Published by the Astronomical League
Vol. 76, No. 4 SEPT 2024

Reflector

OBSERVING WITH A PURPOSE

TOUCH THE ECLIPSE

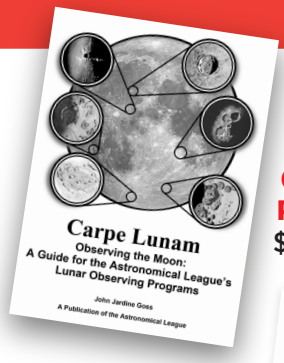
AWARD SEASON

IMAGING CORONAL FINE STRUCTURE

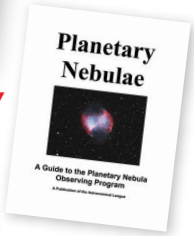
ASTRONOMY OUTREACH FOR VETERANS

SHOP OUR STORE

FOR WIDE VARIETY OF CLOTHING, BOOKS, HATS, & MORE—FAR TOO MUCH TO SHOW IN THIS AD!



NEW MANUAL! SUPPORTS ALL AL LUNAR OBSERVING PROGRAMS!
$20 PLUS $7 S&H



PLANETARY NEBULAE
$19 PLUS $6 S&H

ASTRONOMICAL LEAGUE VISUAL ASTRONOMICAL OBSERVING JOURNAL
$16 PLUS $6 S&H

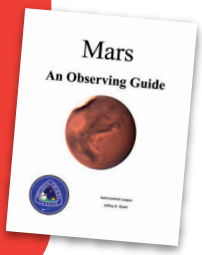
ASTRONOMICAL LEAGUE ASTRONOMICAL IMAGING JOURNAL
$16 PLUS $6 S&H

ASTRONOMICAL LEAGUE BASEBALL HAT
EMBROIDERED LOGO, ADJUSTABLE; ROYAL BLUE, MAROON, KHAKI, NAVY; $18 PLUS $5 S&H

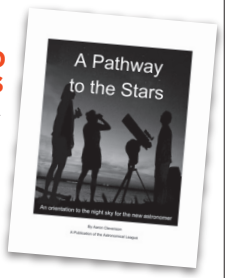
ASTRONOMICAL LEAGUE SPORTSMAN'S BUCKET HAT
EMBROIDERED LOGO, S/M OR L/XL; KHAKI ONLY
$22 PLUS $5 S&H

ASTRONOMICAL LEAGUE LAPEL PIN
(ONE-INCH DIAMETER)
$6 PLUS $3 S&H

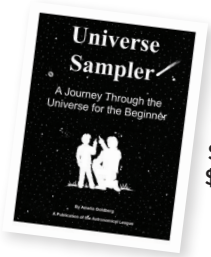
ASTRONOMICAL LEAGUE WINTER KNIT CAP
NAVY/GRAY, PURPLE, BLACK, MAROON, ROYAL BLUE, GRAY, DARK GREEN; $20 PLUS $5 S&H



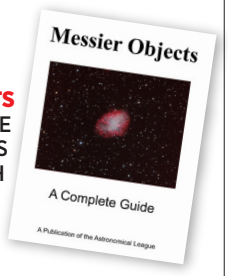
MARS – AN OBSERVING GUIDE
A SYSTEMATIC PROGRAM STUDY OF THE RED PLANET.
$20 PLUS $7 S&H



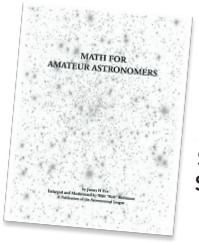
A PATHWAY TO THE STARS
THIS MANUAL IS A GREAT INTRODUCTION TO ASTRONOMY FOR THE NEW ASTRONOMER.
$10 PLUS $4 S&H



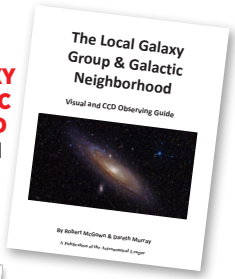
UNIVERSE SAMPLER
A JOURNEY THROUGH THE UNIVERSE FOR THE BEGINNER
$14 PLUS
$5 S&H



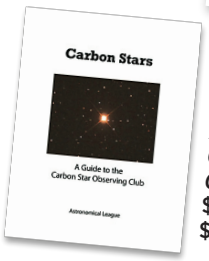
MESSIER OBJECTS
A COMPLETE GUIDE
$16 PLUS
$6 S&H



MATH FOR AMATEUR ASTRONOMERS
$15 PLUS
$5 S&H

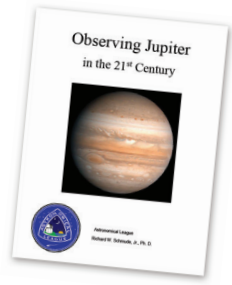


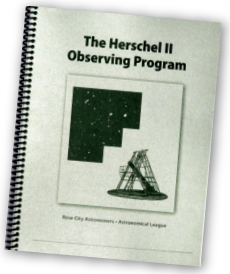
THE LOCAL GALAXY GROUP & GALACTIC NEIGHBORHOOD
$23 PLUS $8 S&H



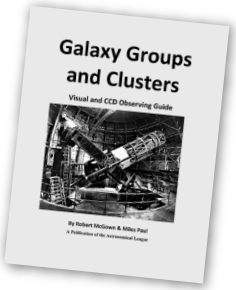
CARBON STARS
A GUIDE TO THE CARBON STAR OBSERVING CLUB
$12 PLUS
$4 S&H

OBSERVING JUPITER IN THE 21ST CENTURY
$14 PLUS $5 S&H

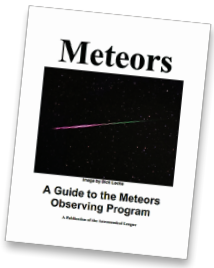




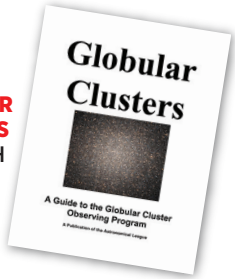
THE HERSCHEL II OBSERVING PROGRAM
$18, PLUS $7 S&H



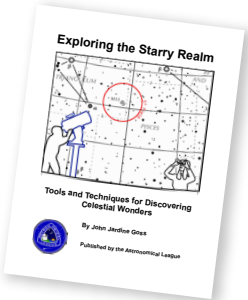
GALAXY GROUPS AND CLUSTERS
$20 PLUS $7 S&H



METEORS—
A GUIDE TO THE METEORS OBSERVING
PROGRAM
$12 PLUS $5 S&H



GLOBULAR CLUSTERS
$16 PLUS $5 S&H



EXPLORING THE STARRY REALM
TOOLS AND TECHNIQUES FOR DISCOVERING CELESTIAL WONDERS
$14 PLUS $5 S&H

HERSCHEL 400
NOW REVISED AND EXPANDED
$16 PLUS $6 S&H

ASTRONOMICAL LEAGUE CLOTH PATCH
(3" DIAMETER) FULL COLOR
$7 PLUS $1.50 S&H
BLUE & WHITE
$6 PLUS $1.50 S&H

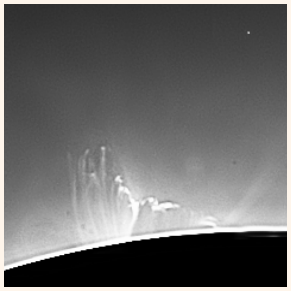
SECURE ONLINE ORDERING FROM
STORE.ASTROLEAGUE.ORG

Or order by mail at Astronomical League Sales,
9201 Ward Parkway, Suite 100, Kansas City, MO 64114.
Enclose check for price and S+H charges as shown.

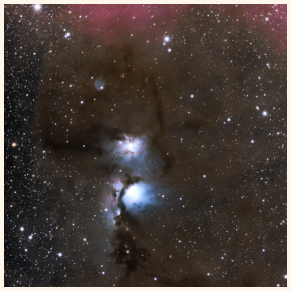
Contents

PAGE 8

PAGE 17



PAGE 22



Shaun Paul *(Fort Worth Astronomical Society) created this composite image using a Canon EOS 6D Mark II camera on an Orion ED80 telescope from Navarro Mills Lake, Texas.*

Reflector

The Astronomical League Magazine

Vol. 76, No. 4 • ISSN: 0034-2963 • SEPT 2024

A FEDERATION OF ASTRONOMICAL SOCIETIES
A NON-PROFIT ORGANIZATION
To promote the science of astronomy

- by fostering astronomical education,
- by providing incentives for astronomical observation and research, and
- by assisting communication among amateur astronomical societies.

Astronomical League National Office:
9201 Ward Parkway, Suite 100, Kansas City, MO 64114

Reflector

QUARTERLY PUBLICATION OF THE ASTRONOMICAL LEAGUE

Issued by the Astronomical League in March, June, September, and December, *Reflector* (ISSN: 0034-2963) is sent directly, either by postal mail or via a digital link, to each individual member of its affiliate societies and to members-at-large as a benefit of League membership. Individual copies of *Reflector* are available at the following subscription rates, payable to the League's national office.

PAPER SUBSCRIPTIONS:

USA & possessions: $3.00 each or $10.00 per year (4 issues)
Canada: $5.00 each or $16.00 per year
Mexico: $6.00 each or $22.00 per year
Other countries: $7.00 each or $25.00 per year

DIGITAL SUBSCRIPTIONS:

All countries, possessions, and territories: $10.00 per year

***REFLECTOR* AND CLUB ROSTER DEADLINES**

March issue	**January 1**
June issue	**April 1**
September issue	**July 1**
December issue	**October 1**

LETTERS TO THE EDITOR

Send to *larsen@ccsu.edu* with subject line "letter to editor"

To the Editor

Andrew Yu's superb June 2024 article on imaging 109 of the 110 Messier objects in one evening caught my attention. Dan Knauss and I did a "photographic Messier Marathon" on the night of March 19 and the morning of March 20, 1988. The details of this marathon can be found at *www.3towers.com/Grasslands_Content/PhotographicMessierMarathon/Marathon.html*. We accomplished considerably less than Andrew. In our case we photographed 84 Messier objects and 19 other assorted NGC or IC objects with Konica 3200 hypersensitized film and a 24-inch f/5 reflector. It was fun but challenging and tiring. Our only rule was the object we claimed to have photographed was recognizably the object in question even if not shown particularly well. As Andrew showed, the Messier objects are bright enough and large enough to be imaged all in one night except for possibly M30. Good work Andrew!

—Tim Hunter, Tucson, AZ

Letter to the Editor: Reply

To Stephen Lieber from New York: First of all, thank you for reading my two-part article (December 2023 and March 2024) as I have been told by folks that since my column isn't about observing, they don't read it. Secondly, I truly apologize if I gave the impression that the Muskogee Chamber of Commerce was bigoted or prejudicial in any way. Her statement stemmed from a state of incredulousness due to a tumultuous past none of us created. As a Californian transplant since 1992, I had no clue as to all the history of Tulsa and the surrounding areas, which can be a blessing of sorts. As we know, there is no perfect state.

The phenomenal opportunity that philanthropist and contractor Charles Crawford offers supports local residents by employing them at his job sites and providing events for their families and local school systems. Because of his personal ethic, I gave him a sketch I did at 8 years old of Mahatma Gandhi after a great mat and framing job (sometimes I call him Gandhi). That being said, as a former staff member of Astronomers Without Borders, my intention in writing the event recap was to show that coming together around a telescope or mobile observatory transcends any socioeconomic or cultural strongholds. The aforementioned issues fall to the wayside when we look up together.

There is so much more coming from our combined efforts 45 miles away in Muskogee, Oklahoma. I can't wait until you hear about the solar eclipse from April. For me personally, anyone can set up and do the usual outreach – I'm all in for this fantastic transformation of a community through astronomy. If you want to talk further, please contact me at *astroleague_steam@cox.net*.

Clear Skies!

—Peggy Walker

New Staff

We are thrilled to introduce Max Nomad, the newest member of the *Reflector* creative team. With a background that blends more than 20 years of innovative graphic design, computers and writing, Max brings a wealth of experiences and expertise to our publication.

By day, Max is an IT consultant and cybersecurity analyst for small firms in the architecture, engineering, and construction industry. He also takes on freelance creative projects, specializing in custom publishing and visual storytelling. He's worked on everything from branding campaigns and web design to print advertising. His clients have ranged from TGIFriday's and STIHL to start-ups and nonprofits. "I've even worked with ostrich farmers," he muses.

As an amateur astronomer Max escapes the rigors of business by surfing on the Moon with Banneker—his Orion XT8 Dob. He's also passionate about stock investing, screenwriting, tournament poker, genealogy, blues harmonica and campy zombie flicks.

"I'm a lifelong student. Combining creativity, detective work and a few laughs keeps me a happy kid," Max says. "Working with Michael, Kristine and the rest of the team is going to be a treat—on top of what I get to learn from the readers!"

Please join us in giving a warm welcome to Max as we look forward to seeing his work in upcoming issues.

Star Beams

I would like to begin my last Star Beams column by extending congratulations to our newly elected executive committee members, who take office on September 1. They are Chuck Allen, president; Terry Mann, vice president; and Michael Coucke, treasurer.

My formal relationship with the League began in 1993 when I attended my first ALCon in Madison, Wisconsin, in preparation for chairing the next year's convention in Kansas City.

As I come to the end of my League presidency, I would like to reflect on what has been a most successful four years, in spite of COVID and other issues. This is due in large part to the wonderful, talented people I have been privileged to work with. Have we had challenges? Yes, plenty of them! Have we left the League in a better place? Yes!

Leading up to the COVID years, executive secretary, Maynard Pittendreigh chaired a most successful ALCon in Florida, combined with a fabulous Bahamas cruise in 2019. The *Reflector* was one of the main voices for the League during the COVID years, when face-to-face activities were extremely limited. Thanks to Kristine Larsen and the entire *Reflector* staff! Also, a big thanks is in order for Ron Kramer, former editor and managing editor of the *Reflector* magazine, who was most instrumental in assembling such a high-quality group of professionals led by Kristine. This amazing group brought the *Reflector* to the very high level of quality today that we often take for granted.

Who could have imagined that COVID-19 would become such a potent force in all our lives, affecting everything we did. And yet, astronomical observing thrived. We might not have been able to move in our normal social circles the way we had before, but people increasingly were outdoors doing more exploration of the skies than ever before. Our Astronomical League membership numbers reflected this, increasing dramatically to where today we are 24,000-plus members strong. Thanks to all our Observing Award coordinators who continually faithfully administer their individual programs.

