

# Reflector

Published by the Astronomical League

Vol. 66, No. 2

March 2014



**Youth & Astronomy Part III**  
**ALCon 2014, San Antonio, Texas**  
**Deep Sky Objects: M42 and the Trapezium**  
**Asteroid CCD Photometry and Light Curve Analysis**

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**Our cover:** Regular contributor **Brian Kimball** took this image of the Eagle Nebula, M16, from his backyard observatory in Longmont, Colorado, in August, 2011. The nebula is a young open cluster of stars in the constellation Serpens discovered by Jean Philippe de Cheseaux in 1745-46. It is the subject of the famous "Pillars of Creation" photograph taken by the Hubble Space Telescope which shows pillars of star-forming gas and dust within the nebula. The nebula is part of a diffuse emission nebula, or H II region, which is catalogued as IC 4703, and is about 6,500 light-years away. The image was taken with an AT10RCF and SBIG STL11000XM camera with Astrodon Ha, OIII, and SII filters and processed with CCDStack 2 and Photoshop CS2.

To our contributors: The copy and photo deadline for the June 2014 issue is April 15. Please send your stories and photos to our magazine editor, Ron Kramer ([editor@astroleague.org](mailto:editor@astroleague.org)), by then.

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

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*Peter Kurtz, Cape Cod Astronomical Society*

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*Chris Ragaisis, on CloudyNights*

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*Joe Lalumia*

**"Four-for-four, Birren's work bats 1000."**  
*Jim Barnett, review on CloudyNights*

## Reflector

The Astronomical League Magazine

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  - By providing incentives for astronomical, observation and research, and
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**Texas Star Party**  
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## John Dobson passes away on January 15 at age 98

Many of us have had the privilege of meeting and talking with John Dobson over the past many years. We recently received word of his passing. He became famous for the economical telescopes and telescopic mounts he designed and built. Mounts based on his original Dobsonian design continue to have widespread use. The emphasis of his sidewalk astronomy program was on taking astronomy where the people are. This is similar to what the League and amateur astronomy in general are currently trying—to get young people interested in astronomy by reaching them where they “live,” which is often in the realm of social media, etc.

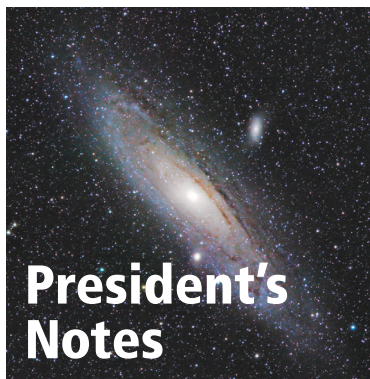
The sidewalk astronomers group that John co-founded is dedicating its annual International Sidewalk Astronomy Night to his memory on March 8. Amateur astronomers around the world are encouraged to join in and celebrate his life. For more information, please see [www.sidewalkastronomers.us](http://www.sidewalkastronomers.us).

The St. Louis Astronomical Society was honored to present a taped video session from Mr. Dobson for its attendees at the society's 75th anniversary celebration in 2011. Thanks to the SLAS for providing some quotes from Mr. Dobson's presentation: “Getting telescopes out to the public had to be done. Somebody had to do it, and I'm not sorry that I did it.”

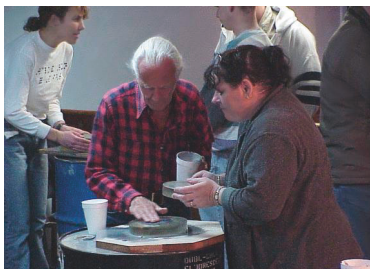
“When I was a kid, it was nearly hopeless for anybody to get a chance to see through a telescope. Now it's easy.”

Other segments from that video session, shared with the permission of the society:

“You see, the importance of a telescope is not on how big it is, it is not on how well made it is, it's how many people, less



looks like, they are going to have to do it through telescopes, they're going to have to do it at night, and they are going to have to do it through amateur telescopes, there is no other way. So if, you see, there were something like a million sidewalk astronomers worldwide—by sidewalk astronomers, I simply mean people that are willing to get their telescopes out and let the other people use or look through them—if there were a million such people and a few thousand people looked through each telescope, there would be a chance for most of the people who live on this world who want to see, to see. But you have to get it to a place where the public goes.”



John Dobson demonstrating his mirror polishing techniques. Sean League owned Sean's Astronomy Shop in the state of Washington until just a few years ago, and John Dobson visited the shop several times.



John Dobson and several guests at a recent Mid-States regional convention.



John looking through a Sun Scope.

fortunate than you, got to look through it.”

“But if the amateurs do not solve the problem of making it possible for the public to have a look at this universe, nobody will solve that problem. The professionals cannot solve that problem. So if the general public is to see what the Universe

looks like, they are going to have to do it through telescopes, they're going to have to do it at night, and they are going to have to do it through amateur telescopes, there is no other way. So if, you see, there were something like a million sidewalk astronomers worldwide—by sidewalk astronomers, I simply mean people that are willing to get their telescopes out and let the other people use or look through them—if there were a million such people and a few thousand people looked through each telescope, there would be a chance for most of the people who live on this world who want to see, to see. But you have to get it to a place where the public goes.”

Here is a YouTube link to several clips including one of John's mirror-grinding workshops, observing sessions and general commentary: [www.youtube.com/watch?v=ght\\_w7BAHaA#t=330](http://www.youtube.com/watch?v=ght_w7BAHaA#t=330).

You may recall the 2013 *Reflector* issues devoted to the problem of getting younger people “hooked” on astronomy. This issue has follow-up articles regarding this challenge.

## Update from the Harvard Observatory DASCH Project — Digitizing the Harvard Plate Stack Collection

Since the request for volunteers in this column in the December 2013 *Reflector* and in the most recent *What's Up With the*

*Continued on page 9*

**IDA at 25 Years**

IDA's 25th anniversary was celebrated at the annual general meeting in Tucson, Arizona, on November 15. IDA was founded in 1988 by Dr. David L. Crawford and me to address the growing problem of light pollution. IDA was also incorporated in 1988 as a tax-exempt nonprofit organization

operating exclusively for educational and scientific purposes under Section 501(c)(3) of the United States Internal Revenue Code of 1987 (Federal Identification Number 74-2493011).

For many years, Dave Crawford was the executive director, driving force, and spiritual leader of IDA and the prime mover in the worldwide effort for responsible, effective nighttime lighting. Nighttime lighting is necessary for public safety, recreation, and security, but the environment has to play an important role in lighting design. Dave and I feel very strongly that quality outdoor nighttime lighting will preserve dark skies. The message developed 25 years ago remains the same: Put lighting where it is needed for safety, security, or recreation. Use the proper lighting levels with the light directed toward the ground rather than into the sky or a neighbor's yard. Turn off unnecessary lights. If we can't solve light pollution and light trespass, how can we expect to solve a whole host of other complex environmental problems?

Dave has retired from the day-to-day operations at IDA but remains a strong advocate for preservation of the night sky. The guy never slows down. It is a joy for IDA's founders to witness the growth of the organization far beyond what we could have expected. In my case, at least, I am thrilled to be associated with the superb IDA staff and the very accomplished IDA board of directors. Two of IDA's most popular and successful programs are the **Fixture Seal of Approval (FSA)** and the **International Dark Sky Places (IDSPlaces)**. Please check out the IDA website at [www.darksky.org](http://www.darksky.org) for an incredible overview of the light pollution issue and the fight for effective, quality outdoor nighttime lighting.

Are we winning the war against light pollution yet? In some places, yes; in most places, probably not yet. Is it a sometimes discouraging, seemingly losing fight? Yes, but times are changing. More people are aware of the problem. More resources are being brought to bear against poor night-



## International Dark-Sky Association

time lighting. It took a couple of generations for the problem to get so bad. It may take a generation to correct the problem. My own view is we are losing the war less badly, and we are on the verge of beginning to win the war. I feel it is much easier to preserve dark places than previously,

and I hope we can begin to restore dark skies to many suburbs, particularly those at a distance from urban centers. It is not at all beyond the realm of possibility for urban sky glow to decrease in the next decade. Stay tuned for more developments. Keep up the good fight.

**IDA Quebec**

On December 4, 2013, IDA Quebec celebrated its tenth anniversary with approximately 40 people attending a conference at the Montreal Planetarium sponsored by Fédération des Astronomes Amateurs du Québec, Stanpro Lighting Systems, Luxtec, Philips Lumec, Rio Tinto Alcan Planetarium, IES Montreal, Compuset printing and packaging, SMi Group, Ville de Montréal, Urbex Innovations, Well Green Solutions, and EALUX. In the 1990s, the Fédération des Astronomes Amateurs du Québec (FAAQ) created a dark-sky committee for reducing light pollution. As the problem continued to accelerate, the Federation decided in the fall of 2003 to form a Quebec chapter of the International Dark-Sky Association. This chapter represented the Federation and raised awareness of light pollution, with the goal of reducing light pollution in Quebec.

The founding members of IDA Quebec were Chloé Legris, Germain Gauthier, Richard Poirier, Gilles Meunier, Chris Blot, and Rémi Lacasse. Rémi Lacasse was the first president of the IDA Quebec chapter. Dr. David Crawford and Mary Crawford were at the founding meeting. In 2010 IDA Quebec became an independent nonprofit organization strongly supported by the FAAQ. This reorganization as an independent group allowed it to more easily take a larger approach to nighttime lighting, addressing light pollution from the perspective of sustainable development, part of which is the protection of the night sky. To find out more about this impressive organization and its work see [www.idaquebec.org/en](http://www.idaquebec.org/en). ✨

**TIM HUNTER**

Co-Founder and Past President, IDA  
Email: [ida@darksky.org](mailto:ida@darksky.org); [www.darksky.org](http://www.darksky.org)

# Reflector

## QUARTERLY PUBLICATION OF THE ASTRONOMICAL LEAGUE

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**June issue** ..... April 15  
**September issue** ..... July 15  
**December issue** ..... October 15

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**Dear Editor:**

I recently had an occasion to do some unscheduled outreach. I was looking for a new location when I happened to talk to a teenager riding his bike by. He directed me to a certain public property location and said he might be back. Later, after dark, he and his mother stayed for over an hour while we talked and I showed them various things in the telescope. We had a second observing session just a few days later. You never know when you are going to do impromptu outreach. In this case it provided me with a new dark sky site. They both enjoyed looking through the telescope as well. Sometimes a good outreach event is an unscheduled one, with just a few people, at a location not usually used by you or your club.

So never be "too busy" for unscheduled outreach. You might just end up with a darker site to observe from or a new member for your club.

**William Carney**

Member of Twin City Amateur Astronomers  
P.O. Box 52  
Bloomington, IL 61702

**Dear Editor:**

I'd like to comment on some ideas presented by Sue Wheatley's letter in the December 2013 *Reflector*. I don't agree with everything she said, but she did suggest that her interest was in the "hunt for that elusive object." I certainly agree with that! Then she asks if there is anything we can do to put the "personal sense of accomplishment" back into our hobby.

