

Reflector

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December 2015



**From Around the League: Youth Awards Report;
Mabel Sterns & Webmaster Awards**

ALCon 2016 – Washington, D.C.

New Observing Program: Active Galactic Nuclei

Observing in the Inyo National Forest



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

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David Lane took this image of Green Spring in the Black Sand Basin area of Yellowstone National Park. The colors of the pools and geysers here defy description—wild electric blues, intense saffrons, crazy greens. Add to this scene the intense colors of a fireball meteor and the Milky Way. This image was taken in August 2015 with a Canon 5D Mark II and 14 mm lens at f/2.8, 2 minutes exposure of sky and ground combined. David is a member of the Astronomical Society of Kansas City.

To our contributors: The copy and photo deadline for the March 2016 issue is January 1. Please send your stories and photos to our magazine editor, **Ron Kramer** (editor@astroleague.org), by then.

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

Reflector

The Astronomical League Magazine

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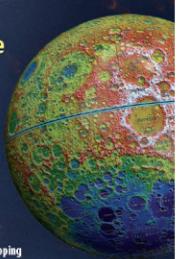
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Influence the Future

One particular clear night years ago, you likely gazed at the heavenly realm and, although you may not have realized it at the time, it changed your life. Perhaps you were a teenager who visited a public event hosted by the local astronomy club.

After standing expectantly in line, you peered for the first time through a telescope at M42, with its stellar sprinklings embedded throughout its wispy regions, and its four closely packed Trapezium stars shining in the central glow, sharply bordered by dark nebulae. What a marvelous sight for a young person to encounter!

We want to make sure that curious young people today have that same experience that leads to that same sense of discovery, and results in that same sense of wonderment. Most of all, we want to make sure that these young observers stay in the hobby long after that first enticing celestial sight.

The thrill of being at the eyepiece examining some enchanting wonder, the fun of sharing the night sky with others, the clarity in writing about what lies above, and the satisfaction of imaging what glows near the edge of visual perception—all of these things encompass much of our amazing avocation. They are also activities that young observers pursue.

Studying about our universe, then investigating deeper to learn more about the cosmos are also part of what we do. This is also the challenge that the young researcher rises to accept. Finally, communicating that knowledge in a passionate, factual way allows others to share in the exploration.

Think back to when you entered the hobby. Wouldn't it have been great to have been acknowledged in some manner for your active interest in astronomy? Imagine how that might have affected your future, not just regarding astronomy, but your life in general. Now, think of how the right recognition might influence an interested young person today.

Over the past twenty-two years, the Astronomical League has administered award programs with young observers, young researchers, and young science journalists in mind. The National (Outstanding) Young Astronomer Award began spotlighting individual research efforts in 1993, with an award presented to Blake Warren Thomas of Edgewood, New Mexico.



Field of View
From the office of your president

In 1998, the Horkheimer Youth Service Award followed, by commending Heather Ann Harland, a high school junior in Vidor, Texas, for her astronomy service to her club and community. The Astronomical League now annually offers ten—yes, ten!—different paths to acknowledge young people's love of the night sky or their desire to learn more about this incredible universe.

Each winner receives an attractive commemorative plaque, and, depending on



Adam Forte (1999 Horkheimer Award): Postdoctoral Research Fellow at Arizona State University in the School of Earth Science and Space Exploration



Ryan Hannahoe (2001 Horkheimer Award): Middle school science teacher at Clancy School near Helena, Montana, and director of STEM camps at the Montana Learning Center



Courtney Flonta (2011 Horkheimer/Smith Award): Pursuing a career in pharmacy technology



Max Moe (2003 NYAA, "Demographic and Atmospheric Effects on the Quality of the Night Sky"): 2015 PhD in astrophysics from Harvard University and the Smithsonian Center for Astrophysics

the specific details of each award program, an expense-paid trip to ALCon and either a fine telescope by Explore Scientific or a cash prize of \$250 to \$1750 from the Horkheimer Charitable Fund. Other sponsors, such as Celestron, often contribute generously to defray important administrative expenses.

The purpose of this awards program, as counterintuitive as it may first seem, is not simply to encourage students to become professional astronomers. No, it is more than that.

It is to open young minds to examine where their futures may lead.

It is to open young hearts to a lifelong love of the night sky.

It is to show that amateurs across the

Continued on page 27

IDA's New Webpage

The Astronomical League is a wonderful organization, and its website is worth touring in depth. The League recently decided to offer the *Reflector* digitally. One can elect to receive it only in digital format, only in paper format, or in both formats. At the current time the League has no

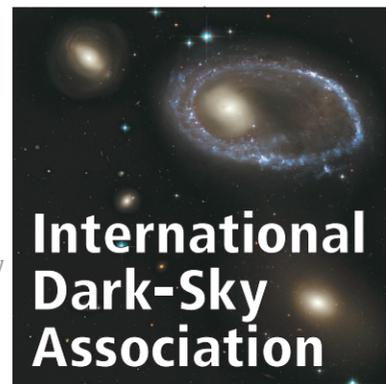
plans to drop the paper edition of the *Reflector*, but it is clear to me the future is digital. Even an older, more mature troglodyte like myself can see that the digital world has replaced the world of film, newspapers, and printed magazines I once knew.

I receive several astronomy magazines digitally without paper copies, and I plan to receive future issues of the *Reflector* only digitally. I actually prefer to read newspapers, books, and magazines in paper-printed form, but it is much easier and less expensive to store digital copies of books and magazines. Printed materials are not going away anytime soon, and I still read the daily newspaper and several weekly or monthly magazines in their printed forms.

IDA used to correspond with its members by mail and offer printed materials for reference. Nowadays, IDA's website at darksky.org offers almost all of IDA's resources digitally, making them readily available to its members and to any interested person around the world, whether a member or not.

A decade ago, websites became necessary evils for organizations like IDA wanting to get their messages out and grow their membership. Websites were difficult to establish and maintain. They required specialized knowledge, and organizations had to devote some of their limited resources to the websites, which was a distraction from their other business.

Not anymore. IDA has wholeheartedly embraced its website and just completed a complete redesign of the site to make it more productive and considerably more user friendly. I highly recommend you devote some time to thoroughly exploring the site. I will highlight just a few of its interesting features. If you are reading this column in a digital edition of the *Reflector*, you should be able to merely click on the links I mention and go directly to them. This is one of the strong features of the digital world. Hopefully, there will be no more



International Dark-Sky Association

carefully writing down a website URL and then carefully typing it into a web browser, hoping it will work.

Go to the IDA website at darksky.org and immediately notice the multiple examples of nighttime scenes showing what a dark sky should look like compared to a light polluted urban environment. While it is somewhat limited, I like the IDA glossary (darksky.org/resources/glossary), which helps one understand the somewhat non-intuitive lighting terms thrown around in discussions of light pollution. Another great place for a first look is the FAQ page (darksky.org/resources/faq). Here you can explore where to find dark-sky-friendly lighting or find out if there is a lighting ordinance in your community.

Need to give a first time talk about outdoor lighting and light pollution, and you have no materials? Download "Introduction to Light Pollution" from IDA's public outreach page (darksky.org/resources/public-outreach-materials/#pp).

I find the IDA publications (darksky.org/resources/ida-publications) and press releases (darksky.org/category/press-release) quite useful. In fact, many of the press releases have been the basis for one of these columns.

Are you an educator? Check out the IDA materials for educators (darksky.org/resources/educators). Need to do serious research about lighting and its effects on the environment? Look at the IDA research literature database (darksky.org/resources/research/alan-database). IDA also has links to other marvelous databases to help you with your research.

Want to get involved in the light pollution struggle? Join IDA (darksky.org/ways-to-give/membership) or, better yet, give a large gift to IDA (idsa.z2systems.com/np/clients/idsa/donation.jsp)—I couldn't resist putting a commercial into this column. Even if you are unable or do not want to make a gift to IDA, get involved in fighting bad lighting in your own community and take advantage of IDA's resources, literally at your fingertips.

Tim Hunter

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Peter Kurtz, Cape Cod Astronomical Society

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Chris Ragalsis, on CloudyNights

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Dear Editor:

Having followed many of his same steps, I really resonated with Ronald Zincone's "How I Became an Astrophotographer." Here's my story.

I was turned on to astronomy by Miss Wicker, my 8th grade general science teacher.

Every Saturday, I'd visit Baltimore's main library and check out a new bunch of books. I bought books as well, including many of the wonderful Harvard series. After the war (WWII, that is), my father bought me a 3-inch Mogeys refractor. Among the things I read about were the great Leonid meteor showers of 1899 and 1933 and hoped I'd be alive to see them in 1966. In 1952, I dropped out of college and joined the U.S. Army.

In my barracks I met a fellow astronomer. He asked to borrow some of my books and promised to return them. That was the last I saw of my wonderful collection! Before entering the Army, I sold my Mogeys to take a road trip west with some buddies. End of my first astronomy career!

My second career began in November 1966. I was married with three kids and reading the morning paper before leaving for work. Suddenly, there it was, a small article announcing that the once-every-33-years Leonid meteor shower was to occur that very night. I was startled! I was alive! That night I leaned my Canon 50 mm f/1.2 (bought in a PX in Korea) against a tree in my backyard, and opened and closed the shutter. Naturally, I caught no meteors (it was early evening and they occurred much later), but I did get some star trails. Thus began my second astronomy career, which, for the first 12 years, was strictly with a still camera on a tripod. Bought my first new career scope in 1978, a 3-incher.

While I've never graduated to photography through a telescope, I feel I've pursued the still camera to its limits. My first published shot, a 31-day time lapse of Vesta moving through Libra, appeared in the August 1968 *Sky & Telescope*. I'd used Kodak's fast 2475 black-and-white film at f/1.8, 50mm. The September 1973 *S&T* contained a full page of my June 30, 1973, total eclipse. My 1974 Comet Kohoutek made the cover of the April-May *Astrograph*. My partial solar eclipse with the Eiffel Tower (*S&T* 9/84) is framed in the office of the director of the Paris Observatory. Skipping ahead, my Jupiter, Saturn,



Reflector Mail

and the Pleiades picture was on the front cover of none other than November 2000's *Reflector*!

There's a lot more, but suffice it to say I haven't yet graduated to astrophotography with a telescope. I'm sticking to still camera and to education. As Baltimore's street corner astronomer, for some 28 years, I've been doing educational work with the public here in my home town. Clear skies!

Herman M. Heyn

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Phone: 410-889-0460
www.hermanheyn.com

Ed. note: Herman also appeared on NPR's "Morning Edition" in August, and the following link has a nice story about his activities; www.npr.org/2015/08/28/435189774/stargazing-from-the-street-corner-telescope-and-hat-in-hand.

Dear Editor:

On page 15 of the June 2015 issue of the *Reflector*, in the article "Part 2: The Moon and Early Manned Space Efforts" by Lee Gaillard, Mr. Gaillard states that the major structures of the ISS were contributed by the United States, Russia, Japan, and Europe.

Mr. Gaillard fails to mention Canada as one of the major contributors to the ISS. In fact, Canada contributed the Mobile Servicing System (MSS). The MSS is a sophisticated robotics suite that was used to assemble the Space Station in space, module by module. The MSS consists of Canadarm2 (a 17-meter-long robotic arm), Dextre (the Space Station's two-armed robotic "handyman"), and the Mobile Base, which is a moveable work platform and storage facility.

Mark Narwa, Member-at-Large
Ottawa, Ontario, Canada

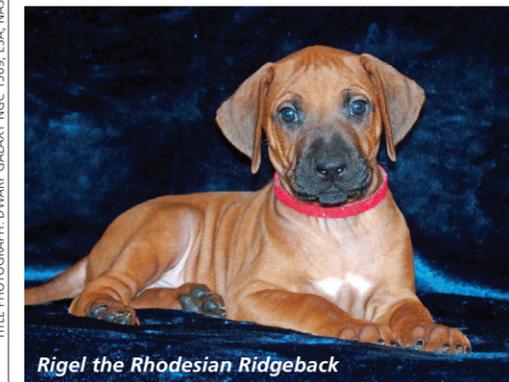
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TITLE PHOTOGRAPH: SEYFERT'S SEXTET; NASA, GODDARD SPACE FLIGHT CENTER

My 60-year astronomical journey started in December, 1955, when I was all of 6 years old. Brooklyn College (New York) advertised a star party at their observatory and I thought it might be a cool thing to do. Dragging my mom along (she had to take me), we climbed the stairs to the biggest telescope in the world (at least that's what I thought at the time). It was a 7-inch Fecker refractor and was pointed at M42, the Orion Nebula. That night I fell in love for the first time.



Reflections



Rigel the Rhodesian Ridgeback

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

I would think we all have our favorite planet, galaxy, nebula, or double star. But what about a favorite constellation? It's the time of year where mine rises before midnight and allows an entire evening of exploration. Of course, I'm talking about Orion, the Hunter. In fact, I like this group of stars so much, I even gave the name Rigel to my Rhodesian Ridgeback.

Let me know (at editor@astroleague.org) if you have a favorite, and why. We'll take the best letters and print them in our *Reflector* Mail column in the next issue. I love Orion for all the things to see; there's something for everyone here.

We are very pleased to announce the addition of two new members to our editorial staff. **Carla Johns** is our new advertising representative, and **Robert Westbrook** is our new photo editor. Their biographies appear elsewhere in this issue. Please contact them directly with your ad requests or photo submissions for the front and back covers as well as the Gallery section.

Our transition to digital copies of the *Reflector* is progressing nicely. We will be sending digital issues to every League member for whom we have a valid email address. Paper copies will also be sent to everyone who has not specifically requested digital. When the digital copies are sent out, you will be able to "opt in" for

paper, digital, or both. Of course, you can change your choice whenever you wish. Paper copies are not going away! Are you prepared for the 2017 solar eclipse? In addition to ALCon 2017 being held near the centerline of the eclipse in Casper, Wyoming, your League has a large quantity of solar eclipse glasses available at competitive prices for League members and their organizations. These high-quality, cost-effective optical aids can be used at any solar observing session as well as at the eclipse. Prices are \$0.30 each in quantities of 1,000, \$0.35 each for 500, \$0.60 each for 100, and \$0.80 each for 25. Further information is available at www.store.astroleague.org. Get yours now, before they disappear.

ALCon 2016 is rapidly approaching. Make your reservations now for this great event, scheduled for August 10-13, 2016 in Washington, D.C. See the ad on Page 12.

Finally, don't forget your League is now on Facebook and Twitter (@AstronomyLeague).

Hope you all have a happy and healthy holiday season—Ron Kramer

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Top (left to right): Doug Stalring; Left (top to bottom): David Hudgins, Dave Lane, Doug Stalring, Mike Myer, Tom J. Marrero, David Young

The constellation Cassiopeia resides along the bright swath of starry glow known as the Milky Way. We know this glow is the plane of our home galaxy and holds a multitude of open star clusters. Dozens of these galactic clusters are found in Cassiopeia. One of the finest, but often overlooked, is NGC 7789.

