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# Reflector

**HOW TO DO PLANETARY IMAGING WITH  
A DOB AND AN INEXPENSIVE CAMERA**

**AN AMATEUR-BUILT CORONAGRAPH  
IMAGES THE SOLAR CORONA**

**QUASARS THAT VARY AND WHAT  
ASTRONOMERS ARE LEARNING FROM THEM**





# Full STEAM Ahead

## ASTRONOMICAL CAUSE AND EFFECT PART 2

Last issue we met Charles Crawford, the contractor working with city leaders and the Broken Arrow Sidewalk Astronomers (BASWA) supporting a family-friendly astronomy night for the diverse population of Muskogee, Oklahoma. When we left the story, event videos had been posted by a noted blogger. Afterwards, Charles received a call from a chamber of commerce member who accused him of altering the video to show children all playing and getting along together. In the caller's experience, students and their parents did not usually integrate as a community so naturally, instead tending to remain within their own neighborhood groups. The sky belongs to us all, and this event proved that without a doubt. A single night under the stars certainly can't erase a town's checkered history, but it does demonstrate the power of astronomy to engage us all, equally.

That August event with children looking through portable telescopes and the Mobile Observatory was a joyous atmosphere filled with wonder and excitement. In fact, the movers and shakers in the chamber of commerce all were grateful to have us there to allow students to use a telescope, many for the first time.

A month later, Charles contacted us again to join him in his new adventure of putting on a homecoming parade and event for the community, with the school superintendent closing the schools for a half-day celebration. The parade would end at the civic center, where we were asked to have our scopes up and running. Charles also added that the August blog videos (and word of mouth) had brought us to the attention of the school superintendent and several science teachers. They had contacted Charles to find out more about us, how we could meet up, and what we had to offer their students.

So, on Saturday, October 6, 2023, with slight cloud cover, solar scopes were set up along with a STEM table and then, the band, the homecoming court, and all the rest arrived *en masse* at the civic center. Immediately, lines formed around the telescopes and the chatter and excitement was overwhelming. I was running the STEM table and, before I knew it, I had a group of teachers surrounding me, all asking for astronomical help.

The high school astronomy club coordinator (a geology teacher) wanted help with the school telescope and advice on how to bring more science to his students. The two middle school science teachers had wanted similar help for their students as well. Fortunately, this city is not densely populated, so its skies are much darker than in Broken Arrow. We came up with the idea to have a school-community club, and we

would have the middle and high school students come together for hands-on telescope operation lessons and observing strategies.

With the colder weather and holidays approaching, the spring semester became the target to start this program. This sizable investment in a community 45 minutes away demonstrates the love that those who do astronomy outreach have for our hobby, and our dedication to its power to lift up not only eyes, but hearts and minds. BASWA is also firming up another event at the Fite Mansion Inn and Spa for the springtime, with plans for a talk and NASA videos projected on the side of the building.

So we will continue to invest our time in Muskogee during 2024, with the school system, the community at large, and movers and shakers like our new friend Charles Crawford.

Full STEAM ahead (with hope for the future).

