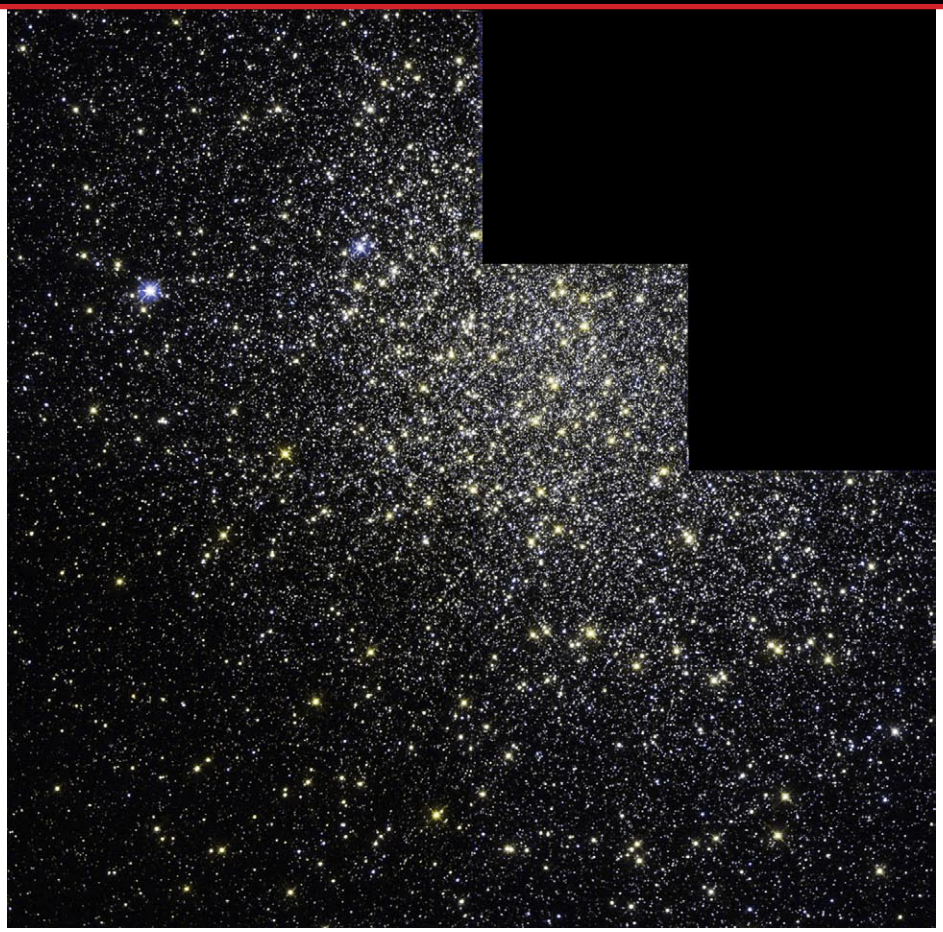
The Denver
OBSERVER
JULY 2018



The globular cluster, Messier 19, one of this month's targets in "July Skies," in a Hubble Space Telescope image.

Credit: NASA, ESA, STScI and I. King (University of California – Berkeley)

JULY SKIES

by Zachary Singer

The Solar System

The big news for July is that **Mars comes to opposition on the 27th,** meaning that it will be at its highest in the south on that date around 1 AM, and also more or less at its largest as seen from Earth. Now, don't let that fool you—Mars is *already* very good as July begins, showing a disk 21" across, which is better than we got two years ago, and only slightly smaller than the 24" expected at the end of the month. (Observations in my 6-inch reflector at the end of June showed an impressive disk at just 150 power.) Realistically, Mars will maintain its size and brightness at similar levels through the end of August, so don't restrict yourself to observing it only at opposition!

For what it's worth, we usually turn our 'scopes towards the planets when they're highest in the sky on a given night, to get the sharpest image—but Mars is worth viewing *naked-eye* when it's rising. Surprised? The red (well, *orange*) planet appears even redder when rising, making for much deeper color. It's a guilty pleasure on an aesthetic level, if not a scientific one. If you want to indulge yourself, Mars rises around 10:30 PM at the beginning of July, an hour earlier mid-month, and about 8:20 PM at month's end.

