The Denver
OBSERVER
FEBRUARY 2016

Comet C/2013, US10 (Catalina), a recent visitor to the inner solar system, in local skies on a rare cloudless night... ***Image © Ron Pearson***

FEBRUARY SKIES

by Zachary Singer

This month, we'll check out an easy but worthwhile binary, an exemplary open cluster, and for experienced observers, a truly "far-out" globular cluster. But first, a quick stop at our solar system…

Local Sky

As we head into February, dawn comes ever earlier, and the lazy, "after 7" sunrises of the month's opening days will give way to sunrise closer to 6:30 a.m. For the first half of the month, though, getting up early will still get you a view of all the naked-eye planets—Mercury through Saturn—in the same sky. (We'll do them in order of view from east to west.)

Nearest the Sun's glow, Mercury shines at magnitude 0, but only about 5° above the southeastern horizon at 6:15 a.m., at the beginning of the month. It draws closer to the sun as the days progress, and will be lost in solar glare by mid-month. (A much better look at this planet is coming in the spring.)

Venus blazes at -4 mag. in the dawn sky, about 5°, on average, to the right and upward from Mercury when you look eastward. As the month goes by, Venus will also move closer to the Sun, finishing February about 25° to the Sun's west.

At the same hour, Saturn shines in the south-southeast at February's beginning, and ends the month in the south. Outshining nearby Antares by at least ½ magnitude, Saturn will be easily identified. (Keep in mind, though, that by month's end you'll need to look for this planet earlier in the morning to keep the dawn from spoiling a telescopic view.)

Mars starts February in the south at 1st magnitude, and brightens about a ½ magnitude by the beginning of March. Even then, though, it's still only half the angular diameter it will have at opposition in late May, so stay tuned.

And finally, there's Jupiter! Only a month away from opposition, it's now both a "morning" and an "evening" object—transiting at around a quarter to 3 in the morning in the first days of February, it crosses the Meridian not long after midnight when March begins. That puts it in the southwest morning sky early in the month, and very low in the west

Continued on Page 6

In the Observer

Sky Calendar

8	New Moon
15	First-Quarter Moon
22	Full Moon
(Mar 1)	Last-Quarter Moon

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The Executive Board conducts the business of the DAS at 7:30 p.m., at Chamberlin Observatory.
Please see the Schedule of Events for meeting dates. All members are welcome.
http://www.denverastro.org

PRESIDENT'S MESSAGE

by Ron Hranac

DAS Elections—Get Involved!

It's that time of year again: Have you renewed your Denver Astronomical Society membership? Notices were sent out last month, and the good news is the number of renewals is on track with this same time last year. Thanks very much to those of you who have renewed to support DAS and astronomy for 2016. If you haven't yet done so, the following link will take you to our renewal web page, where you can use either PayPal or a credit card. (A PayPal account isn't necessary.) *http://www.denverastro.org/dasrenew.html*.

Denver Astronomical Society's success as an organization depends largely on the many volunteers who fulfill a variety of roles. Among those roles are outreach and sharing our love of the day and night sky with the public—think monthly Open Houses, twice-weekly Public Nights, and activities at museums, schools, and other venues. Another important role that often takes place behind the scenes is leadership of the Society. Our annual elections are upon us, and I'd like to invite you to consider tossing your hat in the ring for a position on the Executive Board—otherwise known as the E-Board. At the very least, cast a vote in this month's elections.

Article II, Section 2.0 of Denver Astronomical Society's bylaws says, "The Annual Meeting and election of the Executive Board and Officers shall be conducted at the General Meeting in February or at another date, as the Executive Board may direct. The Officers and Board members will be installed at the Annual Banquet in March."

This year's annual meeting is scheduled to be held on Friday, February 19th at DU's Olin Hall, with things getting underway at 7:30 p.m. MST.

You're encouraged to attend the annual meeting and participate in the elections. Keep in mind that elected officers and board members are your voice in the direction of DAS, so let your voice be heard. Nominations began at the general meeting in January and will continue through February's meeting. If you'd like to nominate someone (including yourself) for a position on the E-Board, send an e-mail to *nominations@denverastro.org*, or let Tim Pimentel know in person.

