The Denver
OBSERVER
JANARY 2018

The Flame Nebula, NGC 2024, featured in this month's "Skies," imaged in infrared by the VISTA telescope. Note the stars behind the central dust lane—to visual observers, this area appears like a dark "gap" in the cloud. The bright star at right is Alnitak, one of three such stars making up Orion's Belt.

Image Credit: ESO/J. Emerson/VISTA. Acknowledgment: Cambridge Astronomical Survey Unit

JANUARY SKIES

by Zachary Singer

Happy New Year!

The Solar System

To start 2018 off right, we'll have **a total lunar eclipse on the morning of January 31st.** The Earth's *penumbra*, the soft-edged part of the shadow, begins its sweep of the lunar surface around 3:53 AM Mountain time, though it won't be immediately apparent—the Moon should become *subtly* darker by around 4:15 or 4:30.

The umbra (the darker and sharper inner shadow) **first takes a "bite" out of the lunar disk at 4:50 AM.** At that point, the Moon will be 25° up in the west. As the umbra continues across the Moon, less and less direct sunlight remains on the lunar surface, until it's all gone at **the beginning of totality, around 5:52 AM**. The Moon begins to exit the umbra, ending totality and bringing back a "bite" of sunlight, around 7:10 AM or so, but Denver observers will see the Moon set behind the Front Range minutes earlier. (Tell your friends on the West Coast, though—they'll get an extra hour to watch.)

If the Earth had no atmosphere, then the area in umbral shadow during a lunar eclipse would be black. But the Earth *does* have an atmosphere, and that atmosphere bends sunlight, so that area within the umbra can often be seen in dark reddish hues—this effect becomes more and more pronounced as more of the Moon slips into the umbra. At totality, the Moon can be copper-colored, orange, or red, leading to the term, "blood moon." Since the effect also depends on atmospheric conditions like storms or the amount of dust,

Continued on Page 3

Sky Calendar

1	Full Moon
8	Last-Quarter Moon
16	New Moon
24	First-Quarter Moon
31	Full Moon (*Lunar Eclipse*)

In the Observer

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

Society Directory

DAS Executive Board

President:
Ron Hranac
president@denverastro.org

Vice President:
Lindsey Shaw
vpresident@denverastro.org

Secretary:
Ed Ladner
secretary@denverastro.org

Treasurer:
Michael Nowak
treasurer@denverastro.org

Executive Board Members:

Brent Blake
Julie Candia
Jack Eastman
Joe Gafford
Zach Gilbert
Ed Scholes
Sorin
Dan Wray

Past President, Ron Pearson
President Emeritus, Larry Brooks

Committees

Van Nattan-Hansen Scholarship Fund:
Megan Daniels (Chair)
VNH@denverastro.org

EGK Dark Site Committee:
Darrell Dodge, Interim Chair
darksite@denverastro.org

IDA Representative:
Dr. Robert Stencel
coloida@hotmail.com

Volunteers or Appointed Representatives

ALCor:
Darrell Dodge 303 932-1309

Newsletter Editor:
Zachary Singer 303 718-4188
editor@denverastro.org

Newsletter Proofreaders:
Darrell Dodge, Ron Hranac

Website:
Darrell Dodge
webmaster@denverastro.org

IT Coordinator:
Ken Sturrock
itdept@denverastro.org

External Outreach Coordinator:
Julie (July) Candia
external@denverastro.org

Public Night Coordinator:
Hugh Davidson 303 679-0629

Librarian:
Eileen Barela

Telescope Loan Program:
Ed Scholes
scopeloan@denverastro.org

DAS Information Line:
(303) 871-5172

DAS Correspondence:
Denver Astronomical Society
P.O. Box 102738
Denver, Colorado 80250
president@denverastro.org

New-Member Ambassador:
Digby Kirby
odigby@gmail.com
(970) 301-2287

http://www.denverastro.org

PRESIDENT'S MESSAGE

by Ron Hranac

State of the Society

2017 was a great year for astronomy—a Nobel Prize in physics was awarded for the detection of gravitational waves (and more gravitational waves were detected), a total solar eclipse crossed the continental U.S., an amazingly successful Cassini mission ended spectacularly, and similar top stories. It was a great year for Denver Astronomical Society, too. Here's a quick recap.