Cassiopeia is one of the most recognizable constellations. The constellation is circumpolar for anyone north of a line from San Francisco to Baltimore. When high above Polaris, five of its brightest stars roughly trace out the letter M. These stars, from left to right (west to east), are named Caph, Shedar, Navi, Ruchbah, and Segin. NGC 7789 can be found 3 degrees south-southwest of Caph. Note that south is the direction away from Polaris and west is to the left of the big M. In binoculars or a finderscope, you will see NGC 7789 about halfway between the stars Sigma and Rho Cassiopeiae; both stars are approximately magnitude 4.6. Sigma is a blue-white star and Rho is a yellow star.

NGC 7789 is worthy of being in Charles Messier's catalog, but Messier never recorded it. The cluster was discovered by Caroline Herschel in 1783. The cluster is often called Caroline's Rose because its loops of stars and dark lanes trace out the pattern of rose petals, more clearly imagined at the eyepiece than in photographs.

DEEP-SKY OBJECTS

NGC 7789: CAROLINE'S ROSE IN CASSIOPEIA

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



Caroline Herschel was perhaps the greatest female astronomer of the 18th and 19th centuries, if not of all time. She was the younger sister of Friedrich Wilhelm Herschel (William Herschel), the discoverer of the planet Uranus.

The Herschels were originally from Hanover, Germany. William was born in 1738 and moved to Bath, England, at the age of 19 to pursue a career in music. He was a very successful musician both as a composer and performer. Caroline was born in 1750 and was scarred by several childhood diseases, one of which stunted her height to only 4 feet 3 inches. Her mother

wanted her to become a domestic servant. Fortunately her father saw to it that all six of his children were trained in math, French, and music. After her father's death the year after William discovered Uranus, Caroline moved to Bath to live with her brother.

William originally took up astronomy as a hobby, making telescopes and recording observations. After discovering Uranus, he gained worldwide fame and was appointed Royal Astronomer with a stipend. Caroline originally worked with William on his music, but became interested in astronomy too. She mostly assisted

William, but after his marriage in 1788, she began working by herself. Caroline went on to discover eight comets and eventually, like her brother,

received a stipend from King George III to do astronomy.

Caroline continued to work in astronomy after William's death in 1822, assisting his son John with deep space catalogues. She received a gold medal from the Royal Astronomical Society in 1828, the only woman to receive one until 1996. Caroline lived 98 years.

Caroline's Rose is a rich, dense star cluster that is easily resolved. The cluster is 25 arcminutes in diameter and its integrated magnitude is 6.7. The brightest members of the cluster are 11th and 12th magnitude stars, and there are more than 150 stars inside the inner region that is 16 arcminutes in diameter. The cluster is 8,000 light-years away and thought to be around 1.6 billion years old.

My image of NGC 7789 was taken with a 10-inch, f/4 Newtonian with a coma corrector using a SBIG ST-2000XCM CCD camera. The exposure was 30 minutes. North is up and east is to the left. The image is 33 by 25 arcminutes, so most of the stars in it are members of NGC 7789. The bright red star on the right side of the cluster is SAO 35903, magnitude 8.4. Above and to the right of this lies the second brightest star in the image, a magnitude 9.4 white star. The red star on the upper left side of the image is magnitude 9.8. All three of these stars are not members of the cluster, but foreground objects.

In a 6- to 8-inch telescope, the cluster's stars appear uniform in brightness. I viewed it with my 6-inch f/6 Newtonian with a 13 mm Ethos eyepiece. The cluster filled most of the field of view and the rose petals were quite obvious.

The cluster's stars cover all spectral classes from red to blue. Larger light buckets will reveal more of their colors. However, the cluster is quite pleasing to view with any sized optics, including binoculars. ☼

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Chasing Jupiter's Shadow

Venus rose a little before four in the morning at September 2012's Black Forest Star Party, held at Cherry Springs State

park, Pennsylvania. I was with former astronomy student (and expert amateur photographer) Elliot Maddox and some of his current classmates from Alfred University.

Someone noticed that Venus was casting our shadows onto a white RV just behind us. So Elliot Maddox took a photo of the shadow of his classmate, Elliot Severn. This was an amazing capture, showing many stars in the background and reflected in the RV's windows!

I never thought too much more about that until recently, when I noticed how bright Jupiter seems—especially in a relatively dark part of the sky, with Regulus as its only competition.

So I wanted to see if Jupiter would cast a shadow that could be recorded. I made my first attempt from a relatively dark farm field in my neighborhood, on the eastern shores of Long Island, where agriculture is still somewhat prevalent and it is still fairly dark (though nothing like Cherry Springs). I had hoped that a simple "sundial" would work (after all, Jupiter's light is reflected sunlight). It did not.

Less than a week later, there was a winter star party, run by the Mid-Hudson Astronomical Association (MHAA) at Lake

Taghkanic, New York. I tried my simple sundial again, but with no success.

Even 10-minute exposures at the camera's maximum ISO

revealed nothing. I thought I might be seeing something at the very base of the dial's gnomon, but it was impossible to bring out, even after serious photo processing using software such as SAOImage DS9, GIMP, and Digital Photo Professional.

Photo 1 is a 3-minute exposure of the first-attempt sundial from the farm field:

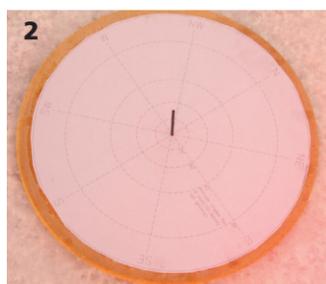
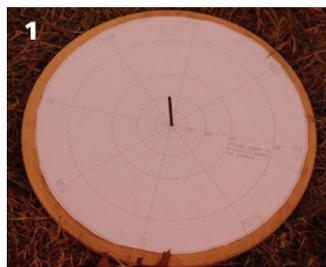


Photo 2 is a 5-minute exposure from the MHAA star party (the background is snow, which I believe was contributing to the ambient light, though conditions were still slightly darker than those in my home town).

That is when I realized that this is a classic signal-to-noise problem. The light from Jupiter—and Jupiter's shadow—was in there somewhere, but it was being overwhelmed by the ambient light. So it was time for a re-design of the equipment.

I made the sundial smaller, (photo 3) and put it on a wood support that holds the camera directly above it. I then made a box to put around the entire thing to block most of the ambient light. Everything was made from scrap wood and discarded foam board.

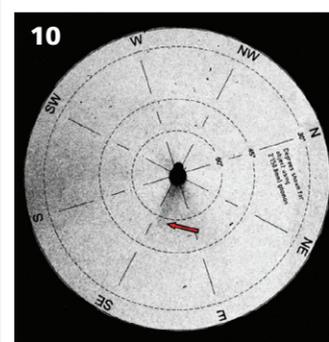
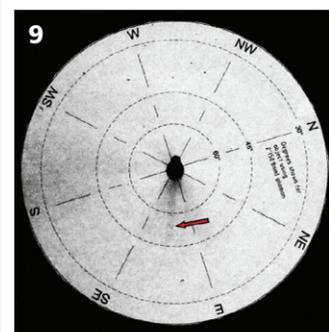
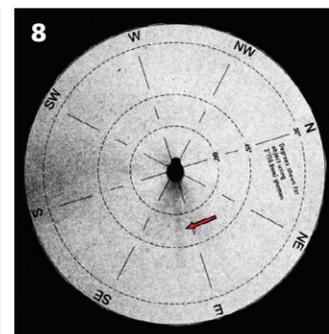
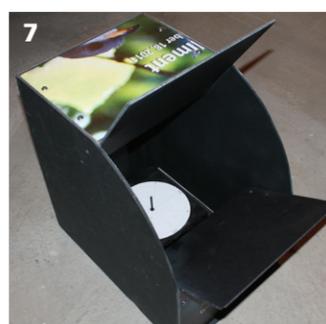
The original, larger sundial had been fully exposed to an entire sky's worth of ambient light. The new one (photo 4) let in roughly 30 degrees x 30 degrees worth, with the opening centered around 45 degrees altitude (not a bad position for Jupiter's current location), so about a 22-fold reduction in ambient light (or a 22-fold increase in the sought-out "signal" relative to the background noise).

Photo 5 was tried this one as-is, and I caught Jupiter's shadow in the farm field—it was faint, but I got it!

I then added two flaps (photos 6 and 7) in the altitude direction to block a little more light and I painted the innards of the box flat black. Only the small round sundial face was white.

I tried again at Orient Point, New York, where it is slightly darker than where I live.

It wasn't the drastic improvement I had hoped for, but the shadow was unmistakably made by Jupiter's light. Well, it was really made by the Sun's light, which had travelled 500 million miles to Jupiter,



bounced off, and then travelled another 400 million miles back to Earth and into my "shadow catcher."

I took photos for two hours and also made a time-lapse video. Each exposure was 5 minutes at ISO 12,800 (the maximum ISO for the camera, a Canon EOS Rebel SL1). Photos 8, 9, and 10 are images from the beginning, middle, and end of my 24-exposure, two-hour session.

Although I did take one dark frame, I did not try a dark frame subtraction, so these photos are essentially raw, straight from the camera.

So now I am wondering if instead of using a camera, you could somehow put your head in there—and if you were wearing (photomultiplier) night vision goggles, could you see the shadow "live?" I may try that next. ☀

OBSERVING WITH MINDFUL PURPOSE

By James Bruce McMath/Photo by Chris Lasley (CAAS)
President of the Central Arkansas Astronomical Society

At first blush, it has seemed to many that science has been demoting us in importance ever since Galileo first used his telescope. First in moving the Earth, and hence us, from the center of it all, then destroying the assumption that our Sun, at least, lay at the center of an eternal, perfect, and unvarying celestial sphere, the realm of god(s). Science revealed instead that the heavens were just another physical place, constantly changing according to the fixed laws of nature. Still not satisfied, science turned our magnificent galaxy, which we again assumed was the whole of everything, into but one of a countless number of relative specks in a nearly empty expanse of such specks beyond the capacity of the mind to comprehend. From lords of it all, the center of the universe, the obsession of the gods, we have descended to top predator on a tiny speck, in an inconspicuous location in an inconspicuous galaxy among an uncountable number of galaxies in a vast universe. Humbling indeed!

But I contend it is not so. Our growing knowledge of the universe only seems to demote us when viewed in the context of our traditional mythologies, created to give us self-importance in our native state of ignorance. In reality the advent of the scientific method was a momentous occurrence, the final act in birthing self-consciousness for the universe through the human mind. A birthing to consciousness that ended a 13.7-billion-year gestation, requiring as many consecutive correct rolls of the dice as years to complete. It involved countless generations of stars, the forming and transforming of the Earth, the arrival and evolution of life, the evolution of a mind capable of rational analysis, and finally the evolution of the intellect required to harness that mind's full power. What a journey and what a result.

As both a product of, and a part of, the universe, our consciousness may fairly be viewed as its consciousness, our awareness of it, its self-awareness. In that sense, the universe, through the collective human mind, achieves a more complete understanding of itself every day, and our awakening to its reality is, for the universe, as the emerging self-awareness of a newborn infant.

It evokes the old question: does a falling tree make a sound if there is no one there to hear it? What is the universe really, if no part of it is conscious of its own existence, its mysteries, its beauty and workings? Without a knowing witness does it even exist in a meaningful sense? No, barring some other consciousness, without humanity the universe is as a brain-dead body on life support; there may be life in it, but without consciousness there is no self.

Each of us, then, to the extent we choose to witness, observe, experience or understand the workings of the universe, or any part of it, are a part of the universe's consciousness and self-awareness. We are, in effect, no different in relation to the universe than our individual brain cells are to each of us. That there may be others out there, as yet undiscovered, does not change that role.

I think we intuitively understand this. I think it is why humanity has observed and sought to understand nature all along. It is why people watch butterflies and birds, study stars, and collide atoms. In a few hundred years we have gone from mythology and ritual worshiping to understanding. That is promotion, not demotion; up, not down.

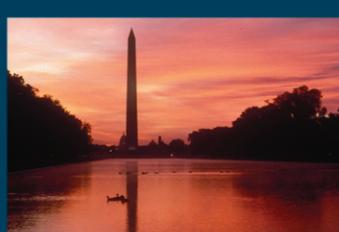
Humanity is embarked upon the greatest possible adventure. Our mission and, so far as we know, unique purpose as a species, is to explore and know the universe, provide it consciousness and self-awareness. When we witness nature with understanding we stand among, if not above, the gods as we once understood them. ☀



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I must be invisible No one knows me

—Eric Clapton

Imagine drifting through space, invisible, from the dawn of time. You were born as one of the first of your kind, but had little of the stuff needed to hold together against the winds and tides that tore and shaped those early days. Diminished orders of magnitude brought forth mere hundreds of stars, a near empty echo in the arc of creation. Your youth, so promising, was followed by an event that ended your line. The few stars you formed would be your only children, a first generation without progeny as fate and size and timing would make you a fossil, as floods to future's reptiles would in future rock.

I was born with a ragin' thirst, a hunger to be free...

Your backbone, grafted with primordial gas, was not visible and interacted only through gravity. When it reached sufficient size your first stars formed. If there were larger siblings among that brood they lived and died young, and left no trace. We now see your ancient suns, nearly all the same age, forged from elements unenriched by subsequent generations of stars, as there were none. Where the normal ratio of this invisible matter to that which we can see is a single digit, yours is a thousand times higher. You are dominated by this dark substance to a degree greater than in almost any known structure, and we wonder if there are ones like you even less luminous, perhaps wholly dark, having made no sons at all.

Some will say that I'm no good, maybe I agree...

There were large congregations in those early times, drawn together by small disturbances in the evenness of space. They burned brightly as a

Lonely Stranger

group of massive first generation stars, and made powerful light capable of separating an electron from a piece of the cation in the hydrogen that permeated the entire cosmos. Once "reionized," it became clear that radiation streamed through space, affecting all in its path. You were its victim, shocked as your meager stock of star-forming material was quickly blown from your grasp.

I have crawled down dead-end streets, on my hands and knees...

You saw your larger cousins, with their greater mass capable of withstanding these winds and holding their valuable treasure, make many more stars whose offspring enriched the following generations. They produced the heavier, complex elements needed to form all manner of things, including rocky planets. But you experienced none of that, as your loss ended your evolution. You became a relic with no scion, buried in the obscurity of a vast space, unnoticed and almost unnoticeable.

Take a look, then walk away, that's all right with me...