Meanwhile, **Mercury** is an evening target, low in the west in early July as it approaches its greatest elongation (largest angular distance from the Sun as seen from Earth) on July 11th. After passing that mark, the planet appears increasingly closer to the Sun until getting lost in sunlight about mid-

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Sky Calendar

6	Last-Quarter Moon
12	New Moon
19	First-Quarter Moon
27	Full Moon

In the Observer

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

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PRESIDENT'S MESSAGE

by Ron Hranac

Happy Anniversary!

July 14th marks the 124th anniversary of first light at the University of Denver's historic Chamberlin Observatory. On that date in 1894, DU Professor Herbert Alonzo Howe (1858-1926) started trial observations with the observatory's 20-inch Clark-Saegmuller refractor telescope.

According to the book *Denver's Great Telescope* (second printing, 2015), by Claire M. Stencel and Robert E. Stencel, among the objects observed that night by Professor Howe were stars in the globular cluster M13, and the Moon. My SkySafari Pro app shows the Moon on that Saturday night at about 93% illumination. Saturn was visible above the southwestern horizon early in the evening, although there is no mention in *Denver's Great Telescope* that Howe looked at the ringed planet during his July 14th observations.

The first public use of the 20-inch refractor took place a couple weeks later on Wednesday, August 1st, "…when Howe entertained the Swedish Methodist Christian Endeavor Society with a look at Saturn." Professional use of the observatory began in late autumn of 1894.

More than a century later, the observatory and its 20-inch refractor are still being used to "entertain" (and of course, educate) the public. Counting our twice-weekly Public Nights and monthly Open Houses, upwards of 4,000 people visit Chamberlin each year and enjoy views through the big telescope.

How big? The observatory's Clark-Saegmuller refractor is nearly 26 feet long, and has a focal length of 300 inches, or *7,500mm*. The width of the objective lens (a doublet achromat, in case you were wondering) on the front of the 'scope is the previously mentioned 20 inches. That makes the refractor's focal ratio equal to f/15. Pop a common 25mm focal length eyepiece into the star diagonal, at the focuser end of the 'scope, and the magnification is a bit more than 300x. (Compare that to one of our 'Scope Loan Program's Orion 8-inch Dobs, whose focal length is 1,200mm; the magnification with the same 25mm eyepiece is just 48x.)

The Clark-Saegmuller's optical tube assembly, German equatorial mount, cast-iron pillar, and iron three-legged support (the latter is beneath the dome room's wooden floor)—which combined weigh more than 11 tons—

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DAS SCHEDULE

July 2018

6	E-Board Meeting—At DU's Historic Chamberlin Observatory, 7:30 PM. All members welcome.
7	DAS Member In-Reach—At DU's Chamberlin Observatory, 7:30 PM
14	Dark Sky Weekend—EGK Dark Site & Brooks Observatory
21	DAS Picnic—DU's Historic Chamberlin Observatory North Lawn—Starts at 4:00 PM
21	Open House—DU's Historic Chamberlin Observatory—Starts at 8:30 PM
27	DAS General Meeting—DU's Olin Hall, Rm. 105—Starts at 7:30 PM

(August 2018)

3	E-Board Meeting—At DU's Historic Chamberlin Observatory, 7:30 PM. All members welcome.
11	Dark Sky Weekend—EGK Dark Site & Brooks Observatory

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

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

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

March 10 - September 30 at 8:30 PM

October 1 - March 9 at 7:30 PM

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

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

President's Message

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sit on top of a 25-foot-tall, 320-ton sandstone pier. The pier passes through the center of the building, and down into the basement. It's not clear how far the pier goes below the basement level; drawings in *Denver's Great Telescope* suggest it might begin at the same level as the building's foundation. In any event, the pier does not go all the way to bedrock.

You might have noticed the unusual brackets supporting the two grandfather type clocks located in the observatory's main level (one clock keeps civil time; the other, sidereal time). Those brackets don't attach the clocks to the walls. Instead, they pass *through* the walls and attach directly to the central sandstone pier. That mounting technique helps to isolate the clocks from vibrations, which would otherwise affect their accuracy.

