Reflector

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Astronomy in a Rocket Garden

International Observe the Moon Night

Advanced Binocular Double Star Program

From Around the League: Officer Candidates' Statements

Contents

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

This image of the **Orion Molecular Cloud Complex** comes to us from **Matt Harbison** of Chattanooga, Tennessee. Matt has been working on shooting on a large scale to capture complete constellations. This mosaic was taken in January and February 2016 using an Atik 383 CCD, Canon 100 mm f/2.8 L lens, Gerd Neumann filter drawer system, and William Optics Star 71 guide telescope. It consists of 9 panels with more than 1,280 individual light, dark, flat, and bias frames. The majestic Barnard's Loop, Horsehead Nebula, Witch Head Nebula, Angelfish Nebula, and the Great Orion Nebula are all visible. Images were captured with Sequence Generator Pro, calibrated in PixInsight, and their levels edited in Photoshop. Matt is a member of the Barnard Astronomical Society.

To our contributors: The copy and photo deadline for the September 2016 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 this 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 FEDERATION OF ASTRONOMICAL SOCIETIES
A NON-PROFIT ORGANIZATION
To promote the science of astronomy
- By fostering astronomical education,
- By providing incentives for astronomical observation and research, and
- By assisting communication among amateur astronomical societies.

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Reflector

QUARTERLY PUBLICATION OF THE ASTRONOMICAL LEAGUE

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

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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**

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

Amateur Astronomy Conventions: Enhance Your Experience Under the Stars

Amateur astronomy is considered by many members of the public—even by a few amateur astronomers themselves—to be a solitary pursuit, where curious people venture alone under the starry dome to observe obscure celestial features or esoteric physical phenomena. One image some may have is that amateurs rarely associate with others.

Why, then, do many people make the effort to attend astronomy conferences and star parties, sometimes traveling great distances to do so? Why do many people devote several days of their limited vacation time attending these gatherings? Why do many of the same people do this year after year?

Could it be that the total experience gained at the eyepiece demands more than just what the eye sees during the moment? Could it be that it also needs an understanding of what is being seen? Could it be that it requires personally interacting with others who have had similar experiences?

A larger sense of discovery

What is not generally recognized about a convention, or any astronomy gathering for that matter, is that it consists of much more than just a collection of talks. Yes, conferences certainly do have educational components where amateurs can speak directly with experts and learn. Yes, attendees commonly meet authorities such as authors, magazine editors, research scientists, university professors, NASA mission specialists and astronauts, and expert observers, sketchers, and imagers. The attendees, however, come away with much more out of the experience than just that.

Denise Moser of League Sales assists a customer at the 2014 ALCon.

With an assembly gathered together from various backgrounds, amateurs have a wonderful chance to discover more about not only the science of astronomy and the art of observing, but, for example, new opportunities for conducting outreach and influencing the young. Club members can discuss their society newsletters and websites, their meeting formats, how their clubs attract and retain new members, and their groups' efforts at battling the scourge of light pollution. Individuals can exchange ideas on telescopes, accessories, and observing techniques. They can show off their sketches and images. Perhaps most importantly, though, they can share their enthusiasm for the night sky with others.

It is also a chance to explore the host area, especially in an astronomical context. Often, tours are arranged to visit interesting locations where some facet of astronomy takes place—planetaria, science museums, observatories, physics laboratories, and space exploration facilities. These help amateurs understand the true nature of astronomy and the role they play within it.

The larger, better-attended events often feature a keynote speaker—perhaps someone nationally recognized. People find it exciting to speak with this person of note, gaining real insight into the topic at hand.

The Astronomical League Convention, ALCon

This summer, the members of the Northern Virginia Astronomy Club bring us the Astronomical League National Convention, ALCon 2016, in Arlington, Virginia. How will it benefit your enjoyment of our hobby? What will it feature? Here are a few events:

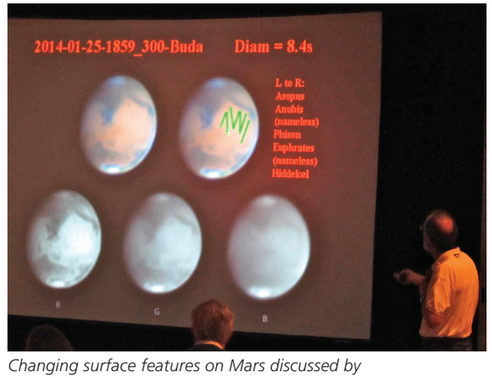
A series of nearly twenty engaging talks dealing with various topics such as planetary observations, outreach on the National Mall, meteor impacts, planetary exploration, youth research, variable star experiences, and more.

A number of special tours: NASA's Goddard Space Flight Center; the historic US Naval Observatory; and several trips exploring the Smithsonian's National Air and Space Museum, its meteorite collection, and its Udvar-Hazy Center annex.

An incomparable keynote speaker: Major General Charles Bolden, Jr., NASA Administrator. Hear about the future of space exploration from the leader of NASA!

What might be the most important opportunities for discovery are impromptu sessions where amateurs learn directly from other amateurs.

How can you make your club stronger? How can you become a better observer? How can you get more out of our amazing avocation? Go to a convention! Go to ALCon!



Changing surface features on Mars discussed by Roger Venable at the 2015 ALCon.

Recent ALCon Keynote Speakers

2015, Las Cruces: Dr. Pat Hynes, director of the New Mexico Space Grant Consortium
2014, San Antonio: Dr. Don Petit, astronaut and explorer
2013, Atlanta: Dr. Charles Wood, selenologist and *Sky & Telescope* columnist
2012, Chicago: David Gaynes, *Saving Hubble* filmmaker
2011, Bryce Canyon: Carolyn Shoemaker, astronomer and comet hunter

John Goss, League President

TITLE PHOTOGRAPH: SEYFERT'S SEXTET, NASA GODDARD SPACE FLIGHT CENTER

Dear Editor:

The *Reflector* periodically runs articles bemoaning the lack of participation by women in this hobby. I've been looking over programs for some of the large star parties that I hope to be able to attend now that I am no longer tied to a school calendar. I am disappointed to see "Ladies programs" for those not observing rather than "spouse" or just programs offered with no labels for anyone who is interested. Do we need gender/marriage status labels for star party side activities?

I appreciate that organizers know that many of the attendees are (still) men with wives that may be along for the ride, but hopefully we wish to attract more women who might come with disinterested spouses or young folks with friends. Words matter. They display and shape attitudes both consciously and unconsciously. How welcoming is a program that assumes that men are on the observing field and the ladies aregoing shopping?

I run the Facebook page for our local club. Half of those who look in on us are women. The interest is out there, but more needs to be done to make the women feel welcome in what has been a men's club. I might be both a woman and a spouse, but at the telescope I am an observer and a photographer.

Ms. Theo Wellington
Nashville, Tennessee

Dear Editor:

Some observations on, and maybe a plug or two for, astronomy outreach.

It's that time of the year again. People dusting off their scopes that were put away for the long winter. People adjusting their scopes after a long winter of observing and even those folks setting up their scopes that they got for Christmas. "A whole lotta scopin' going on out there." And now maybe some of those scopes can be seen at outreach events. It's not hard and it's really fun.

At an outreach event, you don't have to know the mass of the Sun or the size of M13 (whatever *that* is). It's *big*, it's far, far away, and you can show it off in *your* telescope. The point is, to help at an outreach event, all you really need is a little desire to have fun meeting people and listening to them thank you, with gusto, for showing them something they've never seen before.

It doesn't take multi-thousand-dollar instruments. You know that little "dime store refractor?" Did you know that there are a number of folks who come to an outreach event that have the same scope gathering dust in their garage? And they'll tell you that. "Got it for Christmas one year but never could figure it out," they explain, at which point they realize *you* have one just like it. And you know how to make it work! Once they see the image in your scope, you just might have rekindled a spark that turns into a blaze. They now know where to go to get help *and* use their little gem.

What's that you say about "image quality?" You're not sure because you don't think your scope's good enough? Well let me tell you, any view through a telescope, no matter how good or bad, is the best view for someone who has never looked through a telescope before. And if they have, on rare or several occasions, I'll pretty much guarantee they will be appreciative for a view of any kind.

In fact, it doesn't take an instrument at all. The minimum you need is just a desire to point out the stars and constellations that can be seen with the naked eye. Pick out a few constellations and learn their mythology. Then point that out to the guests waiting in line for a view through a scope. They'll be entertained and enthralled. And before they know it, that 10-minute wait for the quick view just evaporated into that clear dark sky and turned into a night they won't soon forget.

So why help at an outreach event? Just ask anyone who volunteers: camaraderie, satisfaction at seeing (but mostly hearing) people enjoying themselves at something they never really knew could be so fun—and you can be a part of that. All it takes is to just show up at an event and pitch in. There are plenty of regulars ready and willing to help you out.

It's kind of like that old saying, "in the land of the blind, the one eyed man is king." No matter how poor you might think your equipment is, or how badly you might think you botched that description of Libra, you'll be treated like a king for showing someone something they have never seen before.

Grant Martin
Previously printed in the Astronomical Society of Eastern Missouri's July 2015 *ASEM Newsletter*

Dear Editor:

The March issue of the *Reflector* ("Join the International Dark-Sky Association," page 7) posts a ringing endorsement of the IDA. Alas, amateur astronomy, and the IDA, continue to support the sales pitch for better fixtures. That well intended advocacy in practice becomes more better fixtures. Darker sky by better technology isn't working because of "more." Capped light fixtures may darken the sky, but they haven't reduced light pollution. That's growing annually. The better-fixtures strategy best serves the lighting industry—like filters on cigarettes serve tobacco sales.

As one of the products that dump fossil fuel energy into our environment, light is an industrial effluent. Twenty years of good science from around our globe says that light in excess or at the wrong time is toxic. Light at night can increase the incidence of human diseases that kill us. Recent studies suggest that artificial light at night also inhibits global cooling. Let's follow the French and simply turn off our lights from 1 a.m. until dawn. Because a dark sky, better health, global cooling, and a better economy all revolve around a natural circadian rhythm on planet Earth.

Bob Guzauskas
www.lightsoutamerica.net

The Sky This Week

To find out what's happening in the sky the coming week, take a look at "The Sky This Week" on *Astroleague.org*. Produced by our own Vern Raben, this weekly five-minute program covers the Moon, visible planets, comets, and interesting stellar features. Why not tune in this week?

International Dark-Sky Association

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

Light Pollution Myth: There are Too Many Lights to Do Anything About Them

Over the years I have discussed myths in the fight against light pollution, such as "the more light the better," "outdoor lighting prevents crime," "LED lighting protects the environment," and "there are too many lights to ever solve the light pollution problem."

Where there are myths, there is often a grain (or more) of truth that started them. For example, you do need enough light to do the task at hand, but too much light produces glare and wastes energy. Sometimes no outdoor lighting is needed for a task, like taking out your garbage on a moonlit night.

Outdoor lighting can provide a sense of safety and security, but if nighttime lighting was truly good at preventing crime, we would have no inner city crime. Some of the brightest urban areas have the most crime.

LED lighting is the wave of the future, due to the long life of LED emitters, and their being easy to dim or turn off and on as needed. They are also fairly energy efficient. Unfortunately, many outdoor LED systems have been installed with no thought to the nighttime environment. They produce much glare, produce too much light for the task, and produce light in the blue range of the spectrum, which is more annoying and possibly more harmful than light in the orange range of the spectrum.

The hardest myth to battle is that there are too many lights to do anything about light pollution. That is a very tough nut to crack, and on my bad days and nights I sometimes feel that way. If all of those who felt that way for the last thirty years had not overcome their sense of discouragement, then the problem would be incredibly larger today. We would not have any dark-sky places, there would be no lighting ordinances, major professional observatories would have no legal protection against light intrusion, and the lighting industry would have not developed a marvelous array of luminaires designed for good nighttime lighting with protection of the dark sky in mind.

Most of us live in urban or suburban environments and have to contend with a lot of light pollution, and possibly even irritating light trespass from neighbors' floodlights. If all stargazers (in the broadest sense) spoke up about light pollution, the problem would be addressed in a much better fashion. It is easy to gripe about various problems, but harder to actually do something about them. What can the average amateur astronomer do about light pollution without dedicating all of his or her free time to the effort?

There are several things one can do that are fairly easy, are not very time consuming, and will have a positive effect. First, simply learn about what constitutes good and bad outdoor lighting. That is mostly self-evident, but reviewing lighting examples and information on the IDA website is informative. Take a look at IDA's "Intro to Lighting" PowerPoint presentation. I will offer a warning in this regard: once you become sensitized to bad lighting, you will never be able to go back! You can't fix every bad light, but once you begin to recognize them, they will stick out. Prime examples are badly aimed floodlights, the ubiquitous farmyard dusk-to-dawn lights, unshielded porchlights with too-bright bulbs, and parking lot lights mounted at such an angle that they send blinding beams of light into the eyes of drivers coming down the road.

Another simple thing you can do is to join your local astronomy club. Astronomy clubs promote amateur astronomy and, directly or indirectly, attune the public to light pollution. (Since you are reading this article in the Astronomical League's journal, you have probably taken this step already!) Also, you can join IDA or even generously donate to IDA (my subtle suggestion).

Sending a letter to your city council or county supervisors requesting appropriate action is helpful, as are letters to the editor of your local newspaper. You could even consider talking respectfully to a local business with bad lighting. This is particularly effective if you happen to be a good customer of the business. Always try to be respectful and offer solutions rather than just mentioning problems. A wealth of information along these lines is available through IDA and other sources. Check out IDA's public outreach materials at *darksky.org/resources/public-outreach-materials*.