We hit a major membership milestone last year, passing the *500* mark for the first time ever. As of mid-December, the count was 505, up from 457 at the end of 2016 (and 428 at about the same time in 2015, and the high-300s in 2014). A sincere thanks to all of you who support DAS, and enjoy the benefits of membership in the organization.

Outreach is one of the things DAS does best. Taking into account our monthly Open Houses and twice-weekly Public Nights at DU's historic Chamberlin Observatory—along with external outreach activities at schools, libraries, museums, and whatnot—we once again reached 5,000+ people in some 130 to 140 events.

2017 marked the formal adoption of "Learner's Land" at Open Houses (the area just outside Chamberlin's south door outlined with red LEDs). Learner's Land provides members of the public (and interested DAS members) with an opportunity to learn how to use a telescope and drive it themselves. A very popular activity just for DAS members is our new In-Reach program. If you haven't attended one, make plans to do so in 2018. A big thanks to Leo Sack for coming up with both of these fantastic programs!

The local media contacted us several times throughout the year for TV interviews, and to get answers to astronomy-related questions. While the edited interviews don't always focus as much on the science as most of us would like, it's nice to know that local reporters feel comfortable reaching out to DAS.

The finances of the Society continue to be sound, and our bank accounts are in good shape. We even have a dedicated financial reserve set aside in case the economy sours (the reserve was established a few years ago). Look for a financial summary by Treasurer Mike Nowak during February's annual membership meeting.

Continued on Page 3

DAS SCHEDULE

January 2018

5	DAS General Meeting—DU's Olin Hall, Rm. 105—Starts at 7:30 PM
12	E-Board Meeting—At DU's Historic Chamberlin Observatory, 7:30 PM. All members welcome.
13	Dark Sky Weekend—EGK Dark Site & Brooks Observatory
20	Dark Sky Weekend #2—EGK Dark Site & Brooks Observatory
27	Open House—DU's Historic Chamberlin Observatory—Starts at 5:30 PM

(February 2018)

2	DAS General Meeting—**E-Board Elections** DU's Olin Hall, Rm. 105—Starts at 7:30 PM
9	E-Board Meeting—At DU's Historic Chamberlin Observatory, 7:30 PM. All members welcome.

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

October's annual auction had a lot more donations and consignments than in recent years, and proceeds were raised for both the VNH scholarship fund and our dark site.

We maintain an active presence on social media, something we started doing a few years back. You can find DAS on Facebook (https://www.facebook.com/denverastro/), Twitter (@denverastro), and YouTube (https://www.youtube.com/user/denverastro). Our Facebook page had 1719 "likes" and 1727 followers as of mid-December; 519 folks are following us on Twitter, and our YouTube channel has enjoyed 49,052 views.

Our monthly general membership meetings at DU's Olin Hall were well-attended last year, averaging around 60 or so per meeting (a few topped 80), up from numbers in the 30s to 40s the year before. A new and popular addition to our membership meetings in 2017 was the Astronomy Minute, a brief, high-level presentation on an astronomy-related topic (if you'd like to sign up to do an Astronomy Minute presentation, drop me a note at president@denverastro.org). Most of the presentations at our meetings are videotaped, but only a few have been uploaded to our YouTube channel. Several videos still need to be edited before they can be posted, and we're looking for someone who can help out with that (see "DAS News" on page 5).

What's in the works? The E-Board has been evaluating results from the last member survey and SWOT (strengths, weaknesses, opportunities, and threats) analysis, and is working on implementing ideas to make DAS even better. For example, a new category of membership called "dual/family" will hopefully be in place by the time you read this.

Have you been thinking about getting involved in the leadership of DAS? Our annual elections are just around the corner. I encourage you to consider running for a position on the E-Board. Plan on attending this month's general membership meeting at DU's Olin Hall on Friday, January 5th. Nominations will open at the January meeting, and continue until our annual membership meeting on Friday, February 2nd. Let this year's election chairman, Ivan Geisler, know if you're interested. He can be reached at ivan.l.geisler@gmail.com.

2017 was a good year for Denver Astronomical Society, and it was a *busy* year, too. A big thanks to all of you for making DAS the great organization that it is!

January Skies

Continued from Page 1

the Moon's exact appearance isn't predictable. In our case, we'll also have brightening twilight, especially at the later stages, to factor in, but it should be a good show.

