Reflector

Published by the Astronomical League Vol. 67, No. 3 June 2015

A Memorable Evening Dancing with Aurora

The Astronomical Community Loses Two Great Friends

Part 2: Discovering Astronomy

Competing at Stellafane

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TITLE PHOTOGRAPH: NGC 1850, THE DOUBLE CLUSTER. CREDIT: NASA, ESA, AND MARTINO ROMANIELLO (EUROPEAN SOUTHERN OBSERVATORY, GERMANY)

Contents

Our very own **Bill Bogardus**, vice president of the Astronomical League, took this image of the Eta Carinae Nebula during a recent trip to Chile. He used a William Optics GTF-81on a Celestron CG-5 mount, unguided, and a 30-second exposure with a Canon EOS 60Da at prime focus.

To our contributors: The copy and photo deadline for the September 2015 issue is July 1. Please send your stories and photos to our magazine editor, **Ron Kramer** (*editor@astroleague.org*), by then.

The Astronomical League invites your comments regarding the magazine. How can we improve it and make it a more valuable resource for you, our members? Please respond to the editor's email address above.

Reflector

The Astronomical League Magazine

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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.

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Reflector

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***Reflector* and Club Roster Deadlines**

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

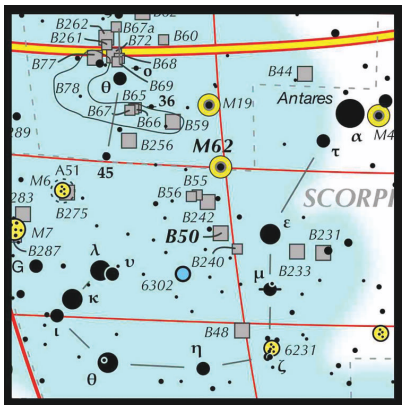
The Authentic Observing Experience

By John Jardine Goss

A late afternoon, and the electric blue sky foretells the coming of a transparent night, one that you have been waiting weeks to enjoy. This is your chance for the authentic observing experience.

When night finally descends, the enveloping dark acts like blinders focusing your thoughts skyward, deep into the starry realm. Tonight, you observe near the Scorpius–Ophiuchus boundary at sights few people have seen. Imagine what awaits.

A feeling of mounting excitement takes hold at the sound and feel of a polished metal eyepiece barrel smoothly sliding into the focuser, followed by the silent, buttery turn of the knurled knob bringing stars into sharp view. The telescope is now primed for discovery. Anticipation grows further while you direct its optical tube toward the evening's first celestial destination, the globular cluster Messier 62. Stars fly by as you slowly sweep the area.



Scorpius–Ophiuchus boundary

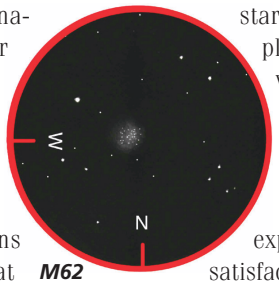
Voilà! Revealed near the edge of the eyepiece's field glows a slightly grainy but mostly fuzzy ball of light. Your excitement turns into wonder while pondering what you see under higher magnification. The celestial guidebook states that you are spying a giant stellar city of well over 100,000 individuals packed into a ball 100 light-years in diameter.

You visually—and mentally—see more than that.

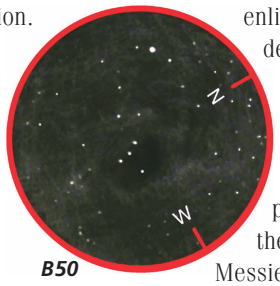
You see numerous faint stars dotting its dull glow. You see its bright, smeared core leaning slightly off-center as the cluster floats among numerous, unnamed field stars. You know that the view from M62, lying just a few thousand light years above the center of the Milky Way galaxy, must be grand with thousands of brilliant stars peppering the sky and with nearby globulars glowing in the distance. You also know that its innumerable stars are five billion years older than our five-billion-year-old sun. After seeing all that, after knowing all that, how do you feel?

You note your impressions, sketching what you see. You gaze into the sky in wonder, wanting to see more. You are having the authentic observing experience.

Your next target is hiding five degrees directly south—one in which you won't see much of anything, unless you know how to look. Between you and the inner regions of our galaxy lie immense forms of cold and nearly invisible gas and dust. Peering intently, you begin to notice areas vacant of stars, devoid of misty stellar glow abutting impressive Milky Way star fields. This is the dark nebula B50. What you see is something that others—even many amateur astronomers casually scanning the region—never will. You see, or rather you *don't* see, the nebula's contents. You glimpse the shadow of material from which stars are created, from which planets are formed, and from which life is made. How does that affect your view of the universe and our place in it? Now, how do you feel?



M62



B50

The authentic observing experience is personal, giving satisfaction, peace, and a sense of enlightenment. It is also an endeavor where the Astronomical League helps guide your observing and recognizes your personal achievements. With the League's many observing programs—in this evening's case, the Constellation Hunter, the Messier, the Binocular Messier, the Globular Cluster, and the Dark Nebula Observing Programs, along with the newly instituted Sketching Observing Award—amateurs such as you can enjoy, explore, and discover what the heavens have to offer.

The authentic observing experience is truly one of observer, telescope, and sky. It is like no other.

Participate. Discover. Volunteer.

John Jardine Goss

TITLE PHOTOGRAPH: BIG LICK GALAXY GROUP; LYNN HILBORN; WHISTLE STOP OBSERVATORY; GRAFTON, ONTARIO, CANADA

TITLE PHOTOGRAPH: "RING GALAXY," AM 0644-741; CREDIT: NASA, ESA, AND THE HUBBLE HERITAGE TEAM (AURA/STSCI)

How to Enact a Lighting Ordinance

By Bob Gent

Many of us are aware of the serious problems from light pollution. Blinding glare is a safety problem, light in your bedroom window disrupts sleep, bright lights disorient wildlife, there is an enormous waste of energy, and sky glow stops us from appreciating our magnificent night sky. What can be done?

First, study the issues. Fortunately, the International Dark-Sky Association has compiled vast resources to help you get up to speed. You will need to understand technical terms as well as the problems of and solutions to light pollution. Visit *www.darksky.org* to get started.

The next step is education. It is critically important to help people understand the adverse impact of poorly designed lighting. After learning about the problems of light pollution, many people voluntarily take action to control it. But what about the neighbor who refuses to turn down his or her floodlights when they are aimed directly onto your property?

A lighting ordinance or zoning code helps level the playing field, and it sets a good standard for everyone. This is not easy, and it takes time, sometimes years. Fortunately, hundreds, if not thousands, of cities, towns, counties, and states have passed laws, so you are not alone.

In my area, we have city, county, and state lighting ordinances. I found that the higher one moves in legislative levels, the more difficult the task, and there are more lobbyists to address. Local codes are easier, and they can be most helpful in limiting light pollution. In Sierra Vista and Cochise County, Arizona, our codes limit brightness, require shielding, and set curfews. The codes do much more than this, too, and we periodically update them.

It is important to build alliances. You will need to speak before local planning commissions, and if you have friends who care about this issue, have them write or speak before a planning meeting. Find a lighting designer who understands the problems of glare and light pollution. They will be able to provide the technical explanation.

Are there any city or county commissioners who are sympathetic to this issue? Ask for their support. They may be able to explain what you need to do to initiate the process. They may suggest that you write a letter to the governing body or the planning commission or that you be placed on their meeting agenda to make your case. Have your friends write letters to the editor of the local newspaper explaining the benefits of better quality lighting.

Ordinances and codes don't happen by magic. A need has to be identified, and you should be prepared to educate and inspire others to take action. Be ready to explain why the municipality should have a lighting ordinance. Give examples of neighboring communities who have adopted ordinances and explain the benefits. Be ready to show photos of good and bad lighting, or volunteer to take elected officials on nighttime tours.

Based on your review of other ordinances and codes, offer to work with them in developing the wording. Don't focus your effort on astronomy and night skies because many elected officials may not share your enthusiasm in this area. Be sure to cover health, safety, wildlife, and energy issues that are of broader concern to everyone.

In many regions, the planning staff drafts and revises ordinances. When the staff is satisfied, the draft may be submitted to the planning commission, the city attorney, or others for comment. The county or city planning commission will review and request public comments. Eventually, the draft code will be presented to the elected body with the power to approve it. This could be city council or county supervisors or commissioners, depending on your local laws.

Be ready for setbacks and don't be discouraged. After working for more than a year with planning staff in a county in Virginia, one of the board members had not been briefed on the latest changes, and he decided to table the action for further study. This set us back a few months, but through persistence, we eventually passed the zoning ordinance.

Although this process can be very slow and arduous, it has many benefits. One of the key advantages of this process is education. People will begin to understand that not all light at night is good. Once enacted, education must continue. Enforcement may be an issue. Will you have an inspector who works at night to investigate problems? Your organization may need to help others with awareness.

Lighting codes, laws, and ordinances are usually a huge amount of work. But they are

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To the Editor:

Having seen the fantastic photographs that are submitted by members, I thought that, as a new member, I would submit a photograph for potential inclusion in the *Reflector* journal that I am particularly proud of, as I only have basic "starter" equipment.

Clavius and its craterlets now hold a fascination for me, as I find this crater "pretty," with the semi-circle of the craterlets, and the larger crater Rutherford at the bottom of the chain.

I have recently submitted my first set of observations for the Lunar Program, and await the results with anticipation. Thanks to this program, our nearest neighbour has been opened up to me, and I regularly study it with my telescope and attempt to capture the detail that I was previously unaware of.

Whilst I am acutely aware that my efforts are nowhere near the quality of some of the others, I feel that as a "first try," my photographs are a personal achievement.

The attached photograph was taken on April 9, 2014, 9:59 p.m., from Swansea, Wales, UK, under conditions of seeing IV and transparency 5, with a Skywatcher 130 mm telescope, Orion StarShoot Solar System Imager IV, and no filters. One hundred fifty individual frames from a 25-second video were extracted to JPG format with IrfanView, stacked with Registax 6, slightly sharpened with the sharpening filter in GIMP, then cropped and exported as a PNG file.

Again—many thanks for the opportunities that the Astronomy League has afforded me!

Andrew Shapton, *Member-at-Large*
Swansea, Wales, UK

To the President:

I enjoyed reading your article about the Open Cluster Observing Program. I have had similar off-and-on frustration with observing programs over the years and your open and honest descriptions of those experiences were helpful.

I have been an off-and-on amateur astronomer since my youth in the late 1950s and am proud to be a pre-Sputnik amateur astronomer. I keep my observations in a series of notebooks separated by categories. I am really a visual astronomer and make drawings of some of my favorite objects. I like to say I do "nineteenth-century astronomy." I live about thirty miles outside of Boston under fifth-magnitude skies.

Thanks for your article and clear skies.

Alan Billingsley Rohwer
Boxborough, Massachusetts

To the Editor:

You do a lot of hard work, and I dislike being critical on small points, but I was a medical editor for 33 years, and so language usage bothers me at times as I read along.

Lee Gaillard's article, about mid-page 15 of the March 2015 issue of *Reflector* uses "hearken back" for proper "hark back." The two concepts are greatly different, and some writers don't know the difference in the attempt to use uncommon words. "To hearken" is 'to listen, give respectful attention to,' whereas "to hark back" is 'to turn back to an earlier circumstance or topic.' Some get confused with the verb "hark," which by itself means the similar 'pay close attention to, listen.'

Carl Masthay, *SLAS member since 1975, St. Louis, Missouri*

Gaillard replies: *Concerning "hark back" versus "hearken back" to the Cold War and its missiles, let me say up front that you are absolutely right. (And if that's the only error in my essay, I'm hugely relieved!)*

But let me also add what a delight it is to hear from someone out there who values etymology and the proper use of words—someone who probably enjoyed as much as I did a recent superb article in The New Yorker, *"Holy Writ," by Mary Norris, the author of* Between You and Me: Confessions of a Comma Queen. *When I heard of your concern, I checked both my* Roget's International Thesaurus *(non-alphabetized version), my* Random House Webster's College Dictionary *and my microprint* Oxford English Dictionary *so I could see the original derivation of hark and hearken.*

Ultimately, according to both Random House *and the* OED, *hark, harken, and hearken all stem from the Old English* heorcian *and the Old Frisian* herkia *and Middle High German* horchen*—to listen attentively to. This is back in the 12th century or earlier. The* OED *identifies hark as a transitive verb, provides three slightly different meanings—all related to the concept of "listen to"—and then in definition 4, subsection b, examines hark back:*

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SEYFERT'S SEXTET; NASA GODDARD SPACE FLIGHT CENTER

TITLE PHOTOGRAPH: DWARF GALAXY NGC 1569; ESA, NASA, AND P. ANDERS (GÖTTINGEN UNIVERSITY GALAXY EVOLUTION GROUP, GERMANY

As ALCon 2015 approaches, I think back to my very first ALCon, in 2013. I was the new editor of the *Reflector* and thought it would be a great idea to attend the Atlanta meeting. This way I could meet the AL board and council members and interact with the speakers, vendors, and local organizations that made such conventions possible. During the council meeting, while listening to the plans about the 2014 convention in San Antonio, Texas, I thought it would be fun to host an ALCon in Las Cruces, New Mexico, where I had been living for the past four years.

The suggestion was brought up to the council, there was some discussion, and it was decided that, indeed, ALCon 2015 would be held in Las Cruces. I returned home, presented the plan to the Astronomical Society of Las Cruces (ASLC) and asked for volunteers. Fifteen people raised their hands, and the work began.

Now, almost two years later, the stage is set. We are ready. The speakers are confirmed; the hotel, catering, and star parties are all set up; transportation and tours are finalized; and the surprises are arranged. There will be live entertainment on two nights, tours of a few of the wonders of New Mexico astronomy, and a bevy of speakers who will inform, educate, and engage the audience. It will be a blast. Hope you can make it.

