The Denver
OBSERVER
OCTOBER 2016

The globular cluster M15, in the constellation Pegasus (the Winged Horse), is one of our objects in this month's "Skies."

Image © Jeff Tropeano.

OCTOBER SKIES

by Zachary Singer

The Solar System

Before we get into the planets for October, we've got a new twist on an event we've seen a lot of this past year: an **Aldebaran** occultation. Here in Denver, this one will be a ***grazing* occultation**—we're right on a line that runs roughly west-southwest to east-northeast, through Los Angeles, Denver, and points beyond. It will happen on the **night of the 18th, a few minutes after 11:35 PM local time**, and last for several minutes**.** Exact times depend on your location, so be early.

Unlike a normal occultation, in which one celestial body, like the Moon, passes definitively in front of another and hides the farther one, an observer along the very thin "line of graze" will witness Aldebaran (the far object) disappearing and reappearing, every few moments. This happens because the graze line marks the boundary between the Moon blocking (occulting) the star, and *not* doing so—the very edge of the Moon's disk will do the occulting, if you will. (Viewers just to the north will see a near miss, while observers to the south of the graze line will see a normal occultation, *starting earlier than listed above*.) Because the Moon's surface has mountains, crater walls, and valleys, the uneven contours of its edge alternately block and pass the light from the star, and *voilà,* you've got a grazing occultation. For this one, the Moon will be about 85% illuminated, so binoculars will likely be necessary.

The angles involved in this type of occultation are *very* narrow, so precise positioning is critical—your elevation factors into it, as does the height of the building you're standing in. For more information about where to go, check out the following link: *occultations.org/Aldebaran/2016October/*.

Sky Calendar

8	First-Quarter Moon
15	Full Moon
18	Grazing Occultation of Aldebaran
22	Last-Quarter Moon
30	New Moon

Leaving the Moon behind, **Mercury** is still a dawn object for now, low on the eastern horizon. **On the 11th, it shares—barely—a 1° field with Jupiter**, when they'll be just a 0.8° apart. Unfortunately, the pair will be only 5° up in a brightening sky a half-hour before dawn. The fast-orbiting inner planet disappears into solar glare a few days later.

For the rest of the planets, don't expect much!

Venus is, in a word, "Meh." It's slowly clawing its way out of the solar glare this month, with a gibbous disk widening to 14" by month's end.

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

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The Executive Board conducts the business of the DAS at 7:30 PM, 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

Answers to Some Common Questions

Denver Astronomical Society's Open Houses and Public Nights provide an opportunity for members to interact with the public. Part of that interaction includes answering questions, ranging from the frustrating, "*Where did you learn so much about astrology?*" (it's astronomy, sigh…), to the more serious, "*How powerful is your telescope?*" Let's start with that last one first.

When the general public asks about the power of a telescope, they're mostly interested in its magnification. Though we'll see shortly that there's more to a telescope's power than magnification, figuring out the latter is pretty straightforward: Divide the focal length of the telescope by the focal length of the eyepiece in use. (Telescopes typically have their focal length engraved or printed on their optical tubes; the same goes for eyepieces.)

For example, my refractor telescope has a focal length of 1000mm. If I use a 20mm eyepiece, the magnification is 1000mm divided by 20mm, and I get 50x (a magnification of 50). Switching to a 10mm eyepiece in the same 'scope gives me 100x, a 5mm gives 200x, and so on. Which takes me to the next question.

"*I saw an ad for an inexpensive telescope with 500 power. Should I buy it?*" Um, no. Often called "department-store 'scopes" or "Christmas junk 'scopes," the typical setup has poorly made optics and a wobbly mount. Though the 'scope might achieve the advertised 500x magnification, the image in the eyepiece will be so blurry, dim, and jiggly that it's unusable.

The problem isn't just shoddy equipment—it's also in what the "power" of a telescope really comes from, and *that* is its *aperture*, not its magnification. Aperture is the "width," or diameter, of the telescope's primary lens or mirror: The larger the aperture, *the more light the telescope collects,* and so the sharper and brighter the image, and the more the view can be magnified before image quality falls apart. Department-store 'scopes typically have small apertures, but even the most finely made small-aperture telescope can only go so far before it's maxed out.

