Reflector

Published by the Astronomical League Vol. 67, No. 4 September 2015

ALCon 2015 in Las Cruces

A Whole New World

Part 3: Discovering Astronomy

Are You Smarter Than a 1944 Boy Scout?

WINNER, WINNER, WINNER!

It is our pleasure to announce the runners-up of the **OPTAS 2015 PICNIC!** Thanks to all that took part. Your images reinforce just how amazing amateur astro-photography has become. Keep it up!

Check out the PICNIC winners and other entries at **OPTAS.NET!**

OPT Astroimage PICNIC* Contest

*Photo Imaging Contest with Nice Images of the Cosmos!

TOP RUNNER UP

Iris Nebula, *Robert Mueller*

TOP RUNNER UP

April 14th-15th 2014 Lunar Eclipse (Blood Moon) Mosaic, *Phillip Cruden*

TOP RUNNER UP

Mars 20140502, *Dale Cupp*

TOP RUNNER UP

Filament and Prominence on the Sun, *Jesus Muñoz*

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

Contents

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

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

IC 1805 (the Heart Nebula) is an emission nebula showing dark dust lanes and glowing gas. This image, taken by **Kirby Benson** of the Astronomical Society of Las Cruces from his home in southeastern Las Cruces, consists of 21 ten-minute subs of H-alpha (on October 11, 2013) for 3.5 hours and 12 twenty-minute subs of O-III (on October 26, 2013) for 4 hours. All narrowband processing was completed in June 2015 using PixInsight with final touches in Photoshop CS4. A synthetic S-II green channel was created using a technique from Kayron Mercieca at Light Vortex Astronomy. Telescope was a Takahashi TSA-102S with a TOA-35 flattener. Mount was a Takahashi EM-200 Temma 2M. Camera was an SBIG ST-8300M with a FW5-8300 filter wheel and Astrodon narrowband filters. Guiding was with an SBIG ST-i and off-axis guider.

Reflector

The Astronomical League Magazine

Vol. 67, No. 4 • ISSN: 0034-2963 • September 2015

A FEDERATION OF ASTRONOMICAL SOCIETIES
A NON-PROFIT ORGANIZATION

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

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Reflector

QUARTERLY PUBLICATION OF THE ASTRONOMICAL LEAGUE

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

***Reflector* and Club Roster Deadlines**

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

Field of View

From the office of your president

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

This is a great time for amateur astronomy

We live in a wonderful, but confusing, time for amateur astronomy, one that could very well be given the curious name the "Post-Modern Era." How did we arrive at this fortuitous juncture? First, though, what happened to the "Modern Era?"

Following the art world's practice of coining periods in art history, the "Modern Era" seems to be a fitting term for the period beginning around 1960. It was then that a sizable number of budding amateurs began purchasing commercial telescopes instead of building their own. Six-inch f/8 Newtonian reflectors were the instruments of choice, just before commercially available Schmidt–Cassegrain telescopes began to seriously enter the hobby. Modernism eventually put amateurs at the eyepieces of larger scopes—those of eight inches or more—that could truly reveal details in previously dim, indistinct objects. The Modern Era faded in the mid- to late 1990s when the Internet took hold and CCD imaging finally superseded film photography.

The era before Modernism, "Impressionism," saw the reign of small refractors providing tantalizing views of many deep-sky objects. Many of these telescopes were equipped with star diagonals, erecting lenses, various filters, several eyepieces, and Barlow lenses. They were also fitted with plenty of ornate knobs, and, sometimes, not just a finder scope, but a guide scope, too. Unfortunately, only a vague impression was often gained of star clusters, nebulae, and galaxies, leaving much to the imagination. It was a frustrating time for many beginning deep-sky observers. On the other hand, the lunar and planetary views were certainly not disappointing, and provided many satisfying hours at the eyepiece.

Post-Modernism is characterized by the popularity of two types of telescopes, those with mounts of the Dobsonian design, enabling the use of large apertures, and those equipped with computerized guide mounts, allowing for precise tracking of the stars and for easy location of celestial wonders. We also have access to two common accessories that have become essential for many amateurs: the reflex (or unit-power) finder for quickly zeroing on targeted areas of the sky, and extra-wide field eyepieces offering incredible, inspiring views of extended objects.

Today's amateur astronomers are now seeing deeper and with greater detail than ever before. Globular clusters are being resolved into sparkling lights, diffuse nebulae are revealing physical features with ranging contrast, and distant galaxy groups are being discerned floating in the darkness. Imaging has exploded, capturing scenes that rival those obtained through professional telescopes of just thirty years ago. Astronomy is now "24/7," with the Internet allowing just about anyone on the planet to experience any aspect of astronomy at any time.

Of course, these glowing accounts completely ignore the very real problem of light pollution wiping clean the star-filled dome. It must not be ignored. It must be solved, not just for astronomy's sake, but also for the betterment of society.

Are we living in the "Golden Age" of amateur astronomy, one of observer, telescope, and sky? We live in a very privileged time, indeed.

So, where will Post-Modernism lead? The logical extension of the above comments indicate that, in areas surrounding the large populations centers of the United States, much observing will be done through automated imaging telescopes placed in remote sites far from sources of light pollution. More home observatories will have computerized telescopes programmed with the evening's observing schedule. Since astronomy will be yet another step removed from first-hand experience of the night sky, perhaps a good term for this next era would be "Abstractism." We stand at its edge.

Will we soon be witnessing a decline in visual observing? Will the fantastic celestial images obtained today dull the sense of wonder gained at the eyepiece? No one knows, but there will always be people gazing upwards, free of computerized gizmos, wanting to know what is really up there and what they can see of it. They will be admiring the universe alongside aspiring imagers capturing the beauty and mystery of the heavens. The Astronomical League will be there, too.

Participate. Discover. Volunteer.

John Jardine Goss

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

IDA Dark Sky Nation

For nearly 15 years, IDA has recognized efforts around the world to preserve special dark sky places through its International Dark Sky Places Program (*www.darksky.org/international-dark-sky-places/about-ids-places*). I personally consider this IDA's most successful program. The International Dark Sky Places consist of parks, reserves, and communities. They are usually placed into one of three tiers—Gold, Silver, or Bronze—depending on the darkness of the sky, with Gold representing the highest tier and the darkest skies, followed by the Silver and Bronze designations.

Many of these columns have described Dark Sky Places. On April 22, 2015, IDA issued a press release naming the Kaibab Paiute Reservation as its first Dark Sky Nation. According to the press release, "never before has an entire group of ethnically and linguistically related people come together to collectively embrace dark-skies principles. As a result of the Kaibab Band of Paiute Indians' work to protect the pristine night skies over its northern Arizona territory, IDA is pleased to announce the designation of the Kaibab Paiute Indian Reservation as an International Dark Sky Community. The IDA status makes the Kaibab Paiute truly the world's first dark sky nation."

The Kaibab Paiute Indian Reservation has a population of approximately 250 residents and is located on the Arizona–Utah state line approximately 50 miles north of the Grand Canyon. The Kaibab Paiute are one of ten member bands of the Southern Paiute tribe. The bands live along the southern Great Basin and the San Juan and Colorado River watershed. For more information about the Southern Paiute Consortium, see *www.kaibabpaiute-nsn.gov/SPC.html*.

The Kaibab Paiute believe they have a special responsibility to protect and manage their lands, and have come to recognize the value of the dark skies over their lands. They consider their dark skies a threatened resource worthy of conservation and protection. Thunder Mountain is a landform that dominates the reservation landscape. The new Dark Sky Community will be officially known as Thunder Mountain Pootsee Nightsky, recognizing the status of the Kaibab Band of Paiute Indians as a sovereign nation. This designation also recognizes the importance of Thunder Mountain and the night sky in Kaibab Paiute culture as well as the unique language spoken by Southern Paiutes, who speak a Uto-Aztecan native language in addition to English.

The Kaibab Paiute have made a clear and determined effort to improve the quality of the outdoor lighting on the reservation. They have adopted and implemented a quality lighting plan and raised awareness of the importance of dark skies both on and beyond their reservation. Their Dark Sky Award is well deserved and quite unique.

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Winning Clubs of the 2015 Horkheimer Library Telescope Program

Because of the generosity and vision of the Horkheimer Charitable Fund, the Astronomical League was able to hold a drawing for ten Library Telescopes at ALCon 2015 in Las Cruces. The names of ten clubs, one from each region, were drawn from the 33 total entries. They will each receive an Orion 4.5-inch StarBlast Dobsonian Telescope, a Celestron 8–24 mm zoom eyepiece, and a commemorative plate, all to be modified by the clubs to create Library Telescopes.

The Astronomical League wishes to thank Orion Telescopes and Celestron. Without their support, this program would not have been possible.

2015 Horkheimer Library Telescopes:
Great Lakes Region: Oakland Astronomy Club
Mountain Astronomical Research Section: Longmont Astronomical Society
Mid-States Region: Broken Arrow Sidewalk Astronomers
Mid-East Region: Back Bay Amateur Astronomers
North Central Region: Northern Cross Science Foundation
Northeast Region: Amateur Observers' Society of New York
Northwest Region: Olympic Astronomical Society
Southeast Region: Flint River Astronomical Society
Southwest Region: Houston Astronomical Society
Western Region: Temecula Valley Astronomers

More information on the Library Telescope Program can be found at *www.astroleague.org/content/library-telescope-program*.

To the Editor:

I particularly enjoyed the June 2015 edition of the *Reflector* and its coverage of auroras. While I enjoyed the article, I was put off by the list of recommended sites for seeing auroras. Most were in exotic locations like Iceland, which most of us would not likely have the time or money to visit. Many might think that you can't see auroras from the United States, while indeed you can. I retired from San Francisco, California, 11 years ago and moved to Michigan. While here, I have seen auroras several times—even from my backyard, only about 25 miles north of Detroit (latitude 42 degrees). I included a photo taken from Cadillac, Michigan, last year at a friend's cabin. The aurora was huge and covered a very wide angle both in azimuth and altitude. This was taken with a Nikon D800 and 20 mm lens at


© BOB BERTA

ISO 2000 and a 20-second exposure on a non-tracking camera tripod. Another member of our club (Warren Astronomical Society) has quite a collection of aurora photos he has taken and we all enjoy comparing these photos as another way to enjoy the wonders of the night sky.

Bob Berta, *Warren Astronomical Society*

To the Editor:

I've been reading the *Reflector* for almost twenty-five years, and have watched it grow from a newsletter to a full-fledged, world-class astronomy magazine. My favorite quarterly article is "Deep-Sky Objects" by Dr. James Dire. Not only does he discuss the science of each object and the history, but he also shares his beautiful digital images and visual notes. Being a visual observer, it's always interesting to read what a skilled observer like James Dire is able to see.

In the mid-1960s, as a 13-year-old budding amateur astronomer, I would run to the mailbox to get my copy of *Sky & Telescope* magazine. I could hardly wait to read about the deep-sky objects that Walter Scott Houston had written about in his "Deep-Sky Wonders" column. After almost fifty years, I'm now excited to find my *Reflector* in the mailbox, and just like those days as a kid, I can hardly wait to begin reading the many interesting articles by so many talented astronomy writers.

SEYFERT'S SEXTET; NASA GODDARD SPACE FLIGHT CENTER

Roger Ivester (*www.rogerivester.com*) *Both Roger and his wifeDebbie are honorary "Lifetime Members" of the Las Vegas Astronomical Society and Roger is a founding member of the Cleveland County Astronomical Society, Boiling Springs, North Carolina.*

To the Editor:

I have been a member of the DVAA (Delaware Valley Amateur Astronomers) for about 30 years and am a professional photographer.

The DVAA honored our very-long-term program chair (18 consecutive years!) and two-term former president, Marilyn Michalski, by presenting her with an engraved crystal bowl at our April meeting in Radnor, Pennsylvania.

Marilyn has worked tirelessly for the past 25+ years on the club's behalf, getting quality speakers, and as an astronomy ambassador to the public through education and outreach. You might say that she is the proverbial face of amateur astronomy, and you would be right! (She also won first prize at Stellafane a few years ago for the incredible "Emerald" Dobsonian that she built.)

I photographed her with the appreciation award that night in April, and then matted an 8x10 print. Shelley Cravetz did the beautiful Photoshop work to add the cosmic background. Club members signed their own tributes, including Derrick Pitts, Chief Astronomer at the Franklin Institute, over the past two monthly meetings, and the framed print was then presented to her two weeks ago.

Mitch Berger, *DVAA and Rittenhouse Astronomical Society*

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

For the past year, we have been discussing the upcoming availability of digital copies of our quarterly magazine, the *Reflector*. We received many comments from our readers, both positive and negative. Most of the negative comments pertained to the possible loss of a "paper magazine which can be read at leisure" or "not having to access a computer to read an issue."

Positive comments included the cost savings (electrons are much cheaper than paper and ink, plus the cost of shipping 16,000-plus copies), the environmental impact, and the ease of storing back issues.

Looking at the numbers, about 40% of our members under the age of 40 prefer digital copies. About 40% of members over the age of 60 prefer paper. The balance, between 40 and 60 years old, are an approximate 50/50 split. As our society continues to age, and greater numbers of younger members join, the trend will move towards the digital. We expect that by 2017 or 2018, some 40% of the *Reflector*'s copies will be digital.

Considering both sides of this coin, and after a rather lengthy discussion at the recent ALCon 2015 convention in Las Cruces, New Mexico, the Astronomical League's Council has accepted the following:

More than 53 AL organizations are represented on this map at ALCon 2015.

Effective with the September 2015 issue of the *Reflector*, every AL member, for whom we have a valid email address, will automatically receive a digital copy of our quarterly magazine. Each member will be sent a link, via email, which, when "clicked," will begin the download process. For most members with a "broadband" (high-speed) Internet connection, this download should take one minute or less. Slower connections will take longer.

In addition, each member receiving the digital edition will also receive a printed copy of the *Reflector,* as usual.

When you receive the digital version, you will be given the option of either continuing to receive the paper copy ("opting-in to paper") or deciding that the digital version is suitable for your needs ("opting-out of paper"). Regardless of your choice, you will continue to receive a copy of the *Reflector* every quarter. You can choose whether you want digital or paper, or both.

Some of the advantages to the digital version include:

- Receipt of your digital copy at least one to two weeks before paper copies arrive in the mail
- Improving the environmental sustainability of the Astronomical League
- A reduction in the costs to produce 16,000 paper copies per quarter

We will also request that each member update their email address (and mailing address) on our website (*www.astroleague.org*) at their earliest opportunity. This will ensure that all paper and digital copies arrive at their intended destinations.

If you have any questions regarding this policy, please contact Mitch Glaze at *rosters@astroleague.org* or Ron Kramer at *rjipublishing@aol.com.* Rest assured that there are no plans to discontinue paper copies of the *Reflector*.

The ALCon 2015 convention saw more than 170 registrants and over 200 people overall, representing at least 53 member organizations. There were 22 speakers discussing everything from auroral activity on Venus to upcoming transits of Mercury, asteroid photometry and astrometry, optical interferometry, New Mexico's unique relationship with the Sun and night sky, the OSIRIS-Rex asteroid sample return mission, and more. For further details, turn to the ALCon article in this issue.

DEEP-SKY OBJECTS

THE HELIX NEBULA

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

The Helix Nebula (NGC 7293) is a famous planetary nebula noteworthy for being one of the largest and nearest celestial objects of its type. A Hubble Space Telescope composite image of the Helix Nebula appeared as the Astronomy Picture of the Day on May 10, 2003; the image soon thereafter started being referred to as the "Eye of God."

