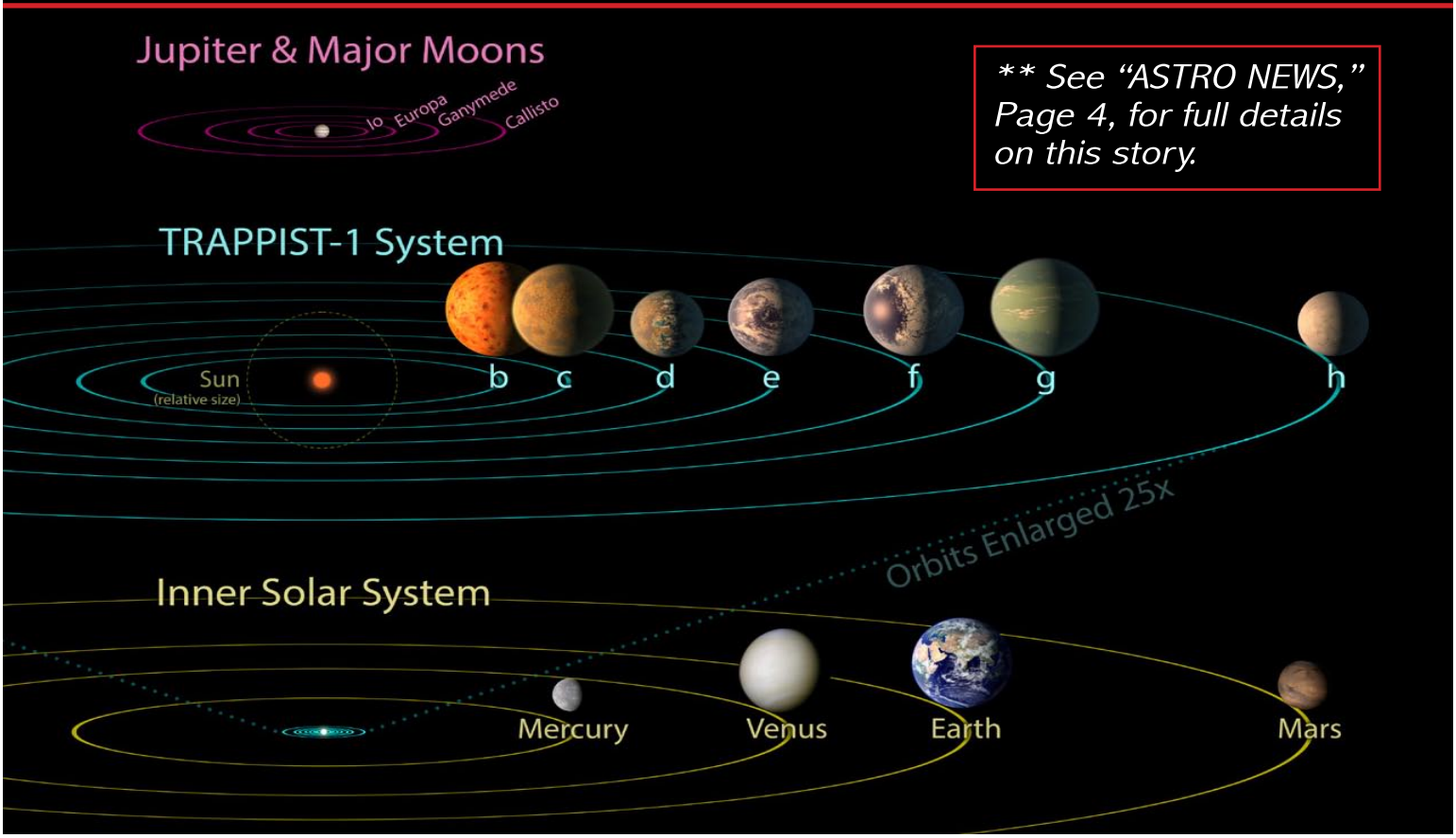
The Denver
OBSERVER
APRIL 2017



** See "ASTRO NEWS," Page 4, for full details on this story.

Overview of the Trappist-1 system (center), with comparisons to the size of Jupiter and the orbits of its Galilean moons (top), and to our inner solar system (bottom). The planets in the respective solar systems are not drawn to the same scale as their orbits, but they are all in proportion to each other.

Image credit: NASA/JPL-Caltech

APRIL SKIES

by Zachary Singer

The Solar System

April starts off with **Mercury** at maximum elongation (its widest angle from the Sun as seen from Earth). On that April 1st morning, the planet will be about 40% illuminated and more than 10° above the western horizon 40 minutes after sunset; Mercury's disk will be 8" across. Over the following week, as the planet sweeps quickly toward its line-up ("inferior conjunction") with the Sun, its disk grows to about 9" and its phase shrinks into a crescent. Soon after that, Mercury's increasingly slimmer (and dimmer) crescent becomes lost in the solar glare; inferior conjunction is on the 20th.