Interestingly, along with being a "blood moon," the eclipse occurs during a so-called "blue moon"—a blue moon is the *second* full moon in a given month (there's usually only one, and the first one this month is on New Year's Day.) There's no practical difference between a blue moon and a regular full moon, but maybe this year we can say we have an "aristocratic" moon—after all, it's a *"blue-blood"* moon…

Mercury starts the New Year, literally, at maximum elongation (its biggest angle from the Sun) on January 1st, and then sweeps around the "back" of its elliptical orbit as January progresses—the planet will be lost in the sunrise before the month is out. **Mercury and Saturn pass within about 40' of each other on the morning of the 13th**. Look for Mercury about 4° up in the southeast around 6:30 AM (a little over 45 minutes before sunrise); it will be bright at -0.3 magnitude—Saturn will appear just above it, dimmer at magnitude +0.5.

Use binoculars or a telescope—though both objects are bright, they'll be low on the horizon in twilight. (You can use the binos or 'scope on the Moon, too—it'll be a gorgeous thin crescent, so come *early*!) Sunrise that morning is at 7:19 AM; keep track of the time and be careful to avoid direct sunlight in your optics—it's permanently blinding.

Venus is at superior conjunction this month, more or less rising

Continued on Page 5

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

New Star Names

The International Astronomical Union (IAU) has added 86 new star names to its list. While the previous 227 official star names have been predominantly traditional Greek, Latin and Arabic, the new additions come mostly from other cultures, including Australian Aboriginal, Chinese, Coptic, Hindu, Mayan, Polynesian, and South African. Examples are Xamidimura (means "eyes of the lion" in the language of the Khoikhoi people of South Africa) and Pipirima (twins who became stars in Tahitian legend) for Mu[1] and Mu[2] Scorpii, respectively. (Mu is the third bright star below Antares, and is perceptible to the naked eye as binary.) Eleven of the new names are Chinese, including three that derive from the names of Chinese lunar mansions (areas of the stars through which the Moon passes). Also in the new star names is Barnard's Star, a nearby red dwarf discovered by E. E. Barnard in 1916; the star's former nickname is now official.

Exoplanet Atmosphere

Observations of the exoplanet 55 Cancri e have yielded ambiguous results for the presence of an atmosphere. The planet is known to be tidally locked to its star—that is, the same side of the planet always faces the star. It's also close to its star, and therefore is quite hot. Previously, the difference between measurements of the daytime and nighttime side temperatures seemed to imply there could be no atmosphere, because atmosphere would distribute more of the day heat to the night side. A new study using observations from the Spitzer infrared space telescope showed that the temperature difference was not as extreme as previous work, and that the hottest spot was not the point directly under its sun. These imply the planet *does* have an atmosphere. The new observations are consistent with an atmosphere of either nitrogen or carbon monoxide, and rule out water or carbon dioxide. The new temperature measurements also appear to discount a previous theory that the planet (at least the dayside) is covered with lava. The planet is a super-Earth, since it is about twice the diameter of Earth and about eight times the mass.

Spectra of Very Distant Galaxies

In 2003-4, the Hubble Space Telescope stared at a small portion of sky in Fornax for over 260 hours, resulting in a portrait of thousands of extremely faint galaxies; the image is known as the Hubble Ultra Deep Field (HUDF). This region has since been studied extensively by many other telescopes in wavelengths from radio through X-rays.

Recently, the Very Large Telescope in Chile has obtained spectra for 1,600 galaxies within the HUDF's area, including 72 that the Hubble failed to detect. The new spectra provided accurate red shifts (and therefore distances) for the first time for most of these galaxies, and established the motions and chemical makeup for the majority of them. Hydrogen halos were commonly found surrounding the subject galaxies.

Flare Star Findings

The planet-finding space telescope Kepler was designed to capture the tiny dimmings of stars caused by planets moving in front of them. But the Kepler data show lots of other events, and a new study exploited Kepler data to survey flare stars. Astronomers have long believed that such stellar flares are caused by a reconnecting magnetic field; the magnetic field itself is generated in a star's convective zone, where hot material rises and cooler material sinks (the circulating particles act like a dynamo, producing magnetism).

The new research brought several surprises: Some spectral-type A stars have flares, though A stars are thought *not* to have convective zones; some giant stars have flares, though they are thought to have magnetic fields that are too weak to cause flares; fast-rotating stars tend to have stronger flares and flare more often; and small percentages of every type of star flare frequently.