The bottom line is to not get discouraged. Get in the fight as much or as little as you can, given your time, resources, and inclination. But do something. Every little bit helps.

Tim Hunter, Co-founder, IDA
Phone: 520-293-3198; Fax: 520-293-3192
Email: *ida@darksky.org*; *www.darksky.org*

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

As editor, I receive dozens of letters each month from some of our 16,000+ readers. Some of these letters question the validity of certain articles (are they too esoteric for the average reader?); others compliment the author or imager. Several of the letters are quite specific in nature (when will we have another "Youth in Astronomy" issue?).

Recently I have seen several letters and emails asking about our cover images. Readers are asking for a front cover that is not a picture of a celestial object. Special telescopes, star parties, planetariums, observatories, and convention speakers have been suggested, and I wholly agree with the concept.

So, dear reader, I now ask you to submit images which are suitable for a front cover. Not just pretty pictures of another galaxy or dark nebula, but of more down-to-Earth subjects. Photos should be sent to *photoeditor@astroleague.org*, and should be in JPEG format, at least five megabytes in size. In addition to the image, please send your name, club affiliation, date taken, and a short caption to describe the image. It would be greatly appreciated.

Of course, we are also always seeking articles, Gallery images, and other submissions for future issues. We are in a fortunate situation in that we have several issues worth of material, but we would like to have a larger selection, so we can do subject-specific issues (observing, imaging, youth, outreach, etc.). Text should be in Microsoft Word (.doc or .docx) format; images should be in separate JPEG files (not embedded in the Word document) and at least 250 kilobytes in size. Please send these to *editor@astroleague.org* or *rjipublishing@aol.com*. Submission due dates are on page 4.

It matters not whether you are a Republican, Democrat, independent, or other party member. Vote for the candidate who best represents your interests and who would be best for our country. It's the only one we have.

We also have several qualified people running for president, vice president, and executive secretary of the Astronomical League. It is your duty to select the candidate who best represents the League and who can support our future. You can read candidates' statements in the "From Around the League" section of this issue.

And, don't forget about ALCon 2016 in Arlington, Virginia, on August 10–13. This convention looks like it will be a dandy, with a bunch of great tours, speakers, and special events. Hope to see you there.

The League Book Service is here for you!

Are you searching for that special astronomy book but don't know where to start? Let the Astronomical League's Book Service fill your request! With its 10% discount and free shipping, how could you not do otherwise?

This is the perfect place for members to go when looking for books currently in print about astronomy, cosmology, mathematics, and physics. Titles can be ordered from many well-known astronomy book publishers such as **Sky Publishing**, **Cambridge**, **Oxford**, **Willmann-Bell**, **Springer-Verlag**, and others.

Moreover, items available through the Book Service are not limited only to books. Posters, charts, and atlases are also available.

Ordering is simple enough. Just provide the name of the item, author, publisher (if known), the retail price, and the shipping address. Be sure to include a check or money order—payable to Astronomical League Book Service—for the retail price minus 10%. Shipping and handling are free. Sorry, credit cards are not accepted.

Mail your requests to:

Star 'N Space Books, 324 W. Gurley St., Prescott, AZ 86301

You should receive your order within two to three weeks.

This benefit is made possible by the efforts of League volunteer Marilyn Unruh, proprietor of Star 'N Space Books. She is also an avid amateur astronomer. Like many of the League's members, she desires to help others enjoy our fascinating avocation. Marilyn notes, "This service allows me to give back to the astronomical community by doing something that I love to do—deal in books!"

For members who are looking to add to their library, the Book Service is definitely the place to go!

DEEP-SKY OBJECTS

PTOLEMY'S CLUSTER

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

The summer Milky Way blazes overhead for northern hemisphere observers, paving a path from Scorpius in the south to Cassiopeia endlessly circling the North Star. Dark molecular clouds break up numerous unresolved star fields. Scattered about are bright emission nebulae and galactic and globular star clusters. The brightest region of the Milky Way lies in the constellation Sagittarius, host to the galactic center.

Just to the right of Sagittarius's Teapot asterism is a bright star cloud not quite resolved by the unaided eye. This splendid star cluster is known as M7 or NGC 6475. M7 is a large open star cluster lying within a dense, concentrated patch of the Milky Way. The cluster contains 80 stars spanning 1.3 degrees. The cluster's brightest stars are in the center, with zigzagging star chains radiating outward. Its integrated magnitude is 3.3, easily seen at a dark observing site.

M7 was described by Ptolemy in the year 130 AD as a "little cloud following the stinger of Scorpius." Claudius Ptolemaeus, as he was called in Latin, was an Alexandrian mathematician and astronomer who did detailed calculations to describe the orbits of the Sun, Moon, and planets in a geocentric solar system. He required 80 circles to explain all observations of these bodies, including retrograde motion and varying brightness. The Ptolemaic model stood until the Renaissance and the works of Copernicus and Galileo. To this day, M7 is still called Ptolemy's Cluster.

Many astronomers after Ptolemy included M7 in astronomical catalogs. These include Hodierna, Halley, and de Lacaille. Of course, Charles Messier made it the seventh entry in his catalog.

The brightest star in Ptolemy's cluster is a magnitude 5.6 yellow giant, HR 6658, located on the southwest side of the cluster's core. HR 6658 is a binary star with the yellow giant's companion shining at magnitude 7.9, located 0.6 arcsecond away. The second brightest star in M7 lies on the northwest edge of the cluster, one-half degree from the center. This star is HR 6648, a magnitude 5.8 yellow giant. The third brightest star lies on the west side of the cluster, 20 arcminutes from the center. This is a blue-white star, V957 Scorpii, shining at magnitude 5.9. V957 varies slightly in magnitude from 5.87 to 5.92. It is the hottest main sequence star in the cluster, with a surface temperature estimated to be 14,600 K (our Sun's temperature is about 5,780 K).

M7 is thought to be 800 to 1000 light-years away, roughly half the distance to M6, its neighboring cluster in the tail of Scorpius. M7 has a diameter of 18 to 25 light-years. The cluster's mass is equal to 2500 suns. The cluster and our solar system are moving towards each other at 14 kilometers per second. The stars in M7 are thought to be 200 million years old—mere infants on the cosmic time scale.

The globular star cluster NGC 6453 lies on the northwest edge of M7. While M7 is easily resolved in binoculars, NGC 6453 is not. It is best viewed with at least a 6- to 8-inch piece of glass. A short focal length instrument with a low-power eyepiece will show M7 and NGC 6453 simultaneously. I can easily capture both in my 6-inch f/6 TPO Newtonian with a 31 mm TeleVue Nagler eyepiece. Zooming in on NGC 6453 with my 14-inch f/6 Dob, I am able to resolve uncountable stars in the globular cluster.

NGC 6453 shines at magnitude 10 and has a diameter of 21.5 arcminutes. The cluster lies more than 30 times farther away than M7. Because the cluster is a background object to this rich Milky Way star field, it is visually difficult to tell whether stars on the outer edges of the cluster are true cluster members or foreground Milky Way stars. All the gas and dust scattered throughout the plane of our galaxy dims the light from NGC 6453 considerably. NGC 6453 would appear much brighter if located at the same distance away, but above or below the galactic plane.

The accompanying image of M7 was taken with a Stellarvue SV102 f/7.9 apochromatic refractor with a TeleVue 0.8x field flattener/focal reducer. The mount was an Orion Atlas German equatorial. I used an SBIG ST-2000XCM CCD camera and the exposure was 50 minutes. North is up and west is to the right. I placed the center of Ptolemy's Cluster on the left side of the field of view to capture NGC 6453 on the right edge of the image near the top. The star cut in half along the top of the image in HR 6648.

Ptolemy's Cluster is a spectacular object to view in any size of instrument due to the contrast of the bright stars with the background Milky Way star clouds and dark nebulae. Finding NGC 6453 in the same field of view is icing on the cake!

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

By Mike Stewart, Astronomical League Historian

May 1966

Southern Cross Observatory

The Southern Cross Observatory was founded in 1922 when S. Lynn Rhorer, a winter visitor from Atlanta, brought with him a 5-inch Alvan Clark refractor which he set up on the grounds of the old Royal Palm Hotel in downtown Miami and invited all to look—free!

It is said that the police looked upon this activity with some concern and one evening took Rhorer to headquarters where he managed to convince the sergeant that he really didn't need a license, since there was no charge for looking through the telescope.

Rhorer added another Clark refractor each year until there were six. He gathered a number of local devotees who became the volunteer "staff" of the open air observatory.

... After Rhorer's death in 1929 it appeared that the project would come to an end, but Rhorer's will left the equipment to the staff provided they set up a corporation to continue the project. The Southern Cross Astronomical Society was thus incorporated in 1930.

Outreach still forms a pillar in many clubs' monthly activities, and some observers can relate to Mr. Rhorer's encounter with law enforcement during an observing session. The Southern Cross Astronomical Society is one of many astronomical clubs formed in the United States during the twenties and thirties. The SCAS website has a collection of black-and-white photos from the Society's early years—well worth a look.

May 1991

Announcing the Astronomical League's Binocular Messier Club

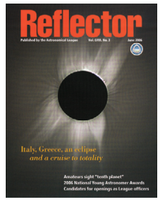
The Astronomical League is pleased to introduce its new Binocular Messier Club. The Binocular Messier Club is for beginning observers as well as experienced amateurs.

Beginning observers will find that it doesn't take an expensive telescope to do serious astronomy, but only a simple pair of binoculars, no matter what the size, cost or condition. On the other hand, experienced amateurs, even though they may already have the AL's telescopic Messier and Herschel certificates, will enjoy the new perspective binocular observing gives them. As they pull back from an object and observe the area around it as well as the object itself, they will be able to put that object in its proper context in the sky.

Then, as now, binoculars and Messier objects serve as an ideal introduction to the night sky. Today, the Binocular Messier program takes its place as one of over fifty Astronomical League observing programs.

June 2006

Aegean Eclipse



It was my third time. The third time that I have planned, schemed and dreamed of going to a total eclipse of the sun. It's time to be honest with myself and admit that I have become an eclipse junky. For those of you fellow chasers reading this, you understand. For you others who have never been on the centerline of a total eclipse of the sun—well—it's just darn hard to explain how very special and personally spiritual it can be.

This past March 29, the Moon's shadow moved across the Atlantic into tropical Africa, up into the Sahara Desert, over the Mediterranean Sea and on into Turkey and beyond. The more adventurous chose a trip into Niger. To see the eclipse there, a trek out into the desert was required, and "sleeping in tents" was mentioned. Even the trips to Turkey and Egypt were perhaps a bit too rustic. The "ah-ha" lights went on for me when hearing the magical words "eclipse cruise" excursion, prior to which you could tour Greece or Italy.

If you just can't travel out of the USA, wait until 2017, when the path of the Moon's shadow cuts across our country from Oregon, through Kansas City, and on to Kentucky, Tennessee and North Carolina! Perhaps I will meet you in the dark of the Moon's shadow someday.

The author, Jackie Beucher, served as a leader on this eclipse cruise. Notable astronomers, including David Levy, Michael Bakich, and the author of Galileo's Daughter, *Dava Sobel, joined over 500 other travelers for a cruise to the centerline. In addition to the cruise, travelers had the opportunity to visit Italy, including Florence, home of the Museo Galileo. Jackie's article is of keen interest today, as she mentioned the total eclipse that will cross the United States from west to east in August 2017.*

MARIA MITCHELL
19TH CENTURY ASTRONOMER

By Ann House, member of the Salt Lake Astronomical Society and former Astronomical League Secretary
Photos by Ann House and family

She is known as the first professional woman astronomer in the United States. In 1865 she became a professor of astronomy at Vassar College and the first person (male or female) appointed to the faculty. Eight others soon joined her on the faculty of the burgeoning college. While at Vassar she had access to a 12-inch telescope, the third largest in the U.S. at the time. But she was known worldwide for her talents in astronomy before she joined Vassar.

Maria (pronounced "Mariah") Mitchell was born in Nantucket, Massachusetts, in 1818. She was one of 10 children in a time where it was unusual for girls to receive a quality education. However, her parents were Quakers who valued education and believed in equality regardless of gender. She came from a heritage of educated ancestors, Benjamin Franklin among them. Maria's father built his own school, which Maria attended and where she also became a teaching assistant. She later opened her own school and allowed non-white children to attend, quite scandalous at the time. For 20 years she was the librarian of the Nantucket Atheneum, which offered her time to read and study.

Her father, William, introduced Maria to astronomy. He had built an observatory, used his personal 4-inch telescope, and made observations for the U.S. Coast Guard. Maria helped her father with measurements. One evening while taking measurements, Maria observed an object—a comet. Over the next few days she tracked it and her father reported her discovery. This comet, C/1847 T1, is often referred to as "Miss Mitchell's Comet."

She was awarded a gold medal by the King of Denmark, who had offered a prize for first identifications of telescopic comets, too faint to be seen with the unaided eye. In light of her accomplishment, in 1848 she became the first woman elected into the membership of the American Academy of Arts and Sciences and, in 1850, into the American Association for the Advancement of Science.