When I read that, I thought about all the public star parties I've been to. We plan in advance what we might show the public. We put in the time and effort to brush up on our knowledge of these objects, set up our equipment, and show everyone in line just what the night sky has to offer.

Trouble is, what they see can't possibly compare with what we see online, and in newspapers and magazines. Photographs from the likes of the Hubble Space Telescope are nothing short of spectacular, and even our largest amateur scopes can't present anything to compete with them. What's more, we did the research and digging to find interesting objects to show the public; they did none of it.

I don't think star parties are the wrong approach to inspiring and educating the public; it just occurs to me that we never seem to let the public experience any of the "fun stuff" that we amateur astronomers enjoy so much.

**Alex Vrenios**

**Dear Editor:**

I strongly disagree with Sue Wheatley's letter published in the December 2013 *Reflector*. I am a 67-year-old graying amateur astronomer and proud member of the Tucson Amateur Astronomy Association, now living in Hamburg, Germany, where the skies are grey (*grau himmel*) most of the time and light pollution is severe. My favorite objects are deep-sky: globular clusters, open clusters, and, of course, galaxies. The hunt for that elusive object was never my thrill; in fact, it was often literally a pain in the neck. When I finally found the object, I looked deeply and wondered and thought about it and read, wrote, and published about it afterwards.

As one point in the 1980s, I owned a homemade 10-inch Dobsonian, with which I had an unforgettable view of Markarian's Chain,



eight galaxies in one field of view, starting with the lenticulars M84 and M86. I would have loved to have had a computer-controlled telescope that could find 30,000 objects for me with ultimate ease! My only recourse for observing ease was the star parties held monthly at the Empire Ranch, one hour from downtown Tucson: I could look at objects that had already been found by more experienced amateurs with

bigger telescopes.

As far as how to restore the sense of accomplishment, the "more-to-learn" aspect of astronomy back into our hobby, as Sue asks, I suggest we look to the future when the ongoing financial crisis will be resolved and funds will be freed for bigger and better telescopes and space missions that will light the intellectual fires of ordinary citizens who will know we are on the path of a Solar System economy with its sense of unlimited future.

**Julian Grajewski**  
Hamburg, Germany

**Dear Editor:**

I look forward to the newsletter retrospective as proposed in the article by Mike Stewart in the December 2013 issue of the *Reflector*. However, Mr. Stewart has two minor errors in his introduction. First, the newsletter was already titled *Reflector* when my club, then the 3M Club Astronomical Society, first joined the League in 1969. Second, *Journal of the Astronomical League* was a subtitle to the *Reflector* and was published for a little more than three years, from August 1974 to August 1977, then as the stand-alone *Journal*, in addition to the *Reflector*, for two years, December 1977 through September 1979, not just two issues as Mr. Stewart states.

It has been amazing to watch the *Reflector's* evolution over the past 40-odd years, from bi-fold newsletter to journal to full-blown magazine. The various editors responsible for this evolution are too numerous to mention, but we owe them all a debt of gratitude. I can't wait to see which tidbits are selected for the proposed series.

**Jim Fox**  
Minnesota Astronomical Society  
Astronomical League Past President

**Dear Editor**

Thank you! I just found out tonight that the *Reflector* published my photograph of the partial solar eclipse in the December issue! I was browsing in my local used bookstore when I checked my email on my smartphone and a fellow member of the Fort Worth Astronomical Society alerted us all to it. Thanks for spelling my name right! For a photograph that didn't even use a telescope, it reproduced very well!

**Matt J. McCullar**  
Forth Worth, Texas

**CORRECTIONS AND CLARIFICATIONS**

In the December 2013 issue, on page 8 in *Deep-Sky Objects*, by Dr. James Dire, the diameter for NGC 7331 was noted as 30,000 light-years. As pointed out by Mrs. Tsuneko Sasaki, the book *A Photograph Tour of the Universe*, ISBN 1-55209-345-X, states the diameter is actually 140,000 light-years; Dr. Dire agrees.

We regret the error.

**Candidate statement for the office of the president of the Astronomical League**

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 15,000-member organization through our changing times. And changing they are.



Club attendance, go-to scopes, CCD imaging and processing, outreach, light pollution, declining youth involvement, large-aperture telescopes, wide-field eyepieces, societal changes, and the great and powerful Internet. These topics—

some of which weren't important factors twenty years ago—certainly affect amateur astronomy today.

Volunteerism, the force that gets things done, 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 twelve 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 editor, *Reflector* advertising representative, awards chair, ALCon co-chair, and, currently, Astronomical League vice president. With your support, I will continue my efforts to bring amateur astronomy to the League membership, this time as president of your Astronomical League.

—John Jardine Goss

**Candidate statement for the office of the vice president of the Astronomical League**

In 2006 I attended my first ALCon, and ever since have been convinced about the importance of the Astronomical League to astronomy clubs. The League is a valuable asset and I would like to be able to continue contributing as vice president.



Outreach has been important to the AL and for me, a rewarding endeavor that dates back to the 1980s. Logging some of my hours has earned the **Stellar Outreach Award**. My college studies have included several astronomy courses and throughout my teaching career I've enjoyed teaching astronomy classes.

My astronomical interest began early in Boy Scouts with the astronomy merit badge. I've enjoyed the same challenge through AL observing programs, earning the title of **Master Observer** (No. 53). Personal adventures and travels have been to observe eclipses all over the world, trips to the Southern Hemisphere skies, star parties and conventions all over the U.S. & Canada.

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

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

—William Bogardus

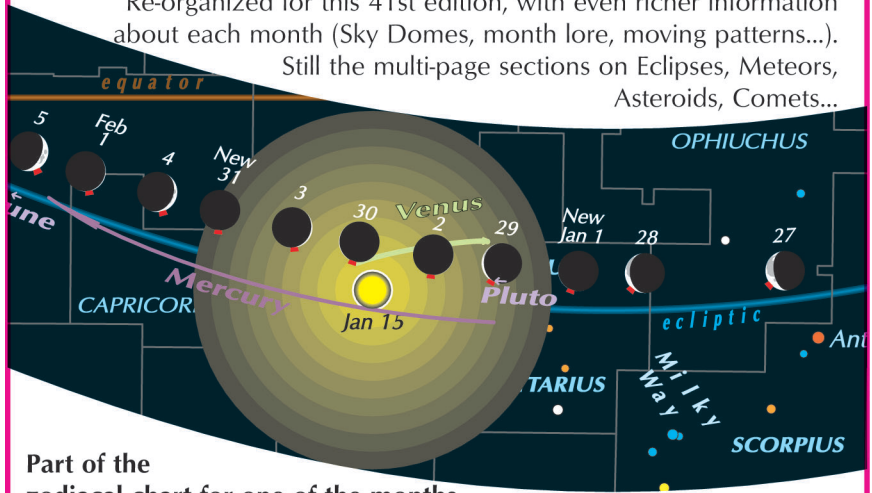
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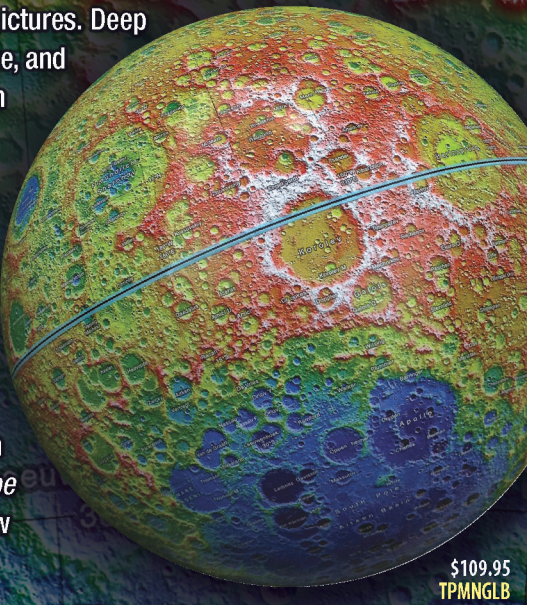
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The Orion Nebula, M42, is not a very challenging object to find and observe. The nebula is visible to the unaided eye at the midpoint of Orion's Sword in the constellation that bears this mythological figure's name. While not easily identifiable as a great nebula without optical aid, this behemoth, gaseous stellar nursery is easily identified in a telescope of any size.

As is the case for most deep-space objects, the larger a telescope's aperture, the brighter the object appears and the more detail that can be seen. Very large light buckets, say 20 inches (0.5 m) and larger, will even show color when viewing M42.

Photographic imaging of M42 brings out much more color and detail than can ever be seen by the human eye. However, if the human eye could see color in dim light, the accompanying photograph depicts the way the nebula's blue and red hues would probably appear. This image is a 50-minute exposure using a Canon 30D camera with a 190 mm f/5.3 Maksutov–Newtonian telescope.

At the center of this famous nebula lies a grouping of four stars, ranging from 5th to 8th magnitude, called the Trapezium, which is easily visible in small telescopes. The challenge for eight-inch and larger telescopes is finding the fainter companion stars to the main Trapezium stars.

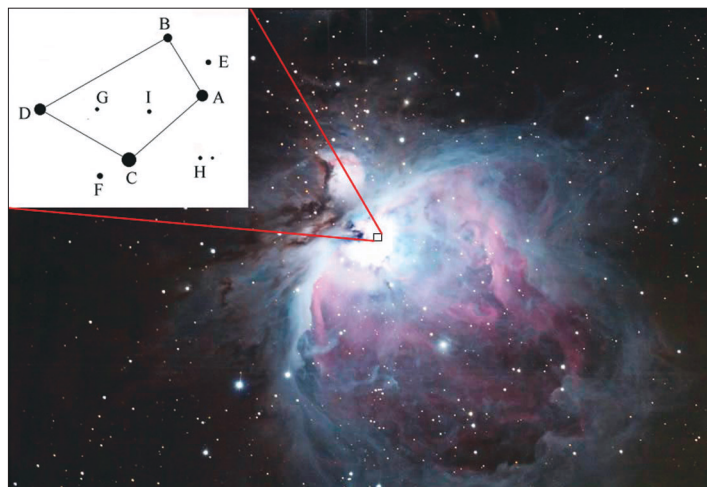
The Trapezium obtained its name because the four brightest stars form a slightly skewed trapezoid. The shortest side of the trapezoid is 8.7 arcseconds, while the longest side is 19.2 arcseconds. The entire cluster fits within a circle half an arcminute across. Very steady seeing and high magnifications (I recommend 200x or greater) are required to find the fainter members of this small star cluster.

The box in the center of the image shows the approximate location of the Trapezium,

# DEEP-SKY OBJECTS

## M42 AND THE TRAPEZIUM THIRTEENTH OF A SERIES

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



although the Trapezium is much smaller than the size of the box. The close-up schematic has the stars labeled with letters to aid in their identification.

The southernmost star in the Trapezium, labeled C, is the brightest at magnitude 5.1. The next brightest is the 6.7 magnitude D star, located on the east side of the grouping. The other two Trapezium stars, A and B, are variable stars. A varies from magnitude 7.5 to 6.7, while B varies from magnitude 8.0 to 8.5. The cluster also contains six fainter stars from 10th to 15th magnitude. Keep in mind that every five magnitudes span a factor of 100 in brightness. Therefore, a 5th-magnitude star is 100 times brighter than a 10th-magnitude star and 10,000 (100 x 100) times brighter than a 15th-magnitude star. It follows that the stars in the close-up section of the image span four orders of magnitude in luminosity!

