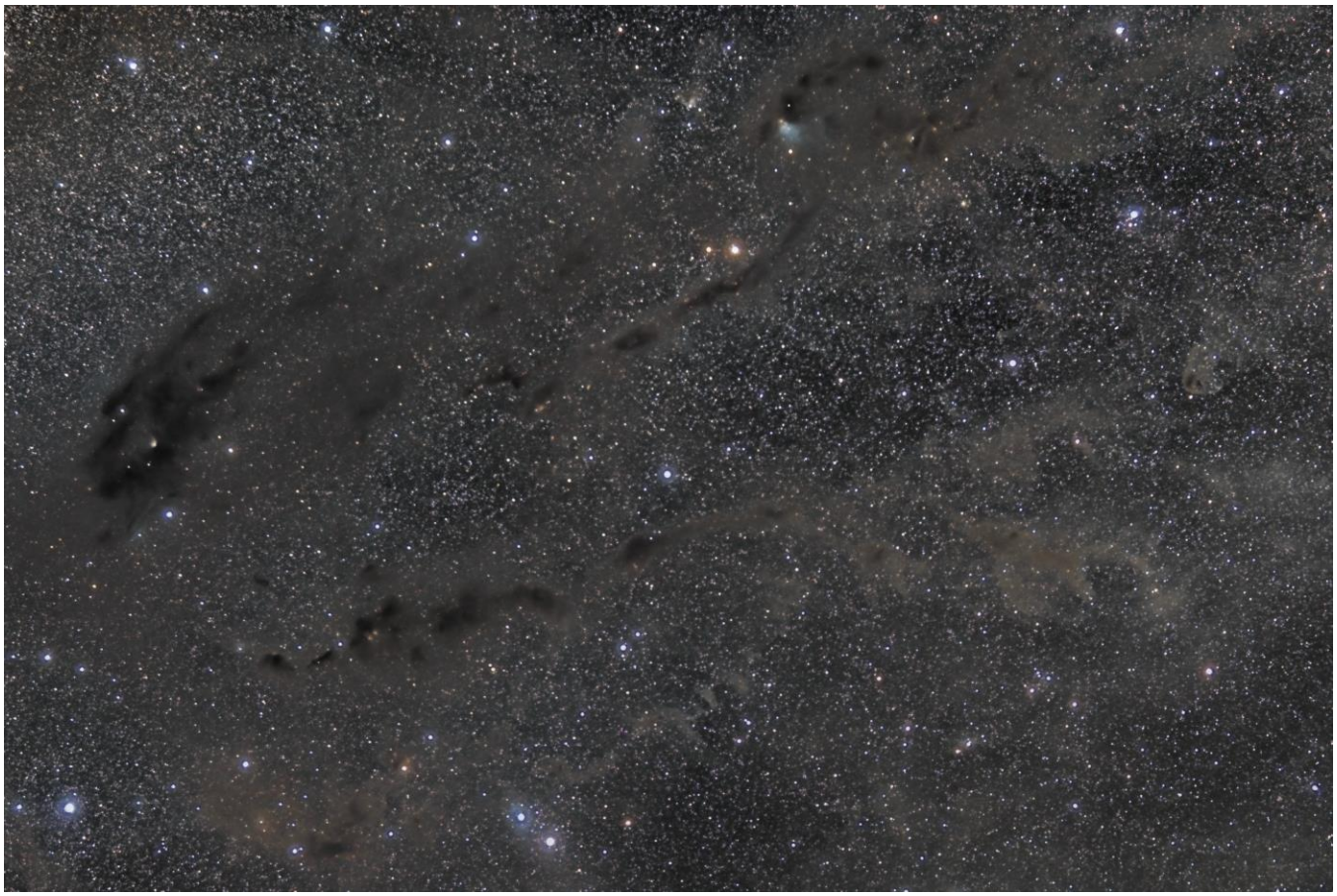
SkyWAAtch

The Newsletter of Westchester Amateur Astronomers

2021 APEX® AWARDS FOR PUBLICATION EXCELLENCE

February 2022



The Taurus Molecular Cloud by Steve Bellavia

This enormous cloud of dust and gas in the constellations Taurus and Auriga is just 140 light years from the solar system. It's the nearest star-forming region to Earth. The cloud was once considered part of the "Gould Belt" but is now included in the "Radcliffe Wave." See "Unbuckling Gould's Belt" in the June 2020 SkyWAAtch. Also see the Research Finding of the Month on page 27 of this issue. The field in the image is almost ten degrees across.

Steve traveled to a dark sky site in the Catskills and imaged through the cold (10-14 degrees Fahrenheit) night of January 3. He used a Canon EF 100-mm f/2.8 lens stopped down from the front to f/3.6, mounted on a ZWO ASI294MM Pro camera. There are over five hours of exposure through LRGB filters, plus additional dark, flat and flat-dark frames, as well as extensive processing with PixInsight and other software. Steve posted more technical information and an annotated image identifying many objects at https://www.astrobin.com/8obfk4/.

WAA February Meeting

Friday, February 11 at 7:30 pm

On-line via Zoom

Mars Month at WAA

Diurnal, Seasonal, and Inter-Annular Variations of Gases in the Mars Atmosphere

Br. Robert Novak
Professor Emeritus, Iona College

Spectral/spatial images taken by the iSHELL spectrograph on the 3.2-meter NASA Infrared Telescope on Mauna Kea can detect gases in Mars's atmosphere such as water (both H_2O and HDO), carbon dioxide, and methane. Searches have been conducted for other organic gases, such as ethane and propane, but up to now, only methane has been positively detected. Since January 2017, Br. Novak has taken data to measure these gases during Mars' early northern winter (January 2017, Mars Year 33), mid-northern summer (MY 34), mid-northern winter (MY 35), and early northern spring (MY 36). He will discuss the detection and variation of these gases in the course of a day, from season to season, and from one year to the next, and the possible implications of these changes.

Following Br. Novak's talk: A report on the current status of surface explorers on Mars, with recent images.

Call: **1-877-456-5778** (toll free) for announcements, weather cancellations, or questions. Also, don't forget to visit the WAA website.

WAA Members: Contribute to the Newsletter!
Send articles, photos, or observations to waa-newsletter@westchesterastronomers.org

Editor: Larry Faltz
Assistant Editor: Scott Levine
Almanac Editor: Bob Kelly
Editor Emeritus: Tom Boustead

WAA March Meeting

Friday, March 11 at 7:30 pm

On-line via Zoom

Comets, Asteroids and Near Earth Objects

Steve Bellavia
Principal Engineer, Vera Rubin Telescope camera, Brookhaven National Laboratories

Starway to Heaven

Star parties will resume on March 5, weather permitting. See the WAA web site for more information.

New Members

Yan Besidski	Irvington
Cathy Carapella	Eastchester
Giuseppe Colombo	Mamaroneck
Thatcher Drew	Bronxville
Martin Hampel	Peekskill
David Sadowsky	Larchmont
Wilson Family	Dobbs Ferry

Renewing Members

Kevin Doherty	White Plains
Cat Hannan	Peekskill
Bob Quigley	Eastchester
Robert Peake	Pleasantville

Westchester Amateur Astronomers

Also In This Issue

ALMANAC For February 2022

Bob Kelly, WAA VP for Field Events


New
2/1


1Q
2/8


Full
2/16


3Q
2/23

Welcome to the shortest month!

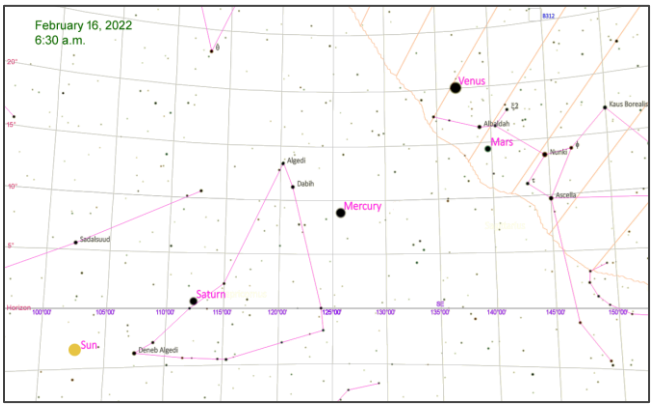
This month we thank the rabid fans of certain Roman emperors, who mined February to make their namesake months longer! Poor Febby ended up with only 28 days. Of course, every four years we grant battered February one more day. Except when the year is evenly divisible by 100, but not 400. Oh, the sacrifices the second month makes to keep our calendar running on time!

Jupiter, Going, Going, Gone

As if wanting to get its job done before the end of the short month, **Jupiter** slips out into the solar glare. Catch it while you can. The giant planet sets an hour after sunset until mid-month, at the end of astronomical twilight. The almost-two-day-old **Moon**, just barely a sliver, is just to the left of Jupiter on the 2nd. The rest of the week, you can use the waxing Moon to point to Jupiter below it.

Where's the New Moon?

Only one new **Moon** this month, at 12:47am EST, on the 1st. From the USA's Central time zone to the International Date Line, the new Moon happens on January 31st. So, anyone living in that 40% slice of Earth won't get a new Moon this month! The next New Moon is on March 2nd.

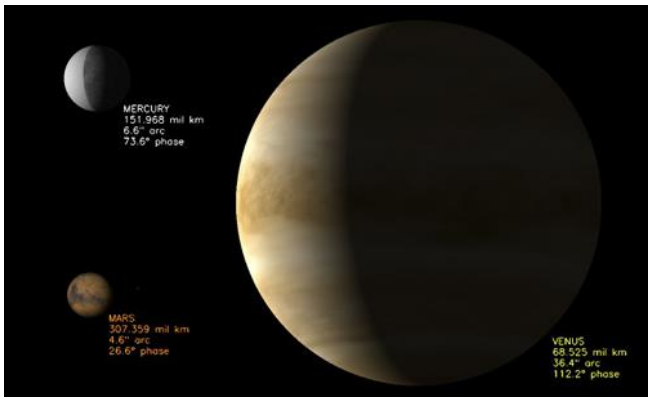


I Wonder Where the Planets Went? Then, it Dawned on Me

Venus lights up the dawn sky, as if carrying fire from appearing to pass near the Sun back in early January.

Mercury is lower than Venus, even at its maximum elongation from the Sun in our sky on the 16th. Mid-month is a great time to get some views of the phases of Venus and Mercury. **Mars** has been hanging out, low in the dawn sky, as if waiting to greet Venus and Mercury.

Get a telescope on Venus to see the thin crescent phase. It's great that something so thin can be so bright. Venus is brightest on the 12th, due to the combination of apparent size and phase. Compare it with smaller and half-lit Mercury.



Comparative sizes of Mercury, Mars and Venus on February 12th. (NASA/JPL Solar System Simulator https:/space.jpl.nasa.gov/)

Morning Tea, Anyone?

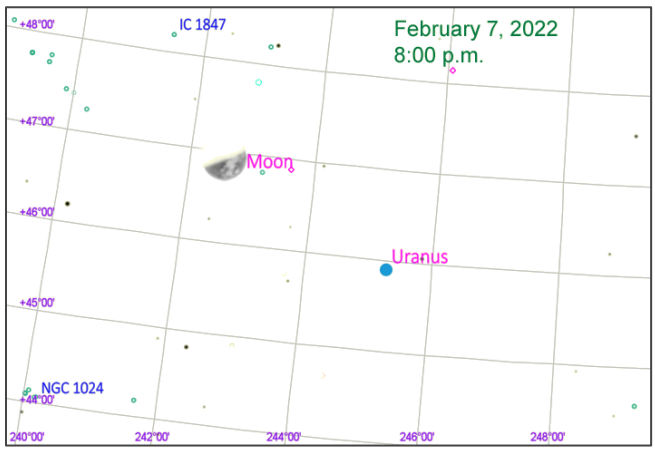
The orbital mechanics of our solar system results in Venus and Mars not gaining much altitude this month. Venus gets out far enough to pass Mars, but then it just stays there, as if stopping for tea next to the teapot of Sagittarius. This morning star rises an hour or so before the beginning of morning twilight, and that's the earliest for all of 2022. Even though Venus will be in the morning sky through October, most of that time Venus won't rise earlier than the beginning of morning twilight.

Walking with the Moon

The morning crescent Moon steps down the crooked line of planets, across to the right of Mars and Venus on the 26th, giving Mars a wide berth on the 27th. A very thin Moon joins Mercury as it welcomes Saturn to the morning sky on the 28th.

Where's that Sun?

The only advantage of having so many planets in the morning sky now is the late time of sunrise, after 6:30 a.m. Next month the time bump from going to daylight time near midmonth moves sunrise forward to before 7 a.m. Tough for the morning commute, but lots of people will see blazing Venus low in the east and maybe pick up the other planets at the tea party.



Find Uranus?

The Moon provides a convenient pointer to **Uranus** on the evening of the 7th. Use binoculars or a telescope to see the magnitude +5.8 planet. Uranus looks more like a dot than a pinpoint star, about four Moon-widths to the right.

Twins Fall

The twins, **Gemini**, lie on their sides more than halfway up in the southeastern sky after dark. In my imagination, they are free-falling out of the sky. (Actually, they are still rising to their highest point between 9 and 10 p.m. local time.)

SOHO and Jupiter and Saturn

Saturn passes through the Solar and Heliospheric Observatory's C3 camera view through the 13th. Jupiter happens into the scene about the 23rd. See https://sungrazer.nrl.navy.mil/transits for more great things to see in SOHO's cameras.