Everything was changing around you. Of the millions of billions of small Ultrafaint Dwarfs like yourself, many or most were being drawn into mergers with growing, larger structures. These were the grand spirals, their volution the most beautiful, vibrant and "alive" in the Universe. From your perch aloft you saw legions of brethren conjoin to form ever-growing galaxies within this local group. From a point of

mass, change and energy, they were Rome to your Craco. Why would anyone notice or care about a backwater, abandoned village with just a few, barely visible signs of simple life? One whose style and content had not changed an iota since the beginning of time? Who would blame those who overlooked you, not caring to wonder if you existed? Even if you were discovered, what stories could you tell, and why would anyone think you worthy of study?

I'm a lonely stranger here, well beyond my day...

If you had any significance, it surely must have been in the distant past. You could have no relevance here, or now. You were an isolated, small and unchanging body, preserved by those very qualities from interacting. Of what possible present use are you, other than being absorbed for your raw materials? Little could you imagine that halfway from the center of that nearby galaxy, on the edge of a spiral spur lay a star of medium size one-third your age, and of a composition enhanced by generation within its dynamic milieu. This star formed a planet, then warmed its rocky gem to keep water liquid, patiently nursing its nascent life for three billion years until conditions and processes produced sentience. Its creatures would one day look back up to their sky in a direction of nearby stars in the pattern of a regal and dominant predator to consider the causes and conditions of their existence. Fortunately quartered, your position allowed one of their clever machines to capture the faint, telling light of

your original stars, and they realized your worth. You were part of a great puzzle to them, a part that explained many things. As old pieces of bone and pottery had for their anthropologists, your unchanged, "fossilized" nature offered unique evidence from a time otherwise beyond recovery. You sat on, were at, and became their threshold.

They turned many of their instruments upon you and found you could teach them so much. Your simplicity, proximity, and purity were generous gifts that helped them perceive the formation of galaxies, reionization of the early Universe, their missing mass problem and the nature of dark matter. Their cosmoscentism offered your name, Segue 1, as an acronymic metaphor. One of them sought to view you with his own eyes, wanting to see for himself this dark galaxy from the edge of time. Several of your ancient stars were visible that night, completing a circle of connection, discovery and understanding that may be the purpose of the Universe.

I'll be on my way... ☼

Dave Tosteson

djtost1@gmail.com

Chisago City, Minnesota

Ed. Note— comments from the author:

The new word "cosmoscenti" in the last paragraph is an astronomical takeoff from "cognoscenti" meaning in the know about arcane ideas or issues. SEGUE is an acronym for "Sloan Extension for Galactic Understanding and Exploration." As an Italian term it ties in with that country's theme within the article. Also, there are a few phrases in the work that may seem out of place, but I, everything is intentional, including "a piece of the cation," which sounds a bit awkward, but has a secondary meaning that ties in with "Craco."

WANDERERS IN THE NEIGHBORHOOD

Understanding Radar Images of Minor Planets

By Berton Stevens

Whenever a minor planet—an asteroid—comes near the Earth, it becomes a target for radar observations. These observations are often released to the public as an image of the minor planet. Since there are usually multiple images taken over time, an animation is often created showing the rotation of the minor planet and the motion of its moon or moons, if any. But these images are not representations of the minor planet's surface in the usual sense.

Radar works by transmitting a very short radio signal—a pulse—at a precise frequency toward the minor planet. The surface of the minor planet reflects the radio signal in many different directions and some of the reflected signal returns to the receiver. The time it takes for the pulse to travel to the target and return, called the delay, tells you the distance to the target, since the pulse travels at a

known speed—the speed of light. One final factor is the Doppler shift of the returned pulse. We experience Doppler shift every day. As a car approaches you, you hear its horn at a higher pitch. As the car passes you, you hear its horn at its normal pitch. As the car recedes, you hear its horn at a lower pitch. The same shift in frequency happens with radar pulses bouncing off a minor planet.

Radar observations require powerful transmitters and sensitive, low-noise receivers, but the distance to the minor planet is critically important since the returned signal strength is inversely proportional to the fourth power of the minor planet's distance. The best observations are made when the minor planet is no more than a few tens of lunar distances away.

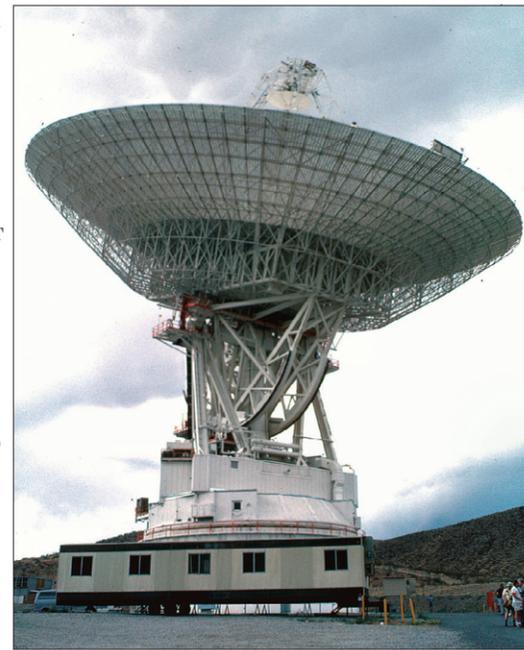
To make the observation, the position of the minor planet

must be known to a reasonably good precision so the parabolic dish antenna can be pointed directly at it. In addition, the motion of the minor planet must be known so the receiver can be tuned to the correct frequency to compensate for the overall Doppler shift resulting from the motion of the minor planet. Both of these parameters can be computed from an orbital solution provided by optical observations.

Areas on the surface of the minor planet nearest to us will reflect the transmitted pulse first.

Slightly more distant areas of the surface will reflect it a little later. In addition, the rotation of the minor planet Doppler shifts the frequency of the signal that returns. The receiver simultaneously records the returning signal strength at a series of closely spaced frequencies to measure the Doppler shift caused by the rotation of the minor planet.

After the observations are complete, the data that was gathered is converted to an image or animation. The vertical axis is the delay time, increasing downward, and the horizontal axis is the Doppler shift (frequency). At each point, the strength of the



The 230-foot (70-meter) "Mars" antenna at the Goldstone Deep Space Communications Complex in the Mojave Desert, California. This antenna has both transmitting and receiving equipment that can image a minor planet. It was originally built to communicate with Mars missions in the 1970s and is still in use today. The parabolic shape of the dish acts just like the primary mirror in a reflecting telescope, gathering the faint radio signals returning from space.

returning signal is displayed as a brightness from black (no signal) to white (a strong signal). The result is the minor planet image that is released to the public.

Unlike in optical images, a point on the side of the minor



A radar image of 2005 YU55 when the minor planet was just 860,000 miles from Earth on November 7, 2011, at 12:45 a.m. MST. This imaging session used the 230-foot (70-meter) "Mars" Deep Space Station antenna at Goldstone, California. This aircraft-carrier-sized rock was making a close approach to the Earth. At its closest point it was 201,900 miles (324,900 kilometers) from the center of the Earth.

planet facing us does not correspond to one point on the radar image. Instead, each point on the radar image corresponds to all the points that are a specific distance from us (the delay plotted along the vertical axis) traveling at the same speed toward or away from us (the Doppler shift along the horizontal axis). The Doppler shift depends upon the orientation of the rotational axis (the north and south poles) relative to our line of sight. If we were looking straight on at either pole, there would be no Doppler shift and the radar image would be a vertical line.

When the rotational axis is tilted to our line of sight, the resulting image will be different, depending on the angle of this tilt. In most cases, each pixel on the radar image will correspond to at least two points on the asteroid's surface, and almost certainly more. In addition, since the back side of the minor planet is not exposed to the transmitted pulse, it cannot reflect a signal back, making the radar image never look like more than a half moon.

So a radar image should not be confused with an optical image. While it does give us information on the size of the minor planet and information about its rotation rate and any possible moons, its most important information is a precise measurement of the distance to the minor planet. This is unique information complementing the right ascension and declination measurements provided by optical astrometry. The distance to the minor planet from radar observations can greatly improve the precision of the orbital elements, and this improvement sometimes allows astronomers to eliminate the possibility that an observed minor planet will impact the Earth in the future. ☀

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

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

By Mike Stewart, *Astronomical League Historian*

September 1965

Total Eclipse in New Zealand—1965

Mr. and Mrs. John E. Welch (West Springfield, Mass.) and Mr. and Mrs. Ralph K. Dakin (Pittsford, N.Y.) returned July 4 from a trip around the world, visiting Hawaii, New Zealand, Australia, Singapore, Nairobi, and Cairo. The excuse for this trip was the total eclipse of the Sun in New Zealand on the morning of May 31 (one day later than elsewhere since New Zealand is west of the International Dateline). Like many eclipses this one crossed very few land areas. Totality began west of New Zealand at dawn, crossed two small pieces of land in the Hervey Islands and ended at sunset on the west coast of Peru.

From time to time, the *Reflector's* publication schedule changed. The winter of 1965–66 marked one such shift. The next published issue was February 1966. Readers will see an excerpt from the winter 1966 *Reflector* next March.

November 1990

Mars is Back!

Mars is about to return for another show! The red planet reaches its largest size on November 20, 1990 during its closest approach to Earth. Opposition occurs seven days later when the planet is located 178 degrees away from the sun. Opposition happens after close approach because the orbits of Earth and Mars are not perfectly round.

While Mars will not achieve the large size that it did in 1988, it will be placed higher in the sky 25 degrees higher than in 1988. There it will not be subject to as much of the Earth's turbulent atmosphere that prevents you from seeing detailed views of the planet.

Planetary observing and deep sky observing have something in common. They are both an acquired skill that is best gained by practice. Deep sky observers have to learn how to use averted vision. Planetary observing requires extreme patience and careful attention to detail. In many respects, planetary observing is the harder, more challenging of the two. Robert Bunge of the Richland (Ohio) Astronomical Society contributed this article to the November 1990 issue. October 2015 marks NASA's announcement that evidence of water has been found on Mars—something imagined by Mars observers for decades.

December 2005

A look back at ALConExpo 2005

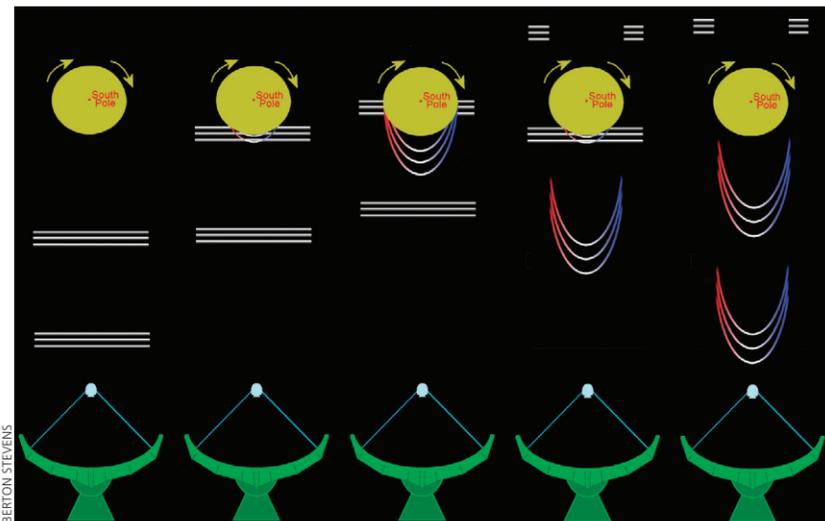
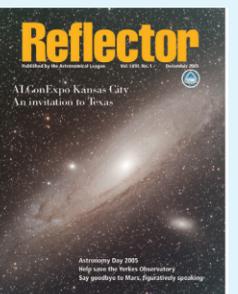
Amateur astronomers from all parts of the country converged on Kansas City, Missouri, in August for ALConExpo 2005 at the Sheraton—Overland Park, Kansas. The Association of Lunar and Planetary Observers and the Mid-States Region of the A.L. held their meetings in conjunction with this event.

Thanks to all the volunteers from the Astronomical Society of Kansas City and all the other volunteers who helped make such a successful convention possible.

Attendees were privileged to have a tremendous variety of speakers at the convention.

One of the major highlights of the convention was the banquet and awards ceremony. The keynote speaker was Bruce Bradley, the librarian for History of Science at the Linda Hall Library. His incredible presentation was entitled "Rara Astronomica: Rare Astronomical Books at the Linda Hall Library (and How We Got Them)." Bruce shared many fascinating anecdotes regarding the process of obtaining these rare and valuable books, including much of the history of the institution.

In this feature article, Carroll Iorg, past president of the AL, recounted the convention's proceedings, covering the many fine speakers and award recipients from across the League. The Linda Hall Library received another notable donation in August 2015: David Levy donated his observing notes to the library.



This is a two-dimensional diagram of a rotating, smooth, spherical minor planet imaging session. Two brief radio pulses are sent toward the minor planet at a fixed frequency. As they strike the minor planet, a pulse returns from the nearest surface first while the rest of the pulse continues onward. As the pulse hits the surface around the side of the minor planet, it is Doppler shifted to a higher frequency (blueshifted) on the side approaching us and Doppler shifted to a lower frequency (redshifted) on the side receding from us. The returning pulse contains both Doppler shift and delay information, which can be processed into an image. A real minor planet with a rough, three-dimensional surface returns a much more complex signal.

"Megan! It's time to go!"

"In a minute" she responds. It's 9 a.m. and I'm pacing, eager to get on the road. Morning traffic should have let up by now, and we should be able to make it across the valley and up the pass without much issue at all. It's a Thursday morning, June 11, and we're heading to

Grandview Campground in Inyo National Forest, in the White Mountains in California, at 8,500 feet elevation, a five-and-a-half-hour drive at our pace. The scopes, camping gear, and cameras are all ready to go. And the "babies"—puppies—even seem to know we're off on yet another one of our adventures. They stick to me like glue, afraid to get separated and left behind. It makes me smile.

Here she comes. "You got everything, right?"

"I think so," she says.

"Well, then, let's go." And so, off we went.

The only eventful part of the trip was when we stopped in Big Pine for fuel, ice, and the few things on the shelves that might offer us some comfort in the

GRANDVIEW

JUNE 2015

By Jamie "Rue" Countryman

middle of nowhere—*candy!* The babies were restless from the hours on the road. They needed to stretch, and, evidently, let everybody in the county know that they were there. Tugging on the leashes, they barked non-stop at anything and everything. It made me smile to see them tangle

Megan up in the leashes. (You have to enjoy the small things.)

From Big Pine to Grandview is a short drive up a road that can be best described as a can of malaria germs. In other words, just take it easy and everything will be okay.

Two p.m. found us at Grandview! Steve Peters had agreed to meet us there, to help us reserve the site for the

others who would be arriving the next day, so we wouldn't have to be out there by ourselves. Steve wasn't there yet when we arrived, so we set about making camp, which

didn't take much time at all. Steve arrived at about 4 p.m., and very soon after it began to rain—and I

do mean *rain*. The kiosk there says that the area gets five to eleven inches of rain annually. What it doesn't tell you is that it would get *half* that on the day I arrive. The downpour found the three of us and Megan's "kids" in the home away from home, our tent. (And Ruth, thank you very much for the treats.) I could take this opportunity to



complain about the rain, but that's not going to happen here. As it turned out, the rain gave us a wonderful chance to get to know our friend Steve better, and he, us. We talked, we laughed, we shared all sorts of things, and I think I may have actually blushed more than once during the course of the conversation.