The two 10th-magnitude Trapezium companion stars can be seen with 8- to 10-inch

telescopes. These are labeled E and F. The stars labeled G, H (a doublet), and I, all between magnitude 14.5 and 15.5, are difficult to see in all

but the largest amateur telescopes. The G star and H star are magnitude 14.5. I have seen both in a 14-inch f/6 reflector at 200x under extremely dark and steady skies. The I star is magnitude 15. My schematic shows H as a double star. The components are 2 arcseconds apart. The fainter component is magnitude 15.5.

It is extremely difficult to photograph the fainter stars in the Trapezium without using a large professional ground-based or orbiting telescope. Because of the proximity of the stars, a long focal length is needed to spread out the stars and the glow of the Orion Nebula, so the nebula doesn't drown out the fainter stars. Hubble Space Telescope images of the Trapezium are fantastic and easily show many more, fainter stars than those on the accompanying schematic. These images verify that a star cluster is forming out of the gases around the Trapezium. ☼

### Deadline Approaches for the Mabel Sterns Newsletter Editor Award

The Mabel Sterns Newsletter Editor Award recognizes the work of club newsletter editors across the country.

The deadline for submissions is March 31, 2014. The names of both the newsletter editor and the nominating club officer must appear on the general membership roster of the Astronomical League.

The nomination package should contain a letter from the club president or vice president explaining why their newsletter editor should be considered for the award, a recent issue of the newsletter, and a photo of the newsletter editor, preferably in an astronomical setting. Listing the club's website where electronic copies of past newsletters are posted is also helpful. In addition, the postal address of the newsletter editor should be included.

The newsletter nomination materials may be submitted by any of these three methods:

1. The preferable method is emailing the materials. The supporting club letter and an issue of the newsletter should be attached in Adobe PDF format, although Microsoft Word format is acceptable. The editor's photograph should be attached as a high-resolution JPEG. Please email entries to [SternsNewsletter@astroleague.org](mailto:SternsNewsletter@astroleague.org).

2. If electronic submission is not possible, paper copies may be mailed to the League's national office. Four copies of the letter of recommendation and four copies of the newsletter are required. Only one copy of the photograph is needed.

3. If the newsletter is available on the club's website, then its web address should be given along with any password required to access it. The editor's photograph (JPEG) and club recommendation letter (PDF) can be submitted by email as instructed in method 1.

It is strongly recommended that the Astronomical League's logo be prominently displayed in the newsletter, preferably on the front page.

For complete information about the 2014 Mabel Sterns Award program, please see [www.astroleague.org/allawards/sterns/sternss.html](http://www.astroleague.org/allawards/sterns/sternss.html).



**Recognize Youth Accomplishments:  
The Astronomical League's  
Horkheimer Awards 2014!**

Now is the time to submit nominations for the Astronomical League's three **Jack Horkheimer Youth Service Awards** and for the **Horkheimer/O'Meara Journalism Award**.

If you know a League member, 18 years old or younger, who has brought amateur astronomy to your club or to the public through outreach, presentations, writing, or observing, please consider nominating that person for the three Horkheimer Service Awards: Horkheimer/Smith, Horkheimer/Parker, and Horkheimer/D'Auria Awards.

Another youth award is more specialized than the others—the Horkheimer/O'Meara Journalism Award. It requires a person who is 8 to 14 years of age to compose a 300- to 500-word essay on any science-related topic.

Since the deadline for the Horkheimer Service and Horkheimer/O'Meara Journalism Awards is March 31, now is the time for potential candidates to gather their nomination materials and to complete their requirements.

If you are a club officer, nominate them. If you don't, no one else will! Complete information about each award can be found at [www.astroleague.org/allawards/awards.html](http://www.astroleague.org/allawards/awards.html).

**Attention ALCors**

Please watch for annual dues statements to be emailed in April from our national office ([leagueoffice@astroleague.org](mailto:leagueoffice@astroleague.org)); payment is due on June 30, 2013.

The League greatly appreciates your support and cooperation.

**President's Notes** / from page 4

Astronomical League ALCor newsletter, we have received an excellent response from society members and members-at-large. As I write this column, we have scheduled the first Google Hangout session to provide training for the first group of volunteers. Thanks to all who volunteered for this worthwhile project.

**ALCon 2014 in San Antonio**

The dates are July 10–12. The League and the San Antonio Astronomical Association have an exciting conference planned in conjunction with the 40th anniversary of the society. More specific information is located elsewhere in this issue. A special lodging rate of \$99 per night is available for our guests at the convention venue, the Hilton San Antonio Airport Hotel.

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BRINGING ASTRONOMY TO THE PEOPLE

**ASTRONOMY DAY**  
**May 10 & Oct. 4, 2014**

The latest tips and information, as well as the Astronomy Day handbook and entry form for the Astronomy Day Award, are available on the League's Astronomy Day website.

Here's your chance to spotlight amateur astronomy while showing off your club!

<p><b>Displays</b></p> <ul style="list-style-type: none"> <li>• Club information</li> <li>• Astrophotos</li> <li>• Light pollution</li> <li>• Tonight's sky</li> </ul> <p><b>Demonstrations</b></p> <ul style="list-style-type: none"> <li>• Telescope varieties</li> <li>• Telescope basics</li> <li>• How to find objects</li> </ul>	<p><b>Discussions</b></p> <ul style="list-style-type: none"> <li>• Relative distances</li> <li>• Moon landing hoax</li> <li>• Life elsewhere</li> <li>• Black Holes</li> </ul> <p><b>Telescope Views</b></p> <ul style="list-style-type: none"> <li>• Solar filtered</li> <li>• Moon</li> <li>• Daytime Venus</li> <li>• Daytime Jupiter</li> <li>• Landmarks</li> </ul>
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**For more information, contact:**  
Garry Beckstrom  
Assistant Astronomy Day Coordinator  
810-853-7827  
[garry@beckstromobservatory.com](mailto:garry@beckstromobservatory.com)

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**Staunton River State Park**  
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For more information or to register: [www.stauntonriver-starparty.org](http://www.stauntonriver-starparty.org)

Spring Full Party: \$35
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# YOUTH & ASTRONOMY III

As a continuation from the June 2013 issue, the following four articles address additional concerns about the future of our hobby. From bringing astronomy to the public to looking at the barriers to youth participation, the authors are wondering, as most of us are, where the astronomers will come from in the future. Between the constant distractions of sports, video games, television, working, dating or marriage, and changes in lifestyle, many young people have little time in their busy schedules to entertain thoughts of a hobby which can require a great deal of time and money.

It is becoming more and more difficult to pique the interest of children, teenagers, and young adults. One of the primary purposes of astronomy clubs, societies, and organizations has been and always shall be outreach programs, which work to educate the public about all things astronomical.

The *Reflector* will continue to address these concerns and will present additional articles about youth and astronomy in future issues.

## TODAY IS A GIFT

By Emma Garrett Emma, the recipient of the 2013 Youth Horkheimer/Parker Award.

**"Yesterday is history, tomorrow a mystery, and today is a gift.**

That's why it's called the present." It's true what they say. Some have said to treasure your ancestors, but the way I see it, they've already done what they've done. Take the group to which I belong, the Temecula Valley Astronomers, for instance. This group has been around for some time and consists mainly of older men and women, and a few younger ones who must be recognized as well, but no minor or his or her parents have stayed for more

than one meeting. We do need to treasure what previous members of the club have done for the community, and we must thank people for making the club what it is today, but what worries me is that there are no teenage or younger members who attend every meeting they can. I am an exception to this—I have attended as many meetings and star parties as I can—but just one person can't change the fate of a club without help. We need more young members who we can trust to carry on the club's

legacy, for without community astronomy clubs, astronomy cannot be widely practiced, and thus may die.

As a branch of science, astronomy contributes to the vitality of our community. Astronomy describes our beginning, with the initial formation of atoms; the supernovae that scattered our atoms; and finally, the creation of planets, one of which we live on. Scientists in NASA and other programs track the motions of the Cosmos, send us to the Moon, send rovers to Mars—and of course they track the ever-present threats of asteroids, which can collide with us, and they predict a threat I have written about in a personal novel, the future collision between our galaxy and Andromeda.

There is no need to be afraid of these things. Science is often described as the pursuit of discovery. Science should not be intimidating: to the contrary, it will save us from imminent threats if only we accept its guidance. Science is there for us, astronomy perhaps even more so.

So I return to my point: Astronomy must survive, but it won't unless younger people carry it on.

I'm aware that there are astronomy clubs larger than mine. There are probably more minors involved than I can see, but I am only able to deal with what I can see. Kids, stand up! Show yourselves! Look at what I've done. I'm merely fifteen. My interest in astronomy began only a few years ago. I've attended every dark-sky event I could and I've shown up to almost every monthly meeting of my club—as well as a few meetings of the Orange County Astronomers. I own two

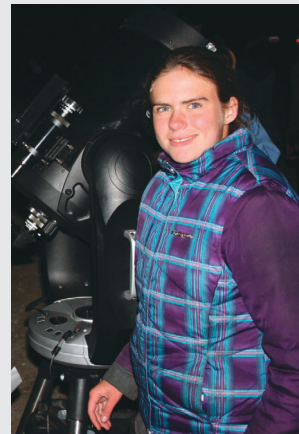
telescopes, but only because my work with one—a tiny one at that—drew the attention of a more experienced astronomer, and he gave me his as a reward.

Yesterday is history. The future cannot survive only on yesterday.

Tomorrow is a mystery. Will we be able to support astronomy in the Temecula Valley and other areas?

But most importantly, today is a gift. The key to discovering the mystery of tomorrow is today, the present. We must work today, while we can, to save tomorrow.

Minors out there! Yoo-hoo! We need you! First and fore-



most, you need to convince your parents that this is an issue so you can attend more meetings and get involved in astronomy!

Parents out there! You're important. Kids need permission from their parents. "You

should come," I'd say to other kids. "I have to ask my parents," they reply. This means that parents need to get involved, too! Listen to your children. I know that often kids are not taken seriously because they're inexperienced. They're minors. They know little of the world in comparison to you. But look at what I've done. I won a thousand-dollar scholarship for participating so actively in astronomy! Your kids can do this, too.

Scout leaders! I'm aware that many scout groups give merit badges for astronomical achievements. If you don't do this, you may want to think about it. If you do, keep up the good work!

Teachers out there! I'm aware that many schools have or want to start astronomy clubs. I'm also aware that budgets are tight these days and money is an issue.

Our club and other clubs are always willing to help. If you need help getting started or continuing with astronomy, search for our websites and contact us. And if you're having success, keep up the good work and try to encourage others out there.