We had to cancel our ALCon 2020 because of the pandemic, then in 2021 we scheduled a virtual ALCon, which was a great success, thanks to the outstanding leadership of Chuck Allen and Terry Mann, co-chairs for that event. Also, thanks to the patience of the Albuquerque Astronomical Society; they were still committed to hosting ALCon 2022 after the two-year delay of in-person conventions. The Baton Rouge Astronomical Society hosted an outstanding ALCon in 2023, the first ever for the state of Louisiana. Now Kansas City is hosting 2024 with a trial run of offering an online streaming option.

We appreciate all the sponsors who have been so supportive over the years. These include Explore Scientific, which has provided invaluable sponsorship and technical support as the League has moved quickly down the road toward a multimedia future. Also, our media officer and former president, John Goss, has been such an outstanding resource for presenting professionally prepared materials and media releases for our internal use as well as for the world at large. Terry Mann, our secretary and former president, has done an incredible job as the liaison with Explore Scientific, effectively managing our weekly participation with its Global Star Parties as well as the monthly Astronomical League Live presentations.

An unheralded hero has been our treasurer, William Dillon. His financial expertise has allowed us to deal efficiently with a couple of major bequests in the past few years, while at the same time helping keep our spending in line with our budgets.

Our vice president and former president, Chuck Allen, has taken on many crucial tasks. One major example is the magnificent job he did in updating our woefully outdated bylaws.

Webmaster John Martin spent countless hours with our website design vendor, totally revamping our website. This whole process turned out to be a far more complicated and laborious process than we had originally anticipated. This was done while John worked full-time in his IT position. Thanks to our membership who have been so patient during the change over to the new site! Aaron Clevenson and others continue to offer invaluable help in finding and resolving issues with the site. Many other volunteers have also helped in fulfilling the mission of the Astronomical League to promote the science of astronomy in so many different ways.

Without the support of our members none of this would have been possible. You have embraced our many Observing Programs, with countless hours spent under the stars to complete the various requirements. Many of you have reached the pinnacle of this activity by finishing the requirements for the Master Observer Program. Others have organized star parties, Astronomy Day events, regular club star parties for the public, and many more beneficial activities.

So, as I step away from active League leadership, I thank you from the bottom of my heart for all the kindness and friendship you have shown me and my wife, Betty. We appreciate this very much.

—Carroll Iorg, President

Night Sky Network

INTERNATIONAL OBSERVE THE MOON NIGHT 2024

During a year in which the Sun has received a lot of love and attention, astronomy clubs have an opportunity to show their appreciation for our Moon on September 14, 2024, during NASA's International Observe the Moon Night. This outreach initiative was started in 2009, to celebrate the arrival of the Lunar Reconnaissance Orbiter and

Credit: Sketches of the Moon from *Sidereus Nuncius*, by Galileo Galilei

Lunar Crater Observation and Sensing Satellite at the Moon. From there, it became a global celebration of all things Moon – from observing with telescopes and your unaided eye, to songs and poems being written for the Moon, to paintings and illustrations of the Moon, hearkening back to the days of Galileo's lunar sketches.

HOW TO PARTICIPATE

This event takes place in the early fall, within the week before and after the first quarter Moon, in addition to the day-of. You can participate in a number of ways:

HOST AN OBSERVING PARTY

Amateur astronomers love nothing more than a good star party, so make sure everyone

is invited to yours! If you have the equipment to allow the public to view the Moon, be sure to set up somewhere public. Like any party, it's best enjoyed with friends, so make sure you have enough support with you. You can also have a virtual observing session by live streaming views of the Moon on your preferred social media platform. The choice is yours!

CREATE ART

Channel your inner Van Gogh and Méliès by creating art around the Moon. You can use paints, pencils, clay, a 3D printer – there are no rules! And once you're done, you will have a permanent memento of the evening.

Image Credit: NASA/Vi Nguyen

STORYTELLING AND LEARNING

Use Night Sky Network resources like ***Moon Myths from Around the World*** (*bit.ly/MoonStories*) and ***Exploring Moon Phases*** (*bit.ly/MoonPhaseCards*). These tools, along with others in the Outreach Resources tab on the NSN site (*nightsky.jpl.nasa.gov*), can guide participants through all things lunar.

GET REGISTERED

However you choose to **#ObserveTheMoon**, make sure to register your event with NASA. Your event will be added to their global calendar of events. Note: this can be as large or as small as you prefer. There is no one way to participate. Be sure to visit *moon.nasa.gov/observe* for a full list of ways you can share this wonderful experience with your community.

—Kat Troche

DarkSky Corner

Save the date: Under One Sky

The annual DarkSky 24-hour virtual conference "Under One Sky" takes place November 8-9, 2024. According to the DarkSky website, the event is a "24-hour virtual conference that aims to inspire and empower individuals like you to combat light pollution in every corner of the world. This event will feature a diverse lineup of speakers, engaging topics, insightful panels, and worthwhile networking opportunities for all attendees." For information on past events (including recordings from the 2023 conference), see *darksky.org/what-we-do/events/under-one-sky*. DarkSky has an open call for speakers to participate in the conference. Contact Chris Peterson, engagement associate, at *chris.peterson@darksky.org* for more information or to submit a talk proposal.

—Tim Hunter

Full STEAM Ahead

TOUCH THE ECLIPSE, PART 1

Just before Easter, Charles Crawford of Muskogee called to say he was planning an Easter event and had students from Oklahoma School for the Blind (OSFTB) coming; he didn't know what to do for them. Immediately I said, "Get those 'Findthings' [AirTags] and put them in a basket and let them track them down." He commented that he knew I would have a great idea. "So now what do I do for my eclipse event next month?" he asked. He expected elementary school students, students from OSFTB again, as well as the Chamber of Commerce and the community. "I'll make you eclipse resources, don't worry," I offered. Charles let me know that the OSFTB has 93 students and only 30 or so are totally blind; a few of that number are also deaf. The rest are legally blind and need heavy corrective lenses to read.

With that new information in mind, I set to work and decided on five resource topics to be created on hardboard. As described in my June 2024 column, I started to look at making a solar eclipse painting tactile. The U.S. map with the totality paths of both 2017 and 2024 eclipses with the partial eclipses across the states would need to be a larger board. Of course, one showing the three types of eclipses needed to be on a panel so students could compare the sphere placement and shadow generation. This board needed to be bigger than my canvas of the 2017 corona artwork to allow room for more than one student at a time to read the board.

As I planned, my thought was how can I get some specific solar astronomy concepts conveyed to them. With Oklahoma having a 97% partial eclipse, I came up with ten panels that were 10 by 12 inches that would show the stages of the eclipse leading up to totality, and the partiality after totality. Knowing that Charles had some round tables, I felt that would be a perfect fit. Of course, how could a solar phenomenon occur and not lead to questions about the Sun's internal structure and atmosphere? I decided to construct a model of the Sun that would show the layered internal structure just like all the diagrams that are on the Internet.

With my pencil, ruler, graph paper, and eraser in hand, I started to map out a cutting sheet to determine what size hardboard would need to be purchased. After plotting and erasing, Rick, my husband, walked by and said, "Give me the sizes you would like to have – there's an app for that." Of course. You simply type in measurements, and it will lay out a saw pattern to follow. I only needed a 4 by 8 foot panel, and Home Depot did the major cuts so it could fit in the back of my truck.

I had weeks to get it all done since we were leaving town – the clock was ticking, and there was no way we were going to disappoint those children (or Charles). *To be continued...*

—Peggy Walker

Deep-Sky Objects

A DOUBLE TREAT INSIDE THE HOUSE

To me, the constellation Cepheus looks like the side view of a house with a very steep roof. Four stars (Alpha, Beta, Iota, and Zeta Cephei), all approximately third magnitude, form the house's walls. Iota, Beta, and Gamma Cephei form the roof.

NGC 7129 and NGC 7142.

Cepheus lies along the Milky Way, so the constellation contains a multitude of star clusters and nebulae. Two that lie inside the house asterism are found within a region approximately the same size as the Moon. They can easily be viewed simultaneously in telescope eyepieces that can contain the entire Moon! These two splendid objects are known as NGC 7129 and NGC 7142.

NGC 7129 is an eleventh-magnitude open cluster with a diameter of seven arcminutes. An eight-inch telescope will show three stars brighter than magnitude 11 and a few more brighter than magnitude 12. Overall, there may be 130 stars in this cluster. If you are wondering how a star cluster can be catalogued as eleventh magnitude but contain stars brighter than eleventh magnitude, so am I. The star cluster is embedded in a nebula catalogued as IC 5134. The nebula features light from the three bright stars reflected off of gas and dust. It appears white to blue on long photographic exposures with small telescopes. Larger telescopes and longer exposures show the reflection nebula with blue and pinkish-red colors. In dark skies, a hint of the nebula can be spied with 8- to 10-inch telescopes. The star cluster is young, perhaps only a million years old. The cluster is 3,300 light-years away.

NGC 7142 is located south and east of NGC 7129. It is a much larger open star cluster, 12 arcminutes in diameter, with more stars visible at the telescope than in NGC 7129. However, the brightest stars in NGC 7142 are not as bright as the brightest stars in NGC 7129. NGC 7142 is much older than NGC 7129, perhaps three to six billion years old. Therefore, it doesn't contain the hot, bright OBA spectral class stars seen in NGC 7129. Any OBA stars that initially formed in NGC 7142 would have long died out since they use up their nuclear fuel quickly. However, the cluster does have a few "blue stragglers." These blue stars are thought to have formed by the merger of two smaller cluster members. The combined star, being more massive, burns hotter and will not live as long as the unmerged stars would have. Although they are close to each other in the sky, NGC 7142 is 3,000 light-years farther away than NGC 7129.

My picture of NGC 7129 and NGC 7142 was taken with a William Optics 132 mm f/7 apo with a Tele Vue 0.8× focal reducer/field flattener yielding f/5.6. The exposure was 220 minutes (using 10-minute subframes) with a SBIG ST-2000XCM CCD camera. In the image, NGC 7129 is at the upper right with the bright stars immersed in some faint nebulosity. NGC 7142 is to the lower left.

When panning the Milky Way through Cepheus for deep-space objects this autumn, try to capture two in the view with NGC 7129 and NGC 7142.

—Dr. James R. Dire

References

NASA. "Nebula NGC 7129." *Spitzer Space Telescope*, *www.spitzer.caltech.edu/download/MediaFile/612/binary/original*.

Straižys, V. et al. 2014, *MNRAS* 437, 1628

From The Editor

As we prepare for the longer, crisper nights of autumn, your *Reflector* team is turning over a new leaf, so to speak. It is the end of an era here, quite literally. Managing editor Ron Kramer is hanging up his newsroom hat after many years at the helm. Ron recruited Kevin and me as his assistant editors in 2013, and in 2019 he handed me the editor's reins. I cannot tell you how honored I was (and still am) for the trust he placed in me. I hope I have lived up to his expectations. Another vital member of the team, design and layout guru Michael Patterson, also recruited under Ron's leadership, is also taking a bow. He will be missed more than I can say. If you have liked the way our magazine looks (and I hope you do!), it is all due to Michael's creativity and talent. As noted elsewhere in this issue, we are fortunate to be bringing on board some fresh new talent, Max Nomad. He has already instituted some changes in the production process, and Kevin and I look forward to seeing what other innovations he brings to the table. Please join me in wishing Ron and Michael well and thanking them for their years of work on behalf of the League!

Eyes on the Skies: T CrB

By the time this issue reaches your hands, the famous "Blaze Star," the recurrent nova T CrB, may have erupted. If so, we hope you are submitting your obsevations to the American Association of Variable Star Observers (AAVSO). Even if it is past peak, observations of the decline are needed all the way back to quiescence. If the outburst has not occurred, please keep an eye on this star (and your eye to the Internet for word of the outburst)– it is a once-in-a-lifetime experience!

More information on observing this star (including finder charts and comparison stars for photometry) can be found at

www.aavso.org/t-crb-finder-charts .

Observing With a Purpose

by Jamey Jenkins
Champaign-Urbana Astronomical Society

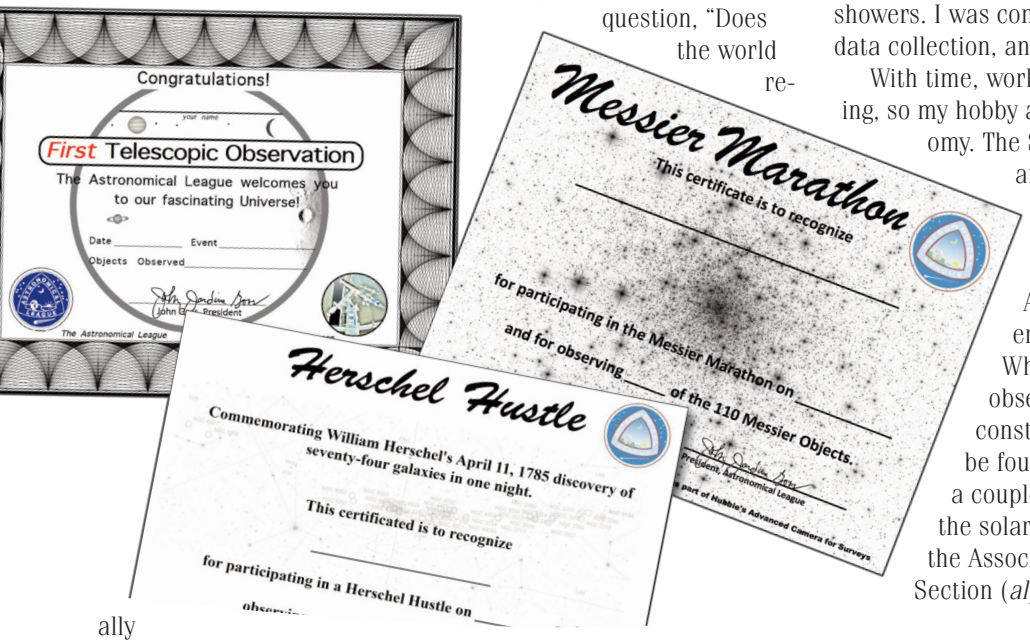
Do you find yourself a lover of all things celestial? An amateur astronomer is described as a person who is fascinated by astronomy or regularly gazes at the stars. The International Astronomical Union (IAU) estimates that there are roughly one million individuals worldwide who pursue amateur astronomy (Kakazu 2021).

I can't speak for everyone else, but my interest began as a 12-year-old during a science class when I opened my textbook to the chapter on astronomy. That day, I stared spellbound at the photos of Saturn, Jupiter, and Mars within its pages. Later on, books as well as time spent under the sky solidified my interest into what has become an enduring hobby. Two epiphanies along the way made a difference in how I approach astronomy and how I encourage others who observe the heavens.