"*Ok, then, what is a maximum recommended magnification?*" The general rule of thumb is an upper limit of about 50x per inch of telescope aperture, or 2x the aperture in millimeters. Going back to my refractor, which has a 5-inch or 130mm aperture, the aforementioned rules of thumb say 250x to 260x is about the maximum magnification for that particular 'scope. Considering the typical seeing conditions (atmospheric steadiness) here in Colorado are only "so-so," I've found the maximum

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DAS SCHEDULE

OCTOBER 2016

1	Dark Sky Weekend—EGK Dark Site & Brooks Observatory
8	Colorado Astronomy Day—DU's Historic Chamberlin Observatory—12:30-4 PM
8	Open House—DU's Historic Chamberlin Observatory—Starts at 6:30 PM
15	DAS Auction—DU's Historic Chamberlin Observatory—Starts at 11:00 AM; see DAS News, Page 3.
21	E-Board Meeting—At DU's Historic Chamberlin Observatory, 7:30 PM
29	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.

DAS NEWS

DAS Telescope Loan Program

Did you know that the Denver Astronomical Society has a variety of telescopes available for loan? DAS member just need to fill out a loan form, available at: *http://www.denverastro.org/miscfiles/Scope_Loan_Form_DAS.pdf*, and submit a deposit check made out to the DAS for $100.

Currently the scopes that we have available for loan are:

* (3) 8-inch Newtonians on Dobsonian mounts (otherwise known as 8-inch Dobs)
* (1) Coronado 40mm hydrogen alpha Personal Telescope (PST)
* (1) Celestron 5-inch Schmidt-Cassegrain.
* (1) 7-inch TEC Maksutov
* (1) 5-inch Orion Maksutov

Scopes can be borrowed for 30 days at a time; you can find more details about the 'scopes online at: *www.denverastro.org/das/scope-loans/*

To check out a 'scope, or for information regarding availability, contact Ed Scholes at: *scopeloan@denverastro.org*.

Volunteer Opportunities

Saturday, 10/8/16, 12:30-4PM: Colorado Astronomy Day at the Chamberlin Observatory. Solar observing on the 20-inch, and on the Observatory's south lawn. (Open House follows at 6:30PM.)

Tuesday, 10/11/16, 7:30PM: The Golf Club at Pradera, Parker. Star Party for members and family.

Wednesday, 10/19/16, 7:00PM: Cub Scouts, Centennial. Night Viewing and Astronomy Badge.

Friday-Sunday, 10/28/16-10/30/16: Comicon, DTC. *Booth:* 2-6PM Fri, 10AM-6PM Saturday and Sunday. *Solar Viewing:* 11:30AM-1:30PM Sat. & Sun. only.

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

DAS Auction

It's time again for the annual DAS Auction, where you can turn your astronomy gear and related items into *cash and scholarship donations!*

Bring your astro-stuff to the auction at the Historic Chamberlin Observatory by about **11 AM, on the morning of Saturday, October 15th.** We'll review the loot for a few hours, take a quick lunch break, then the auction will **start at 1 PM and last until 3 or 3:30 PM.**

Proceeds will go in varying amounts (10% minimum) to the DAS to support the Van Nattan-Hansen Scholarship Fund.

ITEMS TO SELL OR BUY:

Eyepieces	Filters	Motors/drives
Imagers	Telescopes	Books
Adapters	Mounts	Star atlases
Lenses	Wedges	Observing guides
Mirrors	Guide scopes	More!!!
Secondaries	Focusers	

President's Message

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usable magnification is usually a lot less. Indeed, for casual visual observing I rarely go much above 100x on that 'scope, and often keep the magnification in the 50x to 80x range. (For the department-store 'scopes, which typically have 60mm apertures, expect magnifications about half those of my 5-inch.)