On a much more somber note, it is with deep sadness that we lost two giants of amateur astronomy in the past two months. On February 22, Dr. Don Parker passed away after a brief battle with lung cancer. I did not know Don personally, but I certainly knew of him and his accomplishments.

Then, on April 6, we lost Walter Haas, founder of the Association of Lunar and Planetary Observers (ALPO), founder of the Astronomical Society of Las Cruces (ASLC), and friend to many of us. I first met Walter in 1963 and caught up with him again when I moved to Las Cruces in 2008. We became very good friends, chatted numerous times about astronomy, and I was asked to help disassemble his telescope when he could no longer use it. His daughter, Mary, asked me to be one of his pallbearers, and I was more than honored to do so. Walter was 97.

Please read their obituaries in this issue. They were both fascinating people with a great deal of history. Walter was a deeply religious man, and at one of his memorial services it was said, "Walter always looked at the stars. Now that he is in Heaven, he is much closer to the stars he loved so much."

We just received word that our Coming Events editor, John Wagoner, was in a car accident. We certainly wish him a very speedy recovery. Chuck Beucher prepared the Coming Events section in his stead with the support of the *Reflector* staff and AL personnel. Thank you.

In addition to ALCon, July will be an exciting month. The New Horizons spacecraft will pass by Pluto and head deeper into the Kuiper Belt. Scientists around the world have been awaiting this time for many years. It is almost here!

Finally, I want to thank the many readers who responded to the "digital versus paper" discussion. There were many positive (and negative) comments about offering a digital version of the *Reflector*, and the biggest concern was that we were planning to do away with the paper version. That is not the case!

As our organization ages, the trend will be towards digital media. Based on some surveys, about 80 percent of readers under the age of 40 prefer digital versions. About 80 percent of those readers over 60 prefer paper. The remainder (those between ages 40 and 60) is split about 50/50. That being said, we need to prepare today for the future. Within the next 10 to 15 years, more of our readers will be accustomed to digital media than print. We must be prepared for this eventuality.

There are no plans to do away with the paper version. There are no plans to make the *Reflector* digital only. We will be offering our 16,000 readers the option of one or the other. The plan is as follows:

During the production of the March 2015 issue, one member society (in Las Cruces, New Mexico) was surveyed, and each member was asked whether they wanted a digital copy or a paper copy of the magazine. Among those who responded, 33 members chose digital and 18 members chose paper. As the March issue was being printed, the 33 people who requested a digital version were sent a link to a high-resolution PDF file (about 40 megabytes), which they downloaded. This test, after some debugging, was

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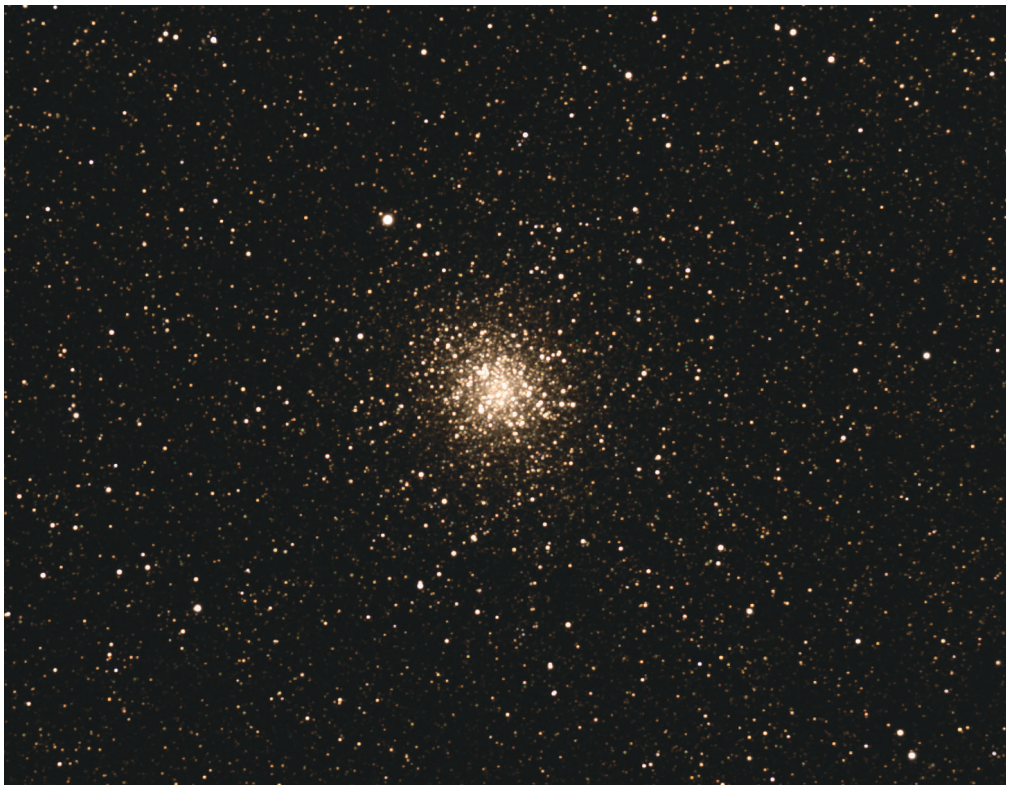
DEEP-SKY OBJECTS

500,000 REASONS TO VIEW M22

By Dr. James R. Dire, Kauai Educational Association for Science & Astronomy



Globular clusters are densely packed star groups containing hundreds of thousands to millions of stars. Unlike most open star clusters (also known as galactic star clusters), globular clusters contain enough mass so that all of their stars are gravitationally bound to the cluster. Our galaxy may have close to 200 globular clusters. The NGC catalog contains 138 globular clusters. I have found 55 other catalogued globular clusters not in the NGC, but some of these may not be members of the Milky Way galaxy. Galaxies that are nearby enough for their globular clusters to be resolved have them. They appear in all galaxy types. Some giant elliptical galaxies are known to have thousands of globular clusters!

Color index studies of globular clusters show two distinct subpopulations: those with more red stars and those with more blue stars. The blue population globular clusters are metal-poor, meaning the stars contain almost entirely hydrogen and helium. These are some of the oldest objects in the universe, nearly 13 billion years old. They either formed before or at the same time as the first galaxies. The red population clusters contain more "metals"—elements heavier than helium—meaning their stars formed out of elements created in earlier generations of stars. These clusters are several billion years younger than the blue clusters.

Globular clusters are located in a spherical halo around our galaxy, meaning they have random orbits not concentrated along the galactic plane. Most reside within 26,000 to 33,000 light-years of the galaxy's center. Since we are located about 26,000 light-years from the center of the galaxy, we observe many more globular clusters looking toward the galactic center than away from it. And since the center of the Milky Way is in Sagittarius, a majority of all globular clusters reside in Sagittarius and the constellations surrounding it. You will find 21 of the NGC's globular clusters in Sagittarius. No constellation in that catalog contains more.

The finest globular cluster in Sagittarius, and, in my opinion, the finest visible from mid-northern latitudes, is M22. It is very easy to find. First find the star Kaus Borealis (Lambda Sagattarii), the top of the lid of the "Teapot" asterism. Then pan two and a half degrees to the northeast. Whether using a finderscope, binoculars, or a telescope, you can't miss it!

M22 shines at magnitude 5.1 and is 32 arcminutes in diameter (about the angular size of the Moon). Compare this to the great globular cluster in Hercules, M13, which is slightly dimmer (mag. 5.8) and smaller (about 25 arcminutes). M22 is about 10,000 light-years away. It is much closer than M13 (about 22,000 light-years distant), which accounts for M22's greater brightness and angular size.

The first recorded sighting of M22 is credited to the German astronomer Abraham Ihle in 1665. Charles Messier added it to his catalog on June 5, 1764. M22 was one of the first globular clusters studied by Harlow Shapley in 1930. Shapley counted 70,000 stars in the cluster. Today we know the cluster contains half a million stars.

Visually, M22 appears slightly elliptical with the major axis roughly east–west and the minor axis north–south. The core of the cluster is 5 arcminutes in diameter, and it appears much less dense than M13's core, with many faint stars resolvable. Stars are distributed around the core in several arms, streams, and clumps. To my eye, more stars are resolved over M22's entire diameter than in M13. The brightest stars in the cluster are 11th magnitude.

M22 is notable because it contains a planetary nebula, discovered by the Infrared Astronomical Satellite during its 10-month mission in 1983 and cataloged as IRAS 18333-2357. This planetary was the second discovered in a globular cluster, the first being Pease 1 in M15. Only four Milky Way globular clusters are known to contain planetary nebulae. In addition, Hubble Space Telescope observations hint at planet-sized objects in M22.

My image of M22 was taken two years ago with a 102 mm f/7.9 apochromatic refractor on an Orion Atlas mount with an SBIG ST-2000XCM CCD camera. The image is the combination of four 10-minute exposures. North is up and east is to the left. The brightest star in the image, located northeast of the cluster, is SAO 187044, shining at magnitude 8.6. This is a foreground star 74 light-years away. The faintest stars in the image are 17th magnitude.

If you are hunting deep-space objects this summer, be sure to check out M22. Compare it to M13 and see which globular cluster you find more striking.

Don Parker, 1939–2015

By Barbara G. Harris, Central Florida Astronomical Society

The astronomical community lost a great friend and ally on February 22, 2015. Dr. Don Parker passed away after a brief battle with lung cancer. Don was a pioneer in the astrophotography community, especially in planetary photography.

Born in January 1939 in Urbana, Illinois, Don was always curious about science and became interested in astronomy at an early age. With the help of his father, Don began building his own telescopes in the 1950s. Despite an interest in astronomy, his career path was in medicine. He completed medical school and went on to complete his residency in anesthesiology at Jackson Memorial Hospital in Miami. After completing service in the Navy, Don settled in Miami to practice at Mercy Hospital.

Don's interest in astronomy was rekindled when his parents shipped his homemade 8-inch Newtonian from Chicago to Miami. During the early 1970s, Don joined the Association of Lunar and Planetary Observers (ALPO). It was through ALPO that Don became acquainted with his mentor, Charles F. "Chick" Capen, of the Lowell Observatory.

Chick Capen introduced Don to advanced planetary photography techniques. Through the years, Don became a leader in planetary photography, and in 1988 he co-authored the book *Introduction to Observing and Photographing the Solar System* with Charles Capen and fellow amateur astronomer Thomas A. Dobbins. Over the years as astrophotography shifted from film to digital photography, Don remained a pioneer in the field. He was at the forefront of techniques used in digital photography of the planets. He wasn't just interested in "pretty picture" photographs of the planets. Wanting his photographs to be scientifically valuable, he worked endlessly to make sure that scientific information could be extracted from his images. His 20,000+ images of the planets have supported professional astronomers at NASA and many other institutions around the world. Don co-authored many scientific papers over the years. The most recent paper, "An extremely high-altitude plume seen at Mars' morning terminator," was published in *Nature* just weeks before his death. Don accumulated many awards over the years. His most cherished awards were the Gold Medal Award from Japan's Oriental Astronomical Association, ALPO's Walter H. Haas Award, and the Astronomical League's Leslie C. Peltier Award. In 1994 the International Astronomical Union honored him for his contributions to Solar System science by naming an asteroid after him, 5392 Parker.

It was also in the 1970s that Don joined his local astronomy club, Southern Cross Astronomical Society (SCAS), and through them became a member of the Astronomical League. Don was a frequent and popular speaker at SCAS, the Miami Space Transit Planetarium, and many amateur astronomy conventions. His talks were standing room only due to his reputation for giving very informative and humorous lectures. His final lecture was at the 31st Winter Star Party in the Florida Keys, just four days prior to his death. Realizing the end was near, the talk was a review of his entire life, not just the astronomy aspect.

On a personal note, Don Parker was one of my closest friends. Since we are both astronomers, some of our best conversations were in the wee hours of the morning. Don and I would text each other if we were up observing: "Are you up?" If there was an answer, we would call and talk. My husband knew I was talking to Don Parker if he woke up and found me on the phone at 2 a.m. Don was the most giving person I have ever known. Don was open and generous. He was always willing to share his imaging techniques with anyone who asked. I will forever think of him every time I look up at the heavens.

Walter H. Haas 1917–2015

Compiled by Ron Kramer

Walter was born on July 3, 1917, in New Waterford, Ohio. He traced his wonder of the celestial world back to an astronomy book his mother used in school. After graduating from high school in 1934, he was given a choice of a year's college tuition or eight weeks studying astronomy in Jamaica under William H. Pickering; the then 17-year-old farm boy chose the Caribbean island. This was where he first met his future wife, Beryl, as she was Pickering's secretary. The internship was extended from 8 to 15 weeks.

He returned to Ohio, where he attended Methodist Mount Union College in Alliance, majoring in math and working on minors in German, physics, and chemistry. He also had extensive use of the 10-inch Saegmuller refractor in the college's Clark Observatory, which he used to study Mercury, Venus, Jupiter, and Saturn. After earning a Bachelor of Science degree from Case Western Reserve University, and a Masters from Ohio State, Walter finished with a PhD from the University of Pennsylvania.

Don Parker receiving the Walter H. Haas Award from Walter H. Hass at ALCon1987

During the day, he trained Navy aviation students in classical navigation, and at night he had virtually unlimited access to the observatory's 18-inch Brashear refractor, where he averaged some 450 hours per year of observing time. He taught math at the University of New Mexico from 1946 to 1950, then moved to Las Cruces to accept a position at White Sands, where he worked until 1954. In 1947 he founded the Association of Lunar and Planetary Observers (ALPO), and was its director emeritus. The then six-page mimeographed newsletter has become a sophisticated, small type, more than 90-page quarterly journal: *The Strolling Astronomer*.

Walter, along with Clyde Tombaugh and others, also founded the Astronomical Society of Las Cruces in 1951.