Before long, perhaps too soon for us, the rain let up for a bit and Steve was able to make it back to his trailer, leaving us to our much-needed rest. It's very good to have made a friend like Steve Peters. And did I mention his wife bakes?

Friday was for the most part uneventful, even restful. We managed to set up the scopes and kick about for the whole day. Late in the day, Chris Clark arrived. After that, Martin Carey graced us. Robin and Rudy snuck in Friday night as well. The place was filling up. Filling up though it was, it didn't look like the night was going to offer us much except for some good conversation. But the sky did clear up, at least a little.

I won't go into all the equipment that was there, except to make some special mentions. Thank you, Martin, for giving Megan and me the opportunity to acquire the monster 25-inch f/5 from Bob Noss. My gosh, that's a big scope! It was a real pleasure to see the attention it got, and an education to see the dynamics of what a large scope has to offer.

Thank you, Perry, for the objective "Lens Made In Germany." We can't pinpoint the actual maker of the objective, but I guess that doesn't really matter to me. It's amazing to see what a 90 mm f/5.6 attached to a camera can do, when it doesn't blink for 20 minutes. You have to see it to believe it.

Saturday we were supposed to rest, to get ready for the evenings event: stargazing! But so much for the best laid plans. We spent the day looking for shade, talking with the gents, listening, laughing, learning.



Megan (left) and Rue with their 25-inch f/5 Obsession telescope.

Late in the day Chris and Martin went for pizza, and though the sky again wasn't looking good, the world just felt right.

Late into Saturday evening, the sky did clear up, and we all got a chance to take our looks. I was so distracted in my own little world that I didn't make note of what the others were looking at. I had the "Perry Lens"—the Lens Made In Germany—up on an Atlas mount, which dwarfed the little

lens. I had the Canon T3i DSLR attached to it, and I was focused. I was hoping my alignment was good because I couldn't see anything looking directly through the camera. I was playing the game of math! I could hear excited voices from across the way, as Megan and the gents put their eyes to the monster 25-inch. It made me smile. I worked so hard to get that scope ready for the trip. Martin pulled out

the best of his eyepieces—eyepieces that are, for now, far beyond our reach—and poked them into the monster, to get the best view possible. It would get quiet for a few moments when whoever was operating the scope was zeroing in on their target. Then it'd be found! Then it was, well, not so quiet!

Sunday morning, Megan and I were moving slowly. Chris and Scott had checked out and headed home long before we got

up. Martin was moving about, packing up his gear, fixing to abandon us as well. Mid-morning found us again alone with only Steve Peters for company. We visited and rested. Sunday night was to be the night that Megan and I got to do our own thing. She wanted to do some time-lapse, wide-field astrophotography, and I wanted to make a second attempt with the Perry Lens. Though my math the night before wasn't bad, it could've been better. I owed Perry something! I needed to come home with something to show. The gift he gave us needed to be respected, and coming home with a picture or two was how I intended to say thank you. The sky that night was more than cooperative: it was fantastic, to say the least. Steve and Megan went back and forth from scope to scope, her 25-inch and Steve's 15-inch. Megan tried to find time to get to her cameras, though not as successfully as she had hoped. Me, I was worn out. I was happy to be doing what I was doing. I would push a few

buttons, wait for the scope to slew, then set the camera into motion. I would find my chair, sip my coffee, and I would wait, sometimes 10 minutes, sometimes 20. Then there would be the "oh wow," or "holy smokes, look at that!" The Perry Lens was giving me a smile from ear to ear. Perry, thank you, sweetheart. By 3 a.m., I could go on no longer. I had held out as best I could. I was hoping for my final object to be the Andromeda Galaxy. I was waiting for it to rise above the trees. With that image captured, I felt a sort of relief. I could go to bed now, happy and exhausted. My visit to Grandview had run its course.

My life is better because of Megan, because of the San Bernardino Valley Amateur Astronomers (the SBVAA), and because of the wonderful people it has allowed us to meet and to befriend.

Steve, thank you for looking after us. ☀



Six-image Milky Way panorama, taken by Megan Huynh on June 14, 2015: each image was a 30-second exposure at ISO 6400 using a Canon 6D DSLR and a 24–105 mm lens at 24 mm. Post-processing was done with Hugin (stitching) and Photoshop CS6.

NEW OBSERVING PROGRAM: ACTIVE GALACTIC NUCLEI

By Al Lamperti, Delaware Valley Amateur Astronomers

There are a host of objects in the universe that inspire wonder and awe in each of us. For me, knowing how long a photon has traveled before it hits my retina is truly a humbling experience. Observing objects with active galactic nuclei fulfills this desire.

The purpose of this new program is to provide an opportunity to observe and/or image various types of active galactic nuclei, including quasars, BL Lacertae objects, and Seyfert galaxies. At first it may seem intimidating to observe them. However, under the proper conditions, an observer or imager will be able to see and document these extremely distant, dim, and energetic objects.

The program will also serve as a new and different challenge for the advanced amateur observer or astrophotographer and will definitely hone your observing skills while finding, detecting, and recording these seemingly elusive objects. No doubt that partaking in this program will increase an observer's or imager's wonderment of the universe.

Background

Galaxies with active nuclei were studied in the early 1940s by Minkowski, Humason, and Seyfert. Some objects originally thought to be variable stars were later recategorized as active galactic nuclei, including BL Lacertae objects (BLOs). Radio galaxies were studied in

the 1950s followed by quasi-stellar objects (QSOs or quasars) in the 1960s. Beginning in the 1980s, the numbers of known QSOs, BLOs, and AGNs have grown almost exponentially¹, particularly due to those discovered by the Sloan Digital Sky Survey.

Active galactic nuclei are the highly energetic compact regions at the centers of some galaxies and are the most luminous sources of electromagnetic radiation in the universe. They are each powered by a supermassive black hole and some have strong emission lines.

The table, below, describes the differences of the various types of active galaxies as compared to normal galaxies: Currently many investigators

are using "orientation-based" unified models to explain some of the differences between active galaxy types. The types seen depend upon the angle from which we are observing the objects, as depicted in **Figure 1**.

Types of Active Galactic Nuclei

Although radio galaxies are also included under the AGN umbrella, they are not part of this particular Astronomical League Observing Program (though they are a part of the League's Radio Astronomy Program). We are concentrating on those AGNs that emit much of their energy in the visible wavelengths.

Blazars (blazing quasi-stellar objects): These have relativistic jets pointing towards Earth and are of two types:

- BL Lacertae objects (BLOs): Variable AGNs hosted in massive galaxies.
- Optically violent variables (OVVs): Highly variable AGNs, very few in number. These radio galaxies have light output that can change dramatically over a very short period of time. They have broader emission lines and higher redshifts than BLOs.

Quasars: These are extremely bright AGNs—so bright that their light often overpowers that of the rest of the host galaxy. This is an important property of quasars. Subgroups of quasars will be discussed in the next section.

Seyferts: These are almost exclusively spiral galaxies. In contrast to quasars, Seyfert galaxies have AGNs that are less luminous, making the rest of the galaxy visible to us.

Seyfert Type I: These have

narrow and broad spectral lines of ionized hydrogen, helium, nitrogen, and oxygen.

Seyfert Type II: These have only a narrow band of spectral lines.

Both Type I and Type II fluctuate rapidly, especially in the X-ray portion of the spectrum.²

Types in between I and II, for example, Sy 1.2, Sy 1.5, denote differences in the appearance of the optical spectrum. Seyfert galaxies can also be categorized by luminosity classes I to V, with galaxies of luminosity class I being the most massive, having the largest number of stars, and having the most strength, greatest thickness, and the most prominent arms.

All of these distant AGN display redshifts (z-values) that correspond to a few hundred million light-years to several billion light-years. (These are their proper distances and not the expanding distances.)

Gravitationally Lensed Quasars

This is one of two unusual subgroups of quasars. In this type, the light from the distant quasar is gravitationally lensed by a massive foreground object, an effect predicted by Einstein's general theory of relativity. In 1979, a twin quasar in Ursa Major was found. Each segment had identical spectra, leading to the conclusion that the light originated from a single source and was split by a foreground object. This optical illusion of multiple images of a single background object obviously requires the background object to be more distant than the foreground object doing the

lensing. Since most quasars are very distant, they are susceptible to being gravitationally lensed. Lists of gravitationally lensed quasars can be found in an article by Wolfgang Steinicke³ and in the Gravitational Lens Database.⁴

True Double Quasars

The first pair in this second subgroup of quasars was discovered by Djorgovsky several years after the discovery of the first lensed quasar. In this subgroup, the spectrum of each quasar in the pair is different. That is the clue that we have two quasars here, not two images of a single quasar. Lists are available in references 3 and 4.

Since the total number of known quasars and BLOs is truly "astronomical," we have, for the most part, limited our list to those described by Wolfgang Steinicke in 1998⁵, where he tabulated objects brighter than magnitude 16.5 and north of -20 degrees declination. For this program, we have chosen those Seyfert galaxies with a luminosity class of I and obtained the list from the NASA Extragalactic Database (NED)⁶ using that parameter. We also limited these Seyfert galaxies to those north of -20 degrees declination.

Requirements for Completing the Program

Observers will be required to observe and/or image a total of any 30 quasars, Seyfert galaxies, or BLOs for the Active Galactic Nuclei Observing Program certificate and pin. In order to fully appreciate the

various types of AGNs, there must be at least 5 quasars, 5 Seyfert galaxies, and 2 BL Lacertae objects from these lists. If so inclined, the observer/imager may include one or more of the optional challenge objects in the lists of gravitationally lensed quasars or true double quasars.

Observations will be telescopic and can be recorded

4-inch telescope is suggested.

Full details, as well as the appendices, are available on the Astronomical League website at www.astroleague.org/programs/active-galactic-nuclei-observing-program.

Hints on Observing Quasars, BLOs, and AGNs

The Wolfgang Steinicke reference⁵ is a very valuable tool for compiling a strategy for

attacking these objects. To make things easier, we also added the pages of the *Uranometria 2000.0* (1st and 2nd editions) and *Millennium Star Atlas* that were obtained from the website of the Delaware Valley Amateur Astronomers. One may use other software programs such as MegaStar for such purposes, as well as for obtaining images of the surrounding star field, which is beneficial when locating a small, dim object under high magnification. A free download of "Observing Variable Galaxies" by Alvin Huey (faintfuzzies.com/DownloadableObservingGuides2.html) may help as well.

Preliminary "homework" includes making an observing list for the upcoming session(s). The observing list will

have the object name, constellation, magnitude, distance and page of *Uranometria* or *Millennium*. In the observing field, one would then star hop using the *Uranometria* atlas under low magnification and, if needed, star hop using the

fainter stars plotted in the *Millennium* atlas. To view the dimmest objects, higher magnification is highly recommended. Once the object is located, then a verbal description can be dictated into a microcassette recorder and/or a rough sketch of the eyepiece field can be made. The appendices also provide the observer with the redshift (z).⁷ Having the distance of the object available to the observer at the eyepiece adds an additional sense of wonder, awe, and satisfaction. ☀

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- ² *Faint Objects and How to Observe Them*, Brian Cudnik, Chapter 5, "The Nature of Quasars and Other Exotics" Springer, 2013.
- ³ "On False and True Double Quasars," Wolfgang Steinicke, www.klima-luft.de/steinicke/Artikel/dqso/dq_e.htm.
- ⁴ www.cfa.harvard.edu/castles.
- ⁵ "Catalogue of Bright Quasars and BL Lacertae Objects," Wolfgang Steinicke, www.klima-luft.de/steinicke/KHQ/khq_e.htm.
- ⁶ ned.ipac.caltech.edu/forms/OBJatt.html.
- ⁷ For information on how to convert from redshift to distance, see www.uni.edu/morgans/astro/course/Notes/section3/math13.html.

Other References

- "Active Galactic Nuclei and the Amateur," Hewitt, N., and Poyner, G., *Deep Sky Observer* 116: 3–13, 1999.
- "Observing Variable Galaxies," Alvin Huey, 2013, faintfuzzies.com/DownloadableObservingGuides2.html.
- For the truly adventurous, "The Million Quasars (Milliquas) Catalogue," version 3.4, 2013, at quasars.org/milliquas.htm.

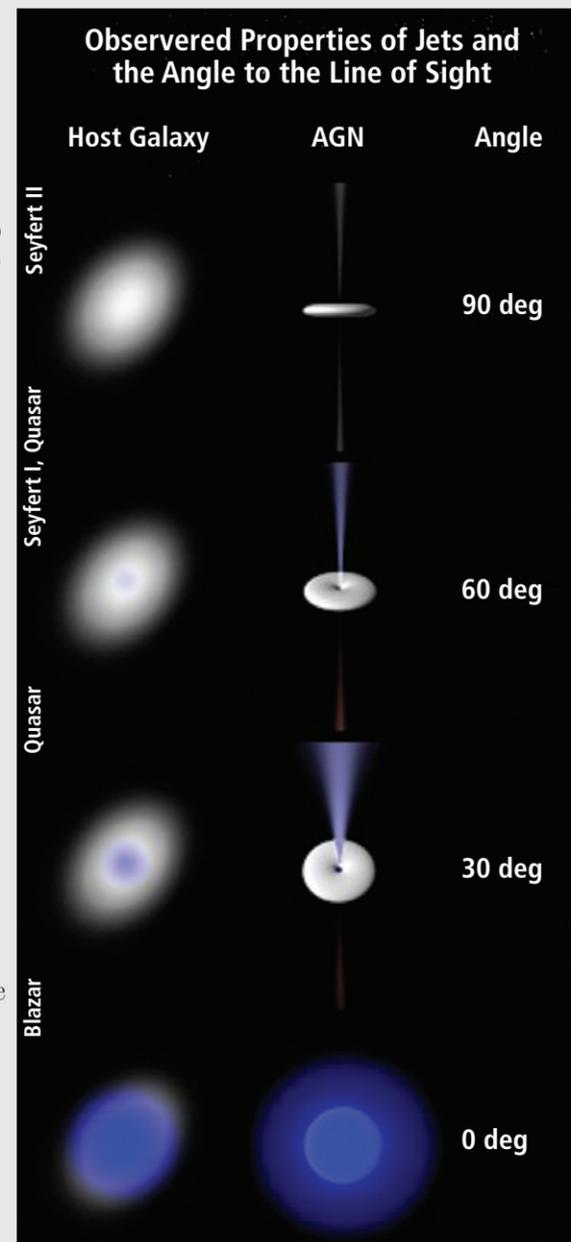
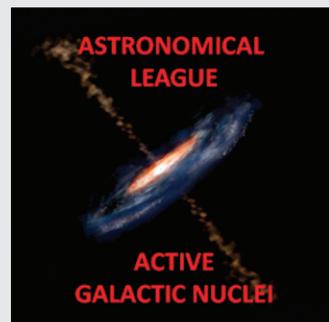


Figure 1. An orientation-based unified model of AGN

either by visual description and sketch (V) or imaging (I). For visual observations, a 13- to 15-inch telescope is recommended as a minimum, and for digital imaging observations, at least a

A New Look for Our Trust Fund

By Bob Gent

The Astronomical League Trust Fund was established in November 1970, and the first trustees were Leonard Perdue (former League treasurer), Art Smith and Bob Wright (past AL presidents), Grace Scholz Spitz (former executive secretary), and Elizabeth F. Hasson. The fund is now governed by the AL bylaws, and the first AL standing resolution covers operational procedures. Today, the fund is managed by five trustees elected by the League council. The current trustees are Jim Fox, Bob Gent, Joanne Hailey, Tim Hunter, and John Wagoner. Except in the event of a grave emergency declared by the council and trustees, the principal of the fund will remain invested in low-risk accounts. The income, including interest and dividends, may be used to fund special projects. For example, dozens of new observing programs were given Astronomical League Trust Fund startup funds to pay for the publication of manuals, certificates, pins, and other expenses.