International Space Station Sightings

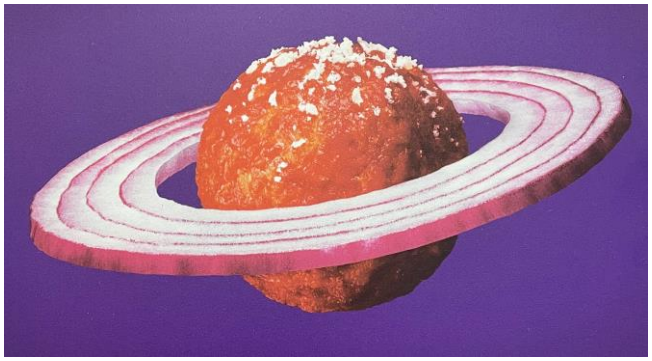
The ISS will be visible in the dusk skies through the 8th and in the dawn skies starting on the 15th. Data from heavens-above.com

Another Movie Telescope

Frederic March (L) and an uncredited actor in the 1936 movie *Anthony Adverse*, directed by Mervyn LeRoy and costarring Olivia de Havilland.

Astronomy in Popular Culture

A poster on the wall of a Subway sandwich shop in New Rochelle.



Member Profile: Olivier Prache

Home town: Pleasantville, NY

Family: Married, 2 children (grown)

How did you get interested in astronomy? I was on the shore of a lake in Michigan around 1974, sleeping outside. The friend I was staying with had a home-made 4" reflector and both the clear naked-eye skies of northern Michigan and looking through that telescope got me hooked.

Do you recall the first time you looked through a telescope? What did you see? I don't have a clear memory of what we were looking at that night in Michigan. I do remember looking at Saturn with my own 4-inch f/10 (yes, f/10) reflector, which I bought right after my Michigan trip. Saturn was a great sight then, and it still is today, no matter what size the telescope is.

What's your favorite object(s) to view? I am mostly a deep sky astro-imaging type, given the sub-optimal New York metropolitan area skies. The modest seeing makes globular clusters less attractive and my preference is for galaxies and nebulae, and in natural (as opposed to narrowband) colors.

From a visual standpoint, I'd say the Milky Way. I enjoy roaming through in the summer using a 4" scope and low magnification eyepiece when I can get to a dark site. Which sadly means I do not do much visual most of the year.

What kind of equipment do you have? At this time, I have 5 telescopes, ranging from an 80-mm refractor to a 320-mm (12.5-inch) f/8 astrograph, including a 1978 Celestron C8 "Orange Can" OTA that I still use visually every now and then and for planetary imaging (which I do very rarely, being more of a deep sky person). The 320-mm is mounted on a 10-Micron GM2000 mount and fitted with a Finger Lakes Instrumentation ML16803 camera. It's dedicated to astrophotography, although at f/8 it is a bit on the slow side. The setup is inside a roll-off roof observatory I built in 2004. It's motorized so I can operate everything from inside the house. My most recent acquisition has been a Celestron RASA-8 that is incredibly fast and can be used on my AVX mount to take nice widefield deep sky images. Were it not for the challenge in taking the 320-mm scope down, I would like to put the RASA-8 on the 10-Micron mount to image during the cold winter nights!

What kind of equipment would you like to get that you don't have? From the realistic to the fantastic, I'd like to have a good portable dual-scope setup for viewing with both eyes. Next, the new ZWO AM5 Mount is interesting both technically and from a transportability standpoint, as it would make trips to dark site easier to manage. The price is better than the other Harmonic drive mounts, so that makes it tempting as an AVX replacement. Then a 16", maybe even 20" imaging reflector (PlaneWave or Orion Optics) would be really, really nice, provided I can station it out west or in Chile (this is the fantasy part).

Have you taken any trips or vacations dedicated to astronomy? I went with S&T to Chile in 2011 to tour the observatories and spend a couple evenings at local amateur observatories. This was my first (and to

this day only) trip to the southern hemisphere and it was a real treat. It is true that the best deep sky objects are down there. I highly recommended it for those who are more hardware oriented: being able to get inside the Victor Blanco telescope observing cage or standing below an 8-meter mirror in Cerro Paranal are spectacular experiences. A special mention goes to the local drink, the Pisco Sour.

Stateside, I have now been going for three years to the Medomak Astronomy Retreat camp in Maine, and thoroughly enjoyed every trip be it for the clear nights (quantity varies), the company, the movie nights (!) and the beautiful landscapes and coastline of Maine.

Are there areas of current astronomical research that particularly interest you? I have a large range of interests but cosmology is likely the one that stands out. It is a bit fascinating that the universe is continuously expanding and yet we will collide with M31 in the near (cosmologically speaking) future.

Do you have any favorite personal astronomical experiences you'd like to relate? My trip to Chile stands out as the best experience I have ever had. Seeing the shadow of one's shoe from just the light of the Milky Way is simply incredible. Being able to put a narrowband filter on an eyepiece and still see gorgeous details in the Tarantula Nebula with a 20-inch Obsession does make a huge impact (but one has to be careful that the impact doesn't come from falling off the ladder that you need to climb to reach the eyepiece)!

The second best was the 2017 total eclipse I saw from Charleston, SC. it was my first totality and it was memorable.

What do you do (or did you do, if retired) in "real life"? While I play with cameras for astrophotography, I work with and develop microdisplays professionally. These are miniature displays that go into viewfinders (remember the video cameras?) for defense, commercial and medical applications.

Have you read any books about astronomy that you'd like to recommend? *Starlight Detectives* by Alan Hirshfeld. It's a great book that retraces the evolution from visual astronomy to the beginnings of astrophysics between 1840 and 1940.

How did you get involved in WAA? I found out about WAA at a NEAF show several years ago and started attending the Friday lectures and sending every now and then some of better images I got from my backyard observatory.

What WAA activities do you participate in? I am on the advisory board but otherwise not very involved, primarily due to a work life that is a very jealous mistress.

What do you want the club to accomplish? The club is quite good as it is. Perhaps, some of the star parties could have a theme like a Messier marathon, or an intro to taking good pictures (planetary or deep sky), a trip down the Moon's prominent features. That may be of interest to a few and possibly attract new members.

Besides your interest in astronomy, what other avocations do you have? I am an avid SciFi reader and have learned much about old-fashioned SciFi movies through WAA. I stop just short of going to conventions, and my favorite genre is space opera. ■

Olivier and Marine Prache at the Château de Chambord

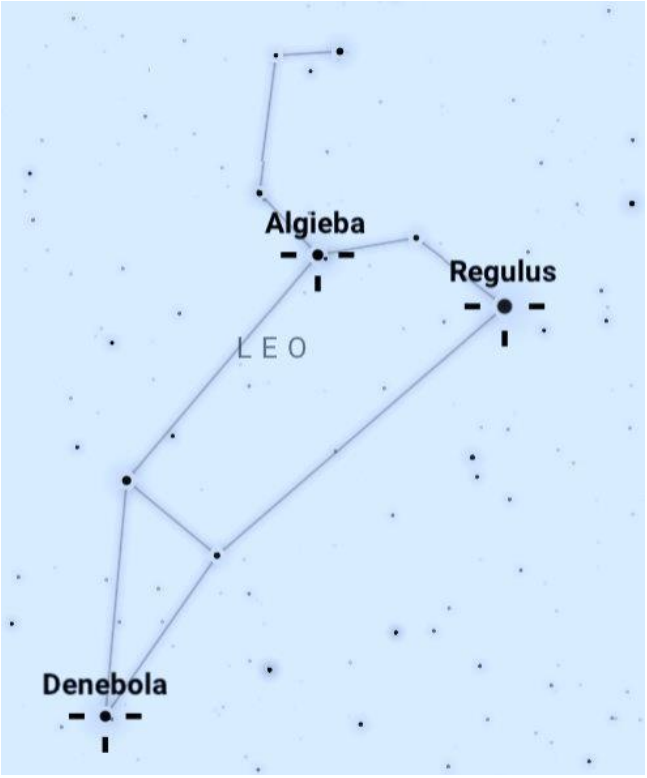
In the Naked Eye Sky

February 2022: Regulus, Leo, and the Sickle

Scott Levine

While we've all been pointing and staring at Orion and the other bright lights of winter, an amazing thing has happened. Sure, it's hard to believe, with all the snow and ice piled up around us, that we're already almost halfway through winter. The groundhogs might give us a hand with the scheduling, but they're always a bit vague and persnickety. For real help, let's turn to the skies.

By mid-evening as we flip the page to February, we'll see a newcomer in the eastern sky above our neighbors' rooftops.



Regulus is the brightest star in the constellation Leo. It's also the dimmest of all first-magnitude stars. On the big board, it comes in just behind Deneb (α Cyg) and ahead of Adhara (ε CMa) among stars we can see in Westchester's skies. It's a system of at least four stars whirling past each other in orbits that somehow stay stable. From across the 79 light years between us and it, all those stars' light blends into just one dot in the darkness. As the first of spring's stars to come back to the night, I'm always a little surprised the first time I see it.

With this relative dimness comes a wonderful subtlety that really makes it worth sitting with for a minute. The next time the skies cooperate, let's turn toward the east or southeast in the early or middle part of the evening. There, we'll find Leo rising as though it's about to leap onto the shoulders of Castor and Pollux, the twins of Gemini.

People are often surprised when they notice that not all stars look the same, and there's quite a bit of color that we can see from one to the next. We can stop here for a minute, even on a chilly night. If we look closely, we can see how different Regulus looks compared to brilliant Capella (α Aur), in Auriga. Both are four-star systems, but Capella is about half as far from us, and appears much brighter. It's the northern nights' fourth brightest. Side by side, we can easily see Regulus is a muted yellow more like a dusty desert sunset than lemon-fresh Capella.

Regulus sits almost exactly on the ecliptic, where we can find it as the dot at the bottom of a backward question mark-shaped group of stars called "the Sickle." This bunch sketches out the lion's front half. It's a fun asterism to track down, and one that you'll probably keep going back to over the months and years whenever Regulus catches your eye. If you need a hand, the medium-bright Algeiba (γ Leo), sits near the spot where the sickle's handle and blade meet.

As the night goes on more and more of Leo rises. Soon, we'll see the lion's rectangular midsection, and then its triangular hind quarters, along with the second-magnitude Denebola (β Leo) at its tail. By the middle of March, just as we pass the equinox and cross into spring, we'll see the whole thing stretched across the sky above us. These stars will stick with us into summer's swelter.

These changes don't come fast, but spring is almost already in the air, with good things to come. ■

Scott Levine's astronomy blog, *Scott's Skywatch*, can be found at https://scottastronomy.wordpress.com/ or email him at astroscott@yahoo.com

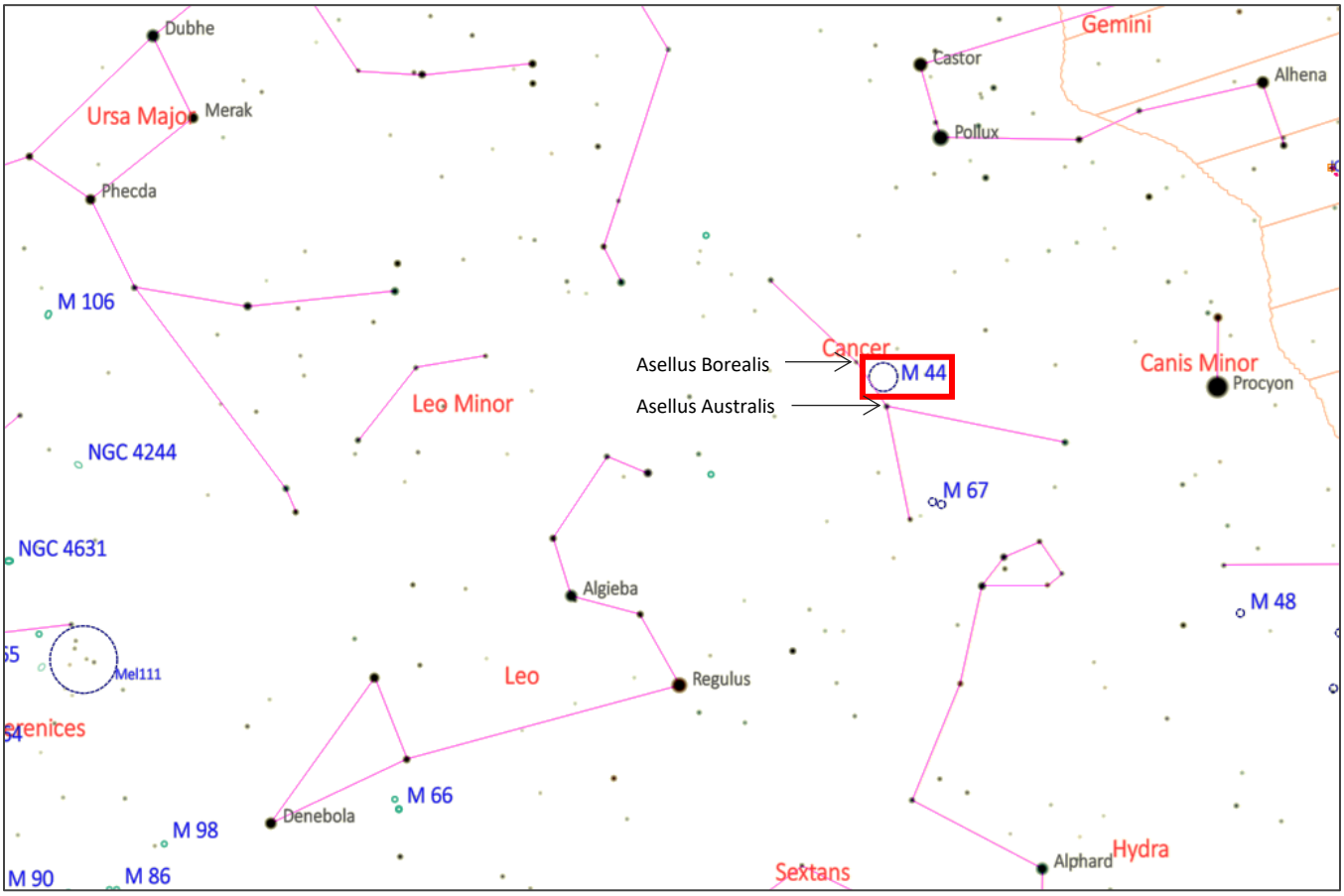
Deep Sky Object of the Month: Messier 44

Messier 44	
Constellation	Cancer
Object type	Open Cluster
Right Ascension J2000	8h 40.4m
Declination J2000	+19° 40’
Magnitude	3.1
Size	1.2 degrees
Distance	515 LY
NGC designation	2632
Other names	The Beehive, Praesepe

The Greeks called it *Praesepe*, meaning “The Manger," a feeding-trough for two donkeys represented by stars on either side of it, Asellus Borealis and Asellus Australis (Gamma and Delta Cancri). To Hipparchos, it was simply *Nephelion* ("Little Cloud"). To the Chinese it was *Tsieh She Ke*, “the exhalation of piled-up corpses.” Galileo viewed it, remarking that it was “not one but a mass of more than 40 small stars.” Messier first noted it in 1769. It’s high overhead this time of year, easy to find and a great view at low power even in a small scope or binoculars.