The observatory is named after Humphrey Barker Chamberlin (1847-1897), who agreed to pay for its construction in the late 1880s. Because Chamberlin worked in real estate, part of the payment to Alvan Clark & Sons and George Saegmuller of Fauth and Company was negotiated to be made with land. That got a bit complicated when the Panic of 1893 (https://en.wikipedia.org/wiki/Panic_of_1893) bankrupted Chamberlin and severely depressed the value of the land he used for partial payment. Things eventually got sorted out with a combination of loans, personal funds, some payments from DU, and delays, but the observatory finally saw first light in 1894. Interestingly, the smaller student observatory next to Chamberlin was built and operational first, with first light via its 6-inch telescope on May 4, 1891. These days, the student observatory building is used for storage.

A couple more tidbits: The cost of the 20-inch Clark-Saegmuller refractor was $4,185 (about $118,000 today), of which $1,000 was just for the objective lens. The "Lyons Red" sandstone used to build the observatory and pier came from a stone company owned by a Mr. Kimball, whose quarry was near Lyons, Colorado, on the south end of Beech Hill (https://www.colorado.edu/fm/sites/default/files/attached-files/_frontrangesandstonequarries-databybilldeno.pdf). Finally, next time you're inside the observatory, take a close look at its door knobs and hinges, and the drawer pulls on some of the old cabinets. They're original hardware from the late 1800s.

July Skies

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month. While Mercury remains visible, telescopic views will show a roughly half-illuminated disk 7" or 8" across. Look for a challenging binocular pairing with a very thin crescent Moon on the 14th; 0.7-magnitude Mercury will lie just over 2° below and slightly rightward.

Venus remains a bright and beautiful object, obvious in the west after sunset, at better than magnitude -4. Its disk grows from 16" to 20" at the end of the month, as its phase progresses from gibbous to roughly half-illuminated, and will appear even larger and brighter next month. Venus has a pairing with the Moon a day after Mercury's, on the 15th; the duo will fit inside a 2° field.

Jupiter is high overhead as July begins, transiting soon after sunset. Its apparent diameter shrinks from about 41" to 38", but the planet will be a wonderful target throughout July. Next month, Jupiter will be noticeably lower in the southwest after sunset, so enjoy it while it's still well-placed.

Because **Saturn** was at opposition in late June, it appears highest in the south just before 1 AM as July begins; by month's end, that transit comes at 10:35 PM, so the ringed planet will be in a terrific position for observing all month. The 0-magnitude planet appears just above the top of Sagittarius's "teapot."

If you're new to observing Saturn, a moderately sized (5- or 6-inch) telescope will give you a tiny, jewel-like, and bright view at 60x, with two moons, Titan and Rhea, likely visible. Under good conditions at 100x, you might see a bit of the shadow between the planet and the rings, and perhaps a hint of the bands in Saturn's atmosphere. At 150x, Saturn won't look "small" in the eyepiece

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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

Alan Bean

Apollo astronaut Alan Bean died May 26 at age 86. He flew two missions: Apollo 12 and the second occupation of the Skylab space station. He was the fourth human to walk on the Moon.

Bean and Pete Conrad collected 75 pounds of lunar rocks and soil. They also visited the Surveyor 3 spacecraft that had soft-landed on the Moon more than two years before. (They removed Surveyor's camera and returned it to Earth.) Bean was a talented artist and accurately depicted the Apollo experience. During the Skylab mission, the crew set the then-record of 59 days in space and took 76,000 pictures of the Sun with the Skylab solar telescope.

Only four of the 12 men who have walked on the Moon remain alive.

Ant Nebula Laser

Astronomers have discovered a natural laser giving off infrared light at the core of the Ant Nebula, an unusually-shaped planetary nebula. (Planetary nebulas are clouds of gas thrown off by stars nearing the ends of their lives.) Because it takes a dense nebula to produce a laser, and the nebula has to lie close to a bright star to absorb the power to run that laser, such lasers are unusual.