FIRST AWAKENING

As time passed, astronomical photography became a passion; having no local club, I found a pen pal who shared my astronomy interests. This fellow, I'll call him Howard, became a correspondent, mentor, and confidant in my astronomical journey. We exchanged letters frequently, sharing photos and practical advice. Howard was a lifelong hobbyist and an expert in Solar System imaging in the days of film photography. He also competently explored the arena of deep-sky objects.

One day the mail brought me a letter in which Howard expressed disappointment with his latest project, imaging the Andromeda Galaxy, M31. While the photo was as good as any amateur could acquire at the time, it seemed that something deeper nagged at him in his question, "Does the world really need another picture of M31?" Howard rebounded with time, but his question got me thinking about the purpose of the pictures I was acquiring. I began asking myself, "Beyond my own amusement, what is the usefulness of my pictures?"



SECOND AWAKENING

The second revelation occurred while reading a paragraph that appeared in a reprinted *Scientific American* article by C. L. Stong (1980). It told how the novelty of observing the heavens can leave an amateur feeling cheated. That is, the view often doesn't meet expectations. After a look or two through a telescope, aspiring amateurs sometimes turn away to unrelated activities. The article went on to explain that some hobbyists are not so easily discouraged: they pursue their hobby until they arrive at the boundless realm of astrophysics. Astrophysics in this context meant the observation of evolving celestial phenomena. Those phenomena today could be an exoplanet transit, the period of a variable star, the changing face and limb of our Sun, or many other dramatic celestial events.

PURPOSEFUL OBSERVING

From that point on, my perspective on astronomical observing began to change from acquiring static photos and casually scanning the night sky to observing with a well-defined purpose. My initial purposeful experience was as an American Meteor Society (*amsmeteors.org*) observer. This activity included conducting hourly meteor shower counts and determining radiants by plotting trails on star charts. Of course, I could still attempt meteor photography in addition to my visual observations. Statistics would be reported to the American Meteor Society for inclusion in their database. Over time I learned a great deal about meteor rates, meteor composition, and other facts about the over 100 known showers. I was contributing to astronomy as a science through data collection, and the satisfaction was exhilarating.

With time, work responsibilities began to limit evening observing, so my hobby activities adjusted to focus on daytime astronomy. The Sun is a star only 93 million miles from Earth, and this distance provides unique opportunities to observe and study remarkable ever-changing phenomena! One activity I embraced was determining the daily sunspot number for the American Association of Variable Star Observers (AAVSO) by counting groups and sunspots. What is hypnotic about solar studies is that every observation is unique because solar features are constantly evolving. The AAVSO Solar Section can be found on the web at *www.aavso.org/solar*. Within a couple months I also began acquiring photographs of the solar disk and individual features for submission to the Association of Lunar and Planetary Observers Solar Section (*alpo-astronomy.org*).

Eventually, looming retirement opened the possibility to observe the night sky regularly again. Variable star photometry piqued my interest to where I began reading all I could find about differential photometry techniques, variables, and the feasibility of contributing to the AAVSO International Database. So, five years ago, I began obtaining photometric data on a handful of stars. Advice from experienced AAVSO observers helped select targets suitable for my skill and equipment. Since then, variable star photometry has developed into a rewarding, purposeful activity for me

OTHER OPPORTUNITIES

When I meet a new observer, my first questions invariably relate to what they like to do with their hobby. Answers vary from simply watching the stars come out at night to the indulgence of observing the Moon and planets. There is no right or wrong answer; people pursue hobby activities for many different reasons. However, I do believe the benefits of all avocations, including astronomy, should include fulfillment and a positive experience.

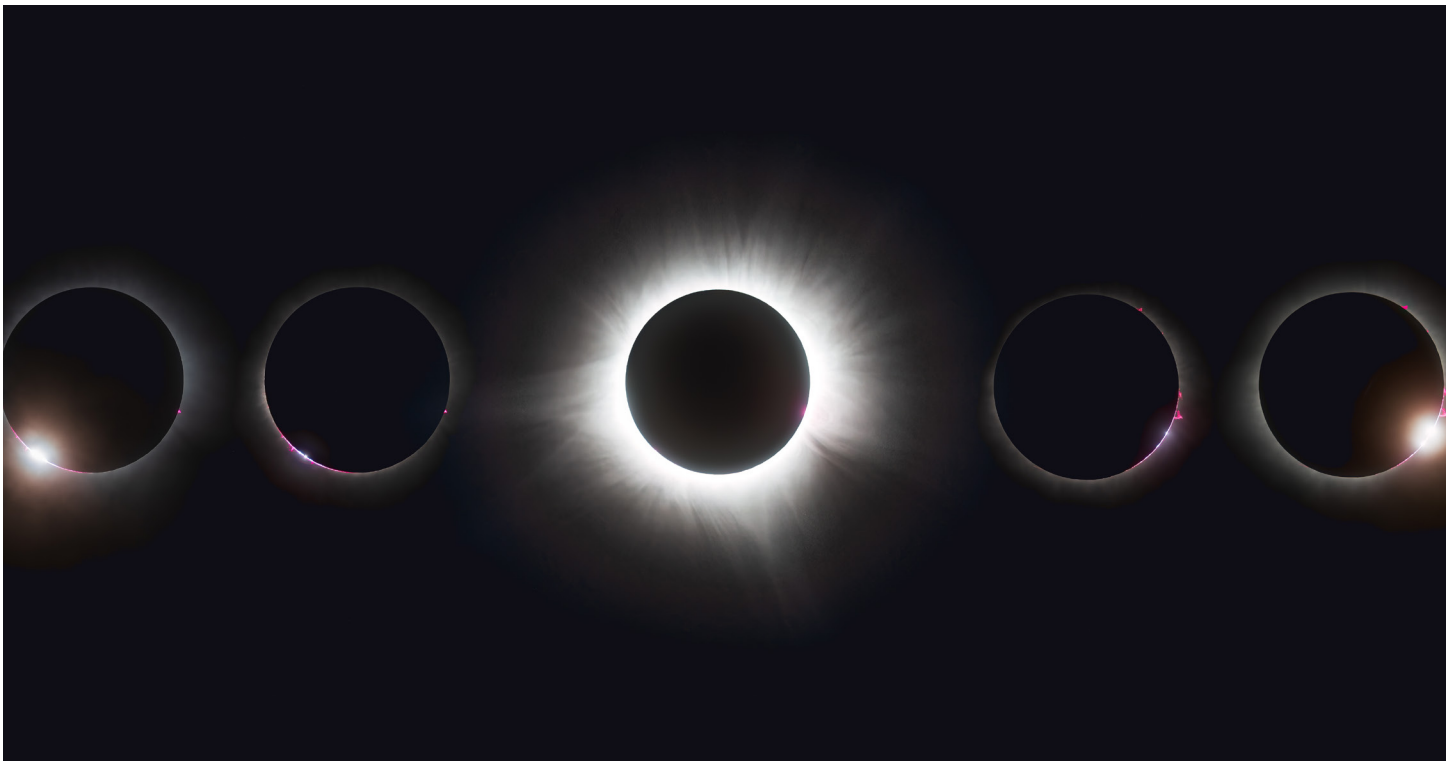
Although the ventures I've described fall into the realm of "citizen science," not all purposeful activities necessitate scientific data collection. The Astronomical League is a great source for ambitious programs that are also designed to provide direction for your observations and lead to a rewardable goal. Several possibilities found on the League's website include the Messier, Double Star, and Lunar Observing Programs. Many other interesting prospects are available for hobbyists desiring to explore a well-defined niche (*www.astroleague.org/alphabeticobserving*).

If you find yourself seeking more fulfillment from your hobby time, my recommendation is to investigate a fascinating League Observing Program or a project that contributes to the science of astronomy. Opportunities within citizen science or pro-am collaborations abound as outlined on the IAU webpage (*iau.org/public/themes/citizen-science-projects*). Any of these programs will open doors that develop your observing skills, while encouraging you to observe with a purpose.

References

Kakazu, Y. "Calling all Amateur Astronomers World-wide." *IAU*, *iau.org/news/announcements/detail/ann21064*.

Stong, C.L. 1980. *Light and Its Uses*. W.H. Freeman and Company.



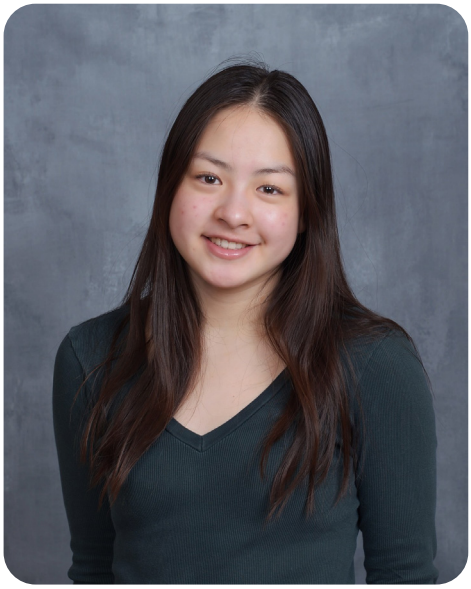
Ann Chavtur (Colorado Springs Astronomical Society) captured this image of totality using a Nikon z6 and Nikkor Z180-600 lens at f/8 600mm from Dripping Springs, Texas

By Chuck Allen

Here are the winners of our 2024 League youth and general awards:

NATIONAL YOUNG ASTRONOMER AWARD

Now in its 32nd year, NYAA is supported by the generosity of Scott Roberts. His company, Explore Scientific, provides outstanding astronomical instruments to our top two winners.



NYAA FIRST PLACE VALENCIA ZHANG

Valencia Zhang is a current senior (award-year junior) at Phillips Academy Andover in Andover, Massachusetts. She is first author on a complex research project entitled "TIC 184 743 498: the First Tri-Axial Stellar Pulsator." She and her team discovered a Delta Scuti pulsator in a tight binary system with nine pulsation modes whose frequencies are between 38 and 56 days. The novelty of the system lay in four of the pulsation modes, which the paper shows to be dipole pulsations along an axis perpendicular to both the tidal axis and the binary's orbital angular momentum axis. Also found were two additional pulsation modes that were explained as dipole modes along an axis aligned with the orbital/rotation axis. The paper proposes that TIC 184 743 498 is a tri-axial pulsator, the first of its kind ever discovered.

In addition to the Explore Scientific telescope prize, Valencia earned a plaque and an all-expenses-paid trip to ALCon '24 to present her paper.

NYAA RUNNER-UP JULIAN SHAPIRO

Julian Shapiro is a current junior (award-year sophomore) at The Dalton School in New York City, New York. His paper is entitled "Discovery of a New Planetary Nebula and Supernova Remnant Candidate in Cygnus."

Julian's paper presented the discovery of a new planetary nebula as well as a potential supernova remnant in Cygnus requiring further investigation. The objects were discovered through online imagery and surveys as well as data taken by amateur equipment. The planetary nebula, dubbed Sha1, was identified through evidence of a signal in oxygen III and hydrogen alpha wavelengths and a potential central star of the planetary nebula. A supernova remnant candidate was discovered nearby, spanning approximately 36 arcminutes.

Julian received a plaque and earned an Explore Scientific telescope prize and an expenses-paid trip to ALCon '24 to present his paper.

NYAA THIRD PLACE MARCUS KING

Marcus King is a current senior (award-year junior) at the Governor French Academy in Belleville, Illinois.

Marcus's extensively researched paper is entitled "Analytic Modeling of Exoplanet Detection via Gravitational Lensing and Orbital Motion." His paper analyzes the effect of orbital motion on gravitational microlensing events and helps form a basis for specialized exoplanet detection in the future. His analysis involved a comparison of two Python programs, pyLIMA and MulensModel. Marcus found that, due to differences in models, the amplitude at the highest point for several parameters could be much more easily modeled in MulensModel.

Marcus received a plaque and earned an all-expenses paid trip to ALCon '24.

YOUTH SERVICE AWARDS

The League offers two major youth service awards, the Horkheimer/Smith Award and the Horkheimer/D'Auria Award, both with substantial cash prizes.

HORKHEIMER/SMITH SERVICE AWARD WINNER: ANDREW YU

Andrew Yu, a member of the Texas Astronomical Society of Dallas (TASD), is this year's winner of the Horkheimer/Smith Youth Service Award.

Andrew co-founded the Teen Texas Astronomical Society of Dallas and became TTAS's first president. He also launched NASA ASTRO-CAMP in partnership with NASA, providing astronomy and STEM engagement activities to youth, especially in underserved communities. He conducted five camps in multiple cities with three more planned. He received the John Wagoner Award from the Texas Star Party for his outreach efforts and received the Presidential Service Gold Award for his TTAS outreach. He re-vamped the TTAS website, *teentas.org*, to include updated activities and events and led a team of six to be part of the Dynamic Eclipse Broadcast Initiative. He engages in astronomical research and astrophotography.

Andrew received a plaque and earned both a $1,700 cash prize and an all-expenses paid trip to ALCon '24. Having also won the Horkheimer/Parker Imaging Award this year, he is only the second youth to receive two major League youth awards in the same year.

HORKHEIMER/D'AURIA SERVICE AWARD WINNER: DHRUVA KALYANI

Dhruva Kalyani, a member of the Milwaukee Astronomical Society, a senior at New Berlin High School in New Berlin, Wisconsin, and a dual-enrollee in UW-Milwaukee data science courses, is this year's winner of the Horkheimer/D'Auria Youth Service Award.

A keyholder to the MAS Observatory, Dhruva assists with public tours and open houses and is a mentor for younger members in their astrophotography pursuits. Now a two-time Horkheimer winner, Dhruva is heavily engaged in citizen science and submits comet and NEO observations to SETI as part of a citizen science planetary defense project. He created a MAS group of the Pulsar Science Collaboratory, an out-of-school citizen science project for students of age 13 and up. He leads the astronomy club at his high school, serves as a NASA Eclipse Ambassador, runs data gathering missions with the MAS's Unistellar eVscope Smart Telescopes, and is heavily engaged in public speaking.

Dhruva received a plaque, a $1,000 cash prize, and an all-expenses paid trip to ALCon '24.

HORKHEIMER/PARKER IMAGING AWARD

The League hosts a youth imaging competition, the Horkheimer/Parker Imaging Award, with cash prizes.

