

OBSERVER



A section of a recent Hubble image of the Antennae Galaxies, NGCs 4038 and 4039, reveals intense star formation resulting from the galaxies' colliding gases. Pink star-forming nebulae and blue (hot), new stars are clearly visible. *Image Credit: ESA/Hubble & NASA*

MAY SKIES

by Zachary Singer

The Solar System

Quite frequently in these pages, you'll see that such-and-so planet is "lost in the solar glare," and this month, **Mercury** embraces the spirit of that phrase with gusto: **The planet transits the Sun on the morning of May 9th**. Already crossing the Sun's face as it rises just before 6 AM, the planet will finish its transit around 12:40 PM, as seen from Denver. The planet's apparent diameter will be 12.1 seconds of arc, making it quite obvious even at moderate power—even small telescopes (*with solar filters*, naturally) should show it clearly. While the DAS won't have an official presence there, DU will open the Chamberlin Observatory from 9 AM to 12 noon.

Looking away from the Sun, **Mars** begins the month appearing some 16" across (already quite good!), and comes to opposition in the wee hours of the 22nd, when its disk will span 18.4". At opposition, the planet will be 0.51 Astronomical Units (AU) from Earth, but Mars comes *slightly* closer about a week later, appear-

ing 18.6" across from a distance of 0.50 AU. Interestingly, at opposition, Mars will be roughly the same distance from us as Mercury at the transit—so their relative disk sizes, 12 arcseconds vs. 18, quickly give you a feel for each planet's physical size.

As May gives way to June, Mars will shrink in the eyepiece, returning to a 16" disk by early July. Even at the smaller diameter, the planet *should* present some of its larger features, like ice caps or large plains like Syrtis Major, through a 'scope. In practice, though, during a recent observation with a 6-inch reflector, only the planet's Creamsicle-orange color came through. I saw a satisfyingly large disk, but no detail, at 150X, a power that ordinarily is well within reason for an instrument of this size.

With our weather the way it's been, I wasn't surprised. The atmospheric transparency was merely fair, and the seeing was awful—but another factor is that even at its zenith, Mars is only about 29° above the horizon as seen from Denver. To get the best views this time around, it's going to be important not just to get a calm night, but to observe when the planet is as close to the zenith as possible—that is,

Sky Calendar

6	New Moon
9	Mercury Transit
13	First-Quarter Moon
21	Full Moon
29	Last-Quarter Moon

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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

Join Us on the DAS Yahoo Group!

Questions occasionally come up from new and old members alike about the Edmund G. Kline Dark Site near Deer Trail, Colorado—as well as astrophotography, filter choices for planetary observing, how to choose a new (or used) telescope, using “go-to” versus star-hopping, or any number of other astronomy-related topics. Wouldn't it be nice if there were a way to discuss those topics with other DAS members without having to wait until the next monthly membership meeting or Open House?

Well, there is. One of the benefits of being a DAS member is a no-cost subscription to the DAS Yahoo Group. Generically known as a listserv, e-mail reflector, e-mail list, or e-mail alias, the DAS Yahoo Group is used by about half of our members to discuss all sorts of astronomy and Society related subjects, almost in real-time. Here's a brief overview of what a listserv is and how it works.

A computer server running specialty software maintains an electronic mailing list of users or subscribers. When a user sends an e-mail message to the server's e-mail address, the server in turn resends that e-mail to all of the addresses that are on its mailing list. (Think of the user's original e-mail being “reflected” by the server to all of its users – that's where the term e-mail reflector comes from.) Many e-mail reflectors allow users to receive individual e-mails or groups of e-mails – say, once per day – the latter via what is called “digest mode.”

Yahoo! offers an e-mail reflector feature called Yahoo Groups. The folks at Yahoo! take care of the computers and software, and allow clubs, societies, organizations, and other entities to create Groups that cater to various interests. DAS operates a Yahoo Group that is a restricted group – that is, one must be a member of DAS in order to use our Yahoo Group.

