hour at New Year's. Look for it 1½° degrees northeast of Omicron (o) Piscium in early December, and just 1¼° north by month's end. If Uranus was "easy-peasy" last month, it's …er… "easy-peasier" now.

Slow-moving **Neptune** sits about where we left it last month, halfway between Hydor, *aka* Lambda (λ) Aquarii, and Phi (φ) Aquarii. It's near the meridian around 6:00 PM in early December, but sinks into the southwest, only 35° up at that hour, a month later. As you might expect because of the conjunction, you can use Mars to find Hydor early in December, and Phi through mid-month.

Stars and Deep Sky

Leaving our solar system behind, we have "a tale of two binaries." (For the beginners, a binary system is one where the two stars within it are in orbit around each other—in contrast, two unrelated stars moving separately through space are merely "optical doubles.")

Neither target this month should be difficult if you can find Mirach (Beta [β] Andromedae) and Almach (Gamma [γ] Andromedae). If you can't, don't worry—they're part of the constellation Andromeda, and lie to the east of the Great Square of Pegasus, which is easy to recognize; the whole area is described in the December 2017 *Observer*, at https://www.denverastro.org/xobserver/december2017_denverobserver.pdf. (Read the section under the subhead, "Getting Started with Navigation," on page 6, and check out the wide-view map—you'll see our current map is just a closeup of the area in and below Andromeda!)

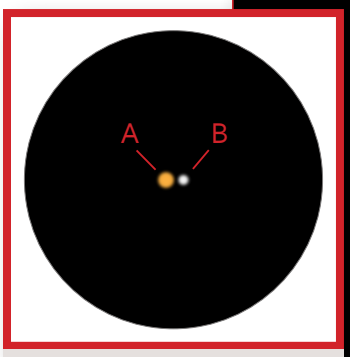
First up, then, is **6 Trianguli**—"6 Tri" for short—at **02h 13m, +30° 23'**. It's a beautiful and interesting system, and not *just* binary, though that's what it looks like. Each main star also has an extra companion star that astronomers detected through spectroscopy—these companions orbit too closely to become visible themselves. The main stars (the ones you can see) are indeed in orbit around each other, as we'd expect from a binary system. What we really have, then, is a four-star system, organized in pairs, and each pair is its own binary system!

In his *Celestial Handbook*, Robert Burnham, Jr. depicts this star as "strong yellow and blue," though noting that it has also been seen as "a bright golden yellow pair." (If you go looking for Burnham's full description, you'll find it listed under "Iota [ι] Tri," another name for this star. Though the *Handbook* was last updated some 40 years ago, Burnham noted that each of the visible stars had unseen companions, as above, and described them in detail. His distance information, though, is dated; Prof. James Kaler, of the University of Illinois, uses a more modern data set for his description, with a new distance estimate of about 300 light-years, about half-again as far as Burnham had noted. That also means Burnham's estimates for the size of the system itself are off a little bit, as well.)