In this case, there is a disk of denser gas orbiting the star at the center of the nebula, allowing the laser process to occur. The disk is likely being fed by material from a companion star, though none has been seen. The unusual shape of the Ant Nebula is, however, another indication that a companion star exists.

In an interesting coincidence, astronomer Donald Menzel discovered the Ant Nebula nearly a century ago and was also one of the first astronomers to suggest that a nebula could produce a laser.

Martian Methane

Analysis of data from Mars rover Curiosity shows that the amount of methane in the atmosphere there is dependent on the seasons, rising in summer and falling in winter. This partially explains the widely divergent measurements of Martian methane by past spacecraft.

The source of the methane is not known. The most intriguing possibility is that it comes from bacteria, though there are also ways to make methane that do not involve life. The atmospheric conditions on Mars destroy methane fairly quickly, so when that gas is detected, it has either been created recently or released from underground.

Martian Organics

Drill samples recently analyzed by the Sample Analysis Mars chemistry lab on Curiosity have been found to contain several organic (carbon-containing) compounds, including propane, butene, benzene, toluene and thiophenes. The samples were collected from mudstone that was formed billions of years ago from silt that settled out in the lake that then covered Gale Crater. Organics are not necessarily created by life, but these compounds' survival of the harsh conditions on Mars increases the odds for finding evidence of simple life on future Mars missions, if indeed life existed there.

Curiosity Drills Again

The rover made its first successful drilling operation since a mechanical problem with its drill probes stopped such processes in December 2016. Bypassing the probes, the rover arm presses the drill against the ground and monitors its motion and the resulting forces. By the time you read this, the Curiosity team should also have evaluated new techniques for depositing the samples into the chemistry labs on board, since the stuck drill probes get in the way of this operation. All new techniques have been tested on Earth.

Unusual Supernova Remnant

New observations in X-rays and visible light of the supernova remnant E0102 in the Small Magellanic Cloud show that its neutron star is unusual in not having a companion star, and the gaseous supernova remnant is also unusual in not giving off radio emissions or high-energy X-rays, only emitting low-energy X-rays. The neutron star is off-center in the ring of X-ray-emitting gas, but it's centered in a smaller ring of gas giving off visible light. Further observations and review of archived images of the object will be performed to explain this.

Earth-Sized Exo-Planets

Observations made by the planet-finding spacecraft Kepler during its K2 mission found a planetary system orbiting the star known as K2-239, which contains three rocky planets about the size of Earth (between 1.0 and 1.1 times the diameter). Their host star is a red dwarf about 160 light-years away in the constellation Sextans. The planets are close to their star, taking only 5.2-10.1 Earth-days for their orbits.

White Dwarf Catalog

Astronomers combed through the second release of Gaia data to find every white dwarf star within 326 light-years of us. This is the first complete catalog of nearby white dwarfs; 13,928 of them were found. The survey showed a significantly larger percentage of white dwarfs are fairly massive, as compared to previous studies using incomplete catalogs of white dwarfs. This implies that the merging of two white dwarf stars is much more common than previously thought, which in turn implies more type Ia supernovas are caused by merging white dwarfs (as opposed to the other cause, companion stars dumping material on white dwarfs). Astronomers will try to correlate these new findings with the frequency of Type Ia supernovas. They will also use this new catalog of white dwarfs to determine the ages and star formation histories of our local area, and (using more Gaia data) eventually star-formation histories of the Milky Way's disk and halo. Gaia's mission is to make a catalog of over a billion stars, with accurate distances, motions, brightnesses, and other factors.

Interstellar Asteroid

Remember 'Oumuamua, the asteroid that came from outside the solar system and is now on its way out again? Astronomers have found another, named 2015 BZ509, but this time the object was captured gravitationally and has long been orbiting near Jupiter, in the opposite (retrograde) direction from essentially everything else. The unusual orbit is part of the evidence for the asteroid's extra-solar origin.