After rekindling their acquaintance in London, England, at the coronation of Queen Elizabeth II in June 1953, he proposed to Beryl. In November 1953 he married Beryl "Peggy" Godfrey in Mandeville, Jamaica. In 1957, Walter and Beryl were blessed with their one and only daughter, Mary. In 1960, he taught astronomy for a short time at Pan American College in Edinburgh, Texas. In 1963, Walter became a mathematician and computer programmer at New Mexico State University's Physical Sciences Laboratory in Las Cruces. He retired from there in 1983.

Walter spent much of his retirement observing with his 12.5-inch reflector in his backyard. It was a very sad day when he told me he decided to sell the instrument and asked my help in disassembling it so the buyer could transport it. I could see his tears as we took all of the pieces and loaded them in a truck.

Contributing to Walter's obituary were Mary Alba, Trudy E. Bell, and others.

10, 25, and 50 Years of the Astronomical League's Newsletter

By Mike Stewart, Astronomical League Historian

April 1965

Astronomy Section—Rochester Academy of Science


REFLECTOR

OFFICIAL PUBLICATION of the ASTRONOMICAL LEAGUE

Yerkes Highlights League Convention

Our society was founded in the early 1920's as the Rochester Astronomy Club. During World War II the organization became inactive due to the long hours that most of the members were spending working for the war effort in local industries. After the war, the club was reformed as one of the "hobby" sections of the Rochester Academy of Science. Other sections of the Academy are Botany, Mineral and Ornithology. As with most amateur clubs, our members come from all walks of life. Among them are physicists, teachers, electronics experts, mechanical engineers, optical engineers, chemists, a commercial photographer, salesmen, a lens designer, and several housewives. Our members own a large number of excellent home-built reflecting telescopes, including at least 12– 6", 4–8", 2–10", and 2–12" aperture instruments. Two home-built refractors and several others with commercial lenses are in use, along with at least three pair of large diameter war surplus binoculars.

The Rochester Academy of Science (RAS) assumed editorship of Reflector *beginning with this issue. Ralph K. Dakin of RAS contributed the article from which this excerpt was taken. Attentive readers will recall that March's "50 Years" entry came from the same issue. The League did not publish winter 1964 or summer 1965 issues, presumably due to the transfer of editorial responsibility.*

May 1990

Comet Austin Loses Pizzazz But Still Glitters

Comet Austin, 1989c1, is no longer being heralded as the spectacle of the decade, but neither is it being labeled a dud. It has lost some of its pizzazz, but it should still sparkle nicely from country skies during the moonless mornings of late April and May.

In those days shortly after Austin's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discovery on December 6, 1989, some optimistic reports indicated a possible perihelion brightening to –2 magnitude. This is the current luminosity of Jupiter in the evening spring sky. Presently, as of mid-March, astronomers at the Smithsonian Astrophysical Observatory in Cambridge, MA have downgraded Austin to about +3 magnitude at closest approach to the sun. This will occur on April 9th. The new information represents a 100-fold decrease in brightness estimates over the past three months. Who says comets aren't fickled [sic] beasts?

Alas, little has changed with comets. They remain elusive and contrary. Yet comets become a treasured entry in our astronomical logs when they do appear. Gary A. Becker of the Lehigh Valley Astronomical Society contributed this piece.

June 2005

The Winter Star Party

By the time February rolls around in Ohio, I'm pretty well sick of winter. The thought of sunshine, clear skies and a star party take me down to the Florida Keys.

I went for the first time in 2003 and met Tippy and Patty D'Auria. Tippy is the founder of the Winter Star Party. I have been fortunate enough to go back every year since then. It's always amazing to see the lineup of speakers, telescopes and new technology from all over the world. The vendors bring a wide variety of accessories and telescopes to covet and the attendees bring equipment that I have only read about.

The skies are breathtaking! I'll never forget my first trip there. I walked down the drive spending more time looking up than I did watching where I was going. I kept thinking, this can't be right! There's Orion and I don't even have on a jacket!! Every year I sit back in a chair and get lost in those beautiful skies. The temperatures usually run from 65 degrees to 75 degrees. They have been a little warmer and a little colder at times. It's much better than being in the East with the snow. It gives you a chance to thaw out.

This story struck a chord, given the tough winter many astronomers experienced in the U.S. during 2014–15. Terry Mann's account of her experience at the Winter Star Party reminds us of the joy and camaraderie that attending a star party can bring. Coincidentally, the May 1990 issue led with a story about the Winter Star Party. The Southern Cross Astronomical Society continues to host WSP.

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Opportunity knocks at the *Reflector*

Amateur astronomy has a wide field of view, featuring all sorts of interesting events and cool equipment. The Astronomical League is seeking someone to help amateur astronomy by volunteering to be part of the *Reflector* magazine team and to assume the duties of the *Reflector* advertising representative. This is a great opportunity to interact with star party and convention organizers, merchandise vendors, and equipment manufacturers while gaining a firsthand view of the state of the hobby. Duties include disseminating advertisement design guidelines, accepting advertisements, and sending invoices. If this fun and important role is for you, please send your name to *Reflector* editor Ron Kramer at *rjipublishing@aol.com*.

New at League Sales!

Get your solar eclipse glasses for the 2017 Total Eclipse visible across much of the USA—solar safe-viewing glasses suitable for direct viewing of the Sun and solar eclipses. The Astronomical League is offering these in anticipation of the 2017 total eclipse, and with League clubs in mind! The pricing structure will be designed to allow clubs to purchase these glasses at very low rates.

Check the League Sales web store at *www.astroleague.org/store* for pricing, availability, and more info. Discounts will be available for various quantities, starting for as few as 10 and for as many as 1000. Stock up early for all your outreach and viewing events!

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DISCOVERING ASTRONOMY:

An Exploratory Series from the Adirondack Public Observatory

Part 2–The Moon and Early Manned Space Efforts

By Lee Gaillard

Following photo surveys by the *Ranger* series and other probes, there was one last step before attempting a lunar landing: human reconnaissance. On December 21, 1968, Frank Borman, Jim Lovell, and William Anders astonished the world when they completed their slingshot trip around the Moon, dipping to within 69.5 miles of the surface before completing many additional orbits and then returning safely to splashdown in the Pacific. (Their color photograph of Earth, a blue marble partly occluded by the Moon's rim, has become iconic.) Humankind had now been around the Moon and back; next would come the landing.

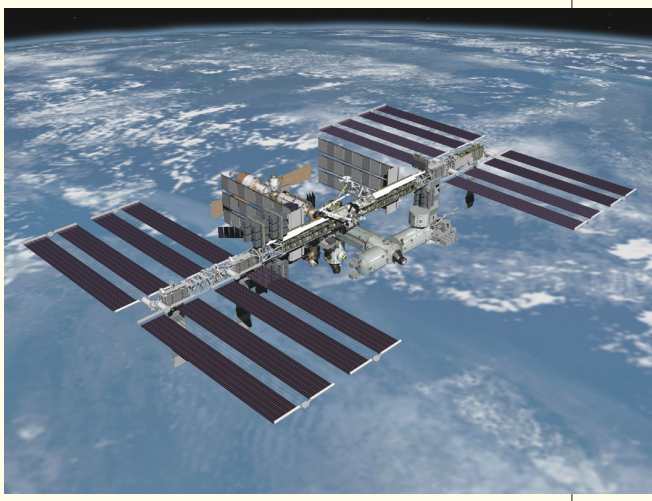
On July 3, 1969, with more than 10 million pounds of thrust thundering from its thirty NK-15 engines, the massive Soviet N-1 lifted itself slowly on a shuddering blue-white column of flame. But when (as author T.A. Heppenheimer narrates in *Countdown*) a small sliver of metal whirled into the liquid oxygen turbopump of engine number 8, "this Moon rocket, fully fueled and weighing as much as a naval destroyer, fell back onto the launch complex and exploded in an enormous fireball."

Two weeks later, on July 16, 1969, the United States launched Apollo 11. Five days later, astronaut Neil Armstrong stepped down onto the surface of the Moon—our first visit to another planetary body. There would be six more Apollo flights—the last, Apollo 17, in 1972. Five of these produced important information about the geology of the Moon and its habitability. The sixth, Apollo 13, was a near-disaster that produced massive anxiety and a tale of incredible ingenuity and adaptability later depicted by Hollywood in its *Apollo 13* docudrama.

Saturn booster hardware left over from the Moon program made possible the launch of Skylab in 1973. Manned by three different astronauts during each of three separate missions, it gathered information about human flight in Earth orbit and especially about solar flares and coronal mass ejections—more information about the Sun than had been gathered in centuries. Apollo–Soyuz linking in orbit in 1975 made good use of one of the last remaining Apollo capsules, increased man's ability to maneuver in low-Earth orbit, and helped decrease Cold War tensions as the United States and the Soviet Union worked together on the project.

Then, of course, there's the Space Shuttle, the STS—Space Transportation System.

Launched using two massive solid-propellant booster rockets and its own 1.2-million-pound thrust liquid rocket main engine, the Shuttle carried a crew of three to seven astronauts plus various cargoes—satellites for release into orbit, modules for the International Space Station, and, of course, the incredible Hubble Space Telescope. With its modified cranked delta wings, the Shuttle was the first manned vehicle to be launched into orbit and then returned to Earth for reuse. Its speed and altitude demanded development of specialized computer controls; reentry speeds of over 17,000 miles per hour required thermal protection tiles to be applied over most of its body; deorbiting maneuvers called for sophisticated retrorocket burns and meticulous attention to angle of attack as it reentered the outer fringes of Earth's atmosphere.



Over its 30-year career, the Shuttle completed 135 missions, during several of which it retrieved damaged satellites and returned them to Earth for repair. It also made possible in-orbit capture of the Hubble telescope for installation of new cameras and equipment or replacement and repair of inoperative stabilizing gyros. The Soviets' more advanced Buran had made good use of the American shuttle's basic design by the time it lifted off in 1988 to make an unmanned automated orbital flight around Earth followed by a computer-controlled landing. Impressive. But the Soviet Union officially dissolved in 1991, and the Buran never flew again, destroyed when poor maintenance resulted in the collapse of the hangar in which it was stored in Kazakhstan.

All this complex technology was developed just to get us *into* space where we could then, above the distorting haze of our atmosphere, finally deploy the Hubble and other space telescopes, enabling us to discover stars, galaxies, and exoplanets we had not even dreamed of.

The International Space Station (ISS)

Following such earlier space station efforts as Skylab, Salyut, and Mir, the most comprehensive effort yet to enable people to live and work in space has been the International Space

Station. The project involved the merging of what had started out as three separate efforts by as many different countries. Zarya, the first ISS module, was launched into orbit in 1998 aboard a Russian Proton rocket; the final component, the Raffaello logistics module, was installed after its arrival on Space Shuttle *Atlantis* in 2011. And it has truly been an international effort, with major structures contributed by the United States, Russia, Japan, and Europe. Continuous human habitation has extended from 2000 to the present; more than 200 people have visited the ISS from a number of different countries. With a mass of almost 1 million pounds and measuring 357 feet end to end, it contains more living space than a five-bedroom house. It has two bathrooms, a gymnasium, and the 360-degree 7-window viewing cupola that some say is reminiscent of the *Millennium Falcon*'s turret in the *Star Wars* science fiction films. The eight solar arrays of the ISS generate 84 kilowatts of power, and 52 computers employing roughly 2.3 million lines of code control its numerous systems.

What do people *do* up there? Mission specialists monitor changes on Earth and compare them with data from mission-specific satellites. They study the correlation between proteins, muscle growth and endurance in tiny, unsegmented nematode worms under microgravity conditions. The *Caenorhabditis elegans*, for example, is a roundworm roughly 1 mm long that has had its entire genome sequenced and is being used as a "model organism" for researching the genetic basis for muscle development and atrophy—clearly important both in long-term space flight as well as in understanding the overall aging process. They analyze the effects of space radiation on mammalian reproductive systems or of space flight on stem cell regeneration. A school-sponsored experiment measured differences in bonding strength between concrete mixed in the microgravity of space vs. concrete mixed under full-gravity conditions on Earth. Others observed the effects of microgravity on fire suppression attempts. An industry-funded project examined the growth of high-quality homogeneous silicon–germanium crystals under microgravity. And much more.

And then there's learning to deal with the stress that builds up when you live in cramped, enclosed quarters over extended periods with people from different cultures who speak different languages, separated from your family for months and months and unable to be present at the birth of children or the death of a loved one. This is good practice for the interplanetary missions that some day will come.

Hubble Telescope Peers into Deep Space

Along with the ISS, the Hubble Space Telescope (HST) in its own way takes its place right up there with early manned space efforts. True, it is in a 350-mile-high orbit and is operated remotely from Earth. But Hubble was launched from the Space Shuttle and was repaired by astronauts performing difficult space walks on a number of occasions. For what it's worth, it is "one of us," an absolutely amazing instrument now nearing the end of its operational lifespan. But it has yielded treasures, providing distant vistas about which we'd had no prior concept.

When I was a boy, I remember excitedly watching as the construction of the 200-inch Hale Telescope progressed—the careful casting of its mirror, its subsequent coating, and its completion and installation in the Palomar Observatory. The universe jumped closer. *Much* closer. But now there's the 94.5-inch Hubble Space Telescope orbiting above Earth's distorting atmosphere, gently placed there by astronauts painstakingly maneuvering it out of Space Shuttle *Discovery*'s payload bay in 1990. Soon the Hubble surpassed the Hale's advances—despite its mirror's having been improperly ground by Perkin–Elmer, just slightly off, necessitating recalculation and manufacture of corrective optics that then had to be inserted *more than 350 miles above Earth, in space*. But now it worked. And the harvest of images from deep space by the HST has been truly awe-inspiring.

What has it shown us? What have we learned?

Planetary dynamics of which we'd had no idea: Hubble images reveal that the moon Enceladus funnels particles to Saturn's E ring; in 2007, the Hubble captured the large "grand design" spiral galaxy M81 in spectacular detail never before achieved; and in 2012, the Hubble revealed a fifth moon orbiting the dwarf planet Pluto. In 2010, astronomers used Hubble's images of gravitationally lensed background galaxies to calculate the location of dark matter in the Abell 1689 galaxy cluster, 2.2 billion light-years distant. Dark matter? We are only just beginning to learn about this mysterious substance that seems to pervade much of the universe. What is it and what are its effects? How is it related to dark energy? Astrophysicists are champing at the bit to find out.