By the 1st, **Venus** has swung out of the Sun's glare, and shines intensely at -4.2 magnitude, just above the eastern horizon, a half-hour before dawn. Telescopic observations will show a pencil-line crescent on a disk nearly 60" across. At mid-month, as Venus gains angular separation from the Sun and distance from us, the disk shrinks but the crescent thickens, so the overall brightness increases to -4.5! (If, instead of getting up early to see the planet, you've had an all-night observing run before looking at Venus, the planet's sheer brilliance in a 5- or 6-inch 'scope will be stunning to your dark-adapted eyes, and you'll probably want to use a "moon" filter….)

Venus, on the evening of March 23, 2017. In early April, the planet will display a similar appearance in pre-dawn skies. ***Image © Ron Pearson.***

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Sky Calendar

3	First-Quarter Moon
11	Full Moon
19	Last-Quarter Moon
26	New 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

UFO? It's Just Venus (or Jupiter, or an Iridium Flare...)

The day before the Denver Astronomical Society's Spring Banquet, I received a strange and somewhat cryptic voicemail message at home: "Watch the western sky at 7:00 PM in the evening." Thinking that perhaps part of the message was cut off before the voicemail recording started, I phoned the number on the caller ID. I introduced myself on behalf of DAS, and asked whether there was more to the message. The unidentified individual said no, the message was intended to be brief.

I followed up with a question about the significance of looking west at 7:00 PM (by now I had a pretty good idea where this conversation was headed), and he told me that most evenings around that time he was able to see a very bright object in the western sky. He added that the object was bright enough that its light could occasionally "punch through overcast conditions," and sometimes it appeared as if something might be orbiting the bright object.

I paused, then said that what he was seeing was the planet Venus. He seemed skeptical of that answer. I went on to explain that Venus is covered with clouds, making it highly reflective, and also mentioned the planet's current position in its orbit around the Sun, and its distance from the Earth. I told him that combination made Venus extremely bright (-4.4 visual magnitude, according to SkySafari Pro 5). After a couple minutes of discussion, he said OK, although I detected a hint of skepticism remaining in his tone as the call ended.

That reminded me of a similar experience back in the late 1960s. An unidentified-flying-object craze was underway at the time, and one day our next-door neighbor told me in no uncertain terms that he saw a UFO each evening in the western sky around 5:00 PM. When 5:00 o'clock rolled around that same day, I walked next door and asked him to point out his UFO. He did, and sure enough, there in the western sky was a bright object hovering above the horizon. The culprit was good ol' Venus.

In mid-March, when the voicemail event took place, Venus was visible in the early evening sky just after local sunset, and resembled a crescent Moon in a telescope or high-power binoculars (I was able to see the crescent shape in my image-stabilized 15x50s). Venus was visible in the daytime, too, if you knew where to look and were very careful to block the nearby Sun with the edge of a building or similar. By early April, the planet will appear as a "morning star" just before local sunrise. (Zach's "Skies" column has the details on this.)

When Venus is visible in the post-sunset evening sky or pre-sunrise morning sky, people who

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DAS SCHEDULE

April 2017

1	Open House—DU's Historic Chamberlin Observatory—Starts at 7:30 PM
7	DAS General Meeting—DU's Olin Hall, Rm. 105—Starts at 7:30 PM
14	E-Board Meeting—At DU's Historic Chamberlin Observatory, 7:30 PM. All members welcome.
29	Dark Sky Weekend—EGK Dark Site & Brooks Observatory

(May 2017)

6	Open House—DU's Historic Chamberlin Observatory—Starts at 8:30 PM
12	General Meeting—DU's Olin Hall, Rm. 105—Starts at 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

April 9, 8:00AM-12:00PM: *8th Annual Race4Kids' Health,* 1st Bank Center, 11450 Broomfield Lane, Broomfield, CO. DAS table and solar telescopes.

April 25, 6:30-9:30PM: *Cub Scouts,* Littleton, CO (location to be determined). Night observing.

May 18, 12:00-1:00PM: Kiwanis Club, ViewHouse Centennial. 7101 S. Clinton St., Centennial, CO 80112. Astronomy-related presentation.

May 20, 6:00-8:00PM: Parker Library, 20105 Mainstreet, Parker, CO 80134. Space/Astronaut-related presentation (age 4-8 yrs).

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

New Members and DAS New-Member Ammbassador

The Denver Astro Society continues to grow, and we'd like to take this moment to greet our New Members. Below is a list of the folks who have joined us, from New Years through the end of February—welcome aboard!

