Longmont Astronomical Society

February 2023

Cone Nebula
by Martin Butley

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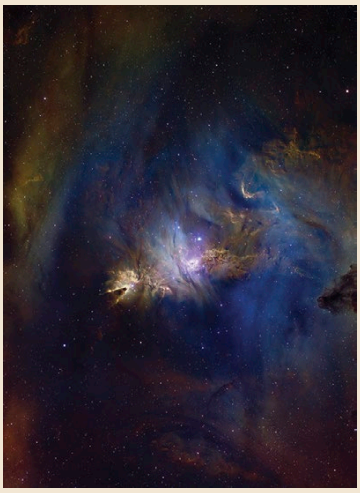
LAS Meeting Thursday, February 16 at 7 pm (Zoom Only)
Spectroscopy: Using Light to Determine Star & Planet Composition

The light that we see from the Moon, planets, and stars contains information about the chemistry of the source of that light, and sometimes, about the celestial body reflecting and refracting that light. Different star types have different spectra according to their color and age. Planets reflect and refract light from the Sun based on the chemistry of their atmospheres. Spectroscopy is the science of using transmitted and reflected light to infer the composition, temperature, mass, and luminosity of an object. Spectroscopy is not just a tool used in astronomy. It is also used in land-based applications for natural resource exploration, mapping, and surveillance. Dr. Burke's talk will introduce the chemistry and other parameters of the stars and planets as determined through spectroscopy for the non-scientist and amateur astronomers. He will also show the results of using a spectroscopic grating and interpretation software with a small telescope from a suburban location.

Dr. Ben Burke

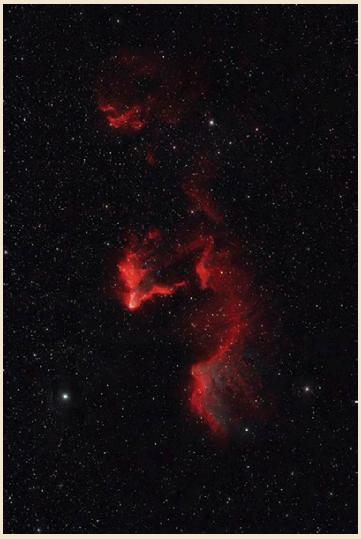
Dr. Burke is trained as a geochemist and geologist and has worked in the environmental consulting, oil & gas, and geothermal industries for a total of 24 years. He is also an affiliate professor at the Colorado School of Mines and a collaborating professor at Iowa State University, both in geosciences. He was one of the junior members of the National Capital Astronomers in the 1980s in his hometown of Washington, DC. He has never been a professional astronomer. He pursues his amateur astronomy with a Meade ETX90 from the suburban Denver area.

Front Cover Cone Nebula by Martin Butley



Martin Butley: Reprocessed some subs taken last winter - SHO 63 x 10 min subs 10.5 hours. Equipment: Takahashi 130 FSQ with an ASI6200 camera on an Astrophysics mount in Hygiene. Processed in Pixinsight and Photoshop

Back Cover: Ghost of Cassiopeia by Jim Pollock



Jim reprocessed IC59 the Ghost of Cassiopeia taken in October . The bright star below and left of The Ghost is Navi, the center peak of the W in Cassiopeia. This was 15 frames of 5-min for a total of 75 minutes of exposure with the 14" EdgeHD at f/2 with HyperStar. ZWO 6200mc one-shot-color camera with an L-Extreme filter as this is an emission nebula being excited by young stars within.

About LAS

The Longmont Astronomical Society Newsletter ISSN 2641-8886 (web) and ISSN 2641-8908 (print) is published monthly by the Longmont Astronomical Society, P. O. Box 806, Longmont, Colorado. Newsletter Editor is Vern Raben. Our website URL is https://www.longmontastro.org and the webmaster is Sarah Detty. The Longmont Astronomical Society is a 501 c(3), non-profit corporation which was established in 1987.

The Longmont Astronomical Society is affiliated with the Astronomical League (https://www.astroleague.org). The Astronomical League is an umbrella organization of amateur astronomy societies in the United States.

Contents

LAS Officers and Board Members in 2023

- Vern Raben, President
- Hunter Morrison, Vice President
- Eileen Hall-McKim, Secretary
- Bruce Lamoreaux, Treasurer

Board Members:
David Elmore, Gary Garzone, Mike Hotka, Brian Kimball, and Tally O'Donnell

Appointed Positions 2023

Sarah Detty, Webmaster; Bruce Lamoreaux, Library Telescope Coordinator; Bill Tschumy, Public Outreach Coordinator; Vern Raben, Newsletter Editor

The Planets in February

Mercury

Mercury is visible before sunrise for the first couple weeks this month. It is about -0.1 magnitude in brightness; the waning crescent disc decreases from 6.6 arc sec across to 5.3 arc sec across by the 17th.

Venus

Venus is visible after sunset in the WSW. It is about magnitude -4 in brightness and the waxing crescent disk is about 12 arc sec across.

Mars

Mars keeps getting smaller and dimmer. It is 11 arc sec across on the 1st but only 8.2 arc sec across by the 31st. It dims from -0.3 magnitude in apparent brightness to +0.5 magnitude by the end of the month.

Jupiter

Jupiter is around 35 arc sec across this month and -2.2 magnitude in apparent brightness. Jupiter will be close to Venus about mid month. The Great Red Spot (GRS) is at mid transit when more than 20° above the horizon at the following times this month:

- Feb 2 at 7:48 pm at altitude 22°
- Feb 7 at 6:59 pm at altitude 29°
- Feb 12 at 6:09 pm at altitude 35°
- Feb 19 at 6:59 pm at altitude 2°

Saturn

Saturn is no longer visible; it has disappeared into the evening twilight.

Uranus

Uranus is in constellation Aries. It is magnitude +5.8 in brightness and its disc is 3.5 arc sec across.

Neptune

Neptune is visible in the evening sky until about middle of February when it disappears in the bright evening twilight. It is magnitude 7.9 in brightness and is 2.2 arc sec across.

Lunar Phases in February

- Full moon: February 5 at 11:30 am
- Third quarter: February 13at 9:02 am
- New moon: February 20 at 12:07 am
- First quarter: February 27 at 1:07 am

Bright Nebula in February

- M42, Orion Nebula in Orion, mag. 4.0
- NGC 1432, Maia Nebula in Taurus, mag. 3.9
- NGC 1435, Merope Nebula in Taurus, mag. 4.2
- NGC 1499, California Nebula in Perseus, mag. 5.0
- NGC 2238, Rosette Nebula in Monoceros mag. 5.5
- NGC 2264, Cone Nebula in Monoceros, mag. 3.9
- NGC 7822, bright nebula in Cepheus, mag. 8.0
- IC434, Horsehead Nebula in Orion, mag. 7.3
- IC 1805, Heart Nebula in Cassiopeia, mag. 6.5
- IC 1848, Soul Nebula, in Cassiopeia, mag. 6.5
- Caldwell 9, Cave Nebula in Cepheus, mag. 7.7

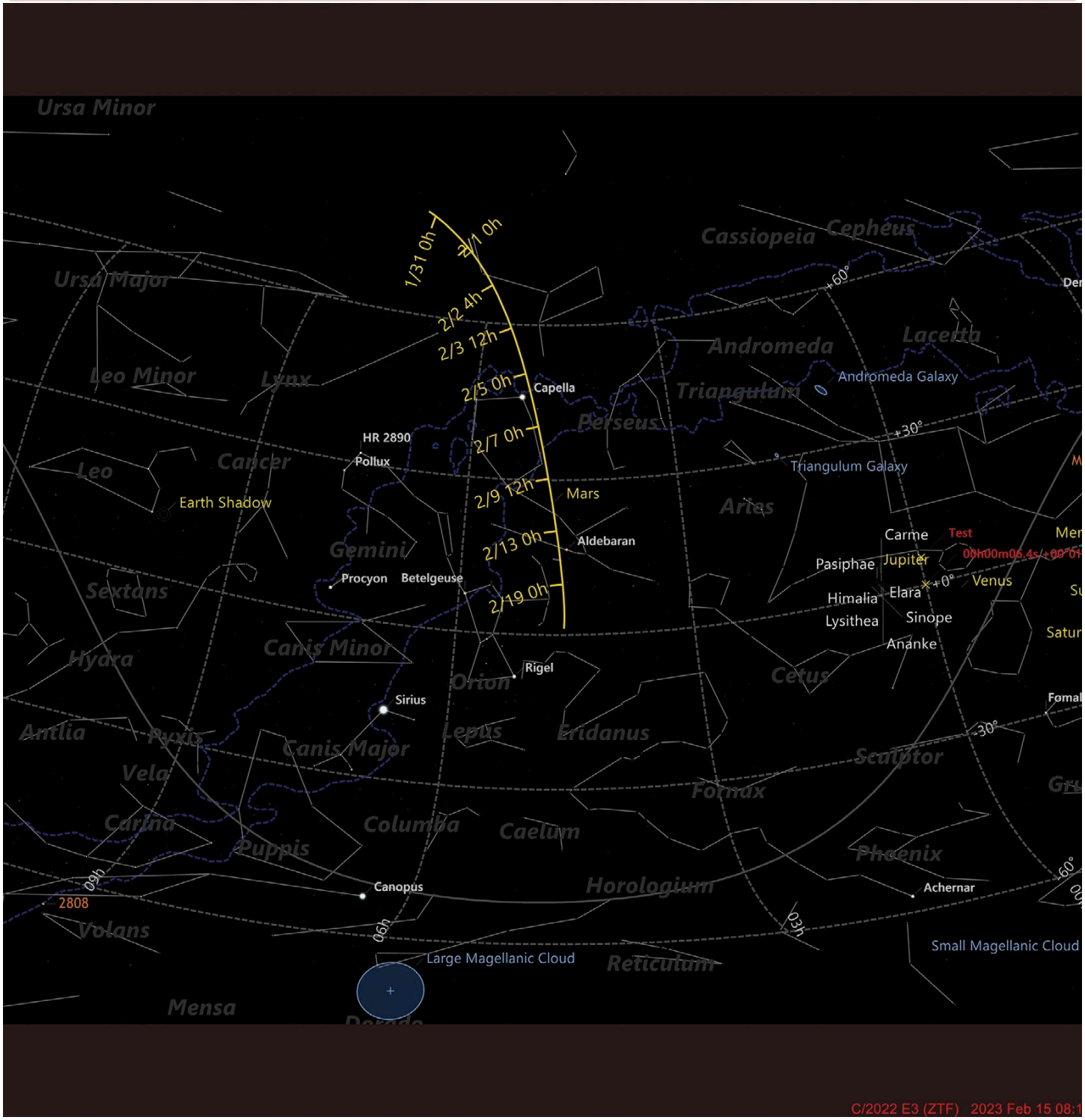
Galaxies in February

- M31, Andromeda spiral Galaxy in Andromeda, mag. 3.3
- M33, Pinwheel Spiral Galaxy in Triangulum, mag. 5.8
- M81, Bodes Galaxy, Spiral Galaxy in Ursa Major, mag. 6.8
- M32, Elliptial Galaxy in Andromeda, mag. 7.9

Planetary Nebula in February

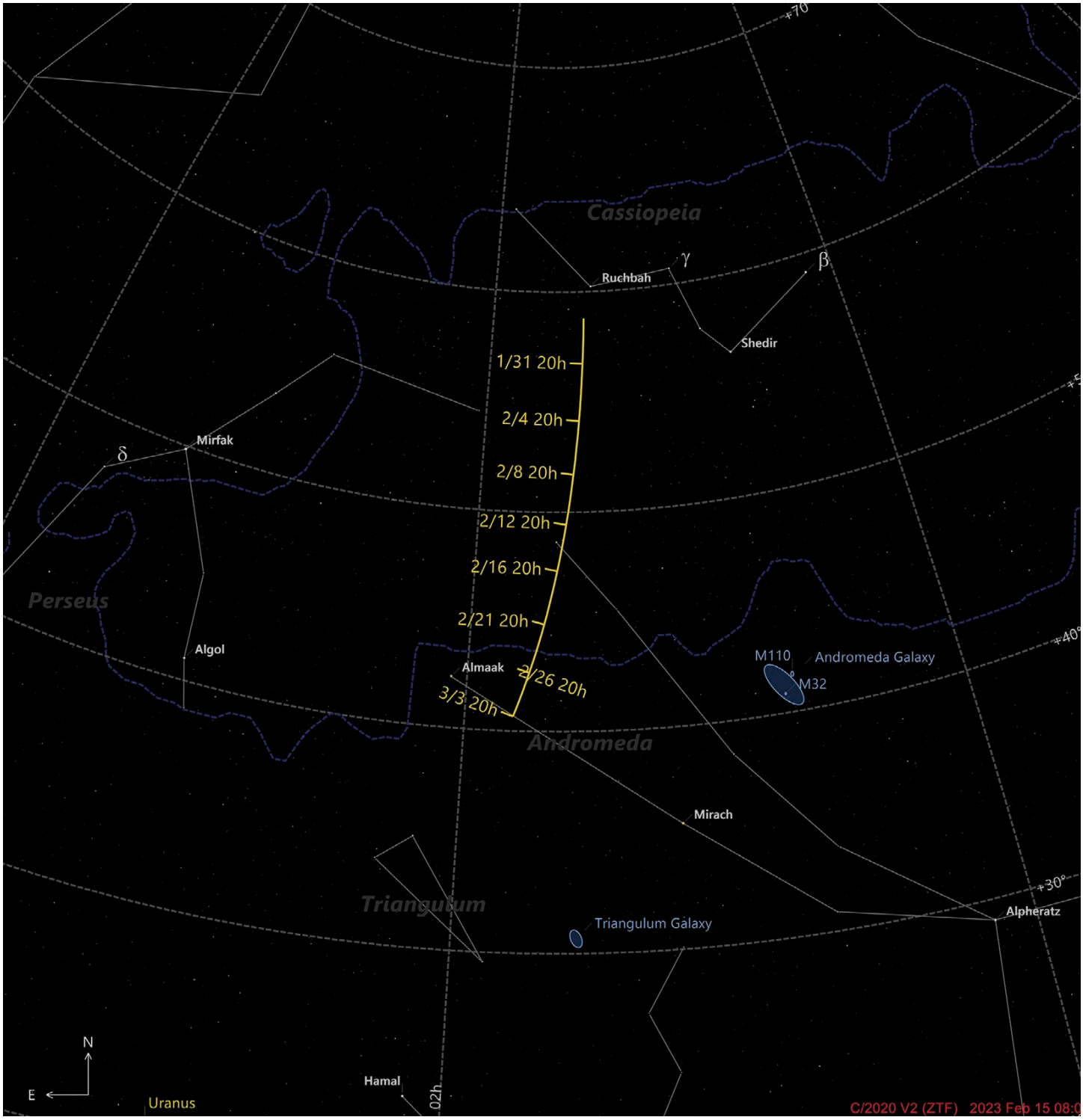
- NGC 2392, Eskimo Nebula in Gemini, mag. 9.2
- M97, Owl Nebula in Ursa Major, mag. 9.8
- M76, Little Dumbbell Nebula in Perseus, mag. 10.1
- Abell 21, Medusa Nebula in Gemini, mag. 10.2
- NGC 40, Bow-Tie Planetary Nebula in Cepheus, mag. 10.6