The Helix Nebula resides in the faint zodiacal constellation of Aquarius, 7.75 degrees southwest of the star Skat (Delta Aquarii, magnitude 3.3). One way to star hop to the Helix Nebula is to find the point one-third of the way from Skat to the star Deneb Algiedi (Delta Capricorni, magnitude 2.8) and pan 4.5 degrees to the south. Those are the two stars closest to the nebula brighter than 4th magnitude. The nebula also lies midway between the first-magnitude star Fomalhaut and Iota Aquarii (magnitude 4.3), two stars separated by nearly 20 degrees. Iota Aquarii is five degrees northeast of Deneb Algiedi.

A beautiful remnant of a dying star, NGC 7293 contains a double ring structure not unlike two coils of a spring, which gives rise to its popular name, the "Helix Nebula." A planetary nebula forms when thick stellar layers slowly expand away from a dying red giant star. When the core of such a star contracts into a white dwarf, high-speed stellar winds and ultraviolet light emanate from the white dwarf, colliding with and exciting the expanding gas layers and causing them to glow. The white dwarf at center of the Helix Nebula shines at magnitude 13.4, well within the reach of 12- to 14-inch telescopes.

At magnitude 7.6, the Helix Nebula is the brightest planetary nebula in the sky. The nebula resides a mere 675 ± 25 light-years away. The bright portion of the main nebula spans 18 arcminutes, which means it extends 3.5 light-years across space. The fainter outer halo of the nebula spans 28 arcminutes, roughly the same angular diameter as the Moon!

The large size of the nebula results in a very low surface brightness. For this reason, Charles Messier never spotted the nebula. It was even missed by the keen observers William Herschel and his son John Herschel. NGC 7293's discovery is credited to the German astronomer Karl Ludwig Harding in 1824, twenty years after he discovered the asteroid Juno.

Most planetary nebulae have a bluish-green color at the eyepiece caused by emissions from doubly ionized oxygen. However, due the low surface brightness of the Helix Nebula, this color is not noticeable. Long-exposure color photographs of the nebula show myriad colors from deep red to blue.

The Helix Nebula appears as a faint, featureless, round disk in 50 mm or larger binoculars or small, rich-field refractors. The nebula is best viewed in rich-field 6- to 8-inch telescopes at low magnification. Through an 8-inch telescope, it appears as a slightly elliptical ring with two thick arcs on the northeast and southwest edges and a darker central region. An oxygen-III or ultra-high contrast nebula filter and averted vision will bring out more detail in the nebula's structure. The nebula is more challenging to view in larger telescopes since higher magnifications, as a result of longer focal lengths, spread the light out more, decreasing the apparent surface brightness.

The accompanying images of NGC 7293 were taken through a 190 mm f/5.3 Maksutov–Newtonian telescope with an SBIG ST-2000XCM CCD camera. The exposure was 80 minutes. The top shows the single-shot color camera's processed image. Variations in the color result from hotter regions of the nebula exciting different atomic emissions than cooler regions. Of course, the human eye cannot perceive color from faint sources. The bottom image is same as the top with the color removed to simulate what the nebula looks like when viewed telescopically. Even without color, the Helix Nebula is a fascinating object to study with any size telescope.

DISCOVERING ASTRONOMY:

An Exploratory Series from the Adirondack Public Observatory

Part 3–Planetary Probes

By Lee Gaillard

We landed on the Moon more than 40 years ago. It's only 240,000 miles away. But getting humans to a planet will be much more of a challenge: the energy requirements, the design and engineering issues, not to mention the hundreds of millions of miles and the months in space. In the interim, we've at least begun to acquire some relevant experience—such as time spent working aboard the International Space Station and on external space walks performing maintenance and repair of uncooperative equipment, and the replacement of gyroscopes and cameras on the Hubble Space Telescope. Such activities will clearly provide valuable preparation for the extended journey required by a planetary visit. And perhaps NASA's tentative concept of capturing a small asteroid will provide additional practice and refinement of our skills working in space.

But before we actually *go* there (if budgets permit and technologies develop sufficiently), and before we come up with any strategic plan to answer key questions about our solar system and our place in the larger universe, we first need better basic knowledge about our neighboring planets, nearby stars and galaxies. Baby steps must precede giant leaps.

And if we can't yet get there in person, our surrogates can. Enter the remotely controlled, automated interplanetary probes and their arrays of sensors and Earth-focused transmitters.

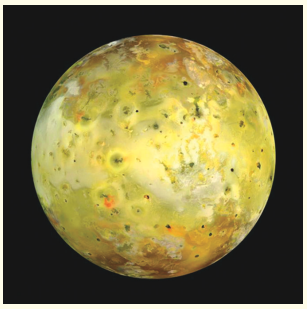
Take a look at the Galileo probe's unprecedented 1998 close-up of asteroid Ida and its tiny moon, Dactyl. (Who would have thought we would see an asteroid *with a moon*?) Or you can watch Io and Europa, moons of fire and ice, orbit over the orange and ochre whorls of Jupiter's bands. The camera shifts to show us Europa, with its arcuate ice ridges, hovering like a veinous eyeball; and from sulfur-yellow Io's Pele volcano, massive gas plumes arc across the black emptiness like blue solar prominences.

Remains of other volcanoes, now dormant or extinct, and their lava flows splotch Venus like lichens. A low-angle shot of Mars reveals layering in a sheet of dry ice hundreds of feet thick—the edge of the north polar ice cap; elsewhere, gullies emerging mid-cliff indicate recent water flow from subsurface aquifers. A color photo of Olympus Mons captures the three-dimensionality of that 75,000-foot Martian volcano, the solar system's highest, as lava flows slump down its slopes in frozen brown swells.

Where on Earth, you ask, will we find such images?

Galileo Galilei felt lucky to discover four of Jupiter's moons with his telescope's one-and-a-half-inch lens. And 300 years later, with his more advanced 24-inch refracting telescope, Percival Lowell thought he saw canals crisscrossing the surface of Mars; he wrote about them in *Mars and Its Canals* early in the 20th century. By the end of that century and in the early years of the 21st, we had come a long way. Unmanned and remotely controlled space probes, launched from Earth across hundreds of millions of miles of interplanetary space, have been returning detailed close-up color photographs of our solar system's planets and moons. This vast flow of information is unprecedented and awe-inspiring; every astronomy textbook was instantly made obsolete.

What did these probes find—and where? Here is a small sampling of how they have expanded our knowledge.



Mercury: Magnetic field indicates a molten core; although it's the closest planet to the searing heat of the Sun, deep craters seem to harbor water ice (United States, Mariner 10, 1974, and Messenger, 2008).

Venus: No longer just the "evening star," a small bright sphere in the darkening night sky, we found instead thick clouds masking its varied topography, part of an atmosphere that blankets the planet with a pressure 90 times that of Earth's at a temperature that would melt lead and zinc (Russia, multiple Venera probes, 1967 and following years). Beneath the clouds lie plains, highlands, and dormant (?) volcanoes pictured in detail (United States, Magellan probe using synthetic aperture radar, 1990–1991).

Mars: Massive extinct volcanoes (Olympus Mons, 75,000 feet high, and others), polar ice caps (frozen carbon dioxide and water ice), dust storms and dust devils, indications of water in earlier times, pock-marked and misshapen moons, an atmosphere primarily of CO_2 at a pressure equivalent to one percent that of Earth, temperatures of –67 °F, the massive Valles Marineris canyon system stretching almost 2,500 miles and in places 30,000 feet deep (United States; Mariner 9, Viking Orbiter, Curiosity; 1971, 1980, 2012).

Jupiter: Massive, 67 moons, not just four; magnetic field lines supporting a flux tube carrying millions of amps of current connecting Jupiter and Io (a unique power-sharing arrangement!); its own auroras and rings, huge storms and powerful lightning discharges and a swirling Red Spot.

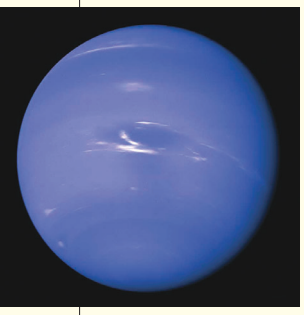
A moon with unusually active volcanoes (Io), another moon covered with ice that encloses what may be water that could sustain life (Europa), the largest moon in the solar system (cratered Ganymede, which sports its own aurora and is larger than Mercury) (United States; Pioneer 10, Voyager 1, Galileo, Cassini, New Horizons; 1973, 1979, 2000, 2007).

Saturn: The first clear delineation of its rings' structure, discovery of its auroras, sightings of more moons (totaling now at least 62). A strong magnetic field, winds of 1,100 miles per hour at temperatures of –185 °C. The Huygens probe landed on its massive moon Titan (larger than the planet Mercury) and found a primarily nitrogen atmosphere (with two percent methane) that is 50 percent denser than Earth's (United States and ESA, Cassini probe and Huygens lander, 2005). Voyager 1, launched in 1977, had discovered three of its moons and is

now the most distant man-made object in space, having coasted beyond the influence of the solar wind and to the verge of interstellar space.

Uranus: Tilted at 97.8 degrees to the orbital plane of the solar system, possessing 27 moons, 10 of them discovered during Voyager 2's 1986 flyby; winds howling around the planet at 560 miles per hour. It, too, has auroras and 13 narrow rings (United States; Voyager 2, HST; 1986, 2005).

Neptune: A large light-blue planet roughly 30 times farther from the Sun than Earth is, with 13 known moons (6 discovered by Voyager 2 in 1989), a magnetic field, rings, auroras, huge storms and winds that swirl around its circumference at hundreds of miles per hour (United States, Voyager 2, 1989). On its moon Triton, geysers spew nitrogen gas and black material.



Human-friendly places to visit? Not really.

Nonetheless, we now have clear photos of them all, filtered images beamed back to Earth so we could reconstitute them in full color, sights never seen before from Earth. Beautiful. Suddenly we are *there*, our horizon expanded far beyond what we ever thought possible. Then add a robotic, unmanned asteroid visit with soil sampling and return to Earth: in 2003, Japan launched Hayabusa, which rendezvoused with asteroid Itokawa in September 2005. Landing on the asteroid, it collected samples of surface material and returned them to Earth in June 2010. An incredible technological achievement.

Why study astronomy? It takes us to the most exciting frontier around.

This concludes the 3-part series.

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

By Mike Stewart, Astronomical League Historian

September 1965

Floyd L. Shirey Memorial Fund


REFLECTOR

OFFICIAL PUBLICATION of the ASTRONOMICAL LEAGUE

SPACE SCIENCE AND TRAGEDY AT MILWAUKEE

Reported by William DeVall

FLOYD L. SHIREY MEMORIAL FUND

Following the accidental death of Floyd L. Shirey during the League Convention in Milwaukee, it was unanimously agreed that a Floyd L. Shirey Memorial Fund would be established. The purpose of this Fund is to aid a worthy student of astronomy, at the Yerkes Observatory. The idea was so well received that immediate contributions were made by delegates at the convention. Within a few days the first society, Southern Cross Astronomical League, Inc., Miami, Fla., made a very generous contribution. A motion was made at the Convention that member societies and regions of the Astronomical League be made aware of this action.

A tragic accident took Mr. Shirey's life during a field trip to the Yerkes Observatory. The Memorial Fund lives on in the form of the Astronomical League Trust Fund. The League's Council established the Trust Fund at the 1970 Convention. A Board of Trustees now administers the Fund, following procedures agreed to in 1989.

August 1990

Another Comet Levy!


REFLECTOR

The Astronomical League Newsletter

High Spirits Prevail at Texas Star Party

Another Comet Levy!

COMET LEVY (1990c)

One of the highlights of this year's Texas Star Party was a chance to be involved in the excitement of a new cometary discovery. Renowned comet hunter David Levy had spotted a 10th magnitude candidate in the Great Square of Pegasus the morning before leaving his Tucson home for the TSP. He confirmed his find Monday morning from the Prude Ranch, and the next day everyone knew!

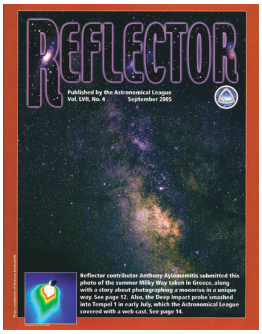
At first it appeared that the comet was already fading, but it soon became obvious that the new Comet Levy (1990c) was still approaching the inner solar system and would only get better.

The latest information, from IAU Circular 5030, shows that the comet will most likely be a naked eye object later this year. Of course Comet Austin has reminded us how fickle comets can be, but other circumstances look very encouraging.

David Levy discovered 1990c on May 20, 1990. The comet was later redesignated C/1990 K1. As noted in the previous Reflector, *comets defy predictions regarding magnitude. This comet became visible to the naked eye, reaching magnitude 3. Bob Shirriff of the Birmingham [Alabama] Astronomical Society wrote the article that appeared in the August 1990 issue.*

September 2005

Mount Graham Astronomy Day 2005



Mount Graham Astronomy Day 2005 was a huge success with about 250 in attendance. The Desert Skygazers Astronomy Club hosted the event at Discovery Park in Safford, Arizona.

Many people from the community helped out to make the day a success. The Boy Scouts parked cars, Eastern Arizona College students helped out with solar viewing and rocket launching, and teachers from Discovery Plus Academy and the Discovery Astros Junior Club assisted in building games. The Lions Club kept us well nourished, and the local police department guarded our feature attraction—Moon rocks. The Moon rocks were from the Apollo 15, 16, and 17 landing sites. Participants were given the unique opportunity to not only look at these rocks but to hold the case that they were in and observe all sides of the rocks.

The Desert Skygazers Astronomy Club hosted this wide-ranging event in April 2005, featuring displays, hands-on activities, observing, and speakers. Astronomy Day originated in 1973 and took place traditionally in the spring, either April or May. Today, Astronomy Day has grown into a twice yearly outreach—April and September—promoting awareness of amateur astronomy and the universe. Has your club made plans to host an Astronomy Day event this September?

A WHOLE N

I can show you the shimmering,

—Alan Menke

Photos compliments of NASA

We are celebrating the 25th anniversary of humanity's most productive instrument of astronomical discovery, the **Hubble Space Telescope** (HST). In a quarter century of operation it has returned over one million images, spawned 10,000 professional papers, and prompted countless articles inspiring people from every corner of one of the few places it hasn't looked. As a species, we've been awakened to wonders few imagined just a generation ago. As this milestone passes, there will be many tributes, but this story is about the sliver of Hubble's glory I've been privileged to see.

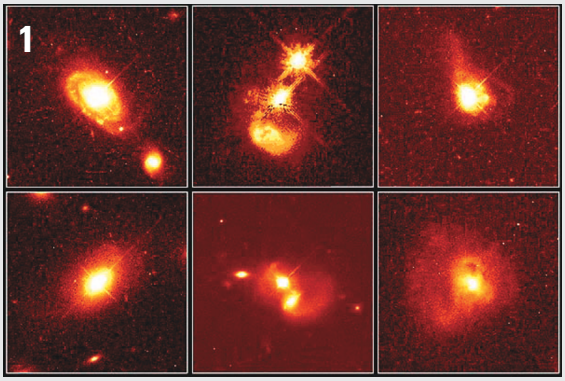
Since the introduction of mass media, it is likely every generation since the Renaissance has felt a privileged place in the history of discovery. But it may be argued that no instrument since Galileo's first use of the telescope to look heavenward has affected our understanding and appreciation for the intricacy of the Universe more than Hubble. In the city that would become Sibiu in central Romania, a young boy in the early twentieth century was enthralled by flights of fancy in Jules Verne's space fiction. Rereading to the point of near memorization, Hermann Oberth would use this inspiration two decades later to propose placing a telescope in space. Oberth, Robert Goddard, and Konstantin Tsiolkovsky are credited as independent "fathers of modern rocketry," with Wernher von Braun lauding Oberth as "the guiding star of my life." Lyman Spitzer published an article in 1946 describing the optical advantages of a space-based instrument, but it took technological and economic forces more than twenty years to engage resources that led to a telescope placed above the limiting atmosphere of our planet. Delayed by budgetary constraints and the loss of the Space Shuttle Challenger, Hubble was launched on April 24, 1990, soon revealing unprecedented detail and discovery.