In the past, the trust fund was kept in savings and money market accounts so that the Astronomical League Trust Fund treasurer could easily write checks. However, during the recent recession, the interest rates of savings accounts and money markets plummeted. For example, in 2013, the total interest on our \$87,000+ trust fund was only \$87! This interest rate of 0.1 percent was insufficient to allow the trust fund to be used for new programs. At the request of the council, the trustees began looking for alternatives.

In late 2014, a new trust fund account was established at Edward Jones. This was the first time our accounts were not held by a bank, but by an investment company. Establish-

ment of this new account served several purposes. First, it was possible to move money into higher-interest, FDIC-insured certificates of deposit. Also, we were still able to move interest into a money market account to be able to pay for new council- and trustee-approved projects.

Another benefit was that, for the first time, we could accept donations of stocks and mutual funds. Thanks to a generous donation from AL trustee and past president Jim Fox, we now own stocks. In addition, by donating to the trust fund (the AL is a 501(c)(3) organization),

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the donor pays no capital gains on the appreciated value of the stock donated, but gets the full value of the donated stock as a tax deduction. If you would like to support the League, what a great way to do it and get a deduction on your taxes. Since moving our account to Edward Jones last year, our trust fund grew from \$87,256 to \$89,217 today (September 17, 2015). That increase includes both interest and donations.

If you would like to make a tax-deductible donation of cash or stocks, please contact Bob Gent, Astronomical League Trust Fund treasurer, at RLGent@cox.net.

Outreach Master Level Report

Several years ago, I happened upon a very interesting discussion about Ichiro Suzuki, one of the great hitters in Major League baseball. The commentators were discussing Ichiro's philosophy of hitting based on Ichiro's own description of his approach when trying to reach base. I am omitting the more

technical details of this discussion, as they are irrelevant; rather, it was the mindset of Ichiro that I found fascinating.

In essence, Ichiro explained that in a certain percentage of at-bats, the pitcher would find a way to get him out, and there was nothing he could do about it. Conversely, in a certain percentage of at-bats, he was going to get a hit; there was no doubt that he would reach base. It was the middle percentage, Ichiro explained, when he needed all his skill and experience to get on base. Of course,

when stepping to the plate, Ichiro did not and could not know the outcome of that particular at-bat, but over the course of a full season all these percentages would average out. I found this approach quite illuminating, especially the realization and acceptance by Ichiro that in many instances his attempts to get a hit or reach base would be futile.

I believe Ichiro's hitting philosophy provides an excellent analogy to the approach I have taken when doing public outreach in amateur astronomy. A certain percentage of individuals, regardless of what I tried, would have little or no interest in what I attempted to explain or demonstrate.

Conversely, a certain percentage of individuals would be greatly interested in what was being explained or demonstrated. As a side note, I later met several individuals on different occasions who said that our efforts to increase public awareness of astronomy spurred them on to take up the hobby. And finally there was that middle percentage—those

on the fence, so to speak. This is where I needed to focus all of my skill and experience to achieve what I still consider to be the most important objective of public outreach—getting individuals to become interested and involved in astronomy.

Over the course of my outreach efforts, I have tried to identify and separate the essentials from the non-essentials: basically, what works and what doesn't; what has demonstrable value and what aspects of public outreach are less important when attempting to present a fairly technical subject to a largely non-technical audience. Most of my essentials were unsurprising, whereas several that I had initially thought were invaluable were ultimately inconsequential. It is on these important essentials I will now concentrate.

The first on my list of essentials was acceptance. This applied more to my thought process than it did to any potential audience I may one day affect or influence. It took me quite a long time to realize and accept that not all individuals shared my love of and interest in astronomy. At first, I thought, "How can someone not be interested in a subject as wonderful as astronomy?" I often considered it a personal defeat when a person walked away from my telescope with an indifferent attitude. As hard as I might try, I slowly realized there were individuals who could not be "converted" to my way of thinking. It was a difficult lesson to learn, but eventually this acceptance made my outreach attempts much easier—I no longer worried that people didn't "get it." It was likely the most important turning point in my thinking about outreach.

I believe that to be an effective advocate for astronomy, one needs enthusiasm. During many outreach events, especially those events that are specifically astronomy-oriented,

I can admittedly be overly enthusiastic. It is a characteristic I have learned to temper; however, I have never seen an amateur astronomer who effectively interacted with the public who did not have incredible enthusiasm. To me, an enthusiastic presenter reaches more people than a presenter who is technically knowledgeable. In fact, I have witnessed learned amateurs—actually brilliant amateurs—who are as bland as white bread. (My apologies to all white bread aficionados.) They often lose their audiences with an uninteresting recitation of what is indisputably fascinating material. In some instances, they know their subject too well. I truly believe that an enthusiastic amateur—one who can connect to his or her audience—becomes a true ambassador for astronomy.

Another of my essentials is patience, because as amateurs we need to understand that the public is often poorly educated in the science of astronomy. It is, in my view, a highly technical subject, one whose nuances must be communicated in unambiguous terms to be effective. To that end, I believe we need a modicum of patience. I can recall, and I'm sure we can all recount, many instances when doing outreach of being asked bizarre questions and hearing outlandish statements. During these instances, I try to remember that the gap between public understanding of astronomy and the actual science of astronomy is often quite large. And, very importantly, I no longer become upset or annoyed when someone asks me about how I got into astrology!

A hands-on approach has always been a staple of my outreach efforts. I cannot say how many times I have had people come up to my telescope and say, "I really don't want to touch your equipment" or "no, I don't think I should" when I

encourage them to do exactly that. I want people to realize this hobby of ours is not the intimidating activity they think it is. Sure, there are things anyone looking through a telescope should not do, but for the most part, I want people working my telescope. In practice, I sometimes purposely misalign the view or create a problem that the individual has to fix. When I explain what they should do, and when they make the effort to correct the problem I have created, they lose much of the fear that once made them too afraid to even touch the equipment I have set up.

As amateurs of varying levels of skill and experience, I believe we often lose sight of the need to talk to the level of the audience. That means making every effort to never talk down to or talk above them. As we gain in both knowledge and experience, we always need to be cognizant of who we are actually trying to communicate with, whether it is an individual or a group. I have been at venues dedicated solely to astronomy as well as venues where astronomy is not the main attraction. We can naturally assume that the audience possesses a certain level of expertise based on the venue, but before my assumptions go too far, I try to ask some questions to get an idea of who I am trying to reach. When I ask, "What do you know about astronomy?," I am trying to gauge the level at which I need to communicate. For me, I am not as technically knowledgeable as many of my peers, so I need to be particularly aware of my own limitations. When I am asked a question that I cannot confidently answer, I believe the worst thing to do is attempt an answer. I would rather say "I don't know," or "this person would know better than I would," or "I'm not sure, but I can find out" rather than guess. To me, showing someone that you don't have all the answers

gives you a lot of credibility, and I have learned that humility goes a long way in amateur astronomy.

Last, as an essential, I always attempt to make it fun. After all, amateur astronomy should be fun. Whoever said—and I paraphrase—that "if you are not having fun in this hobby, you are not doing it right" was spot-on. The enjoyment we experience in astronomy takes many forms; sometimes it is the quiet satisfaction of discovery, or, on the opposite end, the exuberance of an amazing sight in the eyepiece. I have experienced both, and I have seen other amateurs do the same. I believe the public senses the fun we have just by the way we speak or the excitement we exhibit. When I hear a "whoa" or when I hear someone at the eyepiece say to his or her companion, "come here, you have to see this," I know I've reached them. It is a supremely satisfying feeling, one I imagine we have all felt during the times we have engaged in public outreach. I always enjoy telling the story of Charles Messier and our attempts to locate his 110 "nuisance" objects; this never fails to get a laugh. Or how during his time spent in England, John Adams' happiest day was his visit to William Herschel. I find that small anecdotes or tidbits sprinkled into my outreach efforts have

done much to enhance the experience for the public. Simply put, I try to make it fun.

These are my essentials, those aspects of outreach that work for me. Admittedly, they would not necessarily work for other amateur astronomers. After all, we are all different and we come into this hobby with different levels of knowledge and experience, different objectives that motivate us, and varying skills in communication, among other things. And I certainly do not discount other important abilities and approaches to public outreach that may contribute to the effectiveness of an amateur astronomer involved in this most rewarding endeavor. I have seen many amateurs with very different approaches that are just as effective in reaching the public.

Ultimately, each of us involved in outreach must find the best method by which we interact and connect to the public. Just as Ichiro could not know in advance which at-bat would produce a hit, we as amateurs cannot know in advance whose lives we may touch. And if we inspire just one person, we will have accomplished our mission.

Gordon Schaefering

The Albuquerque Astronomical Society (TAAS) Amateur Observers' Society of New York (AOSNY)

Call for League Officer Nominations

The two-year terms of the offices of president and vice president end on August 31, 2016. The three-year term of the office of executive secretary ends on August 31, 2016. If you are interested in using your talents to serve in one of these important positions, we would like to hear from you. Please volunteer!

For specific information regarding the duties and responsibilities of these three offices, please refer to the League's bylaws, which can be accessed on the League website at astroleague.org.

Each candidate should send a background statement explaining why they are interested, along with a photo of themselves for publication in the *Reflector*, to nominating committee chair Ron Whitehead at executivesecretary@astroleague.org. Please limit all statements to approximately 250 words. All nomination materials must be submitted by March 15, 2016, so they can be announced in the June *Reflector*.

2015 Astronomical League Youth Awards Report

William Bogardus,
Astronomical League
Vice President

Jack Horkheimer Service Awards

Any League member under the age of 19 at the time of the application is eligible to apply for the two Jack Horkheimer Service Awards and for the Jack Horkheimer/Parker Youth Imaging Award. The Service awards are based upon service to the League, either directly or through service to any Astronomical League society. Service could be in the form of educational outreach, contributing knowledge and skill to public star parties, or other astronomical service. The Youth Imaging Award recognizes the achievements of imaging intriguing celestial scenes. Young astronomers can apply for the National Young Astronomer Award and the two Horkheimer Service Awards—the Horkheimer/Smith Award and the Horkheimer/D'Auria Award—as well as the Horkheimer/Parker Youth Imaging Award. The winner of the Horkheimer/Smith Award will receive an expenses-paid trip to the annual Astronomical League Convention, a plaque presented at the convention's awards banquet, and a \$1750 cash prize. Companies, such as Celestron, often donate some of their fine equipment to the winners. Top finishers for the Horkheimer/Parker Award and the Horkheimer/D'Auria Award each receive \$1000 cash prizes.

This past year's Horkheimer Service Awards were left unclaimed, with no applicants.

Horkheimer/O'Meara Youth Journalism Award

This award is open to young writers 8 to 14 years old. Submissions should be 300 to

500 words. Entries are not limited to astronomy-related topics; we are open to any science-related topic that interests the contestant—whether robin's eggs, quasars, or something else entirely. We are looking for someone who can take a factual scientific event or discovery and write an accurate story that is so exciting and informative that readers will not want to put it down because they are learning so much. Aside from accuracy, entries will be judged on three criteria: creativity, conciseness, and clarity. We would like to thank past president Terry Mann and author Sue French for helping with the selection of this year's winner.

This year's winner is Ephraim Craddock, now a fifth-grader at Galvez Primary School in Prairieville, Louisiana. He is affiliated with the Baton Rouge Astronomical Society and was nominated by its president, Merrill Hess. Ephraim's composition was written from the point of view of German astronomer Johann Gottfried Galle, about his discovery of the planet Neptune. It is a nicely done composition, especially considering it was written by an 8-year-old!

National Young Astronomer Award

The National Young Astronomer Award recognizes outstanding work by amateur astronomers of high-school age, in the areas of research, public education, academic scholarship in astronomy or science,

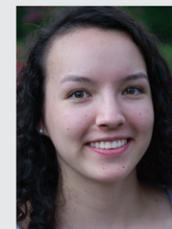
observing, imaging, telescope or equipment design or construction, publications and writing, local club activities, and regional and national organizational activities. This award is supported by Explore Scientific, which donated a 125 mm apochromatic telescope and mount to each winner.

This year's first place winner

FROM AROUND THE LEAGUE

is Theodora Mautz, who graduated earlier this year from Lincoln High School in Portland, Oregon. She is a member of the Rose City Astronomers and has attended a workshop at Pine Mountain Observatory. She now attends Harvard University.

Since she doesn't have to declare until halfway through her sophomore year, she is still unsure of what to major in, but hopes to take some astrophysics courses. Her essay, "Investigating the Effects of Milky Way Globular Clusters' Galactocentric Distances on Their Rotational Velocities About



the Galactic Center," was written for the International Baccalaureate program and was presented at ALCon 2015. While she did not collect the data herself, the analysis she performed on it and the conclusions she drew were all original.

This year's second place winner is Sydney Marler, now a junior at Sherman E.

Burroughs High School, in Ridgecrest, California. She has participated in Astronomy Camp at Kitt Peak National Observa-

tory near Tucson, Arizona. She has spoken to an astronaut on the International Space Station using ham radio and conducted



research on the impact and quantification of light pollution in urban areas.