Following the elections, the new leadership will get busy planning another exciting year for DAS members and the public. If you have comments or suggestions, feel free to contact any of the E-Board members. We welcome your input. Our next major membership event is the DAS Spring Banquet on Saturday, March 19th; I hope to see you there!

Continued on Page 5

DAS SCHEDULE

FEBRUARY 2016

13	Open House—DU's Historic Chamberlin Observatory—Starts at 5:30 PM
19	Annual Meeting at DU's Olin Hall, Rm. 105, 7:30 PM—**Featured Speaker: Alan Erickson, who will discuss astro-imaging with DSLRs (see "DAS News"); DAS E-Board Elections**
26	E-Board Meeting—At DU's Historic Chamberlin Observatory, 7:30 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.

DAS NEWS

Volunteer Opportunities

*** Please note that Lindsey Shaw has passed the baton for managing Volunteer Outreach to Julie Candia. *Lindsey did an awesome job, and the DAS is very thankful for all her work. —Ed.*

February 13, 5:00PM-8:00PM: Night Observing at Heritage Center in Georgetown, CO, for their Cultural Arts Program. Denver Museum of Nature and Science will also be providing their Titan Virtual Arts Program.

February 18, 6:00PM: Astronomy Night at East High School in Denver. Night observing for approximately 65 students. They are interested in locating constellations in the night sky.

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

February Speaker

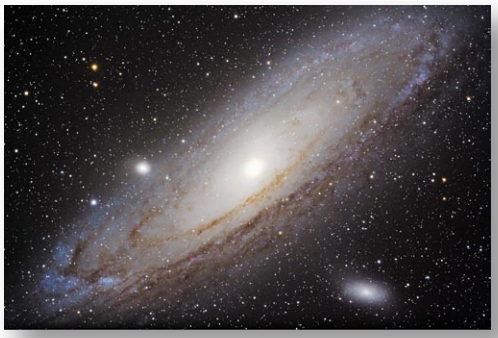
Alan Erickson, Senior Computer Scientist at Adobe Systems and a DAS member since 2000, will talk about getting started in astro-imaging with a DSLR and a camera lens or telescope, at the DAS Annual Meeting, Feb. 19th at 7:30 PM, in Rm. 105 of Olin Hall on the DU campus. His presentation includes an overview of processing software and techniques, as well as resources for imagers.

Alan has developed features for Photoshop, Illustrator, and Lightroom. Photoshop areas include animation, video, image selection, and image adjustments. He started imaging in 2003.

Since 2008, Alan has combined his hobby with his profession, representing Adobe at astro-imaging conferences. Alan has presented Photoshop topics at the Midwest Astro-Imaging Conference, Advanced Imaging Conference, Northeast Astro-Imaging Conference, and Texas Star Party.

After the meeting, all those present are invited to a reception at DU's Historic Chamblerlin Observatory, where refreshments will be served.

Some of Alan's images, like the one at left, may be viewed at *https://alanerickson.smugmug.com/*.



The Andromeda Galaxy, M31. © *Alan Erickson*

MEET A DAS-er

Connor Bray, Van Nattan-Hansen Scholarship Recipient

By Dena McClung

Meet Connor Bray, one of two recipients of the Van Nattan-Hansen scholarships for 2015. He recently began his freshman year at the Colorado School of Mines in Golden.

At age 15, Connor is one of DAS' youngest members and an apprentice operator at Chamberlin Observatory, which is just two blocks from the home where he lives with his parents and younger brother. He has a robust intellect, a sharp wit, and an eagerness to help that made him fun to interview.

Connor's parents realized early on that he was not an average child. As a toddler, he required a lot more stimulation than the toys made for his age provided. He was reading and using a computer at age two.