HORKHEIMER/PARKER YOUTH IMAGING AWARD WINNER: ANDREW YU

Andrew Yu of the Texas Astronomical Society of Dallas is also this year's winner of the Horkheimer/Parker Youth Imaging Award. His winning image is a beautiful capture of M78 in Orion. Andrew is a senior (award year junior) at Plano West Senior High School in Plano, Texas.

Andrew's winning photo of M78 was taken from the TAS's extensive dark-site observing facility near Caddo, Oklahoma, using an Astro-Tech AT80EDT refractor, ZWO ASI533MC camera, and Celestron Advanced VX mount.

Andrew received a plaque and a cash prize of $1,000.

HORKHEIMER/PARKER YOUTH IMAGING AWARD RUNNER-UP: DANIEL ADIBI

Daniel Adibi, a member of the Delaware Valley Amateur Astronomers, is this year's runner-up for the Horkheimer/Parker Youth Imaging Award. He is a junior (award-year sophomore) at the Episcopal Academy in Newtown, Pennsylvania. His image is an incredible wide-field image of M31 showing distinct tidal warping. Daniel is also engaged in astronomical research and teaches classes for local middle school students and online classes for students in the Middle East.

Daniel's photo was taken from his backyard in Haverford, Pennsylvania, using a Sky-Watcher Quattro 6-inch Newtonian telescope with a ZWO ASI 585 MC camera on a Celestron NexStar Evolution 8 mount.

Daniel received a plaque and a cash prize of $500.

HORKHEIMER/PARKER YOUTH IMAGING AWARD THIRD PLACE: DHRUVA KALYANI

Dhruva Kalyani of the Milwaukee Astronomical Society is this year's third-place winner in the Horkheimer/Parker Youth Imaging competition. He captured a magnificent pink and yellow image of the Wizard Nebula in Cepheus. Dhruva engages in countless hours of public outreach and is a mentor for younger members in astrophotography.

Dhruva's image was taken at the Milwaukee Astronomical Society Observatory near New Berlin, Wisconsin, using a Celestron EdgeHD 14 with an SBIG model STT-8306 imager on an Astro-Physics GTO 1600 mount.

Dhruva received a plaque and a cash prize of $250.

HORKHEIMER/O'MEARA JOURNALISM AWARD

The League conducts an annual science writing competition for youths aged 8 to 14. The top two winners of the Horkheimer/O'Meara Journalism Award received beautiful plaques and cash prizes.

HORKHEIMER/O'MEARA JOURNALISM AWARD WINNER: OCTOBER RUNDLE

October ("Toby") Rundle, 14, was adjudged the winner of the Horkheimer/O'Meara Journalism Award. Toby was an award-year 8th grader at the Roosevelt Middle School in Oceanside, California, and is a member of the Roanoke Valley Astronomical Society.

Toby received a plaque and a $1,000 cash prize for the following essay, "Black Holes: What's the Hype?":

Black holes are easily one of the most "out of this world" phenomena observable by society today. They have a rightful place among the most mysterious cosmic objects in the known universe. What's the appeal? What is it about these massive concentrations of matter that captures human attention? To begin, we should make one thing clear: black holes are not holes, but extremely dense clusters of mass with gravity so strong that nothing – not even light – can escape. There's so much about black holes that's unknown, and humans are all about that mystery

Think about *Star Wars*, *The Matrix*, *E.T. the Extra-Terrestrial*, anything like that. Humans and science fiction have always gone hand-in-hand, our interests and fascinations being reflected in music, films, novels, and other art forms. We're creative; we've been making up stories and theorizing since we were first able to think. As a species, we have this constant thirst for more information, more knowledge. That's the reason we're aware of the universe beyond our planet in the first place. We're constantly trying to make sense of nonsensical things, which brings us back to black holes: the perfect outlet for human fixation.

These paradoxical, mind-bending occurrences break down the laws of physics as we know them.

They're inherently invisible, but scientists have found that they can be detected by the way they affect and shape their surroundings, such as the movement of stars or the formation of galaxy clusters. There's also the possibility of anything venturing too close being pulled in and "spaghettified," a theorized process involving a spacecraft, planet, star, or the like being vertically stretched and horizontally compressed, as the name would suggest. Of course, as sentient beings, we're naturally drawn to the exploration of foreign things like this and the pursuit of unraveling their mysteries.

However, there's a fine line between intrigue and fear. It'd very well drive one insane to constantly have lingering thoughts of some dark, looming beast that could effortlessly swallow our entire Solar System. Taking into consideration how little we know, there's lots of room for paranoia and anxiety.

Of course, the actual chances of Earth being consumed by a black hole are lower than that of winning the lottery and being struck by lightning during the same day, in the same spot, twice. They form from the gravitational collapse of heavy objects like stars, and the chances of that happening are roughly one in a thousand. Considering that the black hole nearest to us—named Gaia BH—resides a total of 1,560 light-years away, it's safe to assume the odds are in our favor. Despite the benefit of the doubt, it's still a not uncommon fear.

With black holes being one of the most enigmatic and tantalizing puzzles yet to be fully understood, people are interested for a variety of reasons. Whether it be curiosity, intrigue, fear, or just for the sake of what it represents, we just can't get enough of it.

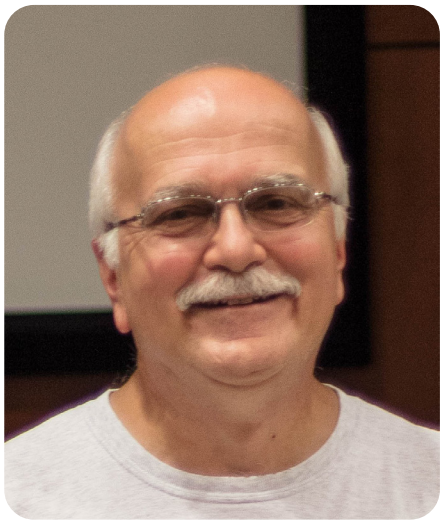
HORKHEIMER/O'MEARA JOURNALISM AWARD RUNNER-UP: IVORY ALTHOFF

Ivory Althoff, 13, has won runner-up honors in the Horkheimer/O'Meara Journalism competition. Ivory was an award-year 7th grader at the Providence Academy in La Crosse, Wisconsin, and is a member of the La Crosse Area Astronomical Society.

Ivory received a plaque and a $500 cash prize for an essay entitled "The Sky Is My Theater." The essay focuses on the beauty of the night sky and inspiration taken from the work of Carolyn Shoemaker.

MABEL STERNS NEWSLETTER AWARD

This award recognizes club newsletter editors whose job is to communicate with members.



MABEL STERNS NEWSLETTER AWARD FIRST PLACE: TOM NOLASCO

Tom Nolasco is editor for *The Delaware Valley Amateur Astronomer*, the newsletter of the Delaware Valley Amateur Astronomers. Tom, who also serves as the club's vice president, has been an amateur astronomer since his youth. In addition to curating diverse content, he also authors original columns such as "The Evolution of Solar System Imaging," an example of how Tom's expertise has expanded as the hobby has progressed. His specific expertise includes telescope making, Solar System imaging, community outreach, teaching, club leadership, and the newsletters he edits.

MABEL STERNS NEWSLETTER AWARD RUNNER-UP: PAUL KURSEWICZ

Paul Kursewicz has been editor of *Skylights*, the newsletter of the Astronomical Society of Northern New England (ASNNE), for an extraordinary 18 years. The newsletter typically exceeds 20 pages and is beautifully illustrated. His content includes publicly available material and articles and photographs submitted by club members. Articles range from what's visible in the sky for naked-eye stargazers to articles of interest to advanced astrophotographers.

MABEL STERNS NEWSLETTER AWARD THIRD PLACE: JOHN LEESON AND GREG FROHNER

John Leeson and Greg Frohner contribute to each issue of *The Prime Focus*, newsletter of the Cedar Amateur Astronomers. They alternate the main editorial duties monthly. Content includes activities at the Eastern Iowa Observatory and Learning Center (EIOLC) and material from NASA, Night Sky Network, and the Astronomical League. Regular columns include updates and photos from the previous month's public events and group visits. A column titled "What's Up" penned by John gives a brief description of what to look for in the sky for the coming month. "What's Up" is also distributed upon request to non-members.

WEBMASTER AWARD

This award recognizes club webmasters whose job is to communicate with the public and potential members.

WEBMASTER AWARD FIRST PLACE: TOBY SHEETS

Toby Sheets serves as webmaster for the Denver Astronomical Society in Colorado. He also serves as a DAS trustee on the executive board and manages the club's IT and social media.

He was asked to undertake a difficult transfer of the website's domain name from a non-U.S. registration location to one on home soil in 2022. He ties other sites into the DAS website and manages the connectivity seamlessly. The DAS website is extensive, easily navigated, and current, and is a key to the large draws that the DAS enjoys at its public events and to its large membership.

WILLIAMINA FLEMING IMAGING AWARDS

In 2021, the League introduced an imaging award in honor of Williamina Fleming (1857-1911). Award plaques for this program are generously provided by Scott Roberts of Explore Scientific. The award recognizes superb imaging skills among female members of the Astronomical League.

DEEP SKY (›500 MM)
CO-WINNERS: BONNIE RYDER AND SUZANNE BEERS
THIRD PLACE: DEBRA WAGNER

Bonnie Ryder and Suzanne Beers, both of the Colorado Springs Astronomical Society, tied for first place honors with Debra Wagner, a Member-at-Large, receiving third place.

Bonnie's winning image was of the IC 405, the Flaming Star Nebula, taken over six nights from her home in Colorado. She used a William Optics Zenithstar 81 mm f/6.9 instrument and a ZWO ASI533MC Pro camera, taking 257 three-minute frames.

Suzanne's winning image was of NGC 6188, the Rim Nebula or the Fighting Dragons of Ara, taken from the Atacama Lodge in Chile. She used an Askar FRA600 108 mm quintuplet APO astrograph and ZWO ASI2400MC camera, taking 52 five-minute exposures.

Debra's third-place image was of NGC 869 and 884, the Double Cluster, from her home in Abiquiu, New Mexico. She used a ZWO Seestar S50 50 mm f/5 with integrated Sony IMX462 color sensor, taking 15 ten-second exposures.

Bonnie, Suzanne, and Debra received plaques representing their imaging achievements.

SOLAR SYSTEM (›500 MM)
WINNER: DEBRA WAGNER

Debra Wagner is a League Member-at-Large from Abiquiu, New Mexico. Her winning Solar System image is of the 2024 total solar eclipse photographed through light clouds. The photo was taken from the Explore Scientific Crossroads of the Eclipse Event in Texas Hill Country using a ZWO Seestar S50 50mm at f250 and integrated Sony IMX 462 color sensor with a resolution of 1920 x 1089 pixels. The image was recorded as a single exposure with no processing.

Debra received a large plaque for her imaging achievement.

RICH FIELD (201-500 MM)
WINNER: TERRY MANN

Terry Mann is a Lifetime Member, past president, and current secretary of the League and is from West Manchester, Ohio. Her winning rich-field image is of NGC 7635 and M52. The image was taken from Marathon, Florida, using a William Optics RedCat 31 telescope with a focal length of 250 mm and a ZWO 533 camera with a 1 square inch sensor and four stacked 10-minute subs.

Terry received a large plaque for her win in the category.

WIDE FIELD (200 MM OR LESS)
WINNER: ANN CHAVTUR

Ann Chavtur is a member of the Colorado Springs Astronomical Society and is from Colorado Springs. Her winning wide-field image is of the Milky Way arch. The image was taken at Big Bend National Park using a Nikon Z 6 backside illumination CMOS mirrorless camera and NIKKOR Z 14–24 mm lens at 14 mm f/2.8. A total of 128 images formed 13 frames that were stitched into the panorama using Microsoft Image Composite Editor.

Ann received a large plaque for her win in the category.

SKETCHING AWARD

The purpose of the Sketching Award is to recognize the art of astronomical sketching at the eyepiece.

WINNER: CLARIZA KERN

Clariza is a member of the Pontchartrain Astronomical Society and is from Mandeville, Louisiana. The winning sketch is a 6-inch by 6-inch sketch of the Clavius crater on the terminator of the 8-day-old Moon using a Prismacolor Ebony jet black pencil on 20-pound brilliant white paper. She observed using a 4-inch Tele Vue NP101 refractor on a motorized German equatorial mount at 216×. Clariza received a large plaque and a cash prize of $250.

RUNNER-UP: BILL CASTRO

Bill is a member of the Central Florida Astronomical Society and is from Oviedo, Florida. He sketched Comet C/2022 E3 (ZTF) and NGC 1647 using 2H, HB, and 2B graphite pencils on sketch paper, then turned the sketch into a negative using Microsoft Paint and slightly enhanced the sketch in Photo Editor. He observed the comet and cluster with a 130 mm Stellarvue SVX130T f/7 refractor at 41×. Bill received a plaque and a check for $150.

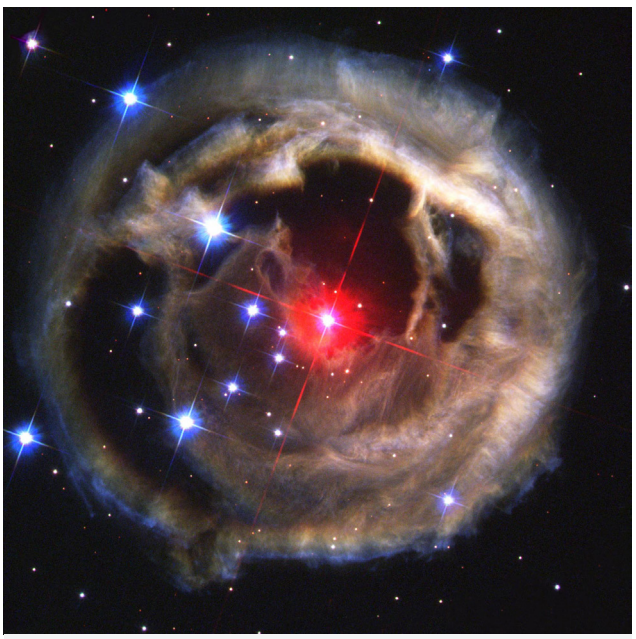
Credit: NOAA U.S. Daily Weather Maps

Wind

"The wind blows where it will"

On a human scale, wind is ephemeral. Gusts, drafts, squalls, and rushes blow past us, stirring our surroundings, but we know neither their origin nor destiny. The nature of weather on small scales is chaotic, but forecasts give more accurate predictions about areas hundreds of miles wide. On Earth as in the heavens, differences of temperature, pressure, and radiation cause energy to flow as wind. The English seaman Francis Beaufort's eponymous 12-step scale has been supplanted in modern maritime meteorology by the more accurate, but less colorful, speed itself. The Universe has no similar wind scale; though, in a likely nod to Beaufort, the movie *Star Trek Generations* depicted a level-12 shock wave produced by a supernova equivalent strong enough to destroy planets.

