

Reflector

Published by the Astronomical League

Vol. 68, No. 2

March 2016



Magdalena: A Stone's Throw to the VLA
ALCon 2016 Registration—Washington, D.C.
Join the International Dark Sky Association
From Around the League: Officer Candidates' Statements

GREEN BANK STAR QUEST XIII

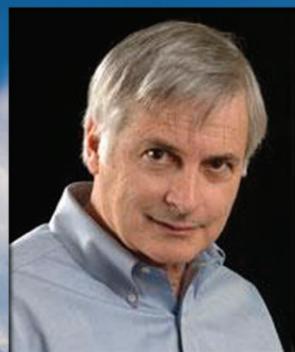


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TITLE PHOTOGRAPH: NGC 1850, THE DOUBLE CLUSTER, CREDIT: NASA, ESA, AND MARTINO ROMANELLO (EUROPEAN SOUTHERN OBSERVATORY, GERMANY)

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Jaspal Chadha imaged NGC 7635 (also known as The Bubble Nebula) from his home in London, England. It is an excellent representation of imaging under very light-polluted skies. This 10-light-year diameter bubble offers evidence of violent processes at work. The center is a hot, O-type star, several hundred thousand times more luminous and around 45 times more massive than our Sun. A fierce stellar wind and intense radiation from that star has blasted out the structure of glowing gas against denser material in a surrounding molecular cloud. It is only 11,000 light-years away, in the constellation Cassiopeia.

Using an Altair Astro RC 250TT telescope, an iOptron CEM60 mount and a QSI 690 CCD camera, the following images were stacked: H-alpha (20 minutes x 5), S-II (30 minutes x 1), and O-III (20 minutes x 2).

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

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

Reflector

The Astronomical League Magazine

Vol. 68, No. 2 • ISSN: 0034-2963 • March 2016

A FEDERATION OF ASTRONOMICAL SOCIETIES
A NON-PROFIT ORGANIZATION



- To promote the science of astronomy
- By fostering astronomical education,
 - By providing incentives for astronomical observation and research, and
 - By assisting communication among amateur astronomical societies.

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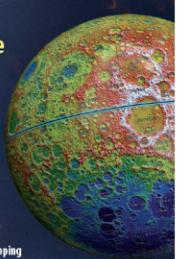
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Issued by the Astronomical League in March, June, September, and December, the *Reflector* is mailed directly to each individual member of its affiliate societies and to members-at-large as a benefit of League membership. Individual copies of the *Reflector* are available at \$2.00 each or as an \$8.00 per year subscription through the League national office. ISSN: 0034-2963.

Reflector and Club Roster Deadlines

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

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A Day or Two for Astronomy

We all live under the same sun, we all see the same moon, and we all gaze at the same planets wandering lazily across the starry dome. Why, then, are just a few people attracted to stargazing and amateur astronomy, while most are not?

Some people enter the hobby on their own, first reading books and magazines, later purchasing telescopes as they learn the night sky. Many others, though, are introduced to what lies above by someone who already owns a quality telescope—someone who has not just a good knowledge of the sky, but an exciting way of conveying enthusiasm to others, causing them to want to experience more.

That second path is what **National Astronomy Day** is all about. On two days each year, one in the spring and the other in the fall, and both just before a first quarter moon, amateurs across the country and around the globe cart out their equipment and share their passion with the public, showing what an amazing avocation amateur astronomy truly is.

Astronomy Day presents an excellent opportunity to increase science awareness in an interested but often-misinformed public, to spark an interest in the young, and to promote your club, all simply by personally introducing people to the wonders encountered in amateur astronomy.

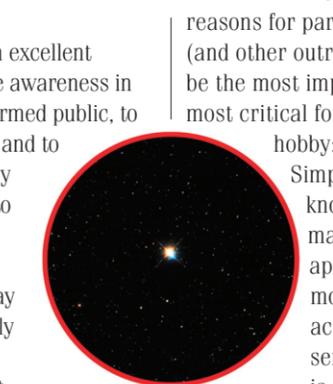
Imagine strolling past an array of quality telescopes, some safely aimed at the Sun and others pointed at the ghostly Moon, but all staffed by enthusiastic and knowledgeable people. Sunspots, prominences, impact craters, and lunar mountains—these are sights people don't see every day. For anyone with the least bit of curiosity, how fascinating these must seem!

Positioned next to the telescopes are displays showing planetary and deep-sky attractions easily found in amateur instruments. Perhaps a club member will have a telescope trained on Venus. Maybe another will be demonstrating techniques for locating celestial objects—an important topic often intimidating to novices.

The **Astronomical League** is here to help. Wouldn't it be great if there were helpful aids



The daytime Moon presents a ghostly, but great target. Photo: Bob Gent



Show people that a single star really might be two. Albireo in the fall sky, photo: Clem Elechi

assisting clubs and individuals in their Astronomy Day outreach endeavors? There are! Download the **Astronomy Day Handbook**. Wouldn't it be great if there were materials answering many common questions the public may likely ask? There are! Download the numerous

Astronomical League Outreach Downloads in either handout or poster format. Wouldn't it be great if there were inexpensive solar glasses through which people could view the Sun? There are! Check out the pertinent details for the eclipse glasses at League Sales.

Furthermore, wouldn't it be great if clubs were recognized for their innovation and efforts in putting amateur astronomy directly in front of the public? The

Astronomical League, with help from *Sky & Telescope* and the **American Astronomical Society**, presents three \$150 cash awards,

one each for the best event in areas with large, medium, and small populations. In addition, \$50 is awarded to a club that consistently holds a quality event. With all the great

reasons for participating in Astronomy Day (and other outreach activities), what might be the most important one is also one of the most critical for the continued success of our hobby: light pollution awareness.

Simply put, the more the public knows about the sky and its marvels, the more they will appreciate dark skies, and the more likely they will be to actively speak out against senseless outdoor lighting. This is a great opportunity for you to affect the course of our hobby and to help benefit your community. This May 14 and

October 8, bring the Sun, the Moon, the planets, and the stars to the people on Astronomy Day. You may very well cause a few of them to want to experience more. You will have touched their lives!

John Goss, League President

More Astronomy Day information

www.astroleague.org/al/astroday/

astrodayform.html

Outreach Downloads:

www.astroleague.org/outreach

Solar eclipse glasses at League Sales:

store.astroleague.org

Dear Editor: Library Telescope Program—Island County Astronomical Society

At ALCon 2014, John Goss talked about the Library Telescope Program. That got me thinking about trying a second time to get a telescope into the town library where our club is located (Oak Harbor, Washington). That hasn't worked out yet but we are still trying. The problem is the inter-library loan system Snohomish and Island Counties have. Our club desires that the telescope not leave the area. Inter-library loan gave us the following problems: it could be lent up to 84 miles away, too far for us to maintain; checked in and out by untrained staff that wouldn't be able to tell if it was damaged; and not available to the area we actually purchased it for.

Since I live in a different county than the club base, I went to my local library—the Mount Vernon City Library—and talked to them about the Library Telescope Program. They said they were very interested but needed to talk to the library board to get approval. They had a way to work with the Skagit County inter-library loan system to keep the telescope at the home library, but patrons from other libraries can come get a Mount Vernon library card and check out and return the telescope (a 4.5-inch Orion Starblast reflector) at Mount Vernon.

A little over a month later I got the okay. I ordered the telescope and all the bits and pieces to go with it per the New Hampshire Astronomical Society web pages on library telescopes. New Hampshire Astronomical Society started this program in 2008 and has now placed over 190 telescopes in libraries.

When all the parts arrived I assembled it and took it to the library.

Meanwhile, Betsy Cherednik, the reference librarian who is my contact at the library, set up classes for all the library staff covering how to use the telescope and check the condition when the telescope was checked back in by a library patron. She also set up a beginner's astronomy class for the public that our local newspaper was invited to.

The class for the public occurred on a rainy night, so I set up an artificial star on the other side of the library so everyone could try out the telescope. My artificial star simulated the double star Polaris. That was a big hit, as no one knew Polaris was a double star.

The lead sports reporter and photographer from the *Skagit Valley Herald* came. I was interviewed before the class. The article ended up on the front page of the sports section. The article even got picked up by a newspaper in Boise, Idaho. Great press for our club and the library telescope program.

At the end of the class we had a drawing for who was to check out the telescope first and to create the waiting list. A family with two young kids checked it out first.

Four months later I had a telescope out in front of the library in the late afternoon showing the Moon. The family that was first to check out the library telescope came by. They had a great time with the library telescope but due to the fall weather in western Washington (clouds and rain) didn't get to use it as much as they wanted. When they signed up to check it out again, there was a nine month waiting list. For this article I was going to get a picture of the telescope at the library but it is always checked out.

The program has been very successful and also quite rewarding on a personal level. I have talked to lots of great people and had wonderful feedback. I encourage all clubs to participate in this program.

Bob Scott, President, ICAS

Dear Editor:

I wish to thank all those individuals who put together new Observing Programs for the Astronomical League. I created the Globular Cluster Observing Program, so I know the dedication that it takes to create a new one.

The most recent additions to the plethora of Observing Programs (OPs) that have caught my eye are the Active



Galactic Nuclei OP and the additional levels of the Master Observer Award. The Radio Astronomy, Variable Star Observing, and Target NEOs! Programs are three that I would not have done without the new Master Observer Awards carrot dangling in front of me. I have not yet begun the Target NEOs! program, but have started the other two. The NEO OP will be a new style of observing for me because I will dedicate observing sessions to recording asteroids instead of looking for deep-sky objects.

In completing the Radio Astronomy Program, I am learning a lot of new material about the topic. Also I am discovering that visiting a star on the variable star observing list for the second time is much easier than finding it the first time. I submitted my first set of observations to the AAVSO and received feedback that all my star observations but one were what was expected, so I appear to be making accurate observations. The star whose observations were not correct must have been the wrong one to observe. I am anxious to revisit the star field to find the correct star.

As a side note, I am headed to Australia to attend the spring 2016 OzSky star party. I have my lists ready and hope to finish the Caldwell Gold OP, sketch the southern constellations, and view the objects I have yet to see on the Southern Telescopic, Southern Binocular, and Southern Planetary Nebulae Observing Program lists. Completing these AL OPs is my primary goal. A second goal is to see all the globular clusters that are below my Colorado horizon. My third goal is to play in the Small and Large Magellanic Clouds. And finally, my fourth goal is to finish the Southern Arp Peculiar Galaxy Program.

Once I complete the ten OPs discussed above, I will be able to count on one hand the number of AL OPs that I have *not* done—just three programs!

Mike Hotka, Master Observer No. 34

Denver Astronomical Society
Longmont Astronomical Society

Dear Editor:

The opinion piece by James Bruce McMath in the December 2015 issue (page 11) of the *Reflector* was both timely as well as on an old topic. It is old in that John Wesley, a founder of the Methodist Church, pondered in 1787 in Sermon 103, "What is Man?" In the text, he offers "When I consider thy heaven, the work of thy fingers, the moon and stars, which thou hast ordained; what is man?" (Psalm 8:3). Further, he observes "It is now allowed that there are thousands, if not millions, of worlds, besides this in which we live." The suggestion follows that man might be only a very small part of the creation.

John Wesley was a natural philosopher and a student in Newtonianism (optics) at Oxford, and as such was acquainted with Sir Isaac Newton at Cambridge. From this beginning, how would our purpose be defined today had professionals in the life issues (clergy) for the last 228 years followed Wesley's philosophy instead of simply pushing it aside? But, it didn't happen, and we are where we are. Wesley gives suggestions on a purpose in life but the conclusion is left to the individual, as it should be. I appreciated this piece in the *Reflector* and would like to see further commentary in this area.

Don E. Bray

Brazos Valley Astronomy Club
Bryan/College Station, Texas

Dear Editor:

I've just read Steven Bellavia's article "Chasing Jupiter's Shadow" in the December 2015 *Reflector* (page 10) and have to tell you about a memorable moment in Arizona back in May 1994.

I was one of a group of about 15 guys including Patrick Moore and his "Sky at Night" TV camera and sound crew. We were there for the May 10 annular solar eclipse which we witnessed from the desert near Douglas

in the far southeastern part of the state.

Days later, we were at Grand Canyon South Rim. One evening some of us went out into the forest to find a spot to do some stargazing. It was properly dark in the trees like we don't get here in England. We were walking along a forest road heading north towards the canyon rim. A voice from the back of the group called for us all to stop. If memory serves he was a surgeon by profession, and we had noted over the week we had been travelling together that he's one of those guys who notices things others miss. For a moment I wondered if he had spotted some wildlife, maybe a bear or mountain lion!

"Look at the ground," he instructed. There it was. Surprisingly we each had an unmistakable shadow. Turning to look back, there, gleaming in the south halfway between horizon and zenith was Jupiter. Wow!

It was an unexpected magical moment and for me and is a highlight in 49 years of sky watching.

Alan Snook, member-at-large
Dover, England

Dear Editor:

Orion is my favorite constellation because:

1) The belt stars—Alnitak, Alnilam, and Mintaka—are an asterism unto themselves for being so well lined up with each other.

2) Rigel with its blue and white stars that I can easily see thru a scope.

3) The Great Orion Nebula—someday I'll just get the right kind of exposure to submit to *Sky & Telescope* for publication.

4) Betelgeuse is proof that stars have color, since it is such a large star and its shade can be seen naked-eye. Plus, I want to be the first one to capture a picture of it when it goes supernova.

Garth Price

Eugene Astronomical Society

CORRECTIONS AND CLARIFICATIONS:

Dr. James Dire's Deep-Sky Objects column on page 8 of the December 2015 *Reflector* stated that William Herschel moved to Bath, England at the age of 19. It should have stated he moved to England at the age of 19. He located to Bath, England later in his career. Also the phrase "Royal Astronomer" should have been lowercase as it was meant as a job description, not an official title. There is also some historical dispute as to whether Caroline was 51 inches or 57 inches tall. Different reference materials have either height listed and the reader can decide which figure to use. Our thanks to K. Lynn King, Presenter of Caroline Herschel and member of the Delaware Astronomical Society (and others) for bringing this information to our attention.

The listing for David Venne, under Bright Nebulae Observing Program, should have been listed as "Advanced" and the Award Number should be "9."

In the September 2015 issue, the article about ALCon 2015 neglected to mention that Mr. Frank J. Melillo was a speaker on Saturday afternoon (first column, page 21). He was a last-minute entry and should have been acknowledged.