Find astronomy clubs that you can join. If you can, please do! We need you, but we also give something in return. Consider my club, the Temecula

Valley Astronomers. We're a relatively new group and still relatively small in terms of members, but we're all friends. We're a great club, but the main thing I've noticed about us is that we have very few regularly attending young people. I've mentioned above that there must be young people to carry on any club's legacy. We won't survive without your help. Join us! ☀

## HAVE FUN BRINGING ASTRONOMY TO THE PEOPLE!

By Garry Beckstrom, Assistant Astronomy Day Coordinator

### Have you ever had neighbors, friends, or other members of the

public look through your telescope? Chances are they got pretty excited at what they saw, maybe craters on the Moon or the rings of Saturn. Then the questions started. What's the farthest thing you can see? How much does your telescope magnify? How much did it cost? Can you see galaxies? Do you believe in aliens? For many of us, this is the best part, explaining how interesting and fun astronomy can be. Explaining that you don't need to be a physics major or a math whiz to enjoy stargazing, that everybody can do it. That's the point: astronomy can be just plain fun!

So why not get out and have some fun with the public? That's the idea for Astronomy Day, "Bringing Astronomy to the People." Astronomy clubs have always offered public events. Many of you I'm sure have heard of John Dobson and the San Francisco Sidewalk Astronomers, who, beginning in the 1970s, set up their telescopes on street corners allowing people passing by to take a look.

Doug Berger, a member of the Astronomical Association of Northern California, thought it would be neat to have everyone organize around a single day and take astronomy to where people congregate, like indoor



Kalamazoo Astronomical Society, Kalamazoo, Michigan, April 20, 2013.

shopping malls. So in 1973, Doug Berger and the Astronomical Association of Northern California held the first Astronomy Day.

The idea spread across North America. That's when *Sky & Telescope* and the Astronomical League began promoting and coordinating the event. Nowadays it has even become an international event with hundreds of locations around the globe. In 2007, the Astronomical League started promoting both a spring and a fall Astronomy Day so that organizers could decide which worked best for them. Events

and *Sky & Telescope* and is endorsed by the International Astronomical Union.

There's even more! Your organization can enter to win an Astronomy Day award. Awards are given for the "Best Event by Population," "Best New Idea," and "Quality Events Year After Year." These awards are sponsored by *Sky & Telescope*,



Travelers Science Dome Planetarium, West Hartford, Connecticut, April 20, 2013.

can be hosted on either or both dates. For even more flexibility, "Astronomy Week" was created to give sponsoring organizations a longer period of time to host special events. Astronomy Week includes the Monday before Astronomy Day and runs through the Sunday after Astronomy Day. In fact, you're not even locked into any of these dates. Some organizations have used other dates more convenient to their area.

Astronomy Day is now sponsored by 14 astronomy and astronomy-education organiza-

the American Astronomical Society, and the Astronomical League. See the League's website at [www.astroleague.org/al/astroday/astrodayform.html](http://www.astroleague.org/al/astroday/astrodayform.html) for the latest entry forms and a list of all past winners.

If your organization doesn't already have activities planned for Astronomy Day, why not start this year? Not only is it a great way to get people interested, but it's a great way to give your local club or organization some publicity, especially if the media gets involved, and you may even get



Popular Astronomy Club, Rock Island, Illinois, April 20, 2013.



Popular Astronomy Club, Rock Island, Illinois, April 20,

some new members. What you do for Astronomy Day can be as simple or as complex as you would like. You can simply have a telescope or two set up in the mall parking lot or the city park to look at and through. You'll be amazed by the response. Or, if your group can handle more, many clubs get together with local observatories, planetariums, science centers, or parks. Go where the people will be. Activities in the past have included displays, talks, games, prizes, scale models of the Solar System, and, of course, both daytime and nighttime observing with telescopes. Many organizations host elaborate exhibits at shopping malls, museums, nature centers, and libraries. It just depends on your circumstances.

The Astronomical League's Astronomy Day Headquarters has a free handbook of ideas, activities, resources and

suggestions. There's a lot of stuff there. Don't get overwhelmed. Pick out what might work for you. You can download the handbook at [media.skyandtelescope.com/documents/AstroDayHbk2007.pdf](http://media.skyandtelescope.com/documents/AstroDayHbk2007.pdf).

This year, "Spring Astronomy Day" occurs on May 10. There will be a waxing gibbous Moon visible that evening so that craters on the Moon can be highlighted in telescopes. Plus, Mars is near the Moon that night. "Fall Astronomy Day" occurs this year on October 4, again with a waxing gibbous Moon in the evening sky.

If you haven't tried hosting an event, you don't know what you're missing. You'll be amazed by how many questions and how much interest you get. I guarantee the public will enjoy it and I bet you will too. So get out there, show off your club, enter for an Astronomy Day award, and have some just plain fun! ☀



Clay Center for Science & Technology, Brookline, Massachusetts, May 18, 2013.

## WHY I OBSERVE

By Dr. William Warren, Master Observer No. 4

**I first became interested in astronomy when, as a child, I** learned what those tiny points of light in the night sky were: stars, lying farther away than I could possibly imagine. My interest grew when I learned that a few of those points of light weren't stars, but planets that orbit the Sun.

I had no trouble seeing the Moon, either, but I wanted to see everything—the Moon, Jupiter, Venus, Mars, Saturn's rings, etc.—up close. As a child growing up in the late 1940s and early 1950s, I could find photos of them in library books, but there was no Internet back then and a telescope was a luxury that my family couldn't afford. So I contented myself with gazing longingly for hours at the 4.5-inch reflector that sold for \$79.95 in the Edmund Scientific catalogs we received in the mail. I had no idea what a reflecting telescope was or how it worked; all I knew was that it would bring the Universe close enough for me to see for myself what the planets, comets, galaxies, and other celestial objects looked like.

Later, as a teenager, the difference between seeing a photo of Saturn and imagining myself seeing it in a telescope was the difference between having a date with a beautiful girl and imagining what a date with her would be like. But I still couldn't afford a telescope. The Edmund 4.5-inch reflector was a pipe dream on the back burners of my mind. I never forgot about it, though.

**Fast forward 35 or 40 years to 1994.**

My wife knew that I was interested in astronomy, so she bought me a 2.5-inch Meade refractor for Christmas. All it took was one look at the Orion Nebula to tell me two things: "This is what I should have been doing all these years!" and "I need a bigger

telescope!" So I went to the store the next day and swapped it for a 3.5-inch refractor.

I used that telescope for two years, damaged it, and bought a 10-inch Orion Dobsonian reflector. I used that scope for about six years, and then stepped up to the 12.5-inch Discovery Dob that I'm using now. I've had great observing experiences with all three telescopes, but in all honesty, I'd have been satisfied with the little refractor if I hadn't damaged it.

For me, observing is the name of the game. Whether using binoculars or a 20-inch telescope, the goals are the same: to have fun, learn about, and enjoy our magnificent Universe. Every observer is part of a small but elite group of humans who have been privileged to see for themselves, as the result of their own efforts, what humans for thousands of years before us could not see. That's why I've always believed that you own whatever you find in the night sky. No matter how many times you or others have seen it, it's yours whenever you capture it in your eyepiece's field of view. Finding objects in the night sky and observing them is an intensely personal experience. In the same way that astrophotographers own the images they produce, you "own" what you see in the eyepiece if you've found it yourself. The visual image becomes a small but permanent part of you, nestled snugly in your mind.

We can and do admire the breathtaking photos that adorn the magazines and light up the Internet—but that's not enough for us. We want to see for ourselves what's up there to be seen. That doesn't make us superior to anyone else in astronomy; it just means that we aren't satisfied with what others have seen or done. ☀

# BARRIERS TO YOUTH PARTICIPATION IN AMATEUR ASTRONOMY

(From my middle-class suburban point of view)

By Sophia Lahey, 2013 Horkheimer/Smith Service Award winner

(Note: Ms. Lahey presented these points during her talk at ALCon 2013 in Atlanta. She outlined the issue of the declining numbers of young people entering the hobby.)

## Lack of promotion and lack of supplies

Forming a club and expecting youth to find the club on their own is unrealistic in today's social media world. Clubs must go where the students are, by visiting schools and youth organizations like Girl Scouts, Boy Scouts, and 4-H. Most high schools have science-related clubs or honor societies, obvious partners.

Astronomy clubs must use social media, but Facebook is not enough. Online meet-ups, Twitter, and Tumblr are up-

and-coming media that most youth are in tune with. Online is how most students socialize now, with little face-to-face contact even with good friends.

Astronomy can be an expensive hobby. Families are hesitant to invest in an interest that may be brief. Loaner telescopes and help on how to use them should be available, not just through clubs but also through schools and public libraries.

Clubs should partner with local museums and organizations promoting science. This is particularly effective during high-profile astronomy events such as the transit of Venus or

the Mars rover landing. For example, the California Academy of Science in San Francisco partners with local astronomy clubs to host telescope viewing sessions during solar and lunar eclipses. This is a great forum in which to recruit.

## Lack of astronomy curriculum in classrooms

In California public schools, students only have two units on astronomy: the Solar System in elementary school and then supernovae, black holes, and

the Universe in early high school. Upper-grade science classes focus on required college-preparatory science like chemistry, physics, or biology. If an astronomy class is offered, it may be a one-

semester elective. Most schools do not have budgets for elective classes these days. So, to promote astronomy as a science, it is important to have it recognized as an approved college-prep science. Schools would then have the resources to offer it and more students would participate.

There is a big focus in schools on careers tied to certain fields. There is no discussion of astronomy as a career. When most students think of astronomy, they think their only possibility is to become an astronaut, which is unattractive to most.

Schools are hesitant to sponsor evening events such as

telescope viewing due to liability and limited funds to pay teachers. Students won't necessarily attend evening events unless they are required, and teachers can't require them to do activities like attend star parties for a grade. But clubs could partner with science teachers in their area. Students could then receive extra credit for attending a star party.

Traditional media cannot be relied upon to spread the word about astronomy. People who grew up in the mid-twentieth-century were exposed to science and astronomy constantly because of the Space Race and the Cold War. Astronomy was exciting and cool! There is very little coverage of astronomy in the media today.

Youth who care about science are often passionate about issues like environmentalism and are very concerned about saving our planet. Some of today's youth may view astronomy as a science that isn't urgently needed because it isn't solving modern problems. This perception needs to be changed.

## Instant gratification, high expectations, and the "self-centered" generation

Students today are overscheduled and over-supervised, leaving little time to explore a hobby. It's all about community service, sports, and other activities that are favored for college preparation. Students often think "what's in it for me?" when contemplating adding another activity to their already-full schedules. Participation in astronomy requires dedication of resources and time, and today's families don't have much time in their schedules to spare. Perhaps a way of making it more attractive is to make it less about the hobby of astronomy and more about it being a way to provide community service by helping out with star parties and framing astronomy as a desirable path to college readiness.

Parents must also be educated and recruited to encourage participation in astronomy. Parents and students must buy in to the idea that they will get something out of astronomy—especially because, in today's light polluted skies, participating in astronomy often means trekking to dark-sky areas outside of brightly lit towns or driving up windy mountain roads at night. The days of setting up the telescope in the backyard are over for most people.