"*Do I need a telescope for astronomy?*" A 'scope isn't absolutely necessary to enjoy astronomy. One can step outside, lie down on a comfortable lawn chair, and view the sky with unaided eyes. It's fun to look at the constellations, spot the occasional meteor, glimpse a satellite or two, perhaps even the International Space Station—all without the benefit of a telescope. Do that kind of observing under truly dark skies away from the light pollution of the city, and one could argue that the star-filled panorama should only be seen naked-eye.

"*Is a go-to mount and telescope setup worth it?*" You might as well be asking about a favorite presidential candidate. First, what is "go-to"? It's computerized technology with which a 'scope user selects an astronomical object from a menu (usually on a handheld controller), and the mount automatically slews the 'scope to that object and then proceeds to track it. Typically, some initial setup is required (enter the location, date, time, etc.), but once past that hurdle, it really is a matter of pushing a button or two to get the telescope pointed at a given target.

The subject of go-to versus non-go-to has been contentious since the technology was introduced years ago. Internet forums are full of arguments on both sides: One camp says you should learn the sky, and how to use star charts and star-hopping to find objects yourself—it gives you a much deeper sense of what you're looking at, and how you relate to it. The other camp says go-to allows the user to spend more time observing and less time finding desired objects. (Go-to 'scopes are also more expensive than equivalent telescopes without that capability; instead of go-to, you could get a larger-aperture 'scope for the same money—you'd get a better image in the eyepiece, but you'd have to do all the navigation yourself.) My recommendation? Give it a whirl on someone's 'scope at an Open House and see what you think.

"*If I get a really good telescope, will I be able to see the Apollo landers and the American flags left behind on the Moon?*" The short answer is no. They are too small and too far away for any earth-based telescope to see, and not even Hubble can do that. You *can*, however, see mountains and enough other detail on the lunar surface to lose yourself for hours on end, even in small 'scopes.

Finally, "*Which telescope is best?*" Simple: the 'scope that gets used. As with everything, there are trade-offs—aperture vs. bulkiness, for example. Here, too, I encourage folks to spend time on the park lawn during one of our Open Houses trying different 'scopes, asking questions of their owners, and using that experience to make an informed decision.

HAVE YOU CONSIDERED GETTING INVOLVED WITH PUBLIC NIGHT?

By Dave Tondreau

Volunteerism Can Deepen Your Astro Knowledge—and Get You Time On a BIG 'Scope

One of the great traditions of DU's Historic Chamberlin Observatory is Public Night. It started in 1894, soon after the Observatory opened, and it's been going ever since. Members of the DAS have been associated with the program from the early 1960s. Nearly 500,000 people have visited. It's not just a Denver thing, most nights we have visitors from other states and occasionally people from other countries (most recently Iceland!).

As members of the DAS, we have an unprecedented opportunity to be associated with a historical observatory and a magnificent, world-class telescope. Not many can claim, "My other telescope is a 20-inch Alvan Clark refractor."

Public outreach is an important function for amateurs and professional astronomers alike, and it's part of the DAS charter. If it weren't for amateurs, many people would never have the experience of looking through a telescope. We all know how that experience changed our lives.

If you are new to astronomy and the DAS, one of the best ways to get started is spending some time with a Public Night team or teams. Knowledge of astronomy on your part isn't required, and there's no commitment—just show up at the Observatory on a Tuesday or Thursday evening. Let the team know you are a DAS member (Public Night is free for DAS members). Team members are more than happy to share their knowledge.

You will get a chance to view a variety of objects in the 20-inch and spend time on the balcony learning the sky as team members point out the constellations and bright stars. You will also learn how to use a telescope by watching team members operate the telescope. Even though the Clark is a big telescope, its basic operation is the same as any other equatorially mounted telescope.

For new, astronomy-savvy DAS members, Public Night is a great way to meet active members and an opportunity to view through the 20-inch.

The 20-inch Alvan Clark telescope at Historic Chamberlin Observatory.

Image © Zachary Singer

For all DAS members, we can use additional help to support the program. Stop by and see what it is all about. It's an opportunity to become a certified telescope operator, lecturer, or just to help guests. The commitment is generally two nights a month and a yearly certification class. You can also join the Open House team for a once-a-month commitment. (Even if you can only fill in part-time or on an ad-hoc basis, it would be a big help, as team members sometimes have other commitments.)