Astronomers Without Borders

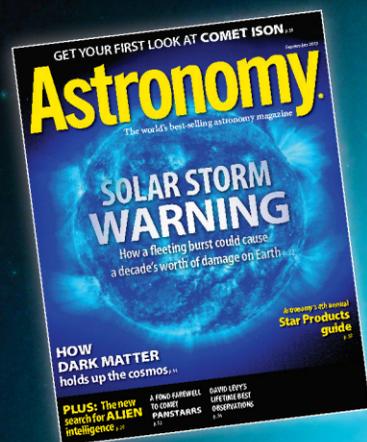
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Do you enjoy a beautiful night sky?

Well, of course you do, or you wouldn't be receiving this copy of the *Reflector* magazine. Have you ever spent money on our hobby? I am guessing the answer is *yes*. In my case, I've built an observatory, and I have bought many telescopes and other pieces of

astronomical equipment. The point is that many of us spend a lot on astronomy.

If we are spending money on astronomy, then shouldn't we be helping the one organization that protects our night sky? There is **only one organization** totally dedicated to night sky protection. That's the **International Dark-Sky Association**.

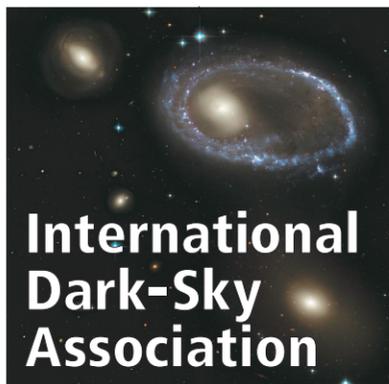
Of the many thousands of people who are amateur astronomers, how many are members of the International Dark-Sky Association? This is the really shocking answer: very few, perhaps less than a few hundred. Do you find this distressing? I, for one, find it unbelievable and profoundly disappointing. Why, you might ask?

We are all facing a global emergency. It's the explosion of bad LED lighting. These are high-glare and overly bright streetlights, parking lot lights, and thousands of new LED signs and billboards. Many do not comply with IDA's newly updated **Fixture Seal of Approval** program. Thank goodness, IDA is leading the charge to help us.

When it was time to update our light pollution codes to fight these newly emerging threats in Sierra Vista and Cochise County, Arizona, we turned to IDA. They have developed vast amounts of reference materials, such as their *Practical Guide* series, and so much more. Without the groundwork completed by IDA, we would have had to start from scratch. Thanks to IDA, defending our night skies was possible.

If we don't care enough to join IDA, who will? Sometimes it's tough to "quantify" what one gets for joining a non-profit organization like IDA. As the only organization dedicated to preserving the beauty of our night skies through improved outdoor lighting practices, IDA provides simple, low-cost solutions to the problems of energy waste, glare, light trespass, wildlife disorientation, and destruction of the night skies.

IDA is making a huge difference. A lot has been accomplished, and the word is getting out. Better lighting is appearing in many



locations. Better lighting fixtures are being developed, and these will improve as time goes on. In addition, IDA has forged new alliances with groups like the Illuminating Engineering Society (IES). They set *de facto* lighting standards with their recommended practices. Several of the IDA board

members are members of IES of North America.

The National Park Service greatly appreciates the work of IDA. They now recognize that poorly designed outdoor lighting is a serious threat to the nighttime environment at parks. They understand that the beauty of a magnificent, star-filled sky is a precious treasure that should be protected.

None of this is cheap. Running an office, paying employees (IDA now has four full-time employees), covering utilities, supplies, insurance, rent, printing, postage, and many other expenses is quite costly. This is why **your membership is critical**. You are helping us help everyone in the battle to save our night skies. In addition, there is strength in numbers, and IDA leverages your support around the globe.

With all this said, don't you want to promote public awareness and improve our quality of life? Don't you want to protect our night skies? Then why haven't you personally joined IDA?

How much is it worth to preserve the beauty of our night skies? To conserve energy? To promote quality outdoor lighting to reduce glare and light trespass? Never before has there been such a good solution to a difficult problem. To me, membership in IDA is **priceless**, but it only costs \$35 per year. Please help IDA by joining *now*. You would be doing a great service to all. Go to darksky.org/newmember and click "join."

Bob Gent

Past president, International Dark-Sky Association

Past president, Astronomical League

The Sky This Week

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

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

January 1, 2016

To all members of the Astronomical League:

Here's a question: What factor has had the most significant impact on the growth of amateur astronomy in the past century? Is it the development of go-to technology? The Dobsonian revolution? The ability to capture stunning cosmic vistas with everyday cameras?

No, it's none of those. The greatest change has come from the spread of light pollution.

Today, few of us are lucky enough to enjoy night skies that are dark enough to see the Milky Way well. Moreover, we are in the midst of the most dramatic shift in outdoor lighting in more than a half century. The ubiquitous rollout of light-emitting diodes (LEDs) is changing how we illuminate our streets, our businesses, and even our backyards with breathtaking speed. LEDs can be good for night skies—yet they can also be very, very bad.

As you know—and as Tim Hunter reminds us in each issue of the *Reflector*—the International Dark-Sky Association is leading the fight worldwide against light pollution. IDA's involvement has already influenced LED rollouts in cities like Boston and Honolulu.

But IDA cannot win this fight alone. This, then, is a call to action. All of us must work together to preserve what's left of our dark skies and, hopefully, to improve them. Here's what you can do to help:

- Find out how your community plans to implement LED street and property lighting, then get involved in that process. Work with your town officials to create outdoor-lighting regulations. One informed voice can make a huge difference, and IDA's website (www.darksky.org) offers many great resources to assist you.
- If you're not comfortable with that level of involvement, then at least determine what's planned in your community. Then pass that information to IDA's Tucson headquarters (520-293-3198) or to one of its many regional and state chapters. We need you to be IDA's eyes and ears.
- Finally, join IDA today, right now (www.darksky.org/newmember). Your \$35 annual membership will allow its dedicated staff and volunteers to educate decision-makers and alter outcomes nationally, regionally, and locally to improve the nighttime environment.

Here's the rub: statistically, only about one of every 100 backyard stargazers is an IDA member. That's just 1%. How sad that the very individuals who stand to gain the most from this one-of-a-kind organization's success—we amateur and professional astronomers—have not stepped forward in greater numbers to offer our support.

So please join us in supporting the International Dark-Sky Association. As IDA cofounder David Crawford has pointedly asked for more than a quarter century, "If not you, then who? If not now, when?"

David Eicher, Editor
Astronomy magazine

Peter Tyson, Editor in Chief
Sky & Telescope magazine

John Goss, President
The Astronomical League



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In the December (2015)

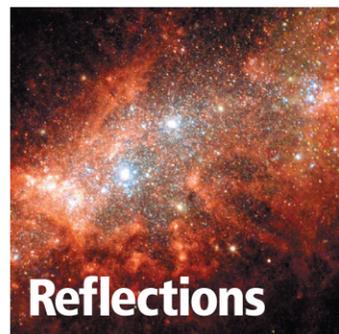
issue of the *Reflector*, we introduced two new experimental features. The first, "From Around the League," provided a mechanism to place all Astronomical League related notifications, awards announcements, observing programs and general news in a group of several pages. Prior to this feature, all of the notices, announcements, etc. were scattered throughout each issue, and several were overlooked by our readers.

The other experimental feature is the "Wanderers in the Neighborhood" section, written by Berton Stevens, co-director of the Desert Moon Observatory (Minor Planet Center No. 448). Mr. Stevens also writes periodic articles for several regional newspapers and is a former trustee of the League.

Based on feedback from readers, both experiments were successful. As a result, one of these two pieces will appear in future issues of our quarterly magazine, starting with this March issue. The other, "Wanderers in the Neighborhood," will start in the June issue, with Bert writing about dwarf planets and how our understanding of them was enhanced in 2015 by different spacecraft.

"From Around the League" has several pieces regarding League elections, awards, dues, master observers and other items of interest. Let me know what you think of the changes (rjipublishing@aol.com), and whether you have any suggestions to improve the overall quality of *your* magazine.

The digital version of the *Reflector* has run into a few technical snags and has not been implemented as quickly as originally anticipated. We expect to have the problems resolved in time for the June issue. Until



Reflections

Washington, D.C., area, this event promises to be loaded with great speakers, tours, and activities for astronomers and their spouses.

2017's AstroCon will be held in Casper, Wyoming on August 16–19, 2017, and there will be a total solar eclipse visible in Casper on Monday, August 21. Registration is open and it should be a great event. Of course, the eclipse will be visible in many locations across the United States and the League has purchased a large quantity of eclipse glasses just for the event. Check our League store for further details. We are offering these custom-made, high-quality glasses at great prices and are available from our stock at the League office. They are great for daytime public outreach programs as well.

Lastly, we have received reports of some of our members not receiving their paper copies of the *Reflector*. The League office will try to replace these missing copies, but please be aware that we print very few extra copies. If you are aware of any member not receiving their paper copy, please contact me directly (rjipublishing@aol.com) with the member's name, full mailing address, and email address. If we have replacements available, one will be shipped. If we have no remaining copies, we will inform the member and ask them to download a copy from our website.

—Ron Kramer

Offer the Night Sky for Your Favorite Charitable Organization

"The celestial wonders in our night sky are owned by no one. Truly, they are for us all."

Amateur astronomers across the nation follow that credo and enjoy giving free telescope sessions to the public. Taking money is not a consideration; however, here is an instance where amateurs may change their minds.

Charity auctions are a common way for non-profit organizations to raise much-needed funds. The amateur astronomer can help his or her favorite group by offering a personalized session at the telescope for the highest bidder. Who wouldn't jump at the chance to see the moons of Jupiter, the rings of Saturn, or the craters on the Moon, up close and personal? Toss in a few globular clusters, nebulae and galaxies and the winning bidder will have a memorable evening! Everyone wins—the worthy organization acquires needed cash, the winning bidder has an enjoyable experience, and the amateur comes away with a good feeling.

the issues are taken care of, all readers requesting digital copies will receive paper copies as well.

ALCon2016 is only 5 months away (August 10–13) and the registration page on our website (www.astroleague.org) should be available shortly. Being held in the

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

Canes Venatici is a faint constellation located at mid-northern declinations. The constellation was established by Johannes Helvelius in 1690 and is favorably positioned for evening viewing during the spring and summer months. In Latin, *canes venatici* means hunting dogs; the dogs, Asterion and Chara, are held on leashes by Bootes the Herdsman.

The constellation contains only one star brighter than 4th magnitude, Cor Caroli (Alpha Canem Venaticorum, magnitude 2.9). Named to honor King Charles II of England, Cor Caroli—"Heart of Charles"—is a splendid double star composed of components of magnitudes 2.9 and 5.6 separated by 19 arcseconds.

Canes Venatici contains a plethora of deep-space objects, including the popular globular cluster M3 and the Whirlpool Galaxy, M51, with its companion galaxy, NGC 5195. In this column I want to cover a less-known galaxy pair in Canes Venatici known as the Whale (NGC 4631) and the Pup (NGC 4627).

NGC 4631 is an edge-on spiral galaxy. Magnitude estimates range from 8.9 to 9.8. The galaxy is 6.5 degrees south-southwest of Cor Caroli. The galaxy also lies roughly just past the midway point on a line from Cor Caroli to 4th magnitude Gamma Comae Berenices. NGC 4631 measures 15.5 by 2.7 arcminutes with the major axis oriented almost due east-west. The galaxy is nearly 30 million light years away and similar in actual size to the Milky Way.

The galaxy is asymmetric in appearance due to gravitational interactions with the nearby

DEEP-SKY OBJECTS

THE WHALE AND THE PUP

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



galaxy NGC 4627. The east end of the galaxy appears brighter and thicker. The west side is not as thick or bright, but the visible disk on the west extends farther from the apparent core than it does on the east side. The galaxy has the shape of the profile of a whale, thus its nickname. The east side represents the whale's head, with a small pectoral fin not far away. A bright foreground star is positioned where the dorsal fin would be found and the west side of the galaxy ends at the fluke.

NGC 4631 was originally classified as an Sc galaxy, where the "S" means it is a spiral galaxy and the lower case "c" means the galaxy's spiral arms are loosely wound and its central bulge is not very large (Sa and Sb galaxies have more tightly wound spiral arms and larger central bulges). More recent studies have classified

the Whale as SBd. The added "B" indicates NGC 4631 is a barred spiral galaxy, like the Milky Way. The "d" means very loosely wound spiral arms and little to no central bulge. High-resolution images of the Whale Galaxy taken with large research telescopes reveal myriad regions of intense star formation, bright emission nebulae, and massive dust clouds. It does not appear to have a prominent dust lane, like those in galaxies such as M104. Tidal streams of visible material connect NGC 4631 to NGC 4627.

The immense central starburst region of NGC 4631 has resulted in so many supernova explosions that large amounts of galactic gas are being blown out of the plane of the galaxy. This superwind is indicated by large Doppler shifts in the gas's spectral lines and has produced a hot, giant,

diffuse corona around the galaxy that emits x-rays.

Swimming through the cosmos with the Whale Galaxy is the Pup, NGC 4627. NGC 4627 is a bright dwarf elliptical galaxy, which may or may not be gravitationally bound to NGC 4631. NGC 4627 is located just

north of the Whale Galaxy's dusty yellowish core. Researchers think that the Pup's gravitational pull is responsible for the asymmetric shape of the Whale. NGC 4627 is 13th magnitude and is 2.6 by 1.8 arcminutes in size. In 2015, a very faint dwarf galaxy was discovered in the halo of NGC 4631. Like NGC 4627, this galaxy is most likely associated with NGC 4631.

My image of the Whale and Pup

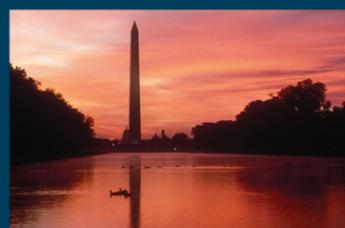
was taken with a 102 mm f/7.9 apochromatic refractor using a SBIG ST-2000XCM CCD camera. The exposure was 90 minutes. In an 8-inch telescope, the shape of NGC 4631 is readily apparent and NGC 4627 is a faint smudge just north of the Whale. Much larger reflectors under transparent, steady skies may bring out some of the dust and emission features seen in the image. ☼

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.