The images produced by the Hubble Space Telescope are another example of the high expectations of today's youth due to the ease of getting information instantly online. Who wants to look through a telescope at a tiny white dot when they can go online and view glorious multicolor images of distant galaxies? Hubble images have made it into hipster gear such as clothing and shoes. Vans Shoes has a line of sneakers with images of galaxies on them! This shows that youth can find an interest in astronomy but their imaginations must be engaged. Get students excited about the things not readily visible through a telescope—like black holes or distant galaxies like those in the Hubble Deep Field—and *then* engage in telescope viewing. Being able to actually *see* an object in real time could be a hook.

## Light pollution

Increasing light pollution is a big piece of the puzzle when thinking about why youth aren't engaged in astronomy. It is difficult to get excited about the stars if you can't see them from where you live.

Youth won't question the decreasing visibility of stars if they grew up only being able to view an orange glow in the night sky. If amateur astronomy is to survive, light pollution must be addressed as an international problem worthy of our attention as individuals and communities. ✨

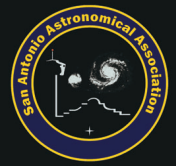


Sophia Lahey at ALCon 2013 in Atlanta

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- NATURAL BRIDGE CAVERN AND WILDLIFE RANCH
- INSTITUTE OF TEXAN CULTURES
- MENDER HOTEL
- SPANISH GOVERNOR'S PALACE

## EXCURSIONS AROUND SAN ANTONIO:

- FRIDAY NIGHT PASEO DEL RIO

SIGN UP FOR THE BUS — AVOID DRIVING  
 AGGRAVATIONS AND PARKING FEES

- MISSIONS TOUR



THE ALAMO



SEA WORLD



McNAY ART MUSEUM

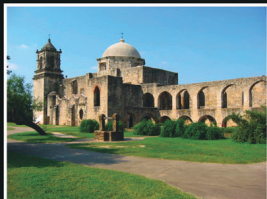


PASEO DEL RIO (RIVERWALK)

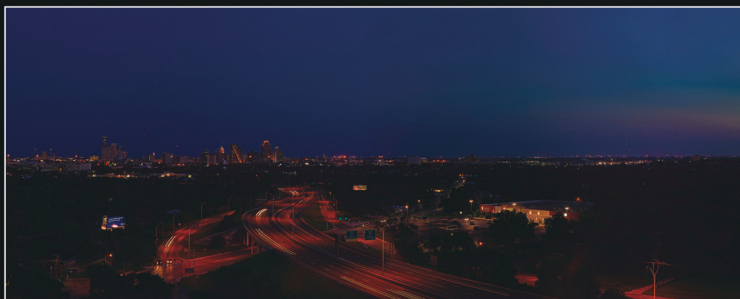
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# ALCon 2014 Registration Information - July 10, 11, 12, 2014

Printable form available at [astroleague.org](http://astroleague.org).

Mail completed form with your check made payable to **ALCon 2014** to:  
 Astronomical League, ALCon 2014  
 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 [alcon2014.astroleague.org](http://alcon2014.astroleague.org) and make remittance with PayPal.

Name: \_\_\_\_\_

Name and Title for ID badge: \_\_\_\_\_

Email address: \_\_\_\_\_

Mailing address: \_\_\_\_\_

City: \_\_\_\_\_

State: \_\_\_\_\_ ZIP: \_\_\_\_\_

Telephone Number: \_\_\_\_\_

Astronomical Affiliation (Club)? \_\_\_\_\_

Are you a member of ALPO? \_\_\_\_\_

## Registration Schedule

**Early Registration Fees** (after June 25, add \$20)

For each item you wish to select, please enter the amount on the right.

Individual 2 or 3 day registration: (\$50) \_\_\_\_\_

Single day registration: (\$35) \_\_\_\_\_

Couples 2 or 3 day registration: (\$80) \_\_\_\_\_

Students: (\$20) \_\_\_\_\_

Children under 15 years of age accompanying adults who are registering: free

## Are you a vendor?

General registration is required for each person.

Vendor Table, include 2 chairs and skirt (\$25) \_\_\_\_\_

## Thursday night Star BQ

BarB-Q Brisket and Smoked Sausage, BarB-Q Chicken; Cole Slaw; Pecan Pie; Iced Tea, Coffee. (\$40) \_\_\_\_\_

## Friday Bus from Hilton Airport to Riverwalk and return

(for those needing transportation), Leave 6:00 p.m. return 10:00 p.m. Avoid driving aggravations and parking fees! Individual (\$20) \_\_\_\_\_ Couple (\$32) \_\_\_\_\_

## Saturday night Awards Banquet (Please select one)

• Vegetarian: Spinach and Fromage Tortellini with Capers, Kalamata Olives and Fresh Vegetables in a Saffron Tomato Basil Sauce (\$42.50) \_\_\_\_\_

• Chicken Roulade stuffed with Sun-dried Tomatoes, Spinach & Boursin Cheese with Cream Sauce (\$45) \_\_\_\_\_

• Roasted Pork Tenderloin (\$45) \_\_\_\_\_

You may make your room reservations at the Hilton San Antonio Airport by calling 1- 888-728-3031. Be sure to ask for the "National Astronomical League 2014 Convention-ALCon 2014" special rate, \$99 per room night. Must reserve by June 14 to receive the ALCon rate. Free parking and free wifi.

## ALCon merchandise (Order Deadline June 25)

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

Embroidered polo shirt, White \_\_\_; Royal Blue \_\_\_  
 Mens: S \_\_\_ M \_\_\_ L \_\_\_ XL \_\_\_ XXL \_\_\_ XXXL \_\_\_ : \$25  
 Womens: S \_\_\_ M \_\_\_ L \_\_\_ XL \_\_\_ XXL \_\_\_ XXXL \_\_\_ : \$25

Help the League help amateur astronomy by making a tax deductible donation \_\_\_\_\_

## Summary:

Registration Type \_\_\_\_\_ +  
 Vendor Table Registration \_\_\_\_\_ +  
 Merchandise \_\_\_\_\_ +  
 Thursday's Star BQ \_\_\_\_\_ +  
 Friday's Riverwalk Bus \_\_\_\_\_ +  
 Saturday's Awards Banquet \_\_\_\_\_ +  
 League Donation \_\_\_\_\_ =

The organizers reserve the right to make such changes to the event as may be necessary due to conditions outside of their control.

**ALCON2014.ASTROLEAGUE.ORG**

**Grand Total: \$ \_\_\_\_\_**

# Amateur-Professional Research Collaboration: Asteroid CCD Photometry and Light Curve Analysis

*Frederick Pilcher, Coordinator, ALPO Minor Planets Section  
Astronomical Society of Las Cruces, Las Cruces, New Mexico*

In terms of what they observe in the sky, the boundary between amateur and professional astronomers has always been fuzzy. In the past hundred years, amateurs have made major contributions valued by the professional community in at least four areas: 1) long-period, large-amplitude, Mira-type variable stars and cataclysmic variables; 2) supernova searches; 3) time-varying features on planets, especially Mars, Jupiter, and Saturn; and 4) comet discovery. This list is not complete, and I apologize for omissions to long-term practitioners in other research fields. An important feature in all amateur research has been the availability of large amounts of telescope time, vastly exceeding what is available to most professionals, and long-term dedication.

An eye trained in magnitude determination can usually achieve an accuracy of about 0.1 to 0.2 magnitudes. Some variable star observers have reported reported much greater visual magnitude accuracy. However, asteroid observers have different comparison star fields each night whereas variable star observers have the same comparison fields. Also, there may be no well established calibration standard stars in the same field as an asteroid. The brightness variation of Mira-type stars is several magnitudes, so these are ideally suited for amateur studies. For many short-period variables and eclipsing binaries, though, the brightness variation is small and amateur success with these objects has, in the past, been limited.

The CCD has vastly improved the angular resolution and magnitude determination achievable by amateurs. The sub-arcsecond resolution in

planetary imaging available using 12-inch and larger telescopes is comparable with the capabilities of the world's largest telescopes a few

target and a nearby comparison star of known brightness. This is exhausting to perform all night long, night after night, and most amateurs who used photoelec-



*The author, his telescope, and CCD camera. In the background is the sliding roof of the observatory.*

decades ago. Moderate-sized telescopes and CCDs can achieve magnitude measurement with accuracy of 0.02 magnitudes at magnitude 15 and brighter. This accuracy has been available for decades with the photoelectric photometer, but this is a cumbersome device that requires almost continuous telescope slewing between the

tronic photometers at all did so for only an hour or two each night.

In this paper I describe a field of study formerly the almost-exclusive domain of professionals and which is now dominated by amateurs with CCD cameras, go-to telescopes, and sophisticated software for image acquisition and analysis. This field is asteroid photometry and

light curve analysis.

As an elongated asteroid rotates, it becomes alternately brighter and fainter as its broad and narrow sides rotate successively toward Earth and Sun. The brightness varies up and down twice with each rotation, and the time between alternate (not consecutive) minima is ordinarily the rotation period. The first asteroid to have its rotation period found accurately was (433) Eros. It was observed to vary by about 1.5 magnitudes at its very close approach in February 1931, and by timing many rotational minima, a rotation period of 5.27 hours was found. The large variation in brightness also showed that the asteroid's long axis was about three times the length of its short axis. Starting about 1949, Gerard Kuiper and his col-

leagues began using the photoelectric photometer to find the rotation periods of the brighter main belt asteroids. In most cases, the amplitudes of brightness variation were less (and often much less) than 0.5 magnitude—Eros turns out to be much more elongated than most asteroids. Most rotation periods were fairly short, from less than three hours to eighteen hours or longer. In the 1970s and 1980s many professional astronomers

entered the field, and by the year 2000, astronomers had measured the rotation periods of nearly 1000 asteroids. The limitations on telescope time often prevented a single asteroid from being followed for an extended time, however, and many published rotation periods were inaccurate.

Beginning around the year 2000, amateurs started using CCDs to measure time-varia-



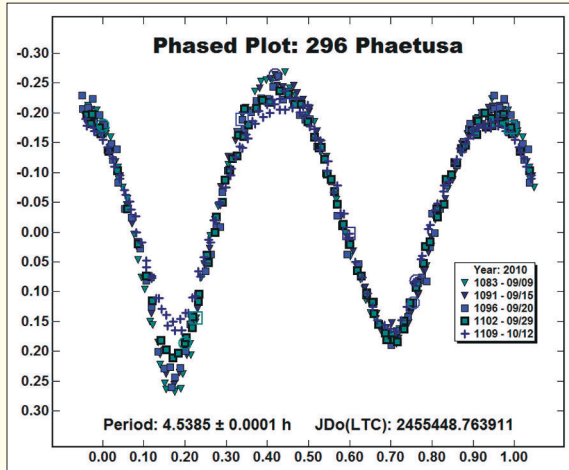
tions of asteroid brightnesses to within a few hundredths of a magnitude. By 2013, about 4000 asteroid rotation periods had been found. The observing procedure is simple: Use software to compute the position of an asteroid, slew a go-to telescope to this position, and take a several-hour sequence of images while the observer sleeps. In the morning, use other software to measure the magnitude of the asteroid and of several comparison stars on each image in the series, and use the software to plot the light curve (graph of magnitude versus time) and compute the rotation period. If the period is long, the amplitude of the light variation is small, or both, observations can be made over intervals as long as two or three months to establish the rotation period.