Comet C/2022 E3 (ZTF)



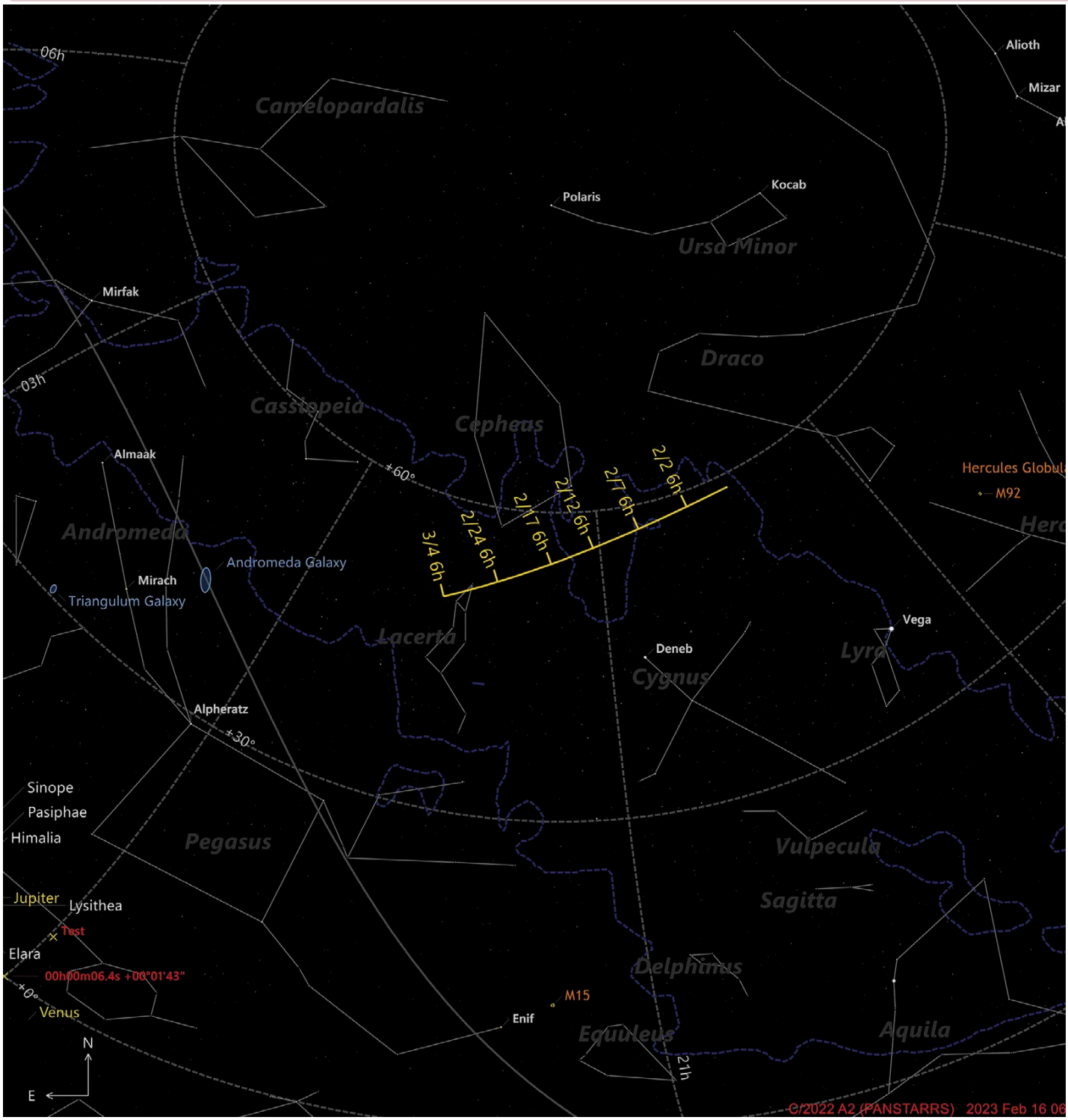
Date	Optimal time	RA	Dec	Constellation	Magnitude	Size (arc min)
Feb 1	10:18 pm	06h12m36.0s	+68°47'48"	Camelopardalis	5.1	20.2
Feb 6	7:47 pm	05h03m25.4s	+41°15'27"	Auriga	5.6	17.2
Feb 11	8:20 pm	04h47m25.0s	+23°06'15"	Taurus	6.3	12.9
Feb 16	8:12 pm	04h41m41.5s	+12°51'42"	Taurus	7.0	9.9
Feb 21	8:13 pm	04h39m37.2s	+06°39'46"	Taurus	7.6	7.9
Feb 28	8:18 pm	04h39m33.6s	+01°21'42"	Taurus	8.4	6.1

Comet C/2020 V2 (ZTF)



Date	Optimal time	RA	Dec	Constellation	Magnitude	Size (arc min)
Feb 1	7:51 pm	01h31m18.1s	+56°12'25"	Cassiopeia	9,9	2.1
Feb 6	7:48 pm	01h33m25.7s	+53°01'51"	Perseus	10.0	2.1
Feb 11	8:02 pm	01h36m05.8s	+50°06'15"	Andromeda	10.0	2.0
Feb 16	8:07 pm	01h39m09.2s	+47°25'52"	Andromeda	10.0	2.0
Feb 21	8:11 pm	01h42m29.8s	+44°59'42"	Andromeda	10.0	1.9
Feb 28	8:17 pm	01h47m31.2s	+41°57'01"	Andromeda	10.1	1.8

Comet C/2022 A2 (PANSTARRS)

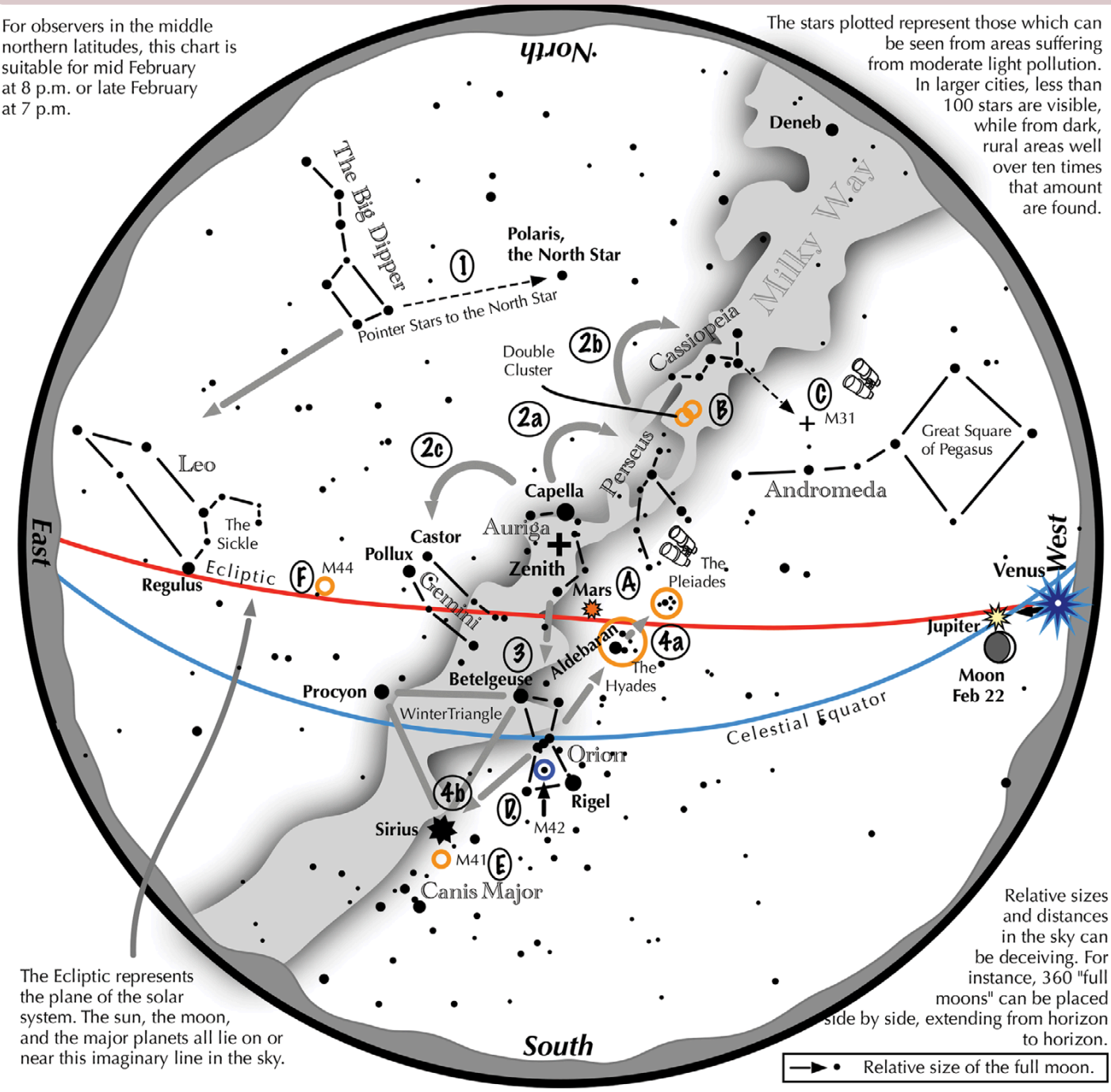


Date	Optimal time	RA	Dec	Constellation	Magnitude	Size (arc min)
Feb 1	6:38 am	19h52m50.0s	+58°31’32”	Cygnus	9.5	4.2
Feb 6	6:37 am	20h31m22.2s	+57°43’16”	Cygnus	9.5	4.1
Feb 11	6:30 am	21h05m19.0s	+56°31’17”	Cepheus	9.6	4.0
Feb 16	6:25 am	21h34m41.7s	+55°05’31”	Cygnus	9.6	3.8
Feb 21	6:19 am	21h59m55.5s	+53°33’48”	Cygnus	9.7	3.7
Feb 28	6:10 am	22h29m25.6s	+51°25’18”	Lacerta	9.9	3.5

Navigating the February Night Sky by John Goss

For observers in the middle northern latitudes, this chart is suitable for mid February at 8 p.m. or late February at 7 p.m.

The stars plotted represent those which can be seen from areas suffering from moderate light pollution. In larger cities, less than 100 stars are visible, while from dark, rural areas well over ten times that amount are found.



The Ecliptic represents the plane of the solar system. The sun, the moon, and the major planets all lie on or near this imaginary line in the sky.

Relative sizes and distances in the sky can be deceiving. For instance, 360 "full moons" can be placed side by side, extending from horizon to horizon.

→• Relative size of the full moon.

Navigating the February night sky: Simply start with what you know or with what you can easily find.