Visibility for M44			
10:00 pm EST	2/1/22	2/15/22	2/28/28
Altitude	58° 41’	65° 44’	68° 20’
Azimuth	125° 42’	149° 24’	179° 58’

M44 is the sixth-nearest open cluster, just a bit further away than the Pleiades. It contains about 1,000 stars, two-thirds of which are class M. Twenty of its stars are brighter than magnitude 8.0



Shooting the Crab — Mauri Rosenthal

Figure 1. My December 2021 HA/O3 Crab Nebula image as showcased in Flickr's Explore. Borg 71FL HA/O3 unguided 8 second exposures; 2 hours HA+ 2 hours O3. Camera: QHY 163 mono. Processed in PIxInsight and ACDSee.

Around midnight on Christmas Eve, I was texting with my brother and a friend in California when my phone started chiming. I was thrilled to see that Flickr had promoted my most recent astrophoto to their "Explore" page! This is where they highlight 500 images selected from their daily haul of about one million. Even placed well "below the fold," my photo would receive over 5,000 views by the New Year. About one viewer in 50 "faves" the image and each time this happens, an angel gets its wings…. Er, no, that doesn't actually happen, but my phone vibrates, and I get a pleasing hit of dopamine, which added greatly to my holiday cheer!

While nerdy social media glory was not part of my original plan for astrophotography, posting in Flickr and Instagram costs me little but adds a couple of important dynamics to my hobby. First is some discipline – when I start processing my data it's with the thought that I'm trying to reach an endpoint at which the image is good enough to share. Otherwise processing can sprawl indefinitely and my hard drive would continue to fill up with incomplete projects.

Second is having a handy catalogue of my images. By posting the "Tech Stuff" with each finished image, I've maintained a cloud- based catalogue dating back to mid-2014—within a few days of my retirement, not coincidentally—which is relevant to this shaggy crab story. Let's go back in time to my early days of astrophotography to see if I've learned anything useful.

I like my first attempt at M1 (Fig. 2) for a few reasons.

Figure 2. Guided 3.5" Questar CCD image, November 2014. 2.5 hours total exposure time, processed with Nebulosity 3.2 and Gimp. Camera: Starlight Xpress Trius SX-9C.

Never mind that I had not yet figured out how to focus consistently. The first big item here is recognizing that this weird ghostly shape may not remind *you* of any crabs you've encountered, but to me it looks a LOT more like a crab than my recent shot looking like an alien Easter egg. With less color and definition of the nifty lacework of debris still holding together after nearly a thousand years, this version speaks to us regarding some of the fascinating history of this celestial object.

A thousand is not a round number I just pulled out of a hat. A hundred years ago, the nebula was definitively linked to a stellar explosion recorded as a supernova by Chinese and Japanese astronomers in 1054 CE. But the 18th and 19th century astronomers who characterized and named the nebula didn't know that. Even though the nebula was first noted in 1731 by John Bevis, it first took on importance when Charles Messier encountered it about 30 years later. Frustrated that he was observing a fixed object rather than a more exciting comet, he was inspired to create his famous catalogue of faint fuzzies. The designation of Messier 1 or M1 arises from the coincidence that it just happened to be in the section of Taurus where Messier was searching for Halley's Comet, and thus was first in his catalogue. I suspect that whatever Messier observed through his 4-inch scope from downtown Paris looked more like this 2014 image than anything else you'll find in this article.

Incidentally, I'm confirming these factoids via Wikipedia, and I highly recommend the entry on the Crab Nebula. It includes a lot more information about its unusual and ever-changing astrophysics. Rather than rewrite the article here, I want to emphasize only how the Crab has evolved as an astrophotography target for me. But do check it out: there's a lot going on up there.

My next imaging attempt about a year later (Fig. 3) came out much closer to my current take:

Figure 3. 2015 Guided 3.5" Questar CCD image with broadband LP filter plus O3, 6 hours total. Camera: Starlight Xpress Trius SX -694C. Processed with Nebulosity and PixInsight.

I had learned a lot and changed much my gear and technique during those 12 months. By using a newer and improved CCD camera, a 0.5X focal reducer, a couple of light pollution filters, and the knowledge gained from a 5-day PixInsight workshop, I was now creating images which resembled those of typical backyard astrophotographers. Not the best, mind you

but good enough to move up from a dismal zero "faves" to three!

The next image from two years later (Fig. 4) is not really any better. But this version used a different approach – a monochrome CMOS camera with red, green, and blue filters. The high focal length Questar still needed guiding, and processing the individual layers from individual filters was a small project. But the progress here relates to the much greater efficiency for capturing the data with a monochrome CMOS versus color CCD camera: Individual exposures were 12 seconds each versus 10 or 20 minutes; and total exposure time was dropped to 2.5 hours from six. Less than half the capture time and five faves!

Figure 4. 2017 Guided 3.5" Questar CMOS LRGB image using mono CMOS camera. Camera: QHY163 mono. Processed with PixInsight.; 2.5 hours total.

Two more years passed while I converted most of my imaging to small refractors and very short exposures. My Questar is a Maksutov Cassegrain reflector, with impeccable optics in a very compact format. A few years in, my deep dive into the hobby taught me that no type of telescope is ideal for all purposes. The Questar's native focal length of 1600 mm, even with the limited 3.5" aperture, is ideal for observation and imaging of solar system targets – especially the gas giants, Mars, the Sun and the Moon. But the combination of a high focal length and small aperture are very inefficient for deep sky imaging. The "focal ratio" of focal length divided by aperture is used for astro as well as terrestrial photography as a measure of the "speed" of an optical system, and Questar's f/16 (1600-mm/90-mm) is something of a joke when it comes to deep sky. So I moved on to faster refractive optics – lenses which are nearly useless for Jupiter but great for faint fuzzies.

This next one (Fig. 5) was shot through my Borg 71FL at f/5.9.

Figure 5. 2019 Borg 71FL unguided color CMOS short exposure image. Camera: ZWO ASI 1600MC; IDAS LPS-V4 nebula filter. 1.5 hours

The Borg fits on a go-to mount that facilitates target acquisition and re-alignment. The SharpCap live-stacking technique lets me accumulate data from 4-second or 8-second exposures, which are so short there is no tracking error which would show in longer exposures as elongated stars. Conventional wisdom says to shoot the longest exposures your gear will allow under given sky conditions, because faint details will be lost in noise if your exposures are too short. But cooled CMOS cameras have a very low noise profile and consequently we can stack 100 6-second exposures in a way that is equivalent to one 600-second exposure. In this case I shot 4-second exposures, which were stacked and saved every four minutes. I then brought 23 stacks into PixInsight, processing them as though they were 4-minute exposures into one integrated image. Total exposure time 92 minutes. In Flickr I got nine Faves!

The 2019 image also used a color camera with a nebula filter. Around 2016 suppliers started making "dual band" filters which only pass the same wavelengths as individual narrowband filters for H-alpha (red associated with hydrogen alpha spectral line) and OIII

(blue associated with doubly-ionized oxygen). These dual-band filters were specifically designed to facilitate narrowband-type imaging with color CMOS cameras, dramatically improving the efficiency of imaging from light-polluted locales. My IDAS LPS-V4 filter is a little more permissive and gives me fine results on nebular targets from the Bortle seven (red) zone conditions of my Yonkers back yard.

With some powerful new features of PixInsight in the mix, I can say that this was my easiest Crab image. No guiding, easy target acquisition, no filter changes, one set of color images collected and processed in one night. And while my final image only had a minimal blue (oxygen) content, I was able to show off the complex internal filaments in red.

That 2019 image just preceded the pandemic; I've done plenty of imaging in the ensuing two years without returning to the Crab until just before Christmas 2021. We had a rare break in a long stream of overcast nights – but during a brilliant full Moon. I likened the moonlight to organic broccoli: it may be natural but it's still broccoli. The full Moon may be a beautiful subject on its own but it still generates city level light pollution. So I decided to shoot with narrowband filters, and an H-alpha layer of M1 fit the bill. It came out well (Fig. 6)!

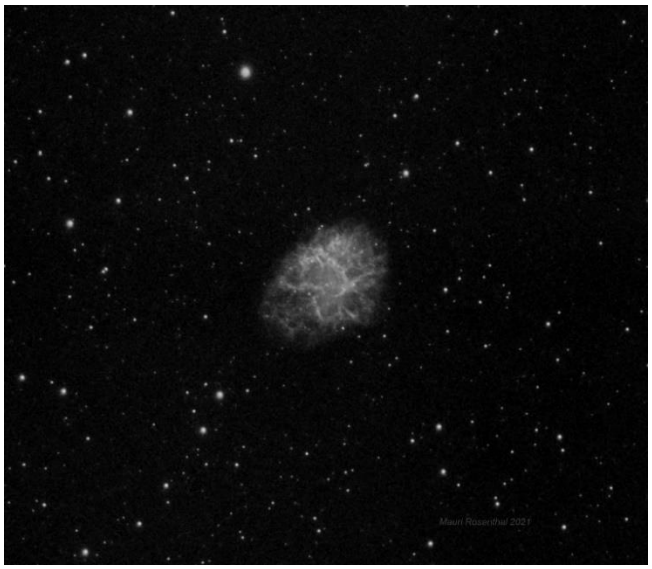


Figure 6. 2021 Borg 71FL H-alpha image; 8 second unguided exposures, 132 minutes total integration time. Camera: QHY 163 mono; filter Astronomik 12 nm H-alpha filter. Processed in PixInsight with 3X drizzle.

In this case I also wanted to take advantage of the latest improvements in SharpCap and PixInsight. Computer power is the other driver of change for backyard astrophotography.

SharpCap now includes some advanced mount control features. This means my $400 CubePro mount can be repositioned with a few clicks of a mouse. Compared with the complicated process I'd go through positioning my Questar on an invisible target in 2014, this feels like magic. The trick involves calling a plate-solving routine which compares an image to a full sky database and reveals with great accuracy where the telescope is pointed. When it's working properly, I can re-center the scope on a target with literally one mouse click. It's amazing and it makes imaging with backyard gear that much more efficient.

Notice that I managed to squeeze more lacy detail out of the 420-mm focal length Borg than the old 1600-mm Questar images. How? An important step was drizzle integration allowing me to "upscale" the resolution threefold. Drizzle is routinely used in planetary imaging to impute values between pixels when you stack frames with small variations in positioning on the sensor. The technique worked well with this dataset enabling me to zoom in and crop down to just a small portion of the frame without making the target look "pixelated" or "blocky."

When the crystalline clear sky returned the next night, I shot two hours of OIII, which I combined with the Hα layer, resulting in the image at the beginning of this article (Fig. 1).

With 123 faves and counting, I'm going to need a good reason to shoot at M1 again in 2023! Maybe I'll have a new camera or that robotic mount I've been coveting for a few years… we'll see….

Instagram:
https://www.instagram.com/mtrastronyc/

Flickr:
https://www.flickr.com/photos/124244349@N07/

Note: This article is appearing both in *Eyepiece,* the newsletter of NYC based Amateur Astronomers Association of New York and *SkyWAAtch*, the newsletter of Westchester Amateur Astronomers. I'm a member and supporter of both organizations.

■

The Astronomer at the Museum: Donati's Comet — Larry Faltz

William Turner, *Donati's Comet, Oxford, 7:30 p.m., 5 Oct. 1858*. Watercolor and gouache on paper, 10 1/8 x 14 3/8 inches. Yale Center for British Art, New Haven, CT.

We always hope that the next comet will be spectacular: brighter than the brightest stars, visible all night and maybe even in the daytime, an awesome sight for months on end. We'd like to view it in a clear, dark sky from a beautiful, restful spot, not too far from home, no mosquitos or bears, no drunken neighbors or malcontents to spoil our focus. Something like the place of William Turner's painting.

Mostly what we get are faint splotches invisible to the naked eye from light-choked urban and suburban areas, the occasional moderately bright comet hanging close to the Sun and visible for only fleetingly in the gloaming for some days just before dawn or after sunset. We're promised a "Comet of the Century" time and time again, but to no avail. Anyway, a "Comet of the 21st Century" will hardly be like prior "Comets of the Century," which didn't have to compete with brightly lit shopping mall parking lots, millions of cool LED streetlights and a general societal fixation on turning night into day. We've damaged our ability to see even moderately bright comets because of light pollution, but we're still hoping.