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DAS NEWS

July General Meeting

Please join us **Friday, July 27th, at 7:30 PM, for "Annals of the Deep Sky, Object Selection: by Design and by Hunch,"** a talk by **Jeff Kanipe**. Jeff has been a science journalist for 35 years, specializing in cosmology and astrophysics. He is the author of *Chasing Hubble's Shadows: The Search for Galaxies at the Edge of Time*; *The Cosmic Connection: How Astronomical Events Impact Life on Earth*; and *A Skywatcher's Year*. He is coauthor of *The Arp Atlas of Peculiar Galaxies: A Chronicle and Observer's Guide* (with Dennis Webb), and *Island on Fire* (with his wife, science writer Alexandra Witze). He has worked as a top editor for *Astronomy* and *StarDate* magazines and written for numerous publications including *New Scientist*, *Nature*, and *Sky & Telescope*.

Jeff and Dennis have been producing an ambitious, unparalleled multivolume series called *Annals of the Deep Sky: A Survey of Galactic and Extragalactic Objects*. Hailed by Richard Berry as "the sky guide we've been waiting for," *Annals* is an up-to-date observing manual for amateur and semi-pro astronomers, which features in-depth astrophysical profiles of stars and deep-sky objects, historical and biographical background, as well as observing advice for amateur astronomers of all expertise. *Sky & Telescope* named Volumes 1 and 2 as Hot Products in 2016, plus Volume 3 in 2017. When completed, the series will comprise all 88 constellations.

Jeff is a member of the American Astronomical Society and its Historical Astronomy Division. He received his Messier certificate (#55) in October 1969 while a member of the Corpus Christi Astronomical Society. Asteroid 84447 Jeffkanipe is named in his honor for his role in identifying the earliest known image of that asteroid. Jeff and Alex live in the foothills northwest of Boulder.

Jeff's presentation will cover the challenges of object selection for the *Annals* project. It's not as easy as you may think! Jeff will talk about how a writer goes about trying to determine which of all the celestial objects in the night sky have stories rich or scientifically detailed enough to investigate.

A reception following the meeting will be held at DU's Historic Chamberlin Observatory. Coffee and light refreshments will be served.

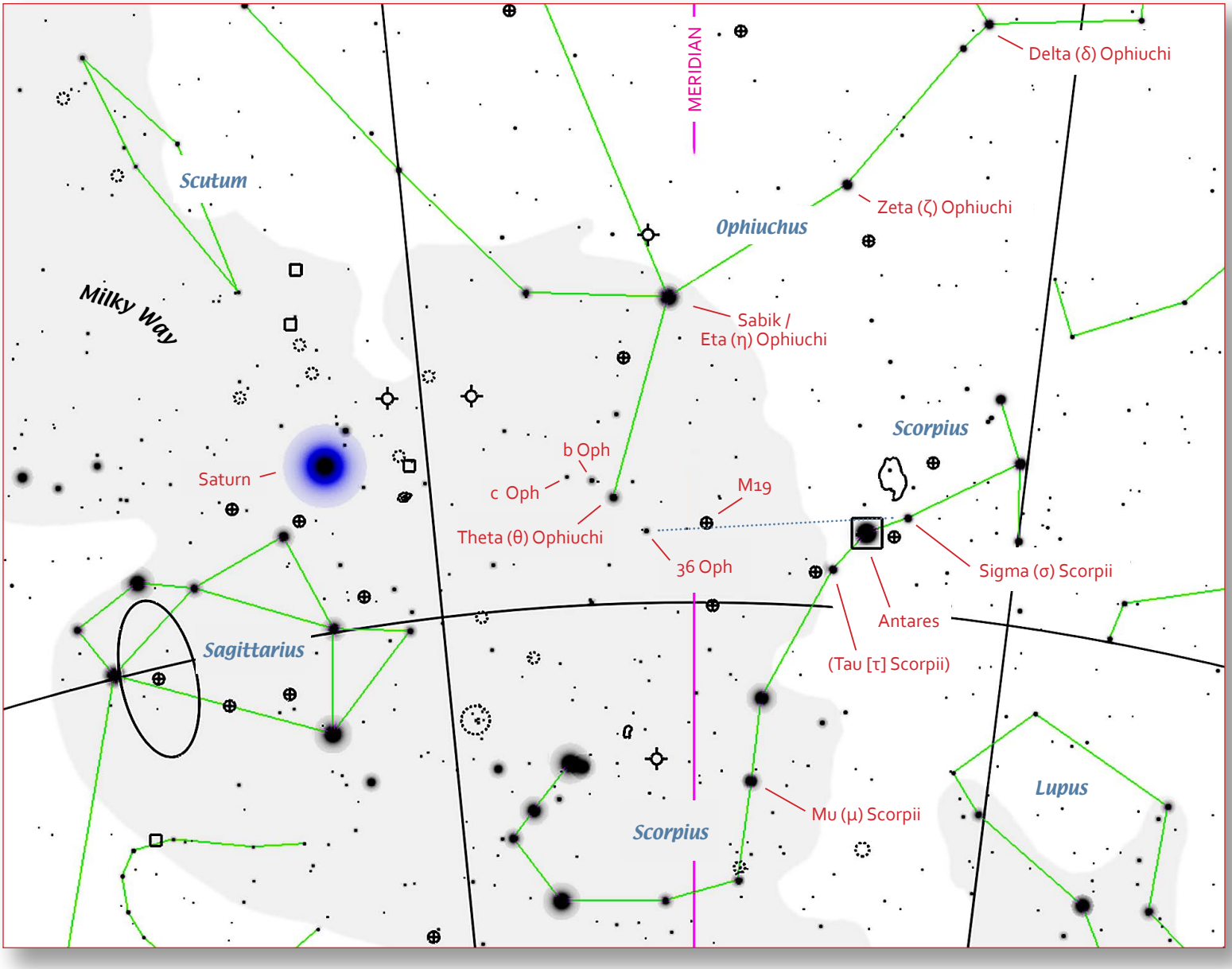
Veteran science journalist Jeff Kanipe.