One person, himself an amateur, has done more than anyone else to bring the study of asteroid rotation into the amateur arena. This person is Brian D. Warner, a professional computer programmer, avid amateur astronomer, and asteroid enthusiast. He has written a suite of programs, *MPO Connections* for telescope and CCD operation, and *MPO Canopus* for measuring the images, drawing the rotational light curve, and finding the rotation period. He is also one of the world's most active asteroid light curve observers. Among his many achievements is the discovery of satellites of small asteroids. As they alternately transit and are occulted by their primaries, the combined light of primary and secondary decreases by a small amount that can be measured by the CCD. This is analogous to the behavior of an eclipsing binary variable star. His

programs can be ordered at [www.minorplanetobserver.com](http://www.minorplanetobserver.com). Richard P. Binzel started observing asteroid light curves

star data. In 2007 I started a vigorous program of asteroid CCD photometry and light curve analysis. I observed all night, or nearly all night, on every clear night for six years, and used the MPO programs to obtain high-quality light curves of more than 150 asteroids. From my own experience, today's amateurs write papers just as good as those of the professionals of twenty years ago, and often the amateurs' unlimited telescope time enables them to have much better data sets. I have been a contributing author on several professional papers published in the journals *Icarus* and *Astronomy and Astrophysics*. I did not write one word of these papers, but my light

most of a rotational cycle can be covered in a single night. Four to six nights are sufficient to obtain the rotational period for these asteroids with high accuracy. Many asteroids, however, in Brian Warner's words, "do not reveal their secrets easily." If an asteroid's rotational period is nearly equal to that of the Earth, or is a simple ratio (1/3, 1/2, 2/3, 3/2, 2, 3, etc.) of the Earth's period, then the asteroid's entire rotational cycle cannot be covered from a single location. If the period is long— from 100 hours to over 1000 hours in several cases—it can also be difficult to cover the entire rotational cycle from a single location. For these cases, observers worldwide observe the same object and regularly exchange their data in a standard MPO Canopus format. The rotational periods of many asteroids that professionals of many years ago did not have sufficient telescope



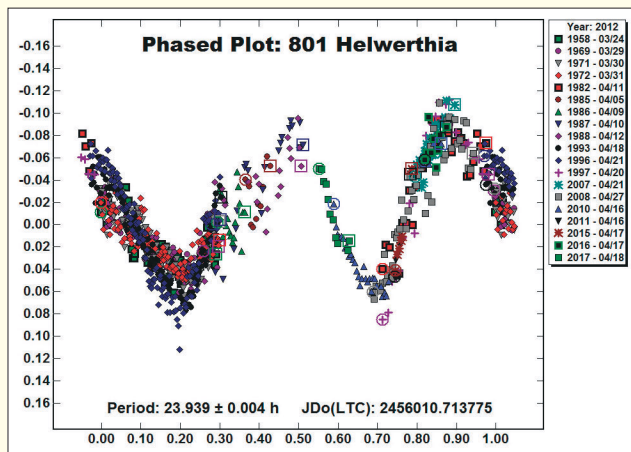
Light curve of an "easy" asteroid, (296) Phaetusa, prepared with MPO Canopus software. On the first night the entire rotational cycle was covered and the rotation period was found to be near 4.54 hours. With four more all-night sessions I refined the period to an accuracy of 0.0001 hours (less than 1 second).

with the photoelectric photometer as an enthusiastic amateur while still in high school. He has progressed to become one of the foremost professional observers of asteroids, has become the editor of the *Minor Planet Bulletin*, and is an outstanding promoter of amateur-professional collaboration. The *Minor Planet Bulletin* has become the preferred medium for the publication of asteroid light curves. In the year 2010 about 90 percent of all published asteroid light curves were in the *Minor Planet Bulletin*, and about 90 percent of these were produced by amateurs! Professional astronomers use amateurs' asteroid data just as professional astronomers use AAVSO observers' variable

curves were used to obtain the results published therein. Some asteroids have large amplitudes and short enough rotational periods, that all or

time to determine have now been solved completely. This work is important, because studies of asteroid rotation have contributed a great deal to our knowledge of the collisional history of the asteroid belt and how asteroids enter potentially hazardous Earth-crossing orbits.

If you found this article interesting, perhaps you would like to start your own research program in asteroid CCD photometry and light curve analysis. With modern technology it is quite easy. Please send me an email ([pilcher@ic.edu](mailto:pilcher@ic.edu)) and I will offer guidance to help you to set up your own program. ☀



Light curve of a "difficult" asteroid, (801) Helwerthia, prepared with MPO Canopus. On the first few nights every light curve segment looked identical. This suggested that I was seeing the same rotational phase on each night and that the period was almost exactly the same as the Earth's synodic rotation period, 23.93 hours. Other sections of the light curve could only be observed from other parts of the globe. I collaborated with amateurs Julian Oey, Australia; Andrea Ferrero, Luca Piero Strabla, Ulisse Quadri, and Roberto Girelli, all from Italy; and professional astronomers Yuriy Krugly, Ukraine; and Raguli Inasaridze, Georgia Republic—a true pro-am collaboration. This consortium sampled the complete light curve and confirmed the Earth synchronicity.

curves were used to obtain the results published therein. Some asteroids have large amplitudes and short enough rotational periods, that all or

## 10, 25 and 50 Years of the Astronomical League's Newsletter, by Mike Stewart

### March 1964—Photometry

"One wouldn't think that a mailbox would have much in common with astronomy, except perhaps to receive copies of *Reflector*. However, Arnold R. Johnson of the Omaha Astronomical Society finds that a good old fashioned rural mailbox makes a fine enclosure for the electronic equipment needed for his photo-electronic photometer. Of course he modified the mailbox to avoid any conflict of interest with the postal authorities.

"Accurate measurements of the apparent magnitude of stars tells the astronomer much about the type of star he is observing, its distance from the observer, and its absolute magnitude. Amateur astronomers having photometers provide a continuing source of new data on variable stars."

*Amateur astronomers continue their contributions to variable star observing five decades later.*

### February 1989—Hubble for Amateurs

"The Amateur Astronomers Working Group (AAWG) had received some 145 preliminary proposals, as of August 1987, from amateurs around the U.S.

"Of the 42 preliminary proposals received by the AL, 36 have been advanced to Phase II. With continued delays, the first shuttle flight [after the Challenger disaster] is not expected until August of 1988 and could very likely be November or December. HST has been listed now to go up on the sixth flight following resumption of shuttle operations, which would place its launch around June, 1989.

"Since preliminary proposals can be submitted until the first shuttle launch, amateurs still have plenty of time to prepare a proposal to gain time on the most technically sophisticated telescope ever built."

*On April 24, 1990, STS-31 (Discovery) placed the Hubble Space Telescope into its planned orbit. Mirror problems delayed the use of HST's full capabilities until a servicing mission installed corrective optics in December 1993. Thirteen amateurs were able to take advantage of Hubble's capabilities before the program ended in 1997.*

### March 2004—Solar Week 2003

"Recently, students representing several District 51 [Colorado] elementary and middle schools took part in an annual program known as Solar Week 2003. Solar Week was developed by Dr. Dave Alexander, of Rice University, Texas. It is an online program that aims to connect students to actual working international scientists who study the sun, stars and space in general.

"The program is open to students around the country and around the world. All week long, students had the opportunity to access information on the sun and ask questions to some of the leading scientists in the field of solar astrophysics.

"One of the most curious students from the elementary level was Shannah, of Darla Youngblood's class at Clifton Elementary. She asked many questions, ranging on a variety of topics. Students learned just how big the sun is, how hot it is, how far away it is, and other amazing facts."

*Western Colorado amateurs contributed by setting up solar-equipped telescopes for the students. The Solar Week program has completed fifteen years and is now held twice yearly, in March and October. Outreach efforts by League members continue to make the Sun, and other astronomical sights, accessible to the public.*

Experience COSMOS: A SpaceTime Odyssey this spring on FOX and the National Geographic Channel, a thrilling 13-part adventure across the universe, picking up where Carl Sagan's iconic series left off. Then, explore your world with official licensed products by Celestron. Journey under the stars and locate celestial objects with a tap of your smartphone using the COSMOS 90GT WiFi Telescope. Or, reveal strange life forms hidden in your backyard with the COSMOS LCD Digital Microscope and Tree of Life Binocular. With Celestron optics, you'll see it all in vivid detail.

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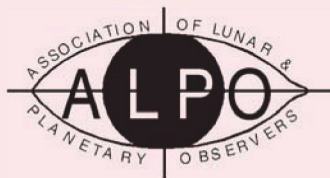


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Or e-mail to [matt.will@alpo-astronomy.org](mailto:matt.will@alpo-astronomy.org)

**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](http://www.astroleague.org/observing). If further assistance is required please contact either of the national Observing Program coordinators.

**Binocular Double Star Award**

No. 58, Terry Trees, Amateur Astronomers Association of Pittsburgh; No. 59, Kevin Johnson, Minnesota Astronomical Society; No. 60, Melissa Adams, Member-at-Large; No. 61, Melinda Hopper, Astronomical Society of Kansas City; No. 62, Lauren Gonzalez, Austin Astronomical Society

**Binocular Messier Award**

No. 997, Dale Niedfeldt, Steele County Astronomical Society; No. 998, Juan Velasquez, Denver Astronomical Society; No. 999, Bruce P. Bookout, Colorado Springs Astronomical Society; No. 1000, Jean Napp, Iowa County Astronomers; No. 1001, James L. Twelman, Astronomical Society of Eastern Missouri; No. 1002, Michael Rapp, Houston Astronomical Society



**Bright Nebula Award**  
No. 2, Scott G. Kranz, Astronomical Society of Kansas City

**Caldwell Award**

No. 203, Jeff Haidet, Silver, Toledo Astronomical Association; No. 204, Douglas Wiese, Silver, High Desert Astronomy Club; No. 205, Coy Wagoner, Silver, Shreveport-Bossier Astronomical Society

**Carbon Star Award**

No. 46, Marc Whitsett, Member-at-Large

**Comet Award**

No. 68, Steve Riegel, Silver, Albuquerque Astronomical Society; No. 69, Carl Stanley, Silver, Boise Astronomical Society; No. 70, Rob Ratkowski, Silver, Haleakala Amateur Astronomers; No. 71, Douglas M. Slauson, Silver, Cedar Amateur Astronomers; No. 24, Bryan R. Tobias, Gold, San Antonio League of Sidewalk Astronomers

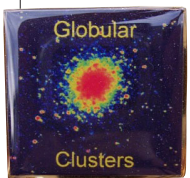
**Constellation Hunter**

**Northern Skies Award**

No. 135, James Fordice, Albuquerque Astronomical Society; No. 136, Carol Ogden, Island County Astronomical Society; No. 137, Rhonda Behrends, Hill Country Astronomers

**Deep-Sky Binocular Award**

No. 345, Barry Johnson, Delaware Valley Amateur Astronomers; No. 346, Nick Anderson, Back Bay Amateur Astronomers; No. 347, John Robinson,