Why subscribe to the DAS Yahoo Group? First and foremost, it's a handy way to stay in touch with other members—think of it as access to a virtual community. Let's say you have a question about whether any other members are planning to go to the Edmund G. Kline Dark Site this weekend. Put that question in an e-mail and send it to our Yahoo Group's e-mail address, and you'll likely get an answer to your question within minutes, or perhaps a bit later the same day. Have a question about how to use some new astrophotography software that you just installed on your computer? Send an e-mail to our Yahoo Group. More than likely, one of our other members has experience with that software, and can share tips about its use.

As mentioned previously, subscribing to the DAS Yahoo Group doesn't cost anything. As long

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DAS SCHEDULE

MAY 2016

- | | |
|-----|---|
| 6-8 | Dark Sky Weekend—EGK Dark Site & Brooks Observatory |
| 14 | Open House—DU's Historic Chamberlin Observatory—Starts at 8:00 PM |
| 20 | General Meeting at DU's Olin Hall, Rm. 105, 7:30 PM |
| 27 | E-Board Meeting—At DU's Historic Chamberlin Observatory, 7:30 PM |

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

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

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

March 10 - September 30 at 8:30 PM

October 1 - March 9 at 7:30 PM

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

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

DAS NEWS

Volunteer Opportunities

May 14, 9:00AM-3:00PM. Astronomy Day at Dinosaur Ridge for the Boy Scouts.

June 5, 10:00AM-4:00PM (Arrive early for set-up.) DMNS Space Day.

June 17, "6:00PM-..." ("Volunteers can come for nighttime viewing and leave when they want"). **Relay for Life, American Cancer Society,**

Green Mountain High School, Lakewood.

June 24, 8:00PM-10:00PM (or later, if you like). Star Party for Boy Scouts earning astronomy badges, at Cherry Creek State Park.

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

Spring Banquet Update

The 2016 Spring Banquet, held Saturday, March 19th at the Embassy Suites DTC, was an enjoyable get-together for members during which new Officers and E-Board members were seated. They include Ron Hranac, President; Jeff Tropeano, Secretary; Mike Nowak, Treasurer; and Ron Pearson, Past President (the Vice President position remains open). E-Board members include Johnny Barela, Jack Eastman, Joe Gafford, Chuck Habenicht, Ed Scholes, Lindsey Shaw, Ken Sturrock, and Dan Wray.

Recognized with plaques during the banquet were outgoing E-Board member, Sorin; outgoing Chairman of the Van Nattan-Hansen scholarship committee, Ron Pearson; and outgoing External Outreach Coordinator, Lindsey Shaw. Thanks to Julie Candia for stepping up to be our new coordinator.

Throughout its history, the backbone of DAS has been its volunteers. Over the decades, hundreds of people have devoted countless thousands of hours to the cause of bringing astronomy to people in the greater Denver metropolitan area. Each year, we recognize volunteers who go the extra mile at various DAS activities and events. In keeping with this, Chuck Habenicht passed out volunteer certificates and pins.

Two years ago we decided to honor long-time DAS member Bill Ormsby by creating and presenting the Bill Ormsby Memorial Volunteer Award to a DAS member who has done some especially heavy lifting for the organization.

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DAS Ambassador for New Members

Last month, we wrote about the need to retain new members by better serving their needs, and our search for someone to fill the newly created position of DAS New Member Ambassador... Happily, Digby Kirby has stepped up, and we know that with his knowledge and experience, he'll be a great addition!

New Librarian

Eileen Barela has volunteered to become the new librarian of the astronomy book collection at DU's Chamberlin Observatory, replacing the long-serving Phil Klos. Welcome, Eileen, and thank you!

Van Nattan-Hansen Scholarship Committee

Two vacancies on DAS's Van Nattan-Hansen Scholarship Fund have been filled by Lindsey Shaw and Dena McClung, and Jeff Tropeano has agreed to become the Committee Chairman. All three are very capable, and DAS and the Fund are fortunate indeed!