Although not a member, she has been involved with the China Lake Astronomical Society and has organized night observing programs for a local Girl Scout camp. She is a self-taught amateur astronomer and astrophotographer, and was recently named an International Google Science Fair finalist. Her paper was

Mabel Sterns Award for Excellence in Newsletters

The Astronomical League presents an annual Mabel Sterns Award for outstanding editing of a League society newsletter. Newsletters from League-member institutions, such as planetariums, museums, and event boards, are ineligible. Competition for this year's award was heavy, with eight entries. A special thank you goes to the judges, consisting of the last three years' winners—Karl Henry (2014), Erika Rix (2013), and Bill Pellerin (2012)—plus *Reflector* editor Ron Kramer.

This year's award goes to Paul Tartabini of the Back Bay Amateur Astronomers for his editing of the

Back Bay Observer. His newsletters may be accessed at www.backbayastro.org/observer/newsletter.shtml. The Back Bay Astronomers serve the Southside Hampton Roads cities of Virginia.



"The Effects of Interstellar Medium on the X-Ray Spectral Characteristics of Gamma Ray Bursts," which she presented at ALCon 2015.

Youth Astro-Imagers! Enter Your Favorite Shot Into the 2016 Horkheimer/Parker Youth Imaging Competition!

Are you 18 years old or younger and do you enjoy the challenges of astro-imaging, whether using a smartphone, a handheld digital camera, or a telescope CCD imager? Have you captured an astro-image that you are particularly proud of?

Why not enter your shot into the Astronomical League's Horkheimer/Parker Youth Imaging competition? After all, the first place winner receives \$1000, second place \$500, and third place \$250!

Submitted images can be of any astronomical-themed subject—an interesting perspective of a planet, a captivating lunar crater, a wondrous deep-sky object, or a wide-field scene of the sky at night.

For all the details and rules of the competition, please see www.astroleague.org/al/awards/horkhmr/horkhmrs.html. The entry deadline is March 31, 2016.

The Astronomical League's Youth Awards 2016: Prepare Now!

Wouldn't it be great to be young again and to be entering amateur astronomy? Now is the time to start considering the Astronomical League's youth awards for 2016: the National Young Astronomer Award, the two Jack Horkheimer Youth Service Awards, a Youth Imaging Award, and the Horkheimer/O'Meara Journalism Award.

If you know a young person who has been involved in an astronomy-related research project—either of his or her own or through an educa-

tional institution—please consider nominating that person for the National Young Astronomer Award. He or she must be between 14 and 19 years of age.

If you know a League member, 18 years old or younger, who has brought amateur astronomy to your club

or to the public through outreach, presentations, writing, or observing, please consider nominating that person for one of the four Horkheimer Awards.

Since the deadline for the National Young Astronomer Award is January 31, 2016, and the deadline for the Hork-

heimer Awards is March 31, 2016, now is the time for potential candidates to work on their projects and to participate in various astronomy activities.

If you are a club officer, nominate them. Information about each award can be found at www.astroleague.org/al/awards/awards.html.

2015 Webmaster Award

Congratulations to Shawn Kirchdorfer for winning the 2015 Astronomical League Webmaster Award. He is with the Fort Worth Astronomical Society, www.fortworthastro.com.

The Fort Worth Astronomical Society is fortunate to have a wonderful, informative website that catches your eye. The attractive home page gives important club details and quick access to a valuable fundraising donation button. Learning about the club is easy by navigating through the site's top menu bar. The site contains a manageable number of pages displaying a wealth of information. It also has many photographs showing amateur astronomy in action as FWAS members interact with the public and pursue their love of the night sky.

2016 Astronomical League Webmaster Award

The Astronomical League's Webmaster Award acknowledges the club webmaster who does an outstanding job of website design and administration.

- The webmaster of any astronomy club that is a current member of the Astronomical League is eligible.
- The website will be judged on its content, its ease of navigation, and its ability to attract people.

Club presidents, please send webmaster nominations and the club's website address no later than April 1 to WebmasterAward@astroleague.org. You can also mail your nomination information to the following address: Mike Rao, Administrator, Astronomical League Webmaster Award, 2559 Rusk Street, Houston, TX 77003, mike.rao@optimus-us.com.



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March 1—10	August 25—September 3
March 30—April 8	October 21—31
April 29—May 8	November 20—30
May 29—June 7	December 20—30



On August 15, 2015, Dennis di Cicco was presented with the Special Service Award of the Northeast Region of the Astronomical League (NERAL). Di Cicco, from Sudbury, Massachusetts, was given the award at this year's Stellafane Convention in Springfield, Vermont.

His famous award-winning photograph of the Sun's analemma in the 1970s was a milestone in his astrophotography career. A long-time Stellafane devotee, he was inspired to build his own backyard observatory, which he would put to good use for many decades to come. He was recognized for his observational talents in 1997 with the Astronomical League's Leslie C. Peltier Award for his significant observations of minor planets, lunar and planetary astronomy, and general astronomy. In 1978 he was presented the Clifford W. Holmes Award at the Riverside Telescope Makers Conference Astronomy Expo for his work popularizing astronomy.

Since then he has gone on to make great contributions as a writer and senior editor for *CCD Astronomy* and most notably for *Sky & Telescope* magazine from 1974 through 2014. His generosity in sharing his knowledge in articles, equipment test reports, eclipse trips, and talks with the amateur astronomy community at club meetings and star parties across the country makes him a star on our earthly sphere for which we are extremely grateful.

Astronomical League and EarthSky join forces

EarthSky and the Astronomical League—the most established

and respected organization of amateur astronomers in the United States—announced that they have agreed to partner in the years 2016 to 2018 to bring the wonder, beauty, and mystery of the night sky to the public.

John Goss, president of the Astronomical League, said, "The Astronomical League, the nation's largest federation of astronomical societies, is proud to partner with EarthSky. We recognize the importance of what stargazing and amateur astronomy offer to the betterment of our society, especially to the benefit of our young."

Among many other activities, the Astronomical League hosts a national meeting for all people interested in astronomy. It's called ALCon, and all are invited to the next meeting, which will be in Arlington, Virginia, August 10–13, 2016.

Deborah Byrd, founder and editor-in-chief of *EarthSky.org*, added, "We are thrilled and honored to be partnering with the Astronomical League, and we have some exciting plans for the coming three years. For example, after surveying our audience and getting their ideas on what they want to see, we've been working toward a slightly different design for our website, which we hope to implement in early 2016.

"There was a lot of enthusiasm in our community for adding two new features to *EarthSky.org*: first, a global map where people can pinpoint their favorite stargazing locations, and second, a calendar of events (star parties and the like) that people can attend and enjoy.

"The Astronomical League will be helping us with both features, and we are grateful for their support."

The partnership will include co-promotion of EarthSky and the Astronomical League in each organization's outreach to club members and the public. And it will include an exchange of information, designed to help each group accomplish its astronomy outreach goals. ☀

Additions to Reflector Staff

Photo Editor: Robert Westbrook (B.A. in journalism/television production, New Mexico State University, 1991)—a resident of New Mexico since 1984, I also lived in Fort Lauderdale, Florida, for two years working as a chef, on Long Island, New York, for a year rebuilding a 29-foot sailboat, and in South Korea for three years teaching English at

public schools in Incheon and at Seikyoung University, but always found that my "roots" are in the "Land of Enchantment." I have nurtured a lifelong love for astronomy and photography, and was co-founder of a long-defunct astronomy club in eastern North Carolina in 1979 (before I could drive—

thanks for all of the late-night taxi rides, Mom!), as well as a newspaper and yearbook photo contributor throughout junior high and high school. I can be found in Las Cruces slinging dogs and homemade brats for hungry Las Cruces Farmers and Crafts Market goers and I cater events. I'm still in my first year of membership with the Astronomical Society of Las Cruces and am proud to have worked with the motivated individuals who gave their all to make the 2015 ALCon such a success. I look forward to this new opportunity to contribute in this small way to a great publication dedicated to the many talented and enthusiastic individuals who make looking and wondering at the night sky a part of their life.

Email: photoeditor@astroleague.org

Advertising Representative: Carla Johns was born and raised in Colorado and developed a deep love and appreciation for the natural world during her family's 4-wheel-drive trips and hikes in the Rocky Mountains.

She looked through a telescope for the first time during an adult education class at the Denver Museum of Nature and Science. Seeing Jupiter suspended in the velveteen blackness of space left her utterly speechless and sparked an absolute obsession with astronomy. She soon joined the Denver Astronomical Society and began volunteering at the University of Denver's Chamberlin Observatory operating the 20-inch Alvan Clark telescope.

After moving to Southern California, she joined the Los Angeles Astronomical Society and the Mount Wilson Observatory Association. Her aptitude for operating telescopes and passion for sharing astronomy dovetailed with positions as a telescope operator at Griffith Observatory and Mount Wilson Observatory. Dedication and a willingness to burn the midnight oil led to a full-time position at NASA's Jet Propulsion Laboratory as a STEM informal education specialist.

After living in California for the better part of a decade, the darker skies of Colorado eventually drew her home. She now shares her love of astronomy with kids of all ages by volunteering at outreach events for the Northern Colorado Astronomical Society and Denver Astronomical Society. She is excited about joining the Astronomical League's volunteer team and looks forward to many years of serving the AL community.

Email: advertising@astroleague.org; Phone: 970-567-8878



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

-CHASING THE WANDERERS THAT MOVE IN THE NIGHT- ANATOMY OF AN IMAGING SESSION

Living in the temperate climate of South Carolina and being retired affords me more opportunities to get out and observe or image the sky than many of my fellow amateur astronomers have. Although life is busy, I'm not hindered by the need to be at work the next morning, and the weather isn't as big a factor as it is for my friends up north. Among my many interests in astronomy are following comets and asteroids as they wander among the stars in their orbits.

Monday night, January 26–27, 2015, presented a rare opportunity: the passage of a larger asteroid (more than 300 meters across) near enough to our home planet to be seen in even moderate-sized backyard telescopes. Asteroid 2004 BL86 made a close pass by the Earth, only three Earth–Moon distances away (about 1.2 million kilometers). Being this large, the asteroid appeared as a ninth-magnitude point of light passing through the stars of Cancer, bright enough for even backyard observers to watch it move among the stars.

The variability of the weather at my home made setup the most difficult part of achieving my goal of capturing this event with my imaging system. Dark clouds and winds gusting to 30 miles per hour made me leery of setting up my equipment. I checked several weather forecasts, which all predicted a minimal chance of precipitation and the likelihood that the clouds would clear for the event. I've been fooled many times in the past by weather that miraculously cleared up just before I was ready to retire for the night, so I decided to take a chance. **Photo 1**

Due to the complexity of my portable imaging setup, I needed to have everything up and ready to go by dark. My setup consisted of an Explore Scientific 127ED refractor and a 60 mm guidescope mounted on a Celestron CGEM DX mount. I used my DSLR to image the asteroid and a guide camera on the 60 mm to keep the mount moving in sync with the stars. Wires had to be run from the cameras and mount to the computer running the software that made it all come together like the instruments in a symphony orchestra. Additionally, I ran some network cable so I could control the system comfortably from my desktop computer inside my home. **Photos 2, 3**

As the day progressed, I set up the equipment in stages, covering it at each step in case I was wrong about the weather. Periodically the clouds would clear from the northwest only to close back in again. I placed my truck upwind of the equipment to help protect the equipment from wind damage. As sunset passed, I only had a very small window open to the west where Venus gleamed brightly above the trees. There were no other "stars" visible to do a proper alignment, so I

used Venus to do a Solar System alignment. Instead of using the hand controller to center Venus, I adjusted the mount manually by a small amount to better align it with the north celestial pole. I then slewed over to Betelgeuse, which peeked out from the clouds just long enough for me

to sync the mount's computer on it, near the area of the sky where I expected to find the asteroid. Hopefully this would be good enough for me to image the asteroid.

As the time to capture the event approached, the clouds cleared and I was able to go to the target area indicated by my SkyTools 3 software. I slewed to the position and used plate solving with AstroTortilla software to pinpoint my location in the sky. I took a 3-minute image, which clearly showed the telltale trail of the asteroid at the top of the field in my DSLR. I then pointed the scope ahead of the asteroid's path and took a series of images. My goal was to be able to use individual subframes to create a movie that would show the asteroid's path among the stars. I took some 60-second, some 15-second, and 265 1-second subframes. After reviewing the images, I decided the 1-second subframes would work well to produce the video. The video I created with 265 subframes shows the asteroid crossing the 53-arcminute field in approximately 7 minutes. I also stacked the subframes and produced an image that shows its track among the stars (see below). The image is very noisy due to the fact I had to use ISO 6400 to capture the asteroid in the 1-second subframes. I only performed some stretching in Photoshop to bring up the brightness level in each of the frames used to create the video. I also downsized the subframes by half to keep the size of the video manageable. **Photo 4**

Here's a link for the video: www.flickr.com/photos/13303982@N04/16198133917/lightbox.

I was very satisfied with the video I produced and the performance of my equipment. One of the reasons the alignment procedure I used worked well was that I had previously imaged from that location in my yard and was able to aim close to the pole, set the latitude, and do the leveling in daylight. It was the first time I used a daytime object (the Sun) to do an alignment that I then used for imaging at night. Waiting for nightfall to start the alignment from scratch really cuts into imaging time. My alignment was so good that I was able to slew to Venus and Mars in the daytime sky. I didn't try for Mercury because it was too close to the Sun for my comfort. This was a great experience, and it will help me prepare for future endeavors in astrophotography. ☀

By Dennis Wilde



Gallery



This image of the Trifid Nebula (M20) was taken by Aubrey Brickhouse, member of the Central Texas Astronomical Society on July 15, 2015, from the CTAS Meyer Observatory field. He used a Celestron C11 with Starizona 0.75x focal reducer on a Losmandy G11 mount, and a SBIG STT-8300M with Baader RGB, H-alpha, and O-III filters at -25 °C. Total exposure was 130 minutes.



Val Ricks from the Houston Astronomical Society imaged IC 410 and NGC 1893 in autumn of 2014 from The Woodlands, Texas using an Astro-Tech AT111EDT and William Optics AFR-IV at f/5.6. A total of 19 hours and 40 minutes of exposure was taken with an SXVF-H9: H-alpha (6 nm) 14 exposures of 1200 seconds each, H-alpha (12 nm) 7 x 900 seconds, S-II 22 x 900 seconds, O-III 31 x 900 seconds, and Alnitak Flat-Man flats. Astronomik narrowband filters were used, along with SX Lodestar and SX OAG guiding, and a Takahashi NJP mount. Software used included Nebulosity, PHD, MaxIm DL, Registrar, and Photoshop CS3 with one Carboni action.



Richard Sass of the Alamogordo (New Mexico) Astronomy Club submitted this image of Omega Centauri, taken with a Nikon D3200 attached to an Orion AstroView 120ST on an EQ-3 motor drive. This is a 15-second exposure at ISO 6400.



Arizona Desert Skygazer Astronomy Club member Paul Schulz imaged a meteor streaking through Orion on February 13, 2015, from Gillespie Wash, Arizona, using a tripod-mounted Canon EOS 60D camera with a 10 mm lens, and a 20-second exposure at f/2.8 and ISO 6400. This image was processed with Adobe Photoshop Lightroom 5.