Few astronomical societies have the opportunity the DAS has with such a unique facility and outreach opportunity. The more members the DAS has supporting Public Night, the stronger the program, ensuring DU's Historic Chamberlin Observatory will be a Denver resource for years to come.

For more information, contact Hugh Davidson: *Hugh.Davidson@dphe.state.co.us*.

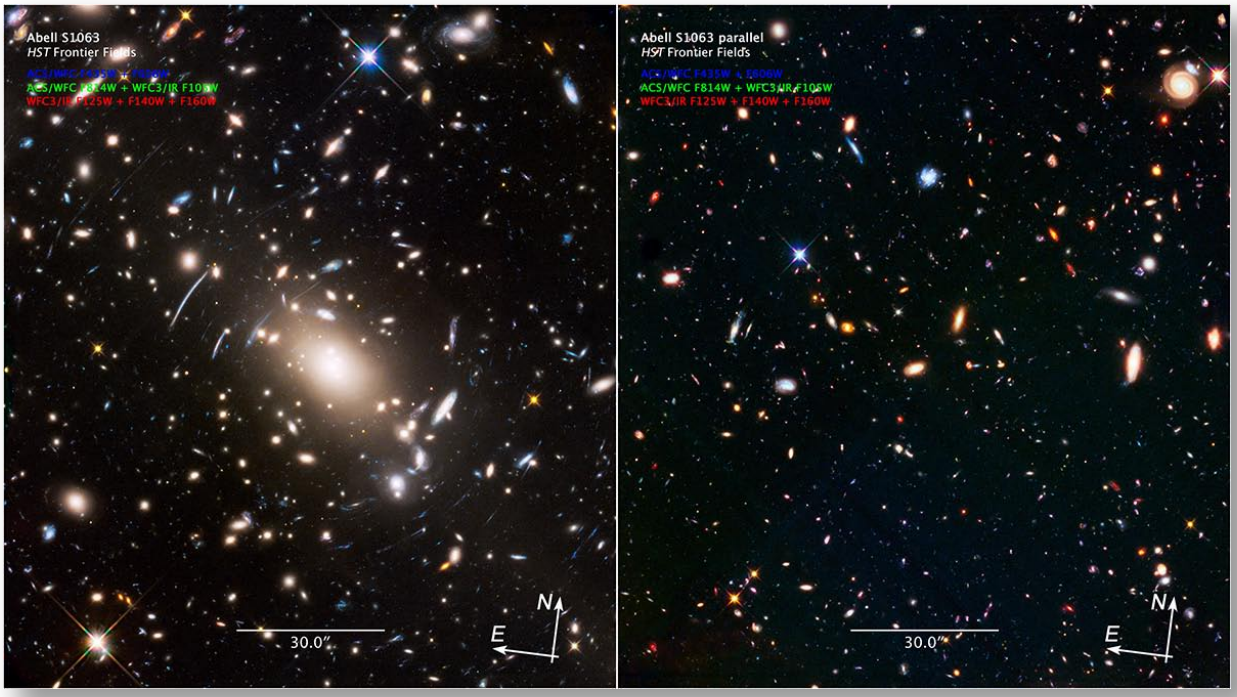
Dave Tondreau has been a member of the DAS since 1977. He's been associated with Public Night since 1986.

ONE INCREDIBLE GALAXY CLUSTER YIELDS TWO TYPES OF GRAVITATIONAL LENSES

By Ethan Siegel

NASA Space Place

There is this great idea that if you look hard enough and long enough at any region of space, your line of sight will eventually run into a luminous object: a star, a galaxy or a cluster of galaxies. In reality, the universe is finite in age, so this isn't quite the case. There are objects that emit light from the past 13.7 billion years—99 percent of the age of the universe—but none before that. Even in theory, there are no stars or galaxies to see beyond that time, as light is limited by the amount of time it has to travel.