At age three, Connor began attending the Ricks Center for Gifted Children at the University of Denver, where he could be given challenges appropriate for his active and demanding mind. He liked Ricks because its structure met his needs and offered him the ability to take selected classes at a higher grade level than his Ricks Center peers. Students were expected to do more than simply complete course work; they also had to show a deep analytical understanding of the material, initiative, and innovation. Towards that goal, one of his teachers graded on a scale of twelve, rather than ten, using the two highest marks to rate students who exceeded the norm.

Connor became interested in astronomy and science at age four and a half. Finding cartoons boring, he watched shows with science themes. His parents began taking him regularly to the Denver Museum of Nature and Science, where he spent countless hours playing with the erosion, impact crater, rover, and shuttle exhibits. He went to all of the planetarium exhibits, 60 Minutes in Space, and space camps.

Five years ago, Connor began attending the Center for Bright Kids during the summer. The last two summers, he has been in the Luminary classes, which are for high school-aged students—they cover the equivalent of a college semester of material in a mere three weeks. Connor has taken classes there on computer

Continued on Page 5

ABOUT THE DAS

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

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

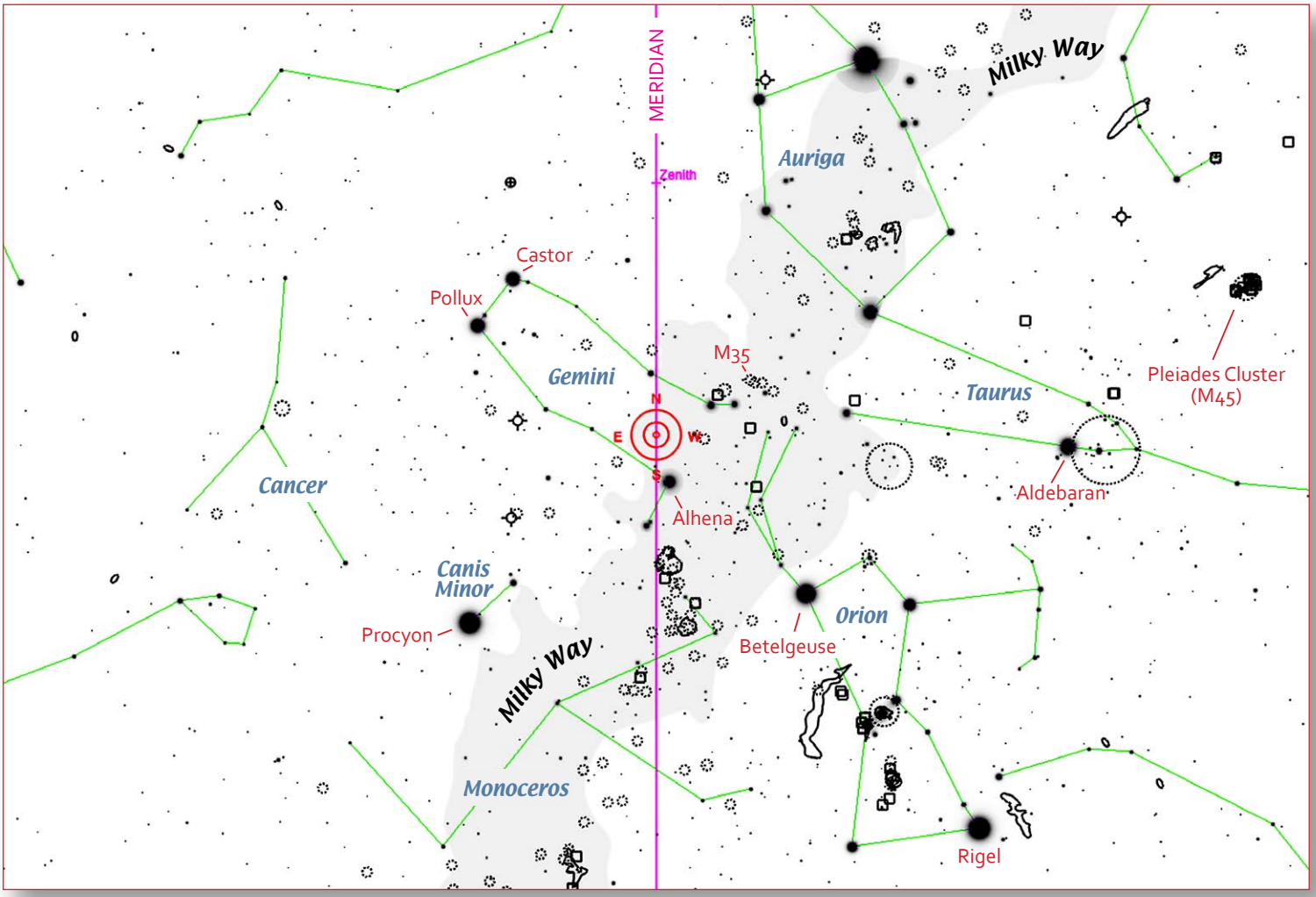
The DAS is a 501 (c)(3) tax-exempt corporation and has established three tax-deductible funds: the Van Nattan-Hansen Scholarship Fund, the DAS General Fund, and the Edmund G. Kline Dark Site Fund.