TITLE PHOTO: NGC 2244; BRIAN KIMBALL

Field of View/ from page 4

country respect the activities of young observers, letting them know that amateur astronomy is a worthwhile avocation.

For these ten awards to be presented, though, ten qualified, deserving individuals need to be nominated. They are not going to nominate themselves—a caring and respected adult must step forward. Doing so just may affect, in the most positive way, a person's life for years to come.

Influence the future, nominate the young!
Participate. Discover. Volunteer.

John Jardine Goss
John Jardine Goss

Complete information about the Astronomical League Youth Awards, including the new Horkheimer/Parker Youth Imaging Award, can be found at www.astroleague.org/al/awards.html.

Celestial Sketches Alert!

Details for a new Astronomical League award program, "Astronomical League/Astronomics Sketching Award," can be found at www.astroleague.org/al/awards/awards.html. Spoiler Alert! First place: \$250, second place: \$125; third place: \$75.

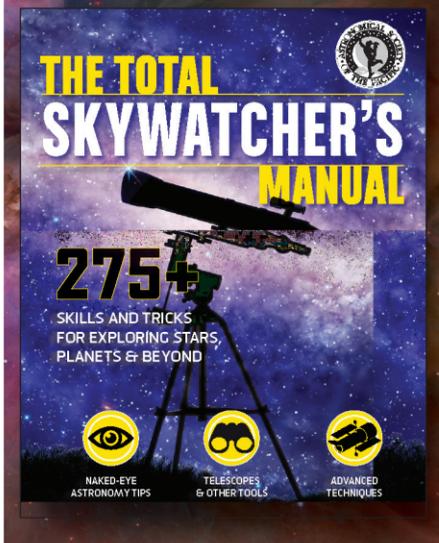
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StarDate, the bi-monthly publication of the nonprofit McDonald Observatory, is offering our members a 25% discount. Their magazine provides easy-to-read articles on the latest astronomy research, skywatching, the history of astronomy, and many other topics. *StarDate* also offers starcharts for each month, a sky calendar, and Merlin's answers to reader questions. The discounted rate is \$19.50 for members in the continental USA, \$22 for Canada, and \$30 to other foreign countries. Members-at-Large should send their check (payable to the Astro League) to Astronomical League Office, 9201 Ward Parkway, Suite 100, Kansas City, MO 64114. For members Societies, the appointed person in each club should gather the subscriptions, and send the appropriate amount to *StarDate* Magazine, c/o Paul Preville, 1 University Station A2100, Austin, TX 78712. You can read more about *StarDate* at www.stardate.org. If you have any questions, please contact the League's National Office at leagueoffice@astroleague.org

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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.

Active Galactic Nuclei Observing Program

No. 1-V, Al Lamperti, Delaware Valley Amateur Astronomers; No. 2-I, Aaron Clevenson, North Houston Astronomy Club; No. 3-I, Dan Crowson, Astronomical Society of Eastern Missouri; No. 4-V, Scott Kranz, Astronomical Society of Kansas City; No. 5-V, Jim Ketchum, Astronomical Society of Kansas City

Advanced Binocular Double Star Observing Program

No. 10, Vincent Michael Bournique, Member-at-Large

Analemma Observing Program

No. 9, Zach Stockbridge, Member-at-Large; No. 10, Brad Young, Astronomy Club of Tulsa

Arp Peculiar Galaxies Observing Program—Northern

No. 82-V, Ken Sperber, Tri-Valley Stargazers

Arp Peculiar Galaxy Observing Program—Southern

No. 9-I, W. Maynard Pittendreigh, Member-at-Large

Asterism Observing Program

No. 26, Jeffrey Corder, Ancient City Astronomy Club; No. 27, Mark Simonson, Everett Astronomical Society; No. 28, Mark Croom, Astronomical League; No. 29, Melinda Hopper, Astronomical Society of Kansas City

Asteroid Observing Program

No. 45, Dan Crowson, Regular, Astronomical Society of Eastern Missouri

Binocular Double Star Observing Program

No. 90, Ethan Maitra, Astronomical Society of Long Island; No. 91, Dee Friesen, Albuquerque Astronomical Society; No. 92, Joe Michail, Member-at-Large; No. 93, Karlis Lubkans, Member-at-Large; No. 94, Ken Boquist, Popular Astronomy Club; No. 95, Gordon Schaefering, Albuquerque Astronomical Society

Binocular Messier Observing Program

No. 1063, Jeffrey Corder, Ancient City Astronomy Club; No. 1064, Valorie Whalen, Atlanta Astronomy Club; No. 1065, Steve Layman, Charlottesville Astronomical Society; No. 1066, Dave Leake, Champaign-Urbana Astronomical Society; No. 1067, Dan Chrisman, Jr., Roanoke Valley Astronomical Society; No. 1068, Andrea McCann, Member-at-Large; No. 1069, John M. Haynes, Houston Astronomical Society; No. 1070, Jody Raney, Shreveport-Bossier Astronomical Society; No. 1071, Jim Kloeppe, Champaign-Urbana Astronomical Society

Bright Nebulae Observing Program

No. 6, Anthony J. Kroes, Neville Public Museum Astronomy Society; No. 7, Dick Francini, Neville Public Museum Astronomy Society; No. 8, David Venne, Minnesota Astronomical Society

Caldwell Observing Program

No. 218, Jim Kvasnicka, Silver, Prairie Astronomy Club; No. 219, Vincent Michael Bournique, Silver, Member-at-Large; No. 220, Ken Boquist, Silver, Popular Astronomy Club; No. 221, Lonnie Mosley, Silver, Astronomical Society of Southeast Texas

Carbon Star Observing Program

No. 62, Ed Valla, Tallahassee Astronomical Society; No. 63, Edward Fraini, Houston Astronomical Society



Observing Awards

Comet Observing Program

No. 83, Dan Crowson, Silver, Astronomical Society of Eastern Missouri; No. 29, Steve Jaworiwsky, Gold, Howard Astronomical League; No. 30, Rod Gallagher, Gold, Oklahoma City Astronomy Club

Deep Sky Binocular Observing Program

No. 369, Mark Simonson, Everett Astronomical Society

Double Star Observing Program

No. 542, Raymond B. Howard, Member-at-Large; No. 543, Andrew Guzie, Rose City Astronomers; No. 544, Lauren Gonzalez, Austin Astronomical Society; No. 545, Nora Jean Chetnik, Member-at-Large; No. 546, Ken Hose, Rose City Astronomers; No. 547, Dan Posey, Austin Astronomical Society; No. 548, Charles Stewart, Rose City Astronomers; No. 549, Stephen Jones, Houston Astronomical Society; No. 550, Lloyd Blake, Boise Astronomical Society; No. 551, Elaine B. Osborne, Echo Ridge Astronomical Society; No. 552, Bernard Venasse, Member-at-Large; No. 553, Lewis Burmeister, Iowa County Astronomers; No. 554, Thomas Watson, Tucson Amateur Astronomical Association; No. 555, Jeffrey Corder, Ancient City Astronomy Club; No. 556, Bill Bauer, Member-at-Large; No. 557, Marie Lott, Atlanta Astronomy Club; No. 558, Vincent Bournique, Member-at-Large; No. 559, Valorie Whalen, Atlanta Astronomy Club; No. 560, David Whalen, Atlanta Astronomy Club; No. 561, Jack Fitzmier, Atlanta Astronomy Club; No. 562, Kevin C. Carr, Member-at-Large

Flat Galaxy Observing Program

No. 28, Kevin Mayock, Regular, Rose City Astronomers

Galileo Observing Program

No. 31, Nora Jean Chetnik, Member-at-Large; No. 32, John C. Zellner, Member-at-Large; No. 33, Bill Sanders, Central Arkansas Astronomical Society; No. 34, Vincent Michael Bournique, Member-at-Large

Globular Cluster Observing Program

No. 273, Roy Troxel, Member-at-Large; No. 274, Bill Sanders, Central Arkansas Astronomical Society; No. 275, Jim Fordice, Albuquerque Astronomical Society; No. 276, Michael Overacker, Star City Astronomy Network; No. 277, Grant Mills, Member-at-Large; No. 278, Gordon Schaefering, Albuquerque Astronomical Society

Herschel 400 Observing Program

No. 540, Mark Bailey, Member-at-Large; No. 541, Alan Scruggs, Amarillo Astronomy Club; No. 542, Paul Harrington, Member-at-Large; No. 543, Michael Overacker, Star City Astronomy Network; No. 544, Mark McCarthy, Member-at-Large; No. 545, Vincent Michael Bournique, Member-at-Large

Herschel II Observing Program

No. 97, Jonathan L. Schuchardt, Manual, Albuquerque Astronomical Society

Hydrogen Alpha Solar Observing Program

No. 27, Mark L. Simonson, Everett Astronomical Society

Local Galaxy Group & Galactic Neighborhood Observing Program

No. 34-M, Nora Jean Chetnik, Member-at-Large

Lunar Observing Program

No. 922, Mary Hebert, Riverbend Astronomy Club; No. 923, Ken Clayton, Texas Astronomical Society of Dallas; No. 924, Jessica Weinreich, Des Moines Astronomical Society; No. 925, Jeffrey Corder, Ancient City Astronomy Club; No. 926, Michael C. Neal, Echo Ridge Astronomical Society; No. 927, Briley Lewis, Member-at-Large; No. 928, Paul Lennous, Member-at-Large; No. 929, Harry L. Berger, Member-at-Large; No. 930, Antone G. Gregory, Minnesota Astronomical Society

Master Observer Award

No. 166, Jim Kaminsky, Member-at-Large; No. 167, Jonathan L. Schuchardt, Albuquerque Astronomical Society; No. 168, Eric Dose, Northeast Kansas Amateur Astronomers' League; No. 169, David M. Douglass, East Valley Astronomy Club; No. 170, Kevin Johnson, Minnesota Astronomical Society; No. 171, William Smith, Member-at-Large; No. 172, Thomas Rocco Pennino, Amateur Observers' Society of New York; No. 173, Jeff Haidet, Toledo Astronomical Association; No. 174, Bill Sanders, Central Arkansas Astronomical Society

Messier Observing Program

No. 2697, Jim Linn, Honorary, Austin Astronomical Society; No. 2698, Marie Lott, Honorary, Atlanta Astronomy Club; No. 2635, Louis Dorland, Honorary, Omaha Astronomical Society; No. 2699, Daniel Otte, Regular, Southern Oregon Skywatchers; No. 2689, Alex Vrenios, Honorary, Member-at-Large; No. 2700, Jeffrey Corder, Honorary, Ancient City Astronomy Club; No. 2701, Patrick Rader, Honorary, West Kentucky Amateur Astronomers; No. 2702, Rakhil Kincaid, Honorary, Haleakala Amateur Astronomers; No. 2703, Stan Westmoreland, Honorary, Shreveport-Bossier Astronomical Society; No. 2704, Mark E. Gerlach, Regular, Back Bay Amateur Astronomers; No. 2705, Mark McCarthy, Honorary, The Astronomy Connection; No. 2706, Valorie Whalen, Honorary, Atlanta Astronomy Club; No. 2707, Chuck Stewart, Honorary, Rose City Astronomers; No. 2620, Jake Hairrell, Honorary, Minnesota Astronomical Society; No. 2708, Shawn Kirchdorfer, Regular, Fort Worth Astronomical Society; No. 2709, Bill Hansen, Regular, Northeast Wisconsin Stargazers; No. 2710, Mike C. Neal, Regular, Echo Ridge Astronomical Society; No. 2711, Steve Weiler, Honorary, Rose City Astronomers; No. 2712, Zach Drew, Honorary, Spokane Astronomical Society

Meteor Observing Program

No. 173, Vincent Michael Bournique, 6 hours, Member-at-Large; No. 58, Kenneth Larry Jones, Honorary, Barnard Astronomical Society; No. 174, Ruth Atwood, 6 hours, Shreveport-Bossier Astronomical Society; No. 175, Terry Atwood, 6 hours, Shreveport-Bossier Astronomical Society; No. 176, Si Simonson, 6 hours, Fort Worth Astronomical Society; No. 60, Steve Jaworiwsky, 30 hours, Howard Astronomical Society; No. 169, Les Rudy, 12 hours, Member-at-Large

Open Cluster Observing Program

No. 69, Jim Pedersen, Advanced, Longmont Astronomical Society; No. 70, Keith Kleinstick, Advanced, Member-at-Large

Outreach Observing Award

No. 242-S Steve (Smitty) Smith, Flint River Astronomy Club; No. 310-M, Ann Bruun, Tulsa Astronomy Club; No. 340-M, Janean L. Shane, Omaha Astronomical Society; No. 408-M, Lauren S. Gonzalez, Austin Astronomical Society; No.