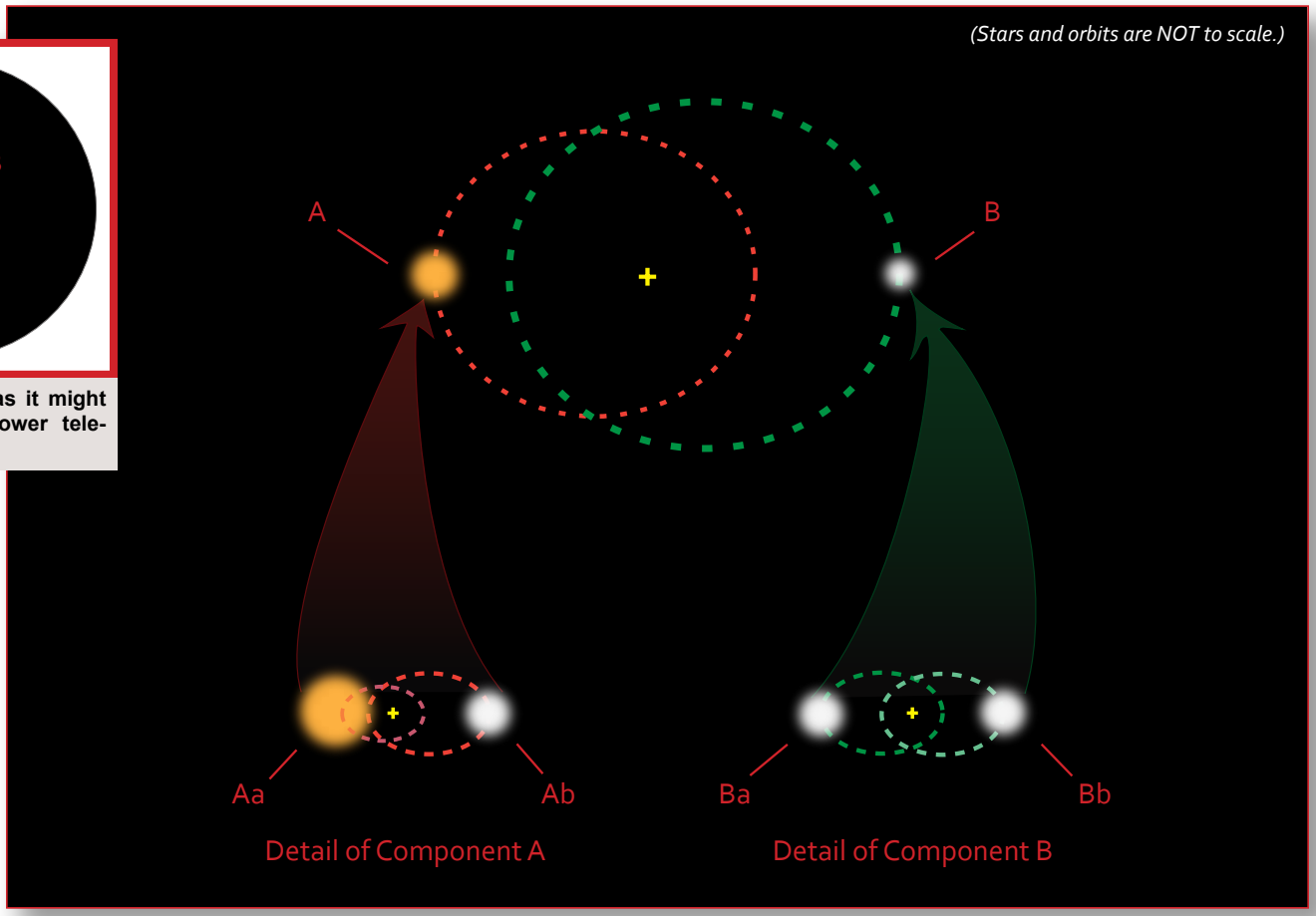
Looking through our Society's 5-inch Mak not long ago, I saw a close but pretty duo, Creamsicle-orange and dim white. It looked best between 125 and 200x, though the pair was quite tight at the lower magnification. In my 12-inch Newtonian a year ago, the primary appeared butter-yellow, and the secondary grayish at 125x—but very pale lavender at 200x and

Continued on Page 7

December Skies



INSET: 6 Trianguli, as it might appear in a high-power telescopic view.



Above: The 6 Trianguli system. The two main components, A and B, are visible in small amateur telescopes (simulated in inset, *above left*). Note how A and B orbit their common center of mass, shown with a "+," and that B's orbit is larger, because it is less massive than A.

Each component is itself a binary system, detectable only with special instruments. The "zoomed-in" view of each component (bottom of main drawing), shows the true makeup of 6 Tri: Component "A" contains two stars, "Aa" and "Ab," and component "B" does too, with "Ba" and "Bb." Each of these sub-systems in turn orbits its own center of mass, in a manner similar to the A-B system—a "wheels turning inside of wheels" scenario. (In the detail of the B component, Ba and Bb have similar-sized orbits, because the stars are of similar mass.)

Illustrations above and inset, © Z. Singer

Continued from Page 6

with more distinct colors at 300x.

Although we often say that a binary's stars "are in orbit around each other," the deeper truth is that both stars circle their common center of mass, much the same way children playing "Ring Around the Rosie" circle their common center. If the children are of equal size (mass), then the circles they make around that center are also of equal size. But if one child is replaced with a bigger (more massive) kid, then both will still "orbit" their common center, but the smaller child will wind up making a larger circle than the bigger kid—*the relative size of their "orbits" is proportional to their mass.*