For all of these people, and for everyone that has joined us since then, *we have someone to help you get the most out of your membership*. That person is our **New-Member Ambassador, Digby Kirby**. If you haven't been in touch with him yet, you really should—here's how: *odigby@gmail.com*, (970) 301-2287. (You can always find his contact info at the bottom of the DAS masthead, as well.)

Phil Kim
Eileen Barela
Angie Manypenny
Charles Manypenny
Neal Jordan
Dennis DeJulio
Sarah DeJulio
Trevor Tisserat
Thomas Russell
Mehmet Unsoy
Roger Wendell
Natalie Margaros
Corky Hilton
Kathy Hilton
Trygve Schneider
John Kyler
Odzorig Mishigdorj
Sara Hendrickson
Keith Langill
Gautam Sachania
Gavin Sher
Jere Albright
Stan Wright
Jon Oligee
Sydni Edwards
Lisa Marsh
Zeinab Mohammadi
Lloyd R. Linnell
Noel Mink
Patrick Mingus
Ashlyn Mooney
John Dwyer
Michael Smith
Michael Barrale
Barbara Dungey
Nathan Wiltsie
Stephanie Wiltsie
M. Bradford
Terry Downing
Charles Hackney

April General Meeting

Friday, April 7th, 2017, 7:30 PM: Our Guest Speaker, Mr. Roger L. Mansfield, Dynamical Astronomer and Astrodynamicist, will talk with us about the "Reconstruction of the 1801 Discovery Orbit of Ceres via Contemporary Angles-Only Algorithms."

Mr. Roger L. Mansfield owns Astronomical Data Service in Colorado Springs, a publishing and consulting business which he founded in 1976. He is a full member of the American Astronomical Society. Roger is presently a consultant to Lockheed Martin in the area of missiles and space trajectory modeling. On Monday, August 21, 2017, the date of this year's total solar eclipse visible across the entire United States, Roger will celebrate the 50th anniversary of his space career, wherein he has modeled the trajectories of Earth satellites, missiles, interplanetary space probes, planets, and asteroids. See Roger's LinkedIn page at *https://www.linkedin.com/in/roger-l-mansfield-2705527* for further information about his space-related assignments in Nebraska, California, and Colorado.

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.

Spring Banquet

Darrell Dodge presents the 2017 Bill Ormsby Memorial Volunteer Award to hard-working DASer Dena McClung at the Spring Banquet.
Image © Ron Hranac.

At the DAS Spring Banquet, held at the Embassy Suites on March 11th, we officially installed the new E-Board members, handed out some well-deserved awards, saw an astronomy presentation—and made sure to have a good time! Our thanks to everyone who helped put the evening together, and to everyone who attended.

ASTRO UPDATE

Selected Summaries of Space News

By Don Lynn

As we've sometimes noted in the Observer, there are a large number of space-science missions currently probing the planets and gathering data coming in from well beyond our solar system—we are very pleased to present DAS member Don Lynn's synopsis of some of these missions. —*Ed.*

7-Planet System TRAPPIST-1

The Spitzer Space Telescope, following up on discoveries by TRAPPIST (the TRAnsiting Planets and PlanetesImals Small Telescope, in Chile), has found 7 roughly Earth-sized planets orbiting a small and dim red dwarf star, called TRAPPIST-1. Currently, this system boasts the most exoplanets known to orbit a single star, and 3 of the 7 planets orbit in the "habitable zone"—that is, at such distances that their surface temperatures should support liquid water. All are quite close to their star (closer than Mercury is to our Sun), so a person on one of these planets would see the adjacent planets somewhat larger than our Moon appears from Earth. (All those bright objects in the sky would make hunting dim galaxies difficult!)