In 1876, Los Angeles installed four arc lights, the butterfly wings that started the hurricane. On May 30, 1878, electric street lights were installed on the Avenue de l'Opéra in Paris and around the Arc de Triomphe. That same year, London began mounting arc lamps and by 1881 four thousand were in use. Also in 1881 Paris lit all of its major boulevards. Fortunately, most of civilization was still dark at night for the Great September Comet of 1882. It might have been the brightest comet of all time, possibly reaching magnitude -20 when it reached perihelion. It was easily visible in daylight even though close to the Sun. But the Great Comet of 1882 probably did not have an impact on astronomy and society as profound as

the second greatest 19th century comet, Comet Donati, the subject of our essay this month.

In 1826, Giovanni Battista Donati was born in Pisa, a birthplace he shared with Galileo. He went to its university, an institution founded in 1343. After graduating, he joined the Observatory of Florence, becoming its director in 1864. He discovered six comets and experimented with stellar spectroscopy. The Arcetri Observatory, sited very near the house that Galileo occupied for the last 11 years of his life, was built under his supervision and was completed in 1872. He attended a conference in Vienna in August 1873, came down with cholera, and died shortly after returning to Arcetri in September 1873, aged 46.

Discovery of a Comet (*Comet V.*, 1858.)

By Dr. Donati.

(*Communicated by S. M. Drach, Esq.*)

On the 2d of June at 10h P.M. Dr. Donati discovered a comet in the constellation *Leo*, of which he obtained the following approximate position:

R.A. h m s	Decl. ° ′
9 24 35	+ 23 55

The observations underneath were subsequently made by him.

1858.	Florence M.T. h m s	Comet—Star. R.A. m s	Comet—Star. Decl. ′ ″	No. of Obs.	App. R.A. of Comet. h m s	App. Decl. of Comet. ° ′ ″
June 7	10 27 5	− 0 54·84	+ 16 42·3	2 with *a*	9 24 59·33	+24 21 58·6
8	9 37 57	−12 46·18	+ 2 14·4	2 — *b*	25 2·40	27 40·7
9	10 52 1	−12 43·27	+ 9 10·2	2 — *b*	25 5·31	34 36·5
10	9 57 54	−12 38·95	+15 32·0	1 — *b*	25 9·63	40 58·3
11	10 25 41	+13 39·55	−13 30·6	2 — *c*	25 15·84	47 38·4
12	10 35 2	+13 44·77	− 7 9·1	2 — *c*	9 25 21·06	+24 53 59·9

Mean Places of Comparison Stars for 1858·0.

	R.A. h m s	Decl. ° ′ ″	
a	9 25 52·76	+24 5 13·0	Lal. 18775
b	37 47·20	24 25 23·9	ι Leonis B.A.C. 3331
c	9 11 35·09	+25 1 5·5	Lal. 18355

The Comet is very faint.

Discovery report in MRNAS.

On the night of June 2, 1858, Donati discovered the comet that was to immortalize his name. At that time it was the fifth comet discovered in 1858, so he called it "Comet V 1858." Its official designation, following the schema approved by the IAU in 1994, is now C/1858 L1. The announcement of the discovery was a simple list of its positions in the *Monthly Notices of the Royal Astronomical* (MNRAS). The note was "communicated by S. M. Drach, Esq." I was unable to find out how this Drach received the information from Donati. Donati may have read a note by Drach in the March 1858 MNRAS "On the Law of Contraction of the Nebulosity of Encke's Comet," and sent him the discovery data, or perhaps it was sent directly to the RAS and Drach was merely the person who read it into the *Notices*. I could find no specific connection between them. I tracked down Drach by searching MNRAS for his obituary, and found an interesting story. Drach was a businessman, clearly an assimilated Jew, who was able to retire early and devote himself to mathematical, astronomical and historical study. I learned from a different source that he was able to read and translate Egyptian hieroglyphics. He apparently became a kind of affable amateur scholar with peculiar interests who would not be out of place as a character in a Sherlock Holmes story. He even wrote a paper on the binomial theorem, reminding me of Holmes' archenemy Professor Moriarty, author of a "treatise upon the Binomial Theorem, which has had a European vogue."[1] Unlike Moriarty, Drach apparently had a gentle soul. His obituary is reproduced at the end of this article.

In a note in French submitted to the *Astronomische Nachrichten* on June 28, Donati wrote that "I noticed that the comet's brightness increased, which agrees moreover with the calculations based on the provisional orbit that I determined. I believe that this comet will become visible to the naked eye, at the time of its passage to the perihelion."

Interest in the comet spread quickly in the astronomical community. The previous great comet, that of 1811, had arrived before the revolution in scientific communication that resulted from the creation , rapid publication and distribution by mail and railroad of scientific journals *(Astronomische Nachrichten* in 1821 and *MNRAS* in 1827). The public was reached by the explosion of daily newspapers and the impact of the telegraph. Astronomy too had advanced: coming after 1811 were great refractors in their equatorial mounts, spectroscopy and eventually photography.

Donati's comet was already being studied by professional astronomers when it became a naked eye object in September 1858, as its discoverer had predicted. It eventually sported a tail 40 degrees in length and 10 degrees wide. Its presence overhead for much of the night in the fall and early winter of 1858 made it a grand entertainment for the public, who were able to see it in all its glory in the dark skies that crowned both urban and rural communities.

[1] Arthur Conan Doyle, *The Final Problem*

The *New York Times*, whose complete archives are on-line, published several stories about the comet. The edition of October 2, 1858 carried a lengthy report, first published in the *Cincinnati Gazette*, of observations by astronomer Ormsby Mitchel at the Cincinnati Observatory. He used an 11-inch Merz and Mahler refractor that, when it saw first light in 1845, was the largest refractor in the western hemisphere and third largest in the world. This observing report is straightforward and descriptive, as one would expect from a professional astronomer. Mitchel also notes,

> No one can gaze on this gigantic object, in all its misty splendor, without a deep impression that the eye is resting on a mass of nebulous matter precisely such as the nebulous theory of La Place *(sic)* supposes to have been the primordial condition of our sun and all its attendant planets, and from which chastic *(sic)* [2] condition this beautiful system of revolving worlds has been evoked by the action of a single law.[3]

On October 9, 1858, the *Times* published a lengthy historical review of comets, which began with "The whole world, just now, are more or less excited about comets, and comets are, therefore, proper subject for journalistic reflections, at a time when DONATI'S *(sic)* comet is in full view, and is attracting the attention of savants, professional and amateur, in both hemispheres."

Journalists rushed to local observatories, reporting both the mundane and the outrageous. At the Paris Observatory, Joseph Urbain LeVerrier wrote to Donati to complain of a "crowd of journalists publishing the most fanciful observations and the most extravagant theories." The *New York Times* carried at least one story of this type, on November 1, 1858:

> DONATI'S COMET SEEN THROUGH DONATI'S TELESCOPE.-The Florence correspondent of the Newark Daily says: "I saw the Comet a few evenings ago through the telescope of Donati, its discoverer; but the effect was not good. Signor Donati estimates its period around the sun at about 30 years. 'Why, then' I asked 'has it not been known and registered?' 'Because,' he replied, 'it may have been obscured by unfavorable seasons; for if it should return in the Winter, it would not be seen.' Other observers conjecture it to be a comet of sixty years ago, but without hazarding a positive opinion. If it should prove so, of course our townsman would lose the credit of discovery, and the Comet its name. Its velocity is so great, said he, that a planet like ours in its course would be involved in its nucleus in about five minutes. What a hurricane that would be! Imagine a wind sweeping across our entire earth in five minutes." [4]

Donati was, at least for the short while that the comet was in the sky, a celebrity of sorts. His obituary[5] in MNRAS, February 1874, notes that

> His fortunate discovery of a small telescopic comet on June 2, 1858, which ultimately became the remarkable comet of that year, brought him at once into general notice. From being a comparatively obscure observer, Donati found himself suddenly the astronomical hero of the day, for his brilliant comet not only formed an interesting subject for intelligent study, on account of the various speculations as to its physical constitution, but it also created for a time a lively taste for astronomy among all classes of the community.

Abraham Lincoln looked at it the night before his third debate with Stephen Douglas. Jules Verne noted it in his diary, as did Dickens and Hawthorne in theirs. It inspired quite a bit of poetry, a literary form more widely respected in the 19th century than now. "The Comet at Yell'Ham"[6] by Thomas Hardy, penned in 1902, wistfully recalls his view as an 18-year-old, and rues the passing of time.

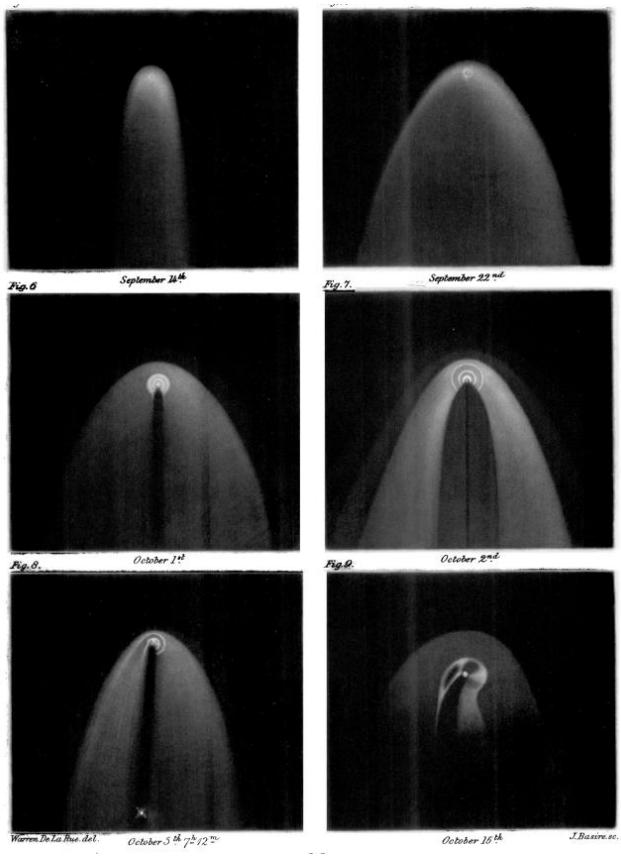
> It bends far over Yell'ham Plain,
> And we, from Yell'ham Height,
> Stand and regard its fiery train,
> So soon to swim from sight.
>
> It will return long years hence, when
> As now its strange swift shine
> Will fall on Yell'ham; but not then
> On that sweet form of thine

Of course, a comet makes its greatest impact on the eyes, and it is through visual imagery that we have our greatest appreciation of this astronomical gem.

Donati's Comet was the first comet to be photographed. William Usherwood made an image on September 27, 1858, with a portrait lens. This image has apparently been lost. The next night Harvard astronomer G.P. Bond made the first of several images

[2] "Chastic" is certainly a typographical error, the word "chaotic" being intended.
[3] "Single law" meaning Newtonian gravity.
[4] The actual orbital period is about 2,000 years, which had already been suggested by November.
[5] From which, sadly, we get no sense of Donati as a person.
[6] Yellowham Hill is near Dorchester in southwest England.

through a telescope. These are reproduced in a lengthy study of the comet that he published in the *Annals of Harvard College Observatory* in 1862. More of a book than a scientific article, Bond's "Account of the Great Comet of 1858" was a landmark in scientific thoroughness, communicating the observations of 87 of his colleagues in exacting detail and earning him a gold medal from the Royal Astronomical Society. Unfortunately, the photographs don't reproduce well in the scanned on-line version of this work.[7] Illustrations in reports by several British astronomers in the *Memoirs of the Royal Astronomical Society* the same year display much better and are worth a look.[8] Here's an example:



A representative plate from"Observations on Donati's Comet. Sketches and Notes" by William Lassell and others, in *Memoirs of the Royal Astronomical Society*, 1862.

There are quite a few paintings, sketches and illustrations of Donati's comet. The stimulus for this article is the painting on page 13 by British landscape artist William Turner (usually called William Turner of Oxford so he is not confused with the more famous Joseph Mallord William Turner). It's a watercolor and gouache rendering of the comet as seen near Oxford, where Turner lived and worked. The painting is at the Yale Center for British Art in New Haven, the largest collection of British art outside of the United Kingdom and well worth a visit (admission is free). The Met has two of his watercolors. Not surprisingly, the Ashmolean Museum in Oxford has the bulk of Turner's output, over 140 paintings and sketches.

Turner shows us that a comet can be an appealing subject for art on its own. James Poole's *Donati's Comet* similarly shows the comet in a natural setting, free of the entrapments of civilization.

James Poole, Donati's Comet, Sheffield Museum, UK.

The comet is still the main focus of a dramatic oil painting by the important British landscape artist Samuel Palmer, but now humanity is brought onto the scene. At least two of the figures in the foreground seem to be astonished at the spectacle. The painting was stolen from a private collection in 2014 and apparently has not yet been recovered.

Samuel Palmer, *The Comet of 1858, As Seen From the Heights of Dartmoor.*

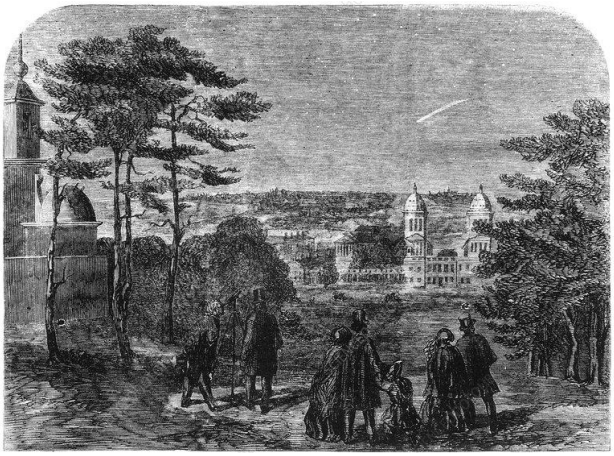
After a while even a wonderful comet like Donati's might become commonplace, a fixture of the scene. Of the people at the seashore in Scottish painter

[7] https://is.gd/gpbond1862. It's a large file (57.6 Mb).
[8] https://is.gd/donatimras

William Dyce's *Pegwell Bay, Kent – a Recollection of October 5th, 1858,* only one fellow on the extreme right seems to be looking at the comet, barely visible in the sky at the top edge of the canvas, right below the red marker. The painting tells us that the comet was bright enough to be visible in broad daylight. Enlarge the page to get a better view.