Maria Mitchell's books and photographic plates in the office observatory on Nantucket

Ann House and her daughters at Maria Mitchell's observatory on Nantucket

She remained at Vassar until shortly before her death. She conducted original research and photographed the Sun and her favorite planets, Jupiter and Saturn. She was an unusual professor for her day, rousing her students at night to join her in the observatory and taking seven of her students to Burlington, Iowa, to see a total eclipse of the Sun. Her observatory also became a gathering place for discussions about politics and women's issues, aided by the fact that the observatory was connected to her living quarters.

Several of her students became astronomers, including Antonia Maury (Harvard College Observatory) and Mary Watson Whitney, Mitchell's successor at Vassar.

Today, on the island of Nantucket, exists the Maria Mitchell Association, dedicated to promoting her legacy of exploration, education, and research. While astronomical research continues each summer with visiting students and scholars and an observatory open to the public, the association also facilitates recognition and study of the ocean and harbor. More information can be found at *www.mariamitchell.org.*

Maria Mitchell wrote, "I cannot expect to make astronomers. But I do expect that you will invigorate your minds by the effort at healthy modes of thinking. There is something elevating in the study of the natural sciences. When we are chafed and fretted by small cares, a look at the stars will show us the littleness of our own interests."

References:

"Maria Mitchell," Dictionary of Unitarian & Universalist Biography, *uudb.org/articles/mariamitchell.html.*
"Maria Mitchell Association," *mariamitchell.org.*
"Maria Mitchell," Vassar Encyclopedia, *vcencyclopedia.vassar.edu/faculty/original-faculty/maria-mitchell1.html.*

MEASURING THE SKY BRIGHTNESS OVER BARNESVILLE, GEORGIA

By Richard W. Schmude, Jr.

Introduction

In 2009, I purchased a SQM-L Sky Quality Meter. Based on information from the manufacturer, Unihedron, this instrument is only sensitive to visible light. Each instrument is calibrated using a NIST-traceable light meter and the precision of each meter is believed to be ±10%. They also claim that the half width at half maximum (HWHM) of the angular sensitivity is about 10 degrees. When pointed at the sky, this instrument measures the sky brightness in units of magnitude per square arcsecond (mag/arcsec^2). Therefore, if the instrument reads 20.0, then one square arcsecond of the sky has a brightness value equal to that of a magnitude 20.0 star. I interpret the uncertainty to be ±0.1 on the instrument readout.

I began my sky brightness study on August 23, 2009, and finished it on July 21, 2015. The date, time, and temperature were recorded along with the sky brightness. The sky brightness near zenith was recorded on clear, moonless nights. A mean of five measurements was always taken. Almost all measurements were made when the Moon was below the horizon. In a few cases, the Moon may have been just above the horizon but was not visible. Almost all measurements were made when clouds were not visible; however, in rare cases, distant clouds were present. There is also a chance that thin hazes may have been present on some nights. These hazes are difficult to detect in moderately dark skies. I made all measurements from my backyard. I selected an area where the trees did not block the view of the sky at zenith. In mid-2015, the limbs are at least several degrees from the zenith; however, they probably were smaller at the beginning of the study period. I will discuss trees later in this report. The goals of my study were 1) to monitor the sky brightness over a multi-year period, 2) to search for monthly changes in sky brightness, and 3) to look for any correlation between sky brightness and temperature.

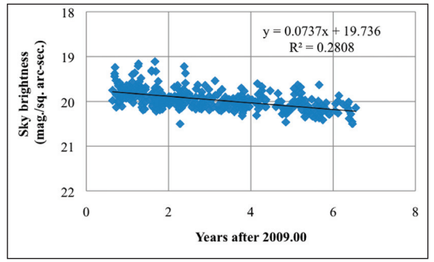


Figure 1: A graph of measured sky brightness versus the number of years after 2009.00

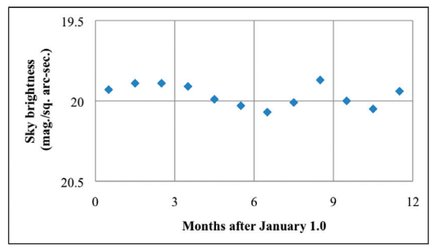


Figure 2: A graph of the mean sky brightness versus month

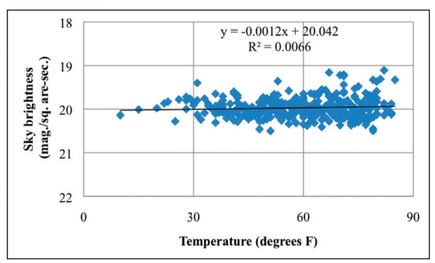


Figure 3: A graph of sky brightness versus outside temperature

Sky Brightness Between 2009 and 2015

Figure 1 shows all 373 sky brightness measurements recorded during the study period. Surprisingly, the measured sky brightness decreased—that is, the sky darkened—over time at a rate of about 0.07 mag/arcsec^2 per year. In late 2009, the mean sky brightness was about 19.8 mag/arcsec^2, but by early 2015, it was 20.2 mag/arcsec^2. There are at least three possible explanations for this trend:
1) tree coverage increased;
2) the instrument's response function changed; or
3) the skies got darker in my area.

In order to determine what was going on, I decided to look at the monthly trends.

Sky Brightness Versus Month

The data were broken up by the month of measurement. The mean sky brightness for each month is shown in Figure 2. A typical monthly standard deviation is 0.2 mag/arcsec^2. Therefore, the monthly differences are only marginally meaningful. The sky was brightest in September. This may be due to a combination of home football games and the town festival, which takes place on the third weekend in September. Both of these events led to the stadium lights being on. The summer Milky Way is also high overhead on September evenings.

The sky is also brighter during the months of January through March. This may be caused by the lack of leaves on my trees. The instrument was always pointed at the sky near the zenith, but tree limbs may have had a small impact on the measured brightness. The hole in the sky, between tree limbs, was about 40 degrees across in mid-2015, so the instrument may have detected the darker tree limbs at the edge. This supports the conclusion that tree growth may be partly responsible for the darkening of the measured sky brightness between 2009 and 2015. During April, trees give off yellow pollen in my area, and pollen in the air may also impact sky brightness readings in that month. The monthly trends, and measuring the brightness near the zenith, seem to rule out zodiacal light being a contributor to the monthly variation.

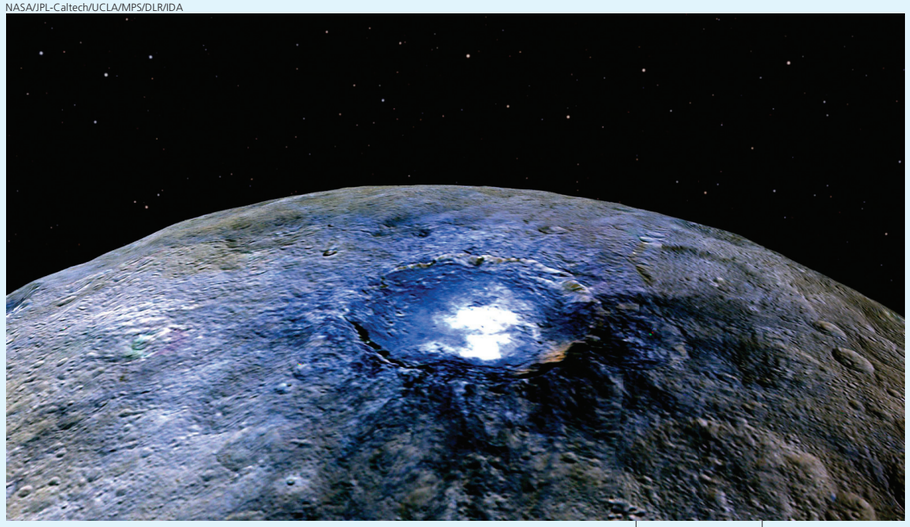
Other Trends

Two other trends were examined. Figure 3 illustrates how measured sky brightness changed with the temperature. Essentially, the sky tended to be slightly brighter at warmer temperatures. It is, however, difficult to separate any monthly influence from the temperature influence. The mean sky brightness for all readings before 5:00 UT was 19.94 mag/arcsec^2 and the corresponding value for 5:00 UT and later was 20.09 mag/arcsec^2. The standard deviation for both means is near 0.2 mag/arcsec^2, so the difference is only marginally meaningful. More than likely, more people turned off their lights after 5:00 UT and this caused the sky to darken.

NASA/JPL-Caltech/UCLA/MPS/DLR/IDA

Troughs are visible all over Ceres. One such trough is visible in this close-up of the crater chain called Gerber Catena located just west of the large crater Urvara.

NASA/JPL-Caltech/UCLA/MPS/DLR/IDA



Ceres' Occator Crater shown in false color, highlighting the differences in the surface composition in and around the crater. In this image, near infrared is represented by red, visible red by green, and visible blue by blue. The bright blue areas in the crater are typical of salts, such as sulfates, on the surface, along with some silicates.

WANDERERS IN THE NEIGHBORHOOD

2015: Year of the Dwarf Planet

By Berton Stevens

The year 2015 was very exciting for dwarf planets. Two spacecraft each studied a different dwarf planet in very different parts of our Solar System. The **New Horizons** mission took a close-up look at the dwarf planet (134340) Pluto, while the **Dawn** mission eased into orbit around the first dwarf planet to be discovered, (1) **Ceres**, discovered in 1801. It then proceeded to start mapping this dwarf planet in great detail.

Ceres is the only dwarf planet that orbits the Sun within the asteroid belt between Mars and Jupiter. All the other dwarf planets, including Pluto, orbit the Sun out beyond the orbit of Neptune. This category was created by the **International Astronomical Union** in 2006 when it became clear there were other objects beyond Neptune that rivaled Pluto's size. Rather than add more planets to our Solar System's roster, astronomers decided to reclassify Pluto into this new category.

One part of the definition of a dwarf planet states that it must be in hydrostatic equilibrium. This means that its gravity has compacted the dwarf planet into a spherical shape. Pluto and Ceres are both spherical, while the second most massive body in the asteroid belt, minor planet (4) Vesta, visited by Dawn in 2011, is distinctly oblate.

The two spacecraft are quite different in design, in keeping with the different regions they visited. Dawn is powered by a large solar array that provides electricity to its instruments and to the ion engines that allowed it to be the first spacecraft to orbit two different solar system objects. **New Horizons** is powered by a radioisotope thermoelectric generator, which produces electricity from the radioactive decay heat of plutonium dioxide. This power source was used because Pluto is too far from the Sun to use solar arrays. New Horizons is the fastest spacecraft to leave Earth, travelling at 36,373 miles per hour.

The different designs also meant different mission profiles. Dawn used its ion engines to slow down, orbit Vesta, and then do the same at Ceres. It could then perform detailed measurements of each object. New Horizons had to be as light as possible, so there were no rockets to slow it down as it flew past Pluto. New Horizons had to make its observations as it raced past Pluto at 30,800 miles per hour.

Because Dawn is in orbit around Ceres, Dawn is able to make its observations from 240 miles away, while New Horizons was 7,750 miles away from Pluto at closest approach. The two spacecraft were still able to provide much new information about these two dwarf planets.

NASA/JPL-Caltech

The five known dwarf planets are shown here at the same scale as our Moon. Dwarf planets are not the only objects to reach hydrostatic equilibrium. Our Moon and many other moons have become spherical as well. The difference is that they orbit a planet instead of orbiting the Sun directly.

Images have shown major differences between the surfaces of these two dwarf planets. Ceres has many more impact craters than Pluto. The impacts that formed these craters, along with contraction of the planet, caused stresses that induced troughs in the crust of Ceres. These troughs are visible all over Ceres' surface, frequently near the larger craters.

Pluto also has troughs, but Pluto's were probably formed by the sublimation or evaporation of nitrogen ice from a deep layer that may be up to a few miles thick. This layer is exposed on the left side of Pluto's "heart," the basin informally named Sputnik Planum, 620 miles (1000 km) across. Since this layer is exposed to the Sun in Sputnik Planum, the nitrogen ice can sublimate into nitrogen gas and then condense back into ice on the surrounding mountains. The newly formed nitrogen ice flows down the mountains as a glacier, forming many of the geological features seen by New Horizons.

Some of the nitrogen escapes the Sputnik Planum basin and helps form the atmosphere surrounding the dwarf planet. New Horizons saw layers of haze in Pluto's atmosphere as it looked back at Pluto occulting the Sun after the close encounter. A complete understanding of Pluto's haze still eludes astronomers. Ceres has an atmosphere as well—it is very thin, and composed mostly of water. The bright spots first seen as Dawn approached Ceres in the crater Occator appear to be composed of a type of magnesium sulfate called hexahydrite, similar to what we know of as Epsom salt.