Sorin

Photo by Ron Hranac.

Presentation by Michael Carroll.
Photo by Ron Hranac.

HUBBLE SHATTERS THE COSMIC RECORD FOR MOST DISTANT GALAXY

by Ethan Siegel

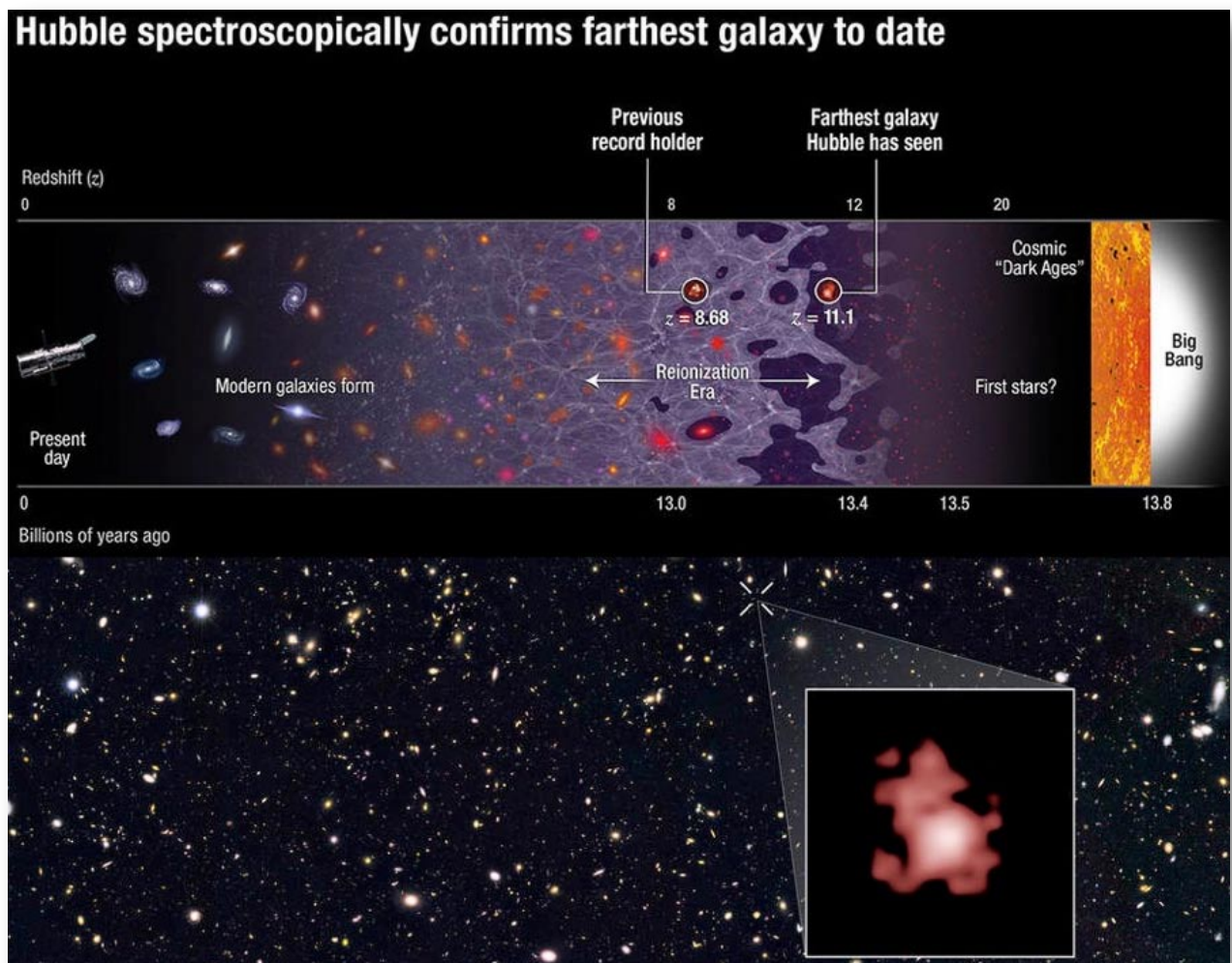
NASA Space Place

The farther away you look in the distant universe, the harder it is to see what's out there. This isn't simply because more distant objects appear fainter, although that's true. It isn't because the universe is expanding, and so the light has farther to go before it reaches you, although that's true, too. The reality is that if you built the largest optical telescope you could imagine—even one that was the size of an entire planet—you still wouldn't see the new cosmic record-holder that Hubble just discovered: galaxy GN-z11, whose light traveled for 13.4 billion years, or 97% the age of the universe, before finally reaching our eyes.

There were two special coincidences that had to line up for Hubble to find this: one was a remarkable technical achievement, while the other was pure luck. By extending Hubble's vision away from the ultraviolet and optical and into the infrared, past 800 nanometers all the way out to 1.6 microns, Hubble became sensitive to light that was severely stretched and redshifted by the expansion of the universe. The most energetic light that hot, young, newly forming stars produce is the Lyman- α line, which is produced at an ultraviolet wavelength of just 121.567 nanometers. But at high redshifts, that line passed not just into the visible but all the way through to the infrared, and for the newly discovered galaxy, GN-z11, its whopping redshift of **11.1** pushed that line all the way out to 1471 nanometers, more than double the limit of visible light!

Hubble itself did the follow-up spectroscopic observations to confirm the existence of this galaxy, but it also got lucky: the only reason this light was visible is because the region of space between this galaxy and