I have experienced winds from calm to hurricane force, the latter mid-continent at the 2006 Okie-Tex Star Party with no clouds in the sky. It was a clear morning when tents were ripped from their stakes, telescopes felled, and belongings scattered. Satellite images showed a thousand-mile-wide cyclonic system spanning a third of the continent. The highest wind speed ever recorded on Earth, 318 miles per hour, was found in that same state during a tornado in 1999. The range of winds we experience on our ne'er-becalmed planet is impressive, but pales in comparison to those across the Solar System and beyond. As observers, let's journey to see what the heavens reveal about these harbingers of change.


V838 Monocerotis (credit: NASA, ESA and H.E. Bond (STScI))

The solar wind constantly washes our planet at a relatively gentle million miles per hour, and bequeaths aurorae and cometary tails. This wind's boundary with interstellar space is called the heliopause. NASA's Voyager 1 spacecraft experienced that edge in August 2012 after 35 years of travel, passing through and giving us, but taking no, pause.

Through our telescopes, the sharp-eyed amateur can appreciate a surprising amount of detail in the planetary atmospheres of Jupiter and Saturn, and imagers have noted subtle, changing features on Uranus and Neptune. The latter has the strongest winds in the Solar System at 1,200 miles per hour.

Star birth is usually veiled in secrecy, but there's an exception where we've been allowed a glimpse inside. The Rosette Nebula in Monoceros (NGC 2237) is a complex H II region with many star clusters. In its NGC 2744, one arcminute north of the sixth-magnitude star 12 Monocerotis, is Herbig-Haro 1 (HH1), the first visible protostar. Travis Rector of the University of Alaska Anchorage described this object (Li & Rector 2004), where the key to its visibility is the strong winds produced by stars forming near HH1. They have blown its dense berth clear, leaving a "naked" protostar. At 14th magnitude, this object can be seen in medium-size telescopes. These jets form as their solar nebular disk gathers accreting material by electric and magnetic forces into bipolar outflows. I have viewed HH1 with my 15-inch reflector, along with a number of other HH jets, including HH 555, 563, 564, and 565 in the Pelican Nebula.

Large stars forming in open clusters project strong stellar winds that carve and sculpt the nebular gas of their formation. These hot O-type stars may create spherical structures in their early stages. A prime example for amateur visual recovery is NGC 7635, aptly named the Bubble Nebula, 38 arcminutes southwest of M52 in western Cassiopeia. Its off-center shaping star and slightly flattened southwestern side show how density variation in the surrounding nebula affects its evolution.

In their senescence, medium-size stars create beautiful structures called planetary nebulae, where outer layers are shed and molded by slow and fast winds, magnetic fields, and complex interactions caused by double central stars. These are the flora of our galaxy, whose intricate shapes, layers, and jets carve their death masks like cosmic artists. The Cat's Eye, or NGC 6543, in Draco, is especially detailed. An O III filter reveals its long-ago shed outer layers, showing its true size to be seven arcminutes in diameter, not the standard half-arcminute. The Helix (NGC 7293 in Aquarius) and M27 in Vulpecula also display much of what can be seen of these dying stars. Sun Kwok was an original proponent of the "interact-

ing winds" theory of planetary nebulae (Kwok 2002), wherein the fast wind of up to 4,000 kilometers per second produced by the evolving, hot central star plows into slower material ejected at earlier stages, to form structure at the boundary.

An enigmatic object visible in amateur telescopes was V838 Monocerotis, first noted in 2002. The star at the center of this unique event erupted in a flash of light that illuminated layers of gas ejected by strong stellar winds toward the end of its life. Hubble caught its complex, honeycombed nebula being progressively lit as "light echoes" traveled outward (ESA 2004). The origin of its flash is still debated, and some consider a collision between stars, or of a large planet with a star, a possible cause. Much of its detail was visible in my 25-inch reflector.

Massive stars produce spectacular fireworks at the ends of their lives. Wolf-Rayets are O-type stars that shed their outer layers by producing an extremely strong wind of up to one solar mass every few thousand years. The intersection of these rapid winds with the slower, previously ejected material is energized by the powerful ultraviolet light of the evolving star, best seen for amateurs in the Crescent Nebula (NGC 6888) and Thor's Helmet (NGC 2359). O III filters greatly enhance the view of these pre-supernova objects.

Supernova explosions possess the acme of stellar winds, blowing almost the whole star outward at up to one-tenth the speed of light. Large amounts of elements heavier than iron are produced through the energy of the interacting ejecta, and their glowing outer layers can be seen for millennia. One of the most accessible supernova remnants for amateurs is the Veil Nebula in Cygnus, an intricately detailed structure providing hours of reward for patient observers. A large reflector fitted with an O III filter at a dark site will show dozens of its fragments scattered over a three-degree field.

One degree northwest of Zeta Tauri lays the first object on Charles Messier's celebrated list. M1 is called the Crab Nebula from its appearance in William Parsons' 1844 drawing, and is the eighth-magnitude remnant of a star that exploded in 1054 CE. Through telescopes of increasing aperture, its filamentary detail can be appreciated, and the central 16th-magnitude pulsar, or spinning neutron star, can be seen. It is the only pulsar visible to amateurs. The surrounding nebulosity and a nearby star several arcseconds away increase that challenge. The Crab is known as a "pulsar wind nebula" from the tremendous energy produced by the stellar remnant. Energy from the pulsar is transferred to a high-energy wind, which then interacts with the supernova's ejecta to light the nebula. The brightest supernova ever recorded, SN 1006, lacks a central, energizing pulsar, and its remnant is expanding into a less dense environment. It has thus faded to near invisibility in the visual spectrum, though I was able to glimpse its northwest edge in Chile using a 28-inch reflector.

Within the Milky Way, our Solar System sits in a relatively clear bubble a few hundred light-years across, produced by several local supernovae in the last 10–20 million years. One of the closest bubbles, and likely the brightest, is Barnard's Loop (Sh2-276), a semicircle of nebulosity on the eastern side of Orion spanning ten degrees of sky. It is visible to the naked eye under excellent conditions. In areas of young stellar clusters, a higher frequency of hot, massive stars with strong solar winds and increased rates of supernovae can cause a much larger cavity, called a superbubble, to be formed. These can grow to a thousand or more light-years in diameter, and an extragalactic example I have seen visually is MF83 in M101 (Lai et al. 2001).

The nearby galaxy M82 is clearly not an average spiral. Mottling is visible across the body of the galaxy, and an intricate reticular structure can be noted extending perpendicularly from its central region. M82 is classified as a starburst galaxy, where something has stirred the gravitational pot and caused a much higher star formation rate to exist for millions of years. A close pass with the larger M81 was the likely cause, and supernovae have been popping off at an increased rate since shortly thereafter. The most recent (SN 2014J) was on January 22, 2014, and the net effect of this stellar carnage is a galaxy that is blowing itself apart.

Whole galaxies can be affected by a dense, intergalactic medium when they have sufficient speed moving within a large cluster of galaxies. This is called ram pressure, where compression of gas and dust produces large, newly-formed blue clusters of stars. These can trail behind as a "tail" when the galaxy moves on. Within Abell Galaxy Cluster 2667 in northern Sculptor such a galaxy is visible in amateur scopes (Cortese et al. 2007). On Hubble images a stream of debris trails a very blue galaxy that appears to be heading west-northwest through the cluster. Many large, active star-forming regions have made this galaxy one of the brightest in its three billion light-year distant cluster. Its morphology has conferred the name "Comet Galaxy," and I have observed the main body of this 18.7-magnitude shredded spiral in my 32-inch scope.

In a manner similar to the jets of the stellar-sized Herbig-Haro objects discussed above, entire galaxies can produce visible outflows powered by supermassive black holes at their cores. If some process brings material within the gravitational domain of their central maw, then whatever is not swallowed will be shepherded into bipolar jets perpendicular to the plane of the galaxy. Several of these jets are visible to keen-sighted amateurs. The best known are those of M87, extending about ten arcseconds to the northwest of its core, and 3C 273. The latter is fainter than that of M87, proceeding to the southwest and curiously disconnected from the stellar-appearing quasar, a likely manifestation of the on-off nature of the jet. The closest and more difficult to spot jet is the elongated northern emanation of Centaurus A. It was faintly visible in my 32-inch reflector in 2011 at the Texas Star Party (Olsen 2014), 7.5 arcminutes northeast of the center of this galaxy at 13h 26m 04s, –42d 57m 09s.

As you search for these winds of change, may the night rise to meet you, the stars shine gently on your face, and the rain fall softly outside your field of view.

References:

Cortese, G.L., et al. 2007, *MNRAS* 376, 157.

ESA, "V838 Monocerotis Revisited: Space Phenomenon Imitates Art." *www.esa.int/About_Us/Corporate_news/V838_Monocerotis_revisited_Space_phenomenon_imitates_art* .

Kwok, S., et al. 2002, *ASP Conf. Series 260*, 245.

Lai, S. et al. 2001, *ApJ* 547, 754.

Li, J., and Rector, T. 2004, *ApJL* 600, 67.

Olsen, R. "Centaurus A Extreme Deep Field – 120 Hours – New Version Feb 2014." *Rolf Olsen Astrophotography*, *www.rolfolsenastrophotography.com/Astrophotography/Centaurus-A-Extreme-Deep-Field/i-6RGLbJp* .

Dave Tosteson
Chisago City, Minnesota
djtost1@gmail.com

Imaging Coronal Fine Structure Without an Eclipse

By Jim Daley

INTRODUCTION

Viewing the solar corona during a total eclipse is one of the most wondrous of human experiences. Recently two amateurs (Hripcsak 2023) have demonstrated that certain features of the inner corona can be observed under reasonably clear skies without an eclipse, even at sea level.

The familiar solar prominences are only about 100 times fainter than the Sun's limb over a 10 angstrom bandwidth and can be observed fairly well in small commercial solar telescopes. These instruments employ ultra-narrow (sub-angstrom) hydrogen-alpha filters and show the prominences somewhat more faintly than the Sun's surface features.

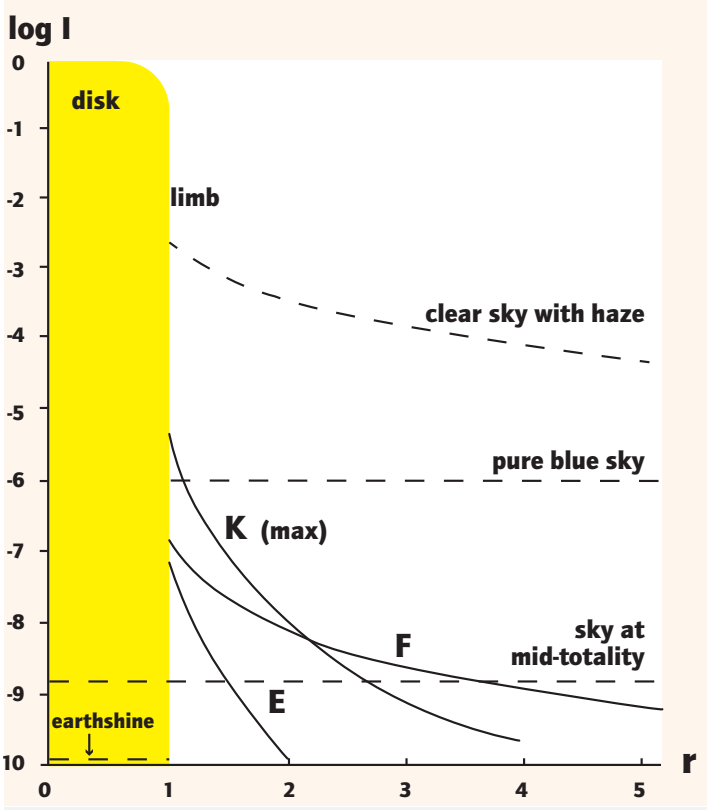


Fig. 1: relative intensities of the components of coronal light, K=continuous light due to electron scattering, F=inner zodiacal light, and E=combined light of emission lines. Graph redrawn by Reflector staff after H. C. van de Hulst in the book The Sun, *edited by Kuiper, 1953.*

Although prominences strongly interact with the corona they are not thought of as coronal structures, as their temperature is far too low. Fig. 1 (Kuiper 1953) shows the huge range of brightness, relative to the Sun, that one must work over to detect the K (continuum), F (Fraunhofer), and E (emission) corona. Despite appearing faintest on the chart, the E corona is the only one accessible to the amateur astronomer without an eclipse. This is because it is plotted there as the combined light of its widely spaced emission lines, with the total flux spread evenly over the entire visible region. However, when seen in isolation, the brightest lines often reach an intensity as high as 2×10^{-4} on the plot. At that intensity level, about 160 times fainter than the Hα prominences, they can be observed under a sky midway between hazy and a pure blue, in my experience.

All we need to isolate one of the brightest lines is a narrow band interference filter, a Lyot type coronagraphic telescope (see Daley 2023) and a nice blue sky. It sounds easy but in reality it represents perhaps the greatest challenge any amateur astronomer/telescope maker will ever encounter.

THE E CORONA SPECTRAL LINES

Called "coronium" before W. Grotrian discovered its true nature (Swings 1945), the E corona is made up of hundreds of mostly identified emission-lines, yet there are only about 15 lines in the visual light spectral region. Among these lines just the green 5303Å (Fe XIV) and the red 6374Å (Fe X) lines have sufficient brightness to be considered for imaging without an eclipse. These iron lines show noticeably different coronal forms, the 5303 line appearing somewhat "bushy" with soft loops and the 6374 line showing a well defined "loopy" and streamer/spray structure, especially when seen over big sunspots. 5303 is generally twice as bright as the 6374 line. Currently my coronal observations are limited to the 6374 red line. The atmospheric scatter at the red line is about half that of the green line, which goes a long way toward washing out their brightness difference. My backyard observatory, housing a homemade 5-inch coronagraph, is located at an elevation of only 1,300 feet, so atmospheric light scatter is potentially very troublesome.