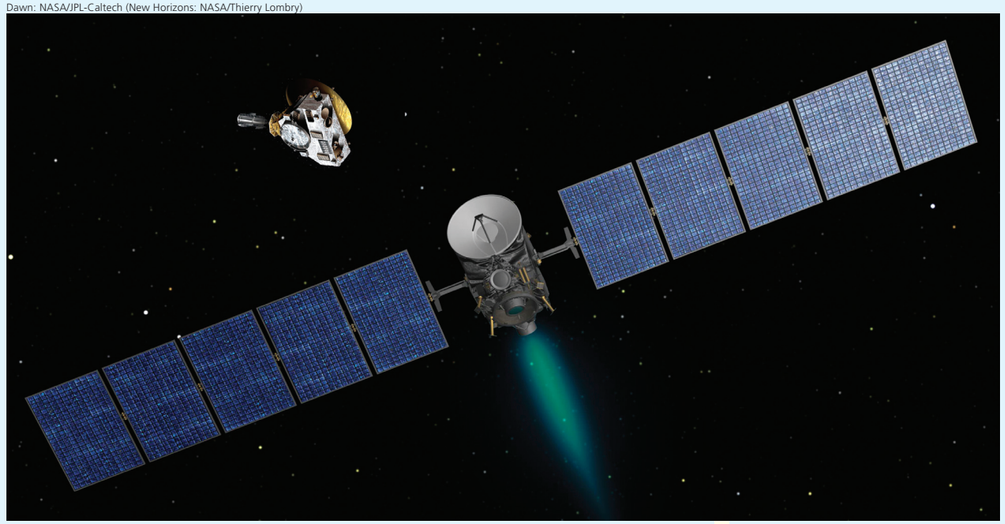
The magnesium sulfate is left behind on the surface as the water-ice it was dissolved in sublimates. This mixture, like the nitrogen-ice on Pluto, comes from a subsurface layer of briny ice that is exposed by impacts from small asteroids. There are over 130 of these bright spots scattered all over Ceres' surface. This indicates that this subsurface layer covers most of the planet. Dawn has observed a haze that fills Occator when the Sun is overhead. The haze is not visible when the Sun is low in Occator's sky.

Other studies from Dawn have shown that Ceres contains ammonia-rich clays. The existence of these ammonia-bearing clays implies that Ceres may have formed in an area of the young Solar System rich in ammonia and nitrogen. This would have been far out in the cold outer Solar System far away from the young Sun's heating. Even with all their differences, perhaps these two dwarf planets formed in the outer Solar System not too far from each other before they went their separate ways.

New Horizons is still sending back its close-encounter observations to Earth at the slow data rate required by its great distance and its lightweight communication equipment. Dawn is orbiting Ceres and it is also sending back new data. Both spacecraft still have much to tell us about the dwarf planets they have visited.

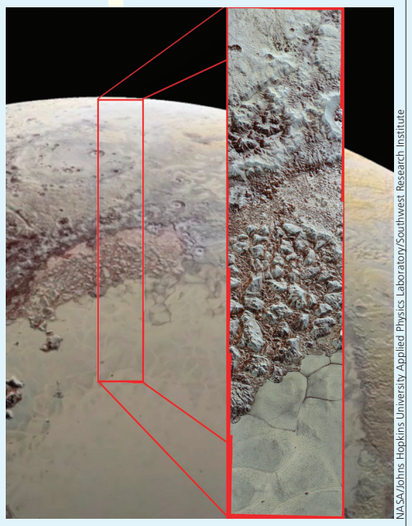
Berton Stevens is co-director of the Desert Moon Observatory (Minor Planet Center #448, www.morning-twilight.com/dm448*).*

Dawn: NASA/JPL-Caltech (New Horizons: NASA/Thierry Lombry)



Above right: The two spacecraft that explored dwarf planets in 2015: New Horizons is upper left; Dawn is in the lower center. The most obvious difference is the New Horizon's lack of solar panels since the sunlight is too weak in the outer Solar System to power the spacecraft. Instead, a radioisotope thermal generator (protruding from the left side of the spacecraft) provides power from the decay of plutonium dioxide.

Right: A close up of a fifty-mile-long strip on Pluto's surface starting at the edge of the badlands northwest of Sputnik Planum. Continuing downward, the image crosses the al-Idrisi Mountains onto the shoreline of the "heart" and into the nitrogen-ice plains at the bottom.



NASA/Johns Hopkins University Applied Physics Laboratory/Southwest Research Institute

Florida astronomy clubs setting up alongside KSC Visitor Complex Rocket Garden—Hubble Space Telescope's 25th anniversary celebration. Photo by BAS member Himanshu Saxena, 4/24/2015.

ASTRONOMY IN A ROCKET GARDEN

Ken Diller, Brevard Astronomical Society

A single, imposing rocket poised on a launch pad appears to us to represent the peak of technical advancement in space exploration and often leads us to imagine what the future has in store as we probe deeper into the universe. But for a moment, picture yourself having set up your telescope for an astronomy outreach event next to a showcase of rockets representing part of America's space history. There, amidst the rockets that propelled Earth-orbiting satellites, deep space probes, and even humans into a world most of us have only viewed through our telescopes, one can experience a flight of imagination, embarking on a journey towards your favorite celestial object.

Over the last few years, the **Kennedy Space Center (KSC) Visitor Complex** staff has invited the **Brevard Astronomical Society (BAS)**, located in Brevard County along the "Space Coast" of Florida, to support special events on three occasions: the space shuttle *Atlantis* rollover, the space shuttle *Atlantis* exhibit grand opening, and, most recently, the Hubble Space Telescope's 25th anniversary celebration.

The first event BAS supported was the space shuttle *Atlantis* rollover held on November 2, 2012, a perfectly clear, sunny day. Hundreds of visitors and former space shuttle workers witnessed the daytime, final rollover of the space shuttle *Atlantis* orbiter from the Vehicle Assembly Building to its new home 10 miles away, the *Atlantis* exhibit facility in the KSC Visitor Complex. In anticipation of a large crowd, BAS set up solar telescopes in **Space Florida's Exploration Park**, the location along the rollover pathway chosen by KSC officials to provide a festive half-day for close-up viewing of the shuttle *Atlantis*. Amongst all the awe and wonder of a space shuttle approaching, we found ourselves surrounded by a steady flow of visitors viewing our nearest star through club members' solar telescopes. On that day, the Sun exhibited spectacular activity with many sunspots and prominences visible. At the same time, our attention was occasionally—okay, often—diverted to watching the historic spacecraft. Soon thereafter, the shuttle continued with its last trek towards the KSC Visitor Complex.

After the last-ever flown space shuttle was fully integrated into the *Atlantis* exhibit about eight months later, BAS was invited for a second event—this time for the space shuttle *Atlantis* exhibit grand opening on the weekend of June 29–30, 2013. Although retired from active service, the orbiter's mission is to provide inspiration and education regarding the history of the shuttle program. In addition to key activities centered on the space shuttle *Atlantis* exhibition, visitors, employees, and several astronauts were treated to solar observing through club members' telescopes positioned just inside the main visitor entrance.

On the second day, Sunday, mid-afternoon, a pattern all-too-familiar to Florida amateur astronomers repeated—we scrambled to tear down our gear in a matter of minutes due a fast approaching thunderstorm. This is a skill we've developed and need to implement on occasion living in the lightning capital of the world. And let's hope we can always be that fast again when so threatened.

While BAS provided solar viewing at the two previous daytime events at Exploration Park and the KSC Visitor Complex, the third event involved nighttime observing alongside massive towering rockets—the **Rocket Garden**. This impressive display of vertical and horizontal spacefaring vehicles was our backdrop for the Hubble Space Telescope's 25th anniversary celebration on April 24, 2015. Off to the other side, a minute away, two full-scale replica solid rocket boosters with external tank greeted visitors to activities inside the shuttle *Atlantis* exhibit. While preparing for the event, the excitement level within BAS was at an all-time high. With KSC Visitor Complex staff requesting as many telescopes as possible, central Florida astronomy clubs, including **Brevard Astronomical Society**, **Kennedy Space Center Amateur Astronomers**, **Melbourne Astronomical Society**, **Central Florida Astronomical Society**, and the **Amateur Astronomy Club of Embry-Riddle Aeronautical University** came together to provide over 30 telescopes for a night of stargazing.

As many amateur astronomy clubs are aware, trying to reduce nearby lighting has its own frustrations during local public outreach events. In the case of the recent **Hubble Space Telescope's 25th** anniversary celebration, the KSC Visitor Complex staff, with advice from participating

Left: Shuttle Atlantis rollover at Exploration Park. Photo by BAS member Oscar Sifuentes, 11/2/2012. Center: Hubble Space Telescope's 25th anniversary celebration at KSC Visitor Complex—nighttime observing with shuttle Atlantis exhibit in background. Photo by BAS member Ken Diller, 4/24/2015. Right: Central Florida astronomy clubs join together to support Hubble Space Telescope's 25th anniversary celebration at KSC Visitor Complex. Photo by BAS member Ken Diller, 4/24/2015.

astronomy clubs, planned in advance to reduce lighting while keeping safety in mind. Several facility lights and path lamps were dimmed, and visitors, mainly the kids, were given small red stick-lights. In addition, the Kennedy Space Center and the Visitor Complex reside in what's generally considered a remote area of the county, overlapping the 140,000-acre **Merritt Island National Wildlife Refuge**. This combination of location and dimly lit rockets still allowed for reasonably dark skies.

Along with a favorably clear sky that night, and 500 guests eager to observe and learn about the night sky, the Hubble anniversary event proved to be another successful and most enjoyable experience involving local astronomy clubs and the KSC Visitor Complex. As KSC Visitor Complex consumer events specialist Ryan Beltzer and staff shouted "Thank you astronomers!," it culminated a night filled with guests, staff, and volunteers expressing appreciation for astronomy outreach support. BAS president John Small also acknowledged that BAS is committed to "sharing the wonders of the universe" with visitors to KSC and throughout the Florida space coast community as a whole.

While BAS also conducts various local astronomy outreach events supporting schools, scouts, and county parks, our proximity to the spaceport has allowed us the fortunate opportunity to support stargazing adventures at the KSC Visitor Complex. BAS extends its sincere thanks to the KSC Visitor Complex team for the pleasure of sharing views of the universe with Floridians and visitors alike in a unique setting, the Rocket Garden.

Shuttle Atlantis exhibit grand opening at KSC Visitor Complex—BAS solar observing. Photo by BAS member Darlene Saunders, 6/29/2013.

Shuttle Atlantis rollover at Exploration Park—BAS outreach coordinator Oscar Sifuentes explains characteristics of the Sun to a visitor. Photo by BAS member Thayne Saunders, 11/2/2012.

FATHOM

I was asked, "Why are you searching?"
I replied, "We are in the spall of night."
"Is there beauty where you seek?"
"There is much, but more than of the eye. Our spirit searches deep."
"Why do you like the dark more?"
"Another of this fathom we have none."
"What do you hope to find?"
"The knot untied."

Creation swords in cambered time
Where I hath herd
An aerie scene to glance
From Heaven to Earth
Amid some are night's dream
That will eye
The whole of darkness

The night sky contains great beauty, some of it visible. In a recent essay (*Sky & Telescope*, June 2014), Michael Deneen contrasts the concepts of beauty and sublimity. The former is something seen and sharable that many agree contains qualities of grandeur evoking a response immediate and gratifying. The sublime is different. He relates it as a personal reaction to something initially beyond what reason coolly comprehends, suddenly understood in an "aha" moment as a piece of the puzzle is seen to fit. We are sometimes surprised and encounter the unexpected, as happened when I viewed the galaxy M82 and noted a bright star within it. I became cautiously excited until I checked sources to find this "great new star" was reported more than a week earlier. Knowing it was a supernova made both it and its setting more interesting, and discovering it independently and understanding its role within a starburst galaxy moved it up on the sublimity scale, but was it more beautiful? As with art, background fosters interest and appreciation, and we're moved pique to peek.

NGC 5907; credit R. Jay Gabany (Blackbird Observatory)

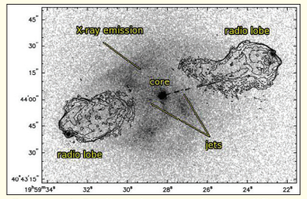
Deneen explains philosopher Immanuel Kant found sublimity in resolution between the unexpected and a revised mental paradigm established to incorporate it. We are shaken from minded mold, allowed and encouraged to observe the process of processing. The *American Heritage Dictionary* defines the sublime as having nobility and majesty, of high intellectual worth, and inspiring awe. The more I know about what I am seeking, the more thrilling it is to see, regardless of appearance. In what may be a subtle distinction, I may find sublimity without surprise or Kant's discoherence, as prior preparation enhances appreciation. The tension of anticipation is resolved in the clarity of confirmation. The sublime may also be conceptual, as I experienced during the announcement of evidence gathered at the South Pole ostensibly confirming tenets of inflation theory in tiny fluctuations of the cosmic microwave background radiation (CMBR). Though later found to be from a different cause, the swirling polarization patterns appeared not unlike a fingerprint of creation.

In this context, not everything beautiful is sublime. Nor, at our present ability to observe, is everything sublime beautiful. Only conceptual sublimity is available regarding ideas, relationships, objects at the limit of our largest instruments and data gathered in non-visible domains. In these we benefit from the imagination of astronomical artists. But there is another level of apprehension, beyond beauty and sublimity. It is an elegance that flows from the interconnectedness and association of things both visible and unseen.

In his book *The Shakespeare Wars* (Random House, 2006), Ron Rosenbaum discusses the concept of "bottomlessness." The polysemity (multiple meanings) of words, and figures of speech such as atanaclasis (multiple meanings of the same word used in one sentence) in Shakespeare create a complex web of ideas, sounds and potential meanings. The use of intricately woven language, themes, action and historical references forge a coherence that can appear to have no limit. To some, the detail, relatedness and density of information uncovered by scholars over the last four centuries have given an impression of a separate reality. On restudying passages within Shakespeare's sonnets and plays, an ever-greater number of associations and meanings, what Rosenbaum terms "resonances," can be found on each cycle of careful rereading. He and other adepts describe them as of a nature compounded with each pass, nearly uncountable. This is "what all the fuss is about" when people ask why Shakespeare is exceptional, different from all other authors. There are so many multiple meanings, multiple possible meanings, and intentional ambiguities ("sin aesthetic"?) in his writing that some feel no amount of study may ever exhaust them. Rosenbaum has a wonderful line to describe this: "the bottomless dimensionality of flickering linguistic resonances." Three things appear of such warrant: creation, Holy Writ, and what the Bard wholly writ.