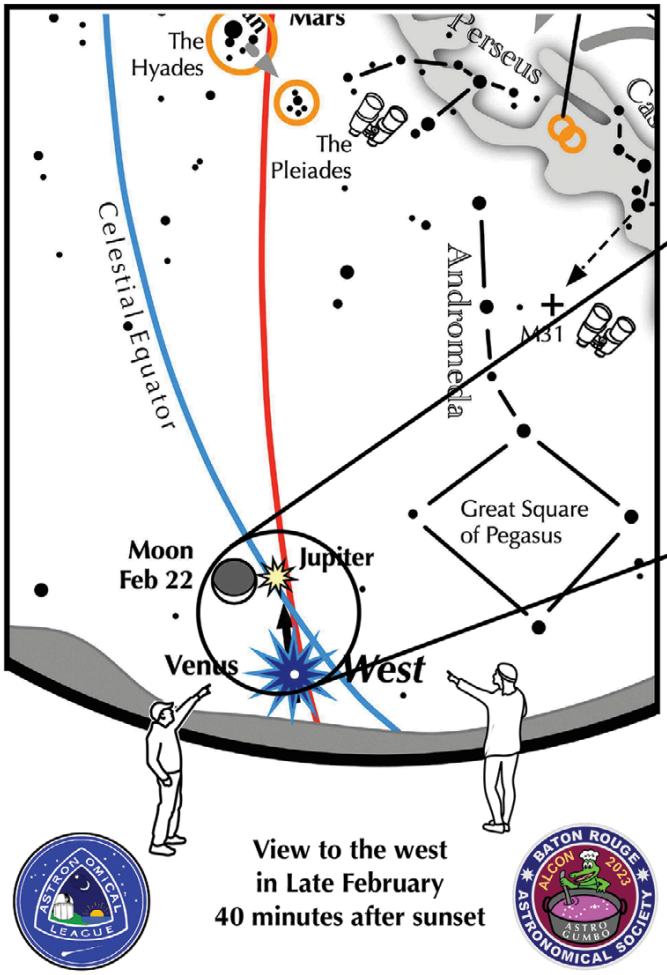
1. Above the northeast horizon rises the Big Dipper. Draw a line from its two end bowl stars upwards to the North Star.
2. Face south. Overhead twinkles the bright star Capella in Auriga. Jump northwestward along the Milky Way first to Perseus, then to the "W" of Cassiopeia. Next jump southeastward from Capella to the twin stars of Castor and Pollux in Gemini.
3. Directly south of Capella stands the constellation of Orion with its three Belt stars, its bright red star Betelgeuse, and its bright blue-white star Rigel.
4. Use Orion's three Belt stars to point northwest to the red star Aldebaran and the Hyades star cluster, then to the Pleiades star cluster. Travel southeast from the Belt stars to the brightest star in the night sky, Sirius, a member of the Winter Triangle.

Binocular Highlights

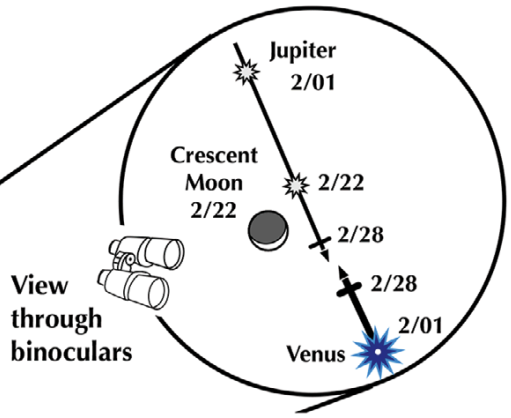
A: Examine the stars of two naked eye star clusters, the Pleiades and the Hyades.
B: Between the "W" of Cassiopeia and Perseus lies the Double Cluster.
C: The three westernmost stars of Cassiopeia's "W" point south to M31, the Andromeda Galaxy, a "fuzzy" oval.
D: M42 in Orion is a star forming nebula. **E:** Look south of Sirius for the star cluster M41. **F:** M44, a star cluster barely visible to the naked eye, lies southeast of Pollux.

Astronomical League *www.astroleague.org/outreach; duplication is allowed and encouraged for all free distribution.*

In the early evenings during the second half of February, try this challenge:



View to the west
in Late February
40 minutes after sunset

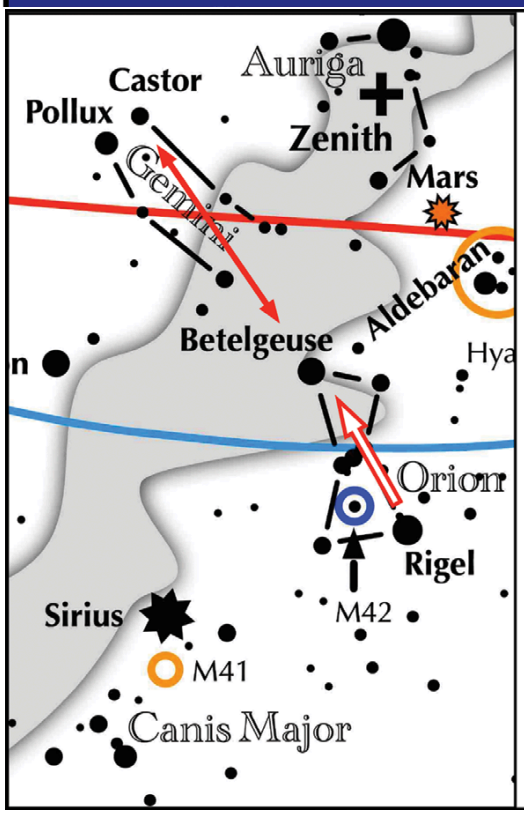


Venus approaches Jupiter

On February 1, Venus appears low above the western horizon 40 minutes after sunset. As the month proceeds, the bright planet climbs higher each evening. Jupiter, on the otherhand, begins the month much higher than Venus, and drops closer to the horizon each evening.

On February 22, the crescent moon joins the scene as it floats left of Jupiter. Look to the west 40 minutes after sunset for the pair. Binoculars allows you to admire the softly glowing earthshine on the night side of the moon. Almost magical!

For the rest of the month, Jupiter approaches Venus. Watch their gap narrow each evening. Finally, on March 1, they nearly bump into each other.



Other Suns: Castor

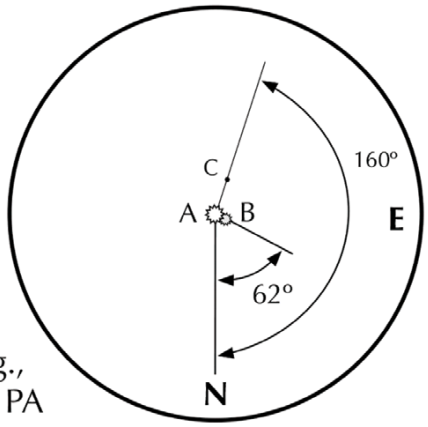
How to find Castor on a February evening

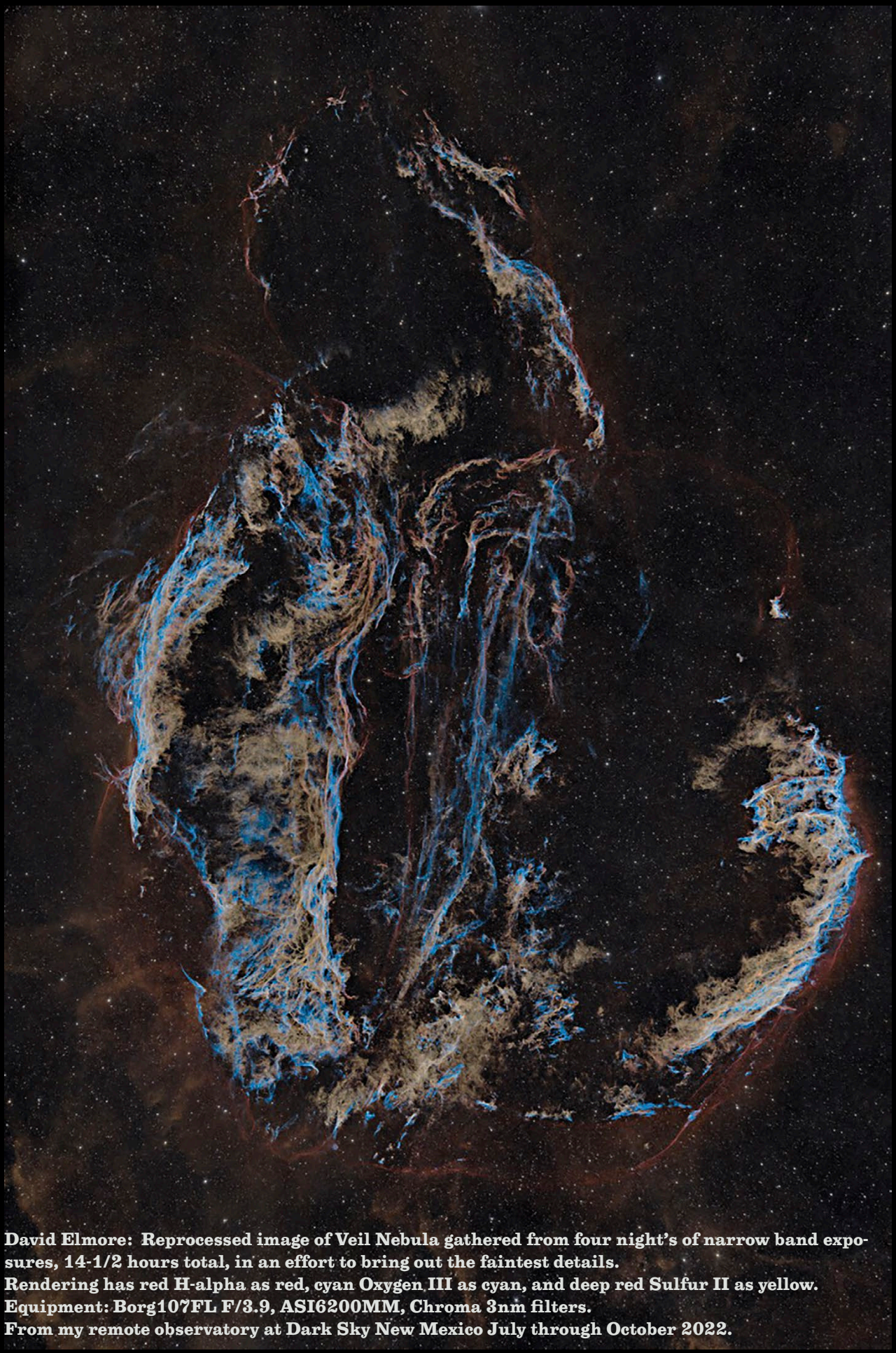
Look south toward Orion. Extend a line northeastward from Rigel through Betelgeuse and continue 1-1/2 times that length. It ends at Castor.

Suggested magnification: >60x
Suggested aperture: >3 inches

Castor
A-B separation: 6 sec
A magnitude: 1.9
B magnitude: 3.0
Position Angle: 62°
A color: white
B color: white

C component: 9.2 mag.,
A-C sep: 71 sec., 160° PA





David Elmore: Reprocessed image of Veil Nebula gathered from four night's of narrow band exposures, 14-1/2 hours total, in an effort to bring out the faintest details.
Rendering has red H-alpha as red, cyan Oxygen III as cyan, and deep red Sulfur II as yellow.
Equipment: Borg107FL F/3.9, ASI6200MM, Chroma 3nm filters.
From my remote observatory at Dark Sky New Mexico July through October 2022.

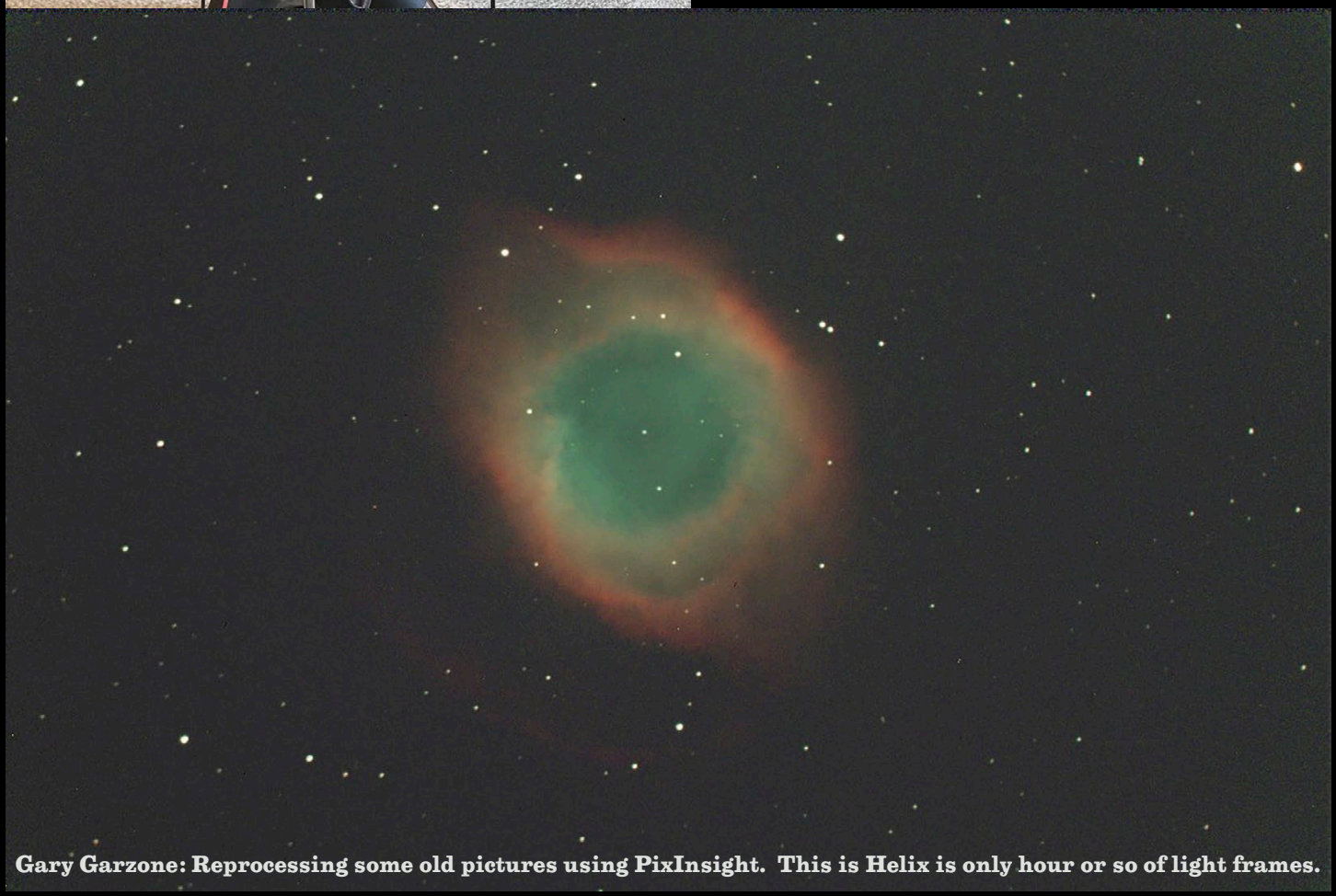
David Elmore: Comet C/2022 E3 (ZTF) from early morning 18 January as seen by my telescope at Dark Sky New Mexico. With the rapidly changing geometry as it approaches Earth, the tail has become very interesting with the dust tail becoming a fan with a component from our perspective in the solar direction. The narrow ion tail has some nice structure and is getting quite long. The frame is 4.8° tall.