our eyes is mostly ionized, which *isn't true* of most locations in the universe at this early time! A redshift of 11.1 corresponds to just 400 million years after the Big Bang, and the hot radiation from young stars doesn't ionize the majority of the universe until 550 million years have passed. In most directions, this galaxy would be invisible, as the neutral gas would block this light, the same way the light from the center of our galaxy is blocked by the dust lanes in the galactic plane. To see farther back, to the universe's first true galaxies, it will take the James Webb Space Telescope. Webb's infrared eyes are much less sensitive to the light-extinction caused by neutral gas than instruments like Hubble. Webb may reach back to a redshift of 15 or even 20 or more, and discover the true answer to one of the universe's greatest mysteries: when the first galaxies came into existence!



Images credit: (top); NASA, ESA, P. Oesch (Yale University), G. Brammer (STScI), P. van Dokkum (Yale University), and G. Illingworth (University of California, Santa Cruz) (bottom), of the galaxy GN-z11, the most distant and highest-redshifted galaxy ever discovered and spectroscopically confirmed thus far.



DAS News

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Darrell Dodge was the award's inaugural recipient in 2014, and David Shouldice was our 2015 recipient. This year's recipient was Dave Tondreau, and the award was presented by Darrell Dodge.

Dave Tondreau has been an amateur astronomer for more than 50 years, a member of DAS since the 1970s, and is well-known to many of you, especially those who volunteer in various Society activities. He volunteers in our Public Night program and has been doing so since the mid-1980s, and is DAS's longest-serving Public Night volunteer. A regular at most of our external outreach events, Dave sets up scopes and does presentations at schools, museums, and many other venues when the call goes out. He has taught astronomy at the junior college level, and has contributed astronomy-related content to Examiner.com. Dave has also served on the DAS E-Board, and is a past Vice President and President of the organization. A sincere congratulations to this year's very deserving recipient of the Bill Ormsby Memorial Volunteer Award.