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

GETTING YOUR BEARINGS

...from the editor

Gemini and the Milky Way



View of Denver's southern sky at 9:00 p.m. in mid-February. ***Center of Telrad circles is about 70° above southern horizon.***

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

This month, our "official" target is the constellation Gemini, "The Twins," but if you take a quick peek at our chart, you'll see something interesting—the band of the Milky Way, littered with deep-sky objects… Though the "Monthly Skies" column can't cover them all, getting a handle on what's going on there will make it easier to visualize the *why* of deep-objects' locations, making our galaxy both more wondrous and more understandable at the same time.

Gemini's outline is meant to be evocative of twin brothers from ancient Greek myths; each brother is represented by a fairly straight line of stars that curve just enough to suggest the hips and shoulders of human forms. Each also has an unmistakable 2nd-magnitude star at its head, named for a twin: Castor and Pollux. Once you've seen where this bright pair is, it will be easy to spot on its own. An equally bright star, Alhena, marks Pollux's foot.

To find Gemini before you're familiar with it, start at Orion (which we covered in this column last month—if you missed it, *http://www.denverastro.org/das/denver-observer/*). Look at Rigel (the bright star in Orion's foot, at lower right), then move diagonally through the belt (to the northeast), and continue until you're at the bright orange star, Betelgeuse, Orion's shoulder. Keep going about the same distance as from the belt to Betelgeuse, and you'll find yourself at the feet of the Gemini Twins! Alhena will be right there, and Castor and Pollux will be obvious to you—they're at the end of a line with Betelgeuse on the opposite end, and Alhena in the middle. When you first find Gemini in dark skies, its 4th-magnitude-and-brighter outline will be easy, too—many of the stars are even visible in suburban skies under reasonable conditions.

Between the outlines of Orion and Gemini lies the great glowing band of the Milky Way. Unlike the summer months, when we look toward our galaxy's center, this view looks more or less outward—if the summer view is towards "downtown," this view is toward the "suburbs." That's actually an important distinction, as different processes mold these regions. Take our "downtown vs. suburbia" metaphor a little further, and consider how the intense concentration of people and money alters the society—and architecture—in a real city's downtown, and how the spread-out nature of the newer 'burbs has its own effects; now think about the concentrated mass, gravity, and altered space-time at the center of our galaxy and the lower densities of material in its arms…

The Milky Way's "downtown" view shows us denser, older populations of stars, both at its center and in the tightly packed globular (ball-like or spherical) clusters that orbit it.

Continued on Page 8

President's Message

Continued from Page 2

While on the subject of DAS business, we have two openings on the Van Nattan-Hansen Scholarship Committee. If you're interested in serving on the VNH Committee, drop me a note at *president@denverastro.org*. More information about our scholarship program is available at *http://www.denverastro.org/das/das-scholarships/*.