ALCon 2016

August 10-13, 2016 • Washington, DC



Register by July 1st and receive a free ALCon 2016 lapel pin

ALCon 2016 Registration

August 10-13, 2016 • Washington, DC

Register by July 1st and receive a free ALCon 2016 lapel pin!



Hosted by the **Northern Virginia Astronomy Club** and the **Astronomical League**, the Astronomical League Convention provides an opportunity for amateur astronomers to gather together to learn and exchange ideas and techniques about astronomy.

Events:

- Special Presentations on Astronomy and Space Exploration
- Star-B-Que at a nearby park with a unique musical interlude and raffle
- Awards Banquet— Special Keynote Speaker NASA Administrator General Charles Bolden Jr.

The plenary sessions and the awards banquet will be held at the National Rural Electric Cooperative Association (NRECA) headquarters, two doors down from the Westin Hotel and a short walk from the Hilton. There will be raffles and door prizes during the plenary sessions.

Unique Tours: (Transportation provided)

- U. S. Naval Observatory
- Smithsonian National Air & Space Museum
- NASA Goddard Space Flight Center
- Smithsonian Natural History Museum Meteorite Collection
- Steven F. Udvar-Hazy Center

Area Attractions:

- Monuments, museums & art galleries
- National parks, Mount Vernon & other area historic locations
- Wineries & fine dining
- More info at <http://washington.org>

Convention Accommodations:

Westin Arlington Gateway — 703.717.6200

Hilton Arlington — 703.528.6000

Ask for the ALCon 2016 prices when making your reservation. A limited number of rooms are available at the special ALCon rate.

More information is available at the ALCon 2016 website.



Register now at the ALCon 2016 website

<https://alcon2016.astroleague.org>

Vendors interested in participating, please sign up on the ALCon 2016 web site

Mail completed form with your check made payable to **ALCON 2016** to:

Astronomical League, ALCON 2016
9201 Ward Parkway, Suite 100
Kansas City, MO 64114

Please use one form for each attendee. One check is acceptable for your group. You may also register at alcon2016.astroleague.org after Feb. 1 and make remittance with PayPal.

Name: _____

Name and Title for ID badge: _____

Email address: _____

Mailing address: _____

City: _____ State: _____

Telephone: _____

Astronomical Affiliation (Club)? (not required): _____

Are you a member of ALPO? _____

Are you an AL Master Observer? _____ # _____

Early Registration Schedule

(after July 27, add \$20)

Please enter the registration amount on the right.

Individual – 2, 3, or 4 day registration: (\$60) _____

Single day registration: (\$40) _____

Couples – 2, 3, or 4 day registration: (\$90) _____

Students: (\$20) _____

Children under 15 years of age who accompany registered adults: FREE. Please give their names for ID badges.

Tours, per person – spaces are limited!

Please indicate first or second choice for day trip preferred.

Tour 1: Smithsonian Meteorite Collection (\$25) _____

Day: Wed. _____, Thu. _____, Fri. _____

Tour 2: NASA Goddard Space Flight Center (\$25) _____

Day: Wed. _____, Thu. _____, Fri. _____

Tour 3: US Naval Observatory (\$25) _____

Day: Wed. _____, Thu. _____, Fri. _____

Tour 4: National Air & Space Museum (\$25) _____

Day: Wed. _____, Thu. _____, Fri. _____

Tour 5: Udvar-Hazy Center (\$25) _____

Day: Wed. _____, Thu. _____, Fri. _____

Total \$ _____

Thursday Night Star-B-Que

Bus to Barcroft Park (\$25) _____

Star B-Que style buffet, entertainment (\$30) _____

Total \$ _____

Saturday Night Awards Banquet featuring NASA Administrator Gen. Charles Bolden!

Buffet: Superb salad, Hanger steak, scallopini of chicken, roasted vegetables lasagna, caramelized onion-mashed potatoes, etc. (\$55) _____

ALCON Merchandise (Order Deadline July 27)

Please check color and size

Silk-screened T-shirt, White _____; or Royal Blue _____
S ___ M ___ L ___ XL ___ XXL ___ XXXL ___ : \$20

Embroidered polo shirt, White _____; or Royal Blue _____

Mens: S ___ M ___ L ___ XL ___ XXL ___ XXXL ___ : \$25

Womens: S ___ M ___ L ___ XL ___ XXL ___ XXXL ___ : \$25

Ball Cap, Blue: _____ : \$15

Please help the League help amateur astronomy by making a tax deductible donation! \$ _____

The organizers reserve the right to make changes to the event as necessary due to circumstances beyond their control.

Summary:

Registration _____ +

Merchandise _____ +

Tours _____ +

Thursday's Star-B-Que _____ +

Saturday's Award Banquet _____ +

League Donation (Thank you!) _____ =

Grand Total: \$ _____

As a former educator who is used to writing lesson plans designed to engage students, I had the opportunity in the summer of 2011 to hold a temporary position as a teacher-ranger for the National Park Service at Montezuma Well National Monument in Rimrock, Arizona. My primary duties were conducting the Junior Ranger camps, but I was also able to help formulate the Well's first weekly night sky programs that summer, and so began my interest in astronomy outreach. I was introduced to techniques designed to divide my interpretation of the night sky between individuals at the eyepiece and those waiting in line. It was necessary to remain flexible for the visitors' benefit. Most importantly, I practiced motivating and instilling wonder in groups and individuals through relevant, thought-provoking engagement. This experience left me with an indelible desire to share the universe with others, and I have been training in, studying, and applying interpretive techniques ever since. It began with students, parents, and faculty at the middle school where I worked, and continues to this day through outreach with the Museum Astronomical Resource Society (MARS) in Tampa, Florida.

The formal techniques I have learned have proven to be effective, including interpretive talks that may use humor, metaphor, storytelling, and demonstrations of scientific principles and equipment, and making a personal connection



with a group using a talking point that is relevant to all. However, I recognize that not all volunteers are familiar with such techniques, and simply use their knowledge of astronomy with the best intentions to teach others. Often, an individual interested in astronomy who attends an outreach event can

Astronomy Outreach: Keeping it Informal

By Brian Buttafuoco



The author, with his homemade 12-inch Dobsonian reflector and equatorial platform at Farrout Observatory, Dade City, Florida

feel overwhelmed by unfamiliar language, or his or her contemplation of our favorite subject can be cut short by an enthusiastic amateur astronomer who is quite knowledgeable, but presents too much of this knowledge. Rather than provoke thought, this volunteer merely instructs. The visitor is there-

fore given much information, but is not engaged in the experience. I

have found that what works best at making the visitors feel at ease, and leaves a lasting impression, is the informal approach to astronomy outreach; a method in which the amateur astronomer puts equal emphasis on camaraderie with visitors and interpretation of the night sky. The benefits occur

naturally and instantaneously in the form of a "give and take," rather than "instructor to student." In addition, an amateur who dabbles in many aspects of astronomy will find this approach advantageous, as it opens many opportunities for engagement. Furthermore, this informal format will leave a lasting, positive impression on both the visitor and the astronomer.

As mentioned earlier, interpretation of the night sky can also use a formal approach—say, an interpretive talk with a theme and a specific objective in mind. With such a structure, a wide range of techniques can be used to make connections with visitors. I found that a formal approach (if kept relatively brief) works best to lay groundwork for the informal remainder of an

outreach event. Here, visitors have received an interesting overview and now have the freedom to enjoy astronomy through a more informal experience: a relaxed, friendly, casual, personal interaction that comes naturally between themselves and a volunteering astronomer.

The interpretation of the night sky as an informal experience works best when visitors can share their experiences with volunteers through their enthusiasm, prior knowledge, and curiosity. The volunteer can add through conversation; thus making it a personable experience. A friendly disposition, patience, and listening skills are therefore important. Thought-provoking engagement is encouraged, but should not dominate the experience. This can be achieved through a casual discussion with someone waiting in line or at the eyepiece of one's telescope. Engaging questions, fun facts, and other interpretive techniques are interwoven in small increments throughout conversation, rather than as a presentation. Allow for flexibility so that the visitor can ask questions, or comment on the activity at hand. These steps will ensure that both parties are completely at ease while doing what comes naturally.

Those who are experienced with public outreach tend to be well rounded in their astronomical knowledge. Part of informal interpretation is using one's knowledge to engage visitors in different ways, in order to appeal to a wide range of possible interests and hopefully to make a connection. In this way, the astronomer becomes a more effective interpreter of the night sky. For example, dabbling in areas such as imaging may appeal to the budding photographer. If DIY projects or the building of telescopes are one's skills, they may excel in engaging a handyman, carpenter, or craftsman. If one has

visited many astronomically relevant places (Meteor Crater in Arizona, Mount Palomar Observatory in California, or the Arecibo radio Telescope in Puerto Rico, to name a few), they might spark a delightful discussion with a seasoned traveler. Advising, chairing, or being active in an astronomy



Showing a visitor that a decent photo of the Moon can be taken with their smartphone, allowing them to leave with a souvenir from their evening

club makes one aware of the many paths people may take in astronomy, and therefore one can communicate effectively with the gadget type, the average Joe or Jane, the photographer, or the armchair astronomer. A well-rounded volunteer lends himself or herself well to the informal outreach setting. This volunteer can create a greater array of opportunities to engage the public through conversation, so dabble away!

While we can appreciate what the visitor walks away with after an outreach event, it is also important to note the impression the volunteer is left with as well. The feeling of goodwill and camaraderie shared with others from all walks of life leaves one with a sense of accomplishment and pride in not just the sharing of

the universe, but in *having made the personal connection*. This feeling is a powerful motivating driver to continue teaching others about astronomy, since it surpasses the mere passing on of astronomical facts. Moreover, it is the *feeling* that is evoked when connections are made and visitors are engaged and happy.

The informal approach should come naturally if one is enthusiastic about outreach. Informality should be balanced with interpretation. Many amateurs get caught up in sharing too much and the experience becomes one-sided. To quote Freeman Tilden, pioneer in the field of natural and cultural interpretation, "The chief aim of interpretation is not instruction, but provocation." This aim can be achieved in a casual setting as well as in a formal talk, as long as the volunteer allows a visitor to balance the "sharing" of the experience with the freedom to ask questions, tell stories, use humor, and engage in good ol' friendly conversation. By using one's knowledge in many areas of astronomy, it is possible to engage more



Performing "Astronomy on the Riverwalk" in downtown Tampa, Florida, with the MARS Astronomy Club

people in this way. Lastly, this type of experience will leave a volunteer with a long lasting positive impression; a sense of accomplishing the outreach goal unhurried and comfortably while rekindling the desire to further pursue what John Goss described as "our avocation like no other." ☀

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

By Mike Stewart, Astronomical League Historian

February 1966

AAVSO Observations Continue at Record Pace

The 16th annual report of the American Association of Variable Star Observers shows a new record number of observations with 102,026 being submitted by 320 observers, from October 1, 1964 through September 30, 1965. The society's Director, Mrs. Margaret Mayall, reports that 66 observers from 21 foreign countries made 24,137 observations while 257 observers from the United States contributed the remaining 77,889 observations.

The total number of observations received as of October 1, 1965 is 2,271,621. The AAVSO website showed 30,126,178 observations as of the second day of 2016. The League offers two observing programs for variable stars.



February 1991

The Wehr Astronomical Society's Venture into Cable TV

The Wehr Astronomical Society of Franklin, Wisconsin has entered into a most ambitious project. We have committed ourselves to producing a one-hour monthly television show for Community Access Cable Television. The program is called *The Sky Tonight*, and is aimed primarily at the general public and the beginning astronomer.

The idea was crystallized in September, 1990, and training for our members was provided by Viacom Cablevision in late October. Our first show was taped December 18, and aired on the public access channel starting January 1, 1991. The show ran every Monday, Wednesday and Friday evening for the entire month!

One can still find community access cable television shows in some areas, although these seem to have diminished over the years. Astronomers now have access to high-quality video streaming, webcasts, and podcasts. It's humbling to recall that a mere 25 years ago, cable TV and the League's Stargate computer bulletin board system (BBS) were state-of-the-art.



March 2006

Stardust Returns Home

"It exceeds all expectations," said Donald Brownlee, the University of Washington astronomy professor who is lead scientist for Stardust. "It's a huge success. We can see many impacts. There are big ones, there are small ones."

The why of Brownlee's excitement? The successful return of Stardust, the first U.S. space mission dedicated to the exploration of a comet. It was also the first robotic mission intended to return extraterrestrial material from outside the orbit of the Moon.

Brownlee calculated there might be more than a million microscopic specks of dust embedded in Stardust's aerogel collector.

These impacts can only be found using a high magnification microscope with a field of view smaller than a grain of salt. But the aerogel collector that we have to search is enormous by comparison, about a tenth of a square meter (about a square foot) in size. The job is roughly equivalent to searching for 45 ants in an entire football field, a single 5-cm by 5-cm (2-inch by 2-inch) square at a time!

"More than 1.6 million individual fields of view will have to be searched to find the interstellar dust grains. We estimate that it would take more than 20 years of scanning for us to search the entire collector by ourselves."

The article also states that "the Stardust spacecraft flew in front of the nucleus and through the halo of gases and dust at the head of comet." Stardust returned the samples to Earth on January 15, 2006. The purpose of the article was to solicit volunteers to aid researchers by reviewing the scanned fields, similar to SETI and Galaxy Zoo citizen science programs with which readers may be familiar.

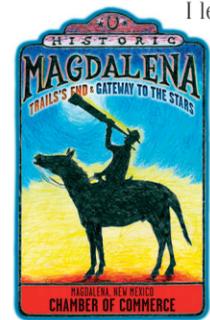


By John W. Briggs

When I returned to live in the small village of Magdalena, New Mexico, never in my wildest dreams did I expect to find a thriving community interest in astronomy. Was I surprised!

Magdalena is among the closest small towns to National Radio Astronomy Observatory's famous Very Large Array radio telescope. An icon of science, the monumental VLA was made famous by the movie *Contact* starring Jody Foster. Yet it can't help but remain mysterious to most folks passing through it on Route 60, a road connecting Arizona to western New Mexico in a very rural area on the Continental Divide. With the VLA just over the horizon, Route 60 continues eventually through little Magdalena, and drivers are forced to slow down. Side streets quickly become dirt, and it's not unusual to see riders on horseback and an occasional loose donkey. Mountains immediately to the south rise to nearly 11,000 feet. They might hardly be noticed, however, given the general high altitude and the all-over splendor of the American Southwest.