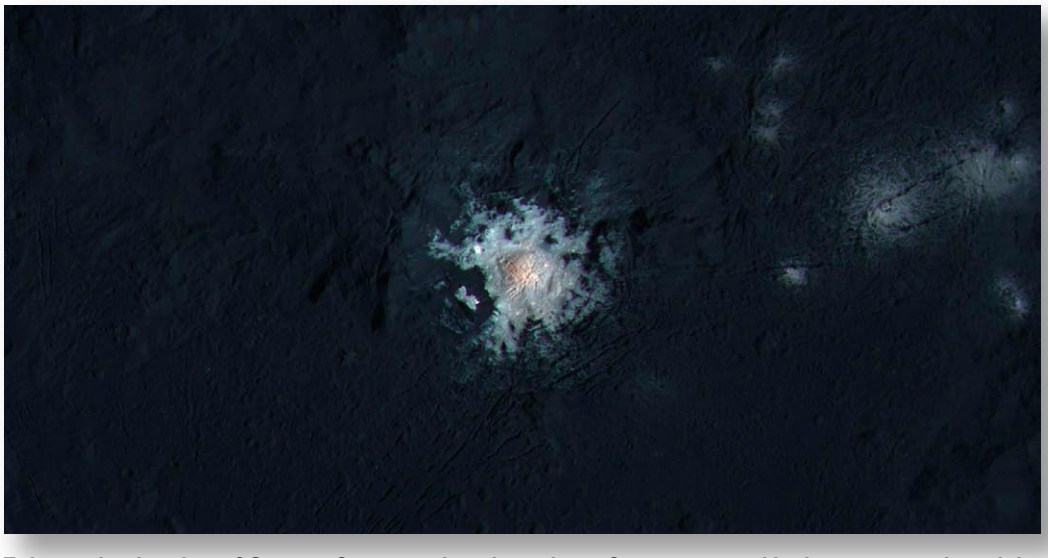
The diameters, masses and densities of six of the planets have been measured, and all are likely to be rocky like the Earth, rather than gas giants. Because these bodies are so close to their star, they likely have become tidally locked—that is, they have one side permanently facing the star. Thus, day and night would be *places*, not times. This could make one side too hot and the other side too cold for liquid water, depending on how winds distribute heat around the given planet.

Hubble Space Telescope is being used to try to observe any atmospheres on these planets. They cannot be imaged separately, but by comparing spectra before and during transits and occultations, the spectra of the atmospheres can be squeezed out of the data. The limited results so far merely confirm that two of the planets do not have large hydrogen atmospheres (such as gas-giant planets have), and there are no results yet for the other five. The James Webb Space Telescope, to be launched next year, is expected to do a more thorough job of finding atmospheres at these planets, as well as enabling temperature measurements. Still, calculations show that the current level of radiation from the star could strip atmospheres in billions of years, so it's not clear what, if any, atmospheres we might find, particularly on the inner planets.

The system is in Aquarius, and relatively close, at 40 light-years from Earth. Due to conflicting observations, the age of TRAPPIST-1, and therefore the age of its planets, is uncertain: the star's spin says it's young, while its quiet flare behavior says it is at least middle-aged, and its motion in space usually indicates old age.

Rosetta Mission

Images from the Rosetta probe show dune-like patterns on the surface of comet 67P, and the patterns moved over time. This comet should have almost no gravity and absolutely no atmosphere or wind—so how could dunes form and move? A new study shows that gas released as the comet warmed near the Sun creates enough wind to do this. The outgassing at most provides only 1/100,000th of the atmospheric pressure found on Earth. But with the extremely low gravity, this is enough. The comet's nucleus has 2 lobes, often compared to the head and body of a rubber ducky. The dune-like patterns were found on the head, body and neck.



Enhanced-color view of Occator Crater on the minor planet Ceres, captured by instruments aboard the Dawn spacecraft. ***Image credit: NASA/JPL-Caltech/UCLA/MPS/DLR/IDA/PSI/LPI***

Dawn Mission

Data indicate that the bright raised dome on Ceres is about 4 million years old, while Occator Crater, in which it lies, is about 30 million years older. The dome appears to have been built up by multiple emissions of briny liquid from within Ceres that deposited carbonate salts. Scientists believe that the impact that created Occator Crater may have fractured the surface, which allowed the briny material to flow through the resulting cracks. Close-up images of Occator Crater show geological structures including fractures, avalanches, and small impact craters. The dome is roughly 2 miles (3 km) across, and 400 yards (400m) high.

Other scattered bright spots appear to be the same salts, but more mixed up with darker material, so that they are not as bright. It is not clear if the activity that made the dome has ended. Some images seem to show a haze that may mean activity continues today.

Mars Erosion

New studies of Mars' Gale Crater, which the Curiosity rover is exploring, show that wind erosion is adequate to explain why much of the sediment within the crater has disappeared, leaving the mountain (Mount Sharp, *aka* Aeolis Mons) within the

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Astro Update

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crater. At one time, perhaps 3 billion years ago, the whole crater had filled up with layers of sediment—these layers sank in a lake that formed in the crater, back when Mars had a thicker atmosphere and rain.

Evidence for the layers and lake have been previously found by Curiosity. But there was debate over whether wind erosion could transform these strata into the layered mountain there today. The new study showed that after the lake dried up billions of years ago, the prevailing wind eroded away the layers, shaping the mountain we see now. Then the mountain began shaping the prevailing wind.

"Planet Nine"

Scientists have noticed that the orbital paths of several objects beyond Pluto strongly suggest the presence of an unseen "Planet Nine" in a remote section of our solar system. A computer search of the WISE (infrared space telescope) images did not find Planet Nine, but the computer is easily fooled by image defects. A new NASA effort aims to work around the computer issues by asking the public to help search the images *by eye* (like Clyde Tombaugh did to find Pluto)—the space agency has set up a website called "Backyard Worlds: Planet 9," inviting the public to examine archived WISE image data to try to find the predicted Planet Nine, as well as brown-dwarf stars. The link, *http://backyardworlds.org*, redirects to a "Zooniverse" (science volunteer) page with more details—be sure to check out the FAQs!