In *A Midsummer Night's Dream* there lays a play within the play where the lines of a character named Bottom subvert the normal human senses, as he misquotes 1 Corinthians 2:9. He garbles a neurological condition called synesthesia, where people "hear" smells or "taste" sounds. Rosenbaum explains how this upside-down involuting implies a more profound truth: that the "tongue," or our ability to express, cannot conceive what our "heart" reports. Words and poetry are inadequate to relate these innermost truths and feelings. This is hinted at dyseponymically in his line, "I have had a most strange dream...that has no Bottom." He then suggests the name itself may have a deeper meaning, inferred from the following line in the New Testament verse, using the likely edition found in the author's family home (1557 Geneva): "For the Spirit searcheth all things, yea, the *bottom* of God's secrets" (my italics). Once discovered, this pattern of hidden meaning just outside the stream of dialogue engenders careful reading with heightened awareness, an osculation toward intent. In earlier times, certain bodies of water were so deep they promoted myths of having no bottom: Lake Baikal in Russia, and the "Bay of Portugal" in *As You Like It*, the latter a possible reference to the Atlantic Ocean. In his book, Rosenbaum offers that certain lines he calls "nodes" open countless possibilities, or "have no bottom," like the rabbit hole in "*Alice in Wonderland*," both illusion and allusion. All's well.

My greatest satisfaction at the eyepiece comes after studying how some thing's nature and relationships fit into the larger Cosmos, physically and contextually. As an example, a quasar can be viewed as a simple point of light, but is immensely more satisfying when understood as the output of a supermassive black hole's accretion at the center of a galaxy billions of light-years away. That appreciation is multiplied if I view recently discovered "green" objects such as Hanny's Voorwerp, "green pea" and "green bean" galaxies, and realize the output of their energizing nearby quasar recently shut off but is still ionizing the observed, distant structures. The experience is compounded once more knowing tidal streams, similar to those of NGC 5907 visible with my large reflector, are the theorized structures of Hanny's Voorwerp the quasar is affecting: a tidal structure dragged from IC 2497 by a nearby passing galaxy. Black holes, at the heart of quasars, suffuse the sky with manifestations as varied as the jets of Centaurus A and 3C 273, the microquasar SS433, radio galaxies such as Cygnus A, and even X-ray flares revealing the binary pair in galaxy SDSS J1201+3003. To spot these in my telescope while appreciating their "connectedness" evokes sublimity and elegance approaching entelechy.



Cygnus A Radio lobes, credit: modified from Wilson and others, ApJ 644: L9–L12, 2006

The supernova in M82 occurred as part of a starburst galaxy, one with increased stellar formation and rapid evolution of the largest stars, creating a high number of supernovae. Subsequent galactic winds removed large amounts of material from the galaxy, and could shut off future star formation. At a much earlier time on a smaller scale, the recently found structures called ultrafaint dwarf galaxies such as SEGUE 1 orbiting the Milky Way were similarly affected by the first large stars' ultraviolent ultraviolet outputs, early supernovae and the "reionization" of the Universe. These processes essentially removed all the dust and gas from these young, early galaxies, setting them adrift as dark-matter ghosts. One billion times less massive than the Milky Way, several of SEGUE 1's stars were visible to me.

Einstein Cross, credit: ESA/Hubble and NASA; Cosmic Eye galaxy, credit: Hubble Space Telescope; cosmic web, credit: NASA, ESA, and E. Hallman (University of Colorado, Boulder)

These are a few examples of what can be seen of an endless series of interconnecting structures. The elegance that combines and supersedes beauty and sublimity is something I experience most intensely at the eyepiece with preparation before observing. Retrospectively, the experience seems less profound. I am often asked, "Why do you observe?" This question has many motivators, but one relates to the modesty of visual impact from most objects. There are exceptions: the Moon, Saturn, Jupiter, certain comets, and bright nebulae and nearby galaxies seen through quality optics can be stunning. But how does viewing it add to the experience, or make it more real? There is the actual physical interaction, with photons striking our retinas starting the neural cascade to our brains and memories. There is the realization this light has traveled a very long way, for a very long time to reach us. We can occasionally discern objects we see are changing, as occurred when I saw a nearby brown dwarf several arcseconds away from a prior position on an image from the 1950s. Careful observation over decades could detect an increase in size of the Crab Nebula, and variable stars, supernovae, and visible gamma-ray bursts can change before our eyes in real time. Rarely, we are the first to see a thing and can add to the canon of human endeavor.

In his book, Rosenbaum discusses the analogy of participating in Shakespeare. The idea is through careful reading we may become a "player," similar to what a violinist such as Isaac Stern would do by playing Mozart, compared with simply listening to the same music. The analogy can be extended to astronomical observing. In seeing something, especially in making the effort were it difficult, faint, or exceptional, awareness is heightened and recollection enhanced. The final result is that our memories of the object and experience are reinforced as we value them for the effort needed to apprehend them, and they become more "real".

Rosenbaum describes nodes in the Poet's work or, aptly, "knots in the grain," where Shakespeare is following the line of the story and suddenly veers off on a tangent, seemingly unrelated to anything that came before or follows. These digressions appear random and disconnected, but on further consideration may be just the apposite. The scholar Stephen Booth considers them "ideational static," the weaving of near subconscious thought into the fabric of the story. As the natural world contains many apparently random events that add to its complexity and realness, so do these additions alter our subliminal perception of the play to pull us in and surround us with a more complex unreality. The draw for those curious about our existence is to understand how things work and fit together. It may be the guiding to a perception of these connections is what makes the small, "static" pieces of the puzzle dynamic, and us ecstatic.

At the beginning of Act 4 of *A Midsummer Night's Dream*, Duke Theseus ("The Zeus"?) introduces just such a series of words and thoughts about hunting and hounds, and we are taken aback by how out of place they seem. That is, until we see the possible acorn of purpose relating them to the process of writing and creating. His "hounds" are words, and the hunt like writing, trying to find prey methodically, "in slow pursuit." The metaphor may be extended to observing the Cosmos. His "cry more tunable" is words, or the community of amateur and professional astronomers, working together toward a goal, uncovering and explaining things previously hidden. The "mutual cry" may be the pleasure of a passion experienced within that community. Lastly, "mouths like bells" may represent beautiful words, ideas or astronomical discoveries, individually important, but having greater meaning as part of a harmonic whole: the Nobel pursuit of art, science, poetry, and literature. We may query at the Duke's Quercia to malappropriate Rosalind: "my affection has an unknown bottom, like the Bay of Hounds."

We live in a fortunate time where interplay between theory, observation, information, and equipment foster interest in our entangled Universe. We are the first generation able to appreciate subtleties of its shaping, interacting forces and structures and have opportunity to view their examples. The extremes of type I've been privileged to see through large reflectors are astounding: from brown dwarfs, to ancestral ultrafaint dwarf galaxies like SEGUE 1, to ultracompact dwarf galaxies in the Fornax and Virgo Clusters, to the farthest Abell Galaxy Cluster (851) and galaxies in the Hubble Deep and Ultra Deep Fields. Relativistic effects are observable in objects such as the gravitationally lensed quasar Einstein's Cross, the Cosmic Eye, and arcs of AGC 2667. We can even see dark matter's reign in galaxies colliding six billion light-years away, in cluster MACS J0025-1222. Unity's manifest is the whole to fathom the elegance of eternity.

Will that we seek
By loosed thought
The secret remains
That has no bottom
To disentangle
This elegant web
And leave one fathom less

Dave Tosteson
Chisago City, Minnesota
Minnesotadjtost1@gmail.com

FROM AROUND THE LEAGUE

Candidate Statement for the Office of the President of the Astronomical League: John Jardine Goss

Officers of the Astronomical League face three considerations when a subject pertinent to the League arises: Who is the League? What is the League? What can the Astronomical League do and what can't it do? Understanding these three points is essential in guiding this 16,000-member organization through our changing times. And changing, they are.

Club attendance, go-to scopes, CCD imaging and processing, outreach, light pollution, declining youth involvement, large-aperture telescopes, wide-field eyepieces, societal changes, and the great and powerful Internet. These topics—some of which weren't important factors twenty years ago—certainly affect amateur astronomy today.

Volunteerism, the force that gets things done, has always been at the heart of the Astronomical League. Without people stepping forward, all League operations and projects would quickly come to a screeching halt. League officers are very lucky to have such a knowledgeable and dedicated team to help smoothly run the many aspects of the organization. Understanding their role is key to the continued success of the Astronomical League.

Over the past fifteen years, I've had the pleasure of working with many of those volunteers while I have served the Astronomical League in various capacities: Chair of the Mid-East Region, Astronomical League Secretary, Dark-Sky Advocate Club Administrator, interim *Reflector* Editor, *Reflector* Advertising Representative, Awards Chair, ALCon Co-Chair, Astronomical League Vice President, and currently, Astronomical League President. With your support, I will continue my efforts to bring amateur astronomy to the League membership as President of your Astronomical League.

League Regional Chairs

GLRAL (Great Lakes Region): Ron Whitehead, *executivesecretary@astroleague.org*
MARS (Mountain Astronomical Research Section): Wayne Green, *dxwayne@gmail.com*
MERAL (Mid-East Region): Terry Trees, *treest@comcast.net*
MSRAL (Mid-States Region): James Small, *webmaster@slasonline.org*
NCRAL (North-Central Region): Gerry Kocken, *gerryk@kockenwi.com*
NERAL (Northeast Region): Maryann Arrien, *Arrien@optonline.net*
NWRAL (Northwest Region): Gene Dietzen, *gene.dietzen@gmail.com*
SERAL (Southeast Region): Richard Schmude, *schmude@gordonstate.edu*
SWRAL (Southwest Region): David Moody, *bicparker@mac.com*
WRAL (Western Region): Wayne Johnson, *mrgalaxy@juno.com*

Candidate Statement for the Office of the Executive Secretary of the Astronomical League: Ron J. Kramer

In 2011, I read a small piece in the *Reflector*, which was seeking an assistant editor. At the time I was a semi-retired book publisher and active in local astronomical activities. Having been a member of the Astronomical League for several years (through affiliation with the Astronomical Society of Las Cruces), this sounded like a good way to get more involved in my hobby and submitted a résumé. A few telephone interviews later, the offer was made and eagerly accepted. The last thing on my mind was what lay ahead in the near future.

As a member of the ASLC, I have chaired various programs, including outreach, observatory, loaner telescope, and apparel; served as director and president; and was the editor of their monthly newsletter, the *High Desert Observer*.

In the past several years, I became the *Reflector*'s editor, chaired ALCon 2015, and have been involved in several other League activities. Many new friends and colleagues have been made along the way, and I believe it is time to consider further opportunities within the League that will aid in our future growth and success.

To that end, I respectfully submit my name as a candidate for the position of Astronomical League Executive Secretary.

Having worked closely with our national officers, members, and affiliated societies for several years, I am aware of the needs and desires of the League, as well as the responsibilities of the executive secretary.

Candidate Statement for the Office of the Vice President of the Astronomical League: Bill Bogardus

Through the last year and a half, it has been a wonderful opportunity to be a part of the leadership of the League as **vice president**. It's been a pleasure and a privilege to work with the other officers and league participants. The League is a valuable asset and I would like to be able to continue in that capacity.

Outreach has been important to the AL and for me, a rewarding endeavor that dates back several decades. This year I completed the hours to earn the **Master Outreach Award**. My college studies have included several astronomy courses and throughout my teaching career I've enjoyed teaching astronomy classes.

My astronomical interest has been a journey though AL Observing Programs, earning the title of **Master Observer** (No. 53). Personal adventures and travels have been to observe eclipses all over the world, trips to the Southern Hemisphere skies, star parties and conventions all over the U.S. and Canada.

Three clubs have contributed to my experience: the RASC Ottawa Chapter, the Amateur Observers' Society of New York, and the Custer Institute. I've held several offices, including **president**, in AOS and Custer. That involvement and leadership included serving as **ALCon 2009 Chair**.

Retiring from a career that included being a secondary school principal, science department chair, and physics teacher, I was elected as **League secretary** in 2009. In 2013 I was awarded the League's **G.R. Wright Award for Outstanding Service to Astronomy**. Now, I am asking for your support to continue that service as vice president.

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

Through the vision of the Horkheimer Charitable Fund, the Astronomical League is again offering a free Library Telescope to a lucky Astronomical League club in each of the ten AL regions. We had 33 entries in last year's drawing!

The Library Telescope consists of an Orion 4.5-inch StarBlast Dobsonian (or equivalent) and a Celestron 8–24 mm zoom eyepiece (or equivalent), along with a nameplate commemorating the late Jack Horkheimer. The value of this opportunity is approximately $300; the potential of the program is enormous.

The Library Telescope Program was initiated 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*.

Telescope presentation to Temecula Astronomical Society

Secretary Leigh Anne presents a telescope to programmer Cyndi Randolph.

The winning entry for each region will be drawn at the annual Astronomical League Business meeting held at ALCon 2016 in Arlington, Virginia, on about August 13. Only one club per region will win, for a total of ten telescope–eyepiece combinations being presented. The telescope, eyepiece, and accompanying commemorative plate will be mailed to the winning clubs 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 may be used at some point as promotional material.