How to Find More Planets

To "train" a computer program that learns to detect unseen planets from patterns in data, researchers input 15,000 Kepler signals of previously recognized planets transiting their stars. The program then examined the Kepler signals from 670 stars known to have multiple planets, and found quite a few previously overlooked planets. (Weak signals are sometimes missed by previous methods used to find planets in the Kepler data.) In the case of Kepler-90, a star-system over 2,500 light-years away which was already known to have seven planets, the program found an eighth one. This ties the record (held by the Solar System) for the most known planets orbiting any star.

Juno (Jupiter Orbiter)

During a close pass of Juno over Jupiter's Great Red Spot last June, the spacecraft's microwave radiometer was able to show atmospheric activity up to 200 miles below the visible surface. (The Spot's structure goes deeper even than the radiometer can probe.) The instrument observed winds up to three times hurricane speeds, and found the lower levels are warmer than the top.

Mars Rover Opportunity

On January 24th, the Opportunity rover celebrates 14 years of operation on the red planet, more than 50 times its planned life. The craft has also survived its eighth Martian winter.

DAS NEWS

DAS Elections

Our annual election process begins at the **January 5th** General Membership meeting, when **nominations open for E-Board officer and trustee candidates**. The election itself takes place at the February General Membership meeting; the new board will be installed in March. This year's Chairman of the Election Subcommittee is Ivan Geisler.

Volunteer Opportunities

Friday, Feb. 9th (Time TBA): Star Party for girls camp in Highlands Ranch off south US 85.

Wednesday, Feb. 28th (Time TBA): Star Party at Renaissance Stapleton.

(Just a bit of information for now. More details to follow in January.)

To volunteer, please contact July Candia:
external@denverastro.org
—and thanks!

New "Dual/Family" Memberships

The DAS E-Board recently voted to create a new class of membership called "Dual/Family." The $60 annual membership is for any two named individuals (sign up with your sweetie!), or for any number of members of an immediate family (spouses and children). The changes go into effect January 1st, and the January renewal materials will provide more specific information.

January General Meeting


Mike Carroll

On Friday, January 5th, at 7:30 PM, Mike Carroll will present "Distant Earths," and will have books available for signing.

Writer, lecturer and artist Michael Carroll has nearly thirty books in print. He is a science journalist and children's author, having written for such magazines as *Astronomy Now* (UK), *Popular Science, Astronomy, Asimov's, Analog, Sky & Telescope, Clubhouse, Odyssey, Sea Frontiers,* and *Artists* magazines. His books include *SPACE ART* (Random House/Watcon Guptil), *Alien Volcanoes* (Johns Hopkins University Press 2008, with Rosaly Lopes), *Living Among Giants: Exploring and Settling the Outer Solar System* (Springer), *Drifting on Alien Winds,* and others.

The meeting will be held at **DU's Olin Hall, Room 105**, and all present will be invited to a reception following the meeting at DU's Historic Chamberlin Observatory. Coffee and light refreshments will be served.

Are you skilled at editing videos?

If you're familiar with iMovie (or more advanced software like Final Cut Pro or Adobe Premiere Pro), the DAS would like you to consider contributing your skills to editing videos of our General Meetings for posting on YouTube.

We need someone who can use an existing on-screen format for creating a title frame, combine videos of the speakers with PowerPoint presentations, and post them on the DAS YouTube channel. A "how-to" guide has been created by Jeff Tropeano.

If you're interested, **please contact Darrell Dodge at dmdodge@aol.com.**

January Skies

Continued from Page 3

and setting with the Sun.

At New Year's, **Mars** is already well-up by 6 AM, more than an hour before sunrise. The magnitude +1.4 planet drifts past Zubenelgenubi (Alpha [α] Librae) as the month begins, and continues on to **a tight conjunction with Jupiter on the mornings of the 6th and 7th**.

On both days, the pair will be less than 20' apart, and changing position subtly by the hour—on the 6th, they'll be just 17' apart, 30° up in the southeast, an hour before sunrise. (If you can still track them after dawn, they'll be less than 15' apart by 10 AM.) For early risers who want more observing time, the pair are about 12° above the horizon around 4 AM, and 21° at 5 AM (sunup comes at about 7:20 AM on the 6th and 7th). This is a good opportunity for time-lapse movies either day—"closing the gap" on the 6th, and "widening" on the 7th.