I came here a decade ago working for New Mexico Tech in Socorro to help build Magdalena Ridge Observatory, but before long I was called away to teach in New England—a one-year opportunity that evolved into a nine-year adventure. My family and



I left behind a small home we'd set up several miles north of the village, with a new well, electricity we'd brought in, new fencing to keep cattle out and horses in, and a backyard hilltop at 6,500 feet. Intervening hills block any village lights shining in our direction.

Earlier I'd had opportunity to watch astronomical development several hours south, near Mayhill, New Mexico, starting in the 1990s. Mayhill is near Cloudcroft, and Cloudcroft is near Sunspot, famous as the high-altitude site of National Solar Observatory, Apache Point Observatory, and most recently, Sloan Digital Sky Survey. Many well-known amateurs built observatories around Cloudcroft, and today, driving east toward Mayhill, there are entire developments with domes popping up, making the place look like a miniature Kitt Peak!

It wasn't like that here in Magdalena when we set our roots. But land was affordable, the local history was neat, and the village was two thousand feet higher than Socorro to the east. A thirty-mile drive didn't seem like too much for a working commute or for the sundries of living. In recompense, backyard skies near Magdalena offered a breadth and darkness beyond the wildest dreams of many friends back East. For example, the all-too-elusive *gegenschein* (solar counter glow), discovered by Barnard in the early days of Yerkes Observatory, is a feature one can point out easily here, even to non-astronomer friends, at certain times of year. The high desert landscape, drab in a passing glance, is in fact replete with life and has a powerful beauty that seduces one to full sympathy with the state slogan, "Land of Enchantment." The general lack of tall trees—like those back home in Massachusetts, the ones we called swamp maples growing like weeds around my first observatory—is a blessing, because the effective horizon here is naturally low and typically amazingly distant. The air is frequently so transparent that seeing a mountain some 70 miles away is not unusual at all.

So in returning here to live and build a new backyard observatory, the potential was clear enough. Perhaps the only concern was astronomical loneliness given that, for example, the excellent activities of the Albuquerque Astronomical Society were centered 100 miles away.

MAKING IT IN MAGDALENA



An 1875 5-inch Alvan Clark refractor, originally at Abbot Academy in Andover, Massachusetts, is now a regular feature at the Enchanted Skies Star Party in New Mexico. Photograph by Michael Mideke, Magdalena Astronomical Society, courtesy of the Astronomical Lyceum collection.



The 13-inch Rutherford refractor, formerly of Columbia University, was built in 1868 and did pioneering work in celestial photography, astrometry, and spectroscopy. It is seen here as currently displayed at the CWB Gallery in Magdalena, New Mexico, in an exhibit prepared for the Astronomical League's 2015 convention. Dennis and Kim Cassia of the Springfield Telescope Makers recently contributed a large Cave Astrola German equatorial mount that will allow this telescope to be used on the sky again.

But in our absence, a significant transformation had begun. The small Magdalena Chamber of Commerce, populated with folks from the local art community, had embraced the idea of promoting astronomical tourism as a new theme. The village slogan, "Trail's End," had been expanded to become "Trail's End, Gateway to the Stars!" I didn't know this. My family and I were newly back in town, dining in a cafe. A table of local ladies sat nearby (who, it turned



Campers await the emergence of zodiacal light as Venus beams in evening twilight at the spring 2015 Enchanted Skies Star Party, one of two organized in Cibola National Forest near Magdalena, New Mexico, in 2015.



FOAH Observatory outside Magdalena, New Mexico, will eventually house several telescopes. The first installation is a 10-foot Parablom portable dome, surplus from White Sands Missile Range. A massive central section lowers hydraulically for three-point contact on the ground, leaving the telescope isolated from the large trailer. The current instrument is a differential image motion monitor for measuring astronomical seeing, a system originally developed for Apache Point Observatory and the Sloan Digital Sky Survey.

out, were representatives of the Chamber). Conversation ensued. When I mentioned to them, perhaps somewhat timidly and apologetically, that I happened to have a keen interest in astronomy, I was entirely unprepared by the explosive and enthusiastic reaction. They'd embraced the idea of promoting astronomy, and now, suddenly, a local astronomer materialized before them!

Beyond mere sloganing, the Magdalena Chamber had united with

the long-running Enchanted Skies Star Party, already over 20 years old in the region, and had enticed the event to come operate a short drive outside the village in Cibola National Forest. At the same time, the Chamber successfully applied to the New Mexico Tourism Department for a \$2,500 grant to support 2015 Star Party activities, including expanded advertising. Most importantly, the Chamber's collaboration brought in a network of folks from Magdalena's art and business communities, all of them enthusiastic to promote astronomy with talent curiously disproportional to the small size of the town. Among the ideas generated by the Chamber, for example, was to create the Magdalena Astronomical Society, a task that fell upon me. Turnout for the star party multiplied, with participants in 2015 coming from as far as Denver, San Francisco, and New York City. A good number said they'll return.

I had a lifetime's collection of antique telescopes, related instrumentation, and books in storage in Magdalena, my interest in such things having been arguably an illness, but one encouraged by fellow members of the Antique Telescope Society. A community theater group had been operating in a former school gymnasium from 1936 on Main Street. It had become inactive, allowing me to acquire the building to house and maintain the telescope collection, display it, and install related labs and a technical library. The "Astronomical Lyceum," as we call it, is becoming a center of activity for the Magdalena Astronomical Society. Our first club project, now underway, is to build a 37-inch Dobsonian for a mirror made by Intermountain Optics and owned by Wheaton College of Norton, Massachusetts. University of New Mexico has donated two surplus observatory domes. New Mexico Tech has established Etsicorn Observatory Field Station with a surplus dome from White Sands Missile Range at the 6,500-foot hilltop, the site dubbed the FOAH Observatory. I had envisioned the site as my "Fool On a Hill" Observatory before collaborations proved so fruitful that I realized, happily, we'd better call it FOAH for "Friends On a Hill!"

The Astronomical Lyceum is a work in progress. But since July 2015, when the Astronomical League's National Convention passed through town on the way to a special tour at the VLA, it was clear to us that we must open a show. Consequently, featured artifacts and images from the Lyceum collection, organized to highlight the life and accomplishments of pioneering American astronomer Lewis Morris Rutherford, were organized for display at Magdalena's CWB Gallery. This proved an interesting attraction to pause the League's tour bus. The display remains in place as I draft this report, and we are now opening it regularly in coordination with other tours at the VLA. The response to all this has been very encouraging.

My experience in Magdalena proves that wonderful things remain possible in New Mexico, perhaps more easily so than in many other places. The Route 60 corridor westward, running through the VLA and on to Pie Town and other truly remote New Mexican villages, offers among the most pristine dark skies of the nation. Other new observatories are underway out there. Magdalena now serves as a front line to the encroachment of urbanization pushing down and outward from Albuquerque. It would seem, however, that we can make a good stand here. And we have hope that the expanded popularity of the Enchanted Skies Star Party, and the example it sets for good collaboration with village and state entities, will prove to endure, educate, and inspire, for a long time to come. ☀

J. W. Briggs is the current president of the Antique Telescope Society and was author of "The Astronomical League and its Origins," *Sky & Telescope*, October 1983, pages 345–347. Contact him at john.w.briggs@gmail.com. Visit the Enchanted Skies Star Party website at enchantedskies.org.

By Robert L. Clark

With help from various members of the Westminster Astronomical Society, and Bill Skinner of Charlotte's Quest Nature Center, as well as advice from Bob Kellogg of the North American Sundial Society and other individuals, I have built two "full size" analemmas in Carroll County, Maryland. One is a mirror-based analemma located on the grounds of Hoffman's Home Made Ice Cream store in Westminster and the other is a shadow-based analemma located at the Charlotte's Quest Nature Center in Manchester, Maryland. Both of these analemmas are intended to be cultural-educational contributions to Carroll County and to bring hopefully favorable publicity to the Westminster Astronomical Society. School groups and members of the public have attended and will attend events highlighting the function of the analemmas. Mr. Frank Roelke contributed an elegant sundial from his fathers' estate for the Charlotte's Quest installation. Each of the analemmas is maintained and marked by a committee of volunteers.

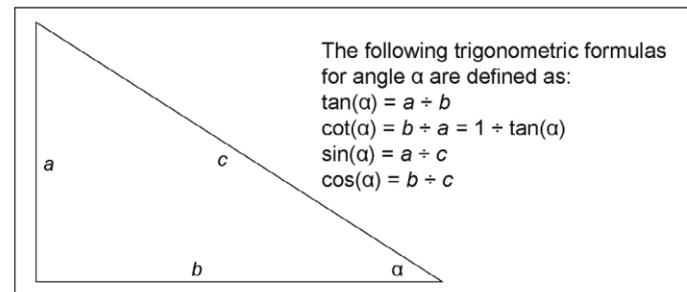
The volunteer committee members and I would like to be able to qualify for the Analemma Observing Award offered by the Astronomical League. The requirements for that award don't seem to allow team efforts. Accordingly, I have built a small analemma for personal use and offer the following description and instructions to encourage its replication. I am considering marketing these as kits, requiring only assembly. In a kit form, all sawing and drilling will be pre-done but fairly careful assembly, sanding, and finishing will be required. I envision that the assembly of an analemma together with marking the position of the Sun for a year could serve as an excellent project at the college, high school, or advanced junior high school level, either as a class or an individual effort. I have given two of the kits as "beta test" items, one to a young man in Westminster, Maryland, who has been assisting with the Westminster analemma, and another to a young man in Derry, New Hampshire.

These instructions are quite similar to, and depend heavily on, those provided by Lowell Martin in his *A Methodology for Constructing an Enclosure for Indirect Observation of the Sun*. That description is an appendix to the description of the Analemma Observing Program of the Astronomical League.

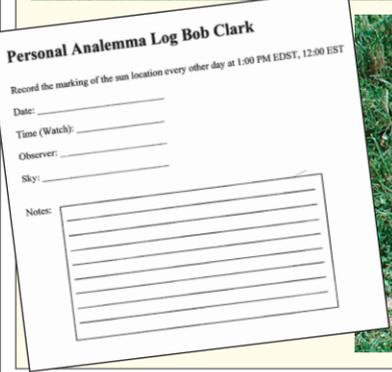
This little article provides dimensions and data for construction of an enclosed analemma specific to Westminster, Maryland. The computations are done and the dimensions can be scaled to a gnomon of any height. If you have a handy telephone pole with an appropriate clear area to the north, or feel compelled to climb to the top and attach a mirror to it, go ahead and use it. Essentially all that I am providing here is a set of appropriate proportions.

My personal analemma is positioned on the southwest corner of a railing around my front porch. It has two wooden blocks that fit over the corner to assure accurate and repeatable positioning, as it is removed when not in use.

To figure some dimensions for an analemma we need to know the latitude of the location where it will be installed. We will call the latitude λ . This set of instructions uses Westminster, Maryland,



UNIVERSAL ANALEMMA COMPUTATIONS AND DIRECTIONS FOR CONSTRUCTING A SIMPLE PERSONAL ANALEMMA



Clockwise from upper left: Manchester Crew; Hoffman's Analemma with Sundial; Hoffman's Marks; Bob Clark's Personal Analemma Log.

and Derry, New Hampshire, as sample locations. A reader working from a different location need only plug in the appropriate value for λ in the following expressions and the instructions will be specific to their location.

The triangle (below, left) will provide the geometry we need. The height of the gnomon is a . The distance from the base of the gnomon for whatever we are computing is b .

The angle α will represent the angle between a line from the top of the gnomon to the ground. That is the same as the latitude of the installation subtracted from 90 degrees.

The most important relationship is $b = a \cot(\alpha) = a \div \tan(\alpha)$. We will make use of the $a \div \tan(\alpha)$ form.

We need to know the minimum length of the board that we will use for the base of our analemma. The largest value of b occurs at midwinter. Our baseboard has to be at least that long.

The shortest b will occur at midsummer. That is when the Sun is directly over the Tropic of Cancer, which is as far north as it gets.

¹ How to visualize the "90°-" part of the formula: If you were standing at the North Pole, then at an equinox (when the Sun is halfway between the winter and summer solstices) the Sun would appear on the horizon. (Which horizon? Oh, come on! From the North Pole, all horizons are southern!) That is an elevation of 0°. The latitude of the North Pole is 90°. Thus 90° - latitude.

thus as high in the northern hemisphere as it gets. That is 23°26' north of the equator. (Correspondingly, the Tropic of Capricorn is 23°26' south of the equator.)

Summer, shortest $b = a \div \tan(90^\circ - \lambda + 23^\circ 26')$

Winter, longest $b = a \div \tan(90^\circ - \lambda - 23^\circ 26')$

Using the triangle above, we can take side a as the height of the light hole (or top of the gnomon). We can designate λ as the angle between horizontal and the light hole. Over the period of one year, the value of λ will range from $(90 - \lambda + 23^\circ 26')$ to $(90 - \lambda - 23^\circ 26')$.¹

The latitude of Westminster is 39°35' north. So $\lambda = 39^\circ 35'$. For any other latitude north of the Tropic of Cancer, substitute your latitude for λ and recalculate. For example, the latitude of Derry, New Hampshire, is 42°53', so that is the value for λ in Derry, New Hampshire.

Thus, at midsummer in Westminster, $\alpha = 90 - 39^\circ 35' + 23^\circ 26' = 73^\circ 51'$. So $b = a \div \tan(73^\circ 51') = 3 \div 3.453 = 0.87$. With a "Sun hole" 3 inches from the floor, we get the closest approach of the Sun spot to the base of the gnomon as 0.87 inches.

If we compute for Derry, New

Hampshire, we get, at midsummer, $\alpha = 90^\circ - 42^\circ 53' + 23^\circ 26' = 70^\circ 33'$. So $b = a \div \tan(70^\circ 33') = 3 \div 2.832 = 1.059$. With a "Sun hole" 3 inches from the floor, we get the closest approach of the Sun spot to the base of the gnomon as 1.06 inches.

The longest b for Westminster will occur at midwinter, with $\alpha = 90 - 39^\circ 35' - 23^\circ 26' = 26^\circ 59'$. $b = 3 \div \tan(26^\circ 59') = 3 \div 0.509 = 5.89$. With a "Sun hole" 3 inches from the floor, we get the greatest distance of the Sun spot from the base of the gnomon as 5.89 inches.