Or take NASA's image of the Cat's Eye Nebula, a combination of photos from the HST blended with images from the Chandra X-ray space telescope to provide sharp outlines of its concentric rings and the delicate interlocking purple, pink, and yellow bubbles of expanding gases, released by its central star during its nova phase that occurred about 1,000 years ago. Then there are spectacularly beautiful images captured in unprecedented detail revealing star formation in the Eagle Nebula—greenish-brown columns of galactic dust rising vertically against the deep black of space as bright stars burst into being all around them. Or picture one galaxy consuming another. The list goes on.

We've thus been able to go back almost to the beginnings of time, to shortly after the creation of the universe in the Big Bang, back to almost 13.8 billion years ago, as we look at galactic images whose light took almost that long to reach us at a speed of roughly 186,234 miles *per second*, just about 6 *trillion* miles per year. Now multiply that by 13.8 *billion*. Beyond comprehension. Meanwhile, the HST provides us with images of galaxies that may no longer even exist, patterns of photons that left their source billions of years before Earth was even born. We will examine related implications in a later article.

Concluded in the September issue

Dancing with Aurora: A most Memorable Evening

By Al Marcella

The Valkyrior, the Dance of the Spirits, polar lights, goddess of the dawn, the mythical firefoxes of Lapland, the northern lights, Aurora. By any name, auroras have intrigued, scared, excited, and fascinated humans since the dawn of time.

Named after the Roman goddess of dawn, Aurora, and the Greek name for the north wind, Boreas, in the Northern Hemisphere, the display is known as the aurora borealis (or the northern lights). In the Southern Hemisphere, it is called the aurora australis (or the southern lights).

These phenomena are commonly visible between 60 and 72 degrees north and south latitudes, which place them in a ring just within the Arctic and Antarctic Circles. Aurora sightings at lower latitudes are uncommon, so making the trek to extreme northern or southern latitudes is a requirement, if you want to get on Aurora's dance card.

The Science behind Aurora's Display

Where does the auroral light come from?

Auroras are caused by energetic particles hurtling out from the Sun in a steady stream called the solar wind. They can also occur as a result of giant eruptions on the Sun, known as coronal mass ejections or CMEs.

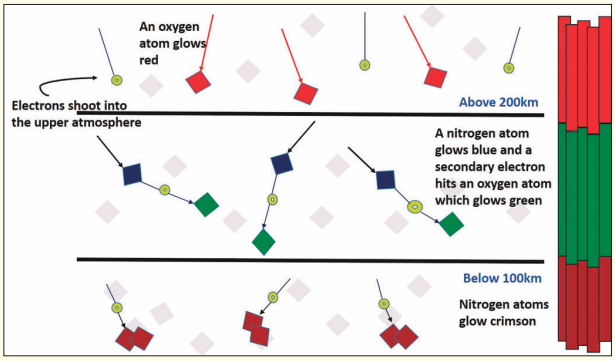
After a trip toward Earth that can take two to three days, these solar particles interact with the Earth's magnetic field and cause the release of particles already trapped near Earth, which in turn trigger reactions in the upper atmosphere. In these reactions, oxygen and nitrogen atoms release photons of light. Most auroral light is emitted by these oxygen atoms, excited from bombardment by charged solar particles.

When a charged particle moves through a magnetic field, a force perpendicular to the particle's motion is created, and that force can divert the particle into a spiral path until it collides with atoms in the upper atmosphere. These upper atmospheric collisions excite oxygen and nitrogen atoms, resulting in the visible auroral light. We artificially create a similar lighting effect here on Earth when we fire electrons into a glass tube filled with neon gas, creating the glow of neon light.

The Colors of the Aurora

When energetic electrons strike an atom or a molecule, they slow down and transfer some of their energy to that atom or molecule. The atoms or molecules can store this energy only for a very short time, and then radiate the energy away as light.

When an atom or molecule emits light as a photon to rid itself of its excess energy, that photon has a wavelength that is characteristic for that atom or molecule. We perceive this characteristic wavelength as color.



Colors of the aurora

Different gases produce different colors when they are excited. Oxygen at about 60 miles up gives off the familiar yellow-green color. Oxygen at higher altitudes (about 200 miles above us) gives the all-red auroras. Ionic nitrogen produces the blue light and neutral nitrogen gives off the red-purple and the rippled edges (see "Colors of the aurora").[1]

The green light emitted from excited atomic oxygen is centered on a wavelength of 558 nanometers, while the rarer red light is emitted around wavelengths in the 630 nanometer region.[2]

The most abundant gas in Earth's atmosphere is molecular nitrogen, and it radiates predominantly in deep blue and red colors. Mixing these together gives purple. The bottom edge of a green auroral curtain gets this purple color when auroral electrons are accelerated to very high energy levels.

On occasion the aurora gets a deep red color. This comes from higher altitudes, around 120–180 miles (200–300 km). It is again oxygen atoms that are responsible for this color. An oxygen atom has an excited state that can produce this red line emission with a mean lifetime of 100 seconds, and only at very high altitudes are collisions infrequent enough to allow this radiation to be emitted.[3]

Viewing the Aurora

Auroras are magical, spellbinding, amazing wonders of nature, produced by solar winds and the Earth's prevailing magnetic and atmospheric conditions. Above all, auroras are not subject to human schedules or timeframes.

Observing the aurora is also subject to local weather conditions, patience, geographic location, sky darkness, patience, minimal ambient light, patience, being in the right place at the right time, patience and some luck. I'll get back to patience later.

Spending an evening with Aurora should be on everyone's life list. However, getting yourself to a good location in either the Northern or Southern Hemisphere that will maximize your potential and opportunity to see the aurora, is your first challenge.

The best Northern Hemisphere latitude? Within the auroral zone—65 to 72 degrees north.

In the Northern Hemisphere you will need to head to destination cities on or slightly above the auroral zone (the auroral zone, also referred to as an auroral oval, is centered about the magnetic poles) and north of the Arctic Circle.

Which cities? That is open to debate, based on whom you ask or which website you search. It also depends on where you live, how far you are willing to travel, and how much you are willing to spend for that evening's dance with Aurora.

You will stand a good chance of viewing an aurora if you head

Kaldfjord, Norway
Nikon D300, Tokina 11–16 mm lens, f/2.8, ISO 1000, 22 sec.

to Tromsø, Norway; Yellowknife, Northwest Territories, Canada; or Bettles, Alaska. Other excellent choices are Svalbard, Norway; Jukkasjärvi, Sweden; Kakslauttanen, Finland; Kangerlussuaq, Greenland; and Reyjavik, Iceland. This is only a representative list as there are many northern latitude cities that make good aurora-viewing destinations.

Possibly the most difficult (unless you are a scientist or a research station support member) and most inaccessible place to see the aurora australis is Antarctica! Because of the limited possibility of travel to remote parts of Antarctica, it is unlikely that this aurora destination will make your aurora viewing hit list.

However, under the right conditions, you can see the aurora australis from Ushuaia, Argentina; Tasmania, Australia; Stewart Island, New Zealand; and the southern tip of South Africa, all Southern Hemisphere destinations that are more easily accessible.

The best time of year? To improve your chances of catching a dance with Aurora, in the Northern Hemisphere, you will need to venture out between late November and March, when the days are short and dark nights are longer. It is also best to schedule three to four days in your destination city to maximize your chances of seeing an aurora and to offset any uncooperative local weather that may roll in.

Although there is a depth of knowledge and science that goes into predicting auroras, in reality, even with perfect observing weather, minimal ambient light, and a 360-degree visibility, there is no guarantee that you will see an aurora. Remember, auroras are not a man-made light show—the Cosmos rules here.

As for actually seeing the aurora, recall my earlier comments on patience. When all is said and done, you are at the complete mercy of the Sun, Earth, the solar wind, nature, and space. That is why, when you do see Aurora's amazing display, it is so very special and you can count yourself fortunate to have been there for the dance.

Oldervik, Norway
Nikon D300, Tokina 11–16 mm lens, f/2.8, ISO 500, 52 sec.

An Evening Out With Aurora

Like most memorable evenings, you will most likely want to take a picture of, and with, Lady Aurora. If the conditions are right and you are prepared, you will have a picture that you will cherish and which will bring you many happy memories long after you have returned home.

Capturing the elusive aurora will take, again, patience, as the aurora may display at any time, without much advance warning and may fade away just as quickly.

In addition to patience, for any long evening that you will spend out in the high arctic, during the cold winter, waiting to photograph the aurora, you will need some advance preparation.

Estote Parati

Being prepared when venturing out for an evening with Lady Aurora means being aware of your surroundings, especially if you are visiting unfamiliar territory, a foreign country, or even your own neighborhood park. Photographing an aurora requires heading out at night, most likely to new and unfamiliar areas, possibly walking in snow and ice or even across frozen bodies of water, typically a distance from city lights into the countryside. Snow can cover up lots of potential dangers!

If possible, try to pair up with someone as excited about viewing an aurora as you are, or who is just willing to sit in a warm car in case you need support. Conduct visual reconnaissance during the day, identify potential ground hazards, lay out a destination path, and test snow and ice conditions on the way to your evening's photographic destination.

If venturing out on your own, it is always best to let someone know your planned destination and anticipated return time. Don't count on your mobile phone working if you are far from mobile phone towers or in a foreign country.

If you are headed to an international destination, joining a professional tour is certainly an option. Most professional "aurora hunting" tour operators have many years of seasonal experience, are very familiar with the local area and the best places for viewing, and know where they can tread both safely and legally (not trespassing on private property).

Estote Parati, your foremost priority out the door, is safety first.

Dressing for the Dance

Plan on wearing and layering clothing appropriate for the season, geographic location, and weather conditions in which you will be photographing, sometimes for several hours. For example, consider a hat, boots, gloves, insulated jacket, insulated/thermal under

Kaldfjord, Norway
Nikon D300, Tokina 11–16 mm lens, f/2.8, ISO 1000, 23 sec.

layer, and windproof outer pants. For outer pants, I prefer loose, baggy snowboarding pants, which allow greater freedom of movement when walking or kneeling.

A fully charged flashlight or headlamp is essential, preferably with a red rather than white light. The red light allows you to easily see where you are walking, yet preserves your night vision so you can easily and quickly operate your camera.

Another important, not-to-forget item is chemical hand and foot warmers. These hand

Kvaløya ("Whale Island"), Norway
Nikon D300, Tokina 11–16 mm lens, f/2.8, ISO 1000, 13 sec.

and foot warmers produce heat when exposed to air. Pack more than you think you will need, because you may need them all, especially if you will be going out to the chase the lights on multiple evenings.

Packing something warm to drink and a snack for energy is always a plus; however, remember that if you drink too much, well, nature rules. Getting undressed through multiple layers of protective cold weather gear is not only time consuming and laborious, it takes you away from your camera and from taking that aurora picture you came all this way to take. So, as the saying goes, "drink wisely, my friend."

Camera Equipment

You don't really need much technical equipment to photograph an aurora, but there are some things you simply cannot do without.

Camera: A camera with interchangeable lenses will be best, but in principle any camera can be used, even your mobile phone. Realize, however, that hand-holding your mobile phone, attempting to capture a shimmering, undulating aurora, will not produce the same quality image that you might get with a digital camera on a sturdy tripod using a remote shutter release. This, however, should not stop you from capturing that moment and preserving your memory of witnessing Lady Aurora's dance.

Be sure to keep your camera dry and avoid contact with snow or moisture as much as possible. When walking, it is a smart idea to place your camera in a large zip-lock bag. Should you trip, slip, or accidentally drop your camera (numb fingers will do that to you) in the snow, it will stay dry and protected from the elements.

Lens: To take in as much of the sky as possible and a bit of foreground, using a wide-angle lens (focal length between 10 and 24 mm, with a maximum aperture of at least f/2.8) will give you the best results overall. In reality, almost any lens will work, but keep in mind that your images will look different than those you see posted on the web, taken with wide- or super-wide-angle lenses.

Sandneshamn, Norway
Nikon D300, Tokina 11–16 mm lens, f/2.8, ISO 500, 72 sec.

Prior to your first shot, focus your camera at a distant point, back off slightly from the infinity setting and then turn off the auto focus feature on your lens. Given the dark sky, you don't want your camera and lens trying to automatically focus on an ever-changing, moving aurora. Locking in on manual focus, set slightly south of infinity, will give you well-focused images.

Sturdy tripod: To avoid blurring your picture due to camera movement, shaking hands, or unsteady footing on snow or ice, a sturdy tripod is essential. Equally important is a quality camera ball head, not only to solidly support your camera but also to allow for ease of movement and independent adjustment of your camera along each axis.

Remote shutter release: A remote shutter release for your camera provides three important benefits in obtaining a memorable photo of the aurora. First, it will be invaluable in its contribution to a sharper image by reducing camera shake, which occurs naturally when you depress the shutter release button. Second, for the longer exposures (three to twelve seconds or longer, depending on conditions and your ISO setting) required for aurora images, you can hold the shutter open without physically touching the camera's shutter release. Third, depending on the type of gloves you select (even a thin second pair under your insulated mittens) you are able to operate the remote release without removing your gloves, thereby keeping your hands warm—a critical consideration in sub-zero arctic temperatures.

Memory cards: Pack extra memory cards, formatted before going outside. Backup and clear your memory cards prior to your next outing. A damaged card or card read/write failure could destroy images taken previously if they remained on the card. Be safe and protect your memorable images.

Spare batteries: Photographing in cold temperatures drains batteries very quickly; photographing in arctic temperatures drains batteries exponentially faster. Always pack extra batteries. I bring eight batteries with me on any high arctic photo trip I take. I went through six fully charged batteries in one evening, photographing in temperatures of –40 degrees Fahrenheit. Running out of fully charged batteries, when the aurora is in full display, is heartbreaking, especially when proper preparation would have prevented this.