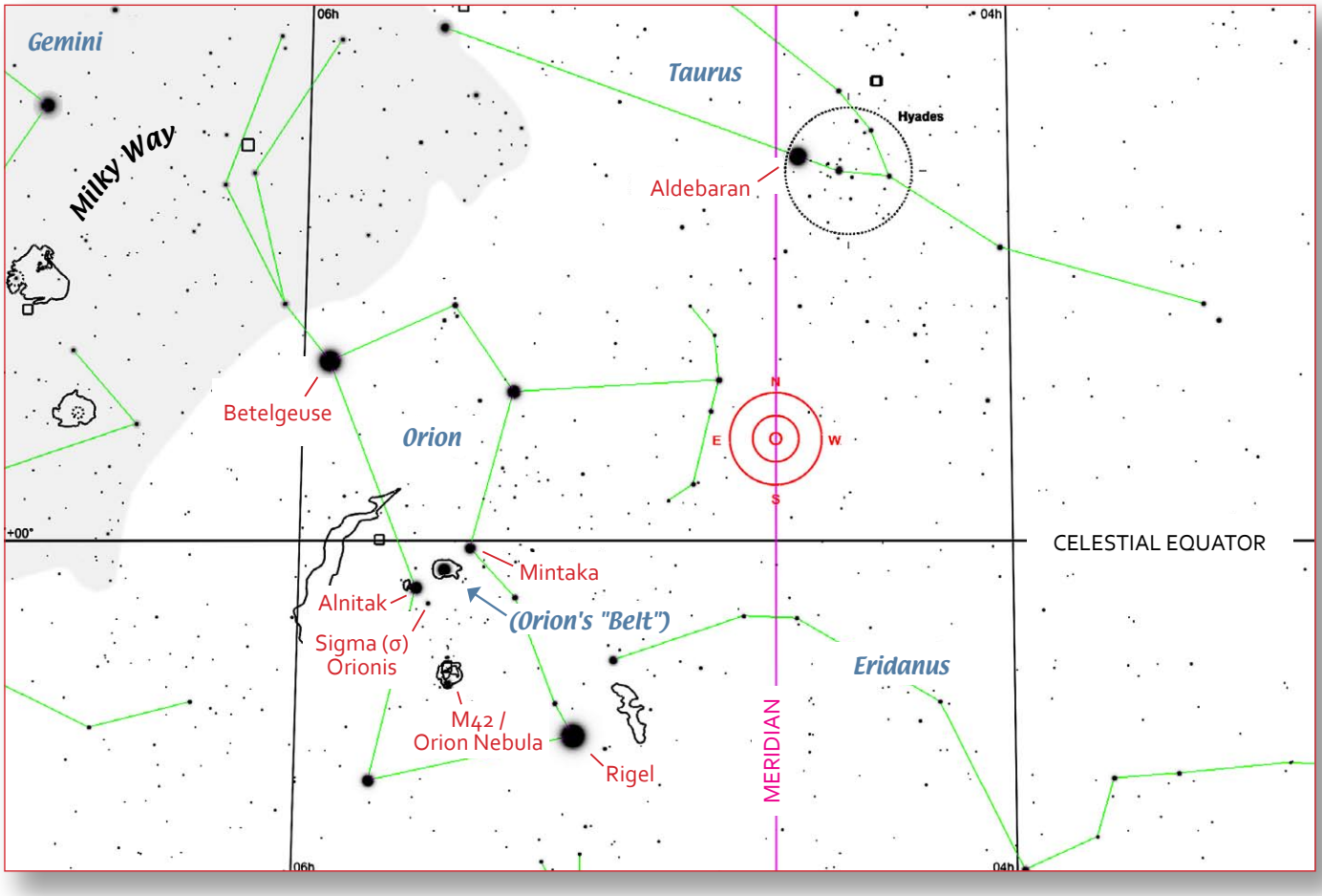
At the beginning of the year, **Jupiter** is already well up, standing 27° above the southeastern horizon an hour before dawn, giving you plenty of observing time. By the end of January, Jupiter is nearly at the meridian, 33° up in the south, with the same interval before sunrise. The planet's disk spans about 34" mid-month; it will grow by about a third to appear 44" across at opposition in early May.

Saturn will not be a good target this month—it's less than 2° up a half-hour before sunrise at New Year's, and only 14° up at the end of January.

Pale blue **Uranus** is at a standstill in early January, as it ends its retrograde motion and resumes its eastern course. You'll find the planet 3½° due west of Omicron (o) Piscium at the beginning of the month, and ¼° closer by the start of February. Uranus will sink into the sunset in late March (as a final bow, Uranus has a *very* close conjunction with Venus on March 28th).