Our featured speaker for the banquet was the popular science and sci-fi author and artist Michael Carroll. His presentation topic, "Living On and Exploring Titan," included recent science discoveries and discussion about human exploration of asteroids and outer planets. Information and artwork were drawn from Mike's latest two books, *Living Among Giants: Exploring and Settling the Outer Solar System* (Springer 2014) and the novel, *On the Shores of Titan's Farthest Sea* (Springer 2015). Some books were available for purchase, signed by the author.

President's Message

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as you're a DAS member, you can subscribe. If you'd like to join our Yahoo Group, you can do so at <https://groups.yahoo.com/neo/groups/denverastro/info>.

When you reach the web page, read the material posted there for some general information about the DAS Yahoo Group (you'll probably have to scroll down to see everything). Next, click the "+ Join Group" button, and follow the directions provided. Be sure to include your name when you apply to join the DAS Yahoo Group so your membership status can be confirmed.

Once your subscription request to the DAS Yahoo Group has been approved, you'll receive a message with further instructions. Be sure to follow those instructions to complete the process. After that you might consider sending an e-mail to the Group (denverastro@yahoo-groups.com) introducing yourself. You'll likely receive several e-mails from other members welcoming you. You'll find that our Yahoo Group community is a friendly and knowledgeable bunch.

A couple tips: Whenever you send an e-mail to the DAS Yahoo Group, be sure to include a relevant topic in the subject line, and sign your e-mail with your name so others know who you are (names aren't always obvious from e-mail addresses). If a given discussion topic changes, be sure to update the subject line to reflect the new topic.

That's all there is to it!