William Dyce's *Pegwell Bay, Kent – a Recollection of October 5th, 1858.* Tate Britain, London.

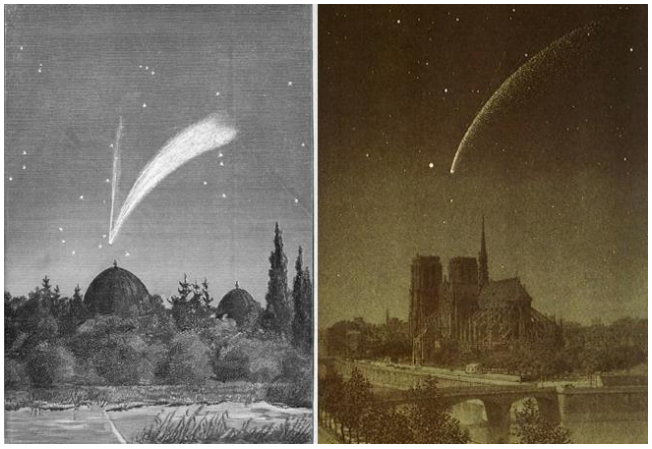
A few newspapers had begun to carry illustrations by 1858. The *illustrated London News* was the first (1842) to feature images. Its graphics were engravings, done quickly but expertly to make publication deadlines. The first successful illustrated newspaper in the U.S. was *Frank Leslie's Illustrated Newspaper*, a weekly that ran from 1855 until 1922.[9] Periodicals also carried lithographs of the comet.



Illustrated London News, 1858. The scene is in Greenwich Park, with the Royal Observatory on the left.

[9] The first half-tone reproduction of a photograph in a newspaper was in 1880.

Ludwig Becker, Donati's Comet as seen at Melbourne, on October 11th, 1858, *Transactions of the Philosophical Institute of Victoria*, volume 4. National Gallery of Australia.

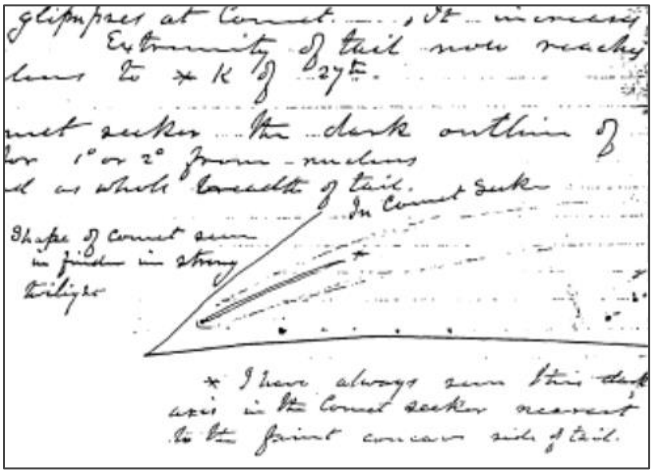


(L) Engraving after a drawing By K Graff; (R) The comet over Notre Dame de Paris, from a contemporary postcard, reproduced in the popular science book "Le Ciel" by Amédée Guillemin (1877).

Henri Daumier, "Monsieur Babinet alerted by his doorkeeper to the appearance of the comet." Published in: *Le Charivari*, September 22, 1858. Brandeis Institutional Repository.

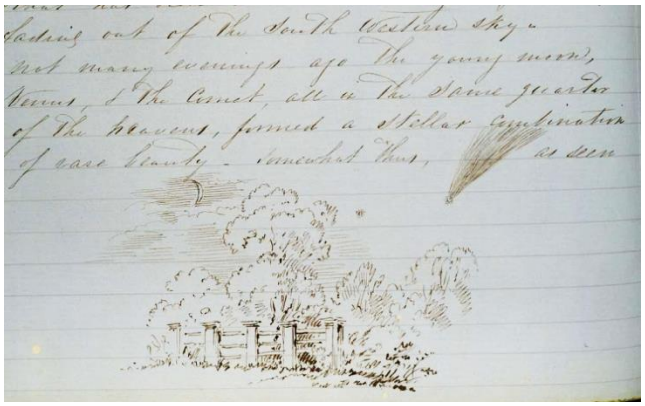
The frenzy surrounding the appearance of the comet, as well as the often peculiar behavior of amateur astronomers (some of it undoubtedly still risible today) was captured by the famous French illustrator Henri Daumier. The cartoon had a second purpose: Jacques Babinet was a mathematician, physicist and semi-professional astronomer who made several important contributions to physics and optics, including standardizing the Ångstrom unit and inventing the Babinet compensator. A device for studying optical polarization, it is still manufactured for use in light microscopy and crystallography. Babinet also wrote and lectured to lay audiences on science topics. He was very popular, a Parisian version, perhaps, of Neil deGrasse Tyson. It was said that "unlike many of his contemporaries, Babinet was beloved by all for his kindly and charitable nature."[10] Somehow that made him an inviting target for Daumier's biting anti-establishment satire. He was featured in a number of the artist's satirical drawings.

Sketches by scientists and laymen, as distinguished from artists' renderings or formal figures in scientific texts, are also part of the legacy of Comet Donati.



GP Bond's notebook of September 28, 1858. From Pasachoff, J, Olson, R, Hazen, ML, The Earliest Comet Photographs: Underwood, Bond and Donati, 1858, *Journal of the History of Astronomy*, 1996 https://is.gd/ZssJQ1.

The New York Public Library owns the diaries and sketches of Thomas Kelah Wharton, a New Orleans architect. Wharton made a number of drawings of the comet and documented his impressions over several months in an elegant script typical of an earlier age and skill with a steel-nib pen. He described the arrangement of the comet, the young Moon and Venus in the early evening of October 15, 1858 as "a stellar combination of rare beauty."



Thomas Kelah Wharton, Diary for October 15, 1858 (NYPL).

The scientific literature regarding Comet Donati in 1858 and 1859 consists of at least one hundred observation reports from around the world, almost all of which were either lengthy tables of the comet's position in the sky at different dates and times or narrative descriptions of its morphology, sometimes accompanied by accounts of the weather. From some of these reports you can glean the excitement or the disappointment of a night's viewing.

Oct. 3, 7h. The appearance of the comet is generally similar to that of last evening. The inner disk, however, appears larger; and on its surface is a well-defined dark spot, about the same size as the nucleus, situated a little to its left, in the direction of the comet's diurnal motion.—[W. C.]

The centre of curvature of the southern edge of the comet's tail was about 3° below 12 *Canum Venaticorum* (*Cor Caroli*). —[G. B. A.]

Oct. 4, 7h. The night unfavourable, and the comet was seen for a few minutes only. The outer annulus of light was narrower and less brilliant; the inner disk was evidently broader than on previous evenings; the spot on its surface was distinctly seen in the same position as before.—[W. C.]

Oct. 5, 7h. The nucleus was much as before; but I am not certain whether the small surrounding circle was visible. I fancied that I saw it, much contracted. The large surrounding circle was very plain, and was distinctly separated from the parabolic envelope; the black shadow more obtuse; the tail about the same length. The general light of the comet, I think, was diminished. Its head now is not so bright as *Arcturus;* whereas, in the last two views I thought it much brighter than *Arcturus*.—[G. B. A.]

A typical observing report, from "Observations of Small Planets and of Donati's Comet, made at the Royal Observatory," *Monthly Notices of the Royal Astronomical Society*, October 1858.[11]

[10] From the profile of Babinet at https://is.gd/SxocCZ.

[11] G.B.A. is the Astronomer-Royal, George Biddell Airy; W.C. is W. Christy, but it's not clear who this actually is. In a later entry in MRNAS, "W. Christy" is described as one of the Observatory's "computers."

Changes in the comet's morphology, intensely tracked and discussed, were correctly ascribed to the influence of solar radiation.[12] There were no spectroscopic observations, since it was only in 1859 that Kirchoff and Bunsen identified the source of the lines in the Sun's spectrum, too late for Comet Donati.

At a 2009 International Astronomical Union conference on "The Role of Astronomy in Society and Culture," three astronomers from the Arcetri Observatory described the impact of Comet Donati across the world. David Livingston, on his second trip to Mozambique, noted the comet in his diary and reported the natives' reactions to it. Mongkut, the King of Siam, respected mathematics and Western astronomy (partially because of an interest in astrology). He observed the comet and gave speeches to try to calm his concerned subjects. This is the same fellow who is the subject of the musical *The King and I*. In Japan, the comet was called *hokiboshi*, the "broom star," because of its resemblance to the Japanese housekeeping utensil. Although the historical fear that comets were harbingers of doom had been abandoned in the West, many Japanese continued to equate its presence with the disruptive political and social events that shook the country at the time, just five years after Commodore Perry sailed into Tokyo Bay to open the country to western commerce and influence.

Contrast the study of comets today with that of 1858. Comets are now detected at magnitude 18 or 20 by an imaging sensor in a survey telescope, not by a patient human eye. Accurate orbits are solved soon after discovery, not after weeks of meticulous observation and manual computation. Morphology has only passing interest (except perhaps to spacecraft); light curves and spectroscopy are key and now we even have comet geology. Journals do not publish ephemerides; data gathered by the IAU Minor Planet Center comes as files we upload to our computer planetarium programs. Most comets are tiny, nearly invisible objects. Yet now, as then, a rare great comet retains its beauty and wonder, entices the public and advances science.

Thanks to John Paladini for reminding me of Donati's Comet. ■

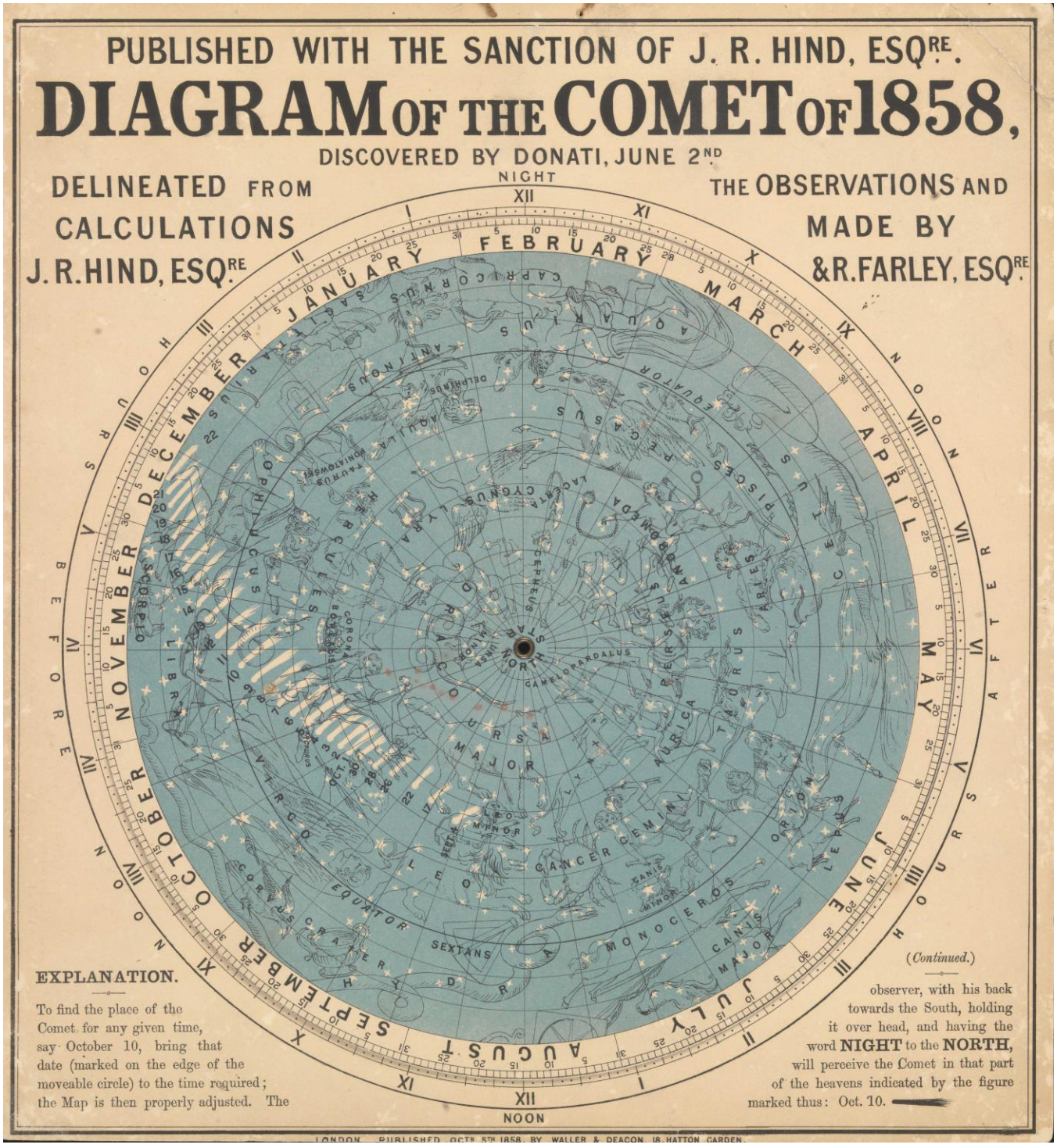
[12] A summary of the astronomical community's findings is in MNRAS in 1859. https://is.gd/Y0c40V pages 141-150.