Remembering Jim Pequette

Jim Pequette, 76, died May 23rd, following a brief bout of leukemia. Jim joined the DAS in the mid-2000s with his daughter, Naomi. Jim quickly became an astronomy enthusiast and always loved trips to the Dark Sky Site, General Meetings, and Open Houses (especially getting to talk with DAS members at the Village Inn afterward) when he could attend. He also served on the planning committee for Chamberlin's 120th Anniversary in 2014 and enjoyed being a test subject for the steampunk photos for the event. He is survived by his wife Linda Mueller, daughter Naomi Pequette, three sons, two stepchildren, six grandchildren, and two brothers.

Remembering Chuck Carlson

As this issue was in its final stages before publication, we were distressed to hear that **Chuck Carlson**, a longtime DASer and former E-Board member had also passed away. Remembrances are still coming in; if you would like to add your memories, send them to: editor@denverastro.org.



Viewing due south in Denver at 10:30 PM in mid-July. Note position of M19 (shown just right of center) slightly above the imaginary line that runs between 36 Ophiuchus and Sigma (σ) Scorpii. (Some labels use "Oph," the standard abbreviation for Ophiuchus/Ophiuchi, for clarity.)

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

July Skies

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anymore and details, like the shadows mentioned above, should be more easily visible.

Uranus is about 20° up in the eastern sky around 3:30 AM in early July, and much better, at more than 40° up at the same hour at the end of the month. You'll find the planet about 4½° northeast of Omicron (o) Piscium mid-month—a little less in early July, and a little more towards the end.

Neptune, like Uranus, is a late-night object, but you'll find it 20° up an hour earlier than Uranus, at 2:30 AM. (Similarly, Neptune will be more than 40° up at 2:30 by month's end.) Look for Neptune a little over 1° west of Phi (ϕ) Aquarii all month—closer in early July and farther at month's end.

Stars and Deep Sky

This month, we're going to have a look at some objects that might take a little experience to appreciate—they're not "showpieces." Beginners are welcome to come along for the ride, and these targets shouldn't be too difficult to find. Still, if you're looking for a better starting place for a beginner, check out this column's previous July issues, in the *Observer* on the web, at www.denverastro.org/?page_id=13. If you look at the column's "Stars and Deep Sky" section from the last three years (usually starting on page 6), you'll see enough to keep you observing for hours, and if you want *more*, check out the June and August issues too—the objects will still be up; just offset a little to the east or west….