SKY CONDITIONS

Sky quality sets the conditions for a modest success or utter failure in our quest to image the E corona in the light of either of the above spectral lines. This is because the sky's light near the Sun is strongly scattered by atmospheric particles (aerosols) such as ice crystals, dust, pollen, forest fire smoke, and airborne seeds such as dandelion, cat o'nine-tails and milkweed. In various proportions these countless airborne particles cause an aureole of brilliant light around the Sun. The phenomenon giving rise to this halo is called narrow angle forward scatter (Minnaert 1954). This scatter is most intense at the Sun's limb, just where we want to observe, and can raise the field glow in the focal plane well above the coronal light itself. Tiny ice crystals are by far the worst offenders, with a scatter angle so narrow that it concentrates the glow in a region just a few arcminutes wide against the limb! The few remaining professional coronagraphs are located on high mountaintops to get above most of the atmospheric particles.

Fig. 2: fine coronal structure, captured April 25, 2024.

OPTICAL SETUP FOR IMAGING THE Fe X CORONA

After a year-long period of imaging solar prominences in Hα light with my homemade 5-inch Lyot coronagraph, (Daley 2023 — here you can find details on the instrument's construction), fellow club member Dave Groski suggested that I should should try to image the corona. After much thought about our local sky conditions, I decided an attempt at imaging the inner corona in Fe X light would be an interesting technical challenge and a chance to resolve the fine structure of coronal loop foot-points and other features. I thought an interference filter of 3Å bandwidth (full width at half maximum) would be about right, considering this (temperature broadened) coronal line is just under 1Å wide. A narrower filter would significantly raise the price, greatly lower transmission, and also introduce thermal stability issues, requiring a high priced temperature controller. As it is, a simple homemade flowing-water-jacketed "oven" keeps the filter close to its factory measured operating temperature of 24ºC. Given the filter's thermal coefficient of 0.18Å per degree C, a comfortable ±2ºC water temperature match seemed fine, and this has turned out to be the case. The filter, supplied by Rapid Spectral Solutions of Brattleboro, Vermont, has good optical quality in terms of wavefront error, allowing its placement near the pupil (just after the Lyot stop). It was supplied mounted in a standard 1.250-inch threaded eyepiece filter ring with a clear aperture of almost 1 inch, more than large enough to pass the 0.625-inch diameter pupil beam. The filter's transmission is a really good 57%, important for imaging success.

My first Fe X image of the corona (I am given to understand this is an amateur first for that spectral line) was obtained September 7, 2023. It was seen in the running video display as a small bump on the Sun's East limb, the limb itself just hidden behind the occulter. To test for its reality I simply moved the coronagraph in declination and observed the bump move with respect to the occulter. I quickly captured and processed a video. With many instrumental improvements, better and better coronal images were obtained. A comparison of PROBA2/SWAP 174Å Fe X extreme ultraviolet (EUV) images with my red Fe X images showed good position and structural correspondence (Habbal et al. 2011).

One big improvement to the instrument was the elimination of interference fringes created by my ZWO 1600MM CMOS camera, by tilting it 6º.

Another improvement was made by removing the detector window, avoiding shadows its imperfections cast on the sensor surface. This also allowed cleaning the chip's glued-on protective glass plate to get rid of most of the tiny dust specks and other particles. I also made a much longer camera barrel (1.25 inch) with an infrared blocker at the far end, which not only seals the detector against dust but also serves as the last window of the filter oven.

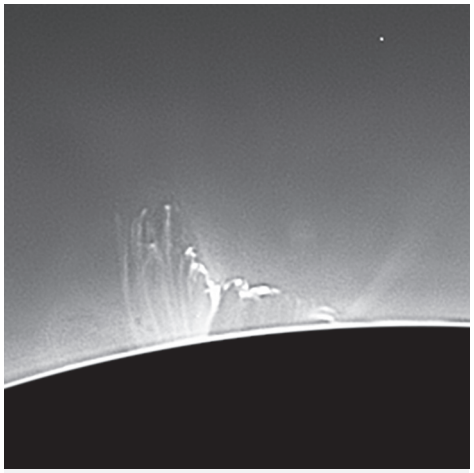


Fig. 4: This image, captured May 13, 2024, shows very fine structural detail over AR 6334, which is the region that gave us the great aurora of May 11.

It is vital that no optical element be near or imaged on the detector surface. Even the field lens showed very unpleasant defocused dust and smudges, as it is only 3/4 inch behind the in-focus occulter. To wash out these artifacts in the stacked image I adopted Lyot's method of continuously rotating the field lens on its optical axis during a (nowadays) video capture. The lens rotation speed is about 6 RPM.

An additional improvement in reduc-

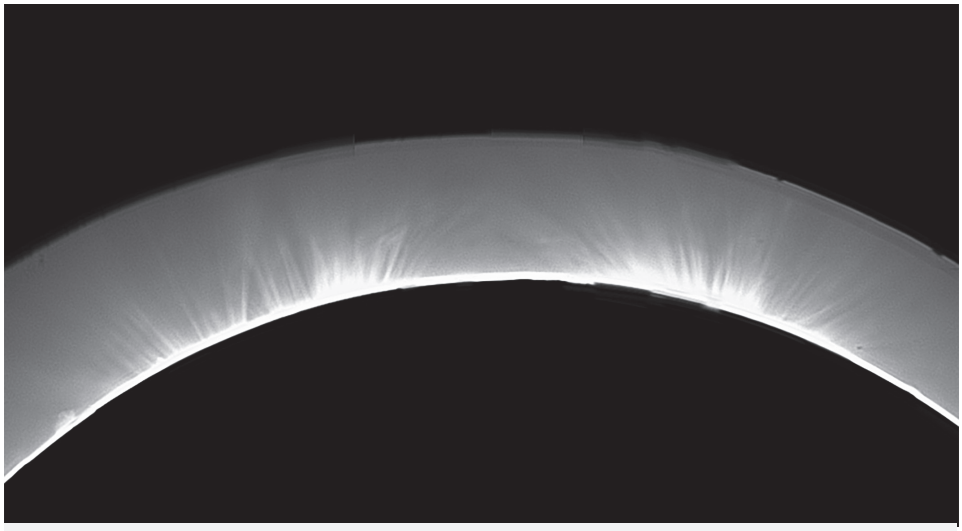


Fig. 3: fine coronal structure, captured April 26, 2024.
There are a few abrupt bends seen in the otherwise smoothly flowing streamers.

ing instrumental stray light was made by abandoning the traditional reflecting cone occulter. Instead I used a water cooled flat copper disk occulter painted with Black 4.0 *(culturehustle.com)* on the skyward face. This, combined with the comparatively steep curves of my coma-corrected fused silica f/18 objective, gives optically weakening (diverging) reflections of the occulter. This brightens the objective slightly but harmlessly. Adding a Lyot spot would block two of three reflections – one ghost of the occulter at 1/5th focal length and one double bounce image of the Sun called the 1/6th ghost – but the calculated focal plane irradiance resulting from this form of occulter without a Lyot spot is already well below that of the Fe X corona itself over the system's spectral bandwidth.

LUCKY IMAGING DILEMMA

For my setup, video single frame exposures run about 166 times longer than the typical 1 ms I use for prominence imaging. This makes the frame rate way too low and the exposures hopelessly long for freezing atmospheric turbulence, which is needed to use lucky imaging techniques. By binning 4× the exposure is reasonable (about 50 ms) but the resolution is only fairly good, just 2 pixels per Airy disk diameter. Typically, 300 frames can be captured with a 10-second-duration video. Ongoing experiments in optimizing the detector gain are promising, and perhaps may lead to 2× binning.

RECENT RESULTS

The two west limb images, Fig. 2, April 25, and Fig. 3, April 26, taken 23:32 hours apart, show interesting coronal changes and good fine structure detail including a few abrupt bends in the otherwise smooth flowing lines of the streamers in fig. 3. The exposures are 44.9 ms and 40.8 ms, respectively, with video durations of 10 seconds each. ✶

James Daley is the author of The Schupmann Telescope *(Willman Bell, 2007) and is a member of the Springfield Telescope Makers.*

The coronal images in this article were further processed by Reflector *staff, and some dust spot artifacts were retouched out. They are © 2024, James Daley.*

References

J. Daley. 2023. *Reflector*, Vol. 76, No. 1, 12

S. R. Habbal et al. 2011. *ApJ*, 734,120

Kuiper, ed. 1953. *The Sun.* University of Chicago Press.

G. Hripcsak. 2023. *Reflector,* Vol.76, No. 2, 14

M. Minnaert. 1954. *The Nature of Light & Colour in the Open Air.* Dover Publications.

P. Swings. 1945. *PASP* Vol. 57, No. 336, 117

Share your expertise with *Reflector* readers

The deadlines for submitting articles to the next issues of *Reflector* are October 1 (December issue) and January 1 (March issue).

For more information, contact Editor Kris Larsen at *larsen@ccsu.edu*.

Congratulations!

Chuck
ALLEN

Terry
MANN

League veterans Chuck Allen and Terry Mann return to the helm of the Starship AL, as President and Vice President, respectively. The *Reflector* staff looks forward to working closely with them as we move forward as an organization.

Clear Skies!

Background image: Frederick Steiling (Astronomical Society of Eastern Missouri) captured this view of the southern prominences using an Olympus Air A01 on an Orion 8-inch f/3.9 Astrograph from Makanda, Illinois.

Serving Those Who Served

Astronomy Outreach for Veterans

When I joined the Amateur Astronomers Association of Pittsburgh (AAAP), another member, Tim K., was arranging small outreach events at some local libraries. I started volunteering at these events and, after a few years, took over arranging them when Tim moved out of state. I became an unofficial outreach coordinator for the club and began expanding the events to more libraries and community centers. We soon began receiving outreach requests from additional groups and some of the Pennsylvania state park directors. I found that I enjoyed arranging these simple events and really enjoyed attending them, talking with the attendees, and hearing the excitement when they first saw the Moon, Jupiter, or Saturn. Eventually, this led me to the AAAP's veterans outreach program.

M27, The Dumbbell Nebula.

"Astronomy for Disabled Veterans" (A4DV) was born in January 2017 when Jim Surman, a senior manager with PwC Healthcare Consulting Services and member of the Knights of Columbus, and Nick Haller, the associate chief nurse of the VA hospital system in Pittsburgh, met at a holiday banquet and began discussing veterans' problems and issues. One issue came from a U.S. Department of Veterans Affairs report by Dr. Alan Teo and colleagues, which revealed shockingly high numbers of veterans experienced moderate to severe symptoms of depression, and many participants in the study showed positive ideation for suicidal thoughts. An average of 20 U.S. veterans die by suicide each day, totaling more than 7,300 deaths annually (Teo et al. 2018). The A4DV was created with the hope of reducing those numbers.

The two men realized that for all the good the VA hospitals do, they can be lonely institutions after business hours. The veterans' days are filled with meetings, appointments, and activities, but these events are limited at night. The men met with veterans and VA hospital staff and volunteers to discuss some nighttime activities that might be possible, and astronomy rose to the top of the list.

As a "test of acceptance" for astronomy as an activity, selected hospitalized veterans were transported to star parties at the AAAP Mingo and Wagman Observatories. The response from the veterans who attended these events was a solid two thumbs up. The on-site trips enabled the veterans to experience real-time astronomy in action.

Surman introduced the A4DV program to the astronomy club. The then AAAP president Ed Moss committed the club to assist with consulting, guidance, and education. The AAAP executive committee unanimously approved the motion. The A4DV planned to raise $5,000 to purchase telescopes and eyepieces for the residents and patients at the VA hospital to use, and plans for an astronomy program for the vets began.

The hospital administrators denied this plan because any program must be accessible to all veterans on campus, and not all veterans would be able to use a traditional telescope. At this point, the AAAP proposed an electronically-assisted-astronomy (EAA) setup. It would include an observatory with a telescope capable of tracking, hardwired to a location inside one of the hospital buildings where images could be shown on a large monitor. It would comply with ADA and all other government regulations. At that time, it was thought the cost would be $80,000. That estimate was generated through a series of meetings with astronomers, engineers, administrators, and volunteers from all walks of life. This amount was staggering to the Knights of Columbus, but they took the challenge to heart and began fundraising.

Once a location on the VA hospital campus was decided upon, an application was made to the national VA administration to start the program and build the observatory on government property. The application was eventually approved and the A4DV was told this was the first program of its kind at any VA facility in the country and would be a pilot program.

Two and a half years from inception, the observatory building was completed. Then the COVID pandemic started, and all activity for the A4DV project halted. In 2022, work on the observatory resumed with the installation of a Celestron CPC 800 telescope, donated by the AAAP, on a wedge mount with all associated hardware, including a 65-inch monitor to show the images.

I became involved with the project in June 2022. Having realized the satisfaction of outreach, I thought this would be a worthwhile cause. There was one major setback, though. I'm a visual observer. I'm comfortable with a big old light bucket and

photons hitting my retinas! This was unknown territory for me. Thankfully, AAAP member Fred Klein and a few of the club's other knowledgeable astrophotographers gave me enough information to be dangerous! Well, not dangerous, but enough information to get me started!

On October 14, 2022, the James R. Surman observatory, located on the H. John Heinz III Department of Veterans Affairs Medical Center campus, was officially dedicated. The A4DV program is still in its infancy. I open the observatory a couple of times a month and tour the skies with the vets and staff. We talk about what we're seeing and what we can't see. Every month or so, I ask other AAAP club members to come out with their own equipment and we host star parties for the residents.

M51, the Whirlpool Galaxy

The goal of the equipment is to replicate the eyepiece view as closely as possible. We are not live-stacking or processing the data in any way. The most we do is increase or decrease exposure time to get as good an image as possible. The observatory is in an urban setting with heavy light pollution. On a moonless night, though, I can show the dust lanes of the Whirlpool Galaxy (M51) or the lobes of the Dumbbell Nebula (M27).

The response from the vets has been positive. Admittedly, not many will become astronomers, but they appreciate the break in their routine and enjoy the show, often talking about their own experiences seeing the night sky from the deck of a ship or desert base. A few do become very interested or already have the astronomy bug. If one veteran's life is saved, this is well worth the effort. We feel we have had a positive impact on a number of veterans.

There are still hurdles to overcome, and the impact is small, but we have goals to expand the program and eventually hope it will spread to other campuses. Within the next year, we hope to be able to stream the images to any monitor on campus, so even bedridden patients can participate. We've been steadily expanding the astronomy section of the VA library with the addition of DVDs, donated books, subscriptions to Astronomy, and copies of *The Guide Star*, the AAAP newsletter. In cooperation with faculty at Carnegie Mellon University, we've begun offering astronomy seminars to the veterans and staff. I'd like to begin training the vets to save and process raw data to begin creating their own astrophotographs using either donated data from club members or data captured from the scope. Eventually, I would like the setup to be fully remote, able to be operated from anywhere on the grounds, and to train the veterans to use the equipment themselves.