While in the field, be sure to keep all extra batteries in an interior pocket of your jacket, close to your body. Trapped body heat, created by your insulated jacket and multiple layers of clothing, will help keep the batteries reasonably warm, holding the charge longer.

Airtight, waterproof, drybag: Tough, waterproof and airtight, a drybag is essential in protecting your camera's sensitive internal optics and circuitry from moisture and condensation buildup that occurs due to the large change in temperature when you bring your camera inside after a long evening photographing outside in sub-zero temperatures. Lens fogging and damage to your camera itself may occur if you don't let your camera acclimatize gradually to the warm indoor temperatures.

Prior to going inside for the evening, slip your camera into the drybag, roll and seal it tightly, and then bring the bag and your camera inside. While there is no official rule as to length of time your camera should remain in the drybag, I typically let my camera remain in the drybag for two to four hours, plenty of time to acclimatize to the much warmer indoor temperature.

If you really, really have to see your images immediately and can't wait a couple of hours,

safely remove the memory card while you are still outside, prior to sealing your camera in the drybag. It is strongly recommended that should you decide to remove the memory card before sealing your camera in the drybag, to do so in a well-lit area where you won't accidently drop the memory card into the snow, not to be found again until spring, if ever.

I also include several small bags of moisture-absorbing silica gel dry-packs in the drybag prior to sealing it. These silica bags may be purchased in many sizes and provide an ideal second level of protection for your camera. The silica protects against mildew, corrosion, fogging, and condensation, which might damage your camera's sensitive electronics.

Taking that Memorable Picture

As if simply watching Aurora's amazing display isn't reward enough for hours if not multiple days of travel, standing outside in sub-zero weather, dressed in multiple layers of clothing, encased in synthetic down from head to toe, many aurora hunters desire to capture the moment in a photo, creating a lasting memory.

While the mechanics of taking a good picture of the aurora are not complex, there are a few guidelines that will enhance your success and the probability of taking a memorable picture.

Always shoot in raw format—this will provide you with the maximum amount of digital information needed to create a final image.

If you use a protective UV filter on your lens (and you should), remove it prior to going out to photograph the aurora. The UV filter could cause concentric rings to appear in your final image.

Set your camera to manual and turn off the camera's flash.

As previously stated, dial the lens focus ring to infinity and back off slightly.

Turn off any auto-focus capabilities associated with your lens. You don't want the auto focus feature of your lens attempting to continually re-focus on the quickly moving, shifting aurora.

Kvaløya ("Whale Island"), Norway
Nikon D300, Tokina 11–16 mm lens, f/2.8, ISO 1000, 13 sec.

Open up the lens aperture as wide as possible. You need to get a lot of light to the camera's sensor, so shoot wide open. This will be when the f-number is as low as possible, that is, f/2.8 or lower for many professional lenses, or f/3.5 or f/4 for many consumer zoom lenses.

Set shutter speed to "bulb." This allows you to use the remote shutter release to keep the shutter open for longer exposures.

Finding the correct amount of time to hold the shutter open will take some experimenting. With your shutter speed set to bulb, depress the remote shutter release opening the shutter. Hold the shutter open between three and twelve seconds. Check your image using your camera's live view function, if it's so equipped. Too long of an exposure will tend to blur both the aurora and the stars as they move across the sky.

Your camera's ISO setting should be set between 100 and 400. The ISO number indicates how quickly a camera's sensor absorbs light. The higher the ISO number, the faster the camera sensor absorbs light. The faster your lens and the longer your shutter speed, the lower your ISO can be, and vice versa.

Increasing the ISO setting is typically done when photographing in low light. Local weather conditions, the presence of ambient and natural moonlight and starlight, and the intensity of the aurora display itself should be your guide to setting an initial ISO value. You may need to modify this ISO setting as conditions change throughout the evening.The higher your ISO setting (for example, 800, 1600, and above) the more noise (similar to grain found in film photographs) you invite into your image. While higher-end (more expensive) "prosumer" DSLR cameras can produce sharp, acceptable images at ISO settings of 3200 and higher, the average hand-held, point-and-shoot camera cannot. To achieve sharp aurora images in low light and long exposures and to keep your camera as still as possible, use a sturdy tripod. If you don't have a tripod, you can use a beanbag, flat rock, or other solid surface. Do not touch the camera until it is done exposing, and shield it from the wind if you can.

Auroras, by their very nature, look best when photographed to include a contrasting foreground. The foreground provides scale, context, and perspective. A suitable foreground can be a tree, a building, a fellow photographer, a car, or even just the horizon.

Good Night, Lady Aurora

Being present during Aurora's magical dance fills the observer with wonder, awe, and excitement, and the experience often leaves one speechless. Capturing Aurora's dance in a photograph preserves that moment for a lifetime. I hope that you may be fortunate enough to be at the right place, during the right months, at the right time, to observe Aurora's magical dance.

Getting to the dance is not easy for most of us, but, once there, none of the logistics, long flights, cost, or cold makes a difference. You are witness to the most spectacular light show orchestrated by nature.

The next time you gaze into the night sky, be assured that Aurora is there, dancing the night away. She is waiting for you to join her.

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AMERICAN ASTRONOMICAL SOCIETY CONVENTION 2015

Prof. Glenn Showalter, M.Ed.

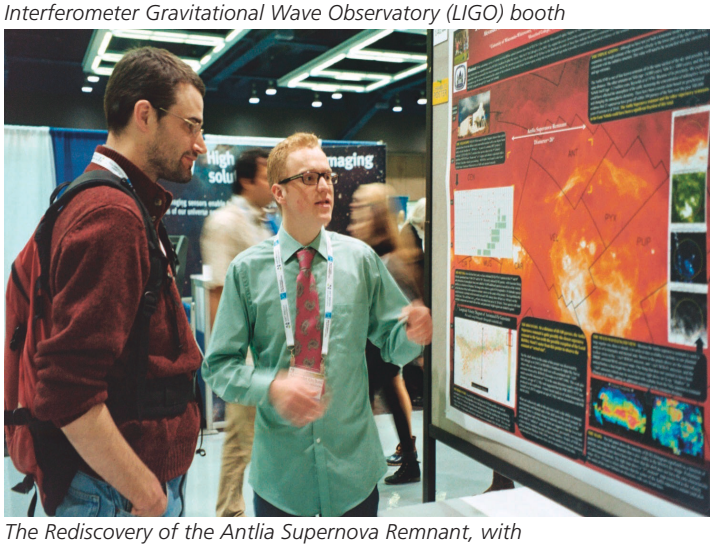
The 2015 American Astronomical Society (AAS) convention (January 2 4–8) was a slice of heaven! So many great astronomy students, professors, professionals, and scientists assembled in Seattle and got to enjoy the moderate winter climate.

Nothing compares to the enrichment of attending a great convention in person. Of course, you can read about great assemblies such as this one, and in this day even see pictures and watch videos, but the old photojournalist's saying of "f/8 and *be there*" really applies. Only in person can you feel the electricity and excitement in the air and behold the enormity of 500 poster presentations of research projects that make up the heart of the convention. These "posters" are just that—large printed posters—summaries of major research projects, many of which will become peer-reviewed papers. The poster presentation has grown, with hundreds of them hosted by their principal investigators. There are morning and evening time slots in the exhibit hall, where the presenters attend their numbered billboards arranged by topic. (*aas.org/meetings/aas225* and *aas.org/meetings/aas225/press-kit*)

If you have ever personally attended a convention, you know that professional equipment and services companies and their representatives often make up a major component of the convention. AAS includes these industry people and their wares and services, but AAS remains focused on research. The excitement for the professors, researchers, and scientists can be euphoric as the convention rolls on and excitement builds. With teaching being among the most critical and honored professions on Earth, it was exciting to be with the brilliant university students. At the very least, their work is preparation for great future research. These posters represent some of the year's significant scientific astronomy research. We are growing our finest minds and building the character of our finest young researchers. In addition to the many international students attending and presenting their research posters, *this* teacher, for one, is so proud of these young scholars and the professors, colleges, and universities that produced them. To be there with all of this talent was like walking on a cloud. I marveled at their hard work and dedication and the outcomes of their endeavors.

In looking at all these posters, one is impressed by the overall quality of design and presentation—all different, yet all looking so professional and scholarly. Obviously, there is a balance between word content and visual elements such as pictures and graphs. Many student presenters thanked their professors and fellow graduate students for their input. Text dominated some designs, but one student described following a guideline of no more than 30 to 40 percent words and using the rest of the space for graphics. Students related that, for the most part, they achieved their goals for the project. For some, their work is completed; others

Seattle public school children attending a mini-lesson at the Laser Interferometer Gravitational Wave Observatory (LIGO) booth



The Rediscovery of the Antlia Supernova Remnant, with Alexander Orchard (author) on right

PlaneWave Instruments, with Rick Hedrick (president) and his daughter

said that this is just the beginning of perhaps the work of a lifetime. Asked if the students if this project took them where they wanted to go with results they hoped to achieve, siblings Marisa Pisano (Columbia University) and Daniel Pisano (West Virginia University) said that they'd exceeded their expectations and were not expecting to find as much as they did. Students often praised their advisors and at least one referred to her professor as a "second dad."

The University of Virginia had a big presence with many posters. One UVa student, Catherine Zucker, mentioned she had three projects to choose from for her poster and chose the one mapping our galaxy's spiral structure. Virginia also exhibited research in education and public outreach with the poster "Dark Skies, Bright Kids Year 6." In this ongoing project, the University of Virginia's Department of Astronomy conducts extensive outreach in local elementary schools. On a personal note, it was impressive to see similar concerns in the poster "Reaching for the Stars in Your Golden Years: The Importance of Outreach for Senior Citizens" by Valerie Rapson at Rochester Institute of Technology: "Many senior citizens are no longer at the forefront of science, especially space and astronomy as they were in the 1960s and 70s with the manned missions of Mercury, Gemini, and Apollo, especially the first men on the Moon. Some are not even aware of the Hubble Space Telescope and need to be brought back to their place in science." A few high school students also presented their fine posters.

We'll be back, because in higher education and astronomy, it doesn't get any better than this!

Interview about the James Webb Space Telescope

Digitalis portable planetarium from Bremerton, Washington

Candidate for League Treasurer

As I complete my first term as the Treasurer of the Astronomical League, I feel I am more qualified today for the role than I was three years ago. Having been through the duties of AL Treasurer, I am now very comfortable with the position and look forward to serving another term.

I have a degree in accounting and have been a certified public accountant for nearly 30 years. I've worked in various accounting roles including public accounting as an auditor, an internal auditor, head of Securities and Exchange Commission financial reporting, and a treasurer with various organizations.

My enjoyment of astronomy has evolved over the years. I grew up in the 1960s and was an avid follower of the Space Race and the landings on the Moon. For many years, I only read about astronomy, but about 15 years ago I bought my first telescope and have been enjoying observing ever since.

I have also been involved in astronomy outreach and look forward to showing as many people as I can the night skies. This isn't very easy from the light-polluted skies of Long Island, but even a good view of the Moon amazes most people.

I would be honored to continue as the Treasurer of the Astronomical League for another term.

—Thomas K. Lynch
moblyn@aol.com

Candidate for League Secretary

I have been an amateur astronomer for well over 40 years, since I began looking at the Texas sky when I was five years old during the days of Apollo. I have been fortunate in my life being able to experience many things in the aviation field as a pilot and technical advisor, another passion of mine. I have since decided to return to school full time and earn my degrees in physics and astronomy to begin professional work as an astronomer and educator.

I was chairman of the San Antonio Astronomical Association from 2003 to 2009 and a founding member of the San Antonio League of Sidewalk Astronomers (SALSA) from 2009 to present. In 2003 I was instrumental in the formation of the "Astronomy in the Park" program that takes place every Wednesday evening in a local park here, and it continues to take place today after 12 years of success. Another accomplishment that I am very proud to be part of is the implementation of the Texas Amateur Astronomers Scholarship at the University of Texas at Austin Astronomy Program. In January of this year we reached full endowment status for the scholarship and the first award to a deserving astronomy student will take place later this year. In 2015, I began as my second year as coordinator of the Astronomical League's Solar System Observers Program, and it has been an absolutely grand experience communicating with all who have applied for the award, sharing knowledge and experiences. This is only a small part of my experience of leadership and involvement in astronomy, and I would be extremely honored and humbled to serve you as Secretary of the Astronomical League.

—Bryan Tobias

How you can help amateur astronomy

Support your Astronomical League! The Astronomical League encourages the active pursuit of astronomy through its various member-directed programs. Your dues and contributions help fund its national recognition awards, ALConExpo and regional meetings, the ***Reflector***, the League Book Service, and, of course, the many popular observing clubs.

If you enjoy the night sky and want others to discover its wonders, why not give a gift to the Astronomical League today? Mail your tax-deductible donation to the Astronomical League, 9201 Ward Parkway Suite 100, Kansas City, MO 64114.

Observing and office equipment donations are another important way of helping your Astronomical League function more effectively. Please contact the League Office for additional information: call 816-DEEP SKY or email ***leagueoffice@astroleague.org***.