Obituary of S.M. Drach (*MNRAS* January 1880)

Solomon Moses Drach was born in Bury Street, St. Mary Axe, London, in 1835 (*sic*, the correct date is 1815.-Ed.). He went to a school kept by Mr. Cutler, in Devonshire Street, and afterwards to one kept by Mr. Tait, where he remained for two years. His own name was Solomon Moses, and he took the name of Drach from his aunt's husband, Mr. Liepman Woolf Drach, who (after his aunt's death) left him his fortune. He married, on August 4, 1841, his cousin Rebecca, the daughter of another aunt who had also been adopted by Mr. L. W. Drach. His uncle died on April 18, 1840, and he continued his business of a commission agent till the death of his aunt, which occurred on June 9, 1847, when he devoted himself to study, being chiefly interested in mathematics, astronomy, and biblical and antiquarian subjects. Mr. Drach's first published paper appeared in the *Philosophical Magazine* for 1839, and was entitled "On the use of Barometrical Formulae for determining the Heights of Mountains." He published also, in the *Philosophical Magazine* for 1849, several papers on mathematical questions relating to the description of epicyclical curves. These also had reference to, and contained some account of, the epicyclical curves which Mr. Perigal had traced geometrically in 1835, and by continuous circular motions in 1840. Mr. Drach published numerous short papers in the Monthly Notices of the Society. He was also a frequent contributor to the library of the Society, having presented at different times many volumes, chiefly old astronomical and mathematical works; and after the removal of the Society to Burlington House he passed much of his time in the library, working at his favourite subjects. Some years ago he presented to the Royal Society two large volumes containing resolutions of numbers into sums of squares and cubes; and he devoted much of his time to work of a similar kind. He died, at 23 Upper Barnsbury Street, Islington, on February 8, 1879. He was elected a Fellow of the Society on May 14, 1841.

Mr. Drach was a member of the old Mathematical Society, and became a life Fellow of this Society when the former was merged into it in 1845.

I wonder if this is the first time in the 21st century, or maybe even since the end of the 19th, that anyone took notice of Mr. Drach. What would astronomy do without so many worthy but obscure or even anonymous individuals? (LF)



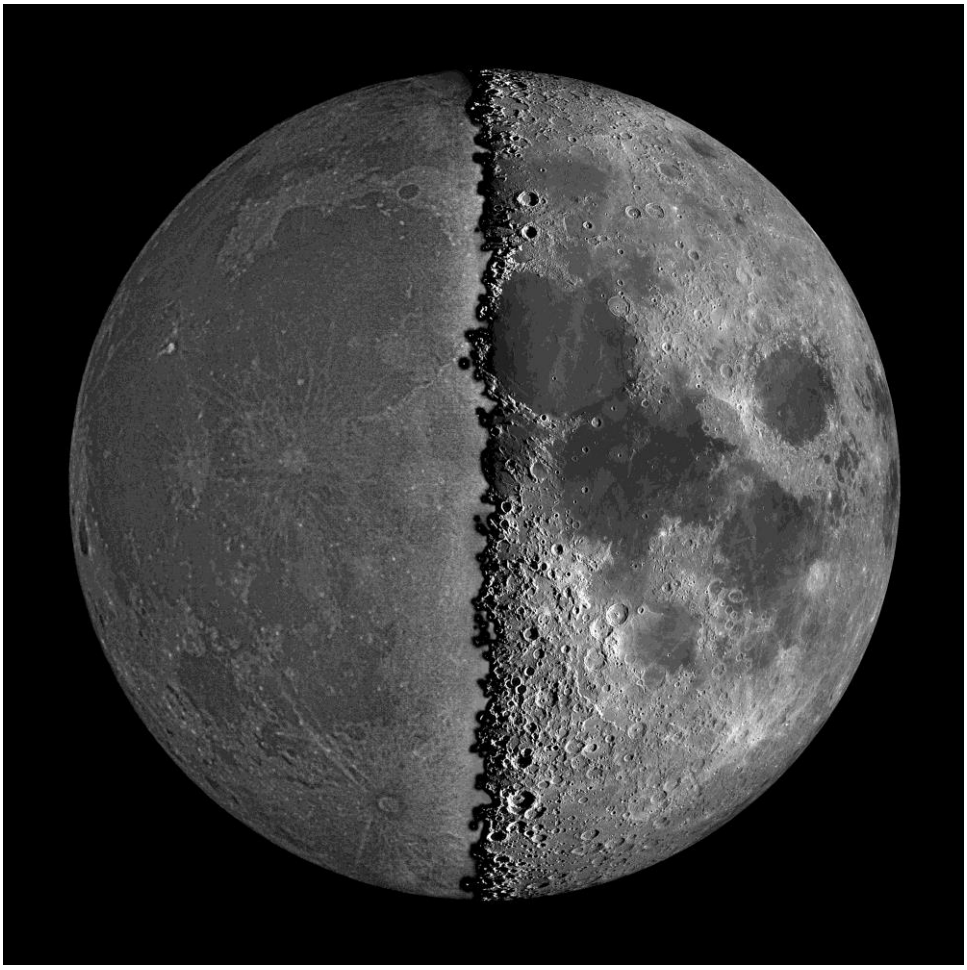
A working planisphere giving Comet Donati's position in 1858. The planisphere was originally published on October 5, 1858, five days before the comet's closest approach to Earth. John Russell Hind was a former assistant at the Royal Observatory, Greenwich, and in 1858 was the Superintendent of the Nautical Almanac Office. Richard Farley was an Assistant and then Chief Assistant at the NAO between 1831 and 1869. A modern printing of this planisphere, with functional rotating dial, is sold by the Royal Museums, Greenwich (of which the Royal Observatory is a component) for £28.95. The size of the object is 22 x 24 cm.

Images by Members

Two Faces of the Moon by Robin Stuart

The hours of darkness prior to the WAA's December lecture by Massimo Capasso on *Single-photon technologies for ground-based gamma-ray astronomy* afforded a brief period of clear skies with unexpectedly good seeing and the six day old Moon near the meridian. This composite image shows the sunlit surface of the Moon on the right and the surface illuminated by Earthshine on the left.

The sunlit side was processed using methods described in the April 2021 SkyWAAtch, p.14. A strong north-eastern libration (sub-Earth point 7.2°N 7.5°E) provides a good opportunity to explore features on the extreme eastern limb. These were described previously in the January 2021 SkyWAAtch, p.20 but this libration was more than 1° greater in overall magnitude. The far eastern shore of Mare Smythii is seen clearly defined. The slight brightening on the Moon's limb between Mare Humboltianum and Mare Crisium encircles the young crater Giordano Bruno, which is surrounded by an extensive ray system and sits just out over the limb.



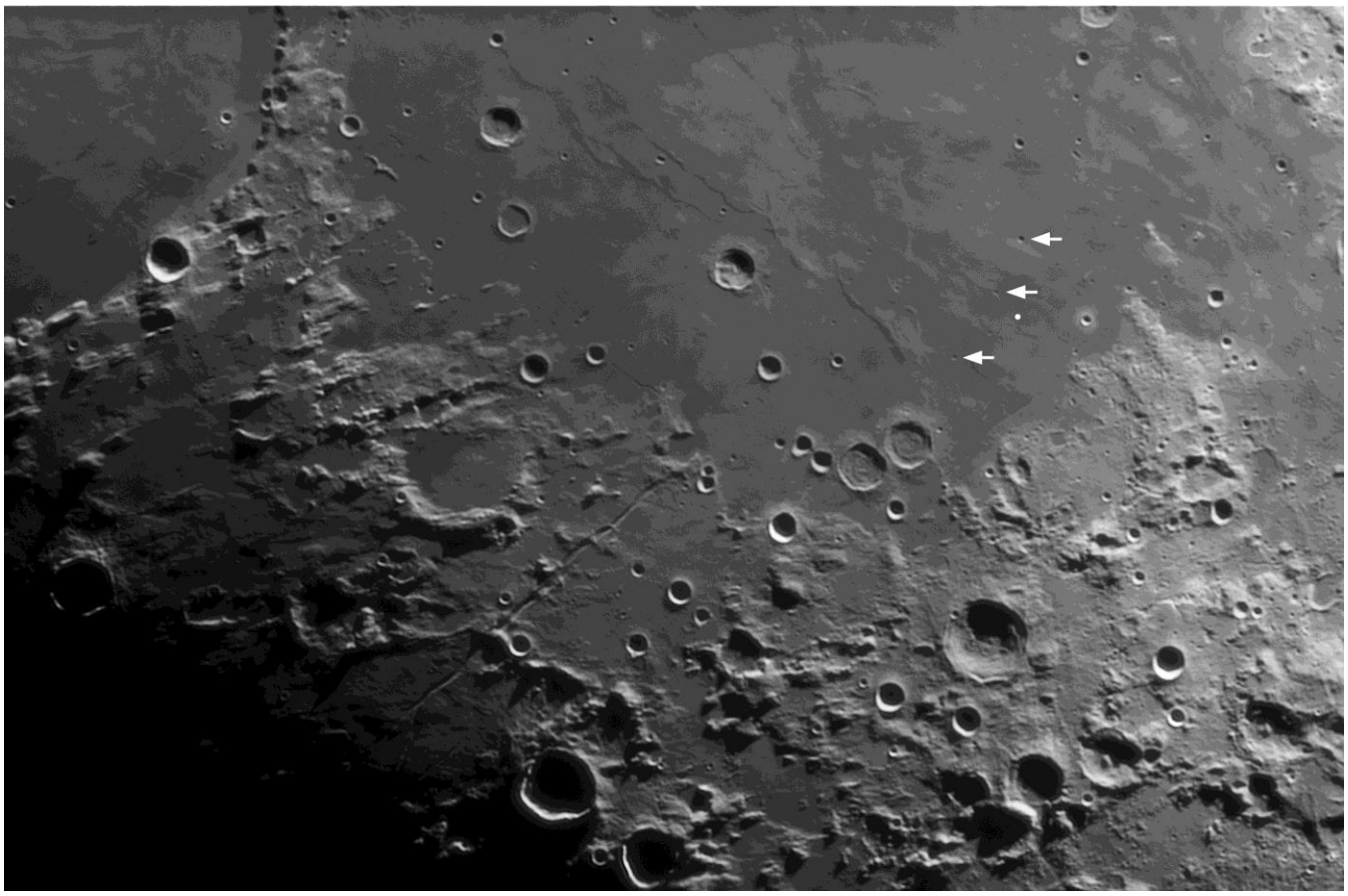
Earthshine or *Old Moon in the New Moon's arms* is easily visible on the young crescent Moon with the night side of the Moon's surface illuminated by the light from the gibbous Earth shining brightly as it hangs in the lunar sky. The direction of the illumination that produces Earthshine is the same as the direction of the illumination when the Moon is full with the difference being that in the latter case the light source is the Sun. Hence, like the light of the Full Moon, Earthshine is uniformly bright across the observed face of the Moon (see April 2021 SkyWAAtch, p.14). As the synodic month progresses the Earth, as seen from the surface of the Moon, wanes and provides less and less light. The Earthshine fades and is increasingly overwhelmed by glare from the sunlit portion of the Moon's surface. By about first quarter, surface features illuminated by Earthshine can still be faintly made out through a small telescope. Photographing them can be challenging however. Exposures have to be long enough to gather sufficient signal but not so long that details are swamped by glare from the sunlit surface and internal reflections within the optics.

Processing of this image was done by first subtracting a smooth approximation of the glare profile and applying the unsharp mask twice – first with a large radius to flatten the residual glare gradient and then a smaller one to

bring out the details. This was performed in *Mathematica* with an adjustment made to the standard unsharp mask which would otherwise produce artifacts at the limb. Some final tweaks were made by manual dodge and burn in GIMP before the images were combined.

Features familiar when observing the Full Moon are clearly visible (see WAA newsletter May 2020 p.17). The broad ray systems of Copernicus and Eratosthenes stand out just north of the Moon's equator while that of Tycho can be seen in the south. The bright young crater, Aristarchus, gleams in the upper left.