Our targets this month officially lie in Ophiuchus, the Serpent Bearer, an ancient constellation. It doesn't have the name recognition of flashy Orion or Scorpius, so it's sometimes overlooked by newer observers, but its position just above Scorpius makes it easy

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July Skies

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to become familiar with.

Our first target is the multiple-star system, **36 Ophiuchi** (36 Oph for short), at **17h 16m, -26° 37'**. 36 Oph is unusual, in the sense that it's made up of class K orange dwarves—that is, each of its three stars has slightly lower mass than our own Sun, and therefore, burns cooler and less brightly.

Ironically, such stars are numerous in our galaxy, but *we don't get to see many of them naked-eye,* because they're not luminous enough to be visible beyond a moderate distance—in 36 Oph's case, the system is just under 20 light-years from us, and the brighter two of its three stars are each visual magnitude +5.1 (our dark-adapted vision, away from city lights, can usually take us down to magnitude +6, or perhaps +7 under exceptional circumstances). Stars like these would be near the limits of human vision at around 40 light-years from us, a short distance as far as stars are concerned—for comparison, many of the bright blue stars we see may lie hundreds of light-years from us, but appear brighter.

The K-stars' cooler outer atmospheres also mean a more orange-looking appearance than most naked-eye stars (orange *giants*, a type of dying star, are one notable exception). Most naked-eye stars are hotter and thus bluer; because they're inherently brighter, they remain visible over longer distances, and so we see more of them.

The two +5.1-magnitude stars, 36 Oph A and B, appear about 5" apart as seen from Earth, and form a binary pair (they're in orbit around each other). According to Professor James Kaler, University of Illinois, they've been observed for centuries, but astronomers are still working out the exact parameters of their orbit (some aspects of their expected masses and orbital periods are inconsistent with each other, implying an error somewhere). In spite of that, we do know that the orbit is highly elongated, and that the pair's *average* distance from each other is about 80 astronomical units (AU), or about twice Pluto's distance from the Sun. The system's third star, 36 Oph C, is slightly cooler (and thus slightly dimmer and redder); it orbits at least 4,400 AU from A and B, about 110 times Pluto's distance from the Sun. Prof. Kaler estimates that 36 C takes 180,000 years or more to circle the inner pair.

In my 6-inch Newtonian, the 36 Oph system is a beautiful trio; as suggested by the stars' color classes and brightnesses, the inner pair appears wheat-colored, while the outer star displays a more orangey hue and is a touch dimmer. (Colors were distinct even though there was a nearly full moon beaming down the barrel of my 'scope.)

Under good seeing conditions, the inner, A-B pair remained tight but split clearly at 100x. It also split at 60x with just a hairline between the two stars, but it will take a practiced observer to pull this off. Under a steady sky, a 150x view didn't add much, but it might provide an easier split for beginners; I also found it took 150x to separate the inner pair when the seeing wasn't ideal. The outer, "C" companion is an easy split, even at very low power—you'd hope so, since it's over 12 arc-*minutes* away! At that distance, though, it still shares an eyepiece field, even in a narrow Plössl, at 150x.

36 Oph is the westernmost of an arc of four naked-eye stars which includes 3rd-magnitude Theta (θ) Oph—36 is the next-brightest star "down and to the right," or southwest of Theta (the other two stars lie to Theta's northeast, 4th-magnitude "b" and "c" Oph). If you're familiar with Ophiuchus, you can get to Theta by looking first for 2nd-magnitude Sabik, aka Eta (η) Oph, the "leftmost" or easternmost star at the bottom of Ophiuchus's "coffin." You'll find Theta about halfway between Sabik and the "tail" of Scorpius (see chart).

If you're not familiar with Ophiuchus, don't worry—look for Antares, the bright, orange star in the body of Scorpius, due south around 10:30 PM in mid-July. (If you're not familiar with the constellation Scorpius, you're missing a lot—it's covered in the July '16 and '17 *Observer*.) Looking upward, or northward, about 15° from Antares (that is, just a bit less than the distance from Antares to the stars in the scorpion's stinger), you'll see three bright stars making a wide, gentle arc—the arc's span is about the same as from Antares to the stinger. The highest and westernmost of them is magnitude +2.7 Delta (δ) Oph, and it's about 45° up at our stated time; the middle one is Zeta (ζ) Oph, directly "above" Antares, and the lowest, at left (or easternmost) is Sabik, which is also the brightest of the three. (From Sabik, of course, drop down to Theta, as described above, and you're on your way.)