For you **Neptune** fans, this is it—by the end of January, the planet will be only 16° above the horizon an hour after sunset, and will

Continued on Page 6



The Denver sky at 9:00 PM in mid-January. The Meridian runs directly north-south—note the position of Orion east of this line. At the same hour, Orion will be farther from the Meridian early in the month, and closer to the Meridian at month's end. Telrad circles included for scale. (See also the detail chart of Orion's Belt on p. 7.)

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

January Skies

Continued from Page 5

disappear into the glow a few weeks afterward. Early in the new year, though, Neptune's still a decent target, and easily found—it's just ½° southeast of Hydor (Lambda [λ] Aquarii); at that time, it's a straight line from Zeta (ζ) through Lambda and on to Neptune. The planet moves eastward from there, finishing January about 1° due east of Hydor.

Stars and Deep Sky

This month, we're going to look at some multiple-star systems and a large, interesting nebula in Orion—and it *isn't* M42! While these objects are accessible to beginners, we'll take a deep enough look at them to offer something for the advanced folks, too.

Briefly though, for our beginners, you can find the constellation Orion by looking southward, about halfway between the horizon and the zenith (straight up) around 9 PM in January (see main chart, *above*). Orion's famous belt of three bright stars will become immediately obvious, somewhat east of due south through most of the month, and due south towards the end. That's where we're headed this month, but as long as you're at it, check out bright Rigel (Orion's foot) at the constellation's bottom-right, and orange Betelgeuse (Orion's shoulder) at top-left—they'll help you make a positive ID quickly, and they're fascinating objects on their own.

(For more detail about finding and recognizing Orion—and how to use it to locate other constellations—check out "Getting Your Bearings" on page 4 of the January '16 *Observer*—you can find it at http://www.denverastro.org/newsletters/january2016_denverobserver.pdf. Rigel and the Great Orion Nebula, M42, are covered in "Monthly Skies" in the same issue, starting on page 6.)

Our first object, then, is **Mintaka, or Delta (δ) Orionis**—"δ Ori" for short. Mintaka isn't hard to find—it's the *westernmost star in Orion's belt,* or (for observers in the northern hemisphere) simply "the belt-star on the right." At **05h 32m, -00° 17'**, it's also positioned almost exactly on the Celestial Equator, the dividing line between stars in the northern and southern celestial hemispheres. Mintaka is the only star of 2nd magnitude or brighter to lie within 1° of this line—and it's joined by just three more stars of 3rd magnitude, making it something of a landmark (for the advanced folks, the other three stars are α Aqr, θ Aql, and ζ Vir).

I'd remembered Mintaka from high school astronomy, but it wasn't until I got my own telescope years ago that I discovered that this old friend had more to it: Even in small telescopes, it's a beautiful binary, with a bright white, magnitude +2.2 primary and a smaller blue companion of magnitude +6.8. Since the pair lie about 53 arcseconds apart, they're easily split.

An unseen companion orbiting the primary star was detected spectroscopically more than a century ago. Since that high school class, though, some 40 years ago, astronomers have been busy—Mintaka's distance from us, which was thought to be about 1,600