Ron Pearson



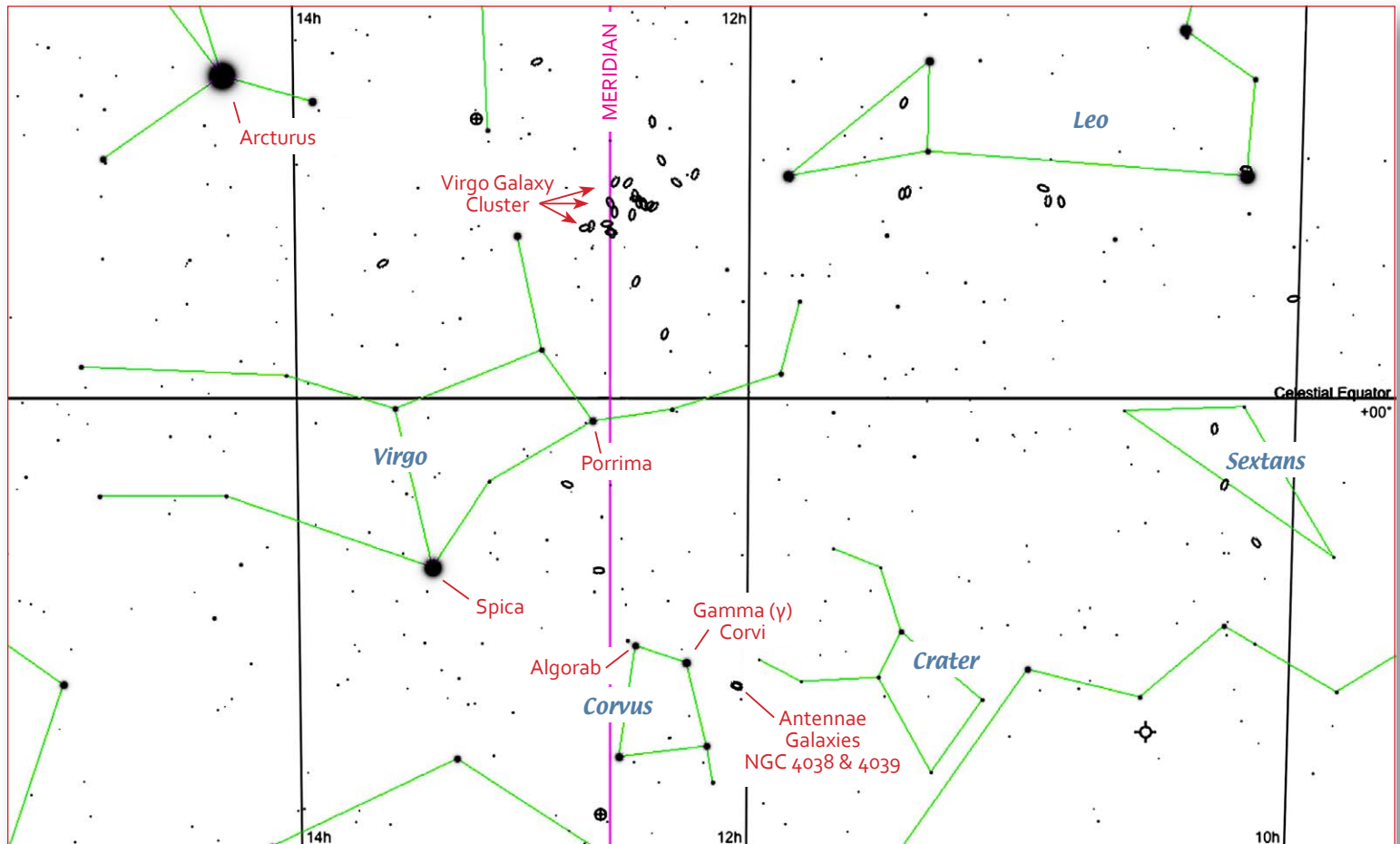
Lindsey Shaw



Dave Tondreau and Darrell Dodge

Photos by Ron Hranac.





Detail chart, looking southward from Denver at 10:00 PM in mid-May; deep-sky objects are plotted to mag. 12, and stars to mag. 6. See next page for wider view providing location relative to other constellations.

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

May Skies

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no more than an hour before or after the time when the planet appears due south. For patient folks, Earth's next pass by Mars in 2018 will bring us much closer, with a 24" disk (almost the maximum possible), though the planet will remain low in our sky—but the approach after that, in October of 2020, will yield a 22" disk, *and about 55° up!*

Jupiter remains an impressive target at the beginning of May with an angular diameter of 41", and its moons continue to dance around the planet as always. **Look for multiple shadow transits on the night of the 6th, starting at 11:45 PM and continuing into the morning of the 7th.** Enjoy the views while you can, though—by the end of the month, Jupiter will be only 35° up and sinking into the west by the time country skies are truly dark.

Saturn, trailing Mars in the southeast, rises around 10 PM mid-month, becoming a relatively decent target (about 25° up) around 12:30 AM. Its disk will be a little more than 18"—about the same as Mars at its best this month, with the rings covering about double that. Because Earth won't be that much closer at Saturn's opposition next month (a difference of just 0.15 AU out of 9), our view of the planet won't improve noticeably, but it will certainly present itself earlier in the evening. To see Saturn at its best, use the same strategy as for Mars—try to catch it within an hour of crossing the Meridian.

Stars and Deep Sky

Our first stop this month, as seasoned observers might expect, will

be in the constellation Virgo—it's famous for the incredible cluster of galaxies bearing its name. As it happens, though, we explored the Virgo Cluster in last year's May Observer, and you can find it at <http://www.denverastro.org/das/denver-observer/>. This area is well worth observing, so don't let the lack of coverage this time around fool you.

Instead of the Cluster, we'll head off toward an object of a timely nature—Porrima, also known as **Gamma (γ) Virginis**, located at **12h 42m, -01° 32'**. We've certainly explored binaries in this column before; what's unusual about Porrima is that its two stars are at the point in their orbit where they've passed their closest approach, and the distance between them is steadily increasing.