Submit your completed entry form, found at*www.astroleague.org/content/astronomical-league-giving-away-ten-library-telescopes*, so that the Astronomical League national office receives it by July 30, 2016. If mailed, the entry must be postmarked no later than July 30, 2016.

Astronomical League Observing Programs

Active Galactic Nuclei Program
Advanced Binocular Double Star Observing Program
Analemma Observing Program
Arp Peculiar Galaxies Northern Observing Program
Arp Peculiar Galaxies Southern Observing Program
Asterism Observing Program
Asteroid Observing Program
Binocular Double Star Observing Program
Binocular Messier Observing Program
Binocular Variable Star Observing Program
Bright Nebula Observing Program
Caldwell Observing Program
Carbon Star Observing Program
Comet Observing Program
Constellation Hunter Observing Program (Northern Skies)
Constellation Hunter Observing Program (Southern Skies)
Dark Nebulae Observing Program
Dark Sky Advocate Observing Award
Deep Sky Binocular Observing Program
Double Star Observing Program
Earth Orbiting Satellite Observing Program (EOSOC)
Flat Galaxy Observing Program
Galaxy Groups & Clusters Observing Program
Galileo Observing Program
Globular Cluster Observing Program
Herschel 400 Observing Program
Herschel II Observing Program
Hydrogen Alpha Solar Observing Program
Local Galaxy Group & Galactic Neighborhood Observing Program
Lunar Observing Program
Lunar II Observing Program
Master Observer Award
Messier Observing Program
Meteor Observing Program
NEO Observing Program
Occultation Observing Program
Open Cluster Observing Program
Outreach Observing Award
Planetary Nebula Observing Program
Planetary Transit Special Observing Award
Radio Astronomy Observing Program
Sketching Observing Award
Sky Puppy Observing Program
Solar System Observing Program
Southern Skies Binocular Observing Program
Southern Sky Telescopic Observing Program
Stellar Evolution Observing Program
Sunspotters Observing Program
Two in the View Observing Program
Universe Sampler Observing Program
Urban Observing Program
Variable Star Observing Program

Can't see the Milky Way? The Urban Observing Program is for you!

It's a crystal clear night and you want to observe. However, you live in a city and you don't have the time or energy to drive to your favorite dark sky location. So—how about your backyard?The Urban Astronomy Observing Program was established to bring amateur astronomy back to the cities, back to those areas that are affected by heavy light pollution. Amateur astronomy used to be called "backyard astronomy." But as cities grew, so did light pollution, and amateur astronomers were forced to drive further and further out into the country to escape the sky glow from light pollution. The Urban Astronomy Observing Program was created to allow those who want to enjoy the wonders of the heavens from the comfort of their homes to do so, and to maximize the observing experience despite the presence of heavy light pollution.In addition to the Moon and planets, a plethora of deep sky objects can be enjoyed under poor urban skies, and it only takes a small- to medium-sized telescope to enjoy them. This program will introduce you to them and the pleasures of convenient, backyard observing.

Terry Trees, PhD
Urban Observing Program Coordinator

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.

Equipment donations are another important way of helping your Astronomical League function more effectively. The League's National Office currently is in need of a color laser printer with a high-end duty cycle. Please contact the League Office for additional information call 816-DEEP SKY; email: *leagueoffice@astroleague.org*.

ADVANCED BINOCULAR DOUBLE STAR PROGRAM
TUNING YOUR BINO FOR PEAK PERFORMANCE

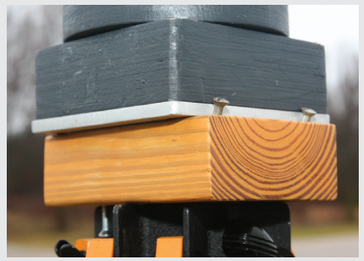
Story and photos by Dick Francini

Before qualifying for the **Advanced Binocular Double Star Program** award, it's a requirement that you complete the original Binocular Double Star Program. The original program is a very good way to get experience observing double stars through binoculars before you move on to the more challenging targets in the Advanced program. These two programs give you extensive lists of targets that are quite different from those we typically observe with binoculars. I have always enjoyed telescopic double star observing, but prior to doing these programs, it would never have occurred to me to try observing double stars with binoculars. Both programs were very enjoyable, well-conceived, and well organized.

When I sent my Advanced log and notes to Bob Kerr, the program's coordinator, he suggested I share my thoughts with other members who might benefit from them.

Both binocular double star programs consist of a nice mix of double and multiple stars of varying magnitudes, colors, and amounts of separation. The main difference between the two programs is that the Advanced program requires you to split much tighter doubles than the original. Where handheld binos may be an option in the original program, they will not be in the Advanced program. You must have a steady mount because the slightest vibration will cause blurring on close pairs. My first attempts at these more exacting observations caused me to immediately question my binoculars' performance, as they were just not getting the job done. Instability in the mount was causing significant issues in my ability to split many of the tight pairs. I went to work fixing these issues. First, I changed the tripod legs. I had a very old set of tripod legs that had been hanging around my basement for 15 years, just waiting for the chance to be used again. They turned out to be much more stable than the original legs. My next problem was that the connecting point between my parallelogram mount and the tripod was not as flat as it needed to be. Two high spots were causing a teeter-totter swaying effect (one of the high points was the leveling bubble). I cut a block of wood and made cutouts on both sides to eliminate the high spots, making for a nice flush connection point.

Machined block of wood



Binocular showing wooden block in place

The two screws on each side of the block keep it from moving when I turn the binoculars. This was a cheap and simple fix. Hopefully, your equipment is better than mine and will require no tinkering or improvements at all. I should also mention that wind will rock your binoculars enough to degrade your view of the tighter doubles, so make every attempt to observe these from a spot where the wind is blocked.

My photos show the full binocular setup, including the more stable tripod feet, the block I added for stability, and a close up of the binos themselves. Note that I have also added dew/light baffles to the objective lenses, a red dot finder, and dew heaters to the eyepieces. These are all helpful as I find dewing up is a large problem with binoculars. The dew heaters are from Tech 2000 and can be run off a 9-volt battery, or you can buy a cord with snaps on one end and a cigarette lighter plug on the other to connect to a larger 12-volt battery (this is the preferred method if you are planning a longer session).

I used 20x80 binos, and, in my opinion, 20x80s or 15x80s are probably needed for the pairs with the closest separations. Binoculars with an aperture even larger than my 20x80s should make the observations somewhat easier than mine. You are required to make 50 observations from a list of 100, so I suspect it would be possible to complete the program with smaller binoculars if you skipped the tightest pairs. I ended up doing 70 pairs with the tightest being only 10 arcseconds apart (STF 1258 in Ursa Major, 7.5- and 7.9-magnitude stars). Who would have ever guessed you could split a double star this tight with binoculars? I believe there are four doubles with a 10-arcsecond separation in the program; these are its tightest pairs.

The level of difficulty in successfully splitting a particular pair is based on two factors: how tight they are, such as my example of STF 1258 above at 10 arcseconds, and the magnitude difference between the pair. As the magnitude difference increases, the difficulty level increases dramatically. One example is STF 60 AB in Cassiopeia, with a 13-arcsecond separation and a huge 3.9 magnitudes separating the components (3.5- and 7.4-magnitude stars). Under conditions of excellent seeing, the two stars appeared connected or elongated but the dimmer star was only visible part of the time, popping in only during moments of exceptional seeing. This was probably the toughest double I observed, and it took quite a few tries to achieve. I'm actually very surprised I got this one! Another example is triple star STF 2816 ACD in Cepheus, with the separation of the closest two stars being 12 arcseconds and with a 1.8-magnitude difference. This was observed on the same night of excellent seeing, the pair also appearing mostly elongated but visible all the time.

I can't stress enough how important it is to have good to excellent seeing conditions in order to split some of the tighter pairs, which I think is the essence of doing this program. I quickly learned I needed to wait for a better night if seeing was average or worse. Unfortunately, we don't have excellent seeing conditions in Wisconsin very often, so when these conditions occurred, I felt I had to take full advantage and observe as many pairs as possible that night.

However, the program does not require an especially dark sky. I did all my observations from home, a typical suburban site with Sky Quality Meter readings from 19.5 to 20.3 magnitudes per square arcsecond (5.1 to 5.7 limiting magnitude). I really appreciate AL programs that do not require a road trip to a darker location!

I also had some issues getting proper fine focus with my binoculars. Normally, when you're scanning wide fields with binoculars, close focus tolerances aren't that important. These double stars require you to be more precise; tack-sharp focus is extremely important to success. To me, focusing binoculars is not an exact science, more like a series of small incremental changes as I "sneak up" on the best focus point. I usually start using the center focus knob (both barrels) with one eye and adjust the single barrel focus with the other eye. I do this procedure once or twice more, and then do the same progression over again with both eyes open. Hopefully, by that time, I'm very close to the best focus. But if seeing is poor, I can rarely get the focus exactly where I want it.

Binocular and parallelogram on tripod

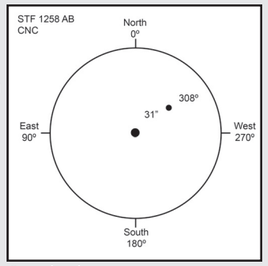
When I first started the program, I would typically fine focus on an open cluster and then go to my first double star. I would look at the object and think the view could be improved and fiddle with the focus. This almost always failed. Trying to fine tune on the double star induced vibration, which then needed to subside before I could tell if I improved the view or made it worse. Usually, I just made matters worse, and then to further complicate things, I could not return to the original better focus point. This caused some real frustration. I ended up coming up with a new strategy which worked quite well: I would fine focus on an open cluster and then fine tune on a double star I knew I could split, preferably one from the program that I had previously split. From this point on, I was not allowed to touch the focus. I would assume this was the best focus I could achieve and went to a new double star to see if I could split it using this preset focus setting. Sometimes on close pairs I would have to wait for brief moments of better seeing before it would split. If I could not split it at all, I marked it as one I would have to come back to when seeing conditions were better and moved on to a new target star. This worked very well, speeding up the time it took to do individual observations and reducing the frustration factor considerably, providing more time at the eyepieces and less time fooling around with the focus knobs. I marked this "best" focus point on the focus knobs of the binoculars so I could return to it at a later date.

Binocular with dew heater, light baffles, red dot finder

I decided to try some of these doubles under a full moon, just to see if this was possible. Doesn't it seem that it's always clear around a full moon with nothing to observe? As long as you stick to the brighter pairs, a bright moon will not stop you from seeing and splitting these doubles. It's nice to have objects you can observe on a moonlit night, although the star hops were quite a bit longer than normal. Since you'll need some kind of star map to find these fainter pairs, I recommend the Cambridge Double Star Atlas as a resource; it was quite helpful, and, in my opinion, it is the best double star atlas available.

The position angle (PA) of these double stars is an important factor in the Advanced program, and this is explained on the program's link on the AL web site. I estimated each position angle on my own before looking up the correct PA in the program, as I did not want "averted imagination" to come into play. When my PA estimate and the program PA agreed, this confirmed I was seeing the double in its correct orientation. Occasionally, I would be 180 degrees off, but I was still seeing the correct orientation of the primary and secondary stars. The brighter star of the pair is almost always designated as the primary, but when two stars are very close in magnitude, it's sometimes difficult to decide which one is brighter, thus resulting in a 180-degree error if you pick the wrong one.

You are required to plot three pairs of double stars, which are simple drawings of the stars' positions on the sky. A plot positions west to the right and north 90 degrees counterclockwise from that. In your binocular field, north will also be 90 degrees counterclockwise from west; west will be the direction the stars are disappearing. This makes it easy to match the orientation in your binocular view with the orientation on your three plots, where north is always at the top. I found the plots very easy to do and, while not required, logged all 70 of my observations using them. A picture is worth a thousand words, right?



Sample plot

The Advanced program can be very challenging under average to poor seeing conditions, but it transforms into something quite different with well-tuned binoculars under skies with excellent seeing conditions. Those difficult tight pairs become simply beautiful and spectacular tiny points of light that seem to be almost touching (or in some cases they were touching). There are lots of "wow" objects on the list—a very interesting and enjoyable "new" way to look at double stars. It still amazes me that it's possible to split pairs this tight with binoculars! I highly recommend these programs! And if you've already completed the original program, by all means tighten up those binos and move on to the Advanced program. As an added bonus, you'll likely end up with binoculars that you'll find work better on all your night sky targets.

Enjoy the program, and clear skies!

Dick Francini is a member of the Neville Public Museum Astronomical Society (Green Bay, Wisconsin) and is AL Master Observer No. 56; dfrancinipkg@new.rr.com.

INTERNATIONAL OBSERVE THE MOON NIGHT: AN OUTREACH OPPORTUNITY THIS OCTOBER

COSMOLARIUM CASTILLO DE HORNOS DE SEGURA, ANDALUSIA, SPAIN, 2015

International Observe the Moon Night (InOMN) is a worldwide, public celebration of lunar science and exploration held annually since 2010. One day each year, everyone on Earth is invited to observe and learn about the Moon together, and to celebrate the cultural and personal connections we all have with Earth's nearest neighbor. The seventh annual International Observe the Moon Night is October 8, 2016. Go look at the Moon, and invite your family, friends, and community to join you!