The longest b for Derry will occur at midwinter. $\alpha = 90 - 42^\circ 53' - 23^\circ 26' = 23^\circ 41'$. $b = 3 \div \tan(23^\circ 41') = 3 \div 0.439 = 6.83$. If we build an enclosed analemma with a small "Sun hole" 3 inches from the bottom of the south end, we get the greatest distance of the Sun spot from the base of the gnomon as 6.83 inches.

The suggested box is 12 inches long. The vertical south end is 8 inches tall to shade the bottom. The Sun hole is about 1/8 inch in diameter and is cut in a thin, opaque plastic material framed by a hole about 3 inches wide by about 3 inches high in the south end to avoid edge shadows (vignetting).

Materials

Some durable, light-colored material that can be easily marked at the position of the daily sun spot should make the floor of the box. Poster board carefully cut to fit without movement using small map pins as marks works well and is attractive. Double-sided tape can make the marking surface more stable.

The south end and floor are cut from 3/4-inch plywood and are 4 x 12 inches and 4 x 9 inches. The sides are cut from 1/4-inch plywood into triangles of any convenient dimensions. Assemble using glue and brads. Finish as you like!

Scaling is easy. For example, a structure 24 inches long and 16 inches high with a Sun hole 6 inches above the floor might be more convenient for some applications. In a reduced-size version, the plywood thicknesses can be reduced as well as the dimensions. A half-sized version could use 3/8-inch plywood in place of 3/4-inch and wood thinner 1/4-inch for the triangles.

Installation and Use

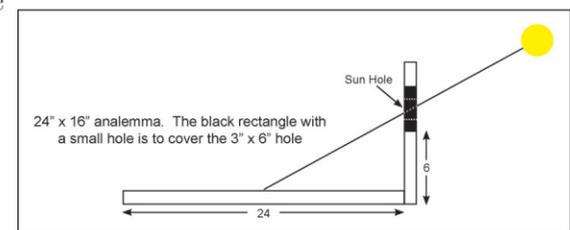
The idea behind building a personal analemma is to make regular, all-season Sun marking easy. The instrument can even be stored indoors and carried outdoors for marking daily if you like. That means that you need to have a designated location and a foolproof way of positioning the instrument so it is placed in exactly the same orientation every time.

Exact north-south orientation is not critical. If you are off by as much as 10°, the only effect will be to lean the figure eight. Incidentally, the magnetic deviation in the Westminster area is 11° west: magnetic north is 11° west of true north. *The big thing is to get your analemma always positioned the exactly same way.*

If your installation is off level by a small amount, the only effect will be to slightly distort the figure eight. It is critical that the leveling (or off-leveling) be the same every time.

Uniformity in the intervals between days of marking will have an effect, but it does not destroy the integrity of the figure. You will get the same figure eight, but your marks will occur at slightly different points on the figure.

Uniformity in timing the marking is important. If you get off time by even two minutes, your mark will occur entirely off the figure eight. ☀



24 x 16 inch analemma. The black rectangle with a small hole is to cover the 3 x 6 inch hole.

FROM AROUND THE LEAGUE

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

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

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

Volunteerism, the force that gets things done, always has been at the heart of the Astronomical League. Without people stepping forward, all League operations and projects

would quickly come to a screeching halt. League officers are very lucky to have such a knowledgeable and dedicated team to help smoothly run the many aspects of the organization. Understanding their role is key to the continued success of the Astronomical League.



Over the past fifteen years, I've had the pleasure of working with many of those volunteers while I have served the Astronomical League in various capacities: Chair of the Mid-East Region,

Astronomical League Secretary, Dark-Sky Advocate Club Administrator, interim *Reflector* Editor, *Reflector* Advertising Representative, Awards Chair, ALCon Co-Chair, Astronomical League Vice President, and currently, Astronomical League President. With your support, I will continue my efforts to bring amateur astronomy to the League membership as President of your Astronomical League. ☀

League Regional Chairs

GLRAL (Great Lakes Region): Ron Whitehead, executivesecretary@astroleague.org

MARS (Mountain Astronomical Research Section): Wayne Green, dxwayne@gmail.com

MERAL (Mid-East Region): Terry Trees, treest@comcast.net

MSRAL (Mid-States Region): James Small, webmaster@slasonline.org

NCRAL (North-Central Region): Gerry Kocken, gerryk@kockenwi.com

NERAL (Northeast Region): Maryann Arrien, Arrien@optonline.net

NWRAL (Northwest Region): Gene Dietzen, gene.dietzen@gmail.com

SERAL (Southeast Region): Richard Schmude, schmude@gordonstate.edu

SWRAL (Southwest Region): David Moody, bicparker@mac.com

WRAL (Western Region): Wayne Johnson, mrgalaxy@juno.com

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

In 2011, I read a small piece in the *Reflector*, which was seeking an assistant editor. At the time I was a semi-retired book publisher and active in local astronomical activities.

Having been a member of the Astronomical League for several years (through affiliation with the Astronomical Society of Las Cruces), this sounded like a good way to get more involved in

my hobby and submitted a résumé. A few telephone interviews later, the offer was made and eagerly accepted. The last thing on my mind was what lay ahead in the near future.

As a member of the ASLC, I have chaired various programs, including outreach, observatory, loaner telescope, and apparel; served as director and president; and was the editor of their

monthly newsletter, the *High Desert Observer*.

In the past several years, I became the *Reflector's* editor, chaired ALCon2015, and have



been involved in several other League activities. Many new friends and colleagues have been made along the way, and I believe it is time to consider further opportunities within the League that will aid in

our future growth and success.

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

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

Asteroid (50251) Iorg

Congratulations to Astronomical League past president Carroll Iorg! Asteroid 2000 BY22 was designated (50251) Iorg by the International Astronomical Union's Minor Planet Center. The formal announcement was made in October 2015 in *Minor Planet Circular* 95804.

I first met Carroll and his wife, Betty, more than 22 years ago. At the time, he was chairman of ALCon 1994 in Kansas City. Over the years, Carroll has served as League vice president (2006–2010), League president (2010–2014), ALCon chairman (1994 and 2005), and president of the Astronomical Society of Kansas City. He is currently the League's media officer and convention coordinator.

Carroll has earned a number of prestigious awards, including the Astronomical League 2003 Bob Wright Service Award. He received this award for his lifelong service to the League and astronomy. During my many years with the League, Carroll was always an inspiration to me and to many others. Minor planet 2000 BY22 was discovered by the Catalina Sky Survey team, and we thank Rik Hill and the CSS team for suggesting this asteroid designation to the IAU.

—Bob Gent, Past President, Astronomical League

Annual Subscriptions to non-AL Members

The following price schedule is for readers of the *Reflector* who are not members of the Astronomical League: Paper copies, USA & possessions: \$10.00 per year (4 issues); Canada: \$16.00 per year; Mexico: \$22.00 per year; Other countries: \$25.00 per year; Digital copies: All countries, possessions and territories: \$10.00 per year

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

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



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

My astronomical interest has been a journey though AL Observing Programs, earning the title of **Master Observer** (No. 53). Personal adventures

and travels have been to observe eclipses all over the world, trips to the Southern Hemisphere skies, Star Parties and Conventions all over the US & Canada.

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

Retiring from a career that included being a Secondary School Principal, Science Department Chair, and Physics teacher, I was elected as League secretary in 2009. In 2013 I was awarded the League's **G.R. Wright Award for Outstanding Service to Astronomy**. Now, I am asking for your support to continue that service as Vice President. ☀

Recognizing Youth Accomplishments: The Astronomical League's 2016 Horkheimer Awards

Now is the time to submit nominations for the League's **Youth Awards**. The deadline for submissions is March 31st. If you are a club officer, please nominate your deserving youth members!

The **Horkheimer/O'Meara Journalism Award** requires a person who is 8 to 14 years of age to compose a 300- to 500-word essay on any science related topic.

If you know an Astronomical League member who is 18 years 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 the **Horkheimer Service Awards**. There are two offered each year: the **Horkheimer/Smith Service Award** and the **Horkheimer/D'Auria Service Award**.

The **Horkheimer/Parker Youth Imaging Award** recognizes the imaging accomplishments of Astronomical League members who are 18 years of age or younger at the time of the nomination.

For more information, go to www.astroleague.org/al/awards/horkhmr/horkhmrs.html and www.astroleague.org/al/awards/awards.html.

2016 Webmaster Award

The time is now: the deadline for submissions for the Astronomical League's Webmaster Award is April 1, 2016.

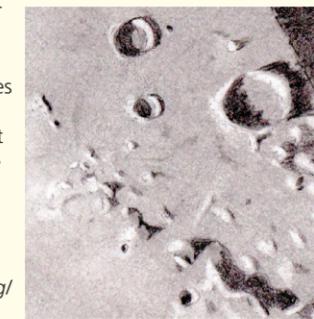
The Astronomical League's Astronomics Sketching Award

Sketching the impression of a celestial scene allows the observer to see more detail and to better enjoy our amazing avocation. Why not try your hand at sketching tonight?

The Astronomical League launches a new award program: the Astronomics Sketching Award. First place sketcher receives a cash prize of \$250, second place \$125, and third place \$75!

For all the exciting details, please visit the Astronomical League awards page, www.astroleague.org/al/awards/awards.html.

This program is made possible through the vision and generosity of Astronomics!



Attention ALCors

Please watch for the annual dues statements to be emailed in April from our national office, leagueoffice@astroleague.org. Payment is due on June 30, 2016.

The League greatly appreciates your support and cooperation!

The **Webmaster Award** recognizes the efforts of those individuals who produce the vibrant, informative websites that are essential to the growth and vitality of astronomy clubs.

Each year the League presents the **Webmaster Award** to the webmaster of the best club website. A website is an important asset to any astronomy club, and this award acknowledges the winning webmaster's outstanding job of website design and administration. Websites are judged on technical and visual design and organization; content, including club activities, club calendar, educational content and links; outreach; and administration and timeliness of content.

Club presidents are asked to send webmaster nominations and the club's website address, no later than April 1, 2016, to webmasteraward@astroleague.org or to Mike Rao, Astronomical League Webmaster Award Administrator, 2328 Naomi Street, Houston, TX 77054.

2016 Mabel Sterns Newsletter Editor Award

The Mabel Sterns Newsletter Editor Award recognizes the work of club newsletter editors across the country. The deadline for nominations—April 1, 2016—is quickly approaching. Nominations from the club president or vice president should explain why their newsletter editor should be considered for the award.

Please email entries to SternsNewsletter@astroleague.org. The nomination should include the following:

- Club name and city
- Name and postal address of the newsletter editor
- A recent issue of the newsletter as an Adobe PDF or a link to it
- A photo of the editor, preferably in an astronomical setting (JPEG please)
- The URL of the club's website where electronic copies of recent newsletter are posted (along with any passwords) would be welcome and helpful.

Both the nominating officer and newsletter editor must appear on the AL roster.

If electronic submission is not possible, four (4) paper copies of the letter of recommendation and newsletter may be mailed to the League's national office. Only one photo is sufficient.

It is strongly recommended
Continued on next page

FROM AROUND THE LEAGUE

that the Astronomical League's logo be prominently displayed in the newsletter, preferably on the front page. Entries will be judged by a panel of previous winners. For further information, visit www.astroleague.org/al/awards/sterns/sternss.html.

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

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

The Library Telescope consists of an Orion 4.5-inch StarBlast Dobsonian (or

equivalent) and a Celestron 8–24 mm zoom eyepiece (or equivalent), along with a nameplate commemorating the late Jack Horkheimer. The value of this opportunity is approximately \$300; the potential of the program is enormous.

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

The winning entry for each region will be drawn at the annual Astronomical League Business meeting held at



Telescope presentation to Temecula Astronomical Society



Secretary Leigh Anne presents a telescope to programmer Cyndi Randolph.

Planetary Transit Special Award

As the Astronomical League has done for the two most recent Venus transits, we will once again have a challenge for you to earn a Planetary Transit Special Award: Mercury Transit. We urge you to try to observe and record the transit, but whether or not you can, you can still do the required calculations to earn the certificate and pin based on observations from the internet. More details will be on the AL website. The transit will occur on May 9, 2016, from 11:12 to 18:42 UT. Mark your calendars!

Aaron Clevenson

Coordinator, Planetary Transit Special Awards

ALCon 2016 in Arlington, Virginia, on about August 13. Only one club per region will win for a total of ten telescope–eyepiece combinations being presented. The telescope, eyepiece, and accompanying commemorative plate will be mailed to the winning clubs in the two weeks following ALCon.

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

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

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

Enter Your Favorite Shot into the 2016 Horkheimer/Parker Youth Imaging Competition!

Are you 18 years or younger and do you enjoy the challenges of astrophotography, 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: for example, 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, see www.astroleague.org/all/awards/horkhmr/horkhmrs.html. The entry deadline is March 31, 2016.

Attention Master Observers

The officers of the League would like to give special recognition to Master Observers who attend ALCon 2016 in Arlington, Virginia. At the awards banquet on Saturday evening, a special wall plaque will be presented in recognition of your accomplishment. Last year we were pleased to present 14 Master Observers with their awards and we will be delighted to repeat the honor this year, as well as at future ALCons. If you intend to be present, please contact William Bogardus at vicepresident@astroleague.org before July 1, 2016.

Can we beat 14 this year? I hope so.



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*.

The Astronomical League helps members explore the wonders of our universe—maximize your membership!



Observe Clubs.

Just about everyone has heard of the nearly 30 AL Observe Clubs. These are a group of **nationally recognized** observing lists and activities. Some are suitable for novices, some are for intermediates, while others are strictly for advanced amateurs. These clubs provide a low stress way to view the many wonders of the night sky.



League Awards.

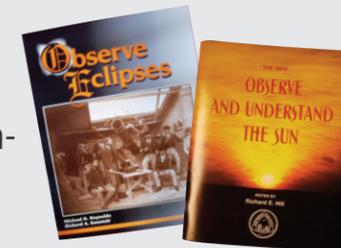
The Astronomical League wants to recognize those dedicated individuals who make astronomy happen. Every year, the League gives awards in several different areas: the Mabel Sterns Newsletter Award, the Webmaster Award, the National Young Astronomer Award, the Jack Horkheimer Young Person's Service Award, and others. People really appreciate the recognition!



Reflector Magazine.

Every member receives this full color quarterly magazine that's published for League members by League members. Members are encouraged to submit articles and images for our national readership of over 16,000 amateur astronomers. The magazine also puts members in touch with dozens of Star Parties located all over the country and features columns from other professional groups.