One of the Hubble's early tasks was imaging the galaxies presumed to **host quasars (1)**. Ground-based instruments were unable to see the faint "quasar fuzz" thought to surround brilliant emanations projected toward us from their active nuclei. Given the resolution of a space-based instrument, Hubble successfully imaged many of these galaxies in the mid-1990s. They inspired me to attempt to observe them using my 25-inch reflector from the Texas Star Party and my home in Minnesota, and I was able to spot several of their host galaxies, including PHL 909 and PG 1012+008.

One of the most familiar images from Hubble in the mid-1990s was the Eagle Nebula, M16, in Serpens, with its "Pillars of Creation." The edges of this nebula are backlit with glow from newborn stars, and detail in the pillars could be discerned in my large reflector. In 1993, Comet Shoemaker–Levy 9 was found to have an orbit intersecting Jupiter, and Hubble imaged the comet breaking into many small fragments one year before it impacted our solar system's largest planet. I recall the "string of pearls" seen in my 25-inch reflector when the comet rounded Jupiter too closely that spring, and the giant planet's scars following July 1994's fireworks.

In the waning days of 1995, HST stared continuously for ten days at a small speck of sky, only a few arcminutes wide, near the handle of the Big Dipper. No one knew what to expect from this gamble of valuable telescope time on a previously vacant area. It could have been a big flop, showing nothing. Instead, this image—the **Hubble Deep Field (2)**—became one of the most iconic images of the sky ever taken. Three thousand galaxies were seen to distances over 10 billion light-years, implying 100 billion galaxies containing ten *sextillion* stars strewn across the whole sky. Hundreds of papers were generated from this study, and follow-up images of this small piece of sky found new, distant supernovae. I observed this field in the spring of 1996 with my 25-inch reflector from the Texas Star Party and made a drawing for later reference. It took over a year to find other images that allowed me to correlate two objects in the Hubble Deep Field with my drawing. Since then I have used other telescopes twice to spot even more galaxies in this amazing field. In 2003, HST was used to explore the southern sky in Fornax with an even deeper image lasting one million seconds. Two galaxies and three stars in that image were visible from western Oklahoma in my 32-inch reflector in 2006.

One of the standard distance markers for measuring the Universe is a Type Ia supernova, where a white dwarf is part of a binary system and material from a nearby companion star accumulates on the white dwarf's surface. Theory predicts this situation will have a violent end: the complete destruction of the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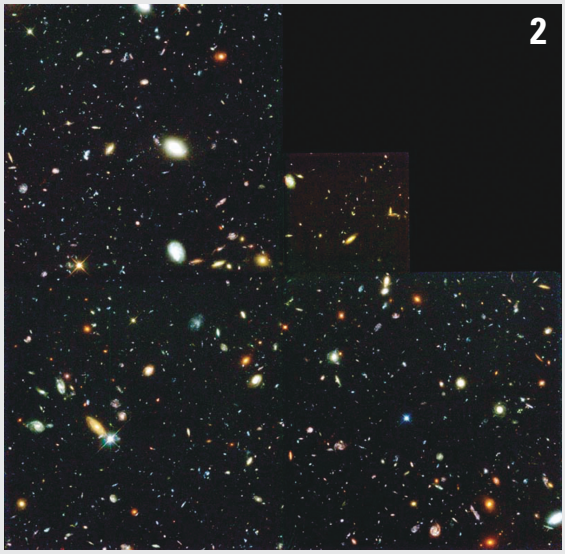
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3

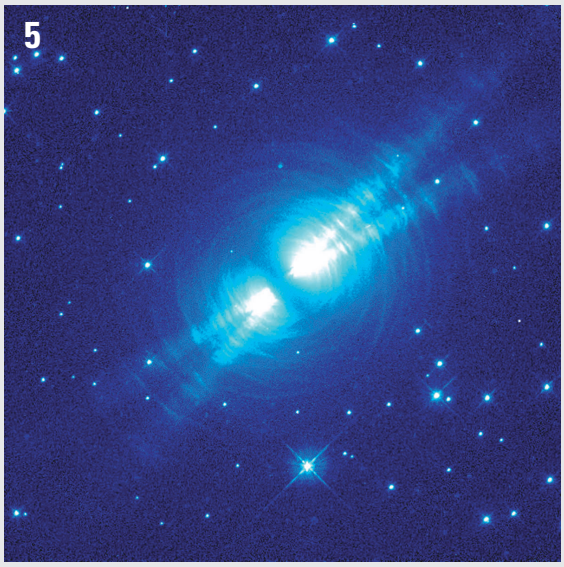
NEW WORLD

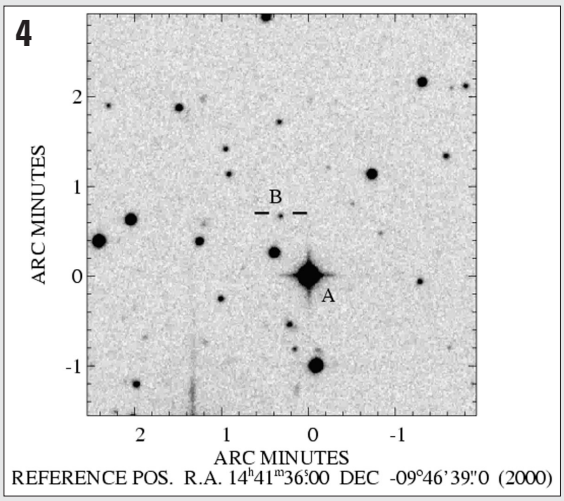
e world... shining, splendid...

and Tim Rice
and The Hubble Heritage Team

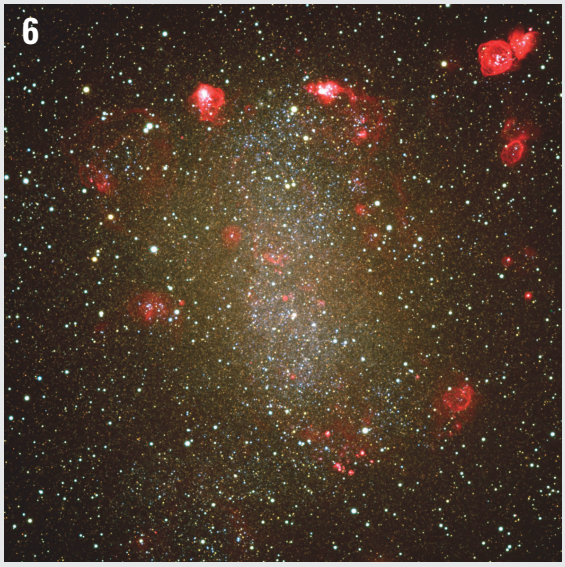
white dwarf if it reaches 1.4 solar masses. At this mass, the quantum pressure of electron degeneracy can no longer resist gravitational contraction, and the star is destroyed as runaway nuclear fusion creates a supernova. Since these stars all have the same mass, their light curves are predictable, allowing distance measurements based on their apparent brightnesses. As it studied these cosmic beacons, what Hubble and other telescopes found in 1998 was remarkable: the Universe is not only expanding, but doing so at an ever-increasing rate, powered by an unknown force termed dark energy. This mysterious force accounts for two thirds of the energy found in the Universe. These supernovae are too distant for visual observation, but Hubble was able to image the aftermath of a much nearer event.

In 1993, a hydrogen-poor star with a massive companion exploded in the nearby galaxy M81. Known as supernova 1993J, it was the closest known example of a rare Type IIb supernova—the violent explosion of a very hot, massive, Wolf–Rayet star, providing astronomers access to data unavailable at greater distances. Hubble has imaged supernova 1993J's remnant, and even its light echoes, similar to those of last decade's **V838 Monocerotis (3)** and the centuries-old Cassiopeia A supernova of 1680 and Tycho's supernova of 1572. Bouncing off previously extruded outer layers, these optical reverberations carry enough information to allow spectroscopic study of the historic events. Infrared echoes from Cassiopeia A have shown this Milky Way supernova remnant to be Type IIb. In 2008, a team using the Subaru telescope used this type of data to peg Tycho's supernova as Type Ia. Think of visiting Tombstone, Arizona, and reconstructing its famous gunfight from sonorous echoes. Using my large reflectors, I was able to observe these three supernovae remnants (*sans* light echoes), and the complex structure of V838 Monocerotis.





Closer to home, the search for what was termed "missing matter" focused in the 1990s and early 2000s on substellar bodies called brown dwarfs—objects with masses between those of planets and the smallest stars. Brown dwarfs were not massive enough to produce conditions in their cores sufficient to begin fusing hydrogen into helium, and they glow with the gravitational energy of their formation. I followed this story with fascination after their confirmed discovery in 1994, and waited a decade for their census to reveal a candidate visible using my instruments. In the spring of 2006, on the night after celebrating what Frank Sinatra termed "the halfway mark," I used my newly acquired 32-inch reflector from my home to spot **DENIS J1441-0945 (4)**, an estimated magnitude 20.5 speck in northwestern Libra. Barely visible on the POSS II red plate, Hubble split this binary brown dwarf, 34 parsecs from us, into components totaling 0.072 solar masses, revealing an orbital period of 118 years and a semimajor axis of 14.1 astronomical units.



Planetary nebulae are some of the most beautiful objects in the sky. Marking the death throes of medium-sized stars, their glowing outer layers are light-years wide and come in an astounding variety of detail affected by factors including the surrounding interstellar material, magnetic fields and binary companions. Prior to Hubble, telescopic observers often did not have images and information to appreciate their intricate structures. Now, using large reflectors under dark skies, reference images, and filters to improve contrast, the subtle outer layers, jets, and twisted cambers of their inner cores are fair game. The shells and jets of the **Egg Nebula (5)** and the sericeous outer layers of the Helix Nebula are examples of what are visible under excellent conditions.

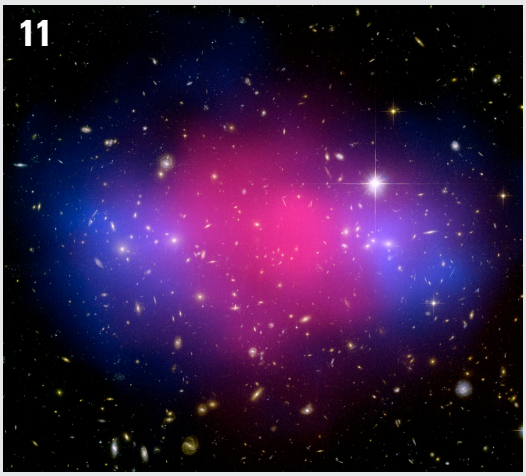
Hubble has given new opportunities to those interested in observing detail within galaxies of the Local Group and beyond. The **irregular galaxy NGC 6822 (6)** in Sagittarius is over 1.5 million light-years from us, and, with the help of Hubble's data and images, I spotted a supernova remnant, globular cluster, and planetary nebula within its confines. The interacting spiral galaxies known as the **Antennae**, **NGC 4038** and **4039; see next page (7)**, have been beautifully imaged by HST. Massive young clusters in their central maelstrom that are destined to form large, new globular clusters, and tidal dwarf galaxies that grace the long arms drawn out by their gravitational interaction, can be seen in large reflectors, using articles from professional journals and Hubble

imaging as references. **Stephan's Quintet (8)** is a group of galaxies four to five times more distant than the Antennae, about 280 million light-years from Earth. In the 1990s, studies showed tidal dwarf galaxies forming among the complex last tango in pairs between its four galaxies. Over two dozen of these

tidal galaxies, what have been termed the youngest in the Universe, were identified by Sally Hunsberger of Penn State in this group, also known as Arp 319. Using Hubble imaging, five of its tidal dwarfs with magnitudes between 18.1 and 19.5 were visible using my 32-inch reflector.

Perhaps the most visually striking and physically interesting phenomena imaged in the last few decades are those involving **gravitational lensing (9)**. The deep gravity wells of supermassive black holes and large galaxy clusters possess great amounts of dark matter. Their mass causes light from distant objects behind them to be bent to produce multiple point images for quasars, or longer, drawn out arcs for galaxies. Hubble displays these details with unprecedented clarity and gives observers the opportunity to attempt their visual recovery. One of the best examples is the quintuply split quasar three billion light-years behind SDSS

J1004+4112, a dense galaxy cluster seven billion light-years away. Images by Hubble show not only the multiple quasar images, but numerous lensed background galaxies. The data suggest this cluster contains over sixty trillion solar masses, and I was able to see two of its quasar images using my 25-inch telescope in 2005. I pursued seeing a lensed arc imaged by HST in one of these massive clusters for over a decade before spotting in 2008 the redshift-1 Wolf–Rayet galaxy located behind the **galaxy cluster Abell 2667 (10)**.



The **dark matter backbone (11)** of galaxy clusters is thought to be distributed in a weblike array that fills the Universe. Teasing out its qualities has been challenging, as it emits no light and interacts only through gravity. One of the best tools to study it is collisions between large galaxy clusters, where "normal" matter interacts to heat intracluster gas to millions of degrees, producing X-rays visible to the Chandra X-ray Observatory. Astronomers use a technique called weak lensing to study the distribution of dark matter within this environment, through how it subtly distorts the shape and orientation of background galaxies. The interacting clusters of MACS J0025.4-1222 in western Cetus provide a near ideal setting for this type of investigation. At a redshift of 0.586 and a distance of 5.6 billion light-years, detail within this cluster was challenging to see even in my 32-inch reflector. From the dark skies of the Okie–Tex Star Party, I was able to spot nine of its galaxies in 2008.

As I reflect, it is apparent the end is in sight for both Hubble and my career. We've shared a number of things, including a birthday, corrected optics, and a desire to view magnificent celestial wonders. Though Hubble will be decommissioned in a few years and gently nudged toward a fiery end, I wish to avoid that last fate and find time for observations where, as a lad on a magic carpet ride, surprise and discovery await.

In the deepest field
Humble boson
You warrant a noble cervus
For your ten sextillionth part

—Dave Tosteson,
Chisago City, Minnesota
djtost1@gmail.com

POTENTIALLY HAZARDOUS ASTEROID 1620 GEOGRAPHOS

By Steven Bellavia, Mattituck, New York

I was all set up to view and image the near-Earth object (NEO) 2004 BL_{86} for its close encounter on the evening of January 26, 2015, but we had a blizzard that night (winter storm "Juno"). I was disappointed, to say the least.

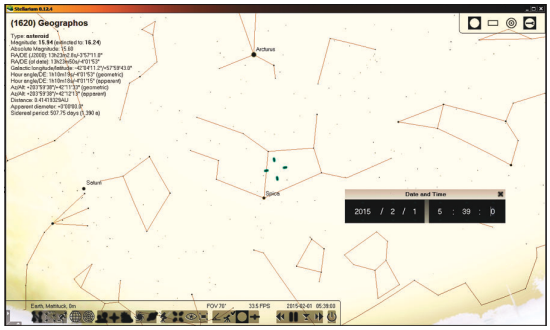
Since it was snowing out, and I still had electrical power and Internet access at home, I started to search for "the next one." I stumbled upon 1620 Geographos on NASA/JPL's NEO close approach tables, where you can search by date, distance, and magnitude: *neo.jpl.nasa.gov/ca*. Later I also found the observing aid program from the Minor Planet Center (MPC): *www.minorplanetcenter.net/cgi-bin/neaobs.cgi*.