Each year, thousands of people participate in InOMN at museums, planetaria, schools, universities, observatories, parks, businesses, and backyards around the world. Any astronomy club, interested group, or individual, anywhere, can host an InOMN event: events range from small family gatherings to community events drawing hundreds of visitors. InOMN events do not need to follow a set agenda: hosts can tailor their events to match their available resources and expertise, and the needs and interests of their communities.

Though telescopes and binoculars are not required to view the Moon, they add to the observing experience. Many astronomy clubs around the world host InOMN events, but if you or your local club would rather not lead an event, consider partnering. Libraries, schools, museums, and other organizations eagerly partner with astronomy clubs to provide telescopes and observing expertise at their InOMN events.

The Moon is a gateway to the Solar System and beyond, so hosts are encouraged to also observe and discuss planets and other celestial objects and events. InOMN 2016 provides a perfect opportunity to highlight another Moon-related event not to be missed in North America the following summer: the total solar eclipse of August 21, 2017.

Participating in InOMN can help astronomy clubs and other organizations reach new and underserved audiences, build public interest and confidence in astronomical observing, and build and sustain public interest in space exploration.

The InOMN website (*observethemoonnight.org*) has resources to help event hosts, including step-by-step suggestions for hosting an InOMN event, customizable flyers, presentation materials, suggestions for activities, certificates of participation, evaluation materials, and links to information about lunar science and exploration as well as to connect with lunar enthusiasts around the world through social media. The InOMN team also offers professional development for hosts, highlighting NASA lunar and planetary science research that hosts can share with their visitors.

The InOMN evaluation team holds training sessions before and after InOMN to help hosts effectively evaluate their events. There is a common baseline survey for hosts and participants. The InOMN evaluation team can also create customized surveys with additional specific questions for even more feedback about their events,

Continued on page 27

By Andrea Jones
Director, International Observe the Moon Night

Lunar enthusiasts of all ages can participate in International Observe the Moon Night. (credit: NASA Goddard/Bill Hrybyk, Greenbelt, Maryland, 2014)

Anyone, anywhere, can host an InOMN event. You can see the Moon from parking lots, open fields, and sidewalks around the world. (credit: Galileo Science Centre, Tamil Nadu, India, 2015)

A Query

We received a letter from long-time member Gus Johnson of the Cumberland (Maryland) Astronomy Club regarding the back cover image of the December issue of the *Reflector*. Excerpts are below; the original letter is dated March 20, 2016. Note that Mr. Johnson is an experienced observer, and the discoverer of a supernova in M100, SN 1979C (*Sky & Telescope*, June 1979, p. 540, and July 1979, p. 12 and 90).

The back cover of the December 2015 issue has a curiosity: a bright star where none should be. Turn the magazine 45 degrees clockwise, find the square of Pegasus and go from Beta (northwest corner) south past Alpha and an approximate equal distance further, going slightly to the left (east). At first I thought it might be Saturn; it is yellowish, but Saturn is far to the east near Beta Scorpii. Under a magnifying glass, the bright object seemed to be Gamma Piscium, normally 3.85 magnitude, but in the photograph it is about equal to Alpha Pegasi at 2.57 magnitude. So, if it is indeed Gamma Piscium, it is about three times as bright as normal. I reported it to the AAVSO a few days ago.

Now, an odd coincidence. I work for the Deep Creek Lake State Park in western Maryland. Among our volunteers there is a 16-year-old girl interested in astronomy, so I decided to give her one of my older issues of Sky & Telescope *(August 1976). On page 91 of that issue, there was a note about a similar observation to mine; Enif (Epsilon Pegasi) had been seen to brighten to equal Altair for a few minutes on September 26, 1972. Similar to Gamma Piscium, it is too bright overall for a solar-type flare to have a noticeable effect, while red dwarf flare stars can brighten significantly. UV Ceti has risen 5+ magnitudes! I wondered if an unknown flare star is in the same line-of-sight as the brighter star.*

We then contacted the photographer of the image, Wayne Suggs, and received this comment:

I honestly don't know what to say. I didn't add any stars or any light to the image. I just gave a talk last night on astrophotography and one of my points was never to add stars or put the sky into a different context because someone will call you on it. This is interesting to me and I'm not sure why it's brighter.

So, we now ask our readers if they can shed any light on this. Please send comments/observations to the editor at *rjipublishing@aol.com*.

TITLE PHOTOGRAPH: M31; COMPLIMENTS OF TOM S. MARTINEZ, ASKC

August 21, 2017, Solar Eclipse

On August 21, 2017, there will be a total eclipse of the Sun visible from the United States (and only the United States!) The path of what is being called the "all-American" total eclipse is only about 60 miles wide and goes from a beach in Oregon to a beach in South Carolina, crossing the country diagonally.

The partial eclipse will be visible to 500 million people in the other parts of the U.S. and North America.

The National Science Teachers Association (NSTA) is making available a popular-level introduction to help explain the eclipse, and how to view it, to students and the public. The free 8-page booklet is available as a PDF file at *nsta.org/publications/press/extras/files/solarscience/SolarScienceInsert.pdf*.

The eclipse information comes from a new book for educators, titled *Solar Science,* which includes 45 hands-on learning experiences (and lots of background information) about the Sun, the Moon, the sky, the calendar, the seasons, and eclipses. You can see the full table of contents and some sample activities at *static.nsta.org/files/PB403Xweb.pdf*.

A revised and updated bibliography on eclipses in general, and the 2017 eclipse in particular, (with sources of maps, trips, observing sites, weather predictions, etc.) is now available at *astrosociety.org/eclipse*. ✵

—By Bill McDonald

Gallery

This image of a gigantic sunspot was taken on April 11, 2016. This sunspot could swallow our entire Earth. Bob Runyan took a chance and combined 2x and 1.9x Barlow lenses to capture this image using his ZWO ASI120MM and SolarMax II 60 setup. This image is from the best 20% of 1000 frames and was processed using Autostakkert!, RegiStax, and Photoshop. It was taken from his AstroAsylum dome observatory in Shelton, Nebraska. Runyan is a member of Platte Valley Astronomical Observers and the Astronomical League.

TITLE PHOTO: NGC 2244; BRIAN KIMBALL

Al Marcella, a member of the Astronomical Society of Eastern Missouri, recently visited the Northwest Territories, Canada, and was fortunate to have witnessed one of nature's most beautiful events: the Northern Lights. He used a Nikon D300 with a Nikon 12–24 mm f/4.5 lens set at 12 mm to make this 40-second exposure on a rather cold night (–38°C).

The first time we see a celestial event is always a great experience. Garvis DiLorio of the Mohawk Valley Astronomical Society was determined to have his first lunar eclipse etched in stone (or at least photons). This montage of 12 black-and-white images taken during various stages of the eclipse, plus a color image of totality, shows great creativity. Garvis captured the event from his backyard in Upstate New York on September 27, 2015, with a Stellarvue SV80S Lomo refractor and a ZWO 174MM camera mounted on a Celestron Advanced VX mount. The images were taken 10 minutes apart and he stacked the best 85% of captured frames. Post-processing was done in Photoshop CC. Totality was captured with a Nikon D7100 and a 70–200 mm f/2.8 VR II lens.

The Pelican Nebula (IC 5070) has been a target for many astrophotographers. This image, by Clement Elechi of the Roanoke Valley Astronomical Society, was taken on October 16, 2015. He used a Canon 1000D with an IDAS LPS-D1-EOS light pollution filter mounted to a Celestron Onyx EDF telescope with an Astrotech 2-inch field-flattener on a Losmandy G11 mount.

Moon viewing at Seagrave Memorial Observatory (credit: Jim Hendrickson, Seagrave Memorial Observatory, Rhode Island, 2015)

and can help hosts determine which format of survey delivery is likely to work best in your event setting. Post-event training will help interested hosts analyze evaluation data specific to their sites. Through host and participant evaluation, the InOMN team seeks to better understand and meet the needs of InOMN participants, and to improve the resources we provide.

InOMN is usually held in the fall, when the Moon is around first quarter. Fall in the Northern Hemisphere is generally a good time for InOMN, because of school schedules and the weather, and a first quarter Moon is visible in the afternoon and evening, a convenient time for most hosts and participants. Furthermore, the best observing is typically along the dusk/dawn terminator, where shadows are the longest, not at full Moon. The InOMN team creates a new Moon map each year showing the exact phase it will be on InOMN, and highlighting a few features of interest with high-resolution images and captions. While hosts are encouraged to hold InOMN events on the announced date, we understand that this isn't always possible—InOMN materials are editable so that hosts can change the date and add the location of their events.

The InOMN Coordinating Committee is led by NASA's Lunar Reconnaissance Orbiter Education and Communications Team, with representatives from NASA's Solar System Exploration Research Virtual Institute, the Lunar and Planetary Institute, the Planetary Science Institute, the Astronomical Society of the Pacific, and CosmoQuest. Our partners include the Science Festival Alliance and Google Lunar X Prize. To learn more about International Observe the Moon Night, register your InOMN event, and access InOMN resources, visit *observethemoonnight.org*.

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. 11, Dick Francini, Neville Public Museum Astronomical Society; No. 12, Keith Davidson, Member-at-Large; No. 13, John R. "Sean" Sayers, Member-at-Large; No. 14, George J. Robinson, Member-at-Large

Arp Peculiar Galaxies Northern Observing Program
No. 84-V, Alan Snook, Member-at-Large; No. 32-C, Stephen A. Tzikas, Northern Virginia Astronomy Club; No. 33-C, Dave Hockenberry, Chester County Astronomical Society

Asterism Observing Program
No. 32, Vincent Bournique, Member-at-Large; No. 33, Nina Chevalier, San Antonio League of Sidewalk Astronomers

Binocular Double Star Observing Program
No. 96, Robert Pitt, Birmingham Astronomical Society; No. 97, Michael Overacker, Star City Astronomy Network; No. 98, Nancy Rauschenberg, Minnesota Astronomical Society; No. 99, John E. Glover, Northern Virginia Astronomy Club; No. 100, Michael C. Neal, Echo Ridge Astronomical Society; No. 101, Seth Watts, Member-at-Large; No. 102, Michael Blase, Tulare Astronomical Association; No. 103, Jack Estes, all 120 objects, Austin Astronomical Society; No. 104, Mark Simonson, Everett Astronomical Society; No. 105, Mark Wainright, Member-at-Large; No. 106, Jeff Oaster, Delaware Valley Amateur Astronomers

Binocular Messier Observing Program
No. 1078, Mike Wepel, Oklahoma City Astronomy Club; No. 1079, John E. Glover, Northern Virginia Astronomy Club; No. 1080, Marilyn Perry, Member-at-Large; No. 1081, Kathy Weaver, Hill Country Astronomers; No. 1082, David Furry, Southern Colorado Astronomical Society

Binocular Variable Star Observing Program
No. 6, Michael A. Hotka, Longmont Astronomical Society; No. 7, Jim Sykes, Olympic Astronomical Society; No. 8, Nora Jean Chetnik, Member-at-Large

Bright Nebula Observing Program
No. 10, Dan Crowson, Astronomical Society of Eastern Missouri

Carbon Star Observing Program
No. 66, George J. Robinson, Member-at-Large

Comet Observing Program
No. 84, John Laning, Silver, Member-at-Large

Constellation Hunter Observing Program (Northern Skies)
No. 168, Mike Neal, Echo Ridge Astronomical Society; No. 169, Coy Wagoner, Shreveport–Bossier Astronomical Society; No. 170, Prashant Viadya, Kern Astronomical Society; No. 171, James Zappa, Member-at-Large

Dark Sky Advocate Observing Award
Honorary, David Crawford; Honorary, Bob Gent; Honorary, Tim Hunter; No. 8, James Zappa, Member-at-Large

Deep Sky Binocular Observing Program
No. 375, Coy Wagoner, Shreveport–Bossier Astronomical Society; No. 376, Mike Neal, Echo Ridge Astronomical Society; No. 377, David Whalen, Atlanta Astronomy Club; No. 378, Gordon Schaefering, Albuquerque Astronomical Society

Double Star Observing Program
No. 571, Paul Harrington, Member-at-Large; No. 572, Dan Thoman, Atlanta Astronomy Club; No. 573, Forrest Holly, Tucson Amateur Astronomical Association; No. 574, Mark Bailey, Member-at-Large; No. 575, Marilyn Perry, Member-at-Large; No. 576, Mark Jones, Saint Louis Astronomical Society; No. 577, Jim Fordice, Albuquerque Astronomical Society; No. 578, Larry Elsom, Member-at-Large; No. 579, Paul Sanders, Kansas Astronomical Observers; No. 580, Dee Friesen, Albuquerque Astronomical Society; No. 581, Steve Bardus, Member-at-Large

Earth Orbiting Satellite Observing Program (EOSOC)
No. 34, Mike Stewart, Regular, Astronomical Society of Kansas City

Globular Cluster Observing Program
No. 279, Dee Friesen, Albuquerque Astronomical Society; No. 280, Christian Weis, Tucson Amateur Astronomy Association; No. 281, Rob Esson, Prescott Astronomy Club; No. 282, William Kowalczyk, Jr., Houston Astronomical Society; No. 283, John Skillicorn, Tucson Amateur Astronomy Association; No. 284-I, Dan Crowson, Astronomical Society of Eastern Missouri

Herschel 400 Observing Program
No. 551, William Kowalczyk, Houston Astronomical Society; No. 552, Ed Halash, Ford Amateur Astronomy Club; No. 553, John Dorio, Texas Astronomical Society; No. 554, David Whalen, Atlanta Astronomy Club; No. 555, Bernie Poskus, Denver Astronomical Society; No. 556, Mark L. Spearman, Brazos Valley Astronomy Club