Mimas

In 2014, scientists proposed a liquid ocean below the frozen surface of Saturn's moon **Mimas** to explain a larger-than-expected rhythmic wobble exposed by the Cassini probe. A new study shows that such an ocean should produce cracks in the surface, such as seen on Europa and other moons; but no such cracks were found on Mimas, so it probably does not have a liquid ocean.

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President's Message

Continued from Page 2

don't have a background in astronomy can be caught off guard when they see it. This is especially true when its visual magnitude is in the -4.0 or brighter range. Venus can resemble aircraft landing lights, except that aircraft lights move (and an aircraft's red and green navigation lights are also sometimes visible). Venus just sits there, deepening the mystery. Indeed, meteorologists at Denver's local TV stations are occasionally asked "What is that object in the sky?" in reference to a bright Venus.

A fair number of DAS members have at least some background in astronomy, and many have spent dozens, hundreds, or even thousands of hours observing the day and/or night sky. That under-the-stars (including the Sun) experience can be helpful in understanding what the strange or unusual things in the sky might be. Some of the objects that frequently cause confusion or questions include the planets Venus and Jupiter; Iridium flares (brief but very bright reflections of sunlight off orbiting Iridium satellites); the International Space Station and other bright satellite passes; meteors and reentering rocket parts; the occasional comet; and even airplanes.

Conjunctions and similar planetary alignments have been known to bring out the end-of-the-world crowd, and news of asteroids passing between Earth and the Moon (very common) or between Earth and geostationary satellites (less common) generate concerns about impact risk. And the list goes on.

The point of all this is to emphasize how we—members of DAS—should respond to inquiries from the public when they have seen unknown or questionable phenomena in the sky. The answer is to be polite but factual, offering a science-based explanation without PhD-speak that answers questions and clears up any confusion. Will we always be successful? No. Some people will remain adamant that they know what they saw, and it wasn't something so easily explained.

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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'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*.

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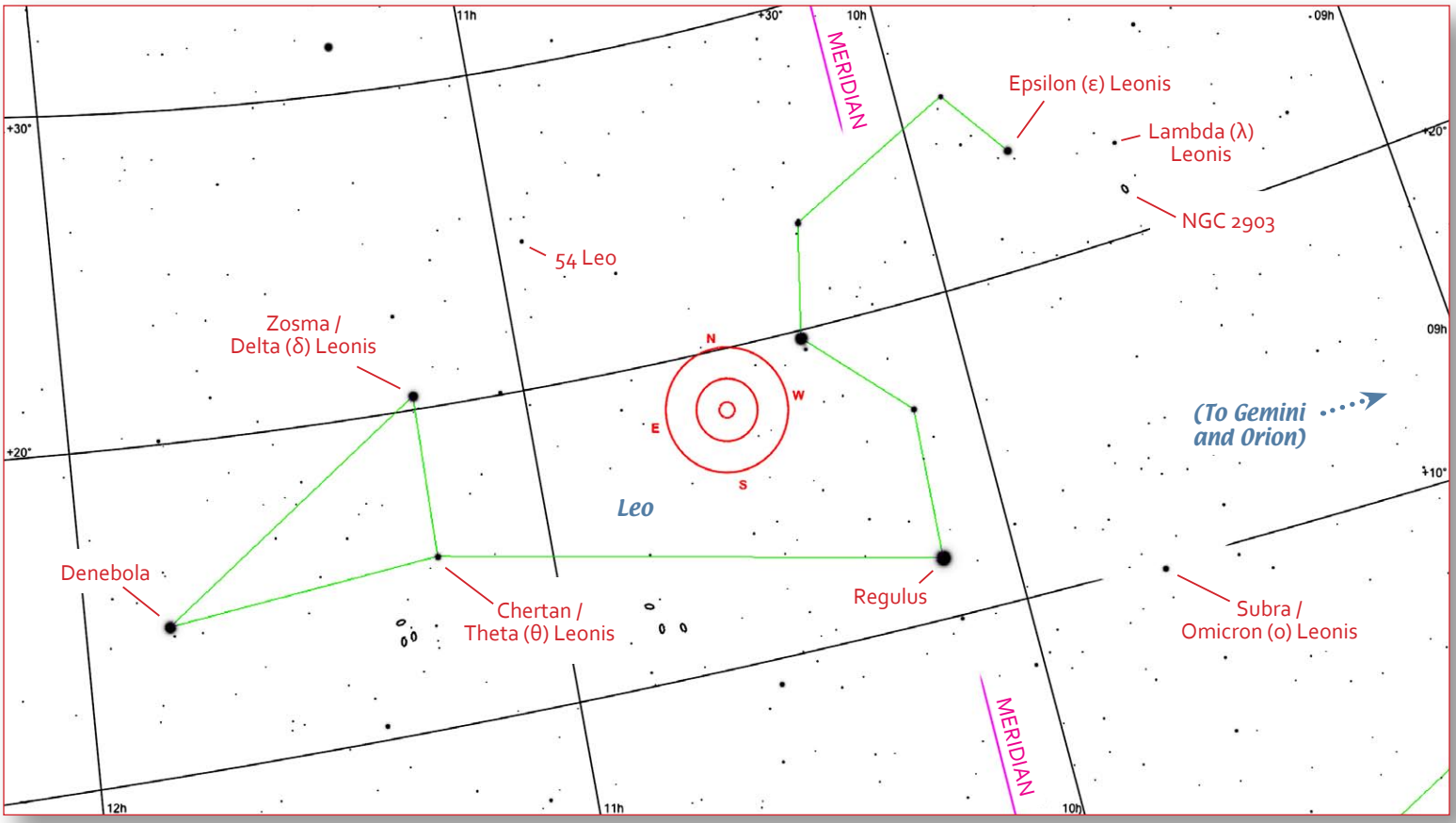