Galaxy cluster Abell S1063 (left) as imaged with the Hubble Space Telescope as part of the Frontier Fields program. The distorted images of the background galaxies are a consequence of the warped space due to Einstein's general relativity; the parallel field (right) shows no such effects. ***Image credit: NASA, ESA and Jennifer Lotz (STScI)***

But with the advent of large, powerful space telescopes that can collect data for the equivalent of millions of seconds of observing time, in both visible light and infrared wavelengths, we can see nearly to the edge of all that's accessible to us.

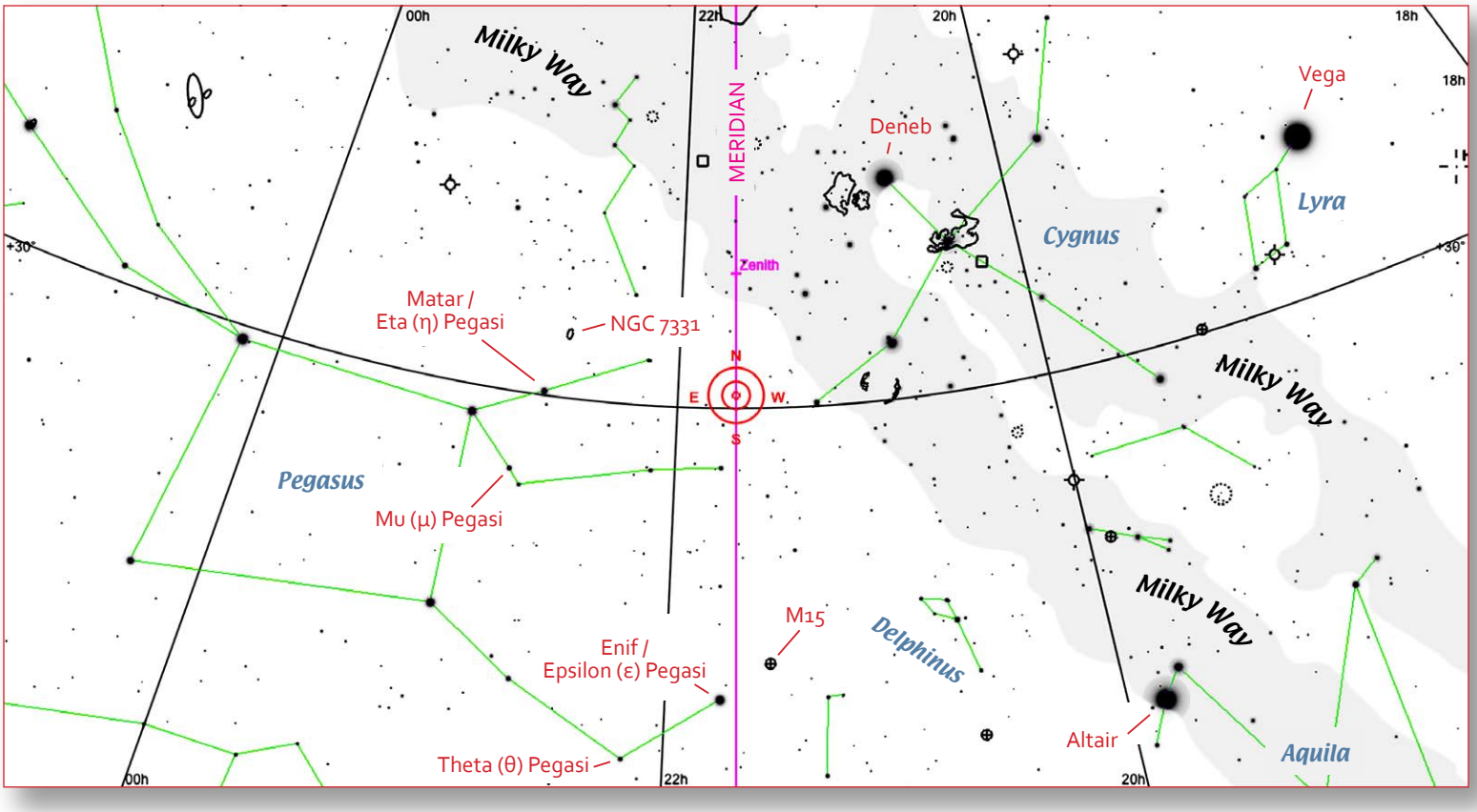
The most massive compact, bound structures in the universe are galaxy clusters that are hundreds or even thousands of times the mass of the Milky Way. One of them, Abell S1063, was the target of a recent set of Hubble Space Telescope observations as part of the Frontier Fields program. While the Advanced Camera for Surveys instrument imaged the cluster, another instrument, the Wide Field Camera 3, used an optical trick to image a parallel field, offset by just a few arc minutes. Then the technique was reversed, giving us an unprecedentedly deep view of two closely aligned fields simultaneously, with wavelengths ranging from 435 to 1600 nanometers.