Gallery

TITLE PHOTO: NGC 2244; BRIAN KIMBALL

On September 29, 2014, Mike Sager, a member of the TriState Astronomers in Hagerstown, Maryland, and the Cumberland Astronomy Club in Cumberland, Maryland, took this image in Canaan Valley, West Virginia, near Blackwater Falls State Park. This was his first attempt at nighttime photography. He used settings of 25 seconds, f/2.8, and ISO 1600 on a Canon EOS Rebel T4i with a Tokina AT-X 116 Pro DX-II lens at 11 mm, a ProMaster Professional XC525 tripod, and Vello Wireless ShutterBoss. Post-processing was done with Photoshop Camera Raw 6.7 in Photoshop CC 2014. *Ed. note: this image appeared in the March 2015 issue but due to a processing error, the image quality was sub-standard. It has been reproduced here as it was intended to be seen.*

Frequent contributor Jeff Johnson submitted this image of M27 (the Dumbbell Nebula), which was taken on June 26, 2012, and November 26, 2014, from Las Cruces, New Mexico. Equipment used was a Takahaski TOA-130F at f/7.7 on an EM200 Temma II mount and SX Lodestar guider. Camera was a QSI 540wsg (at 0 degrees C on June 26 and –15 degrees C on November 26) with Astrodon H-alpha 3 nm and Tru-Balance I-Series LRGB Generation 2 filters. Exposures were 4 x 15 minutes L, 2 x 20 minutes H-alpha, 1 x 5 minutes each RGB (all binned 1 x 1), 2 x 2.5 minutes each RGB (binned 2 x 2), and 10x darks, flats, flat darks, and bias frames. Software used was AstroArt5 and Adobe Photoshop CS4 (slightly cropped).

M101 (the Pinwheel Galaxy) is a beautiful spiral galaxy in Ursa Major about 21 million light-years from us. It is about the size of our Milky Way galaxy, at 170,000 light-years diameter, and has a mass of about 100 billion solar masses. This image was taken by Christopher Gomez of the Escambia Amateur Astronomers Association in the Florida panhandle. He has been doing astrophotography for about five months, and from the looks of this image, he has a great future.

Below: This shows the Rho Ophiuchi nebula, one of the star-forming regions closest to Earth (closer than the Orion nebula). Antares is the bright orange star. You can see three globular clusters: M4 (the big one, closest to Earth), M80 to the bottom right, and little NGC 6144 near Antares. Brian Ottum took this image from midnight to 1:30 a.m. on June 16, 2013 at Bryce Canyon National Park, after showing the sky to over 300 visitors. The camera was set up to shoot over the top of the visitor's center. While volunteers and rangers enjoyed post-observing-party snacks, the camera clicked away. Equipment included a modified Canon 5D Mark III camera with 200 mm lens at f/3.2 on a Losmandy StarLapse drive on a camera tripod. The final image consists of 100 x 1-minute images at ISO 1600, with no darks, flats, or bias frames. The 100 images were combined in ImagesPlus and tweaked in Photoshop 5.

The Astronomical League is giving away up to ten Library Telescopes!

Through the vision of the **Horkheimer Charitable Fund**, the Astronomical League is offering a free **Library Telescope** to a lucky Astronomical League club in each of the ten AL regions. The Library Telescope consists of an Orion 4.5-inch StarBlast Dobsonian (or equivalent), a Celestron 8–24 mm zoom eyepiece (or equivalent), and a nameplate commemorating the late Jack Horkheimer. The value of each telescope is approximately $300; the potential of the program is enormous.

The **Library Telescope Program** was started by the **New Hampshire Astronomical Society**. Clubs donate an easy-to-use, portable telescope with quality optics and a sturdy mount to their local library. Patrons can then check it out as they do books. Full details of this wonderful program can be found at *www.astroleague.org/content/library-telescope-program*.

The winning entry for each region will be drawn at the annual Astronomical League Business meeting held at ALCon in Las Cruces, New Mexico, on about July 11. Only one club per region will win, for a total of ten telescope–eyepiece combinations being presented. A telescope, eyepiece, and accompanying commemorative plate will be mailed to each winning club in the two weeks following ALCon.

By entering the drawing for the telescope, the club agrees to modify the telescope and zoom eyepiece, and have the telescope library-ready within three months of receipt. The Astronomical League would like a photograph of the modified telescope being presented to the library. It may be used in the *Reflector* and as promotional material.

Submit your completed entry form, found at *www.astroleague.org/files/2015%20Horkheimer%20LiTel.pdf*, so that the Astronomical League national office receives it by July 1, 2015. If mailed, the entry should be postmarked no later than July 1, 2015.

The Library Telescope Program is a great club project—one that brings members together while benefiting their community. Indeed, it is the perfect outreach program!

Reflections/*Continued from page 7*

successful. The digital copies were received and the image quality on a computer monitor was equivalent to that of the printed version.

For the June issue, additional member societies have been surveyed, and they will get their digital copies in late May (digital recipients will receive their issues about one to two weeks ahead of the print recipients). Assuming this test is also successful, within the next few months, member societies across the country will be asked to survey their membership, and the appropriate ALCors will modify the rosters sent to the AL each quarter, from which we build the mailing lists for each issue. This will be done in stages, and we expect all ALCors will receive their instructions in time for the December issue. At that point, we expect about 30 percent (perhaps higher) of our members will start receiving their digital versions.

Those who request digital can switch back to paper at any time; just inform your ALCor. Likewise, those getting paper can move to digital. If you are presently receiving multiple paper copies (members of more than one society), you can switch some of them to digital.

I agree that a digital copy would be difficult to read in the bath. It could also be difficult to file a digital copy on your shelf, or to hand such a copy to a prospective member.

However, smartphones and tablets are easier to carry on a bus, train, or plane. Also, you can give a prospective member a digital copy, while you keep the original.

There are positives and negatives all over the place. Ultimately, the choice is yours. We will inform the ALCors when to start their survey. What is most important is that you continue to enjoy reading the *Reflector*. If you have any comments or criticisms, either positive or negative, please let me know (*editor@astroleague.org*). I read and answer all of my email. Always looking for images, articles, and other items of interest to our readers.

Mid East Region of the Astronomical League

MERAL ANNUAL MEETING

In conjunction with the

Green Bank Star Quest

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For additional information, contact:

Garry Beckstrom

Assistant Astronomy Day Coordinator

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COMPETING AT STELLAFANE

By John Symborski

By the time these words make press, there will be only a few short weeks before the optical judging at Stellafane—that venerable gathering of astro-tinkerers, innovators, deep thinkers, and just plain observers of all ages and experience levels. Part star party, part self-help seminar, and part camping trip in beautiful Vermont, it certainly makes a great three-day break from the workaday world. While there are many non-weather-dependent activities to enjoy there, the heart and soul of Stellafane is the judging of home-built telescopes of all sorts (but mostly reflectors) in three categories: optical, mechanical, and craftsmanship.

The standards for the latter two are very high indeed, thus the most accessible (and fun as far as I'm concerned) are the optical brackets for large or small telescopes. But you don't have to be an amateur telescope maker to take advantage of the following tips for tuning up your reflector to yield its peak performance. One can significantly improve the perception of detail and contrast whatever the measurable state of the optics might be, and you don't have to leave home to do it.

On the night of optical judging at Stellafane, experienced teams from the Springfield Telescope Makers compare the image of the same target—a bright star—produced by the entire optical system of every telescope that was entered. This means that it is not just about the mirror. The examination of a high-power star image both in and out of focus is subjective and is strongly influenced by many things other than just what the mirror's numeric test results may have been on the bench.

Of greatest importance is collimation—and the event organizers specifically warn competitors about that in their literature. Collimation is entirely under the owner's control, and without good collimation, the best mirror in the world will not get a second look on the night of judging. Collimation starts with the mirror cell—hopefully one that is sturdy and has heavy-duty springs to keep the mirror from sagging in the cell. So the first tip is to replace questionable mirror springs—and most supplied springs have proved to be "questionable." Replace as many fasteners as is practical with ones made of stainless steel, aluminum, or brass. Substitute collimation screws that have fine threads, as most supplied screws are coarse. Run all the wing nuts repeatedly under tension to smooth the action and lubricate them lightly with white lithium grease.

Be sure the mirror is not pinched on the sides or by the clips, which should have a little clearance between their pads and the edge of the mirror. Now make a clip mask. Judging of each telescope begins with a perfect score and points are deducted as deficiencies are found. Clip diffraction is one thing searched for by sufficiently defocusing the image. If it is seen, there goes a point—and sometimes one point is all that separates a scope from being an award-winner or not. The mask is just an annulus made of thin metal or other blackened material that can simply be taped on top of the clips. The internal diameter of the ring just covers all the clips and completely eliminates clip diffraction.

A clip mask will automatically eliminate any kind of turned edge on the mirror without resorting to painting the periphery black. Many who like to star test (see the Willmann–Bell book on the subject) often think they can detect a trace of turned-down edge whether it really exists or not. A clip mask puts that right out of consideration—especially if one actually has a turned edge.

The next step is to make sure the focuser is truly perpendicular to the optical axis of the centralized mirror. Use a collimated laser in the focuser and adjust with shims until the laser shines through a small witness hole placed exactly opposite from the center of the focuser location. The secondary must be removed before making this adjustment, and it is a good time to consider any change to the spider.

A single curved-vane spider will cast no diffraction spikes because it spreads diffraction over a wide area instead of concentrating it. A single off-center flat vane will do the same thing, but either must be wide enough and thick enough that the secondary cannot wobble. The disadvantage is that the secondary will be more difficult to position properly. A four-vane spider can be quite thin and offset is easier to adjust. But avoid a three-vane spider since it casts six spikes!

The wave-front error of the optical system is cumulative between the primary and secondary of a Newtonian. What's the use of having a 1/12-wave mirror if the secondary has run-of-the-mill 1/8-wave flatness? The star test will then read as only about 1/6-wave, and cheap secondary mirrors often have turned-down edge due to cerium buildup during automatic mass-polishing. The resulting turned-down edge observed in the image will be indistinguishable from the same defect on the primary mirror, and will be assumed to be on the primary. Do yourself a favor and buy a 1/20-wave premium secondary from a reputable supplier.

Contrast can be greatly enhanced by proper tube lining since black paint alone isn't nearly good enough, and crushed nut shells can be messy. Black velvet is the best lining, but hard to apply in relatively small diameter tubes. Use a tube liner made from rolled black window screen (enhanced with a little black spray paint), which can simply be slid inside the outer tube after the spider has been removed. Interior tube baffles can work wonders, although they generally require an oversize tube to be effective.

Making a slide-on tube extension with baffles is a great addition, and will vastly reduce reflected light inside the main tube. Focuser baffles are another advantageous modification. A filter slide can accomplish the same thing, but works even better by stacking filter slides. Avoid low-profile focusers in an attempt to reduce the secondary obstruction to less than 15 percent. There simply isn't much improvement below 20 percent and low-profile focusers allow too much off-axis light into the eyepiece that cannot be baffled.

Many reflectors are built as some variety of push-to configuration lacking guidance once on-target. Competition rules set the standard for the eyepiece you must have with your particular scope. At the resulting high power required for the star test, there isn't much time for the defocused image to remain centered in the field of view before nudging the tube is required. Making it easier for the judges to judge can definitely help. Try to obtain or borrow any sturdy tracking mount or equatorial platform to keep the designated star consistently in the middle of the field.

The present event structure at Stellafane permits either Friday or Saturday optical judging, weather permitting. So it pays to spend the small additional fee for a Thursday afternoon arrival. You can get a better campsite as well as a better place on Breezy Hill to set up and rehearse on Thursday evening. On two occasions, my entries revealed peculiarities on Thursday night that required Friday modifications—and in one instance I had to leave the site to procure the needed tools and materials to make a major modification! Consider finding a location behind the Pink Clubhouse. You will find it much less crowded and many award-winning scopes did not experience the heat waves from the clubhouse that those set up on the front side of the hill had to contend with. Remove the mirror cell or optical tube assembly to a shady spot during the day to prevent overheating. Some have kept theirs either in a cooler or on the ground in a protected place covered with a plastic tub with or without "cool packs" on top.

Luck can be a factor, as some scopes are examined earlier in the evening than others in the first round. Avoid having a full-thickness mirror (6:1 width to thickness). A 10:1 or 12:1 mirror on a nine-point suspension is superior in its quicker response to temperature changes. To sum it up, all of the above techniques will boost any reflector's performance over its as-manufactured state, and in competition this will help your telescope stand out from the others. And for gathering deep-space photons in one's eyes in real-time, an optimized Newtonian will rival any other kind of telescope of comparable aperture and will better those having less.

Good luck and great viewing!

DIVING INTO OUTREACH

By Leigh Anne Lagoe/Edited By Paul Tartabini

Last April, I took the mere 18-dollar leap and joined the **Back Bay Amateur Astronomers**. I was warmly welcomed by email and immediately started looking into events. I had never been to a BBAA event, or any astronomy event for that matter. I was mostly seeking an opportunity to safely go out and view from darker skies, but what I found was far more gratifying.

Author setting up for outreach

In searching for events, I found Skywatch. Here was my opportunity to finally get out to darker skies! All I had to do was venture out to an unfamiliar, obscure park in the middle of the night to meet up with men I met online...

As a female traveling alone, I opted for a daytime event instead: Astronomy Day at the library. A public place during daylight hours was how I chose to check out the BBAA. I brought my kids, was greeted kindly by the members, and got a feel for the club and what they offered to the public: outreach.

Soon after, I attended a monthly meeting and heard about Boardwalk Astronomy. This seemed like the perfect event to dip my toes into outreach, without having to go to the dark park with strangers. Granted, the strangers were all kind, fun people, and I really wanted to get out to dark skies, but I still wasn't comfortable yet. The boardwalk is very public, close to home, and I only had to show easy targets like the Moon and Saturn.

I was very nervous before my first outreach event. The other members had years, even decades, of experience. They discussed things like "seeing" and "transparency" and "fifth versus sixth magnitude." While I knew what these things meant, I certainly was not experienced enough to make those kinds of accurate observations. I saw wires and cables hooked up to massive telescopes and I had no clue what any of it was. I found myself asking questions like "What's a Telrad?" and "What does a dew heater do?" I am the go-to person for astronomy information among my family and friends. But in the BBAA, I'm in a position where I know very little in comparison to the much more experienced members. Not knowing as much as I thought I knew is certainly intimidating.


Building a refractor

Despite my reservations, I decided to give it a try. I carefully planned a calculated entrance into outreach, spending lots of time researching telescopes and objects. Well, I found out I didn't even need to. My feelings of inadequacy were quickly replaced with confidence the moment someone looked through my telescope. Most of the guests were just content to take a look and move on. Very rarely did anyone ask a difficult question, and I managed to be knowledgeable enough despite my newness to the hobby. The experienced members weren't intimidating at all, but helpful and encouraging.