Viewing south and up in Denver at 9:30 PM in mid-April. (Telrad included for scale.) Earlier in the month, look somewhat eastward of the meridian to find Regulus; later in the month, the same view shifts westward. See page 8 for a detailed view of the Telrad / finderscope view around NGC 2903.

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

April Skies

Continued from Page 1

By month's end, Venus's now lemon-wedge crescent stands 12° above the horizon (as before, a half-hour before sunrise); its smaller disk more than made up for by that gain in altitude, where atmospheric conditions will be less disruptive for observations. **Telescope/binocular users: As dawn approaches, be careful to avoid getting any sunlight into your optics—your eyesight can be quickly and permanently damaged.**

Mars will remain visible in the western sky after sunset until it slips into solar glare in mid-summer. For now, it glows at about +1.5 magnitude, with a disk roughly 4" across. (If you're new and you've never seen Mars through a telescope, you can still see it "as a planet," with a perceivable disk, at high magnifications—but don't expect to see any surface detail.)

Jupiter achieves opposition on the 7th—that is, on that date it will lie close to 180° from the Sun in the sky, and therefore is at its highest in the southern sky around 1 AM (the time "should" be midnight, according to your astronomy textbooks, but we're on Daylight Savings). In practice, Jupiter can be seen all night, which will allow all kinds of observing opportunities. Detailed info about the movements of Jupiter's four largest moons is available in the popular astronomy magazines, as well as astronomy apps like SkySafari, so you can plan ahead to see moons "rise" or "set" behind Jupiter or transit the planet's surface.

Of special note this month, the Jovian system has a close conjunction with the 4th-magnitude star Theta (θ) Virginis on the night of the 5th, when the star and planet lie less than 10 arc-minutes apart. If weather permits, try observing 1 or 2 days before and afterward, to see Jupiter's motion relative to this landmark. As long as you've got the 'scope out on the 5th, check out the close Io-Europa pass (from our line of sight) around 9:45 PM Mountain Daylight Time. An observer will see one moon "above" the other and just 12" apart; an hour later, Europa will have swung towards Jupiter, doubling the gap from Io to 24". Even small telescopes should be able to show this, and careful observers might discern movement over a span of several minutes.

Saturn becomes a more reasonable target for viewing this month, albeit in the wee hours. At the beginning of April, the planet is about 20° up in the southeast at 4 AM. At that altitude, the rings will be visible in a telescope, though likely still blurred. By month's end, Saturn is due south, nearly on the meridian by 4 o'clock, and a respectable 28° up—as high as it's going to get this year. If you'd rather not observe at such an hour, though, Saturn will rise noticeably earlier next month!

Uranus and Neptune are washed out by sunlight for now.

Stars and Deep Sky

This month, we've got two interesting binary stars, and a bright galaxy, in the constellation Leo (the Lion). Leo is easy to find, high in the south, at 9:30 PM—the Lion's distinctive head is *exactly* in the south, about 2/3 of the way up from the southern horizon to the zenith, at that time in mid-April, but somewhat to the east early in the month, and somewhat to the west at month's end.

Leo's head looks like a question mark, reversed left-to-right—it's about the same span, roughly 15°, as between your outstretched thumb and pinky finger when you hold your arm straight out in front of you. To make finding Leo's head easier, look

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April Skies

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for Regulus, the particularly bright star at the bottom of the question mark—though it's not quite as luminous as the very showiest stars in Gemini or Orion (which now lie off to the southwest), Regulus is definitely in their league, and there's nothing else to compete with it in its area.