As most of you know, S&S Optika, run by our long-time friends Tim and Cathie Havens, served the Denver area for 43 years. Sadly for us, they retired late last year and moved to New Mexico. The E-Board decided to get them a going-away gift, in part to say thanks for all they did for amateur astronomy over the years. We also wanted to get them something to remind them of Colorado. After considering several ideas for a suitable gift, we went with something that is uniquely Colorado and astronomy-themed: DAS member Roger Clark is a photographer extraordinaire, and we chose one of his gorgeous prints of the Milky Way looming over Colorado's Maroon Bells. The accompanying photo shows Roger presenting the going-away gift to Tim and Cathie.

Cathie and Tim Havens with Roger Clark. ***Image © Ron Hranac***

Meet a DAS-er

Continued from Page 3

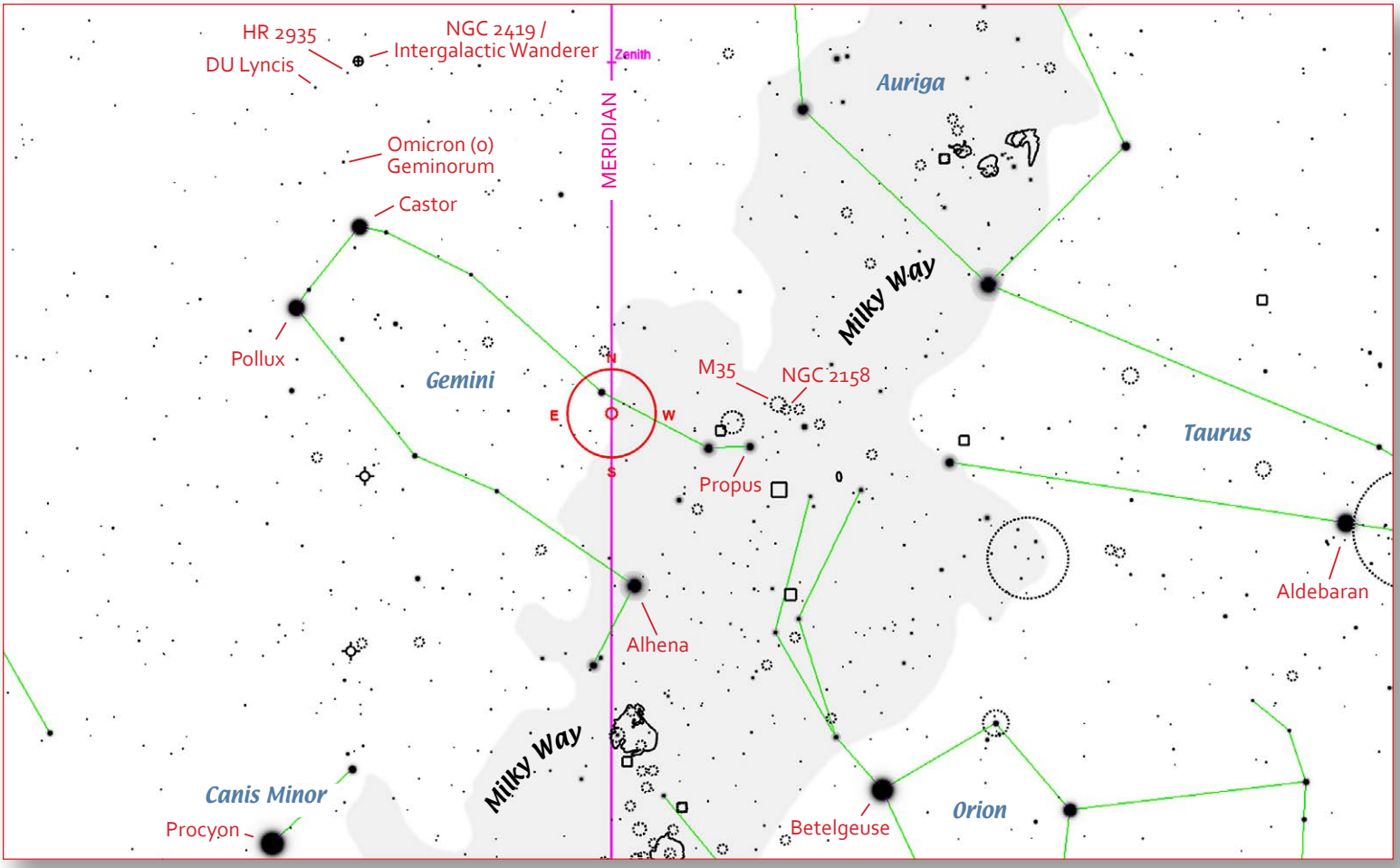
coding, applied math, general physics, astrophysics, and computational physics.