Our second target, the globular cluster **M19**, lies less than 3° westward of 36 Oph, at **17h 04m, -26° 17'**. To fully appreciate this object, it helps to know that a globular cluster is supposed to be *globe*-like, or roughly spherical. Since these star-clusters rotate, they may appear subtly bulged at their equators, for the same reasons as the Earth or the other planets in our solar system do. M19, though, appears *conspicuously oval-shaped*, even in small telescopes—it's among the most oblate globular clusters in our galaxy.

Some sources propose that M19's shape comes from its proximity to the center of our galaxy, implying that tidal forces (the uneven force of gravity across an object) are the cause. (If we could view our Milky Way from the outside, edge-on, we'd see M19 floating "above" and close to the galaxy's central bulge.) Interestingly, the cluster's long, or "major" axis, lies perpendicularly to a line drawn between the centers of the cluster and our galaxy.

Unlike the "showpiece" globulars, like M13 or M5, M19's individual stars are difficult to resolve, and the cluster isn't as bright-looking. In part, that's because M19 is actually a tad dimmer in the first place; its light also travels a slightly longer distance to reach Earth, thus dimming the light further.

However, when we look at M13 or M5, we are also looking more directly "outward," or *away from the plane of the Milky Way*, so there is much less obscuring dust and gas to penetrate. The effect is similar to what we encounter when we look through our Earth's atmosphere—we see objects more sharply when we look *towards the zenith* than we do when looking towards the horizon; in the latter case, the view lacks contrast and is dimmer and redder. In M19's case, we're looking much closer to the Milky Way's axis, and thus through a much thicker slice of the galaxy, and so, predictably, the view is dimmer, redder, and lacks "punch." Ironically, then, the same closeness to the galactic center that may give M19 its interesting shape also prevents us from seeing it as well as we'd like.

(Sadly, I must note our especially dismal conditions in Colorado

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July Skies

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as June ends, due to both inclement weather and several large wildfires. At magnitude +6.7, this object should be reasonably bright, but with our murky transparency these days, you could well find M19 dim even in a large 'scope. Don't give up; just wait out the conditions.)

To find M19, start by centering your Telrad on 36 Oph (it's already done if you were just observing it!). Then slide the Telrad 3° toward Sigma (σ) Scorpii, the bright star just west of Antares. As a guide, stop when the trailing edge of your outer (4°) Telrad circle lies midway between 36 Oph and the nearest part of the inner (2°) circle. If M19 isn't in your telescope's low-power field, try *nudging* the 'scope towards Sabik, in Ophiuchus; if still no luck, spiral around the area carefully. As a further cross-check on positioning, M19 lies almost exactly on the imaginary line between Mu (μ) Scorpii and Sabik, and about midway between the two; use the line's intersection with the 36 Oph-Sigma Scorpii line to improve your positioning, if necessary.

(Note that Sigma Scorpii shares its Arabic-derived name, "Al Niyat," with a similar-looking star just on the other side of Antares, so it's easy to become confused—go by position and Greek letter [Bayer designation] instead. If it helps, the "other" Al Niyat is Tau [τ] Scorpii.)

One last note: **Vesta will swoop right between our "finder" stars, b and c Ophiuchi, in mid-August,** and it should be noticeable many days earlier. If you're familiar with b and c Oph by then, 7th-magnitude Vesta will be much easier to spot.

—See you next month.

Astro Update

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Very Early Stars

Using the ALMA radio-telescope array and the eight-meter VLT telescope in Chile, astronomers have obtained the redshift (and therefore, the distance) to an extremely distant galaxy dubbed MACS1149-JD1, and also measured the age of its stars (by oxygen content), finding that the stars formed only about 250 million years after the Big Bang.

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