6-inch astrograph on a non-computerized Celestron CGEM mount

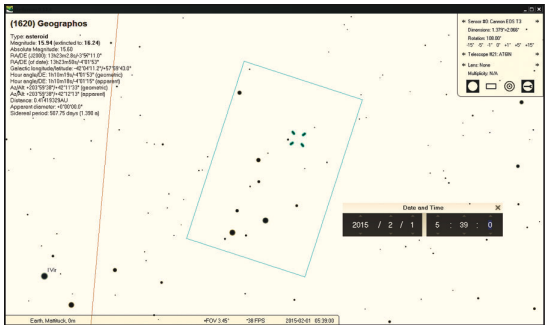
On the first clear night after the storm, January 31, Geographos would be in Virgo, rising before midnight. But a nearly full moon would be up most of the night, more than two feet of snow covered the ground, there was a light wind, and it was 14 degrees outside.

But that wasn't the real challenge. According to Stellarium, NASA/JPL, and MPC, Geographos would be around magnitude 16—no comparison to 2004 BL_{86} at magnitude 8.

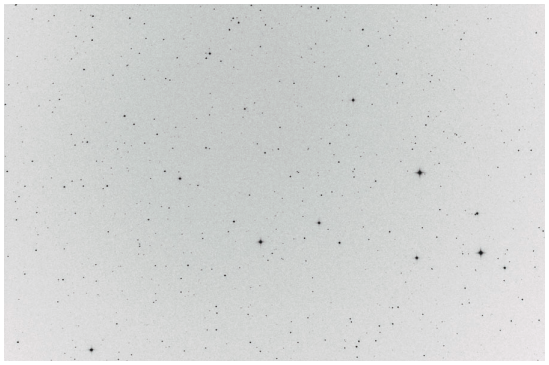
I wasn't sure how faint my little 6-inch f/4 Newtonian and camera would go, and since this asteroid is moving relatively fast, I didn't think stacking exposures was a good option (though there is a "freeze" option in Deep Sky Stacker, intended for comets, that might have worked).



Stellarium view of Geographos in Virgo on February 1, 2015



Stellarium camera view of Geographos



"Raw" full-field (uncropped) photo of the area containing Geographos, 60-second exposure, ISO 6400

Despite the daunting task ahead, I wanted to image a fast-moving asteroid. So I made a chart using Stellarium showing what the field of view would be in my camera with the 6-inch astrograph.

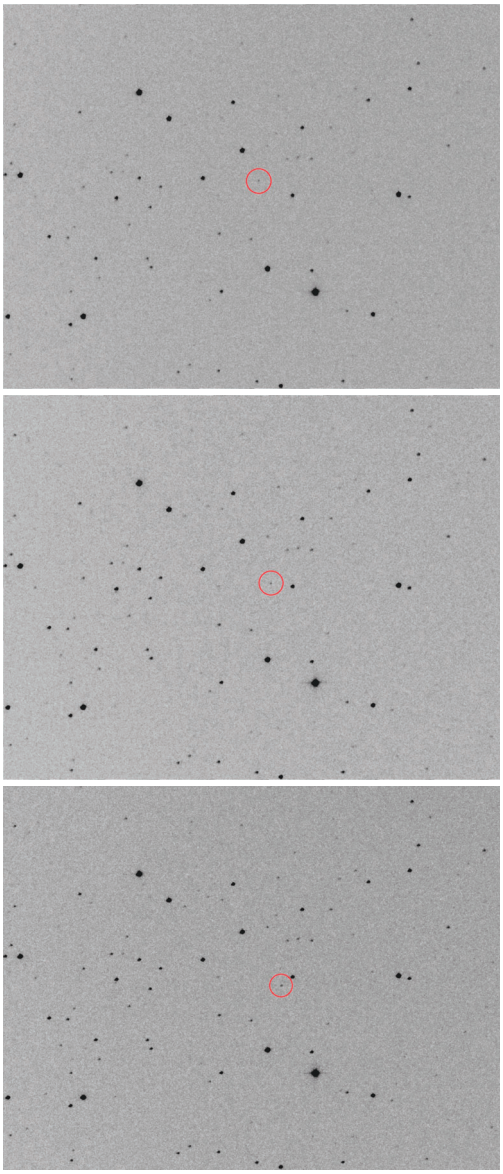
Since my mount is non-computerized (non go-to), my strategy was to locate a recognizable star pattern in the camera's LCD window, take many shots for as long as I could, and then go home and search for the faint little dot, moving among the stars.

After performing a careful collimation, focus, and drift alignment, I tried some shots to see what I was getting. But the moonlight was so overpowering that I could not take long exposures. Most of my shots were 60 to 90 seconds at ISO 3200 and ISO 6400; anything more was washed out.

I imaged from about 2:00 a.m. until 5:45 a.m., when the Sun's light started to fill the sky. I had no idea if I'd gotten the asteroid or not. I went home and started to look over my shots, and I found it! Only images after moonset—4:45 a.m. or so—had it. It was extremely faint, but it was definitely it.

I then used Deep Sky Stacker (version 3.3.4) to register and calibrate the mixed-ISO and mixed-exposure photos, and chose the option to write out the registered and calibrated files while stacking. (I did not use the final stacked image, as I only wanted aligned and cropped frames for creating a time-lapse video of the asteroid's motion. I used a cropping factor of 3x).

Three photos below: The faint asteroid Geographos, indicated by a red circle, over a 50-minute period



What follows are 3 frames showing Geographos over 50 minutes on the morning of February 1, 2015, from 4:49 to 5:39 a.m. EST. A red circle indicates its position.

I would have preferred to have imaged its motion over several hours, so that my uncropped photos would have shown it moving across most of the field. But I am glad I found it at all. And its motion in less than an hour is impressive for any celestial object.

Geographos got slightly brighter on its closest approach in March (magnitude 15.6). But at that point it was close to the horizon, with very little time to image before sunrise. It had a bright moon nearby for about half of February as well, so I think I got it at the best time I could.

I am not sure if I have ever imaged anything so faint, but this was my most exciting venture so far.

By Berton Stevens/Photography by Dale Taylor

ALCon 2015 Las Cruces

The Astronomical League Convention (ALCon 2015) came to Las Cruces, New Mexico, at the beginning of July. ALCon brought together amateur and professional astronomers from all over the country to enjoy learning about the latest developments in the science of astronomy. ALCon was sponsored by the Astronomical League (*www.astroleague.org*), the Association of Lunar and Planetary Observers (*www.alpo-astronomy.org*), and the Astronomical Society of Las Cruces (*www.aslc-nm.org*).

The convention was held at the beautiful and historic Hotel Encanto de Las Cruces overlooking the Mesilla Valley. The hotel was designed to reflect the Spanish and Mexican Colonial historic architecture of the southwest. The artwork at the hotel also reflects these styles.

The six-day convention started with some very exciting tours on Monday and Tuesday, July 6 and 7. There were two tours on Monday, one to the Very Large Array (VLA) and one to the New Mexico Museum of Space History in Alamogordo. Both tours left early in the morning for their destinations.

The first stop on the VLA tour was a visit to the Magdalena Astronomical Society's classic telescope collection at the CWB Art Gallery. Michael Mideke told the group about the telescopes on display at the gallery. He also talked about the restoration process underway on some of the instruments. It was then on to the VLA.

The Karl G. Jansky Very Large Array is situated on the Plains of San Agustin about sixty miles west of Socorro, New Mexico. The VLA is surrounded by mountains that help protect the array from man-made radio interference. The area is sparsely populated, also reducing the potential interference.

Karl Jansky was a radio engineer and physicist. He was an early radio astronomer who discovered the radio emissions from the Milky Way. In 2012, the VLA was renamed in his honor. By the time the bus arrived at the VLA, the group was ready for the lunch that Lorenzo's Italian restaurant had packed for the group. After lunch, the group toured the visitor's center and visited the Array Operations Center for the VLA and the Very Long Baseline Interferometer. Some of the staff thought that Jodi Foster sitting on the hood of a car listening to signals from the VLA in the movie *Contact* was comical, since all the signals are digital and there is nothing for anyone to hear.

The group also had an opportunity to see one of the 27 antennas up close. Each antenna is 82 feet in diameter and is moved on a special lifting locomotive called "Hein's Trein" that can take the antenna anywhere on the 13-mile legs of the Y-shaped rail system. The group also visited the antenna repair building. The tour returned to Las Cruces after dinner at the historic Owl Café in San Antonio, New Mexico.

Meanwhile, the other tour traveled to the New Mexico Museum of Space History in Alamogordo, New Mexico. The museum preserves and displays some of the equipment previously used at the White Sands Missile Range. The first stop was the Museum Service Center. This facility houses many of the artifacts that were not on display in the museum. Museum curator Sue Taylor showed the group some amazing pieces of technology and talked about how they were used on the range. In addition there were numerous pieces previously flown on earlier NASA missions, as well as a

Wednesday's meet-and-greet was well a

View of the Hotel Encanto, venue for ALCon 2015

Display of classic telescopes and equipment at the CWB Art Gallery in Magdalena, New Mexico

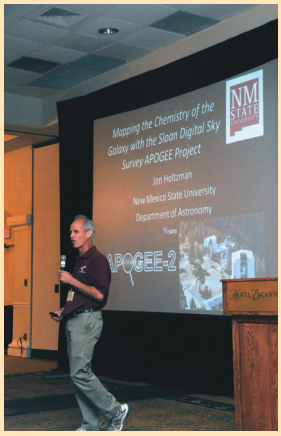
Tour group at Karl G. Jansky Very Large Array radio observatory

ttended

Carroll Iorg, John Goss, and Terry Mann (current and two past presidents)

Thursday night star party included entertainment by a group of fire dancers.

Guzauskas talking
t dark skies



Jon Holtzman discussing the APOGEE project

Dolores Hill presenting the OSIRIS-REx mission

Dr. Candace Gray from NMSU describing her research of auroral activity on Venus

eparate vendor room had a continuous traffic flow

There was plenty of great food at the Friday night Star-B-Que at Leasburg Dam State Park, Radium Springs,New Mexico.

50s 3-D glasses

3-D progress from 1950 to 2015?

Manned Maneuvering Unit (MMU) used to train Shuttle astronauts.

John Briggs also told the group about the efforts to refurbish a 0.95-meter telescope.

The group then traveled on to the museum proper where they enjoyed their pre-packed lunches. Dave Dooling, the education director, discussed the museum's overall philosophy and did an alien autopsy demonstration. Next, Dave and Sue led the group on a tour of the museum.

Robert Goddard, the Father of American Rocketry, conducted many of his early rocketry experiments in New Mexico; the museum exhibits detailed the history of rocketry starting with his work through to the modern age. Scale models of many different rockets provided a visual comparison of the advancements in rocketry. Another exhibit simulated the vibration and noise of several different launch vehicles. If you closed your eyes, you almost felt that you were present at the launch of the Space Shuttle.

The museum is built on the east flank of the Tularosa Basin and provided a beautiful view of the basin, the white gypsum sands of White Sands National Monument, and much of White Sands Missile Range. Another exhibit displayed a number of items taken into space on the Space Shuttle.

The tour next went to the IMAX theatre where the documentary *The Land of Space and Time* was screened. This locally produced movie detailed the developing space program at the White Sands Missile Range. After the movie, the group returned to Las Cruces.

That evening, there was a star party at a local company, EMI Technologies, owned by one of the ALCon staff members. There were clouds in the area, but there were still enough holes to view some parts of the evening sky, including Venus and Jupiter, still close together after their recent conjunction.

Tuesday's tour was to the White Sands Missile Range. The first stop was the White Sands Missile Museum. In the Museum building there was an interesting selection of artifacts from the Missile Range. These included fascinating examples of technology from the 1940s and 1950s, including manual switch-boards, launch consoles, and other

equipment. There were also small rockets and displays of objects recovered from the range.

The museum also had pictures of various events on the range, and a whole room on the Trinity test, the first atomic bomb explosion. The bomb was developed in northern New Mexico at Los Alamos and was transported to the Trinity site at the northern end of the range. There the bomb was assembled and detonated, destroying the tower it was on, except for the very bottom of the support legs. It also turned the desert sand into a radioactive green glass called trinitite.

A V-2 rocket that had been sitting outside for many years was housed in a separate building to protect it from the desert sun, storms and wind. You could walk the length of the V-2 and look at it in detail.

The museum told the story of how the White Sands Missile Range was created after World War II, when captured German V-2 rocket parts and German rocket scientists were brought to the White Sands Proving Grounds. The Germans' rocket development had outstripped America's almost non-existent efforts and American scientists wanted to know what the Germans had developed.

Many V-2 rockets (renamed A-2) were test-fired at White Sands. The United States continued to develop its own rockets as well, including the WAC Corporal sounding rocket. On February 24, 1949, a WAC Corporal sounding rocket mounted on top of a Bumper (V-2) rocket was launched—the first launch of a two-stage rocket. The WAC Corporal reached an altitude of over 250 miles, traveling at 5,150 miles per hour, making it the first flight to travel more than five times the speed of sound.

Intercontinental ballistic missiles (ICBMs) cannot be launched from White Sands, since their first stage would fall on land and could cause damage to life and property east of the range. Large ICBM launches moved east to Cape Canaveral, Florida, so the first stages could fall into the ocean. This left White Sands to testing smaller missiles and other munitions.

Other milestones at White Sands include Project Manhigh, which took men to the 100,000-foot level in a balloon-lifted gondola from which they would jump out and parachute to Earth to help develop escape systems for manned spacecraft. Another milestone was reached on the ground, where a rocket sled test track was built and in December 1954, Colonel John P. Stapp rode a rocket sled to 632 miles per hour (a land speed record) and experienced 46.2 Gs as the sled decelerated as part of a deceleration test.

Right outside the V-2 building was the Missile Park. Here inert samples of many of the missiles and aircraft tested at White Sands were on display. Nike Ajax and Nike Hercules, the anti-aircraft missiles that surrounded many American cities during the 1950s and 1960s, were also on display. There was even a Patriot missile battery, another example of the munitions tested on the Range.

The tour group had lunch at the Frontier Club on base and then headed to Launch Complex 33 where the V-2 missile tests were conducted. This site, previously called Army Launch Area Number One, includes a blockhouse to protect workers from any incidents that may occur while they were launching one of the missiles. A large gantry crane could lift rockets up to 54 feet high into the vertical position for launch. It also provided some protection from high winds. There was also a V-2 rocket on display at this historic site.

The group then traveled on to Launch Complex 36. Here, NASA launches its Black Brant sounding rockets. These missiles can reach altitudes of 250 miles. NASA's launches from this site most recently have been to observe the Sun from beyond the Earth's atmosphere. These launches are clearly visible from Las Cruces and Alamogordo if you are looking in the right direction at the right time.

After examining the launch site, the group then returned to the hotel. There had been a star party scheduled for the evening, but clouds from the local monsoon weather covered the sky and the star party was cancelled.

Wednesday was the Astronomical League's council meeting. While the council met, other convention-goers visited the areas around Las Cruces, including some of the local museums, natural preserves, and national monuments.

Early Wednesday evening, there was a meet-and-greet in the Hospitality Suite at the hotel. This informal

Lots of people attended the festivities on Friday evening (photo: Cristina Lugo).

The Master Observer Award winners with their new plaques

Ron Kramer, ALCon 2015 chair and editor of the Reflector *receiving the G. R. Wright Service Award from Bill Bogardus*

Las Vegas lounge singer Daniel Park entertained the group at the Star-B-Que.

Here is a group shot of the ALCon 2015 attendees.