With a huge, towering galaxy cluster in one field and no comparably massive objects in the other, the effects of both weak and strong gravitational lensing are readily apparent. The galaxy cluster—over 100 trillion times the mass of our sun—warps the fabric of space. This causes background light to bend around it, converging on our eyes another four billion light years away. From behind the cluster, the light from distant galaxies is stretched, magnified, distorted, and bent into arcs and multiple images: a classic example of strong gravitational lensing. But in a subtler fashion, the less optimally aligned galaxies are distorted as well; they are stretched into elliptical shapes a l o n g concentric circles surrounding the cluster.

A visual inspection yields more of these tangential alignments than radial ones in the cluster field, while the parallel field exhibits no such shape distortion. This effect, known as weak gravitational lensing, is a very powerful technique for obtaining galaxy cluster masses independent of any other conditions. In this serendipitous image, both types of lensing can be discerned by the naked eye. When the James Webb Space Telescope launches in 2018, gravitational lensing may well empower us to see all the way back to the very first stars and galaxies.

If you're interested in teaching kids about how these large telescopes "see," be sure to see our article on this topic at the NASA Space Place: *http://spaceplace.nasa.gov/telescope-mirrors/en/*

This article is provided by NASA Space Place. With articles, activities, crafts, games, and lesson plans, NASA Space Place encourages everyone to get excited about science and technology. Visit *spaceplace.nasa.gov* to explore space and Earth science!



Viewing south and nearly straight up in Denver at 9:00 PM in mid-October. The three brightest stars here, Deneb (in Cygnus), Vega (in Lyra), and Altair (in Aquila, *partially shown*) make up the Summer Triangle, and are a handy waypoint for finding Pegasus, at left on this chart.

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

October Skies

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From our Earth-bound viewpoint, **Mars** continues to shrink and dim. Though folks who've never seen it before will be delighted that they can see it at all, that's about as far as it goes.

Jupiter is now clearly a morning object, appearing, as noted earlier, with Mercury before dawn. By Halloween, it rises more than two hours earlier, putting it 15° above the eastern horizon an hour before dawn. Though this isn't great for sharp images, things will improve dramatically over the next month or two, at least for early-morning observers. Opposition comes next April.

As for **Saturn**, well…. "Is it dead yet?" Sinking lower each evening, the planet paces the earlier twilight to remain above the western horizon for viewing. Saturn's image, naturally, is increasingly blurry and washed out—but *oh, those rings!* The planet will remain popular at public star-parties to the end, but if the twilight doesn't get it, trees to the west soon will.

If the planets aren't so great this month, don't worry; we still have the stars!

Deep Sky

Our three deep-sky targets this month lie in Pegasus, the Winged Horse: a gorgeous globular cluster for beginners, a beautiful but lesser-known galaxy for observers of all levels, and *for experienced observers*, a line-of-sight neighbor of that galaxy.

All three objects are near the "Great Square" of Pegasus, the bright center of the constellation. (If you're already familiar with Pegasus, skip this paragraph and the next one.) Look for four conspicuous stars riding very high in the sky at 9 PM in mid-October, and just a bit to your left when you look southward. It's also just eastward of the constellation Cygnus, which we toured last month, and the Summer Triangle—*see the chart*. (You'll find the Triangle shifted westward from last month's position, but it still makes a great way to get oriented.)