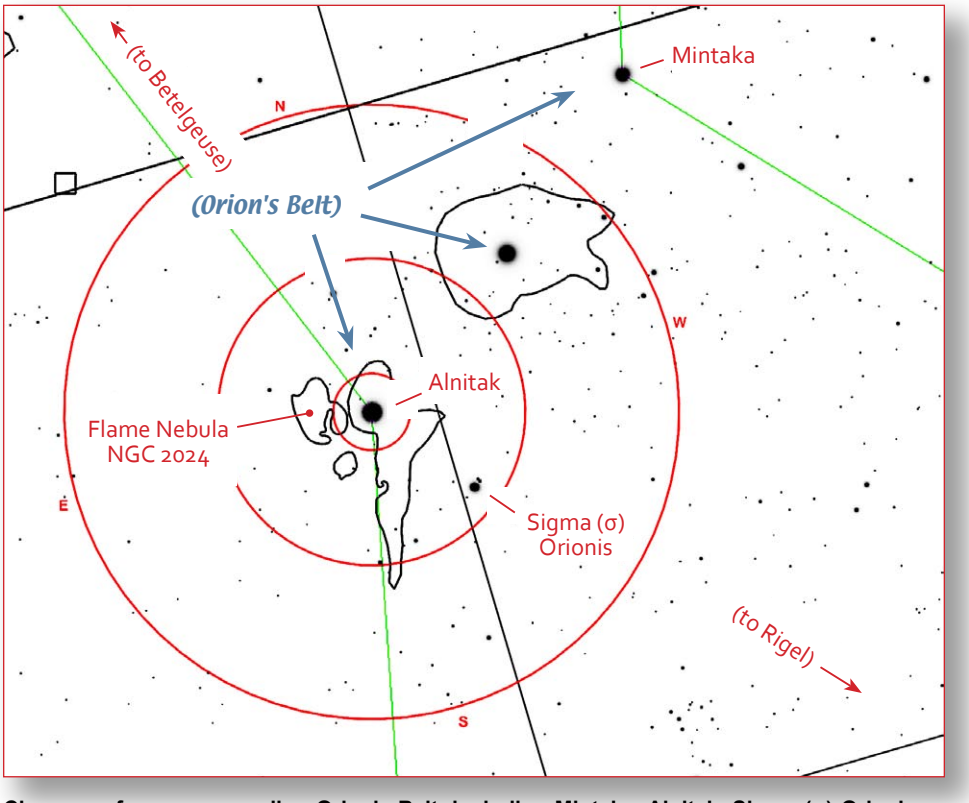
Continued on Page 7

January Skies

Continued from Page 6

light-years back then, was revised to about 900, and then more recently 700 light-years. With these new measures, all the *calculated* measures, like the components' absolute magnitudes (actual brightnesses) and the physical size of the stars' orbits, have changed, too—but not all astronomical resources for amateurs have been updated yet. (Current research also suggests a 14th-magnitude companion about 33" from the primary is also part of the system and that there are other components as well, but I saw conflicting reports.)

For the advanced folks, here's an interesting tidbit: In reexamining the primary (whose spectrum shifted periodically because of the push-pull influence of the spectroscopic companion's orbit), absorption lines of calcium were found in the primary's spectrum—but these did *not* shift. It was the first evidence, in the early 1900s, of the interstellar medium, the gas and dust inhabiting the spaces between the stars. (It was a fitting place to find it, too, since the whole constellation is filled with a giant swath of gas and dust!)



Close-up of area surrounding Orion's Belt, including Mintaka, Alnitak, Sigma (σ) Orionis, and NGC 2024. Note how Telrad's inner ½° circle (and thus a similar field in a telescope) covers a small part of NGC 2024 when centered on Alnitak, as shown.

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

Our next target is also a multiple star—it's **Sigma (σ) Orionis**, or just "σ Ori" among friends. You'll find it at **05h 40m, -02° 36'**, *just below Alnitak*, or Zeta (ζ) Orionis, the easternmost star in Orion's belt (or more easily, "the one on the left"). Like Mintaka, Sigma Ori is known to be a multiple star, but unlike the former, you can see the majority of them! Three of the system's *five* stars are easily seen, even in small 'scopes, and the fourth is sometimes visible. Try 60-100x to start.

The bright primary, known as the "AB" star, is itself a close binary, but its companion—the "B" in "AB"—is too close to be split by most amateur telescopes, at just ¼-arcsecond apart. (This "B" component is the "missing" fifth star.) Given Sigma Ori's distance (very roughly 1,100 light-years from Earth), the AB pair's measured separation suggests a physical distance of about 90 astronomical units (AU); that is, 90 times the Earth-Sun distance, or more than double Pluto's average distance from the Sun. The "A" primary is a huge O-class star, 35,000 times brighter than our Sun, and the "B" is a class-B star with 30,000 times the Sun's brightness; but because of the distance from Earth to the Sigma system, they shine at 4th and 5th magnitudes, respectively. (Blended together, the whole system glows at magnitude +3.7). The AB stars' masses of 18 and 13.5 times our Sun's are enough to cause them to eventually go supernova.

Looking outward from the bright AB component, the next *brightest* stars—the ones you'll notice easily—are the "D" and "E" components (we'll get back to the "C" star shortly). These are somewhat smaller than the AB pair's stars, at a little over 6½ solar masses each (so no supernovae here; they'll grow old as white dwarfs). The 6.6-magnitude D star lies about 13" from the primary (AB), giving a physical separation of about 4,600 AU (well over 100 times the Pluto-Sun distance). The similar-looking E star arcs off the AB-D line and sits 42" from the primary, for a physical distance of approximately 15,000 AU—about a quarter of a light-year.