Vixen VSD100 F/3.0 refractor. ASI2400MC Pro one-shot color camera. No filters just the camera's RGB. 2 hours of 2-minute exposures.

Processing in PixInsight using the CometAlignment as well as Star, Noise, and Blur Xterminator tools. The splotches are residual bright stars.

David Elmore: The OriGem Loop a region of Hydrogen emission caused presumably by a supernova that went off in the middle of the ragged loop of HII regions. From upper left going clockwise are Lower's Nebula that is also in the Sharpless 2 catalog as Sh2-261, then 267, 268, 269, 271, 272, and 266. Borg 107FL refractor. ASI 6200MM Pro camera. Chroma 3nm filters for fast optics. 21, 22, and 26 January 2023 from my observatory at Dark Sky New Mexico.

Eddie Hunnel: Finally purchased a refractor: New items in the setup shown is:
Radian 75mm APO Petzval Refractor
ASIAIR Pro
ASI6200MC Pro camera
Old items are:
ASI120mm guide camera (from the RASA - I will replace eventually)
ZWO 50mm guidescope - also from RASA
CGX

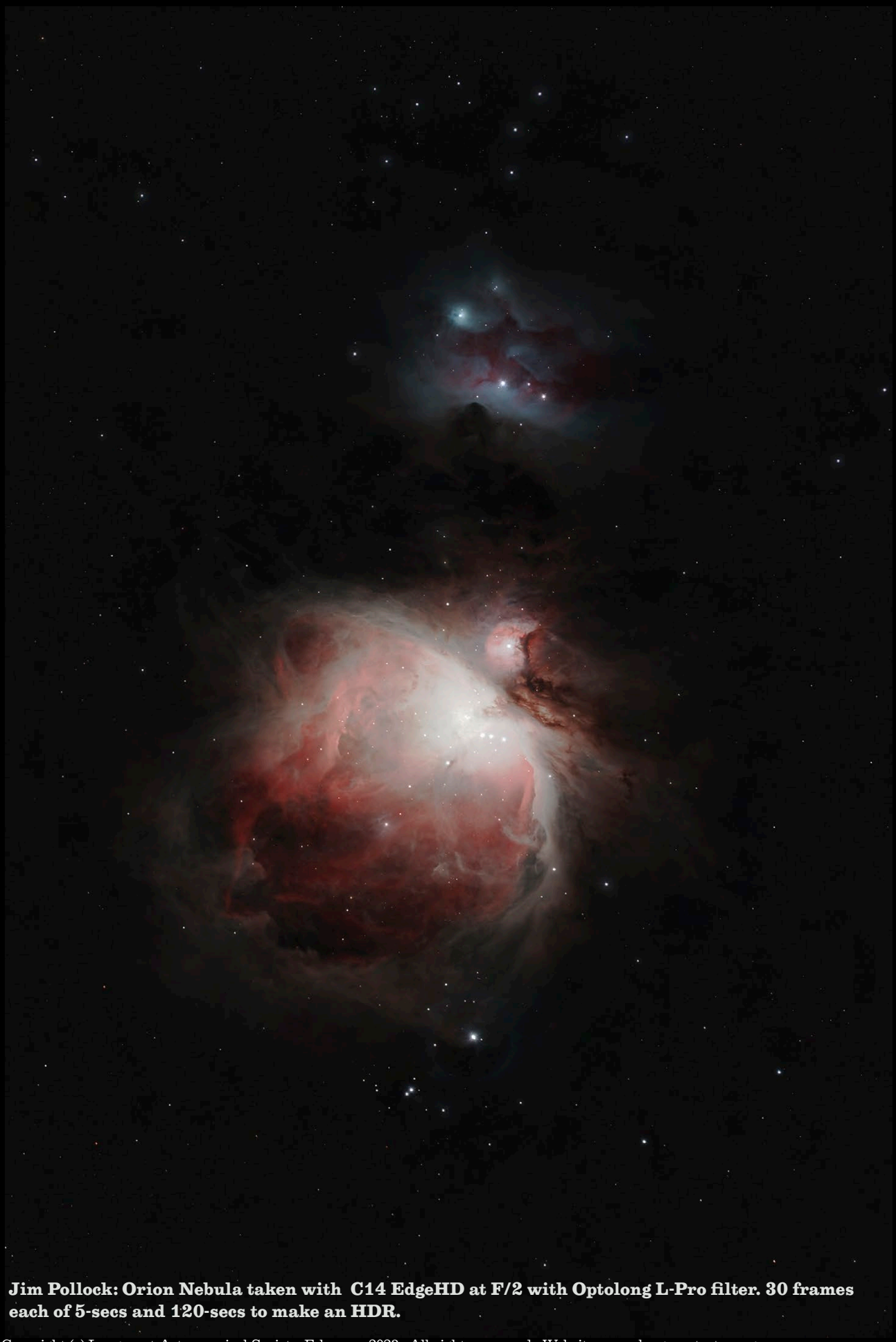


Gary Garzone: Reprocessing some old pictures using PixInsight. This is Helix is only hour or so of light frames.

Gary Garzone: Reprocessed NGC 6888, Crescent nebula.

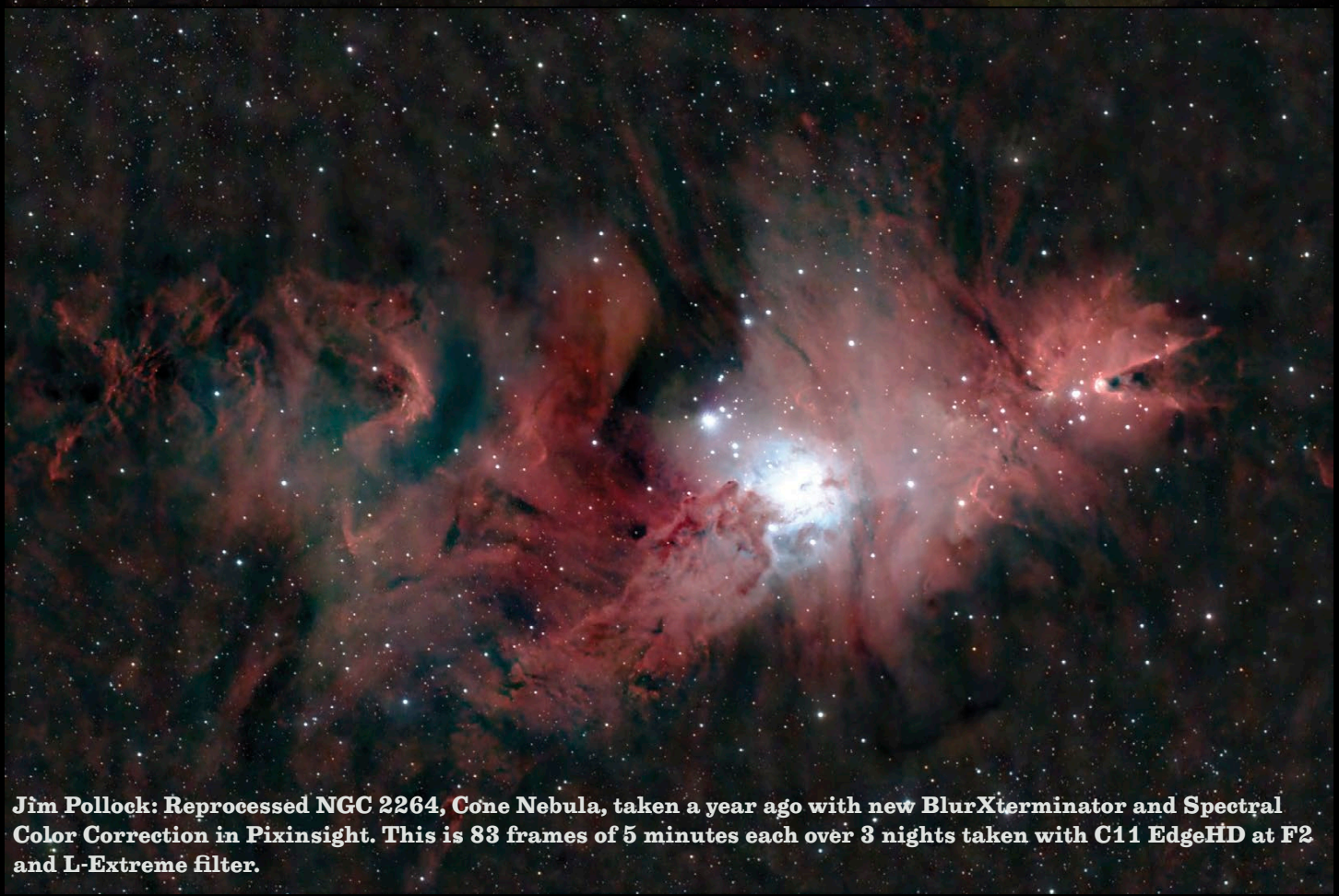
Gary Garzone: Comet C/2023 E3 (ZTF) in constellation Boötes on Jan. 14. Five minute exposure with Celestron 14 HD at F/7. Frosty night with 98% humidity and temperature of 14 °F.

Gary Garzone: Comet C/2022 A2 (PANSTARRS) in constellation Draco on Jan. 14. Five minute exposure with C14 at F/7.



Jim Pollock: Orion Nebula taken with C14 EdgeHD at F/2 with Optolong L-Pro filter. 30 frames each of 5-secs and 120-secs to make an HDR.

Jim Pollock: Here's a reprocess of the Iris Nebula from a month ago using 4 of these: GradientX, BlurX, StarX, and NoiseX after initially calibrating, aligning and stacking in PixinSight. I also use the new Pixinsight process SpectralColorCalibration for, well, color calibration.

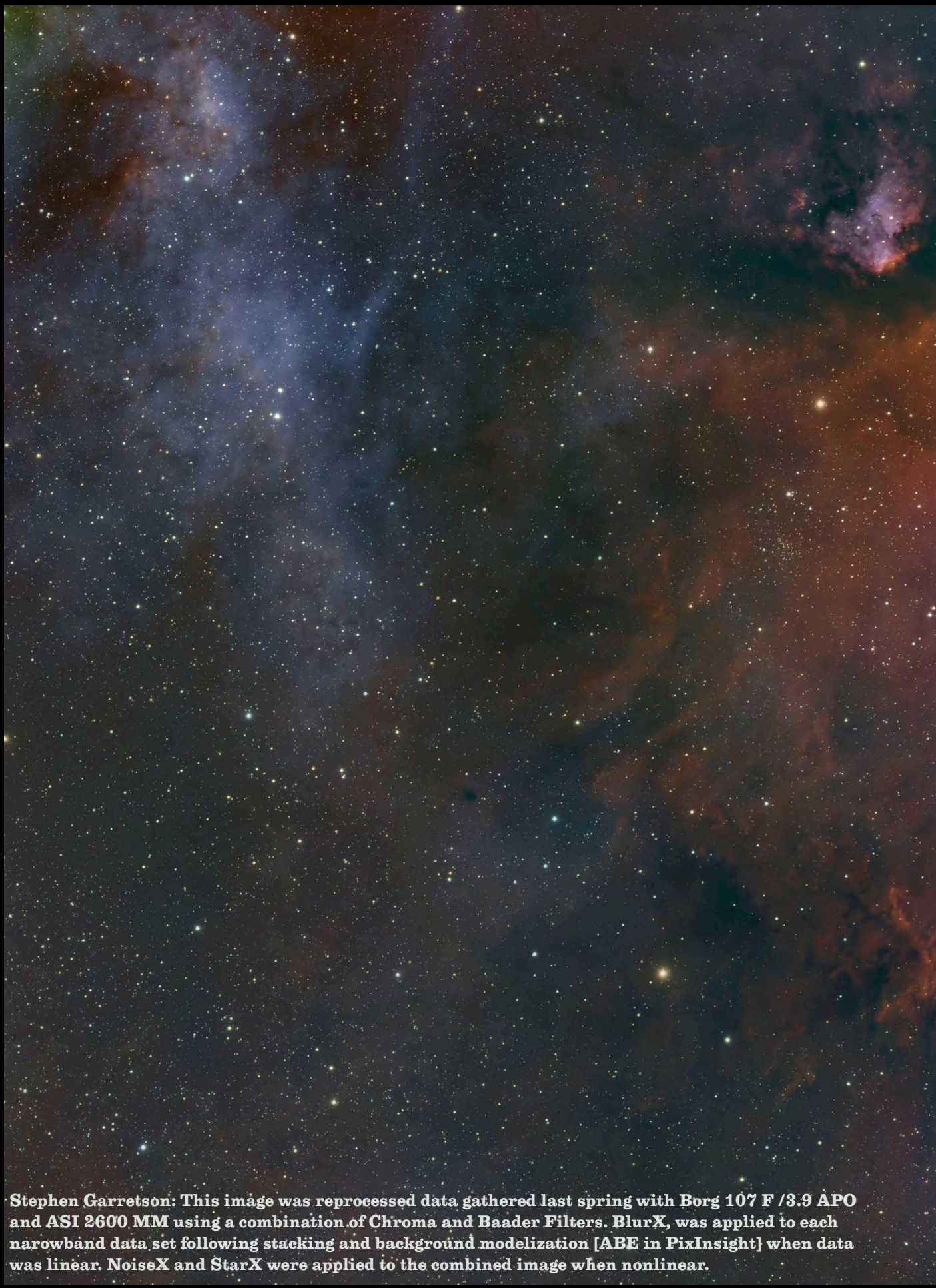


Jim Pollock: Reprocessed NGC 2264, Cone Nebula, taken a year ago with new BlurXterminator and Spectral Color Correction in Pixinsight. This is 83 frames of 5 minutes each over 3 nights taken with C11 EdgeHD at F2 and L-Extreme filter.