In 2013, Connor transferred to Littleton High School, where he exhausted their math and science offerings in two years. While there, he also took an independent study college level number theory class.

Having grown beyond the usual secondary school coursework, Connor and his parents decided to forego having him earn a high school diploma. After taking the ACT test, he was accepted at the Colorado School of Mines and began taking classes in August. In addition to the VNH scholarship, Connor recently accepted a NASA scholarship that includes a mandatory ten-week summer internship at one of their facilities. He is working toward a degree in Engineering Physics, and would like to become an aerospace engineer with NASA or another organization in the field of space exploration.

But Connor isn't all work and no play. He and his family spent some time in Hawaii last summer, they visit family in Michigan almost yearly, and he likes tinkering with Linux and playing *Kerbal Space Program*. *KSP* is a space-flight simulator in which the players build and fly simulated spacecraft; its complexity can make the game quite challenging, but it has been praised for making difficult concepts of spaceflight accessible.

For Connor, that's entirely appropriate.



Looking southward from Denver at 9 p.m. in mid-February; deep-sky objects are plotted to mag. 11. Note "Telrad" placed over Meridian for reference; its center is about 75° above local horizon. Telrad circles are 4° and ½° (2° circle omitted for clarity).

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

February Skies

Continued from Page 1

(but visible) at the end. The planet rises before 9 p.m. in early February, and is already more than 30° up at that hour by month's end.

Deep Sky

Our first stop after leaving the solar system is **Castor, or Alpha (α) Geminorum**, at **7h 36m, +31° 51'**. It's easily located when you look for the brighter of a noticeable angled pair of stars "up and to the left" of Orion—the other star is Pollux, and together they are thought of as the "heads" of the Gemini Twins. (If you're not familiar with the constellations Gemini and Orion, see this month's "Getting Your Bearings.")

At first glance, Castor is a bright binary, a cool-white duo about 5" apart. They're a beautiful pair, even in small telescopes, and their separation (and the ease of splitting them) gives a useful clue about current "seeing" conditions—when this pair is high up but hard to split at moderate powers, then there's a lot of turbulence in our local skies, and views of detailed objects will suffer.

It turns out, though, that Castor has much more to it—both of the main stars are spectroscopic binaries themselves. That is, the light from each comes from their own pair of stars, which orbit each other too closely to be seen separately from Earth. (We infer the unseen companions' presence from the way the lines in the stars' spectra split apart, then merge, and then split again in a consistent cycle.) For Castor, what looks like two stars orbiting each other turns out to be *four* stars in two groups; the stars within each group orbit each other, and together, each group orbits the system's combined center of mass.

As they say on late-night TV pitches, "But wait, there's more!" About 70" to the southeast (a heading of 165° from Castor), you'll find a magnitude 8.8 "red dwarf." It's in quotes because, like the stars of the main pair, this star (known as "Castor C") is also a spectroscopic binary—both of its components are red dwarfs. Castor C is unfamiliar to most observers, and it could be confused with another nearby star (a binary with a wide separation), perhaps making it best for the more experienced, but the dynamics of the Castor system—*six individual stars in all*—is something even a newbie can marvel at.