Looking at the Sun

Driving home from the boardwalk, I felt both relief and a rush. I had just shared the craters of the Moon with people who had never seen them before. I experienced excitement right along with the student viewing Saturn for the first time. I drove with a newfound sense of purpose. I could share the ever-inspiring universe with the general public and I did not need to be an expert.

So now, a year later, I have several Boardwalk Astronomy events, school events, and a couple of Skywatches under my belt. Yes, I finally went to the dark park in the middle of nowhere and it was not scary at all. In fact, it was a lot of fun. Members of the BBAA are eager to help and are no longer strangers to me. Those dark sites are the reason I joined the club, but really they are just one of the perks of being a member.

Every time I hear a "wow" from a guest, it's like reliving the first time I saw Jupiter's moons. I can only hope that with every "wow," some seeds of astronomical wonder are planted in the hearts of our guests. These guests and students may never go on to study astronomy, or even own a telescope, but maybe we can offer them enough inspiration that they at least look up in awe every time they walk out their door. What a wonderful feeling: "bringing astronomy to the people of Hampton Roads." I know I still have a lot to learn, but I'm not waiting until I learn it all before diving in and sharing it with the public. It's far too much fun. My feet are good and wet, and I'm doing a cannonball into the pool of outreach.

Leigh Anne is secretary of Back Bay Amateur Astronomers, Virginia.

ALL THINGS ASTRONOMICAL

Master Observer Network

Did you know that there is a network of Astronomical League Master Observers? If you have an astronomy-related question, the Master Observers are here to help answer your questions. Just submit your question on the AL Master Observer Network Question web page: *www.astroleague.org/al/obsclubs/MONetForm.html*. To navigate to it from the AL home page, in the navigation panel, click "Observing Programs," then click "Master Observer Network." Finally, click the link at the bottom of the page.

If you are a Master Observer and would like to be added to the list server, then please send an email to Aaron Clevenson (*aaron@clevenson.org*), the list administrator. Please include your Master Observer number.

What's Up Doc?

"What's Up Doc?" is a two-page PDF file that is updated each month with information on basic-level Astronomical League Observing Programs. It lists those objects that are visible in the evening sky for the next month, by program. These Observing Programs are included: Meteors, Constellations (Northern), Binocular Messier, Deep Sky Binocular, Messier, Caldwell, Double Star, Solar System, and Lunar. To access this document, click the "What's Up Doc?" link about halfway down the web page at *www.humbleisd.net/observatory*.

Also on that webpage is a link to "What's Up Tonight, Doc?" This is a large spreadsheet in Excel (16.5 megabytes). It includes all current Astronomical League observing programs. Due to the macros that are integral to the spreadsheet, this will not run on Apple Mac computers. This spreadsheet provide buttons to sort by individual Observing Programs as well as the entire list. The user enters their latitude and longitude and the date and time (in Universal Time) when they plan to observe. The spreadsheet then provides target objects listed from highest to lowest altitude. There is a column to check off an object once you have observed it (left side) and also columns to include your observing details (right side).

A Total Eclipse of the Sun

A total eclipse of the Sun has to be one of the most spectacular and awe-inspiring events of the natural world. We see dozens of pictures of these eclipses in the news and on the web, but for those who witness a total eclipse, it is *an experience*. You can feel the shadow approaching. The wildlife becomes quiet. The temperature drops. The light becomes ghostly and strange. Then an eerie darkness engulfs you. You feel awe and anxiety all at the same time. You literally feel the shadow. You are living the experience of a total solar eclipse.

To help celebrate the total eclipse of the Sun on Monday, August 21, 2017, the Astronomical League will hold its annual national convention in the days leading up to the event. Casper, Wyoming, will host the conference, as the eclipse path goes right through the city.

2017 ASTROCON CASPER, WYOMING
TOTALITY - FEEL THE SHADOW

ASTROCON 2017 (Astronomical Convention) will be held at the Parkway Plaza and Hotel Convention Centre in Casper, Wyoming, Wednesday, August 16, through Saturday, August 19, 2017. In addition to the lectures, presentations, and workshops, there are social events: the Star-B-Q and gala awards banquet including a special keynote speaker. Well-known vendors will also be on hand to display a

multitude of astronomical products and provide expert advice.

The public will be invited to visit the vendor displays the full length of the convention. Vendor representatives and other astronomy enthusiasts will be available to answer questions on many astronomical topics, especially how to best experience a total eclipse of the Sun. For further information, visit: *www.astrocon2017.astroleague.org.*

Eclipse Glasses are Now Available

In anticipation of the 2017 solar eclipse (and of course other solar activities), the Astronomical League has secured a large quantity of high-quality eclipse glasses, and is offering them to societies, organizations, and members at excellent prices. Contact League Sales (*www.astroleague.org/store)* for pricing and availability.

For those of you who are not aware of it, the Astronomical League is now on Facebook. We continue to build followers week by week, and we are becoming better known as the word spreads. We are also on Twitter: @AstronomyLeague.

Observing Awards

Editor's Note: Congratulations to all these outstanding astronomical observers! All awards, except the Herschel 400, require current Astronomical League membership for eligibility. If you have questions about an award, please contact the corresponding Observing Program chair. Their contact information can be found on the Observing Program website at *www.astroleague.org/observing*. If further assistance is required please contact either of the national Observing Program coordinators.

Advanced Binocular Double Star Observing Program
No. 8, Steve Boerner, Astronomical Society of Eastern Missouri

Analemma Observing Program
No. 8, David Osenga, Twin City Amateur Astronomers

Asterism Observing Program
No. 18, Diane Ketchum, Middle Georgia Astronomical Society; No. 19, Anthony J. Kroes, Neville Public Museum Astronomical Society; No. 20, Jonathan L. Schuchardt, Albuquerque Astronomical Society

Asteroid Observing Program
No. 43, Raymond Howard, Regular, Member-at-Large; No. 48, Mark Croom, Gold, Lifetime Member

Binocular Double Star Observing Program
No. 81, David Whalen, Charlie Elliott Chapter, Atlanta Astronomy Club; No. 82, Marc Whitsett, Member-at-Large; No. 83, Jody Raney, Shreveport–Bossier Astronomical Society; No. 84, Vincent Michael Bournique, Member-at-Large

Binocular Messier Observing Program
No. 1047, Jarret Lingle, Mason Star Gazers; No. 1048, Ken Boquist, Popular Astronomy Club; No. 1049, Douglas J. Oines, Minnesota Astronomical Society; No. 1050, John C. Zellner, Member-at-Large; No. 1051, Timothy Cowden, Brazos Valley Astronomy Club; No. 1052, James Granahan, Northern Virginia Astronomy Club; No. 1053, Stan Westmoreland, Shreveport–Bossier Astronomical Society; No. 1054, Gordon Schaefering, Albuquerque Astronomical Society; No. 1055, Mark Spearman, Brazos Valley Astronomy Club; No. 1056, Thomas Flatley, Back Bay Amateur Astronomers

Carbon Star Observing Program
No. 57, Preston Pendergraft, Member-at-Large; No. 58, W. Maynard Pittendreigh, Lifetime Member

Comet Observing Program
No. 28, W. Maynard Pittendreigh, Gold, Lifetime Member; No. 79, Gregg A. Meade, Silver, Stonebelt Stargazers; No. 80, Clint Gately, Silver, Oklahoma City Astronomy Club; No. 81, Ron Ziss, Silver, Naperville Astronomical Association; No. 82, Bernard Venasse, Silver, Member-at-Large

Constellation Hunter Observing Program
No. 149, Ken Pryor, Oklahoma Astronomy Club; No. 150, Ida Huntz, Oklahoma Astronomy Club; No. 151, Valerie Whalen, Atlanta Astronomy Club

Deep Sky Binocular Observing Program
No. 361, Cindy Krach, Haleakala Amateur Astronomers; No. 362, Rob Esson, Prescott Astronomy Club; No. 363, Dee Friesen, Albuquerque Astronomical Society; No. 364, Vincent Bournique, Member-at-Large; No. 365, Rob Torrey, Houston Astronomical Society

Double Star Observing Program
No. 539, Richard Loslo, Member-at-Large; No. 540, David Delassus, Denver Astronomical Society; No. 541, Jonathan L. Schuchardt, Delaware Valley Amateur Astronomers

Flat Galaxy Observing Program
No. 23, Honorary, Wyatt Sanford, Jackson Astronomical Association; No. 24, Honorary, David M. Douglass, East Valley Astronomy Club; No. 25, Honorary, Douglas Wiese, High Desert Astronomy Club

Globular Cluster Observing Program
No. 269, David Delassus, Denver Astronomical Society; No. 270, Ken Boquist, Popular Astronomy Club

Herschel 400 Observing Program
No. 527, Eric Dose, Northeast Kansas Amateur Astronomers' League; No. 528, Bob Kacvinsky, Prairie Astronomy Club; No. 529, Jim Kaminski, Member-at-Large; No. 530, Ken Boquist, Popular Astronomy Club; No. 531, Christopher Ober, Houston Astronomical Society; No. 532, Margaret McCrea, Rose City Astronomers

Herschel II Observing Program
No. 88, David Delassus, Manual, Denver Astronomical Society; No. 89, Robert Jardine, Manual, The Astronomy Connection; No. 90, John Schaefer, Device-Aided, Boise Astronomical Society; No. 91, Ed Valla, Device-Aided, Tallahassee Astronomical Society

Lunar II Observing Program
No. 64, Robert Clark, Westminster Astronomical Society; No. 65, David Whalen, Atlanta Astronomy Club

Lunar Observing Program
No. 902, Fulton Wright, Prescott Astronomy Club; No. 903, Tom VanBuskirk, Desert Foothills Astronomy Club; No. 904, Christopher Ober, Houston Astronomical Society; No. 905, Joe Comiskey, Kalamazoo Astronomical Society; No. 906, Caitlin Ahrens, Central Appalachian Astronomy Club; No. 907, Lloyd Blake, Boise Astronomical Society; No. 908, Roberta Allen, Tucson Amateur Astronomy Association; No. 909, Vincent Bournique, Member-at-Large; No. 910, Ed Ting, New Hampshire Astronomical Society; No. 911, Walter Jablonski, New Hampshire Astronomical Society; No. 912, Stan Westmoreland, Shreveport–Bossier Astronomical Society; No. 913, Shane Maxwell, Boise Astronomical Society

Master Observer Award
No. 165, Kevin McKeown, Albuquerque Astronomical Society

Messier Observing Program
No. 2669, Ed Ting, Honorary, New Hampshire Astronomical Society; No. 2681, Kevin C. Carr, Honorary, Member-at-Large; No. 2685, Slava Murygin, Honorary, Westminster Astronomical Society; No. 2686, Nora Jean Chetnik, Honorary, Member-at-Large; No. 2687, Cindy Bahl, Regular, Astronomical Society of Kansas City; No. 2688, Mark Bailey, Honorary, Member-at-Large; No. 2689, Alex Vrenios, Regular, Member-at-Large; No. 2690, Eric Rachut, Honorary, Central Texas Astronomical Society; No. 2691, David M Douglass, Honorary, East Valley Astronomy Club

Meteor Observing Program
No. 55, Barrett Rollen Scott, Honorary, Member-at-Large; 56, George Guest, Honorary, Member-at-Large; Nora Jean Chetnik, 30 hours, Member-at-Large; Kenneth Larry Jones, 30 hours, Barnard Astronomical Society

Open Cluster Observing Program
No. 68, David Delassus, Advanced, Denver Astronomical Society

Outreach Observing Award
No. 305-M, Stuart Riley, Astronomical Society of Kansas City; No. 424-S, Grant Martin, Saint Louis Astronomical Society; No. 560-S, Robert C. Pettengill, Jr., Austin Astronomical Society; No. 580-M, Larry Martin, Austin Astronomical Society; No. 633-M, Doug Lively, Raleigh Astronomy Club; No. 634-O, David Furry, Southern Colorado Astronomical Society; No. 635-O, Doug Villers, Southern Colorado Astronomical Society; No. 636-O, Ron Goins, Southern Colorado Astronomical Society; No. 637-S, David Whalen, Atlanta Astronomy Club; No. 638-O, Edward C. Swaim, Central Arkansas Astronomical Society; No. 639-O, Charlie Ward Trussell, Northern Virginia Astronomy Club; No. 640-O, Daniel Thoman, Atlanta Astronomy Club; No. 641-O, Charles Murphy, Charlottesville Astronomical Society; No. 642-O, Steven F. Goldberg, TriState Astronomers; No. 643-O, Murali Krishna Kanagala, Austin Astronomical Society; No. 644-O, Frank Stonestreet, Popular Astronomy Club Quad Cities; No. 655-M, Stephen Berte, TriState Astronomers; No. 656-S, Randy O'Connell, TriState Astronomers

Planetary Nebula Observing Program
No. 63, Ken Sperber, Advanced, Tri-Valley Stargazers

Radio Astronomy Observing Program
No. 2-B, Anthony J. Kroes, Neville Public Museum Astronomical Society; No. 3-B, Steve Boerner, Astronomical Society of Eastern Missouri; No. 4-B, Adam Yore, Member-at-Large; No. 5-B, Brad Young, Astronomy Club of Tulsa; No. 6-B, Lowell Martin, Fort Worth Astronomical Society; No. 1-S, Anthony J. Kroes, Neville Public Museum Astronomical Society; No. 2-S, Steve Boerner, Astronomical Society of Eastern Missouri

Sketching Observing Award
No. 1, Brad Young, Astronomy Club of Tulsa

Sky Puppy Observing Program
No. 42, Gideon Lingle, Mason Star Gazers

Southern Skies Binocular Observing Program
No. 87, William Bogardus, Amateur Observers' Society of New York; No. 88, Jerry Loethen, St. Louis Astronomical Society; No. 89, Genevieve Goss, Roanoke Valley Astronomical Society

Southern Skies Telescopic Observing Program
No. 48, Jerry Loethen, St. Louis Astronomical Society

Stellar Evolution Observing Program
No. 13, Dave Rudeen, Etna Astros Astronomy Club; No. 14, Stephen L. Snider, The Albuquerque Astronomical Society; No. 15, Steve Bookout, Member-at-Large; No. 16, Patrick Birck, Prescott Astronomy Club; No. 17, Bill Sanders, Central Arkansas Astronomical Society; No. 18, Brian Chopp, Neville Public Museum Astronomical Society; No. 19, Jack Fitzmier, Atlanta Astronomy Club; No. 20, Nora Jean Chetnik, Member-at-Large; No. 21, Marie Lott, Atlanta Astronomy Club; No. 22, Mark Johnston, Austin Astronomical Society

Sunspotters Observing Program
No. 174, Louis Dorland, Omaha Astronomical Society

Two in the View Observing Program
No. 2, John Benham, Olympic Astronomical Society; No. 3, Brad Young, Astronomy Club of Tulsa; No. 4, Ed Valla, Tallahassee Astronomical Society

Universe Sampler Observing Program
No. 116, John C. Zellner, Naked-Eye, Member-at-Large; No. 117, Adam S. Yore, Telescope, Member-at-Large; No. 118, Bernard Venasse, Naked-Eye, Member-at-Large; No. 119, Kevin C. Carr, Telescope and Naked-Eye, Member-at-Large

Urban Observing Program
No. 160, Ken Boquist, Popular Astronomy Club; No. 161, Nora Jean Chetnik, Member-at-Large

TITLE PHOTOGRAPH: M64, THE BLACK EYE GALAXY; NASA AND THE HUBBLE HERITAGE TEAM (AURA/STSCI)

Reflector Mail/*Continued from page 6*

"Of hounds: to return along the course taken, when the scent has been lost, till it is found again; hence fig. to retrace one's course or steps; to return, revert; to return to some earlier point in a narrative, discussion, or argument."