League Store. We have a great League Sales Office, run by a dedicated and talented staff. Our astronomical handbooks are low cost and very popular — another of the many benefits of League membership. League Sales is vastly expanding its inventory, has gone to a color catalog, and now has an on-line, credit card capability.



Book Service.

Searching for that special astronomical title in print? Separate from League Sales, the League provides a 10% discount on astronomy books with no shipping charge.

National Convention of the Astronomical League. At our National and Regional meetings, members rub shoulders with, among others, research astronomers, astronauts, authors, magazine editors, university professors, equipment manufacturers, as well as officers of the League. This is your chance to talk shop with those in-the-know.



National Voice. The League gives amateur astronomy a national voice on important issues, such as local, regional and national levels to fight light pollution and advance astronomical research.

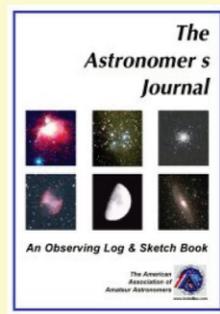
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ASTRAEA: THE STAR MAIDEN

By Amelia Goldberg

This article is about my telescope for public outreach, used mostly at elementary and middle schools and the George Observatory.

When I was given this telescope, it was in pretty bad condition, and it took a lot of work to make it usable. I decided that I wanted it to be a special telescope, one that would attract young girls. I turned to Greek mythology for a name for the telescope. I chose Astraea because in ancient Greek, *Astraea* means "star maiden" or "star goddess." In Greek mythology, she was the daughter of Zeus, and was said to be the last of the immortal gods to live among humans at the end of the Golden Age. She later abandoned Earth as the increasing violence and ignorance became too painful for her to bear. When she returned to the heavens, Zeus placed her in the sky as the constellation Virgo.

I painted the telescope pink to denote that she is female and because many young girls like that color. Using the mythological background of Astraea, I decorated the telescope. I placed her name on the scope using black letters. Since little girls love bling, I blinged her up with jewels befitting a goddess. I used black Swarovski crystals to draw the constellation Virgo above her name and to draw an imaginary star field around the words "The Star Maiden." I gave her a necklace of pink crystals. Astraea is pink and she sparkles: what more could you ask for?

So far, I have only taken Astraea to three star parties: one at an elementary school, one at a middle school, and one at the George Observatory. The school star parties are usually held when the Moon is easily visible, even before dark. Also, there is ample light around the school so that the

telescopes are easily seen even if the Moon is not in the sky, so the kids can see the details on the telescope. Astraea is a real hit and attracts not only girls, but boys and adults as well. During the session at the George, one mother came up to the telescope and told me that she had tried to get her three-year-old girl to look through one of the other telescopes on deck and the little girl refused. She pointed at my telescope and said, "No, the pink one!" To me, that was just priceless. Both young girls and young boys say that it is "sooo cool" and most of the older kids and adults say that it is just awesome. I knew that little girls would love the telescope but I was totally amazed at the reaction of boys and adults to the scope—they like it, too.

I took Astraea to the Texas Star Party this year and entered her in the amateur telescope-making review. I received an Outreach Merit Award for the re-build of this telescope. I was very pleased with the exposure given to my telescope for those who had not seen it out on the upper field.

I have received only positive comments about the pink telescope. At TSP, many of the people that I talked with hope that I've started a trend with this telescope and hope that others will follow suit. Who knows, we might start seeing telescopes of all colors and all kinds of decorations. I certainly hope so. It is a real joy to do outreach with this telescope. The kids love looking through it and I'm having so much fun. We need to do anything we can to attract young people, especially young girls, to astronomy and to make it fun for them. They will certainly remember looking through this telescope. ☀



It was Sunday evening, May 20, 1989, the night of the full Moon, and my twin brother Stash and I were in Ehrets Field, a lovely, sloping, green expanse surrounded by the deep woods of Forestburgh, New York, in the lower Catskill Mountains. My wife Elisabeth, our toddler Janusz Antares (on the early morning of his birth, Antares was prominent in the south!), and I were traveling to Hamburg to spend the summer with Elisabeth's German family. Ahead of leaving Tucson, I shipped my 8-inch Couler Dobsonian to my brother, and it arrived that Saturday.

I wanted to show Stash a few deep-sky objects, but we were racing the moonrise. Additionally, I had not counted on the long northern twilight that blanked out the stars; I was accustomed to the shorter "equatorial" onset of darkness from Tucson's 31° north latitude. Instead of observing globular clusters, open clusters, nebulae, and galaxies, we did see a spectacular moonrise, rising red above the moist field. After the 1% humidity and brutal 117 °F temperature of Sonoran Desert summers, I reveled in the gentle mystery and balminess of the forest around us.

We were looking down at the up-coming Moon, and it felt as if we would fall into it. We detected the Moon's glow with binoculars many minutes before it rose, adding to the suspense. The first sight of the rising Moon was a crimson point that momentarily looked like an aircraft navigation light. Quickly a red dome became evident. The deep red hemisphere seen through my 10x50 East German binoculars (from when there was an East Germany!) reminded me of photographs of hydrogen bombs exploding, in the microsecond after the detonation and before the more familiar mushroom cloud. As the

Moon rose, it became orange and then yellow, its typical color at moonrise in Tucson's drier atmosphere. We could almost feel the Earth under our feet rotating towards it.

The next night, Monday, May 21, we expected a 42-minute window of opportunity—no twilight, no moonlight—before the next rising of the by-now gibbous Moon. We set up the 8-inch in the garden well before darkness, allowing lots of time for the tube to cool down to ambient temperature. We checked star charts while

AN OBSERVING SESSION TO REMEMBER

waiting. I thought we should try for the triplet of galaxies in Leo (M65, M66, and NGC 3678) first, because they are easy to find in a low-power field below Delta Leonis in the hindquarters of the lion. Stash's previous instrument was a 4.1-inch Edmund Scientific Astroscan, and he had never seen a galaxy, except for naked-eye Andromeda. This was less because of the smaller aperture than because it had not occurred to him that he could.

Stash was impressed with seeing three galaxies in one field of view, seemingly floating around each other inside a large circle. M65 and M66 stood out clearly as oval patches of gray light, with NGC 3678's gray streak becoming more obvious as twilight deepened into night. M65 was where the latest supernova had been discovered; he was happy to see the galaxies themselves. I clearly remember the feeling of calm

and satisfaction that welled up within me as I gazed quietly upon these three marvelous heavenly bodies. My brother felt similarly.

By now, I thought it might be dark enough to zero in on the Virgo Cluster. With that same Couler 8-inch, I had seen nine multi-billion-star galaxies in one field of view from the top of Mount Lemmon in Tucson, and I was hoping to replicate the feat here for Stash. The Telrad was very handy, and when I put the red concentric circles on a piece of sky halfway between

Denebola in Leo and Vindemiatrix in Virgo, there was already one dim galaxy in the field of the 32 mm eyepiece. There was no time to check a star chart to determine which it might be. Instead, I slewed around a curved line of faint stars I had memorized from previous observations, and there were the twin M84 and M86 galaxies, large and relatively bright. Stash looked through the Telrad so he could locate the field again before putting his eye to the eyepiece. I told him to move the tube gently, and he was amazed as faint galaxy after faint galaxy, each a separate universe millions of light-years away, swung into view, only to be replaced by others.

Stash thought he could detect the glow of the rising Moon in the southeast, so we raced on to M81 and M82, which I easily found by sighting diagonally across the bowl of the Big Dipper and extending the line for one bowl width. After the faint fuzzies of the Virgo Cluster, M81 and M82 were bright in the 8-inch mirror. Even in the low-power eyepiece, we could gauge the thickness of M82's disrupted streak, and we could detect the spectacular explosion tearing the galaxy apart, which occurred millions of years ago, when its light left the parent

galaxy. We wondered what it might look like now. (That was written in 1989; today cosmologists explain M82's disrupted appearance as caused by stellar winds set in motion by a period of star formation, not a single explosion.)

We felt we could only give seconds to such speculations because Stash wanted to see at least one globular cluster. They are our favorite deep-sky objects. We had no difficulty slewing around to the top of the keystone in Hercules (a fancy Arabic capital letter "H" is what Hercules looks like to me), rising above the blue star Vega and there was M13.

"Wow!" gasped Stash, as he spotted the silver-gray sphere with many starpoints in it; a far better view than he ever had with the 4.1-inch Astroscan.

Stash wanted to see what it looked like at higher powers, so we switched to a 4 mm eyepiece. At such high power, the view was fuzzy and jumpy as the globular cluster raced out of the tiny field of view of the 4 mm ocular. But after a while, we noticed that for split seconds, the seeing would improve and suddenly the dazzle of M13's thousands of stars would pop into view, only to be obliterated again. The star chains were patent, and this makes me think that globular clusters are not globular, but rather three-dimensional pinwheels.

That was our last object, as by now the Moon was rising, blotting out the deep sky. We could not observe it because it would be a while before it cleared the pines, maples, and oaks. I suggested that we look at Arcturus before turning in. The 8-inch mirror gathers a massive amount of light and zero-magnitude Arcturus was an almost-blinding, yellow pinpoint of light, shining pure and steady over the dim shapes of the northern forest. ☀

Julian Grajewski

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A Few Recent Resources for Those Who Teach or Explain Astronomy

- The YouTube channel for the Silicon Valley Astronomy Lectures now features a recent, visually stunning talk by Dr. Carolyn Porco on ten years of Cassini-Huygens exploration of the Saturn system. She takes us through the many discoveries made about Saturn, its complex ring system, and its intriguing moons (especially Titan, with its thick atmosphere, and Enceladus, with its saltwater geysers). The channel includes 42 other illustrated talks, including a personal preview of the New Horizons encounter by Mark Showalter, a Dawn mission review by Marc Rayman, and a discussion of black widow pulsars by Roger Romani. The talks in this series have now had nearly three-quarters of a million views from around the world. They are free for any educational use at www.youtube.com/svastronomylectures.
- *Astronomy Education Review* was a journal on astronomy education research and practice, published first by the National Optical Astronomy Observatories and then



All Things Astronomical

by the American Astronomical Society. It published over 250 papers and articles during its 13-year existence, many of which remain current and useful. An index to the full contents of the journal, organized by topics that both astronomy education researchers and practitioners would be likely to look under, has now been compiled and published at aas.org/teach/subject-index-papers-astronomy-education-review-2001-2013.

- Many students will have questions about Mars and Mars science fiction after they see the hit movie *The Martian*. For more about dust storms on Mars and whether they can “pack the punch” required in the film, see this helpful article from *Mercury*, the magazine of the Astronomical Society of the Pacific: www.astrosociety.org/wp-content/uploads/2015/10/Mars.pdf.
- Over the years, many scientists and writers trained in science have written stories and novels about future Mars exploration. For a list of some favorites you and your students might enjoy, see

www.researchgate.net/publication/282505754_Mars_Science_Fiction_with_Reasonable_Science.

- The American Astronomical Society’s “Astronomy Ambassadors” program trains early-career astronomers on how to be more effective in outreach to schools, community groups, and the public. A resource guide for doing astronomy outreach has been put together under the title Menu of Outreach Opportunities for Science Education (MOOSE). It includes exemplary programs, finding aids for organizations that need astronomers, presentation techniques, sources of activities, evaluation ideas, and more. See aas.org/outreach/moose-menu-outreach-opportunities-science-education.

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

Public observing events provide a wonderful opportunity to introduce the wider community to the extraordinary new understanding of the universe that has been won in recent decades. To be effective we need to incorporate new techniques and new technologies into our programs. Relying solely on traditional observing techniques and settling for Solar System objects, clusters, binaries, and barely discernible faint fuzzies, limits our opportunity to bring the big ideas of modern astronomy into the conversation. How would readers react if the images used in the *Reflector* were limited to what you can see through an eyepiece?

I’ve been doing live video observing programs for eight years, engaging roughly 15,000 visitors at various venues. At first I concentrated on getting images on screen, but I’ve come to see that the key to using video technology is not just the spectacular live images that I can present, but the opportunity that live views offer to engage visitors with the big ideas. There is an important advantage in observing with a group and not having to coach each individual as

he or she approaches the scope. Your time is better spent discussing objects and ideas—and everyone sees a focused image.

A brilliantly colored image of the **Dumbbell Nebula** with its green oxygen and red hydrogen and nitrogen just shouts out, “I’ve made oxygen!” If I don’t immediately explain what we’re seeing, someone will ask, “What in the world is that?” I now have the opportunity to explain the whole process of element formation with attention focused on the Dumbbell. Many of the people that I encounter have a vague notion of our being made of stardust. Expanding on that familiar notion helps to capture their attention.

The Dumbbell coupled with a few of the **Sagittarius** emission nebulae (also brilliantly colored) introduce the idea of stellar evolution, another opportunity to expand on one of astronomy’s big ideas. In winter, the **Orion** and **Crab Nebulae** are a good combination, a star-forming region and a supernova remnant.

The **Milky Way** presents a wonderful opportunity to engage minds. We see it as a band of light in midsummer. At a really dark site, its details are elaborately visible. But what is it all about? I’ve noticed that even people who have seen the **Milky Way** and know that it’s a spiral galaxy often don’t make the connection

between that band of light across the sky and the spiral structure. A low-tech tool works well here. I use a homemade 20-inch model of a spiral galaxy to point out our position and our midsummer view of the next spiral arm in, which looks like a band of stars from here. I also like to point out that on the 20-inch model the whole Solar System, out to Neptune’s orbit, would be one-half of a millionth of an inch.

Other galaxies offer a whole other set of opportunities to expand awareness. **M51**, the Whirlpool Galaxy, elicits the same kind of gasps as a first look at Saturn. Even on nights when the galaxy barely shows on the screen, the faint

ghostly spiral strikes awe. Showing the **Whirlpool** and then going over to **NGC 4565**, a bright edge-on spiral, adds depth to the galaxy story. Once I’ve shown a couple of galaxies, I like to point out that there are roughly 200 billion of them. That statement usually prompts a comment like, “How could you possibly know that?” With a display that supports a computer input, I can bring up the **Hubble Ultra Deep Field** image, explaining that the field of view in which we see ten thousand galaxies is

like looking at one-fiftieth of the full moon or looking through an eight-foot-long soda straw. Being able to show the evidence for the astonishing number of galaxies adds credibility to the program.