The Shores of Tranquility by Robin Stuart

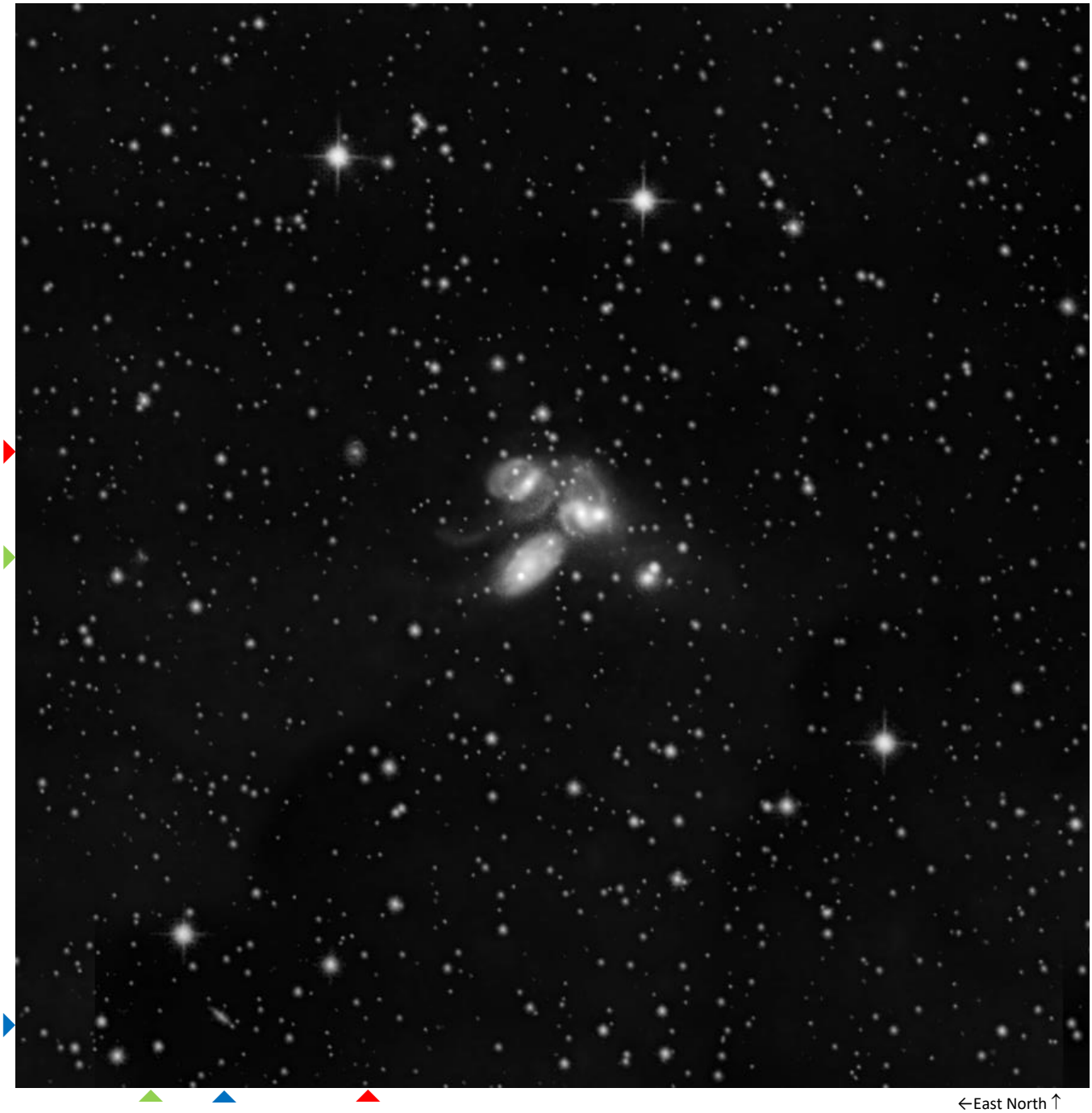


The image above shows the Mare Tranquillitatis (Sea of Tranquility) emerging from the terminator. The most striking feature is the deep rille, Rima Ariadaeus with the more modest Rima Sosigenes running at right angles above its right-hand end. Mare Serenitatis (Sea of Serenity) occupies the top left corner of the image. On the floor of Mare Tranquillitatis, *wrinkle ridges* radiating from and outlining the large inconspicuous buried crater Lamont are visible but will soon disappear as the Sun rises higher. The right side of the image's top border bisects the 22-km crater Maskelyne (see the May 2020 SkyWAAtch, p.9). The three small arrowed craters are, from top to bottom, Armstrong (4.6 km), Collins (2.6 km) and Aldrin (2.8 km), named for the astronauts of Apollo 11. The actual landing site, *Tranquility Base* (or Statio Tranquillitatis), is marked with a dot. For scale, the distance from Armstrong to Aldrin crater is 88 km. Below Aldrin the two shallow channels of Rimae Hypatia can be seen. Along with Apollo 11, this view also encompasses the locations where Ranger 6 (1964) and Ranger 8 (1965) were crashed on the Moon's surface, and the soft landing site of Surveyor 5 (1967).

The image is a stack of 74 subframes taken with a Meade LPI-G monochrome video camera through a Televue NP127 refractor equipped with a 5× Powermate, taken on evening of December 10, 2021.

Robin Stuart

Stephan's Quintet by Rick Bria



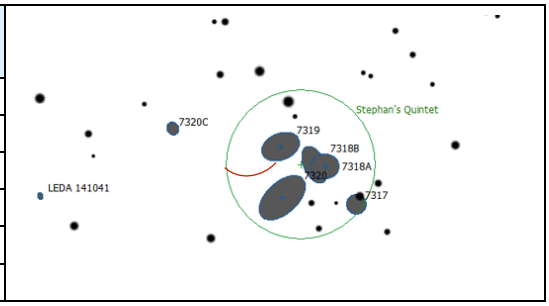
←East North ↑

Rick made this image on the night of December 13, 2021, battling a gibbous Moon just 50 degrees away. It was taken with the 14-inch PlaneWave at the Mary Aloysia Hardey Observatory at Sacred Heart School in Greenwich. Rick writes that he would have waited for a darker night, but wanted to get the image out ahead of Christmas, when many people will be watching *It's a Wonderful Life*, the 1946 Frank Capra movie with James Stewart and Donna Reed that opens with an image of the cluster, representing God and a few of his chief angels. The movie's heart-warming, tear-jerking, life-affirming plot makes it a perennial favorite. [Cynics like your Editor prefer *A Christmas Story* or *Bad Santa* for holiday entertainment. His favorite Capra movie is *It Happened One Night* with Claudette Colbert and Clark Gable.] Capra produced four television science programs in the 1950's for the Bell System: *Our Mr. Sun*, *Hemo the Magnificent*, *The Strange Case of the Cosmic Rays*, and *Meteora: The Unchained*

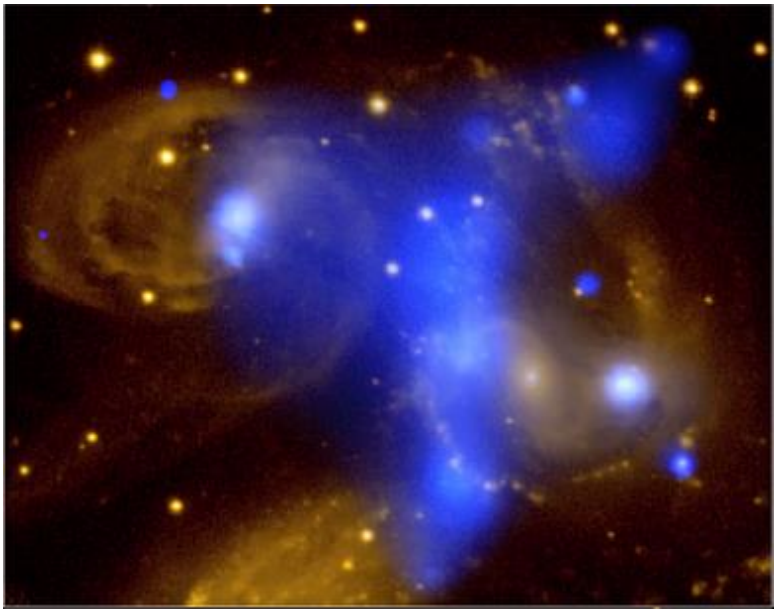
Goddess, and many WAAers of a certain age may have had their interest in science stimulated by these programs, the Editor being one of them.

The quintet, in Pegasus, was discovered in 1877 by French astronomer Eduard Stephan. It consists of NGC 7317, 7318A, 7318B, 7319 and 7320. Only four of the galaxies of Stephan's Quintet are gravitationally bound. The largest galaxy, NGC 7320, is much closer to us than the other galaxies. The true members of the group are formally catalogued as Hickson Compact Group 92. This is the most studied compact galaxy cluster in the sky. An additional member of the Hickson group is faint NGC 7320C (triangulate the red markers), which is much closer to the group than to NGC 7320. If there's NGC 7320C, there must be 7320A and B, right? Where are they? Rick's image captured NGC 7320A (blue markers), a faint spiral galaxy 250 Mpc distant, and thus clearly unrelated to either NGC 7320 or the galaxies of the Hickson group. Only infrared magnitudes have been determined for this galaxy. Spiral galaxy NGC 7320B is just beyond the left side of the image. It is 84 Mpc away from us, but probably too far from the main group to be a member of it. Rick's image contains another very faint galaxy, LEDA 141041 (green markers), about 80 Mpc distant. Its visual magnitude is not given, but it's probably around 17.5. There's no information as to whether it could be (or once was) an outlying group member.

Galaxy	Distance (Mpc)	Visual Magnitude	Type
NGC 7317	90.2	14.7	Seyfert 2 galaxy
NGC 7318A	71.2	14.3	Elliptical galaxy
NGC 7318B	60.0	13.9	Spiral galaxy
NGC 7319	46.7	14.1	Seyfert 2 galaxy
NGC 7320	13.7	12.6	Spiral galaxy
NGC 7320C	83.4	16.7	Spiral galaxy



There is a good bit of astrophysical mayhem going on in the cluster. In 1997, a multiwavelength study of Stephan's Quintet[1] proposed that initially the group initially consisted of NGC 7317, 18A, 19 and 20C. NGC 7320C probably passed through the group at least twice about 100 million years ago and stripped interstellar matter from NGC 7319. It has moved off, but left a tidal trail of stars that Rick's image captured as an arc coming from NGC 7319. It's represented by the red arc in the map. More recently, NGC 7318B has come into the group at high velocity, giving rise to a shock wave in the matter displaced earlier by the passage of NGC 7320C. The shock wave heats the gas to millions of degrees, generating X-rays.



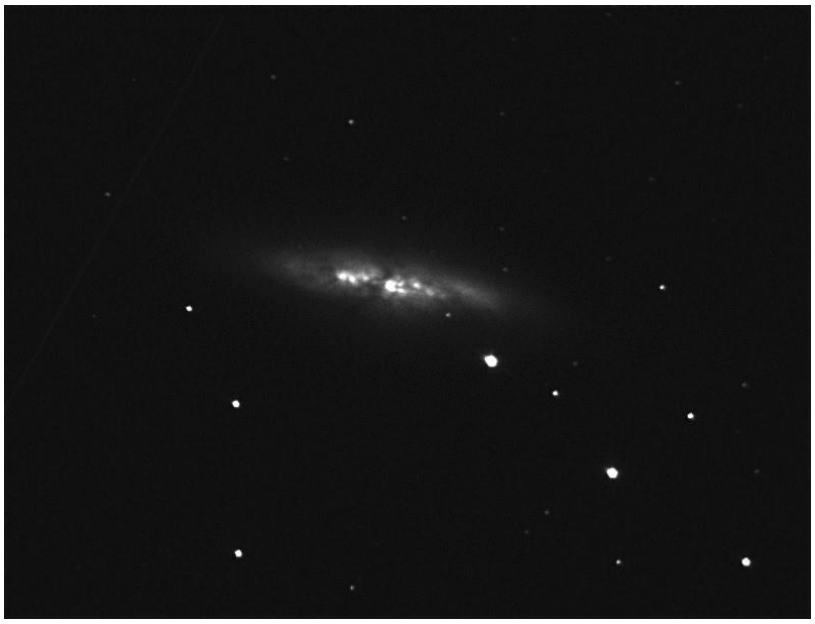
Chandra X-ray image (blue) superimposed on Sloane Digital Sky Survey image (Chandra/NASA)

Half a degree northeast of Stephan's Quintet is NGC 7331, the brightest (mag 10.3) and largest (9.8' x 3.8') member of the Deer Lick group of galaxies, 14 Mpc distant. NGC 7320 may have interacted with NGC 7331 in the distant past. This is a good galaxy to look for an 8-inch telescope.

LF

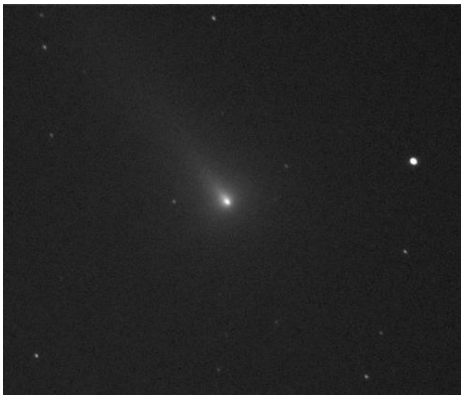
[1] Moles, M, Sulentic, JW, Marques, I, The Dynamical Status of Stephan's Quintet, *Astrophysical Journal*, Volume 485, Issue 2, pp. L69-L73, 1997. On line at https://arxiv.org/pdf/astro-ph/9707194.pdf.

More Planetary Camera images with a Schmidt-Newtonian by John Paladini

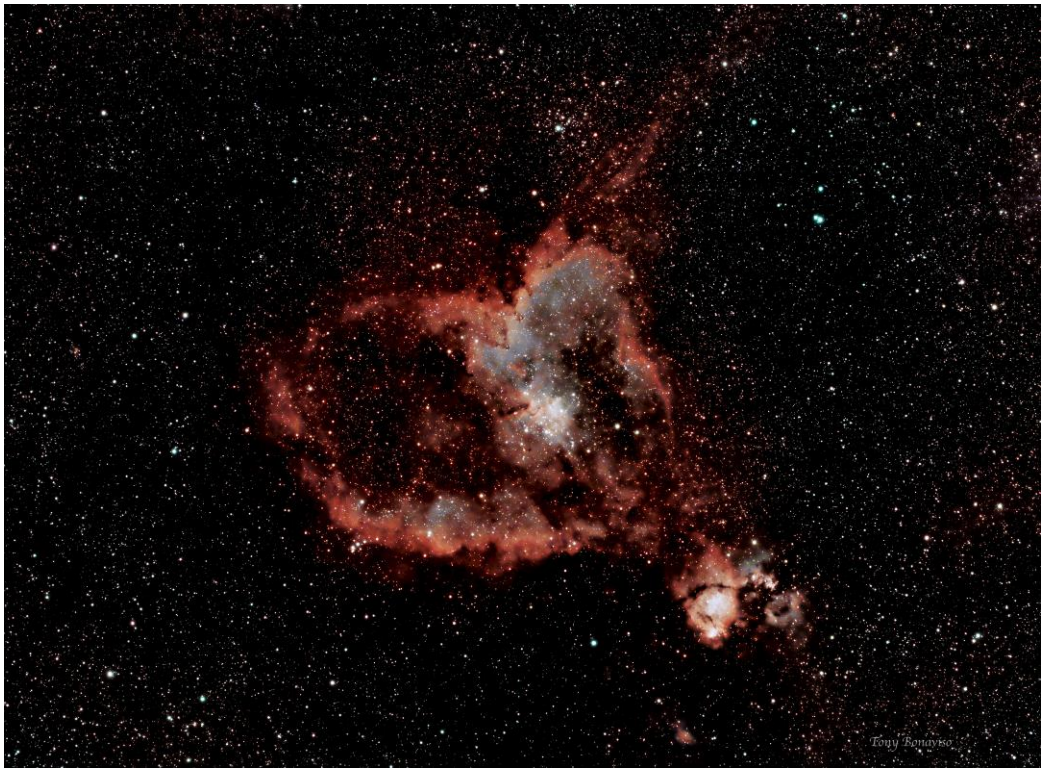


John Paladini submitted two more deep-sky images made with the combination of a fast, small Schmidt-Newtonian telescope (the Celestron Comet-Catcher, 5.5" f/3.64) on an equatorial mount and a ZWO ASI290MM monochrome "planetary" camera. See the November 2021 SkyWAAtch, page 16, for his first images with this system. All CMOS cameras have trade-offs between sensor size, pixel size and image download speeds. Planetary cameras are optimized for very rapid downloads so they can make an avi video file with dozens, if not hundreds of frames per second, reducing atmospheric blurring and avoiding planetary rotation for fast-moving planets like Jupiter. Then the images are stacked and sharpened for a final image. Because planets are bright, you don't want or need many seconds or minutes of exposure for each frame. But the cameras can be used for longer exposures with a fast telescope, up to the point at which thermal noise becomes problematic. John has done here for the images of galaxies M82 (top) and M51. Twenty frames each 20 seconds in duration were stacked to make these images.