Looking at Pegasus, it will be easier to perceive its horse-figure when you realize it's "upside-down" when you face southward—that is, its head and neck are the bent arc of stars to the *bottom*-right of the Square, its front legs are in galloping position at the *top*-right, and our flying horse would be hurtling toward the west. (When the Great Square is rising or setting at our latitude, it's turned somewhat to one side or the other, and looks more like a diamond—remembering this will make Pegasus much easier to recognize when it's not straight overhead.)

From our point of view on Earth, we see the globular cluster, **M15, at 21h 31m, +12° 15'**, as about a half-magnitude dimmer than the Great Cluster, M13, in Hercules, with a noticeably more compact core than its big brother. Under dark skies, it's visible in binoculars, lovely in small and medium telescopes, and increasingly stunning in big-aperture 'scopes. (M15 is also visible from suburban Denver on a decent moonless night in my 6-inch reflector; under those conditions, you can view the bright inner core directly, but you'll need averted vision to see the globular's extended halo.)

If we were to cruise the galaxy and compare M13 and M15 fairly, at equal distances, we'd discover that their true relationships are reversed from what we see on Earth—in actuality, M15 is the more impressive globular, with an *absolute* magnitude of -8.9, compared with M13's -8.5. It turns out that at 34,000 light-years, M15 is half-again M13's distance from Earth, robbing M15 of half its brightness as viewed from our planet, and letting M13 outshine it in our eyes.

To find M15, first orient yourself by following

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October Skies

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the diagonal from top-left to bottom-right across the Great Square, then keep going for a slightly shorter distance along the horse's "neck," to the star at the bend, Theta (θ) Pegasi. (Though the neck's stars are dimmer than those in the Square, they still stand out under dark skies.)

Theta is where the horse's head starts; the nose is marked by Enif, or Epsilon (ϵ) Pegasi, about 7½° away—since it's about the same brightness as the stars in the Square, it will be obvious once you're in the neighborhood.

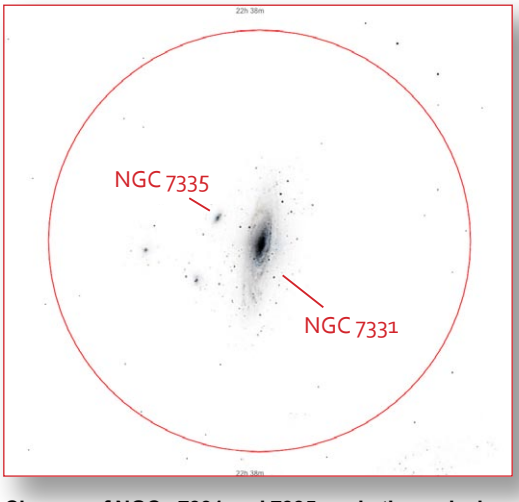
Continue along the Theta-Enif line for about half-again the distance, 4°, and point your Telrad there—M15 should be well inside your finderscope's field. If you're new to this hunt, try it a few times in the country before you attempt it in the city—when there's light pollution, the stars in the neck can get washed out and M15 itself may not show up in smaller finderscopes.

If M15's 34,000 light-year distance seems like a lot, our next object, the spiral galaxy **NGC 7331,** at **22h 38m, +34° 30'**, lies *48 million* light-years away (and for the advanced folks, I have something crazier stashed for you). We see this galaxy in what would be an edge-on view, except that we're "above" (or "below"?) the plane of 7331's disk, giving us a wonderful vantage point. Since this galaxy is thought to be similar to our own Milky Way, observing it gives us an idea as to what we'd look like ourselves, from the same distance. (It's humbling to note that though it's quite visible in a telescope, NGC 7331 is more than 3 magnitudes below naked-eye visibility—and as we'll see soon enough, it's not even all that far away, relatively speaking.)