Although I hadn't lost the scent, clearly that's what I meant, and I should have used hark back instead of hearken back in my essay. But had I done so, I never would have had the chance to travel down this wonderful etymological trail to discover how those hounds of the hunt influence what we say, even today, as we talk about missiles and the Cold War.

Thank you, Mr. Masthay, for providing the delightful opportunity to make this trip!

Ed. Note: Dear reader, not only do you learn about astronomy in the *Reflector*, you can also brush up on the English language!

Corrections & Clarifications

In the "Gallery" section (page 22) of the March issue, Mike Sager's image of the Milky Way, taken from Canaan Valley, West Virginia, was improperly processed by us. As a result, it is reprinted, in all its glory in this month's "Gallery."

In the same issue, on page 18, in the spectroscopy article, on the right side of the page, the three images had the wrong captions. The first image, captioned "Continuous spectrum," should read "Emission line spectrum;" the second image, captioned "Emission line spectrum," should read "Absorption line spectrum;" and the third image, captioned "Absorption line spectrum," should actually read "A comparison between continuous, emission, and absorption spectra."

IDA/*Continued from page 5*

key to preservation of the night sky and protecting the nighttime environment.

The International Dark-Sky Association, Inc. (IDA)
3223 N. First Avenue
Tucson, Arizona 85719-2103
Phone: 520-293-3198; FAX: 520-293-3192
Email: *ida@darksky.org; www.darksky.org*

About the author: *Lt. Col. Bob Gent is a retired U.S. Air Force space systems officer. He is the past president of the Astronomical League and the past president of the International Dark-Sky Association. Over the past 20 years, Bob has traveled nationally and internationally to speak before dozens of city, county, state, and national legislative bodies in support of better outdoor lighting laws and zoning. Bob currently lives in Sierra Vista, Arizona, where he is helping update local lighting codes to protect the night sky.*

June 10-14
Rocky Mountain Star Stare 2015
Colorado Springs Astronomical Society, Gardner, Colorado
www.rmss.org

June 11-13
Symposium on Telescope Science
Ontario Airport Hotel, Ontario, California
www.socastroci.org/symposium.html

June 11-14
Wisconsin Observers Weekend
Hartman Creek State Park, Waupaca, Wisconsin
www.new-star.org

June 11-14
Cherry Springs Star Party
Cherry Springs State Park, Pennsylvania
www.cherrysprings.org

June 12-13
Craters of the Moon Star Party
Craters of the Moon National Monument, Arco, Idaho
nightsky.jpl.nasa.gov/event-view.cfm?Event_ID=19696

June 13
45th Annual Apollo Rendezvous
The Boonshoft Museum of Discovery, Dayton, Ohio
www.mvas.org

June 13-20
2015 Grand Canyon Star Party
South Rim: Tucson Amateur Astronomy Association, Arizona
North Rim: Saguaro Astronomy Club of Phoenix
www.nps.gov/grca/planyourvisit/grand-canyon-star-party.htm

June 17-20
Green Bank Star Quest 12
Green Bank National Radio Observatory, West Virginia
www.greenbankstarquest.org

June 18-21
South Dakota Star Party
Wally's Corner, South Dakota
www.sdsp.org

July 6-11
ALCon 2015
Astronomical Society of Las Cruces
Las Cruces, New Mexico
ALCon2015.astroleague.org

July 10-12
Connecticut River Valley Astronomers Conjunction
Northfield Mountain Recreation and Environmental Center
Northfield, Massachusetts
www.philharrington.net/astroconjunction

July 12-17
Nebraska Star Party
Merritt Reservoir, Valentine, Nebraska
www.nebraskastarparty.org

July 15-19
Golden State Star Party
Frosty Acres Ranch, Adin, California
www.goldenstatestarparty.org

July 15-19
Mason Dixon Star Party
Private Footlight Ranch, Wellsville, Pennsylvania
www.masondixonstarparty.org

July 15-19
Indiana Family Star Party
Camp Cullom, Frankfort, Indiana
www.indianastars.us/starparty

August 11-15
Table Mountain Star Party/GREATCon
Eden Valley Ranch, Oroville, Washington
www.tmspa.com

August 11-16
Oregon Star Party
Ochoco National Forest, Prineville, Oregon
www.oregonstarparty.org

Coming Events

To have your star party or event listed, please send the details, including dates, sponsors and website, to *astrowagon@verizon.net*. Confirm dates and locations with event organizers.—John Wagoner

August 12-16
Northern Nights Star Fest
Long Lake Conservation Center, Palisade, MN
www.mnastro.org/NNSF

August 13-15
Julian StarFest
Menghini Winery, Julian, California
www.julianstarfest.com

August 13-16
Stellafane
Breezy Hill, Springfield, Vermont
www.stellafane.org

August 14-16
Northwoods StarFest
Hobbs Observatory, Beaver Creek Reserve
Fall Creek, Wisconsin
www.cvastro.org

August 14-18
Almost Heaven Star Party
Spruce Knob, West Virginia
www.ahsp.org

August 28-29
Maine State Star Party
Cobscook Bay State Park, Edmunds, Maine
www.downeastaa.com/maine_state_star_party_2015

September 9-13
Brothers Star Party for Oregon Observatory
Brothers, Oregon
www.mbsp.org

September 10-13
Heart of America Star Party
Dark-sky site south of Kansas City, Missouri
www.hoasp.org

September 10-14
Acadia Night Sky Festival
Acadia National Park, Bar Harbor, Maine
www.acadianightskyfestival.org

September 11-13
Black Forest Star Party
Cherry Springs State Park, Pennsylvania
www.bfsp.org

September 12-20
Okie–Tex Star Party
Kenton, Oklahoma
www.okie-tex.com

September 17-20
Great Lakes Star Gaze
River Valley RV Park, Gladwin, Michigan
www.greatlakesstargaze.com

September 18-20
Astrophotography Workshop
Adirondack Public Observatory, Tupper Lake, New York
www.greatlakesstargaze.com

October 5-10
Eldorado Star Party
X-Bar Ranch, Eldorado, Texas
www.eldoradostarparty.org

October 14-17
Enchanted Skies Star Party
Magdalena, New Mexico
www.enchantedskies.org

November 3-8
Deep South Regional Star Gaze
Feliciana Retreat Center, Norwood, Louisiana
www.stargazing.net/dsrsg

TITLE PHOTOGRAPH: "CONE NEBULA"; CREDIT: NASA, H. FORD (JHU), G. ILLINGWORTH (UCSC/LO), M. CLAMPIN (STSCI), THE ACS SCIENCE TEAM, AND ESA.

League Sales are online!

The League's online store is available at the website, **www.astroleague.org**. Click on the link for the store on the top right of the home page. The online store includes the latest shopping cart technology and accepts credit cards. Shipping & handling (S&H) is calculated at checkout. Merchandise is also available by mail order, payable by check. Please select your items, add the applicable S&H fee, and mail your order to:

Astronomical League Sales
9201 Ward Parkway, Suite 100
Kansas City, MO 64114

If you have questions about the merchandise, or discounts on bulk orders, please call the League office, 816-DEEP-SKY, or email: **leaguesales@astroleague.org**.

Trucker Hat
Printed logo, adjustable, navy only;
$12, plus $5 S&H

VC600 Baseball Hat
Embroidered logo, adjustable;
Colors: royal, maroon, khaki, navy;
$16, plus $5 S&H

2100 Baseball Hat
Embroidered logo, adjustable; "Sandwich" bill; Colors: sage w/stone trim, stone w/navy trim, navy w/stone trim;
$20, plus $5 S&H

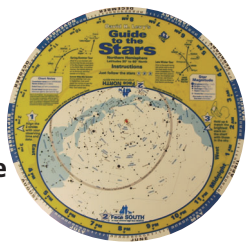
2050 Sportsman Bucket Hat
Embroidered logo, one size; khaki only
$22, plus $5 S&H

Astronomical League travel mug
$10: travel mug plus $1.50 S&H

Astronomical League full color cloth patch (three-inch diameter)
$7 plus $1.05 S&H

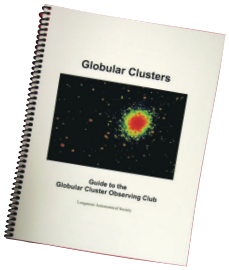
Astronomical League blue and white cloth patch (three-inch diameter)
$6 plus $1.05 S&H

Astronomical League lapel pin (one-inch diameter)
$8 plus $1.20 S&H

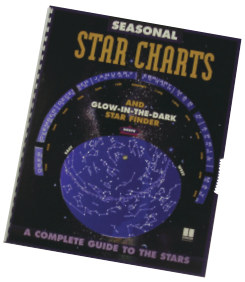


"Guide to the Stars" 16" Planisphere
$21 plus $3.15 S&H

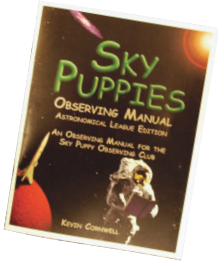
Globular Clusters
$14 plus
$2.10 S&H



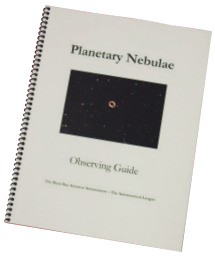
Seasonal Star Chart
$25 plus
$3.75 S&H



Sky Puppies Observing Manual–
For the Sky Puppy Observers Club
Regularly $15,
Sale price $8
plus $2.25 S&H

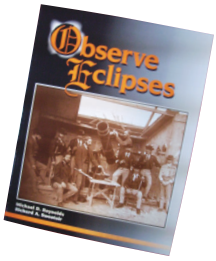


Planetary Nebulae
$14 plus
$2.10 S&H



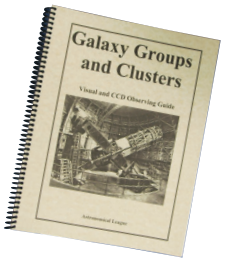
Messier Objects: A Beginner's Guide
$8 plus
$1.20 S&H

Observe Eclipses
Regularly $18,
Sale price $9
plus $2.70 S&H

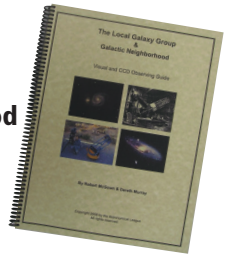


Universe Sampler
$10 plus
$1.50 S&H

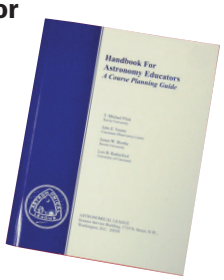
Galaxy Groups and Clusters
$18 plus
$2.70 S&H



Local Galaxy Group and Galactic Neighborhood
$21 plus
$3.15 S&H

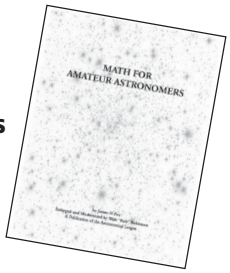


Astronomy for Educators Handbook
A Course Planning Guide
5.5" x 7.25"
Regularly $12,
Sale price $6
plus $1.80 S&H



Observe the Herschel Objects
$6 plus
$1.20 S&H

Math for Amateur Astronomers
$10 plus
$1.50 S&H



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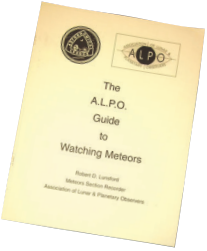

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Proving once again that one does not need terribly expensive imaging equipment to take a really nice picture, Tim Conners of Statesboro, Georgia, captured this wonderful image of the Moon. Using a 25-inch f/5 Obsession Classic telescope and an iPhone 4S at ISO 50, f/2.4, 1/40-second exposure, hand-held at the eyepiece, Tim grabbed this shot on April 20, 2013. Color curves were adjusted using Aperture.

The Astronomical League invites its members to submit astrophotography for publishing in the *Reflector*. When sending photos, please include a brief explanation telling us when and where the photo was taken, your club affiliation, what equipment was used, and any computer processing that was involved.