Our next object, **Messier 35, (6h 10m, +24° 20')** in Gemini, is a beautiful open cluster, something of a "classic" of its type. For the beginners, a cluster of this sort is the product of a giant, star-forming cloud like the Orion Nebula (also known as M42) that we explored last month. To understand M35, imagine that about 100 million years ago, this cluster was enshrouded in a great nebula of its own, as M42 is now, and that the stars you see were hidden within. Over time, radiation pressure from its stars began to blow away the nebula's gas and dust, revealing more and more stars.

Astronomers can estimate the cluster's age because the hottest, type "O" (blue) stars have already used up their hydrogen fuel, leaving cooler (and less blue) type "B" stars to carry the torch. Cooler, dimmer and yellower stars make up the rest of the cluster—as M35 ages, fewer of the bluer "B" stars will remain, as they burn out more quickly than their cooler cluster mates.

Continued on Page 7

February Skies

Continued from Page 6

When you observe M35, start out with a low-power view; this cluster spans more than a half-degree of sky. Then try higher power eyepieces to check out some of the details—you may notice a few unusually bright, orange stars within the cluster. These are "giants"—former hot blue stars which, having expended much of their hydrogen fuel, have gone on to fuse helium or other elements in their old age. (These later phases of stellar evolution don't last long, so there are relatively few stars like them in the cluster.)

M35, the bright cluster at center, lies about 2,800 light-years from Earth; NGC 2158, the smaller-looking cluster at lower left, is more than 16,000 light-years distant. ***Image © Darrell Dodge***

For the curious, there's nearby **NGC 2158, (6h 08m, +24° 05')**, a much older open cluster than M35. Its greater age means that even the "B"-class stars might have conked out by now, and in fact, the cluster is populated by stars much yellower than that—the "B" stars are gone, as well as the longer-lasting and cooler type "A" stars. That leaves a lot of type "G" stars like our Sun along with even cooler stars, and some type "F" stars, just one class hotter than the Gs. All of these types are noticeably yellower and intrinsically dimmer than M35's hotter showboats, but they'll be around a good long time. NGC 2158 is also much farther away than M35 (more than 16,000 light-years from us, compared to M35's "mere" 2,800), so it's also dimmer and smaller in the eyepiece than M35. It makes for an interesting comparison (see photograph).

M35 is at the "feet" of the Gemini Twins, a constellation noteworthy for its roughly parallel matching "stick figures." The "foot" you want is on Castor's side, but it's easier to find the other foot (on Pollux's side) first—just look for Alhena, Gamma (γ) Geminorum, the bluish 2nd-magnitude star halfway between Pollux and orange Betelgeuse (Orion's shoulder). Having Alhena as a reference quickly orients you to the length and direction of the "twins" figure, and makes it easy to gauge where Castor's foot is.

In dark country skies, you'll see M35 as a subtle glow a little more than 2° northwest of Castor's foot—orange, 3rd-magnitude Propus, Eta (η) Geminorum. If you can't see the cluster with naked eyes, imagine a line from Alhena to Propus, extend it a shade over 2°, and put your Telrad's center there. The Telrad's outer edge will then be on or close to Propus, and M35 will be visible near the center of your finderscope's view. At least *some* of the cluster should also be visible in a wide, (one-degree) telescopic field. Once you've got M35, look ½° southwest for NGC 2158—that 1° field should include it when M35 is centered; if not, a slight nudge should pick it up.

Our last object, as advertised, is truly "far-out"—it's both an oddball and distant. This object, **NGC 2419, or the "Intergalactic Wanderer," at 7h 39m, +38° 51'**, is a dim globular cluster due north of Castor, in the constellation Lynx. If you've sailed the starry sea awhile, the idea of a globular in this area will likely raise an eyebrow! If you haven't, this giant ball of stars is in a very unusual spot, almost 180° across the sky from where most globulars are found—you'd ordinarily expect to find them in the general direction of Sagittarius, the constellation overlying the center of our galaxy.