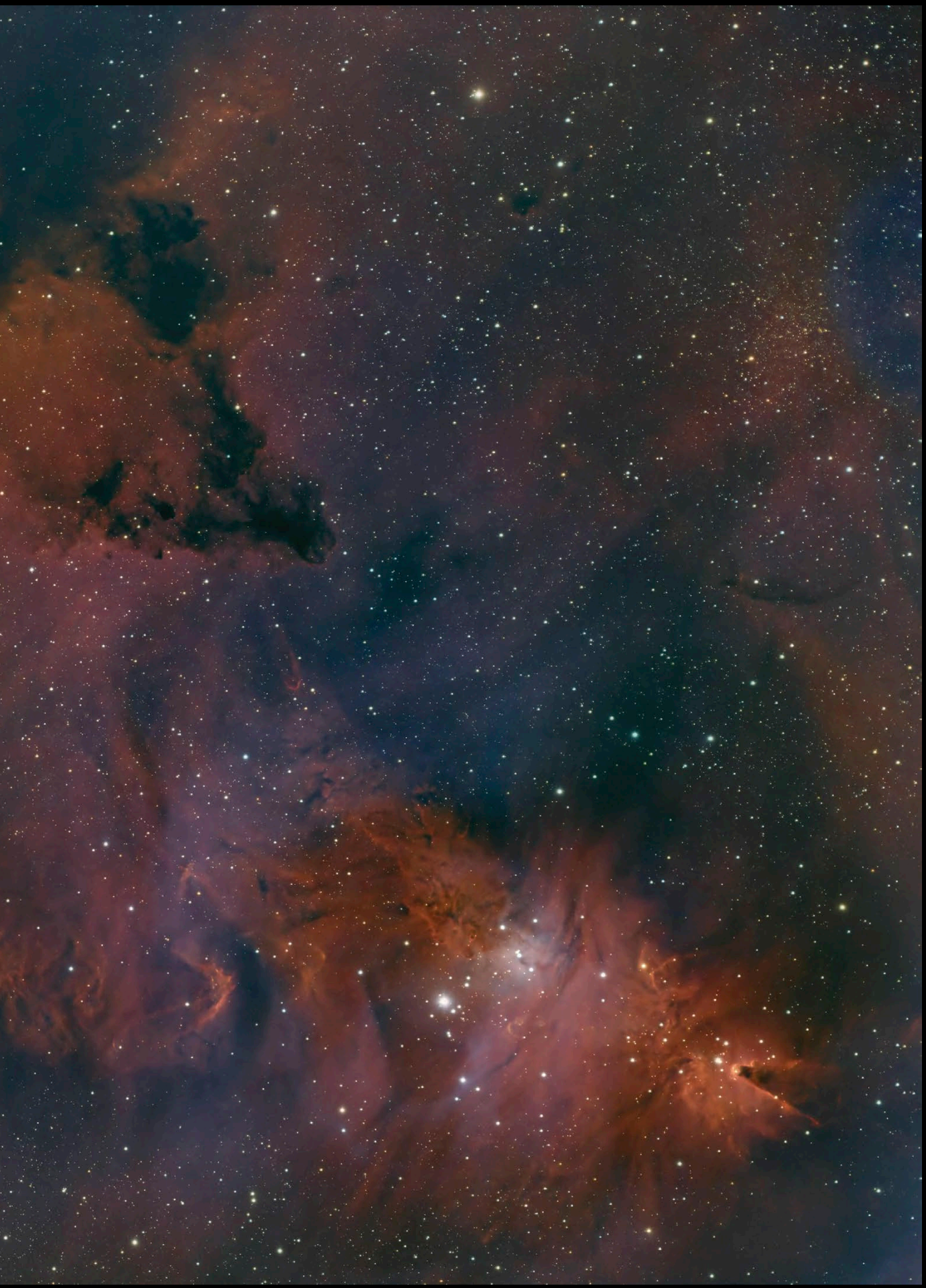
Jim Pollock: Comet C/2022 E3 (ZTF). The night sky was crisp and clear. Fired up the scope with no intention other than The Green Comet! Got about 53 good frames of 1-minute each between the comet coming out of the trees and before the clouds rolled in an hour later. This is 53 frames of 60sec (53 minutes exposure) from the 14" EdgeHD at f/2 Hyperstar. I used an L-Pro filter with the ZWO 6200mc one-shot-color camera. Calibrated and star-aligned all the images. Then used Pixinsight Comet Align to re-align the images to the comet. Then integrated the comet-aligned images.

Martin Butley: Lagoon Nebula from Fort Robinson, Nebraska from a club field trip to see the Persieds in 2019. Took 47 x 5 minute subs in Ha, SII and OIII for a total of about 4 hours. Equipment was Software Bisque mount, FLI 16200 monochrome camera, and Takahashi FSQ 130 telescope .

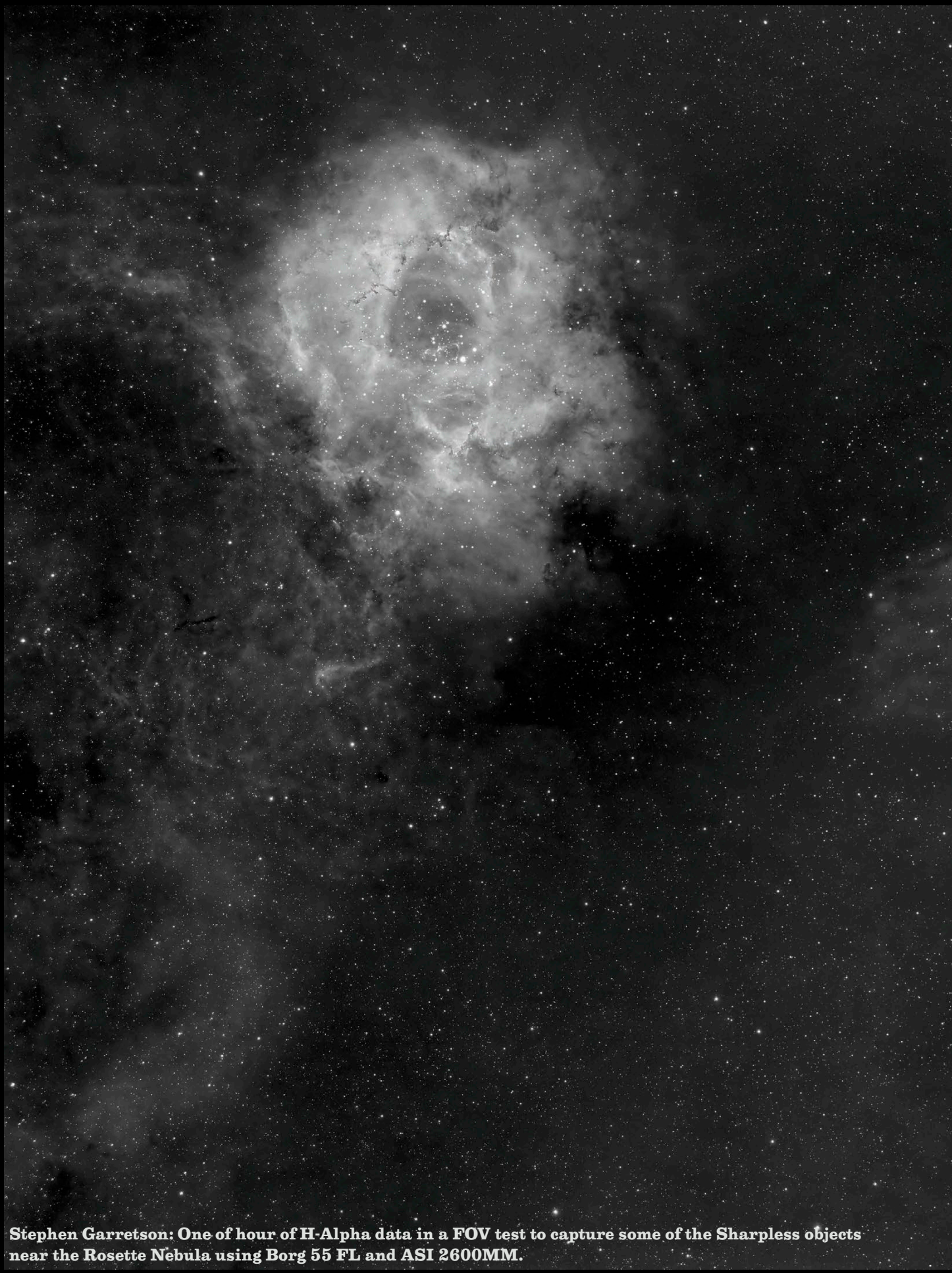
Rolando Garcia: The Helix, NGC 7293, taken back in November. NGC 7293 has the distinction of being one of the few planetary "nebulas" that can be imaged easily under murky skies at fairly short focal length. It looks pretty big (~25') because it is pretty close (~600 ly).



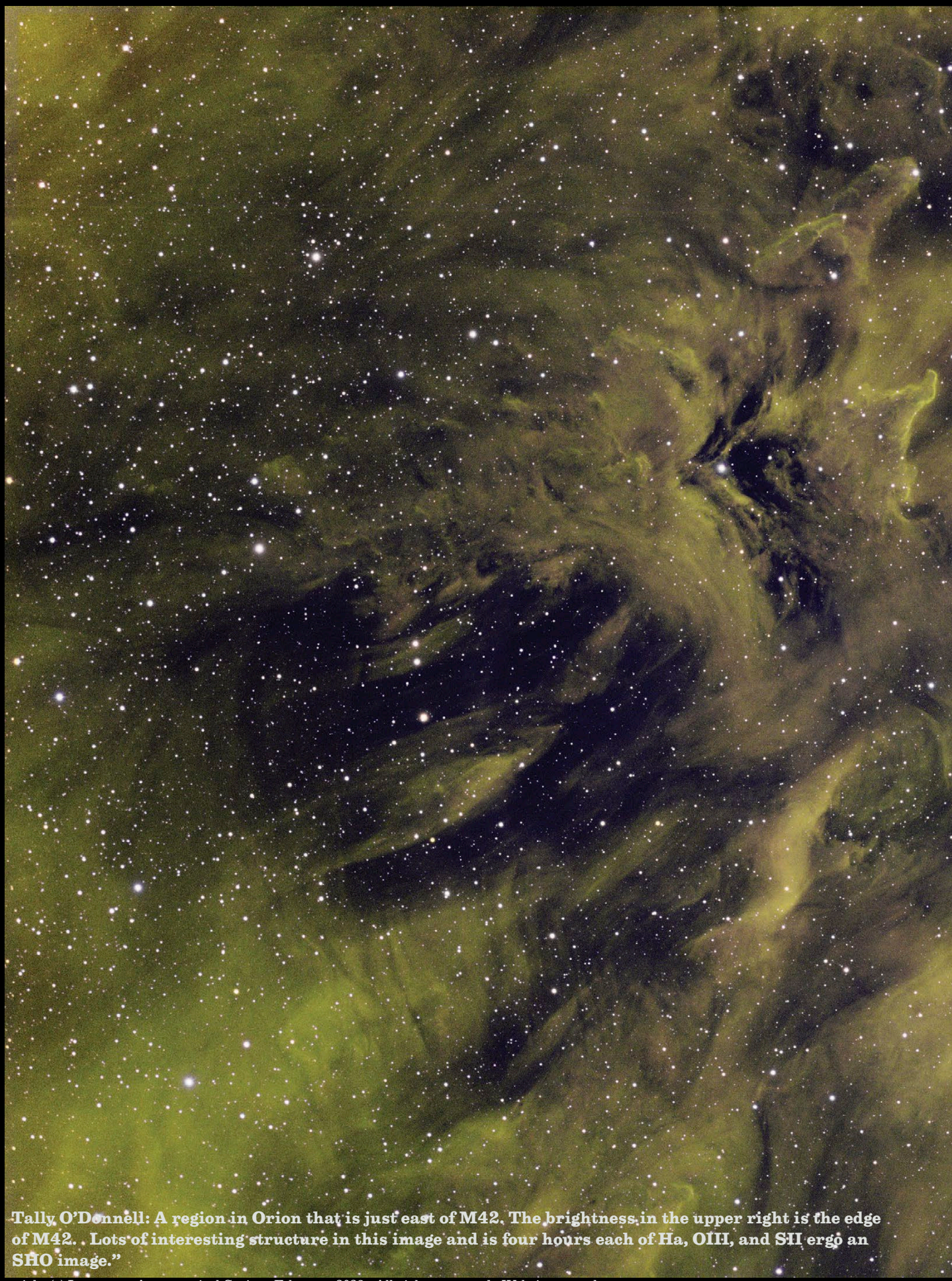
Stephen Garretson: This image was reprocessed data gathered last spring with Borg 107 F /3.9 APO and ASI 2600 MM using a combination of Chroma and Baader Filters. BlurX, was applied to each narowband data set following stacking and background modelization [ABE in PixInsight] when data was linear. NoiseX and StarX were applied to the combined image when nonlinear.