In 6-inch telescopes, 7331 is clearly visible at moderate power—try 60-90x, and see how it works for you. This past August and September, I observed the galaxy in my 12-inch from the DAS dark sky site: At roughly 120x and 200x, the views were fantastic, showing a brighter inner area and mottling in the halo, in spite of the fact that the skies on both nights were noticeably hazy (that's especially bad for low-surface-brightness objects like galaxies). While we're talking about big-aperture views, let me remind DAS members that we have access to a 14-inch telescope at our dark sky site on designated "dark sky nights," so don't let a lack of aperture or know-how discourage you from coming out to view this object.

To find NGC 7331 for yourself, start at the Great Square, and imagine it as the Winged Horse's body. Take a look at the horse's legs, which extend to the west and northwest of the body, and find Matar, or Eta (η) Pegasi, on the straighter of the two legs, and Mu (μ) Pegasi, near the "knee" of the other. Shining at magnitudes 2.9 and 3.5, respectively, they're both easily visible in the country (and they're marked on our chart).

If you imagine a line running from Mu to Eta, and continue 4½° beyond, you'll arrive at our target. Put the center of your Telrad along that line, and position it so that the outer 4° Telrad circle lies halfway between the Telrad's center and Eta Pegasi. That will give a 4° total spread from the Telrad's center to Eta (just slightly less than the actual distance); then "cheat" the center away from Eta by ½°—just a "nudge"—and you should be very close. I used this approach to find it myself with the big 'scope, and it works—if you miss, try a low-power eyepiece and spiral around this position until you see the galaxy's glow.



Closeup of NGCs 7331 and 7335, and other galaxies. (North is up and East is left.) Note the relative positions of the galaxies' *centers*, compared to the red, ½-degree circle.

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

A quick Google search for NGC 7331 will bring up troves of images, and many will show you its "companions"—these would remind experienced observers of M32 and M110, the small galaxies surrounding M31, the Great Andromeda Galaxy. In 7331's case, though, these fellow travelers aren't what they seem—they are far, literally, from any relationship—some *6 times farther*, more or less.

One of the most noticeable, **NGC 7335**, lies just 3½ *arc-minutes* from 7331, at **22h 38m, +34° 32'**. As you can see in the close-up chart, they share a ½-degree field with plenty of room to spare. Getting verifiable information on this object is difficult, even with all the resources of the Internet, but sources suggest a distance in the range of 300 million light-years—quite a distance for an amateur astronomer, especially for visual observation!

How do we know this? In the late 1920s, astronomer Edwin Hubble demonstrated that within a certain distance range, galaxies' redshifts are roughly proportional to their distance from us—the higher the redshift (apparent velocity receding from us), the farther away a galaxy is (and the further back in time is the light with which we see it). NGC 7335 (and its equally small- and dim-looking neighbors) displays redshift-velocities around 6300 km/sec—suggesting a distance about 6 times that for NGC 7331's more "pedestrian" 818 km/sec. (The relative sizes and brightnesses of the galaxies are also about what you'd expect from such objects at their respective distances.)

Photographically, the near-far grouping of NGC 7331 and its distant relatives makes wonderful compositions. In terms of *visual* observation though, you might guess that NGC 7335 is a difficult target, and you're right—at magnitude 13.3, it's nearly 4 magnitudes dimmer than NGC 7331—you'll need very clear skies and a lot of patience. Don't anticipate much more than a small, fuzzy glow—the payoff here is the *knowledge* of what you're looking at.

Finding NGC 7335 will be an exercise in looking for a tiny "cotton ball" adjacent to 7331's glow; look for it lying near the line of 7331's *shorter* axis, roughly towards the northeast (in the direction of Andromeda). Visually, the galaxies will appear smaller than in their photographic images on our chart—*use the relative positions of their centers compared to the ½-degree field.* (Remember that your view may be flipped or rotated compared to the one shown.)

Here's one more thought for the road: Whether you see NGC 7335 or not, this "remote" galaxy, so challenging to see clearly, is merely a *tiny fraction*—just over 2%—of the distance across the observable universe.

—See you next month.

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 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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