Research with ever-better instrumentation over the decades paints a picture of a truly remote object some 270,000 light-years from us, and 300,000 light-years from the center of the Milky Way—that's *at least* 10 times farther than the bright ones you might be familiar with. Earlier astronomers, while greatly underestimating 2419's distance, also erroneously believed this object flies free through space (thus its nickname); the Wanderer, though, is now thought to orbit the Milky Way—about every 3 *billion* years!

Looking at NGC 2419, it must be said, is not the same experience as viewing the great globulars, like M5 or M13. Compared to these bright (mag. 5.7-5.8), easily resolved showpieces, NGC 2419 is nearly 5 magnitudes, or almost 100 times, dimmer at mag. 10.4; and even large amateur telescopes won't show much beyond a round fuzzy glow that would remind you of how the showpieces look in a finderscope. Still, it *is* visible, even in smaller telescopes, and the *ideas* behind it, rather than a flashy view in a 'scope, are the point here. (One more for the road: at the Wanderer's distance, it should be closer to mag. 11 than 10, if it's the same inherent brightness as M13 or M5. The "extra" brightness tells us this globular is intrinsically much more luminous—2419's actual output is nearly *double* that of M13. Ironically, this faraway globular, dimmed by distance, is among the very brightest, intrinsically, that we know of.)

If you're good at star-hopping or your 'scope has go-to capability, and you're already familiar with globulars, the Wanderer will be worth a look—for the sheer difference in appearance, if nothing else. If, on the other hand, you're lacking either the experience with brighter globulars or the ability to navigate to this challenging target, you'll likely find this more trouble than it is worth—file this one away until you're ready for it, and give it a proper go then.

If you want to give the Intergalactic Wanderer a try, precise technique will be important, as the object's magnitude will likely make it too dim to appear in a finderscope. If you're not using a go-to system, the "second-best" approach is with *an equatorial mount:* Align Castor with the *western edge* of your Telrad's innermost (½°) circle, and move *directly north* a little over 7°. Use the setting circles or Telrad to measure out most of the way, and sweep the

Continued on Page 8

Getting Your Bearings

Continued from Page 4

The "suburban" view is that of the galaxy's wide arms—the thinner, outer part of the galaxy's "flying saucer" shape—it's home to more recent nebulae, like the Great Orion Nebula (M42) and the open (loosely shaped) clusters that formed within them.

This month's "Skies" column focuses on some of the open clusters in Gemini, but take a close look at the map here, and you'll see lots of small, dotted-circle symbols that stand for clusters like them; the many squares and cloud-shapes mark nebulae. Notice how uncluttered the top left and bottom right of our chart appear, away from the band of the Milky Way and towards intergalactic space.

As a last thought, it's worth noting that this part of the Milky Way continues beyond the top and bottom of the chart, with *even more* nebulae and clusters—don't consider this map to be an exclusive list… Even if you don't explore all these objects with your telescope, I hope the sheer weight of their numbers leaves an impression on you.

February Skies

Continued from Page 7

last degree or two looking through a low-power eyepiece.

For Dobsonian users, well…. Theoretically, you could use the equatorial folks' trick when the Wanderer is at the Local Meridian (due south), but it so happens that that also puts the globular very close to the zenith, where even easy-to-see targets are a real pain for dobs. You'll probably be better off trying at least an hour before or after that, when your 'scope will be easier to point, and star-hop the hard way.

In that case, try hopping from Castor to 5th-magnitude Omicron (o) Geminorum, a little bit less than 3° away and roughly north-northeast (see chart, p.6). From there, continue in the same direction to orange DU Lyncis, about 3½° beyond Omicron Gem.; it's also 5th mag. There's one last hop, about 1½° northwest, to another orange star, 6th-magnitude HR 2935—it should be obvious near the edge of your finderscope field when you've centered DU Lyncis. Your prize, the Wanderer, is just 2/3° to the northwest from there; a 1° field in your telescope, strategically placing HR 2935 near the appropriate edge, should include both the star and the globular. If not, keep the star near the edge of the field while you circle-sweep the 'scope around it, and the Wanderer should reveal itself.

—Good luck, and see you next month.

The Denver Astronomical Society
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