Herschel II Observing Program
No. 98, Roy R. Troxel, Member-at-Large

Lunar Observing Program
No. 939, Bev Novak, Northeast Nebraska Astronomy Club; No. 940, Gary Fugman, Northeast Nebraska Astronomy Club; No. 941, Roland Albers, Tri-Valley Stargazers; No. 942, Seth Watts, Member-at-Large; No. 943, Edgar G. Fischer, Albuquerque Astronomical Society; No. 944, Steve Coltrin, Rio Rancho Astronomical Society; No. 945, James Granahan, Northern Virginia Astronomy Club; No. 946, John Laning, Member-at-Large; No. 947, Kevin Shackleton, Member-at-Large

Lunar II Observing Program
No. 71, John Goss, Roanoke Valley Astronomical Society

Master Observer Award
No. 175, Elaine B. Osborne, Echo Ridge Astronomical Society; No. 176, Vincent M. Bournique, Member-at-Large; No. 177, Michael Overacker, Star City Astronomy Network; No. 178, Ken Boquist, Popular Astronomy Club; No. 179, Kevin C. Carr, Member-at-Large; No. 180, Ken Prior, Oklahoma City Astronomy Club; No. 181, Grant Mills, Member-at-Large

Messier Observing Program
No. 2719, John Richard Laning, Honorary, Member-at-Large; No. 2720, William K. Kowalczyk, Honorary, Houston Astronomical Society; No. 2721, Hector Franceschini, Regular, Central Texas Astronomical Society; No. 2722, Jack Mellott, Honorary, Charlottesville Astronomical Society; No. 2723, James C. Sanders, Honorary, Smoky Mountain Astronomical Society; No. 2724, Steve Coltrin, Regular, Rio Rancho Astronomical Society; No. 2725, Bryce Heiniger, Regular, Twin City Amateur Astronomers; No. 2726, John Skillicorn, Regular, Tucson Amateur Astronomy Association

Meteor Observing Program
No. 176, Si Simonson, 12 hours, Fort Worth Astronomical Society; No. 179, Coy Wagoner, 12 hours, Shreveport–Bossier Astronomical Society

Open Cluster Observing Program
No. 73, Ed Valla, Tallahassee Astronomical Society; No. 74, Roy Troxel, Member-at-Large

Outreach Observing Award
No. 239-M, Tom Moore, Flint River Astronomy Club; No. 259-M, Bob Vickers, West Kentucky Amateur Astronomers; No. 289-M, Steve King, Astronomical Society of Kansas City; No. 395-M, David H. Bender, Boulder Astronomy and Space Society; No. 469-S, Carlos Flores, Flint River Astronomy Club; No. 532-M, John Whisenhunt, San Antonio League of Sidewalk Astronomers; No. 534-S, Erik Erikson, Flint River Astronomy Club; No. 598-S, Jim Phfistner, West Kentucky Amateur Astronomers; No. 640-S, Daniel Thoman, Atlanta Astronomy Club; No. 703-O, Bert Kelher, Huachuca Astronomy Club; No. 704-O, Chris Brandt, Astronomical Society of Kansas City; No. 705-S, Mark Johnston, Austin Astronomical Society; No. 706-S, Jack Fitzmier, Atlanta Astronomy Club; No. 707-O, Mark Bailey, Member-at-Large; No. 708-S, K. Lynn King, Delaware Astronomical Society; No. 709-O, Randy Holst, Boise Astronomical Society; No. 710-O, Gil Machin, Astronomical Society of Kansas City; No. 711-M, Denis Svechkarev, Omaha Astronomical Society; No. 712-O, Cherrie O'Keeffe, Flint River Astronomy Club; No. 713-O, Delilah Milligan, Flint River Astronomy Club; No. 714-O, Emily Milligan, Flint River Astronomy Club; No. 715-O, Cindy Pippert, Popular Astronomy Club, Quad Cities; No. 716-O, Elizabeth Beals, Popular Astronomy Club, Quad Cities; No. 717-O, Ellis Garrett, Temecula Valley Astronomers; No. 718-O, Laura Hintz-Keller, Indiana Astronomical Society; No. 719-O, Fred Keller, Indiana Astronomical Society; No. 720-O, Thomas Whalen, Atlanta Astronomy Club

Planetary Nebula Observing Program
No. 8, David M. Douglass, Imaging, East Valley Astronomy Club; No. 29, Steve Bell, Basic, Boise Astronomical Society; No. 64, Vincent Michael Bournique, Advanced, Member-at-Large; No. 65, Clayton Jeter, Advanced, Houston Astronomical Society

Radio Astronomy Observing Program
No. 4-G, Michael Hotka, Denver Astronomical Society; No. 15-B, Mark Simonson, Everett Astronomical Society

Sky Puppy Observing Program
No. 46, Aiden Shank, Shenandoah Valley Stargazers; No. 47, Jonathan D. Locklin, Northeast Florida Astronomical Society

Solar System Observing Program
No. 87, Kevin C. Carr, Member-at-Large; No. 88, Emory Horvath, Member-at-Large; No. 89, Rakhal Kincaid, Haleakala Amateur Astronomers; No. 90, Steve Boerner, Astronomical Society of Eastern Missouri; No. 91, Norma Jean Chetnik, Member-at-Large; No. 92, Paul Herrington, Member-at-Large; No. 93, Vincent Michael Bournique, Member-at-Large

Stellar Evolution Observing Program
No. 33, Valorie Whalen, Atlanta Astronomy Club; No. 34, Carl Wenning, Twin City Amateur Astronomers; No. 35, Juan Velasquez, Denver Astronomical Society

Sunspotters Observing Program
No. 180, Frank Franceschini, Central Texas Astronomical Society; No. 181, Nina Chevalier, San Antonio League of Sidewalk Astronomers; No. 182, Frank Garner, Atlanta Astronomy Club; No. 183, Preston Pendergraft, Member-at-Large

Two in the View Observing Program
No. 10, Anthony J. Kroes, Neville Public Museum Astronomical Society; No. 11, David M. Douglas, East Valley Astronomical Society

Universe Sampler Observing Program
No. 123, Vincent Michael Bournique, Telescope, Member-at-Large

Variable Star Observing Program
No. 24, W. Maynard Pittendreigh, Member-at-Large; No. 25, Jeff W. Robinson, Central Arkansas Astronomical Society

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

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

Prairie Skies Star Party
This star party has ended.
The staff extends a heartfelt thank you.
www.prairieskies.org

Mason–Dixon Star Party
is on sabbatical for 2016.
Private Footlight Ranch, Wellsville, Pennsylvania
www.masondixonstarparty.org

June 2–5
Wisconsin Observers Weekend
Hartman Creek State Park, Waupaca, Wisconsin
www.new-star.org.index.php?option=com_content&view=category&layout=blog&id=38&Itemid=82

June 2–5
Cherry Springs Star Party
Cherry Springs State Park, Pennsylvania
www.cherrysprings.org

June 3–5
Craters of the Moon Star Party
Craters of the Moon National Monument, Arco, Idaho
www.ifastro.org

June 3–5
2016 Bootleg Astronomy Star Party
Green River Conservation Area, Harmon, Illinois
www.bootlegastronomy.com

June 3–6
MSRAL 2016 Convention
University of Missouri, Columbia, Missouri
slasonline.org/msral2016.html

June 4–11
2016 Grand Canyon Star Party
South Rim: Tucson Amateur Astronomy Association
North Rim: Saguaro Astronomy Club of Phoenix
www.nps.gov/grca/planyourvisit/grand-canyon-star-party.htm

June 11
46th Annual Apollo Rendezvous
Boonshoft Museum of Discovery, Dayton, Ohio
www.mvas.org

June 29–July 3
Golden State Star Party
Frosty Acres Ranch, Adin, California
www.goldenstatestarparty.org

June 29–July 4
Rocky Mountain Star Stare 2016
Colorado Springs Astronomical Society, Gardner, Colorado
www.rmss.org

July 6–9
Green Bank Star Quest XIII
National Radio Astronomy Observatory, Green Bank, West Virginia
www.greenbankstarquest.org

July 8–10
Connecticut River Valley Astronomers Conjunction
Northfield Mountain Recreation and Environmental Center, Massachusetts
www.philharrington.net/astroconjunction

July 31–August 5
Nebraska Star Party
Merritt Reservoir,
Valentine, Nebraska
www.nebraskastarparty.org

August 2–6
Table Mountain Star Party
Eden Valley Ranch, Oroville, Washington
www.tmspa.com

August 2–7
Oregon Star Party
Ochoco National Forest, Prineville, Oregon
www.oregonstarparty.org

August 3–7
Indiana Family Star Party
Camp Cullom, Frankfort, Indiana
www.indianastars.com/starparty

August 4–6
Julian Starfest
Menghini Winery, Julian, California
www.julianstarfest.com

August 4–7
Stellafane
Breezy Hill, Springfield, Vermont
stellafane.org/stellafane-main/convention

August 5–7
Northwoods Starfest
Hobbs Observatory, Beaver Creek Reserve, Wisconsin
www.cvastro.org

August 10–13
Astronomical League Convention
Hilton Hotel, Arlington, Virginia
www.astroleague.org/files/alcor/WhatsUpwithAstroLeagueMarch%202016.pdf

August 26–27
Maine State Star Party
Cobscook Bay State Park, Edmunds, Maine
www.downeastaa.com/mssp_2016

August 31–September 3
Northern Nights Star Fest
Long Lake Conservation Center, Minnesota
www.mnastro.org/NNSF

August 31–September 5
Brothers Star Party for Oregon Observatory
Brothers, Oregon
www.mbsp.org

September 1–5
Iowa Star Party
Whiterock Conservancy's Whiterock Resort, Coon Rapids, Iowa
www.iowastarparty.com

September 2–4
Black Forest Star Party
Cherry Springs State Park, Pennsylvania
www.bfsp.org

September 2–6
Almost Heaven Star Party
Spruce Knob, West Virginia
www.ahsp.org

September 22–25
Acadia Night Sky Festival
Acadia National Park, Bar Harbor, Maine
www.acadianightskyfestival.org

September 22–25
Dark Sky Astrophotography Exchange 2016
Tupper Lake, New York
apobservatory.org

September 24–October 2
Okie-Tex Star Party
Kenton, Oklahoma
www.okie-tex.com

September 29–October 2
Great Lakes Star Gaze
River Valley RV Park, Gladwin, Michigan
www.greatlakesstargaze.com

September 29–October 2
Heart of America Star Party
Astronomical Society of Kansas City
Overland Park, Kansas
www.askc.org/HOASP.htm

September 29–October 2
Hidden Hollow Star Party
Mansfield, Ohio
www.wro.org

September 30–October 1
Idaho Star Party
Bruneau Dunes State Park, Idaho
www.boiseastro.org

Mid-East Region of the Astronomical League

MERAL ANNUAL MEETING

In conjunction with the
Green Bank Star Quest
NRAO, Green Bank, West Virginia
Saturday, July 9, 2016

Nominations are open for some MERAL offices. $75 Door Prize for MERAL member attendees! Here is your chance to give back to the hobby that has given you so much!

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What does the League offer you as Members-at-Large?

• Full voting privileges at AL meetings.• A subscription to the *Reflector*.
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Astronomy magazine $34.00; 2 years $60 • *Sky & Telescope* magazine $32.95
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(Foreign rates are higher; see website)
• Free Astronomical League Observing guide with membership.

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Astronomical League National Office, 9201 Ward Parkway, #100, Kansas City, MO 64114
Phone: 816-333-7759; Email: *leagueoffice@astroleague.org*
Or join online at: WWW.ASTROLEAGUE.ORG

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;
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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
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Astronomical League travel mug
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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)
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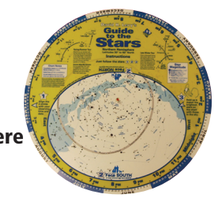

Astronomical League lapel pin (one-inch diameter)
$8 plus $1.20 S&H

"Guide to the Stars" 16" Planisphere
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10 units:	$ 9.00, plus shipping	250 units:	$ 112.50, plus shipping
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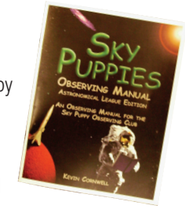
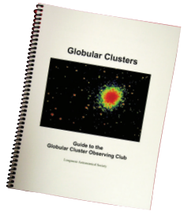
100 units:	$ 60.00, plus shipping		

Individual pairs of glasses are also available for $1 each, plus shipping.
Available at http://store.astroleague.org/. Shipping rates will be added at checkout. Or call or email for shipping rates and options.

Get ready for the Great Total Solar Eclipse of 2017! Don't miss out, supplies are limited...



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



Globular Clusters
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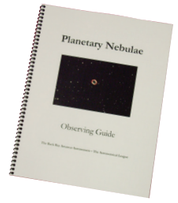

Planetary Nebulae
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$2.10 S&H

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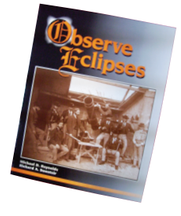
Messier Objects: A Beginner's Guide
$8 plus
$1.20 S&H

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



Observe Eclipses
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Sale price $9
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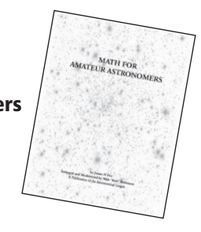

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