TAC-AL; No. 348, Melissa Adams, Member-at-Large; No. 349, Melinda Hopper, Astronomical Society of Kansas City; No. 350, George Guest, Member-at-Large; No. 351, Roger Dillon, Astronomical Society of Southeast Texas

**Galileo Award**

No. 29, Bryan Tobias, San Antonio League of Sidewalk Astronomers

**Galaxy Groups and Clusters Award**

No. 33-DA, John Robinson, TAC-AL Bay Area; No. 34-DA, Al Schlaffli III, Colorado Springs Astronomical Society

**Globular Cluster Award**

No. 248, Gregory F. Rohde, Texas Astronomical Society of Dallas; No. 249, Karlis Lubkans,



Member-at-Large; No. 250, Pamela Lubkans, Member-at-Large

**Herschel 400 Award**

No. 498, Doug Lively, Raleigh Astronomy Club; No. 499, Stephen Berte, TriState Astronomers; No. 500, Scott Reeves, Rockland Astronomy Club; No. 501, Douglas Wiese, High Desert Astronomy Club; No. 502, Bruce Heath, Denver Astronomical Society; No. 503, George Guest, Member-at-Large; No. 504, Edward Rumsey, Temecula Valley Astronomers; No. 505, Kinchen Searcy, Temecula Valley Astronomers

**Herschel II Award**

No. 83-DA, Vincent S. Foster, Member-at-Large; No. 84-M, John L. Goar, Olympic Astronomical Society; No. 85-DA, Denis G. Janky, Seattle Astronomical Society; No. 86-DA, David M. Douglas, East Valley Astronomy Club

**Hydrogen-Alpha Solar Award**

No. 1, Michael A. Hotka, Denver Astronomical Society; No. 2, Steve Boemer, Astronomical Society of Eastern Missouri; No. 3, Bryan R. Tobias, San Antonio League of Sidewalk Astronomers; No. 4, John H. McCammon, Member-at-Large; No. 5, Ted Forte, Huachuca Astronomy Club; No. 6, Diane Ketchum, Middle Georgia Astronomical Society; No. 7, Brad Young, Astronomy Club of Tulsa

**Lunar Award**

No. 841, Louis Dorland, Omaha Astronomical Society; No. 842, John Whisenhunt, San Antonio League of Sidewalk Astronomers; No. 843, Slava Murygin, Westminster Astronomical Society; No. 844, Todd Sanders, Tallahassee

Astronomical Society;

No. 845, Danny F. Wheeler, Knoxville

Observers Astronomy Club; No. 846, William Crispino, Amateur Observers Society of New York; No. 847, Bruce Bookout, Colorado Springs Astronomical Society; No. 848, Gary McFall, Southwest Florida Astronomical Society; No. 849, Diomar De Jesus Santana, Member-at-Large; No. 850, Greg Perry, Member-at-Large; No. 851, John Livermore, Northern Virginia Astronomy Club; No. 852, Jody Raney, Shreveport-Bossier Astronomical Society

**Lunar II Award**

No. 53, Vincent S. Foster, Member-at-Large; No. 54, Brian Chopp, Neville Public Museum Astronomical Society; No. 55, Rob Ratkowski, Haleakala Amateur Astronomers

**Messier Award**

No. 2646, Ethan D. Gregory, Regular, Olympic Astronomical Society; No. 2647, R. James Talbott, Honorary, Minnesota Astronomical Society; No. 2648, Mark Spearman, Honorary, Brazos Valley Astronomy Club; No. 2649, Robert Torrey, Honorary, Houston Astronomical Society; No. 2650, Don Sannes, Honorary, Austin

Astronomical Society; No. 2651, Hagan Hensley, Honorary, San Antonio League of Sidewalk Astronomers; No. 2652, Bob Hoover, Honorary, Huachuca Astronomy Club; No. 2653, Fred Leslie, Honorary, Von Braun Astronomical Society; No. 2654, Denny Henke, Honorary, Eastern Ozarks Astronomical Society; No. 2655, Joseph Mezzafonte, Regular, Astronomical Society of Long Island

**Meteor Award**

No. 161, William Pillucere, 6 hours, Member-at-Large; No. 162, Ken Gourley, 6 hours, Member-at-Large; No. 163, Jean Napp, 6 hours, Iowa County Astronomers; No. 164, Ed Bruns, 6 hours, Astronomical Society of Kansas City; No. 165, Christopher Todd, 6 hours, Howard Astronomical Society of Central Maryland; No. 166, Thomas P. Mazingo, 6 hours, Barnard Astronomical Society

**Open Cluster Award**

No. 57, Larry Farrington, Basic, Etna Astros

**Outreach Award**

No. 271-S, Laura Harness, Stellar, Flint River Astronomy Club; No. 306-S, Denise Moser, Stellar, Astronomical Society of Kansas City; No. 387-S, Timothy T. Myer, Stellar, Astronomical Society of Southeast Texas; No. 408-S, Lauren S. Gonzalez, Stellar, Austin Astronomical Society; No. 435-M, Dawn Davies, Master, Austin Astronomical Society; No. 442-S, Gary Bell, Stellar, Northwestern Suburban Astronomers; No. 453-S, John Brueggemann, Stellar, Northeast Florida Astronomical Society; No. 466-S, Erika Rix, Stellar, Austin Astronomical Society; No. 494-S, JoAnne Trees, Stellar, Oil Region Astronomical Society; No. 495-S, Terry N. Trees, Stellar, Oil Region Astronomical Society; No. 512-O, Donna Pryor, Outreach, Omaha Astronomical Society; No. 513-M, Van Webster, Master, Member-at-Large; No. 514-S, Zachery Colvin, Stellar, Back Bay Amateur Astronomers; No. 515-O, Jim Tomkins, Outreach, Cumberland Astronomical Society; No. 516-O, Chris Costanza, Outreach, Astronomical Society of Long Island; No. 517-O, Dennis Gavarian, Outreach, Astronomical Society of Long Island; No. 518-O, Barbara Macedonio, Outreach, Astronomical Society of Long Island; No. 519-O, Ken Spencer, Outreach, Astronomical Society of Long Island; No. 520-O, John Speroni, Outreach, Astronomical Society of Long Island; No. 521-O, Jack Stearman, Outreach,



Cumberland Astronomical Society; No. 522-O, Benjamin McLerran,

Outreach, Cumberland Astronomical Society; No. 523-O, Jim Opalek, Outreach, Cumberland Astronomical Society; No. 524-O, Chris Jarvis, Outreach, Back Bay Amateur Astronomers; No. 525-O, Thomas Jarvis, Outreach, Back Bay Amateur Astronomers; No. 526-M, Mark E. Gerlach, Master, Back Bay Amateur Astronomers; No. 527-M, Jean Napp, Master, Iowa County Astronomers; No. 528-M, Billy Hix, Master, Von Braun Astronomical Society, Master; No. 529-O, Christopher Allison, Outreach, Northeast Florida Astronomical Society; No. 530-O, Benjamin Allison, Outreach, Northeast Florida Astronomical Society; No. 531-O, Susie Stahlhut, Outreach, Northeast Florida Astronomical Society

**Planetary Nebula Award**

No. 59, Carl J. Wenning, Advanced, Twin City Amateur Astronomers; No. 60, Cindy L. Krach, Advanced, Manual, Haleakala Amateur Astronomers

**Sky Puppies Award**

No. 21, Tyler Scheetz, Delaware Valley Amateur

**LUNAR CLUB**



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

Astronomers; No. 30, Nicholas Scheetz, Delaware Valley Amateur Astronomers; No. 35, Annalise Biermann, St. Louis Astronomical Society; No. 36, Sarah Jimenez, Northern Virginia Astronomy Club

**Solar System Award**

No. 78, Nick Anderson, Back Bay Amateur Astronomers

**Southern Skies Binocular Award**

No. 82, George Guest, Member-at-Large; No. 83, Mike Dole, Seattle Astronomical Society

**Sunspotter Award**

No. 160, Steve Jaworivsky, Howard Astronomical League of Central Maryland; No. 161, Janean L. Shane, Omaha Astronomical Society

**Target NEOs! Award**

No. 1, Aaron Clevenson, North Houston Astronomy Club

**Urban Observing Award**

No. 153, Mark Simonson, Everett Astronomical Society; No. 154, Matthew J. Wedel, Pomona Valley Amateur Astronomers; No. 155, Dr. Marc Whitsett, Member-at-Large; No. 156, Paul Sanders, Kansas Astronomical Observers

**Variable Star Award**

No. 17, John H. McCammon, Member-at-Large; No. 18, Peter Bagyinszki, Member-at-Large; No. 19, James Bruce McMath, Central Arkansas Astronomical Society; No. 20, Aaron B. Clevenson, North Houston Astronomy Club  
**NOTE:** If you are a Sky Puppy, or know of anyone who has earned the Sky Puppy observing program certificate, please email [graceaikman@yahoo.com](mailto:graceaikman@yahoo.com) with the information. We are trying to fill in missing data on our website. Thanks!



**ASTRONOMY DAY**  
**APRIL 12, 2014**  
**11:00 AM - 6:00 PM**  
*Free to the Public*  
**PRESENTATIONS**  
 Telescope Workshop  
 Solar Viewing & Night Viewing  
**KIDS ACTIVITIES**  
 Activities  
**EXHIBITS**  
 Presentations & Displays  
**Speaker: Dr. Alex Filippenko**  
**1:00 p.m. - 2:00 p.m.**  
 Sponsored By: **Dr. Joshua R. Modlin, DPM**

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 11515 Bolthouse Drive  
 Event Sponsors  
 Kern Astronomical Society • William M. Thomas Planetarium  
[www.kernastro.org/astroday/index/html](http://www.kernastro.org/astroday/index/html)

**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](http://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?

**Mid-States Region of the Astronomical League Convention**  
**Friday, June 6 – Sunday, June 8, 2014**  
 Hosted by:  
**The St. Louis Astronomical Society**  
 Sponsors:  
 Washington University  
 Washington University Physics Department  
 Earth and Planetary Sciences Department  
 St. Louis Science Center  
 James S. McDonnell Planetarium  
**Keynote Speaker:**  
**Dr. Ray Arvidson**  
 Registration is OPEN  
 All regions are invited!  
 Contact us for more information:  
 Link from: [www.slasonline.org](http://www.slasonline.org)  
[MSRAL2014@slasonline.org](mailto:MSRAL2014@slasonline.org)



**NEAF THE 23RD NORTHEAST ASTRONOMY FORUM & TELESCOPE SHOW**  
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Compiled by  
**John Wagoner.**  
To have your star party  
or event listed, please  
send the details, includ-  
ing dates, sponsors and  
website, to  
[astrowagon@verizon.net](mailto:astrowagon@verizon.net).