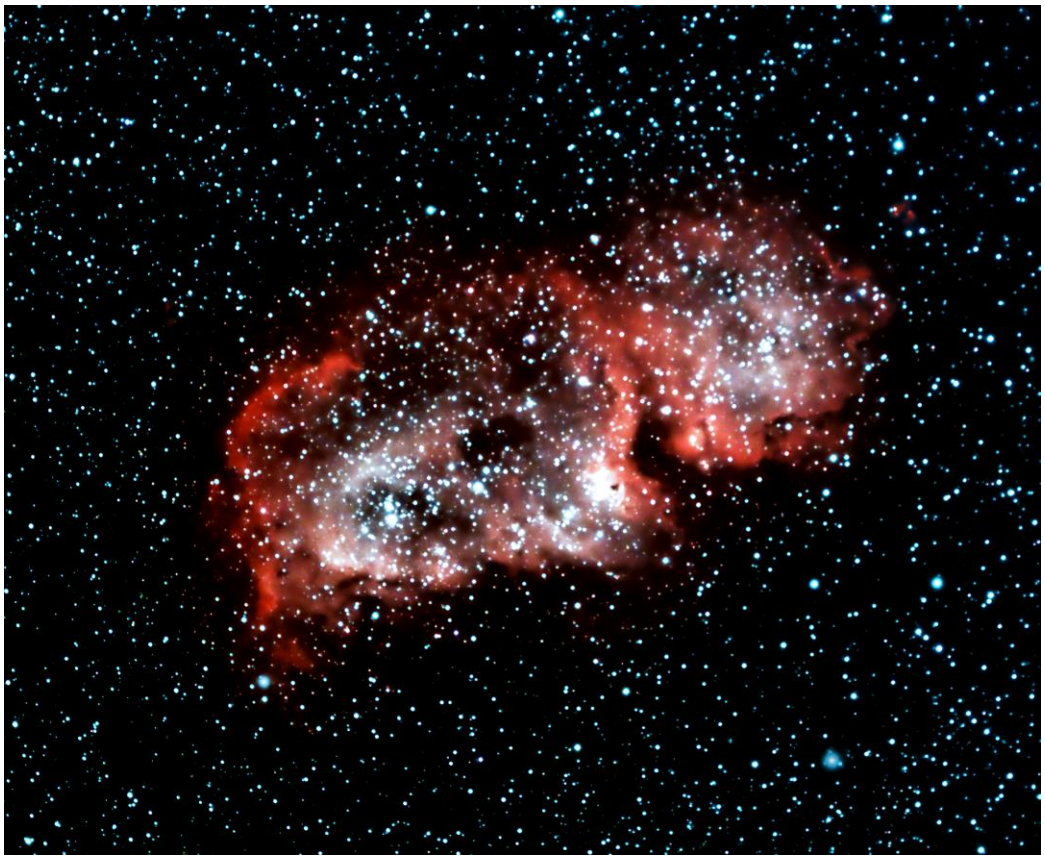
And John even caught a comet with his Comet Catcher, C/2021 A1 Leonard was imaged from Mahopac in the early morning of December 4th.



Heart and Soul by Tony Bonaviso



The Heart Nebula, catalogued as IC 1805 and Sharpless 2-190, is in Cassiopeia. The cluster at the center, catalogued as Collinder 26 and Melotte 15, provides the radiation that energizes the nebula and structures its gas. The bright knot at the lower right was the earliest part of the nebula to be discovered and is catalogued as NGC 896. The nebula spans almost two degrees of sky. Its distance is 7,500 light years.



The Soul Nebula is nearby, but is fainter. It is often referred to as IC 1848, but that's properly the designation of the star cluster within it. The nebula itself is properly Westerhout 5. The Westerhout catalog was compiled by a radio survey in 1956 by the Dutch astronomer Gert Westerhout, using the Dwingeloo radio telescope in the Netherlands. There are 82 radio sources listed, but only 79 are actual objects. Two were unsuccessful attempts to detect galaxies, and the third was just a test shot of the Moon!

Research Highlight of the Month

Zucker, C, Goodman, AA, Alves, J, *et. al.*, Star formation near the Sun is driven by expansion of the Local Bubble, *Nature* 2022; 601: 334-348 (January 20, 2022)

Abstract: For decades we have known that the Sun lies within the Local Bubble, a cavity of low-density, high-temperature plasma surrounded by a shell of cold, neutral gas and dust. However, the precise shape and extent of this shell, the impetus and timescale for its formation, and its relationship to nearby star formation have remained uncertain, largely due to low-resolution models of the local interstellar medium. Here we report an analysis of the three-dimensional positions, shapes and motions of dense gas and young stars within 200 pc of the Sun, using new spatial and dynamical constraints. We find that nearly all of the star-forming complexes in the solar vicinity lie on the surface of the Local Bubble and that their young stars show outward expansion mainly perpendicular to the bubble's surface. Tracebacks of these young stars' motions support a picture in which the origin of the Local Bubble was a burst of stellar birth and then death (supernovae) taking place near the bubble's centre beginning approximately 14 Myr ago. The expansion of the Local Bubble created by the supernovae swept up the ambient interstellar medium into an extended shell that has now fragmented and collapsed into the most prominent nearby molecular clouds, in turn providing robust observational support for the theory of supernova-driven star formation.

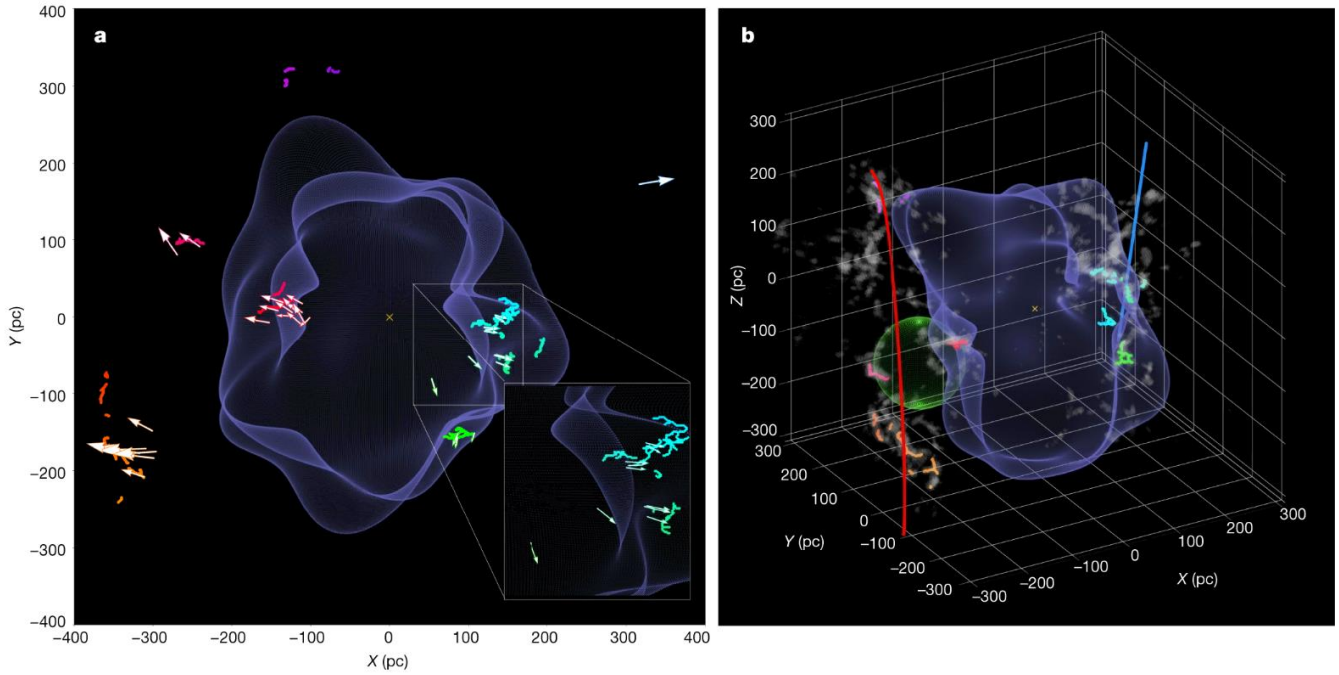


Fig 1 from Zucker et. al. a: A top-down projection of star-forming regions on the surface of the Local Bubble, whose young stars show motion mainly perpendicular to its surface. The surface of the Local Bubble is shown in purple. The short squiggly coloured lines (or 'skeletons') demarcate the 3D spatial morphology of dense gas in prominent nearby molecular clouds. The 3D arrows indicate the positions of young stellar clusters, with the apex of the arrow's cone pointing in the direction of stellar motion. Clusters are colour-coded by longitude. The Sun is marked with a yellow cross. The enlargement to the lower right shows a close-up of Ophiuchus, Pipe, Lupus and Corona Australis on the bubble's surface, along with arrows illustrating the outward motion of their young stellar clusters. **b**, A 3D view of the relationship between the Local Bubble, prominent nearby star-forming regions and Galactic structure. The Local Bubble and cloud skeletons are the same as in a. We also overlay the morphology of the 3D dust (grey blobby shapes) and the models for two Galactic scale features—the Radcliffe Wave (red) and the Split (blue). The Per-Tau Superbubble (green sphere) is also overlaid.

For more on Gould's Belt, the Radcliffe Wave and the Split, see the June 2020 SkyWAAtch.

Member & Club Equipment for Sale

Item	Description	Asking price	Name/Email
Stellarvue 90-mm triplet refractor	90 mm f/7 triplet refractor, aluminum tube, 2½-inch Stellarvue focuser, clam shell mounting ring with standard Vixen dovetail, soft case. Excellent condition.	$400	Thomas Boustead bousteadtom@gmail.com
Meade 390 refractor	90-mm f/11 doublet refractor in very good condition with several eyepieces, Barlow, aluminum tripod, accessory tray, straight-through finder. The alt-az mount head is very solid. An image of the mount head is here. Proprietary Meade interface between tube rings and mount (two thumb screws). Slow-motions with flexible stalks. A few minor blemishes on the tube. A great lunar/planetary scope.	$100	WAA ads@westchesterastronomers.org
NEW LISTING Celestron Nexstar 8i	8" Schmidt-Cassegrain go-to scope on single arm alt-az mount. Excellent optics and mechanics, mild tube blemishes. Hand control, dew shield, tripod, diagonal, 40-mm Celestron Plossl eyepiece.	$495	Jeffrey Jacobs jacobsfilm@gmail.com
ADM R100 Tube Rings	Pair of 100 mm adjustable rings with large Delrin-tipped thumb screws. Fits tubes 70-90 mm. You supply the dovetail bar. Like new condition, no scratches. See them on the ADS site at https://tinyurl.com/ADM-R100. List $80.	$50	Larry Faltz lfaltzmd@gmail.com
Celestron X-Cel 5-mm eyepiece	60-degree field, 6 elements, fully coated. Retractable rubber eye guard. Excellent condition, unmarked. Lists at $99.95. Donated to WAA.	$40	WAA ads@westchesterastronomers.org
Laser Collimator	Orion LaserMate Deluxe II Telescope Laser Collimator (for Newtonian reflectors). Donated to WAA. It works. Uses CR2032 battery. Manual and instruction video on line on Orion's web site.	$35	WAA ads@westchesterastronomers.org
T-adaptor for SCT	In original box, new condition. Front screws onto back of SCT, back end has male T-threads for attachment to a camera-specific T-adaptor or directly to a CMOS camera with T-threads. This one is branded Orion; identical to Celestron #93633-A.	$15	Larry Faltz lfaltzmd@gmail.com

Want to list something for sale in the next issue of the WAA newsletter? Send the description and asking price to ads@westchesterastronomers.org. Member submissions only. Please offer only serious and useful astronomy equipment. WAA reserves the right not to list items we think are not of value to members.

Buying or selling items is at your own risk. WAA is not responsible for the satisfaction of the buyer or seller. Commercial listings are not accepted. Items must be the property of the member or WAA. WAA takes no responsibility for the condition or value of the item, or for the accuracy of any description. We expect, but cannot guarantee, that descriptions are accurate. Items are subject to prior sale. WAA is not a party to any sale unless the equipment belongs to WAA (and will be so identified). Sales of WAA equipment are final. *Caveat emptor!*