The ultimate goal of the project is to give the residents someone to talk to, something to think about, and to show them something that not many people get to experience. Maybe it will help them realize that in the vastness of the universe, their life is a gift, and the possibilities, like the stars, are too numerous to count.

Additional information can be found at *bit.ly/3AP-Astronomy-ForDisabledVeterans.*

Rich Dollish, Amateur Astronomers Association of Pittsburgh

References

Teo, A.R., et al. 2018, *J. Affective Disorders* 230, 42.

Gallery

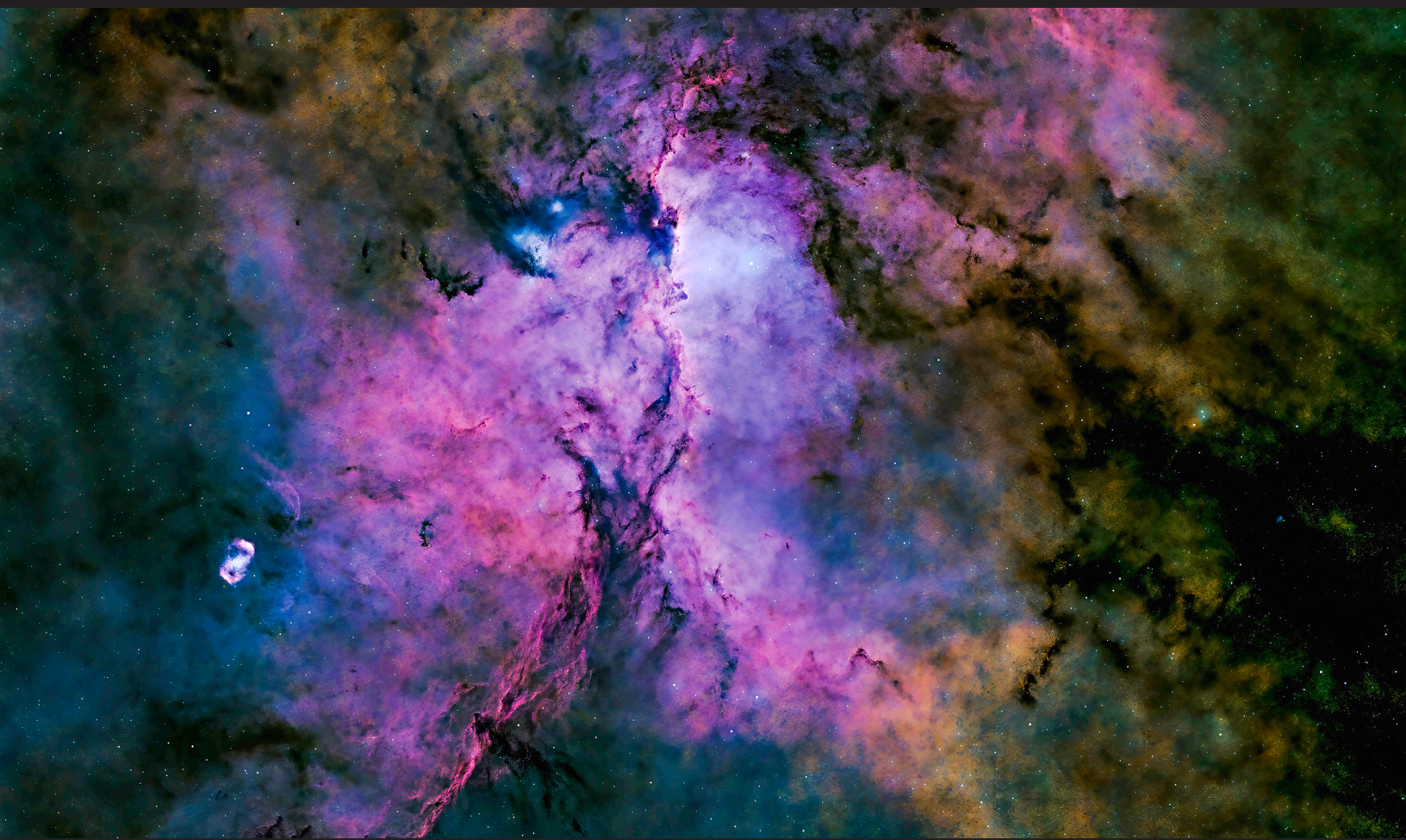
Images are processed by *Reflector* staff for better contrast and tonal range on the printed page.

The astrophotos featured in this issue's gallery are all winners from the Horkheimer/Parker and Fleming competitions. Details about the winners and their equipment are featured in the "Award Season" section on pages 10-13.

ABOVE: Andrew Yu (Parker winner) - Messier 78 in Orion

NEXT PAGE TOP: Bonnie Ryder (Fleming - Deep Sky co-winner) IC405, Flaming Star Nebula in Orion

NEXT PAGE BOTTOM: Suzanne Beers (Fleming - Deep Sky co-winner) NGC 6188, The Fighting Dragons of Ara

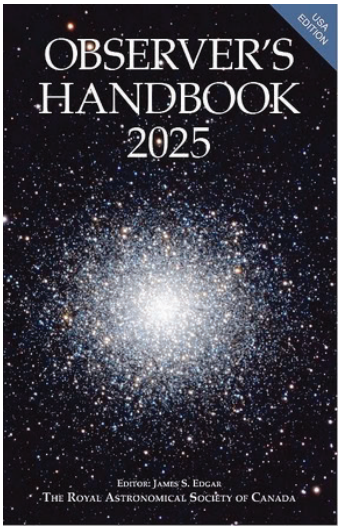


Gallery

TOP LEFT: Debra Wagner (Fleming - Solar System winner) - Total Solar Eclipse through Clouds
TOP RIGHT: Terry Mann (Fleming - Rich Field winner) NGC 7635 and Messier 52 in Cassiopeia
BOTTOM: Ann Chavtur (Fleming - Wide Field winner) - Milky Way Arch

ROYAL ASTRONOMICAL SOCIETY OF CANADA

BEST PRICES AROUND ON RASC OBSERVERS' RESOURCES!



OBSERVER'S HANDBOOK

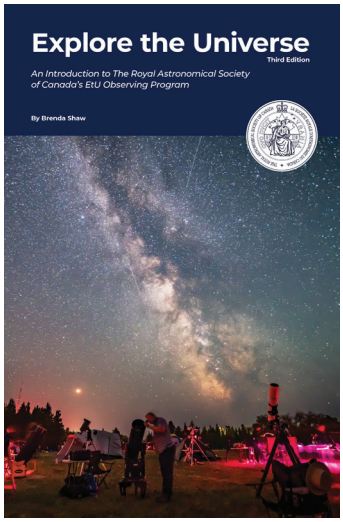
The popular 350–page classic in its 117th Year.
Special pricing for the 2025 USA edition!
Contents include • Basic Astro Data
• Planets • Optics and Observing
• The Sky Month by Month
• Eclipses • The Moon • Time (civil, astronomical, standards, & more) • The Sun
• Dwarf and Minor Planets • Meteors, Comets, and Dust • Stars • The Deep Sky

$27 EACH + $7 S+H
ORDERS OF 10 OR MORE:
$26 EACH WITH FREE SHIPPING!

EXPLORE THE UNIVERSE GUIDE

A PERFECT GUIDE FOR THOSE LEARNING THEIR WAY AROUND THE NIGHT SKY

$24 PLUS $7 S+H



STAR FINDER

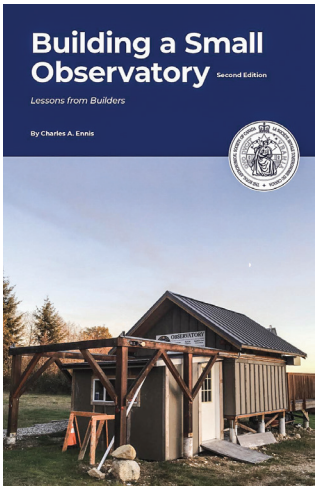
DISCOVER THE NIGHT SKY WITH THIS AFFORDABLE, EASY TO USE COMPACT PLANISPHERE

$2 PLUS $1 S+H

OBSERVER'S CALENDAR

A beautiful complement to the Handbook, filled with dates of notable celestial events – lunar and planetary conjunctions, eclipses, meteor showers and more.

$23 EACH + $7 S+H
ORDERS OF 6 OR MORE: $20 EACH WITH FREE SHIPPING!



BUILDING A SMALL OBSERVATORY

This book is the result of interviews with 140 small observatory owners to learn what it takes to fund, build, and operate a small observatory. It will help you maximize your chances of successfully creating a trouble-free installation, and help find the best site and equipment.

$24 PLUS $7 S+H

SECURE ONLINE ORDERING FROM
STORE.ASTROLEAGUE.ORG
Or order by mail at Astronomical League Sales, 9201 Ward Parkway, Suite 100, Kansas City, MO 64114.
Enclose check for price and S+H charges as shown.
Questions? Call 816-DEEPSKY or email leaguesales@astroleague.org

Observing Awards

ACTIVE GALACTIC NUCLEI OBSERVING PROGRAM

No. 35-I, **Mark Mitchell**, Delaware Astronomical Society

ADVANCED BINOCULAR DOUBLE STAR OBSERVING PROGRAM

No. 63, **Joe Fazio**, Cumberland Astronomy Club

ARP PECULIAR GALAXIES NORTHERN OBSERVING PROGRAM

No. 122, **Rick Olson**, Rose City Astronomers; No. 123, **Peter Natscher**, Member-at-Large; No. 124-I, **Lauren Rogers**, Escambia Amateur Astronomers Association

ARP PECULIAR GALAXIES SOUTHERN OBSERVING PROGRAM

No. 25-I, **David Whalen**, Atlanta Astronomy Club

BAMBURY 600 CERTIFICATE

Steve Boerner, Member-at-Large

BENNETT OBSERVING PROGRAM

No. 3, **Rob Ratkowski**, Full List, Haleakala Amateur Astronomers

BEYOND POLARIS OBSERVING PROGRAM

No. 73. **Jack Fitzmier**, Member-at-Large

BINOCULAR DOUBLE STAR OBSERVING PROGRAM

No. 213, **John Jardine Goss**, Roanoke Valley Astronomical Society; No. 214, **Bill Bond**, Omaha Astronomical Society; No. 215, **Jeremy Mullican**, Lifetime Member

BINOCULAR VARIABLE STAR OBSERVING PROGRAM

No. 68, **Stephen Pavela**, La Crosse Area Astronomical Society

BRIGHT NEBULA OBSERVING PROGRAM

No. 44, **Rod Hughes**, Advanced Visual, Member-at-Large; No. 45, **Ann Chavtur**, Advanced Visual, Colorado Springs Astronomical Society; No. 46, **Gregg Ruppel**, Advanced Imaging, Tucson Amateur Astronomy Association; No. 47, **Jeff Hoffmeister**, Basic Visual, Olympic Astronomical Society

CALDWELL OBSERVING PROGRAM

No. 34, **Rick Ray**, Gold, North Houston Astronomy Club; No. 35, **Aaron Clevenson**, Gold, North Houston Astronomy Club; No. 295, **Preston Pendergraft**, Silver, Member-at-Large; No. 300, **Rick Ray**, Silver, North Houston Astronomy Club; No. 301, **Brian McGuinness**, Silver, Northern Colorado Astronomical Society; No. 303, **Keith Lawrence**, Silver, Vermont Astronomical Society

CARBON STAR OBSERVING PROGRAM

No. 160, **David Hasenauer**, Astronomy Section of the Rochester Academy of Science

CITIZEN SCIENCE SPECIAL PROGRAM

William Clarke, Tucson Amateur Astronomy Association, Variable Stars, Observational, Gold Class 5; **William Clarke**, Tucson Amateur Astronomy Association, Binocular Variable Stars, Observational, Gold Class 8; **Dan Crowson**, Astronomical Society of Eastern Missouri, Active Asteroids, Active, Gold Class 55; **Dan Crowson**, Astronomical Society of Eastern Missouri, Variable Stars, Observational, Gold Class 45; **Mark Ellison**, Member-at-Large, Variable Stars, Observational, Gold Class 1; **Rich Krahling**, Richland Astronomical Society, SuperWASP Variable Stars, Active, Gold Class 12; **Rich Krahling**, Richland Astronomical Society, Citizen ASAS-SN, Active, Gold Class 1; **Al Lamperti**, Delaware Valley Amateur Astronomers, Active Asteroids, Active, Gold Class 287; **Al Lamperti**, Delaware Valley Amateur Astronomers, Cloud Spotting on Mars, Active, Gold Class 8; **Brad Young**, Astronomy Club of Tulsa, Variable Stars, Observational, Gold Class 14; **Brad Young**, Astronomy Club of Tulsa, EOSOP, Observational, Gold Class 30

COMET OBSERVING PROGRAM

No. 65, **Lauren Rogers**, Gold, Escambia Amateur Astronomers Association; No. 66, **István Mátis**, Gold, Member-at-Large; No. 67, **Paul Morgan**, Gold, Umpqua Astronomers; No. 139, **Mike Reitmajer**, Silver, Rose City Astronomers; No. 140, **Richard Beaver**, Silver, Boise Astronomical Society

CONSTELLATION HUNTER OBSERVING PROGRAM - NORTHERN

No. 318, **James D. Anderson**, Astronomical Society of Kansas City; No. 319, **Dean Herring**, Raleigh Astronomy Club; No. 320, **Margaret Velte**, Rio Ranch Astronomical Society; No. 321, **Joe Comisky**, Kalamazoo Astronomical Society

CONSTELLATION HUNTER OBSERVING PROGRAM - SOUTHERN

No. 16, **Aaron Clevenson**, North Houston Astronomy Club

DEEP SKY BINOCULAR OBSERVING PROGRAM

No. 454, **Joe Fazio**, Cumberland Astronomy Society

DOUBLE STAR OBSERVING PROGRAM

No. 712, **Randal Finden**, Raleigh Astronomy Club; No. 713, **Robert Abraham**, Shreveport-Bossier Astronomical Society; No. 714, **Steve Riegel**, Colorado Springs Astronomical Society; No. 715, **J. Robert Kirkham**, Member-at-Large

FLAT GALAXY OBSERVING PROGRAM

No. 48-I, **David Whalen**, Honorary, Atlanta Astronomy Club; No. 49, **Viola Sanchez**, Honorary, Albuquerque Astronomical Society

GLOBULAR CLUSTER OBSERVING PROGRAM AWARDS

No. 403-I, **Rod Hughes,** Member-at-Large; No. 404, **Mike Reitmajer**, Rose City Astronomers; No. 405, **Penny Kunitani**, Riverside Astronomical Society

HERSCHEL 400 OBSERVING PROGRAM

No. 663, **Brian Hayward**, Rose City Astronomers; No. 664, **Jack Fitzmier**, Member-at-Large; No. 665, **Brian McGuinness**, Northern Colorado Astronomical Society; No. 666, **Robert Anderson**, Member-at-Large

HERSCHEL II OBSERVING PROGRAM

No. 128, **Lauren Rogers**, Device-Aided, Escambia Amateur Astronomers Association; No. 129, **Kevin Mayock**, Device-Aided, Tucson Amateur Astronomy Association.