The same is true for stars orbiting in space—in 6 Tri's case, the more massive orange giant and its companion (together, they're the orange- or yellow-looking "A" component) have a greater mass than the class F star-pair that we see as the white or blue "B" component. So component A has a smaller orbit than the B component does—and we can see a similar situation within this system's individual pairs, too. There, we see the unequal-mass A components in orbits of unequal size, while the matched stars of the B component have orbits of the same size. (*See the illustrations above for an overview of 6 Tri's arrangement.*)

To find 6 Tri, we'll need to find the small constellation of Triangulum itself—to get started, first look for the stars we mentioned above, Almach and Mirach, in Andromeda (see star chart, on page 1.) Imagine the line between these two bright stars as the base of an upside-down equilateral triangle, with its third vertex "below" the line, towards the south—*under dark skies*, you'll soon see a moderately bright (3rd- and 4th magnitude), skinny right-triangle sitting in that area—as you might guess from its name, that's Triangulum!

Once you've got Triangulum, look at the star marking the right angle—that's Beta (β) Tri. Then look at the triangle's "far" star, at the constellation's narrow end—that' Alpha (α) Tri; the third star, closer to Beta, is Gamma (γ) Tri. Next, visualize a line between Almach in Andromeda, and Beta Tri. Now, to hit 6 Tri, slowly slide the center of your Telrad down that line, away from Almach, and towards Beta—*keep going*, past Beta, until the *trailing edge* of your Telrad lines up with the imaginary line between Gamma and Alpha Tri—6 Tri should be in your finderscope, and if you were careful, in or near your telescope's low-power eyepiece field. Our chart shows the Telrad's positioning.

One last note: At 5th magnitude, 6 Tri is more than bright enough to appear in a 7x30 finder (even under city

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lights) but it might be a bit dim to show up in your Telrad, even in the country—I find 5th magnitude stars difficult through a Telrad's plastic, even though I can see the same stars naked-eye. You don't need to see 6 Tri in your Telrad to find it with this approach.

Our second binary is **Gamma (γ) Arietis**, *aka* **Gamma** or **γ Ari** for short, or **Mesarthim** on some charts. Located at **01h 55m, +19° 23'**, Gamma Ari is worth seeing, "just because." For one thing, unlike 6 Tri, it's not at all difficult to split its components—the stars are of roughly matching brightness and appear about 8" apart—easy even in small 'scopes. In the 5-inch, I saw two softly glowing pearls at 100x, an enchanting view—but the pair split cleanly enough even at half that power.

Even "simple" systems like this one have their fascinations: Since Gamma Ari's two stars are of similar spectral type, and they're within about 10% of each other's mass, you might not be too surprised that their brightnesses are somewhat similar, too. The difference is only 0.1 magnitude, so your eyes won't notice, but it's worth mentioning, because the *dimmer* star is the more massive one.

Normally, the more massive the star, the hotter (and thus brighter) it is. But hotter stars' light is also bluer in color—and in Gamma Ari's case, that drives the light of its more massive star enough towards the blue end of the spectrum to push it into *ultraviolet*. We don't see ultraviolet light, so the more massive star's *visual* luminosity seems lower than it is. (Its *total* luminosity, counting the ultraviolet, is brighter than its smaller companion's, as expected.) Appearances—and physics—can be deceiving.

If you peruse our chart, you'll see the constellation Aries, home to Gamma Arietis, on the opposite side of Triangulum from Almach—Triangulum is almost centered between Andromeda and Aries. Look for bright, 2nd-magnitude Hamal, or Alpha (α) Arietis, just west of the extended line running from Almach through Beta Tri and into Aries. Now follow the arc of stars to the southwest—you'll encounter mag. +2.7 Beta (β) Ari, *aka* Sheratan, next (it's about 4° from Hamal), and then you'll arrive at Gamma, our target, just 1½° south of Beta.

With a little practice, you'll be able to pick up Gamma directly with your naked eyes under a dark sky, but at magnitude +3.9, it's barely on the edge of visibility on a good night in the city, and often washed out. That's no problem; just center your finderscope on Beta, and Gamma should be obvious within its field. (If it's a lousy night and you can't see Beta either, center on Hamal, and guesstimate Beta's position—follow the same angle as you see between Almach and Mirach—it's crude, but it will put Beta in your finderscope, which you can center as above to get Gamma.

One last note for Dobsonian users: We're looking very close to the zenith, or *almost straight up*, for our main targets this month. Make life easier for yourself, and observe at least an hour earlier (or an hour or more later, if that's better), when the angles aren't as difficult for your 'scope.

Have a Happy Holiday! —*See you on the Web.*

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