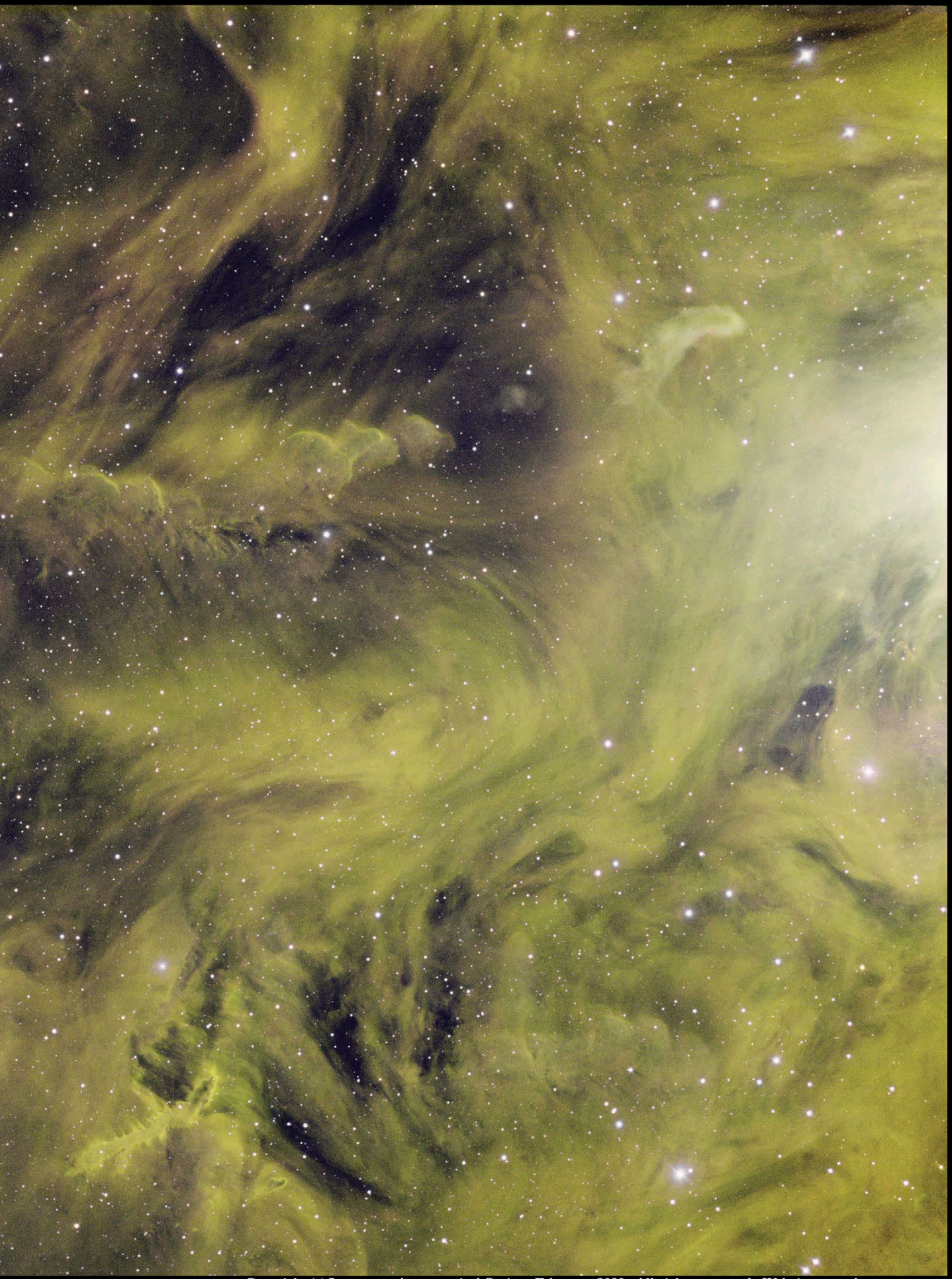
Stephen Garretson: Wide field image shows the Tadpoles and the Spider Nebulae in Ha. Equipment: Borg 55FL f/3.6 Pitzval Astrograph; ASI 2600MM; Baader 3.5nm Ha filter.
Baader 3.5nm Ha filter



Stephen Garretson: One of hour of H-Alpha data in a FOV test to capture some of the Sharpless objects near the Rosette Nebula using Borg 55 FL and ASI 2600MM.



Tally O'Donnell: A region in Orion that is just east of M42. The brightness in the upper right is the edge of M42. . Lots of interesting structure in this image and is four hours each of Ha, OIII, and SII ergo an SHO image."



LAS February Newsletter 2023 Secretary Notes
Thursday, Jan. 19, 2023 by Eileen Hall-McKim

I. Introduction

LAS President, Stephen Garretson, opened the meeting and introduced the officers.
20 people attended by Zoom

The agenda for the January 2023 election meeting is a forum of member presentations, followed by elections of new officers and board members. Three forum presentations were given.

II. Main Presentation: LAS January Meeting Forum

Bill Tschumy: Measuring Variable Stars

1. What are variable stars?

Variable stars are those that change their brightness over time. Their variability may be due to various factors:

Geometric processes such as rotation or eclipse by a companion star

Physical processes: such as pulsation, as seen in Red Giants, solar flares or cataclysmic explosions, such as Novas or dwarf Novas

2. Naming of variable stars

Variable stars are named by a sequencing method using capital letters from R-Z and constellations. First there is a capital letter followed by abbreviation of the constellation they are in. The first variable found in a constellation would be given the letter R, R Boo (Bootis) the next S, and so on to the letter Z. The next star is named RR then RS and so on to RZ, SS to SZ, and so on to ZZ. Then the naming starts over at the beginning of the alphabet: AA, AB...continuing to QZ. The letter J is always admitted to not confuse with I. This system can accommodate 334 names. After QZ, the variables are named with a first letter, V, starting with V335 and so on. Those known for a long time such as Algol keep their designation (Beta Persei). Highest number of V stars around 8500 in a constellation.

3. Observing variable stars

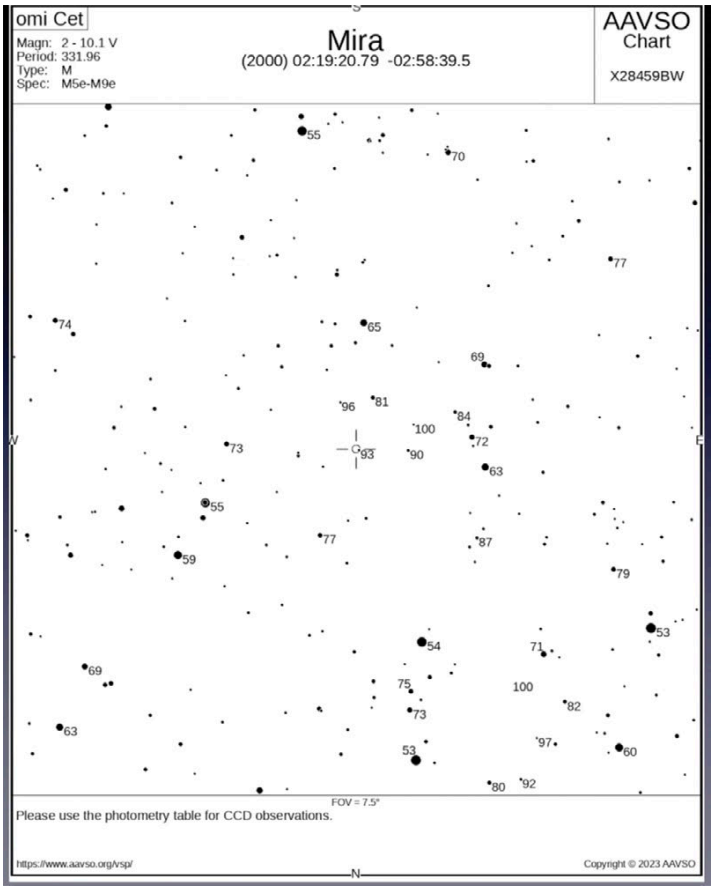
Visual stars can be observed visually with binoculars or using a camera

Best to start with binoculars. If using binoculars, best to have mounted binoculars for stability.
DSLR photometry is also used, some limitations on what filters can be used.
Starting with binoculars, then DSLR, Bill now uses an Astronomical CMOS camera and filter wheel with B & V photometric filters.

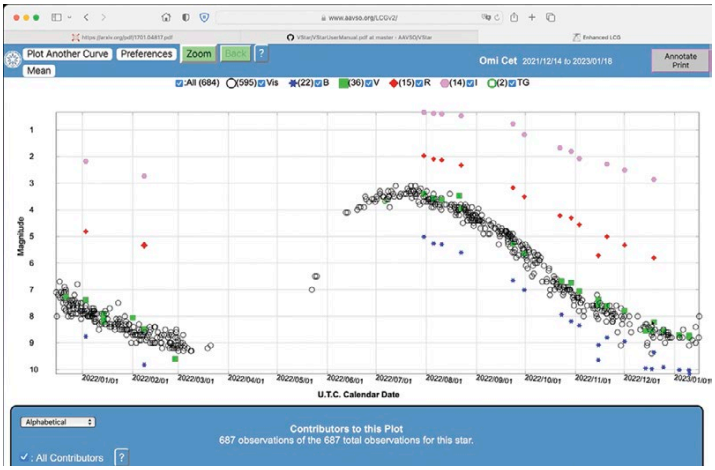
The AAVSO (American Association of Variable Star Observers) is an organization dedicated to observing and studying variable stars. The organization collaborates with professional astronomers, and encourages and enables amateur involvement.

The AAVSO has over 1300 members worldwide.
They support members with:
- Courses in various aspects of variable star observing
- Maintains an over 110 year old database of observations
- Supports observers with a network of remotely accessible telescopes
- Online forums for discussing various aspects of variable star observing
- Several "Sections" for observers interested in various aspects of variables and for those interested in developing new instruments and equipment useful in taking variable star images and measurements.

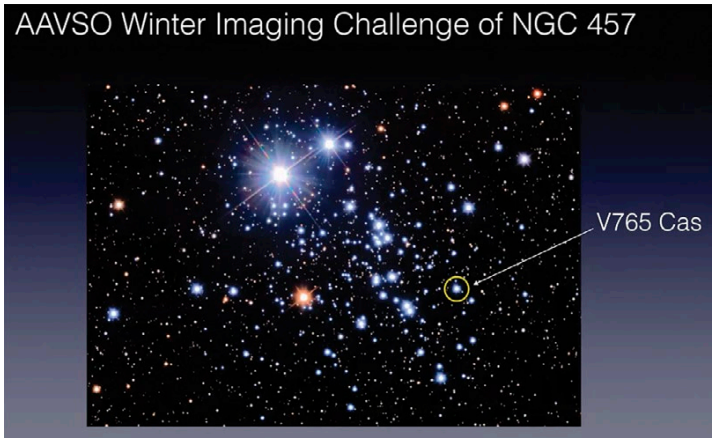
4. Measuring variable stars
- Measuring variable stars can be done naked eye or with binoculars using AAVSO's free "Variable Star Plotter" to create a chart "sequence".
- Find the variable in question both in the sky and on the chart.
- Locate the comparison stars in the sky and on the chart, trying to find comparison stars that are a little brighter and a little dimmer than the star chosen to observe.
- Interpolate as best you can
- Generally can get to 0.2 magnitudes in accuracy
- Report value to AAVSO website, will need to apply for observer code to use to report
- Go to interface on website (Light Curve Generator) to plots with other contributors
- Look at plot data, see if yours is in range with others, if so, submit your measurements
- 5. Differential Photometry with CMOS or CCD Cameras



– Take one or more images of the field containing the star of interest , close attention must be paid to saturation and linearity, if problems here, data not useful.



– Calibrate the images using Darks, Flats, and Biases (no other processing) this would invalidate the data.
– Load images into your photometry software and place "apertures" around the variable star, one or more comparison stars, and a check star. Comparison stars are NOT variable and have accurate known magnitudes in the passband (filter) you are using. The check star is also not variable but is a "check" that the process is working correctly.
– Push the button and software will compare fluxes from the stars, calculating the magnitudes of the variable and the check star. The check star magnitude should be close to its known magnitude.
– Upload your observations to the AAVSO, again plotting a light curve.
– Two types of observations:
– 1) Single time period usually through multiple filters
– 2) Times series using single filter. This is for stars that are very quick in their time period. This method takes an image every minute or so, depending on period of variability, for several hours, then submit 300-400 images in observation report
– Bill has submitted several thousand observations, with a bulk of them in time series, along with 50-60 single star observations.