Theodora Mautz is presented her NYAA First Place Award plaque by Bill Bogardus and Scott Roberts (of Explore Scientific)

Above: Sydney Marler being presented her NYAA Second Place Award plaque by Bill Bogardus and Scott Roberts

Left: Dr. Pat Hynes offering her keynote presentation, Everything But Astronomy: How We Keep the Public Looking Up

The "Cast of Characters," better known as the ALCon 2015 committee (clockwise from top left: Bert Stevens, Frank Fiore, Joe Alvarez, Jim Fox, Tony Levatino, Daniel Giron, Ron Kramer, Robert Westbrook, Cristina Lugo, Judy Kile, Ed Montes, Mary Alba, Janet Stevens)

gathering enabled attendees to chit-chat, enjoy refreshments, find old friends and make new acquaintances.

The star party scheduled for Wednesday night went on even though there were still clouds in the sky. Members of the Astronomical Society of Las Cruces and other local amateur astronomers pointed their telescopes at the sky for convention-goers to look through. A number of the guests also brought their own telescopes and there was plenty of time to look at the heavens.

Thursday saw the beginning of the papers sessions that would run for the next three days. While the papers sessions went on for the astronomically minded, ALCon also provided the opportunity for less-interested partners to visit several Las Cruces attractions.

On Thursday there was a special tour to the New Mexico Farm and Ranch Museum conducted by one of the ALCon staff members. Friday took them to historic Old Mesilla where small stores surrounding the plaza sell unique gifts and jewelry. The Double Eagle restaurant provided a tour of its historic areas, including the room where the famous ghost of a young woman is said to appear. Saturday they were off to the best farmer's market in New Mexico in downtown Las Cruces, where they could also visit the Las Cruces' museums.

Back in the San Andreas Ballroom, the attendees were welcomed by representatives of the convention sponsors. John Goss, president of the Astronomical League, welcomed everyone to the convention, followed by Carroll Iorg, the ALCon chair. The Association of Lunar and Planetary Observers (ALPO) was represented by executive secretary Matthew Will and the Astronomical Society of Las Cruces's president, Daniel Giron gave a few welcoming words. Finally, convention chair Ron Kramer gave his welcome. After the welcoming, the papers began in earnest.

If there was a theme for the day, it was asteroids. Three talks dealt with these minor planets, most of which circle the Sun between the orbits of Mars and Jupiter. The first asteroid talk was presented by Fred Pilcher of ALPO, who discussed observing these tiny objects with a CCD camera to measure their changing brightnesses as they tumble through space. A telescope usually targets one asteroid all night, taking images of the asteroid and the surrounding star field. The images are then reduced to provide magnitude measurements to make light curves.

The second asteroid talk focused not on asteroids' brightnesses, but their positions. The program at the Desert Moon Observatory in Las Cruces, New Mexico, presented by co-director Bert Stevens, focuses on those asteroids that come near the Earth (near-Earth objects or NEOs) and gets their positions to help improve our knowledge of their orbit. This allows astronomers to make better predictions of whether a particular asteroid could impact the Earth in the future.

The last asteroid talk highlighted the OSIRIS-REx asteroid sample return mission. Dolores Hill from the University of Arizona's Lunar and Planetary Laboratory told us how this mission will travel to an asteroid that comes near the Earth, pick up a sample from the surface, and then return that sample to Earth. This will give scientists an opportunity to directly examine the surface of an asteroid without having to visit it themselves. The results will help us understand the composition of these objects and formulate a plan to divert them should one of them be heading toward the Earth.

In other talks, Bob Guzauskas, president of Lights Out America! focused on keeping the skies dark. In addition to the lighting industry's "better fixtures" strategy, Lights Out America! advocates purchasing brief media ads asking people to turn outdoor lights off at night in America like they already do in France.

Richard Schmude, a member of ALPO and a professor of chemistry at Gordon State College, told the group about measuring the infrared brightness of Venus with an SSP-4 photometer. He uses filters to transform the measurements to the J and H system (near infrared).

Jon Holtzman, professor and department head at New Mexico State University, described the chemistry of the Milky Way galaxy as mapped with the near-infrared spectra of hundreds of thousands of stars. The Apache Point Observatory Galactic Evolution Experiment (APOGEE) project is recording these spectra with the Sloan Digital Sky Survey just a hundred miles to the east of the convention site. The end result will help us understand the evolution of the galaxy.

Thursday night's star party featured some very unusual entertainment. Odd Lab, a fire dancing company, put on a show at the star party location. They twirled fire, spun fire, and drew patterns in the fire as they danced across the parking lot. The darkening sky allowed each member of the troupe to handle fire in a slightly different way. Some twirled flaming batons, while others performed with burning hula hoops. There was even fire breathing! It was perhaps the most unique entertainment ever seen at a star party.

A vendor room with displays from Explore Scientific, New Mexico Skies, Celestron, International Dark-Sky Association and many others was available. There was brisk activity at the vendors during the convention.

Visitors from Roswell asked to be "taken to our leader," so we gave them John Goss.

On Friday, while the papers session was getting started in the San Andreas Ballroom, Aaron Clevenson chaired a discussion amongst several Astronomical League observing award program coordinators. Observing Awards allow Astronomical League members to structure their telescope time to observe specific target objects and eventually qualify to receive observing awards when they have completed the requirements of particular programs. After receiving awards for ten of these programs, the observer qualifies to receive the Master Observer award.

Back in the Ballroom, Friday's speakers were more eclectic, but just as interesting. Mike Reynolds, ALPO member and professor of astronomy at Florida State College, discussed the upcoming 2017 total solar eclipse that will be visible in the United States and the best ways to observe it. Another observing paper, presented by John Kutney of the Astronomical Society of Las Cruces, discussed our perception of darkness and the objects that become visible in the dark. It also investigated the visibility of objects in dark skies and the ways to predict which ones will be visible in telescopes of different sizes.

Optical interferometry at the Magdalena Ridge Observatory near the VLA was another interesting talk presented by Ifan Payne, program director. The light from up to ten 1.4-meter telescopes is carefully combined to produce high-resolution images of astronomical objects. These objects include multiple stars, new stars, and active galactic nuclei. The interferometer allows the small telescopes to produce the same resolution as a 340-meter telescope.

Two speakers detailed the more down-to-earth aspects of astronomy. Dee Friesen, president emeritus of the Albuquerque Astronomical Society, covered the techniques used to bring astronomy to the public in northern New Mexico. Alex Mares, park ranger at Leasburg Dam State Park, discussed the symbolic relationship between the Earth, the Sun and the sky.

One speaker touched on the previous day's asteroid theme. Albert D. Grauer, observer for the University of Arizona's Catalina Sky Survey, described this survey, which covers as much of the sky as possible each clear night, looking for, among other things, near-Earth asteroids. They have also found more distant asteroids and comets as well as some supernovas.

The weather that evening was somewhat threatening, but forecasts indicated that though it would not be clear, at least it would not rain for a few hours. Convention goers piled into a bus and vans to head for Leasburg Dam State Park, the location of the Astronomical Society of Las Cruces' observatory. There, Famous Dave's was serving delicious barbeque.

While people were eating, Las Vegas singer Daniel Park entertained everyone. There was much conversation at the tables until, suddenly, three green aliens jumped out of the bushes and proceeded to dance around the conventioneers as they finished eating their meals. Even as the aliens cavorted in the crowd, a few drops of rain came down.

The aliens soon disappeared again, but the rain only became more intense. People headed for the bus and vans. However, the party did not stop. Everything was moved back to the hotel where the party continued for a while longer. It was a very interesting sight to behold; a rather large group astronomers were dancing to the tunes of Daniel Park. They finally ran out of steam at 11:00 pm.

Dr. Arlo Landolt receiving the Peltier Award from John Goss

Saturday began with the annual business meetings of the Astronomical League and the Association of Lunar and Planetary Observers. The Astronomical League event included a short presentation on next year's ALCon in Arlington, Virginia.

After the business meetings, the final papers session started in the main room. The first speaker was Theodora Mautz, the National Young Astronomer first-place winner. She told the group about her studies comparing the motion of the Milky Way's globular clusters to their distances from the Milky Way's nucleus. Normally, objects closer to the nucleus would move faster than those farther away would. Ms. Mautz's analysis indicated that there was no relationship between the distance from the nucleus and the motion of the globular cluster. This implies that there is substantial dark matter in the halo of our galaxy affecting the gravitational field around it.

The next speaker was also a National Young Astronomer winner: Sydney Marler took second place in this year's competition. Ms. Marler studied gamma ray bursts caused by mergers of neutron stars or collapse of massive stars. After the burst, the afterglow from these explosions can also be studied in X-rays and Ms. Marler used these observations to learn more about the chemical composition of these bursts and test the validity of models of interstellar absorption.

The next regular presentation was given by Mike Simonsen, membership director and development officer for the American Association of Variable Star Observers (AAVSO), on how amateurs can contribute to the science of astronomy. Professional astronomers have been encroaching into areas that were exclusively the province of amateurs. An amateur astronomer can spend large amounts of telescope time on a particular research project, providing an opportunity to contribute to the science. Meanwhile, professionals have built survey systems that cover the sky on a regular basis, reducing the need for such focused observations. Nonetheless, amateurs can still contribute to the science, if they are willing to learn how to do it.

Astronomical League Award presented to past president Bob Gent by John Goss and Carroll Iorg

But how do we get new people

interested in astronomy? Libraries normally lend out books, but why should they not lend out telescopes to the public as well? Some local astronomical societies have been providing small, high-quality telescopes to libraries in their areas to help promote astronomy. John Goss, Astronomical League president, and Jim Small, chair of the Mid-States Region of the Astronomical League, detailed a library telescope program in the St. Louis, Missouri, area and the libraries' experience loaning these telescopes to the public.

The Saturday afternoon talks were all about our Solar System. John Westfall of ALPO told listeners about the two Mercury transits visible from the United States coming up this decade: May 9, 2016, and November 11, 2019. These two will be best visible in the eastern United States, but at least part of each of them will be visible in the west. Careful timing of the limb contacts can contribute to a precise determination of the Sun's diameter.

Mars images were next up, with some images showing what appear to be the classical canals. Roger Venable, coordinator of the ALPO Mars Section, said that they correspond well to Percival Lowell's drawings of the Red Planet. Saturn was not ignored, with a review of the observations of the ringed planet as reported to the ALPO Saturn Section. Saturn, with its bands, belts, and bright and dark spots, is not a boring planet, according to Julius Benton, coordinator of ALPO's Saturn and Venus Sections. Then there are the rings, which have a great deal of detail available to the amateur. A number of pro–amateur cooperative research projects were described.

While Venus appears featureless, the 557.7 nm green line of oxygen does appear in its atmosphere. It has been studied for 40 years, without much understanding of the source of the emission. Candace Gray, a PhD astronomer at New Mexico State University, provided evidence that this emission line is caused by auroral activity deep in Venus's atmosphere. Mars shows the same deep atmosphere emission, demonstrating that even planets without a strong magnetic field can have auroras.

The final act of this entertaining convention was the traditional awards banquet. In addition to the annual awards presented this year, the banquet included a tribute to Walter Haas, director emeritus of the Association of Lunar and Planetary Observers. His daughter, Mary (Haas) Alba told us about growing up with an astronomical father. Walter started two enduring organizations, ALPO and the Astronomical Society of Las Cruces. He also initiated the ALPO newsletter, *The Strolling Astronomer*, now the *Journal of the Association of Lunar and Planetary Observers*. Walter's attention to detail not only in his own observations, but also in those of others, and his willingness to help anyone who wanted to observe the sky, made him a friend to many fellow amateurs. Walter passed away April 6, 2015, at age 97.

There were many well-deserved awards presented, including the Astronomical League's Leslie Peltier Award, which was presented to Arlo Landolt. His work on precision photometry of selected fields literally set the standard for photometric observations. The Landolt fields allow for the calibration of photometers for measuring star magnitudes in the UBVRI spectral bands. It was a great honor to have Dr. Landolt at the convention.

In addition, former AL president Robert Gent was the recipient of the Astronomical League Award, Don Parker received the Peggy Haas Service Award, and several Master Observers received their awards.

The keynote speaker addressed an issue of concern for all amateur astronomers: "Everything but Astronomy: How We Keep the Public Looking Up." Pat Hynes, director of the New Mexico Space Grant Consortium (NMSGC), described the activities of the NMSGC in promoting astronomy in New Mexico. These included working with New Mexico State University's Astronomy Department to promote the research done by its graduate students. They also organize events that not only promote astronomy, but also innovation and networking. STEM-based research is an area of great interest to the NMSGC.

Convention chair Ron Kramer thanked the "cast of characters" that helped make this convention a great success. With the awarding of the final door prizes, the convention came to an end. Many of the attendees are looking forward to next year's convention in Arlington, Virginia.

2015 Peltier Award

Arlo U. Landolt

By Roger Kolman

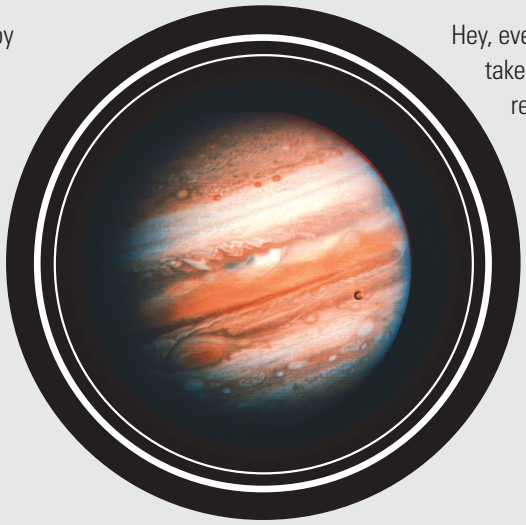
The sky first attracted Arlo's attention as a farm boy out on the prairies of southern Illinois. When it was too hot to sleep in the farmhouse, he would sleep on the hay frame wagon out in the barnyard. He would look up and watch the stars move across the sky as the night progressed. The different patterns, brightnesses, and colors were a spectacle full of wonder!

This led to a professional life both as a university professor and as an observational astronomer specializing in astronomical photometry. The detectors have changed over time, from photographic photometry in the early days, to photoelectric photometry, to modern CCD photometry. Observing and being able to watch the sky through the open slit always has been a source of wonderment and joy, along with the smell of the night air, and following the stars as they wended their way across the sky through the night and throughout the year. This love of the night sky defines the word "amateur."

His observing has centered on standard star sequences, both distributed over the sky and for individual variable stars. These sequences in the Johnson UBV and Johnson–Kron–Cousins UBVRI photometric systems are of use to the entire astronomical observational community, since the standard stars range in brightness between 7th and 22nd magnitudes in V. The color range in the Johnson (B–V) is between –0.3 and +2.0 or so. These standards are adaptable to use with any detector in the amateur or professional community.

Over the years, he has given dozens of lectures to groups at small institutions with no astronomers on staff. Many attendees were amateurs. These lectures allowed for interaction with individuals interested in observational programs and techniques. Reprints from his publications had finder charts, enabling unambiguous identification of his standard stars. The stars covered a range in brightness, so that there was a calibrating star for every need. Amateurs could then calibrate and transform their data to a standard photometric system, thereby making more reliable the inter-comparison of their data with those of other observers. The sequences he established and published from his own data enable anyone to tie in their own measurements. The calibrated photometry of various variable stars that he has observed should be able to aid in establishing the zero points of variable star light curves where such effort is of value.

In addition, these standards provide value for photometry of asteroids, minor planets, satellites, comets, and any astronomical object needing accurate calibration.



How I Became An ASTROPHOTOGRAPHER

Story and photos by Ronald Zincone

My journey began when I was a young boy around 12 years of age, living with my family in the city of Providence, Rhode Island. I always had a fascination with the skies and subjects that most kids my age didn't always talk about. UFOs? I went through that phase. I even formed a UFO club in elementary school. Okay, I'll say it: I was a geek.