### March 1

**Tri-Star 2014**  
Guilford Technical Commu-  
nity College, Jamestown,  
North Carolina  
Greensboro Astronomy Club  
and the Cline Observatory  
[www.gtcc.edu/observatory/tristar.aspx](http://www.gtcc.edu/observatory/tristar.aspx)

### March 20-23

**Fourteenth Annual Mid-Atlantic Mirror Making Seminar**

Delmarva Star Gazers  
[www.delmarvastargazers.org/archive/mw14](http://www.delmarvastargazers.org/archive/mw14)

### March 26-29

**Mid-South Stargaze**

Rainwater Observatory, French Camp, Mississippi  
[www.rainwaterobservatory.org/rainwater/index.cfm/information/upcoming-events/mid-south-star-gaze](http://www.rainwaterobservatory.org/rainwater/index.cfm/information/upcoming-events/mid-south-star-gaze)

### March 26-30

**Hodges Gardens Star Party**  
Baton Rouge Astronomical Society  
[www.bastro.org/hgsp.html](http://www.bastro.org/hgsp.html)

### March 27-30

**Staunton River Star Party**  
Staunton River State Park, South Boston, Virginia  
[www.chaosastro.com/starparty](http://www.chaosastro.com/starparty)

### March 29

**2014 All-Arizona Messier Marathon**  
Salome Emergency Airfield (south of I-10 at Exit 53)  
[www.saguaroastro.org/content/messier2014.htm](http://www.saguaroastro.org/content/messier2014.htm)

### April 4-5

**NCRAL 2014**  
Lakeview Conference Center,  
Port Washington, Wisconsin  
[www.ncsf.info/ncral2014.htm](http://www.ncsf.info/ncral2014.htm)

### April 4-5

**North Carolina Statewide Star Party**  
40+ public sky-watching sessions from  
the North Carolina mountains to the coast  
[www.ncsciencefestival.org/special-opportunities/starparty](http://www.ncsciencefestival.org/special-opportunities/starparty)

### April 10-11

**Northeast Astro-Imaging Conference**  
Rockland Astronomy Club, Suffern, New York  
[www.rocklandastronomy.com/INEAIC](http://www.rocklandastronomy.com/INEAIC)

### April 12

**Astronomy Day**  
Kern Astronomical Society,  
William M. Thomas Planetarium  
[clpowers@bak.rr.com](mailto:clpowers@bak.rr.com)

### April 12-13

**Northeast Astronomy Forum and Solar Star Party**  
Rockland Astronomy Club, Suffern, New York  
[www.rocklandastronomy.com/NEAF](http://www.rocklandastronomy.com/NEAF)

### April 24-27

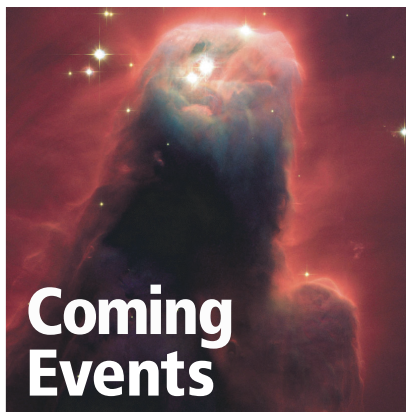
**Southern Star Astronomy Convention**  
Charlotte Amateur Astronomers Club, Little  
Switzerland, North Carolina  
[www.charlotteastronomers.org/southernstar](http://www.charlotteastronomers.org/southernstar)

### April 24-27

**South Jersey Astronomy Club Spring Star Party**  
Belleplain, New Jersey  
[sjac.us/starparty.html](http://sjac.us/starparty.html)

### April 25-27

**Grand Canyon Caverns Star Party**  
High Desert Astronomy Club  
Route 66 (mile marker 115), 53 miles northeast  
of Kingman, Arizona  
[www.astroleague.org/content/grand-canyon-caverns-star-party](http://www.astroleague.org/content/grand-canyon-caverns-star-party)



## Coming Events

### May 1-4

Two Rivers Spring Star Party  
Heavens Gate Farm, Barry,  
Illinois  
[www.freewebs.com/tworiversstarparty](http://www.freewebs.com/tworiversstarparty)

### May 2-4

**Tennessee Spring Star Party**  
Fall Creek Falls State Park,  
Tennessee  
[www.cumberlandastronomicalsociety.org](http://www.cumberlandastronomicalsociety.org)

### May 8-11

**Spacefest VI**  
Pasadena Convention  
Center,  
Pasadena, California  
[www.spacefest.info](http://www.spacefest.info)

### May 16-17

**Custer Institute's Radio Astronomy Conference**  
Custer Institute, Southold, Lony Island, NY  
[www.custerobservatory.org/radioconf.htm](http://www.custerobservatory.org/radioconf.htm)

### May 22-26

**RTMC Astronomy Expo**  
YMCA Camp Oakes, Big Bear City, California  
[www.rtmcastronomyexpo.org](http://www.rtmcastronomyexpo.org)

### May 25-June 1

**Texas Star Party and Imaging Symposium**  
Fort Davis, Texas  
[www.texasstarparty.org](http://www.texasstarparty.org)

### May 30-June 1

**Bootleg Astronomy Star Party**  
Green River State Wildlife Area, Harmon, Illinois  
[www.bootlegastronomy.com](http://www.bootlegastronomy.com)

### June 1-4

**Wisconsin Observers Weekend**  
Hartman Creek State Park, just west of  
Waupaca, Wisconsin  
[www.new-star.org/index.php?option=com\\_content&view=category&layout=bl%20og&id=38&Itemid=82](http://www.new-star.org/index.php?option=com_content&view=category&layout=bl%20og&id=38&Itemid=82)

### June 6-8

**MSRAL 2014 Convention**  
St. Louis Astronomical Society, Missouri  
[www.slsonline.org/msral2014.html](http://www.slsonline.org/msral2014.html)

### June 12-14

**The Symposium on Telescope Science**  
Ontario Airport Hotel, Ontario, California  
[www.socastrosci.org/symposium.html](http://www.socastrosci.org/symposium.html)

### June 21-28

**Grand Canyon Star Party: North Rim**  
[www.saguaroastro.org/content/2014GrandCanyonStarParty/NorthRim.htm](http://www.saguaroastro.org/content/2014GrandCanyonStarParty/NorthRim.htm)

### June 25-28

**Green Bank Star Quest**  
National Radio Astronomy Observatory, Green  
Bank, West Virginia  
[www.greenbankstarquest.org](http://www.greenbankstarquest.org)

### June 25-29

**Rocky Mountain Star Stare**  
Gardner, Colorado  
[www.rmss.org](http://www.rmss.org)

### June 27-28

**Craters of the Moon Star Party**  
Craters of the Moon National Monument,  
Arco, Idaho  
[www.ifastro.org](http://www.ifastro.org)

### June 27-28, July 25-26, August 21-24

**Stars Over Yellowstone**  
Madison Campground, Yellowstone National  
Park, Wyoming  
[www.smasweb.org/?page\\_id=546](http://www.smasweb.org/?page_id=546)

### July 10-12

**ALCon, San Antonio Astronomical Association**  
San Antonio, Texas  
[www.ALCon2014.astroleague.org](http://www.ALCon2014.astroleague.org)

### July 27-August 1

**Nebraska Star Party**  
Merritt Reservoir, Valentine, Nebraska  
[www.nebraskastarparty.org](http://www.nebraskastarparty.org)

### August 19-24

**Oregon Star Party**  
Trail Spring, Ochoco National Forest, Oregon  
[www.oregonstarparty.org](http://www.oregonstarparty.org)

The Minnesota Astronomical Society presents:

## NORTHERN NIGHTS STAR FEST

When: August 27 - 30 2014  
Where: Long Lake Conservation Center  
Palisade, MN

Join avid amateur astronomers and dark sky enthusiasts for our 6th annual Northern Nights Star Fest. Enjoy some of the darkest skies in Minnesota and view thru 25" and 30" Obsession scopes.

Onsite accommodations. Guest speakers, swap meet, and door prizes are some of the scheduled events. Meals also available.

Registration information at [www.mnastro.org/NNSF](http://www.mnastro.org/NNSF)

Minnesota Astronomical Society  
7th Annual Presents  
Camping with the Stars

WHERE: Eagle Lake Observatory at Baylor Park  
Norwood-Young America, MN  
WHEN: August 1, 2, & 3, 2014

Speakers, prizes, and viewing through the 14", 16" and 20" telescopes. Tent Camping and camper sites available.

Visit our website: [www.mnastro.org/campwithstars/](http://www.mnastro.org/campwithstars/)  
Call 952-466-5250 to register and reserve your spot.

## Astronomical League Membership-at-Large Program

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

- Full voting privileges at AL meetings.
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*RASC Observers Handbook* \$26.00 • *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 \$30.00, \$45.00 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](mailto:leagueoffice@astroleague.org)  
Or join online at: [WWW.ASTROLEAGUE.ORG](http://WWW.ASTROLEAGUE.ORG)



# League Sales are online!

The League's online store is available at the website, [www.astroleague.org](http://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](mailto:leaguesales@astroleague.org).



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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



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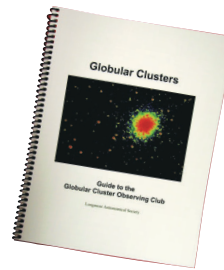
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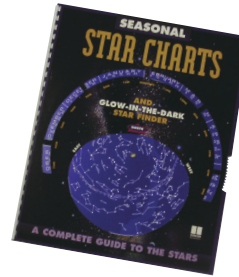
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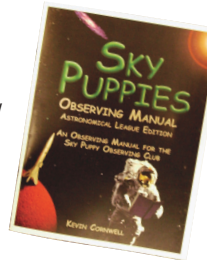
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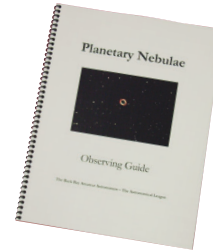
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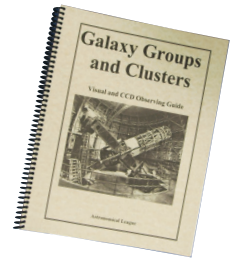
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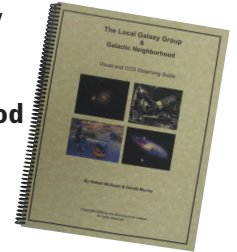
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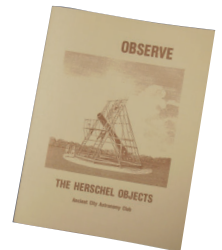
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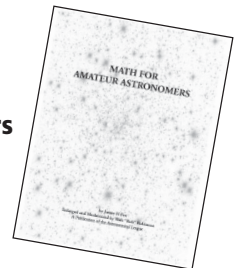
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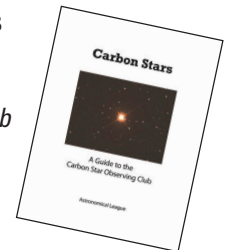
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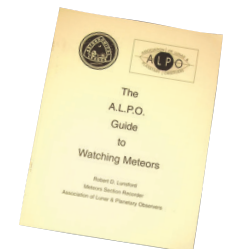
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This image of the Diamond Ring was taken during a total solar eclipse by Glenn Showalter in 1970 in Virginia. He has forgotten what camera he used, but the photo was taken with Tri-X 35 mm 400 ASA film at 1/30 second, f/8 with a 200 mm lens, and printed on Kodak Polycontrast II paper. Glenn is a member of the Charlottesville Astronomical Society, Charlottesville, Virginia.

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.