In the middle of the last decade, when the pair was closest together in their 169-year orbit, they appeared about ½ arcsecond apart, as seen from Earth, but now the separation has increased to about 2.5", and a decent telescope should split them on a good night. (For comparison, the two pairs of the famous "Double-Double," or Epsilon Lyrae, are 2.2 and 2.8 arcseconds apart; they're about 2 magnitudes dimmer than Porrima but sit at a much higher declination and are less vulnerable to atmospheric turbulence.) Seen near the zenith, you should have a good crack at splitting Porrima; if not, the pair will be easier next year and every year after that until the 2080s, when they'll appear a wide 6" apart.

That's actually the reason to look now: Even if you can't quite resolve Porrima this year, it will make a memorable

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May Skies

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comparison; the separation will increase to a full 3" by 2020, making for either a clean split at last, or an easier one than you'll find this year—how often do you get a chance to watch binary stars orbit each other?

As an aside, consider this: Since we see this pair from a distance of 38 light-years, we're actually "lagging" in our view of what's happening there—what we think "will" happen in 38 years is actually happening there "now." In fact, *the pair has already widened*, enough to appear 5.4" apart from our line of sight—we just don't see it yet.

To find Porrima, start at Spica, Alpha (α) Virginis, the brightest star in Virgo. Porrima is the first bright star to Spica's northwest. (There's only one noteworthy star between them, marking a slight bend in Virgo's outline, but at 4th magnitude, this star doesn't compete with either Spica or Porrima.)

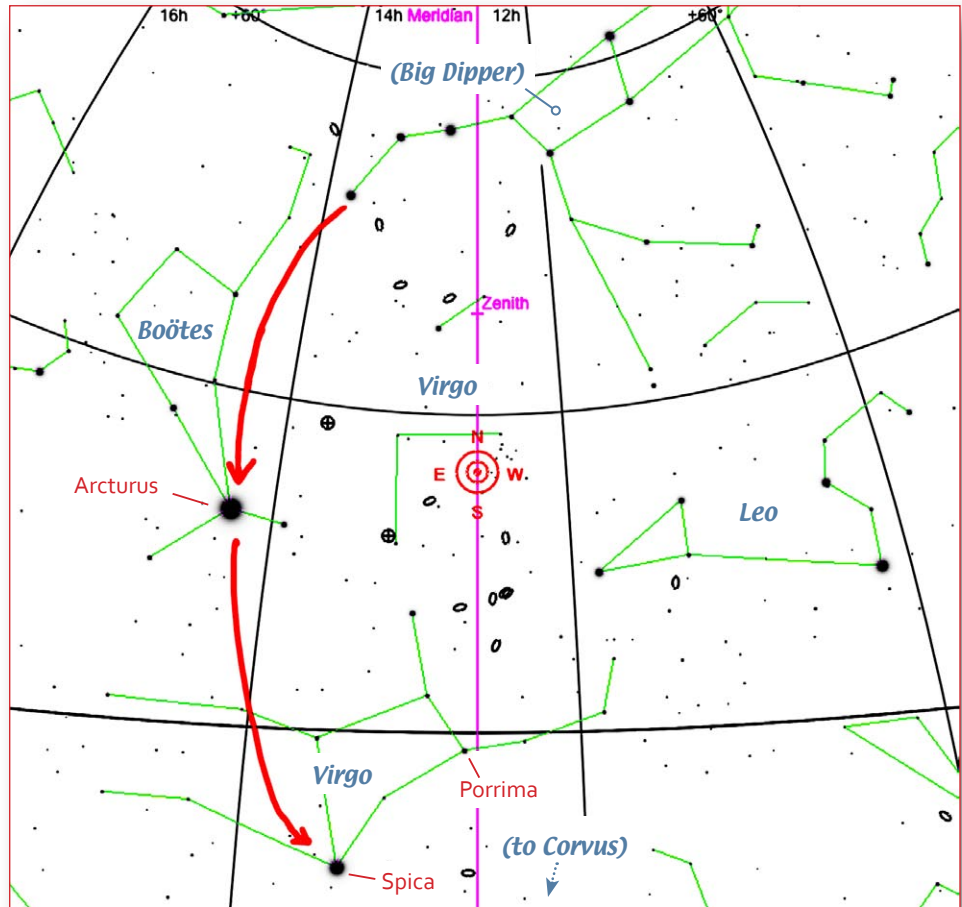
If you're a newbie and totally unfamiliar with Virgo or Spica, you can get there by following the curving handle of the Big Dipper around and "down" to the south (away from the dipper's bowl), and continuing the arc until you see a very bright star, Arcturus. (The distance from the end of the handle to Arcturus is about the same as the span across the Big Dipper.) Keep following the arc a similar distance southward, and you'll find Spica, the next conspicuous star. (See chart at right.)