My real passions growing up were photography and especially astronomy. So, one Christmas morning, guess what I received—no, not an official Red Ryder carbine-action, two-hundred shot Range Model air rifle—a Tasco 50x (variable power) #4VTE telescope.

My Tasco took me on a never-ending cosmic journey.

I have many fond memories of my older brother Ray and me observing the Moon and planets from our light-polluted neighborhood. It was from this time that I became passionate about astronomy and developed my love for the Moon and planets. This was the early 1970s. I excelled in science in school. As I became an older teen, my life revolved around education.

Author with his Canon

Fast forward to 1999 when my wife and I built our home in Richmond, Rhode Island. Richmond is part of Washington County and offers some nice dark skies—much better than those in the big city. Seeing these rural dark skies really reignited the spark to get back into amateur astronomy and eventually try my hand at astro-imaging.

First scope

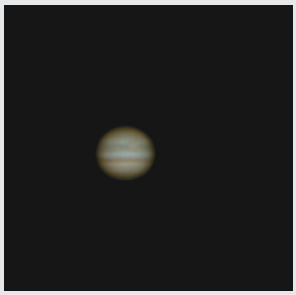
My next telescope, and my real first "serious" beginner's scope, was a Meade 4500 reflector. It had a 4.5-inch mirror and an equatorial mount. The year 1999 was also when I joined my astronomy club, the Astronomical Society of Southern New England (ASSNE, *www.assne.org*).

ASSNE's motto is "to educate and inspire." It has been so influential on me and has helped me meet and make friends with fellow amateur astronomers and astrophotographers. I've learned so much from these folks—and you can, too.

That year, 1999, was also my first step into astrophotography. I combined my passions for photography and astronomy and began reading and absorbing everything I could on this specialized branch of photography. I started capturing celestial subjects, first using black-and-white 35 mm film, then on 35 mm color negative film, and then I settled on 35 mm chrome slide film. I just loved the vibrancy of slides! When shooting chrome, your settings had to be "dead-on." What you see is what you get. Hey, even Paul Simon didn't want his Kodachrome taken away! Slides were colorful, easy to store and retrieve, and could be presented easily with a projector. For several years, I continued to learn from reading and from applying what I learned "hands-on" using my astro equipment—a telescope, a tripod, a manual Chinon 35 mm camera, and a basic 50 mm lens. Like many astro-imagers, I started at the basic level of "camera-on-tripod" wide-field celestial photography. As time went by and I became more proficient at astronomical imaging, my equipment and my challenges changed.

Several telescopes, such as a club-made 10-inch Newtonian Dobsonian, an 80 mm ED Orion doublet refractor, a Meade 12-inch LightBridge, a SkyWatcher 120 mm ED APO, and several 35 mm cameras, such as a Nikon F, an Olympus OM-1, and a Canon EOS 20Da, passed through my hands. Then, it happened—I finally took the plunge and switched to digital in 2006. I've never looked back.

Today, my passion—okay, obsession—with amateur astronomy and astrophotography continues, and still centers on the Moon and planets. After reading more than 50 books and spending countless hours in the field learning my craft and networking with fellow astro-imagers, I can truly say that it has paid off. I don't mean just the technical and artistic rewards, but also, and mainly, the enjoyment of experiencing what is truly the greatest hobby in the world!



Jupiter using ZWO ASI120MC webcam

In 2005, I officially started as a sole proprietor and became an independent contractor and teacher of 35 mm digital photography and astronomy specializing in lifelong learning. Today, I can proudly say that I am southern New England's #1 travelling photography teacher.

Canon remote shutter

I currently use what I call my "dream scope"—a 16-inch Meade LightBridge Newtonian Dobsonian telescope. This scope is a "light bucket," but some may say it looks like a portable hot water tank (with truss tubes). My camera is a Canon EOS 60Da, which is Canon's second-generation camera optimized for astrophotography (the 20Da was first). Along with countless other accessories, such as some high-end eyepieces and lenses, I have been able to advance my skills and improve my artwork.

Like many astrophotographers who have been bitten by the bug, it was only natural that I advanced into using a telescope for astro-imaging. At this level, the learning curve gets tougher and more challenging. Several methods are:

Circumpolar star trails with camera on tripod

Piggybacking, which involves attaching your 35 mm camera to a bracket on your telescope. This allows long-exposure, wide-field, "tracked" imaging using your scope's tracking motors to follow the Earth's rotation.

Prime focus: using your camera's specific T-ring and adapter, you can attach your DSLR camera to your scope for higher magnifications. For example, if your scope is an f/8 with a 1200 mm focal length, your resulting image capture would be a 1200 mm f/8 shot. This method is best for lunar photography.

Eyepiece projection is how we capture celestial subjects at "high resolution." Resolution is how much detail can be captured in your subject. This involves using a method similar to prime focus, but you insert an eyepiece into the camera's extender tube. This method is best for planetary and lunar high-resolution images.

International Space Station passing Jupiter

Two other methods using your astronomical telescope are **afocal imaging** and **webcam imaging**. The afocal method captures images of celestial subjects directly through your telescope's eyepiece by using a special bracket to hold your smartphone or point-and-shoot digital camera directly above the eyepiece.

The webcam method is a very popular and revolutionary method of obtaining many "AVI" frames—video images—in a short amount of time in order to capture the brief, lucky moments of good seeing. This method is best for the Moon and planets and the results can be truly astonishing! I currently image with the ZWO ASI120MC webcam. The Jupiter image represents one of my best webcam captures using a Celestron NexImage.

I enjoy all forms of astrophotography. Yes, it is challenging and frustrating at times, but also very rewarding. To be an astrophotographer, you must have a passion for the night sky and be prepared to sacrifice sleep, travel to dark sites, be diligent, be patient, and enjoy hands-on learning. With some basic equipment, you, too, can become a night sky photographer!

Ronald Zincone is a member of ASSNE, ALPO, the Astronomical League, and FDO, is a Certified Photographic Consultant (CPC), and is a certified Skywarn spotter for the National Weather Service. His website is *ronaldzinconephotography.com*.

The 2015 winning essay of the Horkheimer/O'Meara Journalism Award

Inspired by Le Verrier

By Ephraim Craddock,
Baton Rouge Astronomical Society

It is just past midnight on September 24, 1846, and I, German astronomer Johann Gottfried Galle, have just found a new planet that is interfering with calculations of Uranus's orbit! And guess what, this new planet was not discovered using only a telescope, it was discovered using math!

I was inspired by French astronomer Urbain Le Verrier. In 1845 Le Verrier wrote a paper talking about irregularities in the orbit of the last planet to be discovered, Uranus. Lots of people had tried to explain these irregularities, but Le Verrier thought that all their theories were wrong. Earlier this year Le Verrier wrote two more papers on his theory that an undiscovered planet was responsible for the irregularities in Uranus's orbit. He even theorized the mystery planet's mass and orbit. I've heard rumors of a British astronomer, John Adams, doing similar research, but I'm not sure he's done as much work as Le Verrier.

Then earlier today, or I mean yesterday, on September 23, 1846, I received a letter from Le Verrier asking me to help locate the new mystery planet! The telescopes my friend Le Verrier had access to in Paris were not as accurate and he did not have access to any good maps of that part of the sky. He has not been able to get any help from other scientists in France, so he sent letters to other astronomers asking for their help locating his mystery planet. His letter told me where to look. My graduate assistant, Heinrich Louis d'Arrest and I pointed the telescope into the night sky in the area Le Verrier predicted it would be located. It took us less than an hour to find it!

We'll need to observe this new planet for a couple more nights to confirm our findings, but I have already started drafting a letter to Le Verrier with the good news. I'm excited to tell him that "the planet whose place you have computed really exists!" He will probably get to name the new planet, but hopefully he will listen to my suggestion and name the new planet Janus "for the most ancient deity of the Romans, whose two-sided face signifies its position at the frontier of the solar system."

Nine-year-old Ephraim Craddock was in fourth grade at Galvez Primary School in Prairieville, Louisiana, when he composed his essay.

Beginning in 2016, the Horkheimer/O'Meara Journalism Award will offer a $1,000 prize for the first place essay, $500 for second, and $250 for third.

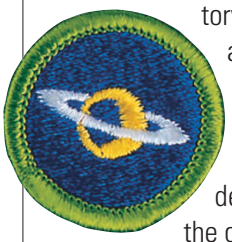
ARE YOU SMARTER THAN A 1944 BOY SCOUT?

By Matt J. McCullar

Recently a friend surprised me with a great gift: a Boy Scouts of America (BSA) merit badge pamphlet for the Astronomy merit badge, copyrighted 1944! For a small book that's 70 years old, it's in remarkably good condition. It is interesting to see how people regarded astronomy as a hobby at that time. There are no color photographs, no photos of planets at all (a curious omission), and no satellites had yet been launched into space. Even so, this 60-page pamphlet brought back a lot of memories.

For those unfamiliar with the BSA's merit badge system, each badge (there are well over 100 different ones) has a set of requirements that a Scout must complete in order to earn it. These requirements are updated for each badge every few years. When I earned the Astronomy merit badge as a Scout in the early 1980s, the requirements were different (and, in my opinion, much tougher) and had last been updated in 1971. Regardless of the year, each badge has an accompanying pamphlet published by the BSA. The pamphlet contains photographs, illustrations, and text to introduce the Scout to the topic of the badge. The Scout demonstrates his knowledge of the subject and shows a certified adult merit badge counselor that he has completed the requirements for that badge. The counselor signs the official paperwork, and the Scout receives that merit badge at his troop's next Court of Honor. (Sounds a lot like the Astronomical League's Observing Awards, doesn't it?)

This 1944 booklet contains the famous black-and-white photographs of the Horsehead Nebula in Orion and the M13 globular cluster in Hercules taken at the Mount Wilson Observatory (and which appeared in just about every astronomy book published then). At the time of publication, the term "spiral nebulae" was still sometimes attached to what we now know are galaxies. The pamphlet does a good job of describing the major constellations (especially the ones in the zodiac) and the stories behind them. The number of known satellites orbiting other planets was much lower in 1944 than it is now. Quite telling is the sentence, "No one knows what the other half of the Moon looks like."



In describing how stars are named, the pamphlet notes that "the Chicago World's Fair of 1933 was opened by a beam of light from the star Arcturus. When one lady heard about this she gushed enthusiastically, 'You know—I think it's simply wonderful the way astronomers have discovered the names of all those stars!'"

As you will see in the requirements that follow, today's Scouts must work much harder to earn this badge than their predecessors did. Then again, the opportunities are much wider. I wonder what the requirements might be 100 years from now. Perhaps they will include radio astronomy, spectroscopy, SETI participation, software programming, or even stellar viewing from other worlds.

It may seem odd that in none of these requirements was grinding a telescope mirror even mentioned. Perhaps the BSA believed doing so was just a bit too much to expect; it's a great deal of work for anyone of any age, and always has been. Merit badges are designed to stimulate a Scout's interest, not snuff it out. (Yet I am still impressed by the young astronomers featured in *Reflector* and their clever ideas, many of which go far beyond even these latest requirements.) What requirements would you include or leave out? One thing I do envy those Scouts of 1944: I'll bet their skies were far less light-polluted. These nights, I don't think I could find eight first-magnitude stars in my backyard in the city. I can still remember lying on my cot at summer camp one night long ago, with my head poking out from underneath the tent, far from the city lights, and being absolutely amazed by the sheer number of artificial satellites plainly visible to the naked eye, chasing each other around the Earth. I'll never forget it. That experience, plus the Astronomy merit badge, helped lead me into astronomy as a serious, rewarding hobby. If you're a Boy Scout, it can do the same for you.

Good night, Scouts!

Matt J. McCullar is a member of the Fort Worth Astronomical Society and writes a book/media review column called "Cloudy Night Library" for Prime Focus*, their monthly newsletter. He became an Eagle Scout in 1986.*

Here is what a Boy Scout had to accomplish in 1944 in order to earn the Astronomy merit badge:

Astronomy merit badge requirements (1944)

1. Identify in the sky:
   10 conspicuous constellations, including at least 4 in the zodiac;
   At least 8 first-magnitude stars.
2. Chart the position of Venus, Mars or Jupiter among the stars over a period of four or more weeks; OR chart the Moon's path through four constellations in the zodiac.
3. Sketch the position of the Big Dipper and its relation to the North Star and the horizon early some evening and again six hours later the same night. Record the date and hour of the making of each sketch.
4. Indicate in the sky, the limits of the group of stars which, as seen from your latitude, never set. By your own observations determine whether the Big Dipper or Cassiopeia ever set.
5. Draw a diagram showing the relation of the Sun, Moon, and Earth at new moon, first quarter, full moon, and last quarter. Draw a diagram showing the relation of the Sun, Moon, and Earth at an eclipse of the Sun, and another for an eclipse of the Moon.

6. Explain the principal causes of the tides. Draw a diagram showing the relation of the Sun, Moon, and Earth when we have the highest tides and the lowest tides.
7. Explain the principal difference between a reflecting and a refracting telescope. Illustrate by simple diagrams.

Well, if you're not scared off by now, you just might have what it takes to earn this badge. Can you do it?

It's interesting to note that a Scout did not have to actually look at anything through binoculars or a telescope. Not even identifying the largest features of the Moon was necessary. It could be that most families could not afford such things back then, although I speculate that the adult counselors were amateur astronomers themselves and owned optical devices that were available for use. In those days, few commercially made telescopes were available, and if an amateur astronomer wanted a telescope, he or she usually had to make it himself or herself. This was, fortunately, not a requirement in 1944. Television had not yet come into general use; how many Scouts looking up at the Moon then would have believed that astronauts would be walking on it just 25 years later?

The BSA updates the requirements of each merit badge every few years, to reflect changes in technology, among other reasons. Some badges are updated more often than others. Here are the requirements for the Astronomy merit badge as written in 1971:

Astronomy merit badge requirements (1971)

1. Do the following:
   a) Sketch the face of the Moon, indicating on it the locations of at least five seas and five craters.
   b) Within a single week sketch the position of the Moon in the sky at the same hour on three different evenings. Explain the changes observed.
   c) Tell what factors keep the Moon in orbit around the Earth.
2. Do ONE of the following:
   a) Photograph or locate on a map of the sky a planet at approximately weekly intervals at the same time of night for at least 4 weeks. Explain any changes noticed on the photographs or map.
   b) Find out when each of the five visible planets will be observable in the evening sky during the next 12 months and compile this information in the form of a chart or table.
3. Do ONE of the following:
   a) In a sketch show the position of Venus, Mars, or Jupiter in the sky at approximately weekly intervals at the same time for at least 4 weeks.
   b) Using a compass, record the direction to the Sun at sunset at approximately weekly intervals for at least 4 weeks in spring or fall (for 6 to 8 weeks in summer or winter) and relate this information to the seasons of the Earth.
   c) With the aid of diagrams explain the relative positions of Sun, Earth, and Moon at the times of lunar and solar eclipses and at the times of New, First Quarter, Full, and Last Quarter phases of the Moon.
4. Using the shadow of a vertical pole in sunshine, lay out a true north–south line (a meridian). Then, using the line and the pole on another day, measure the altitude of the noontime Sun and determine your latitude.
5. Identify in the sky at least 10 constellations, four of which are in the zodiac. Identify at least eight conspicuous stars, five of which are of first magnitude. Then do the following:
   a) Show in a sketch the position of the Big Dipper and its relation to the North Star and the horizon early some evening and again 6 hours later the same night. Record the date and time of making each sketch.
   b) Explain what we see when we look at the Milky Way.
6. With the aid of diagrams (or real telescopes if available) explain the difference between reflecting and refracting telescopes. Describe the basic purpose of a telescope, and list at least three other instruments used with telescopes.
7. Do the following:
   a) Describe the composition of the Sun, its relationship to other stars, and some effects of its radiation on the Earth's weather. Define sunspots and describe some of the effects they may have on this radiation.
   b) Identify at least one star that is red, one that is blue, and one that is yellow, and explain the meaning of these colors.
8. Do ONE of the following:
   a) Visit a planetarium or observatory and submit a report to your counselor both on the activities occurring there and on the exhibits of instruments and other astronomical objects you observed.
   b) Spend at least 3 hours observing celestial objects through a telescope or field glass, and write a report for your counselor on what you observed.
9. Name different career opportunities in astronomy. Explain how to prepare for one of them. List the high school courses most useful in beginning such preparation.