– 6. AAVSO Winter Imaging Challenge of NGC 457

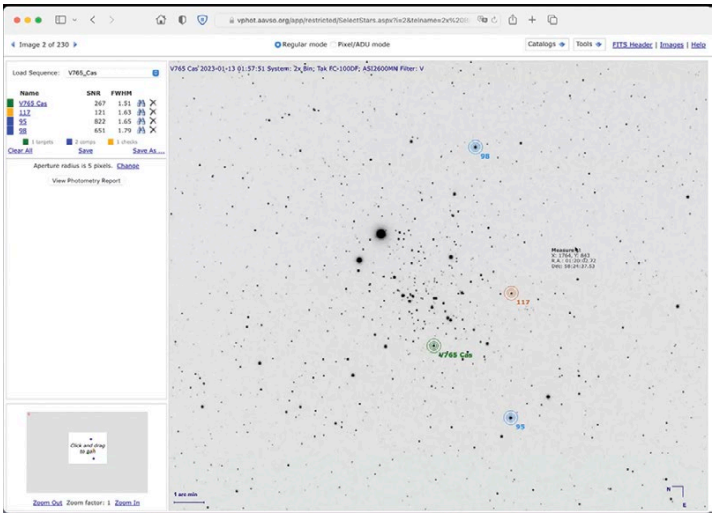
In December 2022 Bob Buchheim, Board member of AAVSO and amateur astronomer, posted a Winter Imaging Challenge on an AAVSO forum requesting observations in open cluster NGC 457 also called the ET cluster.

Inside the cluster is a variable star called V765 Cassiopeia. V765 is an Eclipsing Binary- a pair of stars that orbit around each other. The orbits are aligned, so that periodically (once every 1.72 days), the fainter star blocks the light coming to us from the brighter star, making their combined light drop by about half a magnitude.

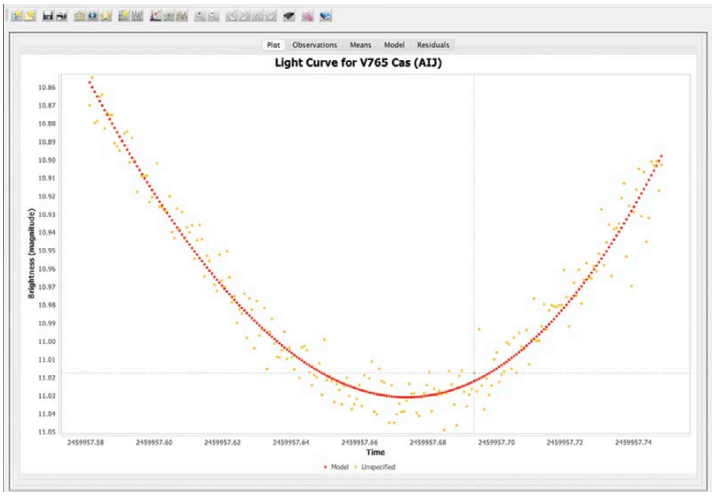
V765 Cas also happens to be a neglected system- it appears that nobody has paid attention to it since its discovery in 2008, despite the many wonderful images that have been made of the cluster this star resides in. There are no observations in the AAVSO database. A modern observation of the eclipse will confirm the orbital period and improve the precision of the period. For eclipsing binary systems, the period can gradually change for a variety of reasons:

(1) a third star in the system may be "pulling" on the eclipsing pair
(2) there is a mass exchange between the two stars
(3) there is a mass loss from the system (e.g. stellar wind)
(4) there are magnetic interaction
All of these occurrences have been detected on binary stars and AAVSO would love to better understand this system.

Bill's interest took hold and he began working on observations and using AAVSO data software analysis. He has recently plotted a light curve calculating a new minimum (shown below) which has become a very useful addition to AAVSO database for correcting the period on the system.



AAVSO software map of variable star V765 (green), 2 comparison stars (in blue) and check star (Orange)



Light Curve for V765 Cas (AIJ)
Plotted from Bill Tschumy's observations

7. Summary
- Variable stars are very interesting and can be addictive, many people very involved
- Equipment is minimal, especially compared with deep sky photography, you can do quite a bit naked eye or with binoculars.
- Its forgiving. Your stars don't have to be perfectly round. You don't need a dark sky. Exposures tend to be short (except time series).
-It's also exacting. You need to attend to lots of details to ensure your observations are scientifically useful.
-If anyone is interested in trying this, Bill is happy to serve as mentor or collaborator and work on this together and have some fun with it.

Eileen Hall-McKim : "New research on the age of the magnetic field of Mars'

New research on the age of Mars magnetic field
Mars was on our minds and in our telescopes frequently this fall and winter as it brilliantly crossed the southern skies. We saw many great images from LAS members including Vern's new Mars-Scapes of vast geological features on Mars.

This is a brief overview of a review recently published in Science of a paper by Graduate Student Sarah Steele and Planetary Scientist Roger Fu, both at Harvard University, that was presented at the most recent American Geophysical Union (AGU) Annual meeting in December 2022. For those who have never attended, the AGU holds an annual conference of roughly 27,000 international attendees from Earth and Atmospheric Sciences, Astronomy and Space Sciences, Climatology, Oceanography and much more. Every year for 4 days in December they meet to present, mull-over hundreds of new papers, posters, new ideas and hash-over old ideas. The presentation by Steel and Fu was one highlighted in the members newsletter in the weeks following the AGU and this review published in Science Dec 2022: "Mars had long-lived magnetic field, extending chances for life", Zack Savitsky, Science: Vol 387; 20 Dec 2022.

Fragments from a famous Martian meteorite, Allan Hills 84001, (ALH84001) found in Antarctica in 1984, studied with a new tool, a Quantum Diamond Microscope (QDM), have yielded evidence that the planets magnetic field persisted until 3.9 billion years ago, hundreds of millions of years longer than previously

thought.
The findings also support the idea that, as on Earth, the magnetic field of Mars sometimes flipped around- reversing polarity, behavior that could shed light on the molten dynamo in the outer core that once powered it.

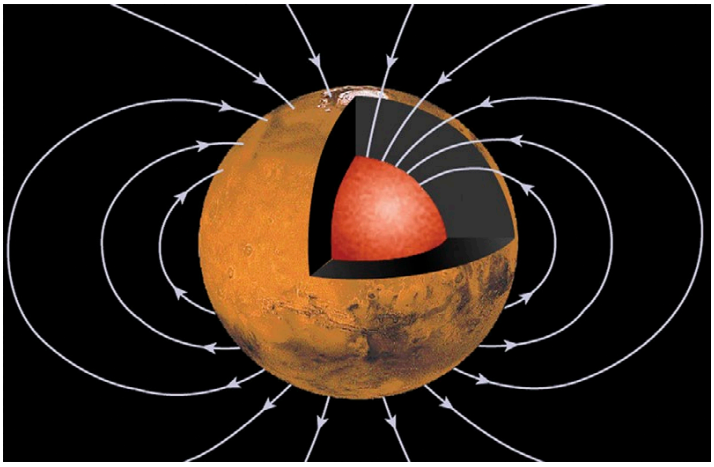


Figure 1. Illustration of Mars Magnetic Field and Outer Core

When certain kinds of iron-bearing minerals crystallize out of molten rock, their internal fields align with the planet's magnetic field like tiny compasses, preserving a stamp of its orientation. When magnetic signatures differ in orientation this indicates the field direction has changed. Clues from the meteorite could also extend Mars window of habitability and reconcile the conflicting timelines of the planets early history.

Figure 2. 4.1 Billion Years Old
Allan Hills 84001 Martian Meteorite

Study of the Meteorite
Planetary scientist Roger Fu and graduate student Sarah Steele imaged three paper-thin slices of the meteorite with a QDM and fragments have yielded evidence that the planets field persisted until 3.9 billion years ago, hundreds of millions of years longer than many had previously thought.

When analyzing the slices, Steele and Fu found distinct populations of iron-sulfide minerals strongly magnetized in different directions.
The magnetic field of a planet is generated by energy produced by the dynamo – a convecting, rotating , electrically charged fluid in the outer core. It's been proposed that the longer the ***dynamo*** is active, the longer a period on Mars that can potentially support life forms.

The field appears to have been relatively strong, about 1/3 of Earth's average field strength, and according to planetary scientist Ben Weiss MIT, could have helped deflect harmful cosmic rays, protecting potential early life forms. This could have also shielded the atmosphere from the solar wind, a stream of particles that can accelerate the loss of water vapor and other constituents to space.

Bob Lillis, planetary geophysicist, is more cautious about that line of reasoning, proposing a field could also accelerate atmospheric losses by funneling more solar wind to the poles.
The magnetized minerals could also hold a clue to the planets internal workings. Computer simulations have shown dynamos only reverse within a narrow range of convection conditions in a planet's molten outer core, so analyzing the signatures of Martian reversals could help constrain the history and nature of its dynamo.
As a bonus, magnetic reversals analysis could provide a common time marker for dating rocks from different locations on Mars.

Quantum Diamond Microscope

A new tool, the Quantum Diamond Microscope is enabling geologists to sense and map the magnetic fields imprinted in rock grains at scales smaller than the width of a human hair, allowing geologists to tease out history that coarser techniques overlook.
One of only a handful in the world, and developed and built by Roger Fu, Harvard University, the microscope is currently being used for expansive research in several fields such as:

- Probe meteorites for clues about the Solar Systems earliest days
- Chronicle rainfall thousands of years ago from stalactites

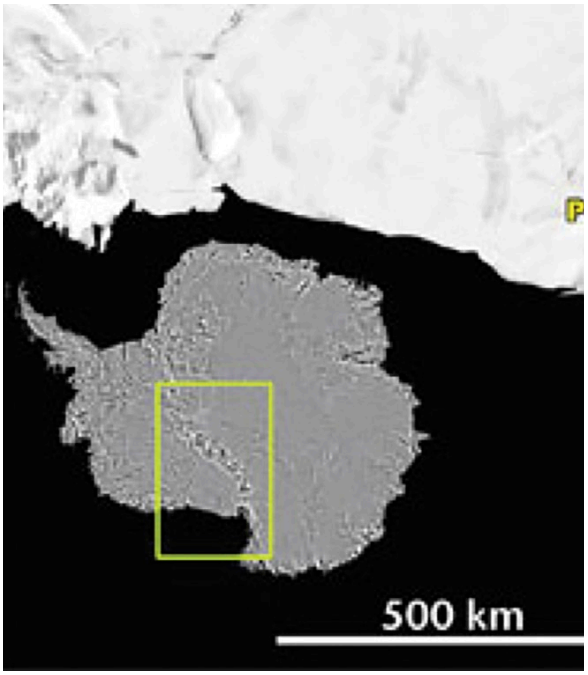
- Detect some of the earliest motions of Earth's tectonic plates in ancient lavas

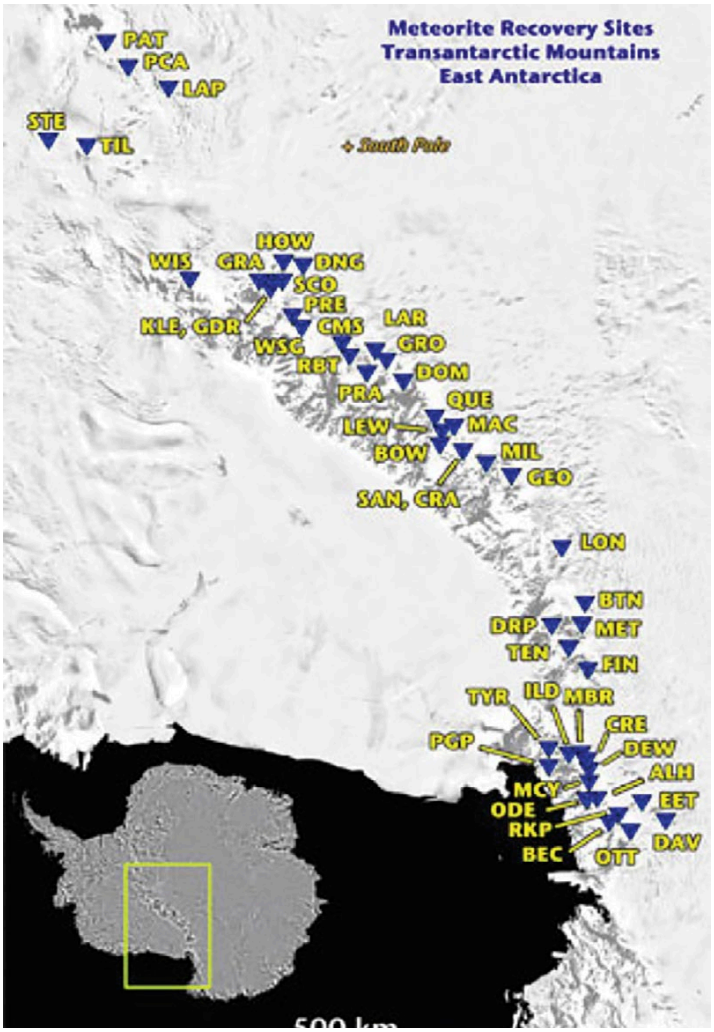
Although the QDM does not yet have the sensitivity of traditional superconducting sensors, the maps that it is capable of producing will likely become the gold standard and mandatory for analyzing any claims of ancient magnetism such as the start of Earths own magnetic field.

Another very good article on the QDM can be found in: Science 368 Issue 6489, April 2020 Diamond microscope unlocks ancient rocks magnetic secrets

Antarctica Search for Meteorites

Although not part of the AGU presentation article, Eileen became interested in where and how the Martian meteorite was found in Antarctica and visited the ANSMET website. ***ANSMET (Antarctic Search for Meteorites)*** is a program funded by the Office of Polar Programs of the National Science Foundation that looks for meteorites in the Trans-antarctic Mountains. This is a very interesting site with all the information about how many meteorites have been found on various expeditions (beginning 1914) how they are prepared, cataloged and stored, where they are from and where they are now. Most are sent to the Smithsonian Museum, more that 20,000 meteorites have been recovered by ANSMET. Meteorites are named by first initials of where they were found, followed by the year they were found and then a identifying number ALH84001was found in Allan Hills Valley in southern end of mountains, in 1984.