The **Moon** is a wonderful target for group observing. Explaining the geology and history of the **Moon**, and the Apollo landing sites, works well with a live view in front of you. Shutting off tracking is a handy way to point out how fast the **Earth** is rotating. Current supernovae and comets occasionally provide wonderful targets of opportunity and lead to extensive discussion.

Having access to stored material allows me to introduce many big ideas that would otherwise be inaccessible. For example, everyone is fascinated by black holes. How do you address black holes in an observing setting? I use an animation produced by the **Galaxy Center Group** at UCLA. It shows stars orbiting the 4.3 million solar mass black hole at the center of the **Milky Way** over 16 years. With the animation on screen, I can expand on the basic ideas of black holes. This often leads to a discussion of orbits in general—lunar, planetary, globular clusters, binaries, stars and gas within the **Milky Way**, and galactic clusters.

I use the black hole animation and the **Hubble Ultra Deep Field** and other stored material as a

warm-up act, starting programs long before dark. With Internet access available I sometimes use the **Night Skies Network**, a site where other amateur observers broadcast live observing sessions. Here in Arizona we can watch live video observing, using essentially the same equipment that we will use after dark, from the East Coast long before our sunset.

There are many other big ideas that work well in group discussions. Many of my evenings are spent at **Lowell Observatory** in Flagstaff, Arizona. There, in 1910, **Vesto Slipher** collected the first spectral evidence for the expansion of the universe, so it’s hard to imagine not discussing the expansion, redshift, and the **Big Bang** while observing in the shadow of Slipher’s telescope.

Dark matter and **dark energy** are big ideas that are in the back of many people’s minds. Introducing ideas like these into outreach discussions really adds to the depth of an evening. Formation of the **Solar System**, **exoplanets**, **comets**, **meteorites**, **asteroids**, the **Moon**, **Newton**, **Galileo**, and **Einstein** all make good subjects to add to the visual experience of an observing evening. Some might best be presented in a format separate from observing stations. A display available before sunset could introduce some of these topics. For a club, this would provide an opportunity for members who don’t have portable scopes and who don’t normally participate in outreach to share their knowledge.

Much of the public that we address at outreach events is at least vaguely familiar with many of the big ideas of modern astronomy. We can improve the depth of our engagement by bringing new technology and new techniques to bear on these ideas.

I’m sure that this will sound like heresy to some. But face it—traditional outreach programs have not excited enough of our neighbors. We need fresh ways to engage people in greater depth.

One of the benefits of video observing is that the video camera is much less limited by bright skies than is visual observing. I recently did an observing event three nights after the first quarter moon and was able to get good views of **M27**, **M57**, **M8**, **M20**, and **M17**. The observing window is always open. In the last few years, the cost of effective near-live video cameras has dropped substantially. Six hundred dollars or less will now buy a system that will allow you to present a wide range of deep-sky objects.

Visitors come eager to learn. Enriching our observing programs will increase the likelihood that they will leave with a fresh appreciation of the spectacle that is modern astronomy.

Bill is with the Prescott (Arizona) Astronomy Club and can be reached at Skyhighaz@cablene.net. ☼ —By **Bill McDonald**

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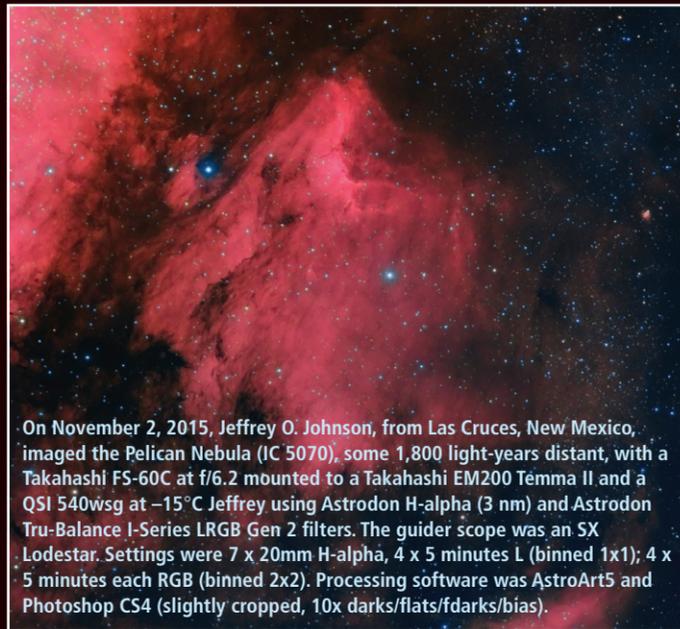
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Gallery

The large dark nebula (NGC 281A) that makes up this “gaping mouth” is a molecular cloud made up predominantly of molecular hydrogen, but also dust and other gases. New generations of solar systems are being forged within its cold interior. Once these young stars’ fusion engines switch on they will irradiate their surroundings—heating up, ionizing and eroding away the remaining dark material from which they formed.

Originally the whole Pac-Man Nebula would have been one large dark molecular cloud—the stars that formed early on at its center having progressively hollowed out the center of the nebula. The gas in and around this central region is ionized by the copious ultraviolet radiation emitted by the central open star cluster (IC 1490), causing it to glow and providing the light by which this narrowband image was taken.

Contributor Jaspal Chadha from London, England, provides us with the image and narrative. Taken on various dates throughout September and October 2015, using a Skywatcher Esprit 100ED on an iOptron CEM60 mount and a QHY9S mono CCD along with Chroma 3 nm H-alpha (18 x 20 minutes), 3 nm S-II (10 x 20 minutes) and 3 nm O-III (10 x 20 minutes) filters.



On November 2, 2015, Jeffrey O. Johnson, from Las Cruces, New Mexico, imaged the Pelican Nebula (IC 5070), some 1,800 light-years distant, with a Takahashi FS-60C at f/6.2 mounted to a Takahashi EM200 Temma II and a QSI 540wsg at -15°C Jeffrey using Astrodon H-alpha (3 nm) and Astrodon Tru-Balance I-Series LRGB Gen 2 filters. The guider scope was an SX Lodestar. Settings were 7 x 20mm H-alpha, 4 x 5 minutes L (binned 1x1); 4 x 5 minutes each RGB (binned 2x2). Processing software was AstroArt5 and Photoshop CS4 (slightly cropped, 10x darks/flats/fdarks/bias).



Frequent contributor Dan Crowson, imaging from Dardenne Prairie, Missouri, over three nights in October and November 2015, took this image of Sharpless 249 (also known as IC 444 and LBN 840), a large emission nebula in Gemini. Located next to the popular Jellyfish Nebula (Sh2-248 or IC 443), part of which can be seen at the bottom right of the image. The blue nebula around the star 12 Geminorum (just up and to the right of center) is cataloged as van den Bergh 75 (vdB 75). Sh2-249 is one of the Astronomical League’s Bright Nebulae Program objects.

This image was taken with an SBIG ST-8300M on an Astro-Tech AT90EDT at f/6.7, 603 mm with a total exposure time of 8 hours (H-alpha 12 x 30 minutes) binned 1x1, RGB 8 x 5 minutes (binned 2x2).

Surrounding AE Aurigae, a bluish star in the constellation Auriga, is emission nebula IC 405, also known as the Flaming Star Nebula. This image was taken by Christopher Gomez of the Escambia Amateur Astronomers Association in the Florida Panhandle on October 11, 2015, with 18 x 600 10-minute exposures (3 hours total), using an Orion 8-inch f/3.9 Newtonian Astrograph on an Orion Atlas EQ-G mount, Orion Short Tube 80 guide scope, and Orion StarShoot Autoguider. The imaging camera was a modified Canon T5i with an Orion SkyGlow 2-inch astrophotography filter. Gomez used PixInsight 1.8, Photoshop CC, Noel Carboni’s Astronomy Tools for PhotoShop, and StarSpikes Pro 4 software. He can be reached at cgame004@gmail.com.

TITLE PHOTO: NGC 2244, BRIAN KIMBALL

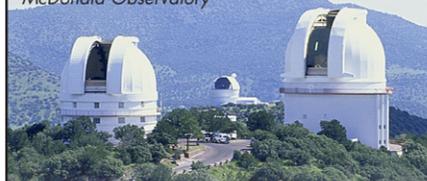
A MEMBER BENEFIT FROM McDONALD OBSERVATORY

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 Previte, 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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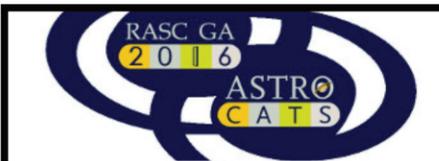
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Editor's Note: Congratulations to all these outstanding astronomical observers! All awards, except the Herschel 400, require current Astronomical League membership for eligibility. If you have questions about an award, please contact the corresponding 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. 6-V, Dick Francini, Neville Public Museum Astronomical Society; No. 7-I, Anthony J. Kroes, Neville Public Museum Astronomical Society; No. 8-V, Brad Young, Astronomy Club of Tulsa; No. 9-I, W. Maynard Pittendreigh, Lifetime Member

Asterism Observing Program

No. 30, Melissa Adams, Member-at-Large; No. 31, Ken Pryor, Oklahoma City Astronomy Club

Asteroid Observing Program

No. 50, Dan Crowson, Gold, Astronomical Society of Eastern Missouri; No. 51, Richard Owens, Gold, Astronomical Society of Kansas City; No. 52, Junda Liu, Gold, Member-at-Large

Binocular Messier Observing Program

No. 1072, Mike Neal, Echo Ridge Astronomical Society; No. 1073, John Laning, Member-at-Large; No. 1074, Andrea Boeck, Omaha Astronomical Society; No. 1075, Wayne Boeck, Omaha Astronomical Society; No. 1076, Hector Franceschini, Central Texas Astronomical Society; No. 1077, Michael Blaze, Tulare Astronomical Association

Binocular Variable Star Observing Program

No. 1, Mike Simonsen, Member-at-Large; No. 2, Robert Togni, Central Arkansas Astronomical Society; No. 3, William Clark, Tucson Amateur Astronomers Association; No. 4, Brad Young, Astronomy Club of Tulsa; No. 5, Al Lamperti, Delaware Valley Amateur Astronomers

Bright Nebula Observing Program

No. 10, Ted Forte, Huachuca Astronomy Club

Caldwell Observing Program

No. 222, Michael Overacker, Silver, Star City Astronomy Network; No. 223, Steve Boerner, Silver, Astronomical Society of Eastern Missouri; No. 224, Keith Kleinstick, Silver, Member-at-Large

Carbon Star Observing Program

No. 64, Bob Scott, Island City Astronomical Society; No. 65, Michael Overacker, Star City Astronomy Network

Comet Observing Program

No. 31, Tim Hunter, Gold, Tucson Amateur Astronomy Association

Constellation Hunter Northern Skies Observing Program

No. 155, Kevin Carr, Member-at-Large; No. 156, Kevin Nasal, Neville Public Museum Astronomical Society; No. 157, William T. Mach, Member-at-Large; No. 158, Angela den Boer, Member-at-Large; No. 159, David Whalen, Atlanta Astronomy Club; No. 160, Bernard Venasse, Member-at-Large; No. 161, Anne Kochendorf, Astronomical Society of Long Island; No. 162, John Lanning, Member-at-Large; No. 163, Johnny Scarborough, Central Texas Astronomical Society; No. 164, Philip Sacco, Flint River Astronomy Club; No. 165, Kristin Hendershot, Shenandoah Astronomical Society; No. 166, Vincent Michael Bournique, Member-at-Large; No. 167, Hector Franceschini, Central Texas Astronomical Society

Observing Awards



Constellation Hunter Southern Skies Observing Program

No. 6, Vincent Michael Bournique, Lifetime Member

Dark Nebula Observing Program

No. 21, Jim Kaminski, Member-at-Large; No. 22, Dick Francini, Neville Public Museum Astronomical Society

Deep Sky Binocular Observing Program

No. 370, Nancy Rauschenberg, Minnesota Astronomical Society; No. 371, Jarret Lingle, Mason Star Gazers; No. 372, Michael Overacker,



Star City Astronomy Network; No. 373, Andrea Boeck, Omaha Astronomical Society; No. 374, Paul Harrington, Member-at-Large

Double Star Observing Program

No. 557, Carol Ogden, Olympic Astronomical Society; No. 558, Vincent Michael Bournique, Lifetime Member; No. 559, Marilyn Sameh, Wabash Valley Astronomical Society; No. 560, Doug Liebert, Olympic Astronomical Society; No. 561, James C. Smith, Member-at-Large; No. 562, Kevin C. Carr, Member-at-Large; No. 563, Jack Fitzmier, Atlanta Astronomy Club; No. 564, Marie Lott, Atlanta Astronomy Club; No. 565, Valerie Whalen, Atlanta Astronomy Club; No. 566, David Whalen, Atlanta Astronomy Club; No. 567, Mark McCarthy, The Astronomy Connection; No. 568, John Lanning, Member-at-Large; No. 569, Coy Wagoner, Shreveport-Bossier Astronomical Society; No. 570, Eric Rachut, Central Texas Astronomical Society

Flat Galaxy Observing Program

No. 11, Brad Young, Honorary, Astronomy Club of Tulsa

Herschel 400 Observing Program

No. 546, Kevin C. Carr, Member-at-Large; No. 547, Grant Mills, Member-at-Large; No. 548, Nora Jean Chetnik, Member-at-Large; No. 549,

Roy Troxel, Member-at-Large; No. 550, Dee Friesen, Albuquerque Astronomical Society

Hydrogen Alpha Solar Observing Program

No. 30, David Whalen, Atlanta Astronomy Club

Lunar II Observing Program

No. 68, Steve Bell, Boise Astronomical Society; No. 69, Jeffrey Corder, Ancient City Astronomy Club; No. 70, Steve Boerner, Astronomical Society of Eastern Missouri

Lunar Observing Program

No. 931, Enid Norton, Salt Lake Astronomical Society; No. 932, Hector Franceschini, Central Texas Astronomical Society; No. 933, Brent Burton, Austin Astronomical Society; No. 934, Raymond B. Howard, Patron Member; No. 935, Jim Kloeppel, Champaign-Urbana Astronomical Society; No. 936, Kristen Hendershot, Shenandoah Astronomical Society; No. 937, Alexander Stewart, Youth Member-at-Large; No. 938, Trey Anding, Baton Rouge Astronomical Society