This is an awful lot to ask a Boy Scout to do, even today. Most merit badges aren't nearly this complicated. As an active Scout myself in the 1980s, I didn't meet many other Scouts who earned the Astronomy badge. It was (and remains) an elective badge, not a required badge for advancement. Even so, the Astronomy merit badge is among the oldest merit badges still available. It's been around for over 100 years, just about as old as Scouting itself. (I'm not certain what the original requirements were.)

The physical appearance of the Astronomy merit badge has changed over time, too. Decades ago, the badge boasted only a large, monochromatic star. Today it shows a silhouetted Saturn against a dark blue background. Who knows what it may look like in the future?

The current requirements were updated in 2013. Some requirements haven't changed much, even after all this time, but the new requirements do rely heavily on computers and web sites to help the Scout. Star parties are popular now, though they probably weren't decades ago. Binoculars and telescopes can be easily obtained. Planetariums are everywhere, and it's now far easier to photograph stellar objects.

Astronomy merit badge requirements (2013)

1. Do the following:
   a) Explain to your counselor the most likely hazards you may encounter while participating in astronomy activities, and what you should do to anticipate, help prevent, mitigate, and respond to these hazards.
   b) Explain first aid for injuries or illnesses such as heat and cold reactions, dehydration, bites and stings, and damage to your eyes that could occur during observation.
   c) Describe the proper clothing and other precautions for safely making observations at night and in cold weather. Then explain how to safely observe the Sun, objects near the Sun, and the Moon.
2. Explain what light pollution is and how it and air pollution affect astronomy.
3. With the aid of diagrams (or real telescopes if available), do each of the following:
   a) Explain why binoculars and telescopes are important astronomical tools. Demonstrate or explain how these tools are used.
   b) Describe the similarities and differences of several types of astronomical telescopes, including at least one that observes light beyond the visible part of the spectrum (i.e., radio, X-ray, ultraviolet, or infrared).
   c) Explain the purposes of at least three instruments used with astronomical telescopes.
   d) Describe the proper care and storage of telescopes and binoculars both at home and in the field.
4. Do the following:
   a) Identify in the sky at least 10 constellations, at least four of which are in the zodiac.
   b) Identify at least eight conspicuous stars, five of which are of magnitude 1 or brighter.
   c) Make two sketches of the Big Dipper. In one sketch, show the Big Dipper's orientation in the early evening sky. In another sketch, show its position several hours later. In both sketches, show the North Star and the horizon. Record the date and time each sketch was made.
   d) Explain what we see when we look at the Milky Way.
5. Do the following:
   a) List the names of the five most visible planets. Explain which ones can appear in phases similar to lunar phases and which ones cannot, and explain why.
   b) Using the Internet (with your parent's permission) and other resources, find out when each of the five most visible planets that you identified in requirement 5a will be observable in the evening sky during the next 12 months, then compile this information in the form of a chart or table.
   c) Describe the motion of the planets across the sky.
   d) Observe a planet and describe what you saw.
6. Do the following:
   a) Sketch the face of the Moon and indicate at least five seas and five craters. Label these landmarks.
   b) Sketch the phase and the daily position of the Moon, at the same hour and place, for four days in a row. Include landmarks on the horizon such as hills, trees, and buildings. Explain the changes you observe.
   c) List the factors that keep the Moon in orbit around Earth.
   d) With the aid of diagrams, explain the relative positions of the Sun, Earth, and the Moon at the times of lunar and solar eclipses, and at the times of new, first-quarter, full, and last-quarter phases of the Moon.
7. Do the following:
   a) Describe the composition of the Sun, its relationship to other stars, and some effects of its radiation on Earth's weather and communications.
   b) Define sunspots and describe some of the effects they may have on solar radiation.
   c) Identify at least one red star, one blue star, and one yellow star (other than the Sun). Explain the meaning of these colors.
8. With your counselor's approval and guidance, do ONE of the following:
   a) Visit a planetarium or astronomical observatory. Submit a written report, a scrapbook, or a video presentation afterward to your counselor that includes the following information:
      1. Activities occurring there
      2. Exhibits and displays you saw
      3. Telescopes and other instruments being used
      4. Celestial objects you observed
   b) Plan and participate in a three-hour observation session that includes using binoculars or a telescope. List the celestial objects you want to observe, and find each on a star chart or in a guidebook. Prepare an observing log or notebook. Show your plan, charts, and log or notebook to your counselor before making your observations. Review your log or notebook with your counselor afterward.
   c) Plan and host a star party for your Scout troop or other group such as your class at school. Use binoculars or a telescope to show and explain celestial objects to the group.
   d) Help an astronomy club in your community hold a star party that is open to the public.
   e) Personally take a series of photographs or digital images of the movement of the Moon, a planet, an asteroid, meteor, or a comet. In your visual display, label each image and include the date and time it was taken. Show all positions on a star chart or map. Show your display at school or at a troop meeting. Explain the changes you observed.
9. Find out about three career opportunities in astronomy. Pick one and find out the education, training, and experience required for this profession. Discuss this with your counselor, and explain why this profession might interest you.

Gallery

TITLE PHOTO: NGC 2244: BRIAN KIMBALL

Discovered by William Herschel in 1788, NGC 2403 is a spiral galaxy and an outlying member of the M81 galaxy group, about 12 million light-years distant. Steve Reilly took this image from Dogwood Ridge Observatory in Scottsville, Virginia, from January 28 to February 19, 2015. He used an Optical Guidance Systems 12.5-inch Ritchey–Chrétien at f/9 on an Astro-Physics 1200GTO mount and an SBIG STL-11002M/CW8 camera. Filters included Baader LRGB H-alpha 7 nm, S-II 8 nm, and O-III 8.5 nm unmounted filters. The image consists of 19 luminance, 17 red, 16 green, and 17 blue 15-minute exposures totaling 17.25 hours, all taken at –30°C. The RGB images are binned 2x2 while the luminance images are binned 1x1. All data were acquired using MaxImDL/CCD version 5.24 using ACP7.1. PixInsight version 1.8.02.1098 was used for processing and dithered guiding was on.

Bob Runyan, a longtime member of the Platte Valley Astronomical Observers, submitted this image of M8, the Lagoon Nebula. As he describes it, the image was "taken from my BYO AstroAsylum using my cradle mounted RC6/ST8i located in Shelton, Nebraska." Autoguided by an Orion SSAG/adapted 8 x 50 finderscope, this is H-alpha + LRGB and about two hours of total data acquisition. Processed using MaxImDL, Photoshop, and Astronomy Tools.

Dave Doctor, member of the Astronomical Society of Las Cruces, provided this image of the Deer Lick galaxy group, highlighted by NGC 7331 in the center. There are at least 4 other visible galaxies in the foreground. The image was taken in October 2014 from Doña Ana, New Mexico, about 10 miles east of Las Cruces, using an Astro-Tech 10-inch Ritchey–Chrétien, SBIG ST8XE, Paramount ME, MoonLite 2.5-inch CSL focuser rotator and Astrodon E-series filters. Capture data: LRGB unbinned 35 hours total exposure, temperature-matched dark frames and null point sky flats, processed using PixInsight.

Manuel Lois, a member of the Fort Worth Astronomical Society, sent this great lightning image, taken with a GoPro camera, 5-second exposure at ISO 800, and processed with Photoshop.

ALL THINGS ASTRONOMICAL

Planetary Resources' First Spacecraft Successfully Deployed

Planetary Resources, Inc., the asteroid mining company, announced that on July 16, 2015, its Arkyd 3 Reflight (A3R) spacecraft deployed successfully from the International Space Station's (ISS) Kibo airlock and has begun its 90-day mission. The demonstration vehicle will validate several core technologies, including the avionics, control systems and software, which the company will incorporate into future spacecraft that will venture into the Solar System and prospect for resource-rich near-Earth asteroids.

The A3R launched to the ISS onboard the SpaceX Falcon 9 in April as a part of the CRS-6 crew resupply mission. Once the A3R completes its mission, the validated and evolved technologies will be the main components of the Arkyd series of deep-space asteroid-prospecting spacecraft. The next demonstrator, the Arkyd-6 (A6), will be launched later this year and will test the attitude control, power, communication and avionics systems.

Planetary Resources will use the greater payload capacity of the A6 to begin demonstrating core technology to measure resources on water-rich asteroids. Included in the payload is a mid-wave infrared imaging system, able to precisely measure temperature differences of the objects it observes, as well as acquire key data related to the presence of water and water-bearing minerals. The system will first test target areas of our own planet before being deployed to near-Earth asteroids on future missions.

A MEMBER BENEFIT FROM McDONALD OBSERVATORY

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

Journal of the Association of Lunar & Planetary Observers

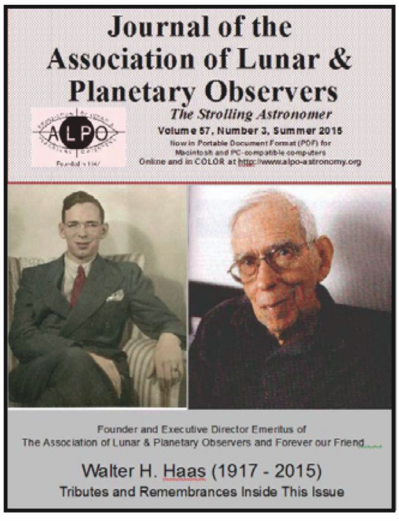
The Strolling Astronomer

In this issue:

- Tributes and remembrances about ALPO founder and director emeritus Walter H. Haas, who passed away on April 6. Walter was beloved by so many of us, and we include some touching personal accounts.
- Planetary apparition and smiliar studies compiled with observing data submitted by ALPO members and nonmembers worldwide – the meat-and-potatoes of what we do, that is, study and report detailed findings – no matter how minute.

Use the various e-mail addresses, bookmarks, and other hyperlinks (in blue text) throughout this issue to instantly e-mail authors and ALPO staff members PLUS instantly jump to various online sites named throughout the issue.

For password information to access earlier on-line issues of the digital ALPO Journal or for information on becoming an ALPO member, please contact the ALPO membership secretary at *matt.will@alpo-astronomy.org*



To download your copy, simply click on this link:
http://alpo-astronomy.org/djalpo/57-3/JALPO57-3-Summer2015.pdf

Observing Awards

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

Advanced Binocular Double Star Observing Program
No. 9, Vincent R. Sheetz, Delaware Valley Amateur Astronomers

Asterism Observing Program
No. 21, Eric D. Johnson, Member-at-Large; No. 22, Jeff Haidet, Toledo Astronomical Association; No. 23, Carol A. Ogden, Olympic Astronomical Society; No. 24, Dick Francini, Neville Public Museum Astronomical Society; No. 25, Dan Posey, Austin Astronomical Society

Asteroid Observing Program
No. 44, William Conner, Indiana Astronomical Society, Regular; No. 49, Daniel Otte, Southern Oregon Skywatchers, Gold

Binocular Double Star Observing Program
No. 85, Vincent R. Scheetz, Delaware Valley Amateur Astronomers; No. 86, John R. Sayers, Member-at-Large; No. 87, Jack Fitzmier, Atlanta Astronomy Club; No. 88, Marilyn Perry, Member-at-Large; No. 89, Roy Marsh, San Antonio Astronomical Association

Binocular Messier Observing Program
No. 1057, John G. Hoff, Albany Area Amateur Astronomers; No. 1058, Marie Lott, Atlanta Astronomy Club; No. 1059, Bob Kacvinsky, Prairie Astronomy Club; No. 1060, David Whalen, Atlanta Astronomy Club; No. 1061, Lloyd Blake, Boise Astronomical Society; No. 1062, Johnny Scarborough, Central Texas Astronomical Society

Caldwell Observing Program
No. 215, Al Hamrick, Raleigh Astronomy Club, Silver; No. 216, Bob Kacvinsky, Prairie Astronomy Club, Silver; No. 217, Thomas Rocco Pennino, Amateur Observers' Society of New York and Astronomical Society of Long Island, Silver

Carbon Star Observing Program
No. 59, Ken Boquist, Popular Astronomy Club; No. 60, Eric Dose, Northeast Kansas Amateur Astronomers' League; No. 61, Michael Vincent Bournique, Member-at-Large

Dark Nebulae Observing Program
No. 20, Robert Pitt, Member-at-Large

Deep Sky Binocular Observing Program
No. 366, Forrest Smith, Baton Rouge Astronomical Society; No. 367, Jim Twellman, Astronomical Society of Eastern Missouri; No. 368, Brad Payne, Northern Virginia Astronomy Club

Flat Galaxy Observing Program
No. 26, W. Maynard Pittendreigh, Member-at-Large, Honorary; No. 27, Robert Pitt, Birmingham Astronomical Society, Honorary

Globular Cluster Observing Program
No. 271, Vincent Michael Bournique, Member-at-Large; No. 272, Kevin C. Carr, Member-at-Large

Herschel 400 Observing Program
No. 532, Margaret McCrea, Rose City Astronomers; No. 533, Steven Childers, Forsyth Astronomical Society; No. 534, Kevin Johnson, Minnesota Astronomical Society; No. 535, Ken Hose, Rose City Astronomers; No. 536, Thomas Rocco Pennino, Amateur Observers' Society of New York and Astronomical Society of Long Island; No. 537, Jay Drew, Springfield Telescope Makers; No. 538, Bill Biermann, St. Louis Astronomical Society; No. 539, Wayne E. Frey, Central Florida Astronomical Society

Herschel II Observing Program
No. 92, David Hasenauer, Texas Astronomical Society of Dallas, Manual; No. 93, Clifton B. Mygatt, Jr., Olympic Astronomical Society, Device-Aided; No. 94, Bill Smith, Member-at-Large, Device-Aided; No. 95, William Hennessy, Neville Public Museum Astronomical Society, Manual; No. 96, Robert Pitt, Birmingham Astronomical Society, Device-Aided

Hydrogen Alpha Solar Observing Program
No. 15, Scott Azmus, Member-at-Large; No. 16, Jay Drew, Springfield Telescope Makers; No. 17, Rodney L. Martin, TriState Astronomers; No. 18, Mark Bailey, Member-at-Large; No. 19, Gerard Jones, Minnesota Astronomical League; No. 20, Bill Sanders, Central Arkansas Astronomy; No. 21. Marie Lott, Charlie Elliott Chapter of Atlanta Astronomy Club; No. 22, Jack Fitzmier, Atlanta Astronomy Club; No. 23, Lee Sikstrom, Member-at-Large; No. 24, Dan Thoman, Charlie Elliott Chapter of Atlanta Astronomy Club; No. 25, Robert Anderson, Member-at-Large; No. 26. Valorie Whelan, Charlie Elliott Chapter of Atlanta Astronomy Club

Local Galaxy Group & Galactic Neighborhood Observing Program
No. 33-M/CA, Robert Pitt, Birmingham Astronomical Society