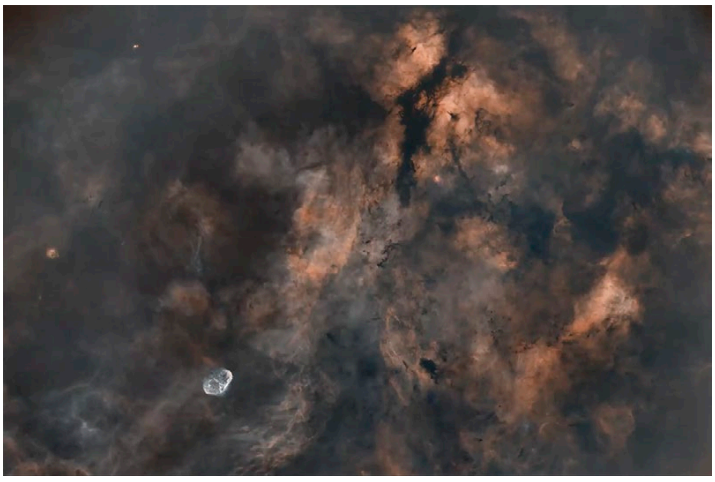
The trans-antarctic mountains are a series of mountain ranges that extend across the continent of Antarctica, north to south, dividing East and West Antarctica.
This geographical area serves as a collection point for meteorites that have originally fallen on the extensive high-altitude ice fields throughout East Antarctica. Such meteorites are quickly covered by the subsequent snowfall and become embedded in the vast sheet of ice.
Ice fields are in motion and are moving and 'flowing' constantly. Once embedded, the meteorites then begin a centuries-long journey traveling "downhill" across the Antarctic Continent. The average elevation of the East Antarctic Ice Sheet (EAIS) is 8,000 ft. while the highest elevation of the EAIS is 13,400 ft.
Portions of such flowing ice can be halted by natural barriers such as the Trans-antarctic Mountains. Subsequent wind erosion of the now motionless ice brings embedded meteorites back to the surface once more where they may be collected.
This process concentrates meteorites in a few specific areas to much higher concentrations than they are normally found everywhere else. The contrast of the dark meteorites

against the white snow, and lack of terrestrial rocks on the ice, makes such meteorites relatively easy to find. However, the vast majority of such ice-embedded meteorites eventually slide undiscovered into the ocean.

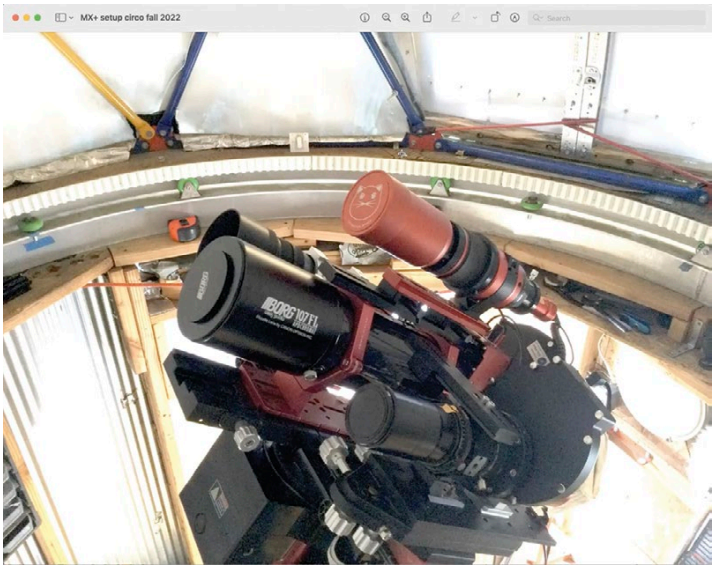
Closing Thoughts and Takeaways:
Evidence now indicates that Mars magnetic field persisted until 3.9 billion years ago, hundreds of millions of years longer than previously thought
The ancient magnetic signatures identified by the analysis with the QDM show the magnetic fields have reversed polarity, shedding light on the molten dynamo in the outer core that once powered it.
The longer the magnetic field persists the longer a period on Mars that early life forms potentially are protected, implications for possible early life on Mars to be sustained
The Quantum Diamond Microscope is a breakthrough analytical tool for many fields of geophysics, climatology and space science
Antarctica is a gigantic time machine!! Many advances will be made in understanding the early solar system and more as we are enabled to decipher the information of meteorites as well as ice cores, sub-glacial lakes sediments and other proxy records.

Stephen Garretson: Creating HOO Images in Pixinsight

Stephen goes through steps and tips on how he processes images in HOO using one of his images as example of different versions and variations. Displays his home telescope set up and how he uses different instruments.
Linear
Nonlinear/HA
Nonlinear/HOO Hydrogen Oxygen



Stephen's Example Gamma - Cygni Image



Stephan's Equipment Setup

Business Meeting

Treasurers Report (No report last month)
1/19/2023

Main checking account:	$9,455.00	
2-Yr Savings Account:	$8,135.00	
Telescope Fund	$1,100.00	
Petty Cash	$50.00	
Total Assets	$18,740.00	$680.00 up from last report

Active Membership: 111
Student Membership: 4
Total 115 17 Renewals overdue

New Business
Star Parties Requests:
Sandstone Ranch & Visitors Center;
Hunter Morrison has set up an April 15th Star party
Topic of Presentation:
The Life cycle of Stars; star birth, life cycle, stellar nucleus synthesis, star death

Other tentative star parties:
Legacy Elementary, Fredrick
Maybe Moon viewing, maybe even daytime Moon
Delayed from last fall
Frederick High School Astronomy class, Kevin Davis, teacher and coordinator
Pawnee School, Grover, CO
Contact received from High Plains Library outreach person
Pawnee school K-12 out in Grassland area, may be too far for us
Boulder County Open Space Coordinator for Rabbit

Mountain has been sent tentative dates for this year, dates have not yet been confirmed

Officer Elections
New President will be Vern Raben
Motion by Bill Tschumy, seconded by Clarke Yeager
Hunter Morrison nominated for LAS Vice-President
Motion by Vern Raben, seconded by Tally O'Donnell
Hunter Morrison will be LAS Vice-President
Bruce Lamoreax will remain as LAS Treasurer
Secretary position not filled at the time of meeting

Editor note: Eileen Hall-McKim volunteered and was appointed Secretary by the President per LAS By-Laws on Jan 21.

Board members 2023: Mike Hotka, Gary Garzone, Brian Kimball, Tally O'Donnell, David Elmore
Bill Tschumy moves to reelect the current board, Vern Raben seconds the motion
Slate of Board members were reelected.

Vern Raben will remain as Newsletter Editor
Sarah Detty will remain as Webmaster
Bruce Lamoreax will remain as Library Telescope Manager

Editor note: Bill Tschumy volunteered and was appointed Public Outreach Coordinator by the President on Jan 21.

February Newsletter Archive by Eileen Hall-McKim

30 Years Ago 1993

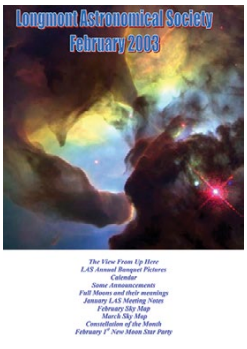
January minutes- last years officers were thanked and the new year officers were welcomed.

Present Bob Spohn spoke of the club's direction towards observing, encouraging members to obtain their Messier certificate. Steve Albers (ex-presidante) was unofficially named "our grazing occultation organizer"

Bob Spohn wrote in his monthly letter- The View From Up Here: "Now for the news that's had you on the edge of your observing stools in anticipation: The Elwood Hog Day result. But first, a narration of this most sacred L.A.S. legend. The Elwood Hog ventures forth from his abode on the night of the February full moon. If he cannot perceive his shadow, the next six new moons will be clear. If, he should happen to behold his shadow, the next six new moons will be cloudy. Alas, our beloved Hog did indeed detect his dark double on the 6th. But be ye of hope: the Hog's prognostications come with some modifications. For the next 6 months, the time between last quarter and new moon will be cloudy, but clear skies will prevail from new to first quarter This year the Elwood Hog has gone out on a limb to guarantee his prediction with a margin of error of only 98%."

Announcement: Dr. David Crawford, Kitt Peak National Observatory, Founder of the International Dark-Sky Association will give free, public talk on: "Light Pollution: Causes and Cures", Boettcher Center Auditorium, Univ. Denver.

20 Years Ago 2003



A fine dinner was served at the Wayside Inn in Berthoud with 47 people attending. Keith Gleason manager of CUs Sommers-Bausch Observatory was keynote speaker.

Article on Full moons and their meanings – from Farmer's Almanac (Thanks to Karen Mendenhall).

At January meeting: President Bob Spohn introduced the Astronomical League Observing Club Programs, Jim Crane, Astronomical League Correspondent, talked about the observing programs, especially the Messier program. Presentation: Bob Noble provided a presentation of earth-based photographs of the moon from the historical book titled "Consolidated Lunar Atlas". These pictures are available from NASA for the public, and he will compile these pictures onto a CD for anyone who would like them. Cost is $.05 per CD- the cost to cover the CD. The photographs were very high quality, and we played "Name That Feature"

Mike Hotka works on organizing for Astronomy Day to be held at the Twin Peaks Mall

Lists presented of February Messier objects and locations and fun facts about them

Feb 1 New Moon Star Party

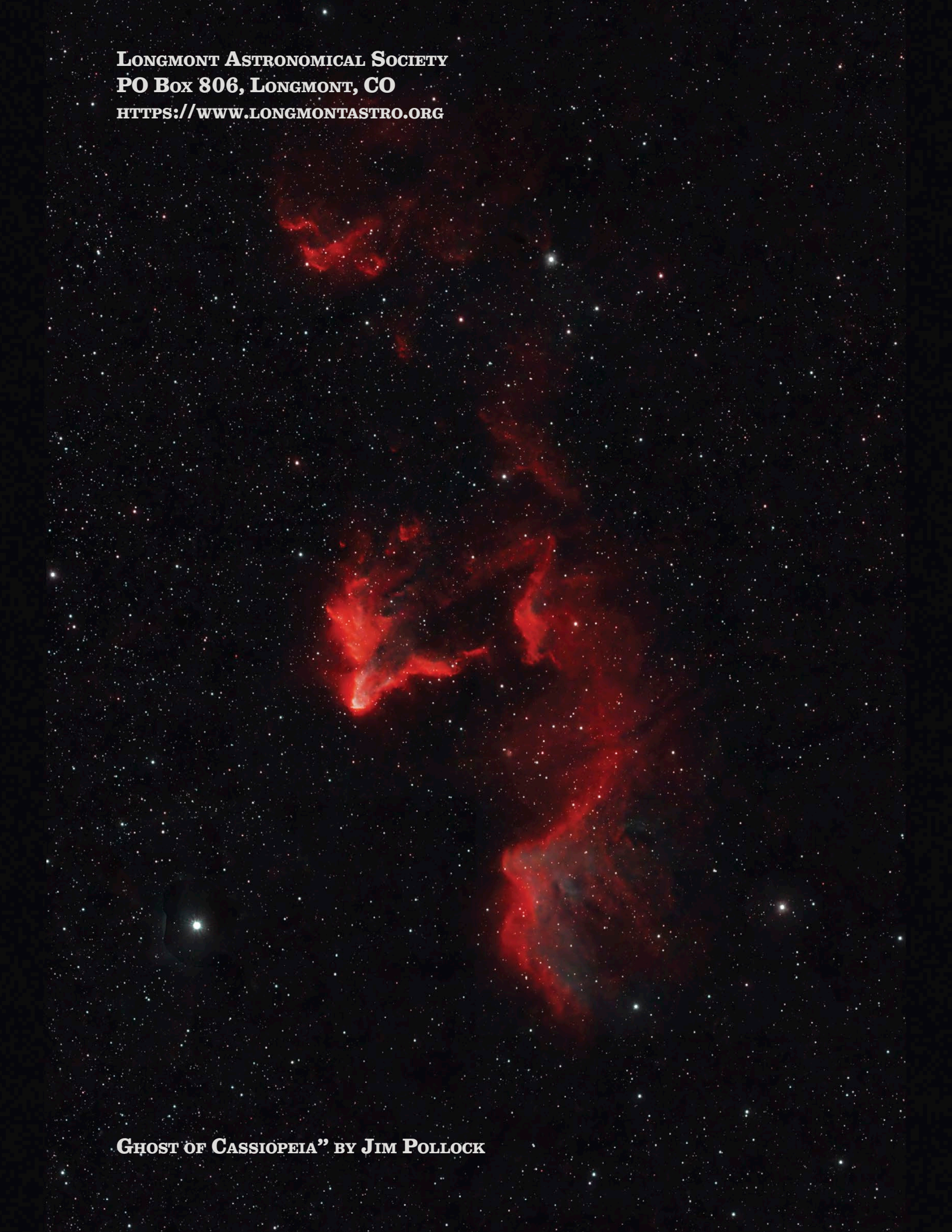
Pictures taken at Gary's house while preparing for the Feb 1st New Moon star party

LAS 2003 Annual Banquet Pictures

February 2013

No newsletter was published.

Longmont Astronomical Society
PO Box 806, Longmont, CO
https://www.longmontastro.org



Ghost of Cassiopeia" by Jim Pollock