Unlike the constellation Cancer, just to the west, which pretty much disappears under city lights, many of the main stars outlining Leo remain visible under decent (not too hazy) city skies. This keeps some of Leo's "city" targets, like binary stars, still readily available to folks who can't get out into the country. It also makes finding reference points for the dimmer objects easier under dark country skies, because the "reference" stars stand out—and Leo can also help to find dimmer adjacent constellations, like Coma Berenices to the east, that would be much tougher otherwise.

Our first target, then, is that bright star at the bottom of the question mark—most star charts show it as **Regulus** or **Alpha (α) Leonis** (or its short version, **α Leo), at 10h 09m, +11° 53'**. Regulus isn't simply a binary, though it looks like one in a telescope—in reality, it's a fascinating quadruple-star system. The primary star, Regulus A, is hot (12,000 K) and luminous, over a hundred times the intrinsic brightness of our Sun—and *double* that when you add in its ultraviolet (UV) light (the hotter a star is, the more blue and UV light it puts out). Regulus A spins so quickly that it has a pronounced bulge—if you were close enough to see the star's shape, it would look distinctly oval, like a football without the pointy ends. Regulus A's first companion is too close to be resolved in a telescope, but was detected through other means—it's thought to be a white dwarf. Astronomers believe that in the past, this unseen companion was actually a larger, brighter star than Regulus A—but as it evolved, much of its mass was lost to the now-dominant star. Currently, this small companion orbits at 0.35 astronomical units (AU), or about half of Venus's distance from our Sun.

Another pair of stars (Regulus B and C) orbits much farther away, at roughly 5,000 AU from Regulus A, or about 125 times Pluto's average distance from the Sun; one orbit around Regulus A takes more than 130,000 years. From Earth, this outer pair shines at 8th magnitude, at a very wide 177" away from 1st-magnitude Regulus A. With such a large separation between A and the B/C pair, the latter might be seen *in binoculars*, in spite of our vantage point from some 80 light-years away.

The pair itself has 100 AU between its two members, and to us they appear 2.5" apart. If this pair's stars were of more equal brightness to each other, a 5- or 6-inch 'scope in Denver could split them—but instead, they're *5 magnitudes* apart—one star is 100 times brighter than the other. (In Denver, a pair of stars with a 2.5" split and *half* the B/C pair's magnitude difference can be quite difficult, so expect to see the B/C outer pair only as a single star.)

Still, the bright beacon of Regulus A, and its distant, "single-looking" companion, together make a beautiful and somehow graceful sight in a telescope—in the 6-inch, all powers from 30x on up to 150x turn in great views and are easy to see. (At the higher powers, Regulus A sure is bright!)

Our other binary, **54 Leonis,** at **10h 57m, +24° 39'**, is a nice little gem. It's a fairly easy split, even in small telescopes, because it's reasonably bright and has a separation of 6.5" with a moderate magnitude difference. It's also not too tough to find, so it's great for beginners, and a pleasant stop for more advanced folks looking for a double star they may not have seen before. Most sources agree that this pair is a true binary, with a distance from Earth of roughly 300 light-years. (My frequent go-to for stellar information, Prof. James Kaler of the University of Illinois, has noted inconsistencies between the observational data and what those numbers *should* be for a binary like this, so stay tuned….)

Up-to-date catalogs list the brighter star as class A1 V, and the dimmer one as class A2 V, which *may* explain the slight differences between the stars' reported colors: Though both stars are "white," according their spectra, observing reports traditionally describe a bluish-white tint for one star, and *greenish*-white for the other. As with many other double stars, though, their appearance can be a product of the way subtle color-contrast effects affect human perception, and the reported colors are not set in stone. I do remember the greenish effect from my first look, years ago; but observations a few weeks back instead showed a pale near-banana-yellow tint on the brighter star, while the dimmer companion seemed to go in and out between gray and a very subtle purple or lavender.

Interestingly, more-modern observing reports (from astronomy clubs and the like, instead of historical sources) often report a yellow/blue or yellow/purple duo. From my own experience with this pair, I'm not surprised; neither would I be if they said they didn't see color in either star at all. (Out of curiosity during my follow-up, I pulled out an eyepiece with the same 8mm focal length that I'd liked best on this pair just a few minutes earlier, but of a different design and manufacturer—this second eyepiece, giving the same 100x power, showed the two stars with roughly matching pale-cream-yellow hue!)

One last observing note about 54 Leo before we get into how to find it: Most sources suggest the pair is easily split at 60 power, or even less, but I found 60x a very tight split. Perhaps it was the poor seeing here in Denver that night, but I had much better luck, as noted just above, at 100x. (For what it's worth, at 150x, the gap between the pair widened predictably, but it didn't help much.) The colors were washed out at the lowest power view, and became more apparent under higher magnifications—try different eyepieces and see what works for you.