477-S, Aaron Calhoun, Flint River Astronomy Club; No. 577-S, Truman Boyle, Flint River Astronomy Club; No. 604-S, Leigh Anne Lagoe, Back Bay Amateur Astronomers; No. 662-O, Alan Pryor, Flint River Astronomy Club; No. 665-O, Jeff Purcell, Omaha Astronomical Society; No. 666-M, John Laning, Member-at-Large; No. 667-M, Vickie George, Tristate Astronomers; No. 668-O, Megan Huynh, San Bernardino Valley Amateur Astronomers; No. 669-O, Jaime Countryman, San Bernardino Valley Amateur Astronomers; No. 670-O, Domingo Rochin, Austin Astronomical Society; No. 671-O, Dawn Chappell, Flint River Astronomy Club; No. 672-O, Olga Flores, Flint River Astronomy Club; No. 673-M Jody Raney, Shreveport-Bossier Astronomical Society; No. 674-O, Stan Westmoreland, Shreveport-Bossier Astronomical Society; No. 675-O, Richard Fredrick, Astronomical Society of Kansas City; No. 676-O, Barney Hohl, Southern Colorado Astronomical Society; No. 677-M, Jennie R. Goodwin, Shreveport-Bossier Astronomical Society; No. 678-S, Emma Garrett, Temecula Valley Astronomers; No. 679-O, Harriet Dupuy, Shreveport-Bossier Astronomical Society; No. 680-S, Phil Sacco, Flint River Astronomy Club; No. 681-S, Chris Koers, San Antonio League of Sidewalk Astronomers; No. 634-S, David Furry, Southern Colorado Astronomical Society; No. 682-O, Sean Wood, Forsyth Astronomical Society; No. 683-M, Gordon Schaefering, Amateur Observers' Society of New York; No. 684-O, Naveen Vetcha, Von Braun Astronomical Society

Planetary Nebula Observing Program

No. 7, Hilary Jones, Imaging, Tri-Valley Stargazers; No. 28, Vincent Michael Bournique, Basic, Member-at-Large

Sketching Observing Award

No. 6, Jeffrey Corder, Ancient City Astronomy Club; No. 7, Willie K. Yee, Amateur Observers' Society of New York

Sky Puppy Observing Program

No. 43, Gideon Lingle, Mason Star Gazers; No. 44, Lily Payne, Northern Virginia Astronomy Club; No. 45, Etienne Lois, Fort Worth Astronomy Club

Southern Skies Binocular Observing Program

No. 91, Jeffrey Corder, Ancient City Astronomy Club

Sunspotter Observing Program

No. 175, Theo Ramakers, Atlanta Astronomy Club; No. 176, Ethan Maitra, Astronomical Society of Long Island; No. 177, Dan Thoman, Atlanta Astronomy Club

Two in the View Observing Program

No. 9, Michael A. Hotka, Longmont Astronomical Society

Urban Observing Program

No. 162, Mark McCarthy, The Astronomy Connection; No. 163, Alex Vrenios, Member-at-Large; No. 164, Raymond B. Howard, Member-at-Large

Variable Star Observing Program

No. 23, Scott Donnell, Colorado Springs Astronomical Society

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

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- List your event for both the public and media to see
- Check out past Astronomy Day Award winners
- All this and more at your "one stop Astronomy Day shopping" site

For additional information, contact:
Gary Tomlinson
Astronomy Day Coordinator
gtomlins@sbcglobal.net

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



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

January 16
Regional Meeting of Amateur Astronomers 2016
Gardner-Webb University's Ritch Banquet Hall
Boiling Springs, North Carolina
www.ccastro.org

February 5-6
Furnace Creek Resort/Las Vegas
Astronomical Society Star Party
Death Valley National Park, California
www.furnacecreekresort.com

February 8-14
Winter Star Party
West Summerland Key, Florida
scas.org/winter-star-party

March 2-6
Orange Blossom Special XXII
International Star Party
Withlacoochee River Park
Dade City, Florida
www.stpeteastronomyclub.org/obs.php

March 5
Tri-Star 2016
Guilford Technical Community College,
Jamestown, North Carolina
Greensboro Astronomy Club and the
Cline Observatory
observatory.gtcc.edu/tristar

April 1-3
Pickett Astronomy Weekend
Pickett-Pogue Dark Sky Park
Jamestown, Tennessee
tnstateparks.com/parks/events/pickett

April 2-9
The 2016 OzSky Star Safari
(a.k.a. Deepest South Texas Star Safari)
Coonabarabran, New South Wales, Australia
www.ozsky.org

April 6-9
Mid-South Star Gaze and Astronomy Conference
French Camp, Mississippi
www.rainwaterobservatory.org/rainwater

April 8-9
North Carolina Statewide Star Party
35+ public skywatching sessions from the
North Carolina mountains to the coast
www.ncsciencefestival.org/starparty

April 9-10
Northeast Astronomy Forum
Suffern, New York
www.rocklandastronomy.com/neaf.html

June 29-July 3
Rocky Mountain Star Stare 2016
Colorado Springs Astronomical Society,
Gardner, Colorado
www.rmss.org

Before ALCon 2015 in Las Cruces, Observing Program coordinator Aaron Clevenson and AL vice president Bill Bogardus began seriously discussing what many amateurs had wondered: whether the circumstances were right to broaden the Master Observer Program by including some of the League's expanded slate of Observing Programs. This is the result of those initial discussions.

The Master Observer Progression

Since the inception of the Master Observer Award, the number and diversity of the Astronomical League Observing Programs has grown quite a bit. There are currently over 50 different Observing Programs designed to meet the needs of a membership with diverse interests, and many of you have pursued these certifications. The AL has developed a progression related to the Master Observer Award to meet the needs of this growth. Our goals are to:

- Integrate more of the observing programs.
- Create a logical progression from novice to expert.
- Make the levels of the Master Observer Progression meaningful, not just adding more certifications.
- Reward and recognize those who are taking on the breadth and depth of the AL Observing Programs.

The new progression will include these levels:

- Observer Award—to provide an introductory level for new observers.
- Master Observer Award—to recognize those observers who have completed a number of programs.
- Advanced Observer Award—to encourage observers to branch out and learn about new types of astronomical objects.
- Master Observer Silver Award—to recognize those observers who have gone beyond the current Master Observer level.
- Master Observer Gold Award—to recognize those who continue to increase their knowledge and hone their observing skills.
- Master Observer Platinum Award—to provide recognition to astronomers for a broad mastery of the AL Observing Programs.

The Master Observer Award will remain the same as it has been. There is no change in the requirements or in the recognition of members. With the exception of the Master Observer Award, the levels are progressive. You must earn the previous level to earn the next level. Some of the new levels are tough. Some may require you to borrow equipment from fellow observers. And for some members, some of the requirements may not be of interest. But for those who are interested in knowing more about astronomy, the universe awaits.

The details of the requirements for each of the levels will be available on the AL website. If you have questions, please contact the coordinator, Aaron Clevenson, at aaron@clevenson.org.

Observing Coordinators Needed

If you are interested and willing to help the Astronomical League, we need you! These programs are currently in search of new coordinators:

Galileo Observing Program and **Sky Puppies**.

If you are interested, please contact Aaron Clevenson at aaron@clevenson.org by the end of the year.

ADVERTISING RATES for the REFLECTOR

The following is a listing of the advertising rates for the *Reflector*. If you are interested in promoting your products, consider placing an ad with us. We offer a highly targeted market with a circulation of 16,000 astronomers.

Rates for the inside front cover, inside back cover, and back cover are negotiable.

Deadlines: March issue – January 1 June issue – April 1 September issue – July 1 December issue – October 1

Number of Issues	Full Page	1/2 Page	1/3 Page	1/6 Page	Mini Ad
H = Horizontal V = Vertical	7 1/2" H x 10" V	7 1/2" H x 5" V	5" H x 4 1/4" V or 2 1/2" H x 10" V	2 1/2" H x 5" V or 4 1/2" H x 2 1/2" V	2 1/8" H x 2 1/8" V
1	\$1,000 B/W \$1,100 Color	\$500 B/W \$550 Color	\$400 B/W \$440 Color	\$200 B/W \$220 Color	\$150 B/W \$165 Color
2	\$900 B/W (each) \$990 Color (each)	\$450 B/W (each) \$495 Color (each)	\$350 B/W (each) \$385 Color (each)	\$175 B/W (each) \$192.50 Color (each)	\$125 B/W (each) \$137.50 Color (each)
4	\$800 B/W (each) \$880 Color (each)	\$400 B/W (each) \$440 Color (each)	\$300 B/W (each) \$330 Color (each)	\$150 B/W (each) \$165 Color (each)	\$100 B/W (each) \$110 Color (each)

Note: Advertising pricing is subject to change without notice.

To submit advertisements or for further information, please contact: Carla Johns, Advertising Representative, at cjohns@icloud.com or 1-970-567-8878.

Astronomical League Membership-at-Large Program



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

- Full voting privileges at AL meetings.
- A subscription to the *Reflector*.
- Book Service offering astronomy-related books at a 10 percent discount.
- Optional subscriptions at discounted rates to the following publications:

Astronomy magazine \$34.00; 2 years \$60 • *Sky & Telescope* magazine \$32.95

RASC *Observer's Handbook* \$27.00 • *StarDate* \$19.50

(Foreign rates are higher; see website)

- Free Astronomical League Observing guide with membership.

To join the Astronomical League as a Member-at-Large, send a check for \$40.00, \$50.00 foreign, made payable to the Astronomical League, to:

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

League Sales are online!

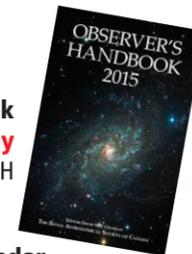
The League's online store is available at the website, www.astroleague.org. Click on the link on the left side of the home page. The online store includes the latest shopping cart technology and accepts credit cards. Shipping & handling (S&H) is calculated at checkout. Merchandise is also available by 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.

RASC 2015 Observer's Handbook
Limited Quantities—Order Early
\$27 plus \$4.50 S&H



RASC 2015 Calendar
Limited Quantities—Order Early
\$20 plus \$6 S&H

Astronomical League travel mug
\$10: plus \$4.50 S&H



Coffee mug (ceramic)
\$12 plus \$6 S&H



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



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



Canvas tote bag—Royal
\$16 plus \$6 S&H

New Items!



Duffle bag
\$28 plus \$7 S&H

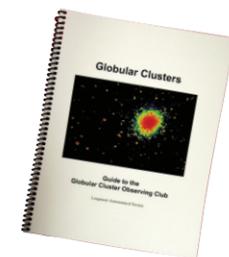
Bandana
\$12 plus; \$2 S&H
Natural or White



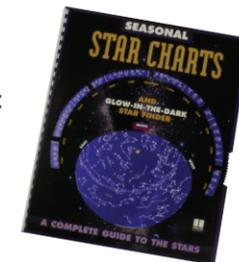
"Guide to the Stars"
16" Planisphere
\$21 plus \$3.15 S&H



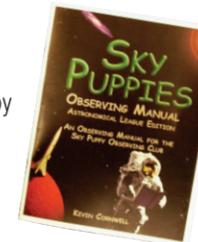
Globular Clusters
\$14 plus \$2.10 S&H



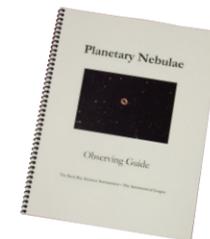
Seasonal Star Chart
\$24 plus \$3.60 S&H



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



Planetary Nebulae
\$14 plus \$2.10 S&H



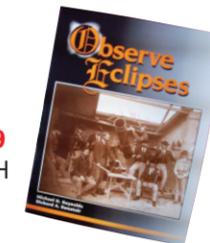
Messier Objects: A Beginner's Guide
\$8 plus \$1.20 S&H



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



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



Universe Sampler
\$10 plus \$1.50 S&H



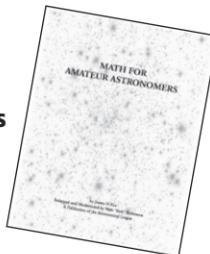
Astronomy for Educators Handbook
A Course Planning Guide
5.5" x 7.25"
Regularly \$12, Sale price \$6 plus \$1.80 S&H



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



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



Carbon Stars
A guide to the Carbon Star Observing Club
\$10 plus \$1.50 S&H



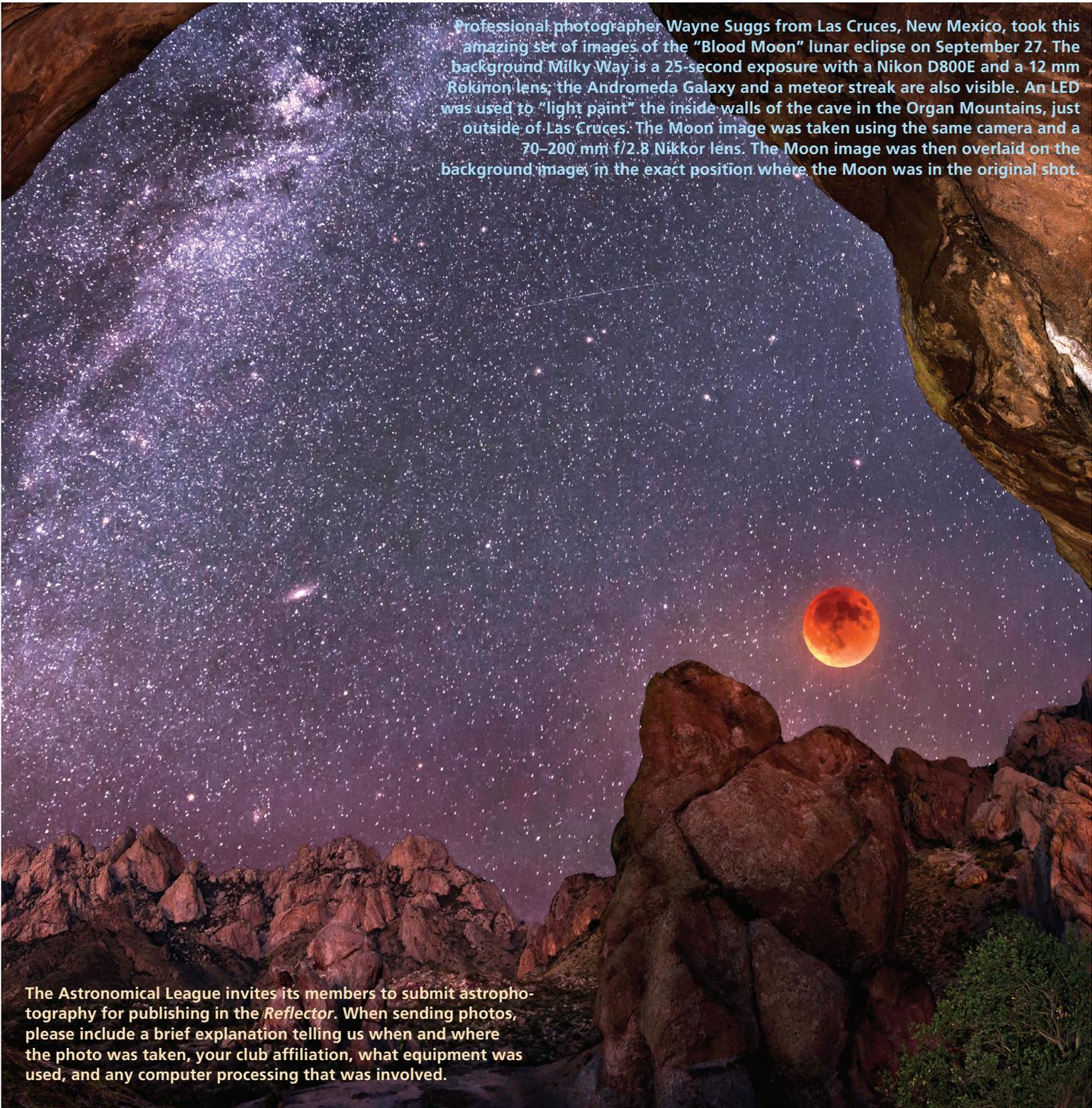
The A.L.P.O. Guide to Watching Meteors
\$3 plus \$1 S&H



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

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Professional photographer Wayne Suggs from Las Cruces, New Mexico, took this amazing set of images of the "Blood Moon" lunar eclipse on September 27. The background Milky Way is a 25-second exposure with a Nikon D800E and a 12 mm Rokinon lens; the Andromeda Galaxy and a meteor streak are also visible. An LED was used to "light paint" the inside walls of the cave in the Organ Mountains, just outside of Las Cruces. The Moon image was taken using the same camera and a 70-200 mm f/2.8 Nikkor lens. The Moon image was then overlaid on the background image, in the exact position where the Moon was in the original shot.

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