Our next object, **Algorab**, or Delta (δ) Corvi, is a beautiful binary, located south of Virgo in the constellation Corvus, the Crow, at **12h 31m, -16° 36'**. Unlike Porrima, Algorab is an easy split, even in moderate telescopes, with components of 3rd and 8th magnitude lying 24" apart. In my 12-inch scope on a very hazy night, the pair were striking, with a bright-white primary and a companion displaying a subtle shade of lilac. (125-200X worked best under these conditions.)

The primary is a hot, 10,000° K star almost 50 times our Sun's brightness; its companion is slightly cooler than our home star, at 5000° K, and puts out less than half the Sun's light. According to Professor James Kaler, of the University of Illinois, this companion is a "post-T Tauri" star—that is, this very young sun is just now settling down to "normal operations" for a star fusing hydrogen in its core, still surrounded by dust left over from its formation. The two stars orbit each other more than 600 AU apart, or more than 15 times the average distance from Pluto to the Sun, and take more than 9,000 years to complete a cycle.

It shouldn't be too tough to find Algorab in the northeastern corner of Corvus; the constellation itself makes a reasonably bright, distinctive trapezoidal shape "below," or to the south of, Virgo (see chart, page 6). Algorab glows just 15° south of Porrima, and it's the first star of similar brightness in that direction. When Porrima is at the zenith, placing it just outside the eastern edge of your Telrad and slewing straight downward should nearly center Algorab. At other times, keep in mind that these two stars form a rough equilateral triangle with Spica. Cross-checking all these approaches will confirm Algorab's identity—as will a good look through your eyepiece!

Our last object, the **Antennae Galaxies, NGCs 4038 and 4039**,



A wide view of the Denver sky at 10 PM in mid-May. Arrows show the path from Big Dipper to Arcturus and then to Spica, in the constellation Virgo. (Brighter stars are drawn larger.)

Objects, constellation and meridian lines charted in SkySafari, and then enhanced.

are a fascinating pair, still interacting with each other hundreds of millions of years after their initial collision. Located on the western edge of Corvus at **12h 03m, -18° 57'**, these former spiral galaxies have distorted each other's shapes quite noticeably and are in the process of merging with each other over the next few hundred million years, likely becoming a single elliptical galaxy.

Both galaxies are 10th magnitude, with a high surface brightness that makes them moderately visible even in 6-inch 'scopes. Though the main bodies can be seen, the thin, wispy tails that give the pair their name can't, even in telescopes of large aperture—they beckon for astrophotography. At the same time, the pair's interactions have caused remarkable areas of starburst activity which are easily seen in recent Hubble images. Both visual and "Internet-based" astronomy will be rewarding—you'll find the very latest, high-resolution Hubble image at <http://www.spacetelescope.org/images/potw1345a/>.

The Antennae Galaxies are conveniently located just south of a line running through Algorab and Gamma (γ) Corvi; Gamma is the next bright star west of Algorab, and forms the northwest corner of Corvus's trapezoid. The galaxies are about the same distance, roughly 3½°, from Gamma as from Gamma to Algorab; making a good visual estimate with a Telrad should bring the pair close to the Telrad's innermost ring. Nudging the 'scope about ½° southward should bring in the galaxies.

— 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 pre-

serve 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.