Lunar II Observing Program
No. 66, Gary George, Harford County Astronomical Society; No. 67, Vincent Michael Bournique, Member-at-Large

Lunar Observing Program
No. 914, Suzanne Bjork, Mason Star Gazers; No. 915, Bridget Langdale, Mason Star Gazers; No. 916, Jarret Lingle, Mason Star Gazers; No. 917, Michael A. Pascavage, Delaware Valley Amateur Astronomers; No. 918, Dan Thoman, Atlanta Astronomy Club; No. 919, Bill Smith, Member-at-Large; No. 920, Larry Elsom, Member-at-Large; No. 921, Carol Smith, Boise Astronomical Society

Messier Observing Program
No. 2393, Eugene Garcia, Olympic Astronomical Society, Honorary; No. 2655, Joseph Mezzafonte, Amateur Observers' Society of New York and Astronomical Society of Long Island, Honorary; No. 2692, Adam S. Yore, Member-at-Large, Honorary; No. 2693, John Day, Big Bear Valley Astronomical Society, Honorary; No. 2694, David Whalen, Atlanta Astronomy Club, Honorary; No. 2695, Vincent Michael Bournique, Member-at-Large, Honorary; No. 2696, Bernard Venasse, Member-at-Large, Regular

Meteor Observing Program
No. 57, Nora Jean Chetnik, Honorary, Member-at-Large

Northern Skies Constellation Hunter Observing Program
No. 152, Jody Raney, Shreveport–Bossier Astronomical Society; No. 153, Carolyn Alter, Rose City Astronomers; No. 154, Linda Huffman, Member-at-Large

Outreach Observing Award
No. 657-O, Mark Simonson, Everett Astronomical Society of Camano Island; No. 658-S, Chris Miskiewicz, Howard Astronomical League; No. 659-O, Gail Sederquist, Popular Astronomy Club Quad Cities; No. 660-O, Adam Beals, Popular Astronomy Club Quad Cities; No. 661-O, John Webber, Southern Colorado Astronomical Society; No. 662-M, Brian Buttafuoco, Museum Astronomical Resource Society; No. 663-O, Ron Yates, Flint River Astronomy Club; No. 664-O, Walter Russell, Southern Colorado Astronomical Society

Planetary Nebula Observing Program
No. 6, Paul Forward, Denver Astronomical Society, Imaging

Radio Astronomy Observing Program
No. 7-B, Doug Kniffen, Astronomical Society of Eastern Missouri and Central Missouri Amateur Astronomers; No. 8-B, Alex Vrenios, Member-at-Large; No. 9-B, William Bogardus, Amateur Observers' Society of New York and Custer Institute; No. 3-S, Doug Kniffen, Astronomical Society of Eastern Missouri and Central Missouri Amateur Astronomers; No. 4-S, Scott Lookabill, Central Arkansas Astronomical Society

Sketching Observing Award
No. 2, Bill Smith, Member-at-Large; No. 3, Mark L. Simonson, Everett Astronomical Society; No. 4, Aaron Clevenson, North Houston Astronomy Club; No. 5, Michael A. Hotka, Longmont Astronomical Society

Solar System Observing Award
No. 85, Jim McLaughlin, Auburn Astronomical Society; No. 86, Bernard Venasse, Member-at-Large

Southern Arp Peculiar Galaxy Observing Program
No. 6-V, Robert Pitt, Birmingham Astronomical Society; No. 7-V, Dave Tosteson, Minnesota Astronomical Association; No. 8-V, Douglas Wiese, High Desert Astronomy Club

Southern Planetary Nebula Observing Program
No. 3, Michael A. Hotka, Longmont Astronomical Society, Basic

Southern Skies Binocular Observing Program
No. 90, Vincent Bournique, Member-at-Large

Two in the View Observing Program
No. 5, Scott Kranz, Astronomy Society of Kansas City; No. 6, Albert Lamperti, Delaware Valley Amateur Astronomers; No. 7, Jim Ketchum, Astronomical Society of Kansas City; No. 8, Aaron Clevenson, North Houston Astronomy Club

Universe Sampler Observing Program
No. 120, Glenn Wolford, Member-at-Large, Naked-Eye; No. 121, Peter Moore, Seattle Astronomical Society, Telescope

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

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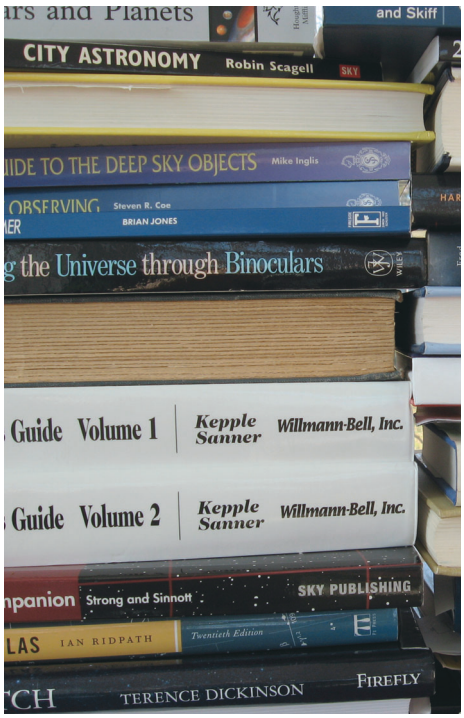

September 9–13
Brothers Star Party
Brothers, Oregon
www.mbsp.org

September 10–14
Acadia Night Sky Festival
Bar Harbor, Maine
www.acadianightskyfestival.org

September 10–13
Hidden Hollow Star Party
Warren Rupp Observatory
Mansfield, Ohio
www.wro.org

September 10–13
Illinois Dark Skies Star Party
Jim Edgar–Panther Creek State Fish and Wildlife Area, Illinois
www.sas-sky.org

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

September 11–12
Craters of the Moon Star Party
Craters of the Moon National Monument and Preserve, Idaho
www.ifastro.org

September 11–12
Idaho Star Party
Bruneau Dunes State Park, Idaho
www.isp.boiseastro.org

September 10–13
Heart of America Star Party
Astronomical Society of Kansas City
Overland Park, Kansas
www.hoasp.org

September 11–13
Jersey Starquest
Hope, New Jersey
www.princetonastronomy.org

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

September 17–20
Great Lakes Star Gaze
Gladwin, Michigan
www.greatlakesstargaze.com

September 18–20
Astrophotography Workshop
Adirondack Public Observatory
Tupper Lake, New York
www.apobservatory.org

September 19
National Astronomy Day
Worley Observatory, LSU–Shreveport, Louisiana
www.shreveportastronomy.com

September 25–26
Astronomy at the Beach
Kensington Metropark, Brighton, Michigan
www.glaac.org/kensington-astronomy-at-the-beach

September 26
Gateway to Space
St. Louis, Missouri
www.gatewaytospace.org

September 26–27
Tennessee Fall Star Gaze
Pikeville, Tennessee
www.cumberlandastronomicalsociety.org

October 3
Virginia Association of Astronomical Societies
NRAO Headquarters, Charlottesville, Virginia
Charlottesville Astronomical Society
cvilleastro.com/vaas-2015

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

Coming Events

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

October 8–11
SJAC Fall Star Party
Belleplain State Forest, New Jersey
www.sjac.us

October 9–11
Connecticut Star Party
Edmund D. Strang Scout Reservation, Goshen, Connecticut
www.asnh.org

October 9–11
Custer Jamboree
Southold, New York
www.custerobservatory.org/events.htm

October 11–18
Peach State Star Gaze
Deerlick Astronomy Village, Crawfordville, Georgia
www.atlantaastronomy.org/PSSG

October 12–18
Staunton River Star Party
Scottsburg, Virginia
www.stauntonriver-starparty.org

October 13–18
Astroblast
Oil City, Pennsylvania
www.oras.org

October 14–17
Enchanted Skies Star Party
Socorro, New Mexico
www.enchantedskies.org

November 3–8
Deep South Regional Star Gaze
Norwood, Louisiana
www.stargazing.net/dsrsg

November 5–8
Nightfall (Star Party)
Borrego Springs, California
www.rtmcastronomyexpo.org

November 9–15
CSPG Fall Star Party
Chiefland, Florida
www.chieflandstarpartygroup.com/fall.html

November 14
Evening Star Party at Ralph A. Worley Observatory
Shreveport, Louisiana
www.shreveportastronomy.com

SPRING 2016

March 9–13
Staunton River Star Party
Scottsburg, Virginia
www.stauntonriver-starparty.org

April 2–9, 2016
OzSky Star Safari, a.k.a. Deepest South Texas Star Safari
Coonabarabran, New South Wales, Australia
www.ozsky.org
Attendance is extremely limited—that is why this event is listed so far in advance.

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

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RASC *Observer's Handbook* $27.00 • *StarDate* $19.50
(Foreign rates are higher; see website)
• Free Astronomical League Observing guide with membership.

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Phone: 816-333-7759; Email: *leagueoffice@astroleague.org*
Or join online at: WWW.ASTROLEAGUE.ORG

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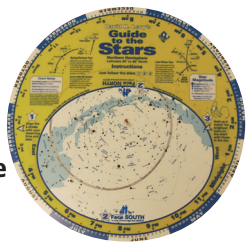

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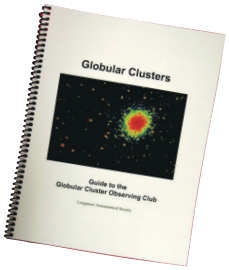

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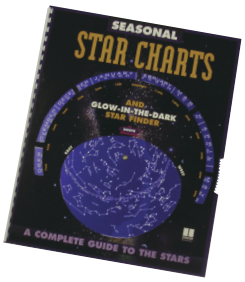

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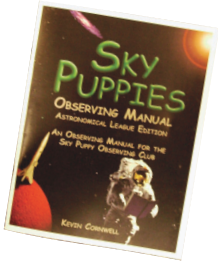

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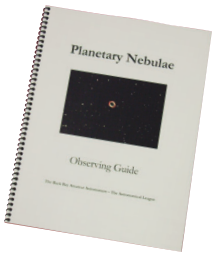

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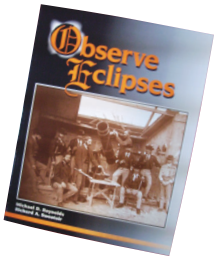

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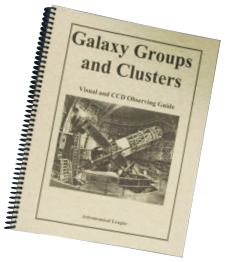

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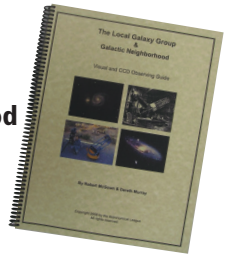

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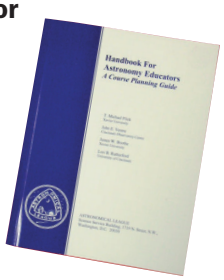

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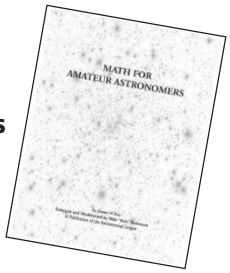

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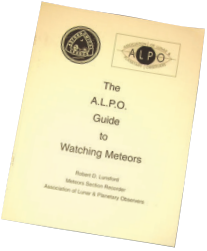

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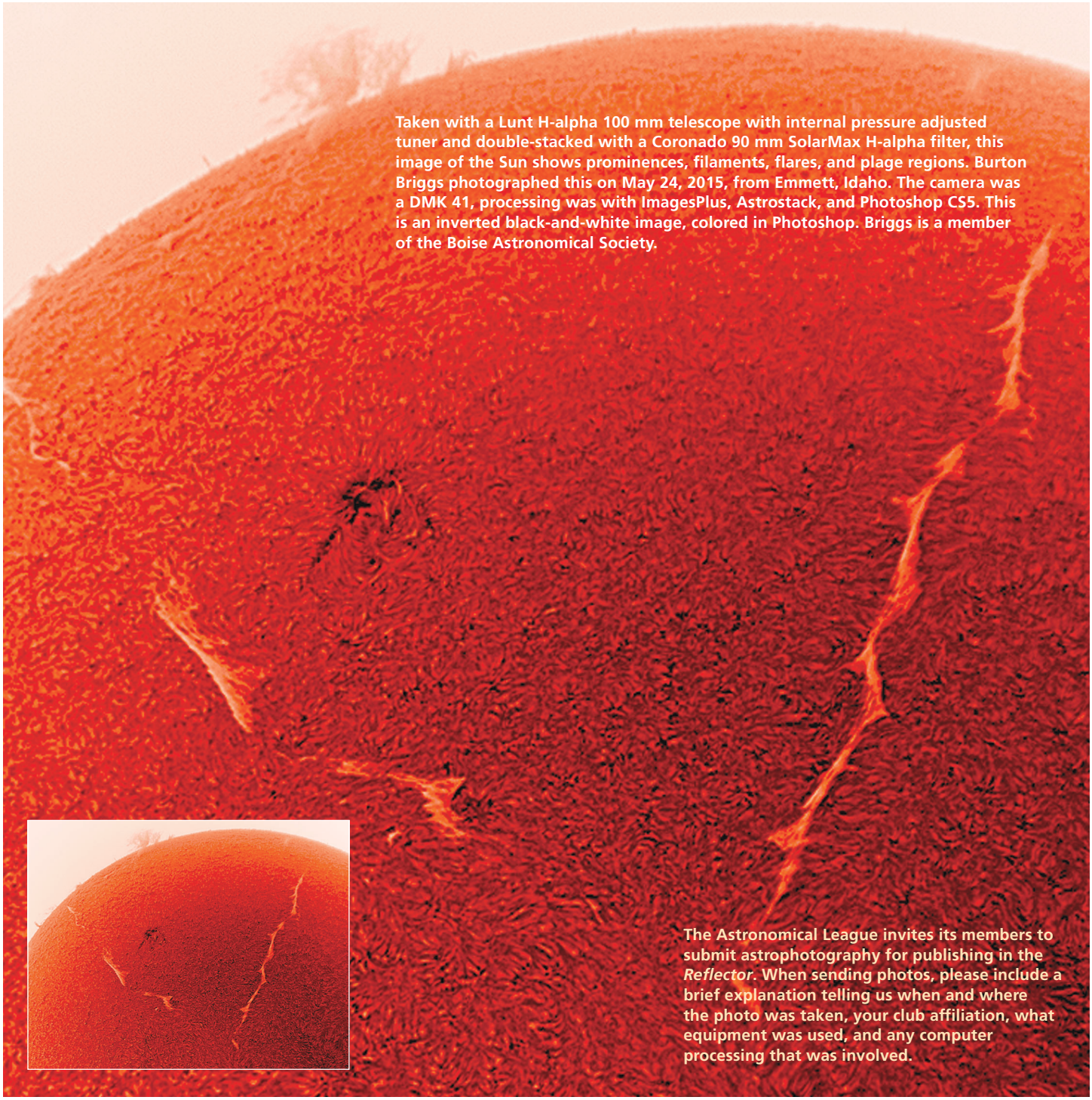

Taken with a Lunt H-alpha 100 mm telescope with internal pressure adjusted tuner and double-stacked with a Coronado 90 mm SolarMax H-alpha filter, this image of the Sun shows prominences, filaments, flares, and plage regions. Burton Briggs photographed this on May 24, 2015, from Emmett, Idaho. The camera was a DMK 41, processing was with ImagesPlus, Astrostack, and Photoshop CS5. This is an inverted black-and-white image, colored in Photoshop. Briggs is a member of the Boise Astronomical Society.

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.