HERSCHEL SOCIETY

Wyatt Sanford, Silver, Jackson Astronomical Society

HYDROGEN ALPHA SOLAR OBSERVING PROGRAM

No. 78, **John Goss**, Roanoke Valley Astronomical Society; No. 79-I, **Dean F. Herring**, Raleigh Astronomical Club; No. 80-I, **Alec Sheedlo**, Northwest Suburban Astronomers; No. 81, **Tom Karnuta**, Member-at-Large

IMAGING – CALDWELL OBSERVING PROGRAM

No. 1, **Thomas V. Schumann**, Silver, Lifetime Member; No. 2, **Russell F. Pinizzotto**, Silver, Southern Maine Astronomers; No. 3, **Dan Crowson**, Silver, Astronomical Society of Eastern Missouri; No. 4, **Keith Kleinstick**, Silver Imaging, Lifetime Member

IMAGING – MESSIER OBSERVING PROGRAM

No. 7, **Mike Conley**, Rose City Astronomers; No. 8, **Gregg Ruppel**, Tucson Amateur Astronomy Association; No. 9, **Russell F. Pinizzotto**, Southern Maine Astronomers

LIBRARY TELESCOPE PROGRAM

No. 40, **Bill Pence**, Silver, Amateur Observers' Society of New York

LUNAR OBSERVING PROGRAM

No. 1226, **Aaron Niskode-Dossett**, Minnesota Astronomical Society; Nos. 1227 & 1227-B, **Zach Williams**, Northeast Florida Astronomical Society; No. 1228, **David Nasser**, Colorado Springs Astronomical Society; No. 1229-B, **Aaron Niskode-Dossett**, Minnesota Astronomical Society

LUNAR II OBSERVING PROGRAM

No. 140, **Paul Morgan**, Umpqua Astronomers; No. 141-I, **Dean F. Herring**, Raleigh Astronomy Club

LUNAR EVOLUTION OBSERVING PROGRAM

No. 37, **Kevin C. Carr**, Minnesota Astronomical Society

MESSIER OBSERVING PROGRAM

No. 1863, **Rob Lentini**, Honorary, Northern Virginia Astronomy Club; No. 2893, **Andy Walker**, Honorary, Astronomical Society of Eastern Missouri; No. 2922, **Stephen Koehler**, Honorary, Minnesota Astronomical Society; No. 2924, **Larry Bloom**, Honorary, Longmont Astronomical Society; No. 2926, **Zach Williams**, Regular, Northeast Florida Astronomical Society; No. 2927, **Dana R. Bostic**, Honorary, Raleigh Astronomy Club; No. 2928, **Joe Fazio**, Honorary, Cumberland Astronomy Club; No. 2929, **Brad Nasset**, Honorary, Minnesota Astronomical Society

OPEN CLUSTERS OBSERVING PROGRAM

No. 122-I, **Robert Wood**, Member-at-Large; No. 123, **Albert E. Smith**, Member-at-Large; No. 124-I, **Rod Hughes**, Member-at-Large; No. 125-I, **Gregg Ruppel**, Tucson Amateur Astronomers Association

OUTREACH PROGRAM

No. 895, **Edward Fraini**, Master, Houston Astronomical Society; No. 1060, **Peter K. Detterline**, Master, Member-at-Large; No. 1138, **Chelsea Neckel**, Stellar, Flint River Astronomy Club; No. 1235, **Rich Dollish**, Master, Amateur Astronomers Association of Pittsburgh; No. 1237, **Dan Crowson**, Master, Astronomical Society of Eastern Missouri; No. 1283, **Rick Palmer**, Master, Buffalo Astronomical Association; No. 1290, **David Stone**, Stellar, Flint River Astronomy Club; No. 1291, **Rosanne Stone**, Stellar, Flint River Astronomy Club; No. 1350, **Jim Reagan**, Master, River Bend Astronomy Club; No. 1397, **Eric Hanson**, Master, Member-at-Large; No. 1402, **Dean Herring**, Stellar, Raleigh Astronomy Club; No. 1403, **Susan Herring**, Stellar, Raleigh Astronomy Club; No. 1448, **Jeffrey Thornton**, Outreach, Back Bay Amateur Astronomers; No. 1449, **Alan Bott**, Stellar, Northeast Florida Astronomical Society; No. 1450, **Cooper Westley**, Outreach, Stellar, Northeast Florida Astronomical Society; No. 1451, **L. John Keller II**, Outreach, Villages Astronomy Club; No. 1452, **Annelies Gentile**, Outreach, Raleigh Astronomy Club; No. 1453, **Terry Ellis**, Outreach, Northeast Florida Astronomical Society; No. 1454, **Zach Williams**, Outreach, Northeast Florida Astronomical Society; No. 1566, **Robert Richard Wilmore**, Outreach, Stellar, Master, Member-at-Large; No. 1567, **William Beckett**, Outreach, Corpus Christi Astronomical Society; No. 1568, **Brittney Miller**, Outreach, Atlanta Astronomy Club; No. 1569. **Paul Morgan**, Outreach, Umpqua Astronomers; No. 1570, **Diana Nevins**, Outreach, Omaha Astronomical Society

PLANETARY NEBULA OBSERVING PROGRAM

No.49, **Brian McGuinness**, Basic, Northern Colorado Astronomical Society

RADIO ASTRONOMY OBSERVING PROGRAM

No. 31, **Viola Sanchez**, Silver, Albuquerque Astronomical Society; No. 32, **Jeff Rodriguez**, Silver, Cincinnati Astronomical Society; No. 41, **Viola Sanchez**, Bronze, Albuquerque Astronomical Society; No. 42, **Stephen Kelly**, Bronze, St. Louis Astronomical Society; No. 43, **Michael J. Caba**, Bronze, Independent; No. 44, **Jeff Rodriguez**, Bronze, Cincinnati Astronomical Society; No. 45, **Lois Oxley**, Bronze, Cincinnati Astronomical Society; No. 46, **Emmy Bursk**, Bronze, Cincinnati Astronomical Society

SKETCHING OBSERVING PROGRAM

No. 67, **Dean Herring**, Raleigh Astronomy Club

SKY PUPPY OBSERVING PROGRAM

No. 96, **Claire Kimball**, Member-at-Large; No. 97, **Max Busacker**, River Bend Astronomy Club; No. 98, **Lorelie Brown**, River Bend Astronomy Club; No. 99, **Jacob Huelsmann**, River Bend Astronomy Club

SOLAR ECLIPSE OBSERVING CHALLENGE (2023)

Keith Blanton, Silver, Member-at-Large; **Larry Bloom**, Gold, Longmont Astronomical Society; **Brett Boller**, Silver, Prairie Astronomy Club; **Tiffany Nash Effinger**, Silver, Gold, Member-at-Large; **Ken Gourley**, Silver, Member-at-Large; **Cam Heringshaw**, Silver, Austin Astronomical Society; **Jim Michnowicz**, Silver, Raleigh Astronomy Club; **Paul Morgan**, Silver, Umpqua Astronomers; **Doug Pieschel**, Silver, Umpqua Astronomers; **Chris Randall**, Silver, Member-at-Large; **Rob Ratkowski**, Gold, Haleakala Amateur Astronomers; **Karl Schulz**, Silver, Central Arkansas Astronomical Society; **Nicole Sharp**, Silver, Cumberland Astronomy Club; **Laura Stewart**, Silver, Member-at-Large; **Debra Wagner**, Gold, Member-at-Large; **Tony Warner**, Silver, Member-at-Large

SOLAR ECLIPSE OBSERVING CHALLENGE (2024)

Al Ansorge, Silver, Westminster Astronomical Society; **Laurie Ansorge**, Silver, Lifetime Member; **Ed Barrows**, Silver, Raleigh Astronomy Club; **Brett Boller**, Silver, Prairie Astronomy Club; **Dana Bostic**, Silver, Raleigh Astronomy Club; **Keith Brandt**, Silver, Houston Astronomical Society; **Scott Cadwallader**, Silver, Baton Rouge Astronomical Society; **Mark Casazza**, Silver, Stillwater Stargazers; **Aaron Clevenson**, Silver, North Houston Astronomy Club; **Andrew Corkill**, Silver, Lifetime Member; **Aleta Cox**, Silver, Salt Lake Astronomical Society; **Dan Crowson**, Silver, Astronomical Society of Eastern Missouri; **Anna Daly**, Silver, Kalamazoo Astronomical Society; **Mark Davidson**, Silver, Miami Valley Astronomical Society; **Larry Dove**, Silver, Flint River Astronomy Club; **Tiffany Nash Effinger**, Silver, Member-at-Large; **Dale Gentry**, Silver, Texas Astronomical Society; **Vince Giovannone**, Silver, Lifetime Member; **Ken Gourley**, Silver, Member-at-Large; **Blair Groden**, Silver, Raleigh Astronomy Club; **Dean Herring**, Silver, Raleigh Astronomy Club; **Susan Herring**, Silver, Raleigh Astronomy Club; **Michael Hotka**, Silver, Longmont Astronomical Society; **Darcy Howard**, Silver, Central Arkansas Astronomical Society; **Stephen Jones**, Silver, Houston Astronomical Society; **Emily Kindell**, Silver, Stillwater Stargazers; **Rex Kindell**, Silver, Stillwater Stargazers; **Joseph Kubal**, Silver, Naperville Astronomical Association; **Bridget Langdale**, Silver, Hill Country Astronomers; **Doug Lively**, Silver, Raleigh Astronomy Club; **Martiel Luther**, Silver, Houston Astronomical Society; **Mike McCabe**, Gold, South Shore Astronomical Society; **Janet McGeorge**, Silver, Stillwater Stargazers; **Jim Michnowicz**, Silver, Raleigh Astronomy Club; **Brittney Miller**, Silver, Atlanta Astronomy Club; **Carolyn Newman**, Silver, Raleigh Astronomy Club; **Samantha Pickard**, Silver, Raleigh Astronomy Club; **Doug Pieschel**, Silver, Umpqua Astronomers; **Russell Piniz-zotto**, Silver, Southern Maine Astronomers; **Rob Ratkowski**, Silver, Haleakala Amateur Astronomers; **Nathan Raynor**, Silver, Raleigh Astronomy Club; **Krystal Reyes**, Silver, Astronomy Club of Tulsa; **Karl Schulz**, Silver, Central Arkansas Astronomical Society; **Laura Stewart**, Silver, Member-at-Large; **Marshall Sweet**, Silver, Raleigh Astronomy Club; **Debra Wagner**, Silver, Member-at-Large; **Kathy Watkins**, Silver, Cumberland Astronomical Society; **Lloyd Watkins**, Silver, Cumberland Astronomical Society; **Zach Williams**, Silver, Northeast Florida Astronomical Society; **Brad Young**, Silver, Astronomy Club of Tulsa; **Jim Zappa**, Silver, Member-at-Large

SOLAR NEIGHBORHOOD OBSERVING PROGRAM

No. 11-I, **David M. Douglass**, Telescopic, East Valley Astronomy Club; No. 12, **John L. Goar**, Telescopic, Olympic Astronomical Society; No. 13, **Eric Edwards**, Telescopic, Albuquerque Astronomical Society; No. 19, **Lauren Rogers**, Eyes Only, Escambia Amateur Astronomers Association

SOLAR SYSTEM OBSERVING PROGRAM

No. 227, **Paul Morgan**, Umpqua Astronomers

SOUTHERN SKIES BINOCULAR OBSERVING PROGRAM

No. 111, **Daryel Stager**, Lifetime Member; No. 112, **Aaron Clevenson**, North Houston Astronomy Club

SOUTHERN SKY TELESCOPIC OBSERVING PROGRAM

No. 68, **David Cooper**, TAC-AL; No. 69, **Aaron Clevenson**, North Houston Astronomy Club

SUNSPOTTER OBSERVING PROGRAM

No. 246, **Trevor Raney**, Member-at-Large; No. 247-I, **Debra Wagner**, Member-at-Large

TARGET NEO OBSERVING PROGRAM

No. 33, **W. Maynard Pittendreigh**, Advanced, Lifetime Member

TWO IN THE VIEW OBSERVING PROGRAM

No. 64, **Gregg Ruppel**, Imaging, Tucson Amateur Astronomy Association; No. 65, **Dean F. Herring**, Visual, Raleigh Astronomy Club; No. 66, **Marie Lott**, Imaging, Atlanta Astronomy Club

URBAN OBSERVING PROGRAM

No. 244, **Albert E. Smith III**, Member-at-Large

VARIABLE STAR PROGRAM

No. 61, **Pete Hermes**, Tucson Amateur Astronomy Association

MASTER OBSERVER PROGRESSION

OBSERVER AWARD

Larry Bloom, Longmont Astronomical Society; **Dean F. Herring**, Raleigh Astronomy Club; **Richard Wheeler**, Northeast Florida Astronomical Society; **Jack Fitzmier**, Member-at-large

MASTER OBSERVER AWARD

No. 267, **Steve Riegel**, Colorado Springs Astronomical Society; No. 268, **Jack Fitzmier**, Member-at-Large

BINOCULAR MASTER AWARD

Stephen Pavela, La Crosse Area Astronomical Society

ADVANCED OBSERVER AWARD

Dean F. Herring, Raleigh Astronomy Club; **Jack Fitzmier**, Member-at-large

MASTER OBSERVER SILVER AWARD

Dean F. Herring, Raleigh Astronomy Club

Did You Know?

On July 31, 1964, the Ranger 7 spacecraft sent back 4,308 images of the Moon within the mission's final 17 minutes, before crashing into the surface. The final image, taken from a height of 1600 ft, had a resolution of just 15 inches. Learn more at

www.nasa.gov/history/60-years-ago-ranger-7-photographs-the-moon

Membership Secretary
Astronomical League
National Office
9201 Ward Parkway, Suite 100
Kansas City, MO 64114

NON-PROFIT
ORGANIZATION
U.S. POSTAGE
PAID
Tucson, AZ
permit #271