To get to 54 Leo, first look for the three bright stars that make up the right-triangle outlining the lion's rump—they're a little over a fist's width to the east of the question mark (when you hold your arm out straight). If you imagine Zosma, or Delta (δ) Leonis, as the center hub of a clock face, and Chertan, or Theta (θ) Leonis, as the "6 o'clock position," then you'll find 54 Leonis roughly in the "2 o'clock position," at about the same distance from Zosma as Chertan is.

In dark skies, 54 is easily seen with the naked eye and immediately recognized when looking in its general vicinity, because there's nothing else comparable for several degrees. In the city though, 54 will be washed out enough by light pollution to require optical aid, so the trick will be to point your Telrad to its *expected* position, and use a finderscope (where 54 will still be easy to see) to center it.

Our last object, the bright and beautiful barred-spiral galaxy **NGC 2903**, lies at **9h 33m, +21° 25'**, about a Telrad-width southwest of Epsilon (ϵ) Leonis, the star at the end of the question mark's loop. In a 6-inch reflector, the galaxy's oval shape displays noticeable brightening as you approach the middle, as well as a distinct inner core. In larger 'scopes, 12 inches and up, details of the thicker arms become visible. Some of this is mottling from large H II regions—they're "stellar nurseries" or "star-forming nebulae,"

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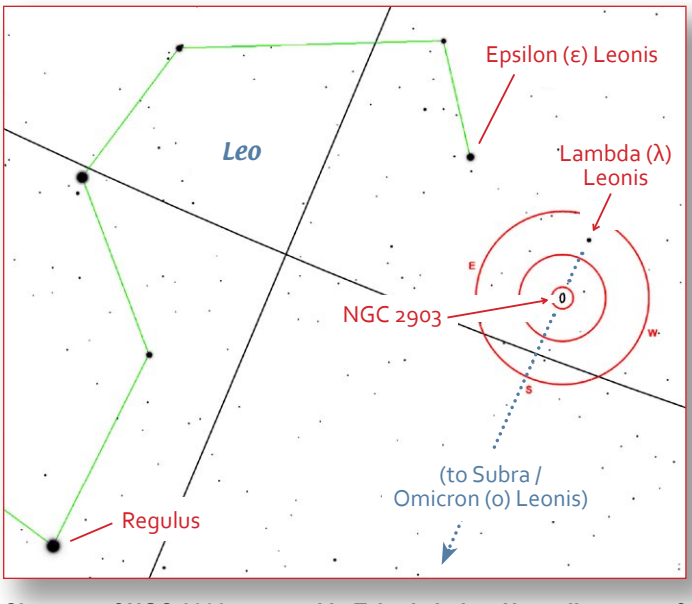

Close-up of NGC 2903 centered in Telrad circles. Note alignment of Lambda (λ) Leonis and NGC 2903 along the line toward Subra / Omicron (o) Leonis (which would be near the bottom of this text), as well as the position of Lambda between the largest and mid-sized Telrad circles. Start with Lambda centered in the Telrad; then slide it along the line to the location shown to put NGC 2903 in your telescope.

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

like the Orion and Lagoon Nebulae within our own galaxy. In 2903's case, though, we're seeing these clouds from 32 million light-years away! (Though you won't see color through your telescope, long-exposure astrophotographs should reveal the H II regions' pinkish coloration against their blue spiral-arm backgrounds.)

The gateway to NGC 2903 is the 4th-magnitude star, Lambda (λ) Leonis—it's the first moderately bright star to the west of Epsilon Leo (the star at the end of the loop in the question mark). If you tip your head to view the question mark as "straight up and down"—not tilted—then you'll see Lambda almost directly right of Epsilon.

NGC 2903 is bright enough to show up in a 9x50 finderscope under clear, dark skies, and it's just 1½° south of Lambda, so centering Lambda in your finderscope should also include 2903 in the finderscope's field, towards the edge.

If the galaxy isn't visible in the finder, though, don't worry—there's a simple approach from Lambda to put 2903 into a low-power telescope field directly. Once Lambda is centered in your Telrad, look for Subra, *aka* Omicron (o) Leonis, a +3.5-magnitude star about 7° west of Regulus—it's the first "obvious" star to Regulus's right, when you view the question mark straight up and down. Starting from Lambda, slide the Telrad's center along a line toward Subra, until Lambda is halfway between the Telrad's outer (4°) circle and the mid-sized (2°) circle. If you do this *carefully*, keeping the Telrad's center on the Lambda-Subra line, you should get NGC 2903 in a low-power telescope field.

—See you next month.

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