Messier Observing Program

No. 2713, Chris Brandt, Regular, Astronomical Society of Kansas City; No. 2714, Bruce McMath, Regular, Central Arkansas Astronomical Society; No. 2715, Michael D Thompson, Honorary, Island County Astronomy Club; No. 2716, Keri N. Thompson, Honorary, Island County Astronomy Club; No. 2717, Claudiu Nistor, Regular, Seattle Astronomical Society; No. 2718, Clifford Bullock, Honorary, San Bernardino Valley Amateur Astronomers

Meteor Observing Program

No. 177, Christopher Price, 6 hours, Houston Astronomical Society; No. 163, Jean Napp, 12 hours, Iowa County Astronomers; No. 59, Alice Stanley, Honorary, Member-at-Large; No. 60, Michael D. Stewart, Honorary, Astronomical Society of Kansas City

Northern Arp Peculiar Galaxy Observing Program

No. 82-V, Ken Boquist, Popular Astronomy Club

Open Cluster Observing Program

No. 71, Vincent Michael Bournique, Basic, Lifetime Member; No. 72, Steve Jaworivsky, Advanced, Howard Astronomical League

Outreach Observing Award

No. 458-M, Brad Young, Astronomy Club of Tulsa; No. 685-O, Michael

Pusatera, Astronomical Society of Eastern Missouri; No. 686-O, Jeremy Bray, Southern Colorado Astronomical Society; No. 687-O, Gerry Pearson, Popular Astronomy Club; No. 688-O, John Douglas, Popular Astronomy Club; No. 689-O, Tanya Duncan, Popular Astronomy Club; No. 690-S, David A. Warner, Colorado Springs Astronomical Society; No. 691-O, Sharon Flemings, Temecula Valley Astronomers; No. 692-O, John A. Leonelli, Temecula Valley Astronomers; No. 575-S, Mark V. Baker, Temecula Valley Astronomers; No. 665-S, Jeff Purcell, Omaha Astronomical Society; No. 602-S, Clifford Bullock, San Bernardino Valley Amateur Astronomers; No. 693-M, Roy Gustafson, Popular Astronomy Club; No. 424-M, Grant Martin, Astronomical Society of Eastern Missouri and the Saint Louis Astronomical Society; No. 110-M, William Bogardus, Amateur Observers' Society of New York; No. 693-O, Louise Warren, Flint River Astronomy Club; No. 694-O, Jeremy Milligan, Flint River Astronomy Club; No. 599-S, John Schaub, Popular Astronomy Club; No. 695-O, Ed Averyt, Oklahoma City Astronomy Club; No. 696-O, Emily Brake, Oklahoma City Astronomy Club; No. 697-O, Caleb Haldane, Oklahoma City Astronomy Club; No. 698-O,

Chelsea Haldane, Oklahoma City Astronomy Club; No. 699-O, Peter Khor, Oklahoma City Astronomy Club; No. 700-O, Christine Murphy, Oklahoma City Astronomy Club; No. 701-O, Chris Petroff, Oklahoma City Astronomy Club; No. 702-O, Patrick Rosch, Oklahoma City Astronomy Club

Radio Astronomy Observing Program

No. 10-B, Blair Hearth, Rockland Astronomy Club; No. 11-B, JoAnne Trees, Amateur Astronomers Association of Pittsburgh; No. 12-B, Terry N. Trees, Amateur Astronomers Association of Pittsburgh; No. 13-B, Aaron Clevenson, North Houston Astronomy Club; No. 14-B, Michael Hotka, Denver Astronomical Society; No. 5-S, Blair Hearth, Rockland Astronomy Club; No. 6-S, Dr. Alex Vrenios, Patron Member; No. 7-S, Terry N. Trees, Amateur Astronomers Association of Pittsburgh; No. 8-S, Dr. Richard Russel, Colorado Springs Astronomical Society; No. 9-S, JoAnne Trees, Amateur Astronomers Association of Pittsburgh; No. 10-S, Lowell Martin, Fort Worth Astronomical Society; No. 1-G, Dr. Richard Russel, Colorado Springs Astronomical Society; No. 2-G, JoAnne Trees, Amateur Astronomers Association of Pittsburgh; No. 3-G, Terry N. Trees, Amateur Astronomers Association of Pittsburgh

Southern Skies Binocular Observing Program

No. 92, Kevin Shackleton, Member-at-Large; No. 93, Patrick Hanrahan, Rose City Astronomers

Southern Skies Telescopic Observing Program

No. 49, Jeffrey Corder, Ancient City Astronomy Club

Stellar Evolution Observing Program

No. 24, Ronald A. King, Northern Virginia Astronomy Club; No. 25, Mark Simonson, Everett Astronomical Society; No. 26, Michael Overacker, Star City Astronomy Network; No. 27, Joe Castor, Kansas Astronomical Observers; No. 28, Anthony J. Kroes, Neville Public Museum Astronomical Society; No. 29, Kevin McKeown, Albuquerque Astronomical Society; No. 30, Jim Kaminski, Member-at-Large; No. 31, Kevin Johnson, Minnesota Astronomical Society; No. 32, Lauren Gonzales, Austin Astronomical Society

Sunspotter Observing Program

No. 178, Devin Booth, Minnesota Astronomical Society; No. 179, Stephen A. Tzikas, Northern Virginia Astronomy Club

Universe Sampler Observing Program

No. 122, Bill Sanders, Telescope, Central Arkansas Astronomical Society; No. 113, Nora Jean Chetnik, Telescope, Member-at-Large

Urban Observing Program

No. 165, Kathy Machin, Astronomical Society of Kansas City

North Central Region of the Astronomical League

NCRAL 2016 ANNUAL MEETING
Friday & Saturday, April 29 & 30
Heartland Community College
Normal, Illinois
Twin City Amateur Astronomers
<http://www.ncral2016.org/>
tacc@caa.us

Staunton River Star Party – Spring 2016

March 9 – 13, 2016
Staunton River State Park
Scottsburg, VA (Near South Boston)
 For more information or to register: www.stauntonriver-starparty.org
 Fee: \$50 Sponsored by: CHAOS

Nebraska Star Party

A Vacation for the ENTIRE family!
July 31 ~ Aug. 5, 2016
 This year, experience a *Parade of Planets* beneath some of the darkest skies in the US at Nebraska's Merritt Reservoir.
 Register before July 1st and attend for only \$45 per adult, \$15 for children under 12!
 Register online at www.NebraskaStarParty.org

RMSS
Rocky Mountain Star Stare
June 29 - July 3, 2016
Starry Meadows, Gardner, Colorado
Celebrating our 30th Anniversary in 2016!
RMSS.org
 Sponsored by the Colorado Springs Astronomical Society

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



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

March 4–5
Tri-Star 2016
Greensboro Astronomy Club and the Cline Observatory
Guilford Technical Community College, Jamestown, North Carolina
observatory.gtcc.edu/tristar

March 9–13
Staunton River Star Party
South Boston, Virginia
www.chaosastro.com/starparty

March 10–13
Don Surles' Mirror Making Workshop No. 16
Delmarva Star Gazers, Georgetown, Delaware
www.delmarvastargazers.org/archive/mw16

March 12
2016 All-Arizona Messier Marathon
Salome Emergency Airfield (south of I-10 at Exit 53)
www.saguaroastro.org/content/messier2016

April 1–3
Pickett Astronomy Weekend
Pickett-Pogue International Dark Sky Park
Jamestown, Tennessee
tnstateparks.com/events/details/astronomy-weekend4

April 2
Astronomy Day
Kern Astronomical Society, William M. Thomas Planetarium, Bakersfield, California
www.astroleague.org/astronomyday/spring (see ad)

April 7–8
Northeast Astro-Imaging Conference
Rockland Astronomy Club, Suffern, New York
www.rocklandastronomy.com/naic.html

April 7–10
Southern Star Astronomy Convention
Charlotte Amateur Astronomers Club, Little Switzerland, North Carolina
www.charlotteastronomers.org/southernstar

April 7–10
South Jersey Astronomy Club Spring Star Party
Belleplain, New Jersey
sjac.us/starparty.html

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

April 9–10
Northeast Astronomy Forum and Solar Star Party
Rockland Astronomy Club, Suffern, New York
www.rocklandastronomy.com/neaf.html

April 29–30
NCRAL 2016
Heartland Community College, Normal, Illinois
www.ncral2016.org

May 1–8
Texas Star Party
Fort Davis, Texas
www.texasstarparty.org

May 5–8
Two Rivers Spring Star Party
Heaven's Gate Farm, Barry, Illinois
www.freewebs.com/tworiversstarparty

May 6–8
Tennessee Spring Star Party
Fall Creek Falls State Park, Tennessee
www.cumberlandastronomicalsociety.org

May 19–23
AstroCats
London, Ontario, Canada
www.astrocats.ca

May 26–30
RTMC Astronomy Expo
YMCA Camp Oakes, Big Bear City, California
www.rtmcastronomyexpo.org

June 2–4
The Symposium on Telescope Science
Ontario Airport Hotel, Ontario, California
www.socastrosci.org/symposium.html

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

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

June 3–5
MSRAL 2016 Convention
University of Missouri–Columbia
www.msral.org

June 4–11
Grand Canyon (Arizona) Star Party: North Rim
saguaroastro.org/content/2016GrandCanyonStarPartyNorthRim.htm

June 9–12
Spacefest
Starr Pass Resort, Tucson, Arizona
www.spacefest.info

June 29–July 3
Rocky Mountain Star Stare 2016
Gardner, Colorado
www.rmss.org

July 6–9
Green Bank Star Quest 13
National Radio Astronomy Observatory, Green Bank, West Virginia
www.greenbankstarquest.org

July 27–31
York County Star Party
Shreveport North Airport, Kralltown, Pennsylvania
yorkcountystarparty.org

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

August 2–7
Oregon Star Party
Trail Spring, Ochoco National Forest, Oregon
www.oregonstarparty.org/oregonstarparty

August 10–13
ALCon in Washington, D.C.
Northern Virginia Astronomy Club
alcon2016.astroleague.org

Astronomical League office email addresses

Society rosters: rosters@astroleague.org
National office: leagueoffice@astroleague.org
League Sales: leaguesales@astroleague.org

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	7½" H x 10" V	7½" H x 5" V	5" H x 4½" V or 2½" H x 10" V	2½" H x 5" V or 4½" H x 2½" V	2½" H x 2½" 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 c.johns@icloud.com or 1-970-567-8878.

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

- Full voting privileges at AL meetings.
- A subscription to the *Reflector*.
- 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 for the store on the top right of the home page. The online store includes the latest shopping cart technology and accepts credit cards. Shipping & handling (S&H) is calculated at checkout. Merchandise is also available by mail order, payable by check. Please select your items, add the applicable S&H fee, and mail your order to:

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

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



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



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



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



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

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



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



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



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



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



Solar Eclipse Glasses from the Astronomical League!!

10 units: \$ 9.00, plus shipping 250 units: \$ 112.50, plus shipping
 25 units: \$ 20.00, plus shipping 500 units: \$ 175.00, plus shipping
 50 units: \$ 37.50, plus shipping 1000 units: \$ 300.00, plus shipping
 100 units: \$ 60.00, plus shipping

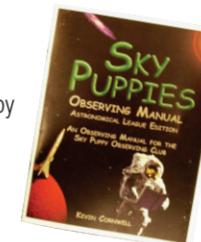
Individual pairs of glasses are also available for \$1 each, plus shipping. Available at <http://store.astroleague.org/>. Shipping rates will be added at checkout. Or call or email for shipping rates and options.

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



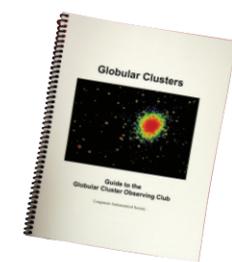
Sky Puppies Observing Manual-

For the Sky Puppy Observers Club
Regularly \$15, **Sale price \$8** plus \$2.25 S&H



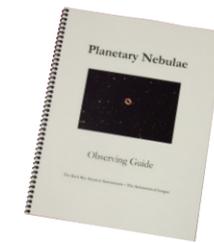
Globular Clusters

\$14 plus \$2.10 S&H



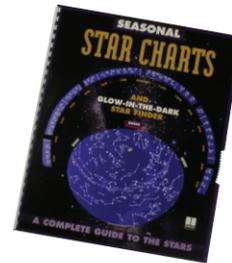
Planetary Nebulae

\$14 plus \$2.10 S&H



Seasonal Star Chart

\$25 plus \$3.75 S&H



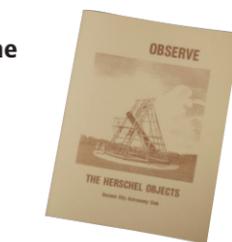
Messier Objects: A Beginner's Guide

\$8 plus \$1.20 S&H



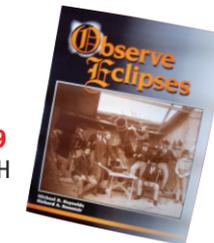
Observe the Herschel Objects

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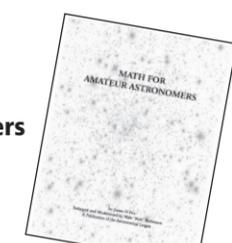
Observe Eclipses

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Math for Amateur Astronomers

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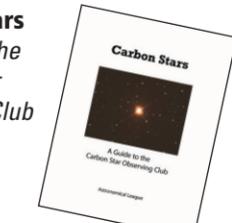
Universe Sampler

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Carbon Stars

A guide to the Carbon Star Observing Club
\$10 plus \$1.50 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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National Office
9201 Ward Parkway, Suite 100
Kansas City, MO 64114

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Comet US10 Catalina was discovered in October 2013 by the Catalina Sky Survey in Tucson, Arizona. Initially visible from the Southern Hemisphere, it made its way into northern morning twilight skies throughout December 2015. Reaching naked-eye visibility on November 15, it made its closest approach to Earth on January 17 at some 68 million miles away. This very speedy visitor (more than 100,000 miles per hour) will most likely slingshot out of our solar system in the future.

These two images were taken by Gregg Ruppel of the St. Louis (Missouri) Astronomical Society on December 2, when it was about 15° above the St. Louis horizon. The camera was an ST8300C, 18 x 180 seconds, and the telescope was a Takahashi FSQ-106. The upper image is a colored picture of the comet, while the lower image is a grayscale negative. Note that the negative shows additional detail as compared to the positive image.



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.