That leaves the previously mentioned "C" star. This system member can be challenging to observe, because at magnitude +8.8, it's about five magnitudes dimmer than the bright AB primary, and it sits somewhat closer-in than the D star does. I've seen the C component only twice, once in my 6-inch Newtonian, and once in my 12-inch, both on nights of good seeing. If you'd like to look for it, it's on the opposite side of AB from the other companions; my notes from the 12-inch describe it as "dim and blue."

When you observe Sigma Ori, you'll soon notice *another* trio of stars, all at about 8th magnitude, just 3½ arcminutes to the northwest (that's close enough to appear in the same eyepiece field, even at high power). This group is Struve 761; details about even the basics of this system are contradictory, but it does seem that at least two of the stars are in orbit around each other. Some sources suggest that all three are related, not just to each other, but to Sigma Ori as part of a mini-cluster. Regardless, they are beautiful to see.

Under darker skies, Sigma Ori can be seen naked-eye, hanging less than 1° below Alnitak, in the direction of the bright star Orion. In the city, just center your finderscope on Alnitak, and Sigma will share the field, about halfway towards the edge. (If you use a straight-through finderscope, remember its view is inverted, so Sigma will appear on the opposite side of Alnitak than it does naked-eye.)

Our last object, **NGC 2024**, or more romantically, **the Flame Nebula**, is a large emission nebula; it lies on the opposite side of Alnitak from Sigma Ori, at **05h 43m, -01° 52'**. Like its larger cousin, the famous Orion Nebula (M42), the Flame Nebula is a

Continued on Page 8

January Skies

Continued from Page 7

vast stellar nursery of gas and dust; in both cases, huge numbers of unseen stars lie hidden within the cloud. (It's worth noting that these two nebulae *really are* "cousins," in that they're both part of an immense structure, the Orion Molecular Complex, that covers most of the constellation.)

NGC 2024 has a prominent dark lane down its center, and other dark markings to the sides. (Visually, this nebula can sometimes strike you as *two* clouds, separated by the dark lane.) In spite of appearances, the dark lanes are not "holes" or "gaps" in the glowing cloud; these dark areas are actually much denser areas of gas and dust, and as such are especially prolific star-forming regions. The VISTA telescope, a 4.1-meter instrument in Chile run by the European Southern Observatory, imaged the Flame Nebula in infrared; it clearly shows the contents of the cloud, including the otherwise-concealed stars within the dense areas. (A crop from this huge, detailed image is on this month's cover.)

The Flame is a large enough object to avoid the need for great magnification, but it still fits nicely into an eyepiece—a ½° field will show it well. In large 'scopes, the cloud will remain visible even when Alnitak is in the field of view, but you'll see much better if you slew your 'scope to exclude the bright star. This nebula can be seen without the benefit of filters, but a UHC may help—as with M42, there are arguments to be made about the quality of the view with and without the filter, so try it both ways. According to notes from my last observing run on the Flame in late October, about 10x per inch of aperture worked well but 15-16x was too much. (Note that that was at around 2 AM, after I'd been in the dark for many hours—if you have trouble seeing the nebula, either adjust your power up or down, or try again in a few hours, when your eyes are deeply dark-adapted, too.)

This nebula should be common on observing lists, but it's often missing—the showpiece M42, it seems, gets all the attention. Ironically, another distraction is the elusive Horsehead Nebula, only about a degree away from the Flame—the lure of a dim, difficult, *horse-shaped* dark lane's silhouette looms larger in many observers' minds than the much larger one they can see more easily next door! That's a shame; the Flame can be so much more rewarding. (By the way, although this nebula can be seen in small 'scopes, a big one can reveal deep detail—DASers, try this object on our 14-inch at the Dark Site!)

To get to the Flame Nebula, just head back to Alnitak, and center it. A ½° telescopic field will include a portion of the Nebula near the edge; nudge the 'scope gently towards Betelgeuse (the bright red star in Orion's shoulder) to center the nebula. *See the close-up chart on page 7.*

Wishing you clear skies, literally and figuratively, in this New Year.

—See you next month.

The Denver Astronomical Society
P.O. Box 102738
Denver, Colorado 80250