—Peggy Walker

*Astronomical League STEAM and Jr. Activities Coordinator*

## Deep-Sky Objects

### A COOL SPOT ON THE GIRAFFE

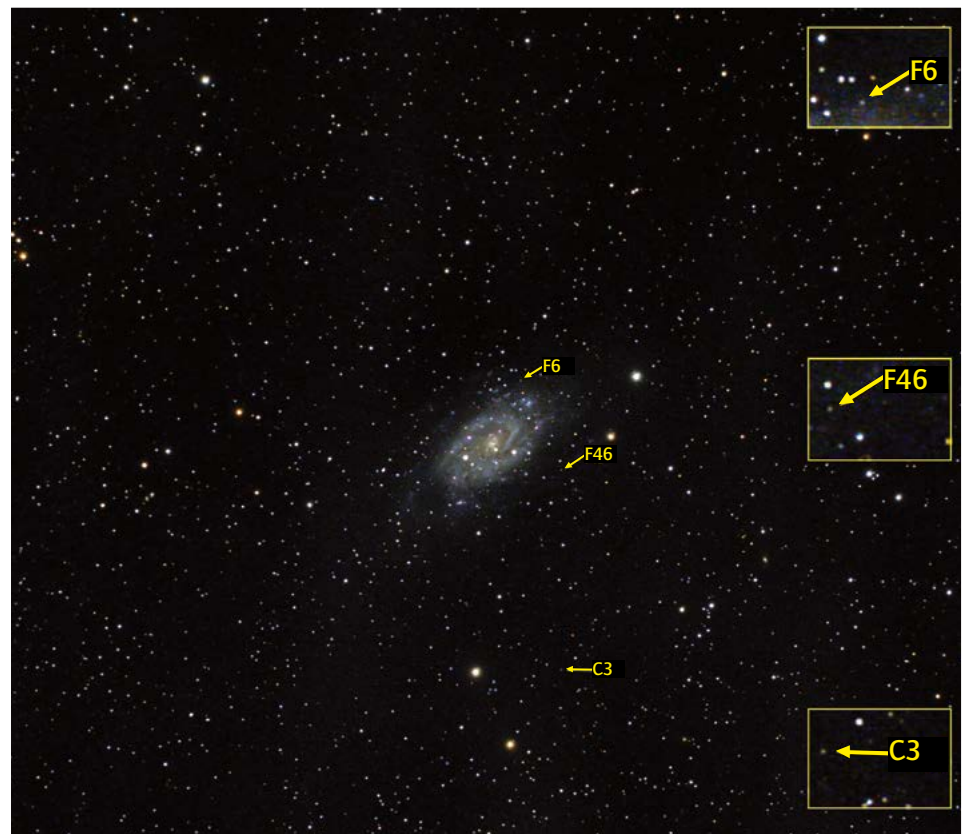
Camelopardalis (kam uh low PAR dah liss) is my favorite constellation name – it flows so nicely across the tongue. In English the word means giraffe. The constellation is near the north celestial pole, sandwiched between Cassiopeia, Ursa Major, and Ursa Minor. Camelopardalis doesn't contain

really bright stars or a plethora of deep space objects. But it does have one that stands out: spiral galaxy NGC 2403, in the southeast corner of the constellation near the border with Ursa Major. This is the opposite side of Ursa Major from the handle of the Big Dipper.

William Herschel discovered NGC 2403 in 1788. It is classified as intermediate between a normal spiral galaxy and a barred spiral galaxy, with a very small galactic bulge. From our line of sight, the galaxy is tilted slightly from face-on. The galaxy has two main spiral arms near its center, each branching off into myriad fainter arms farther away from the galactic center.

Magnitude estimates for the galaxy run between 8.4 and 8.9, bright enough to be seen in binoculars as well as to have its spiral nature resolved in amateur telescopes. The galaxy measures roughly 15.8 by 7.9 arcminutes and lies close to ten million light-years away. At that distance, the diameter of the galaxy would be 98,000 light-years. NGC 2403 is a distant member of the M81 galaxy group and the second brightest galaxy in the group.

NGC 2403 was the first galaxy outside of our home Milky Way where Cepheid variable stars were recognized. These variables were used in the first measurement of distance to the galaxy. Nearly 20 of NGC 2403's globular star clusters have been identified and studied. These star clusters are brighter than magnitude 20, and the galaxy



*Note: Although these globular clusters are faintly but clearly visible in Dr. Dire's image file, they are tiny and may not be visible in the main image as rendered in ink on paper here. You should be able to see them in the insets.*

likely contains many more fainter examples.

I captured the accompanying image of NGC 2403 with a 132 mm f/7 apochromatic refractor with a 0.8× focal reducer/field flattener using an SBIG ST-4000XCM CCD camera. The exposure was 220 minutes.

I was able to identify NGC 2403's three brightest globular star clusters in the image, all looking like extremely faint stars. I placed three small yellow arrows on the image pointing to the clusters. They are, from top to bottom, cataloged as F6 (magnitude 17.87), F46 (magnitude 17.96), and C3 (magnitude 18.66). The three boxes on the right side of the image are enlargements of the regions around the three globular clusters to make them easier to see on this page.

Capturing globular star clusters with a 132 mm refractor in a galaxy ten million light-years away is beyond anything I ever imagined when I started astrophotography. These clusters may be near the edge of detection visually in the largest amateur telescopes. Those with 6- to 10-inch telescopes will get plenty of enjoyment spying NGC 2403 and imagining if its globular clusters look as impressive to its inhabitants as M13, M22, and Omega Centauri look to us Milky Way residents

—Dr. James R. Dine

Reference:

Day, J., et al. 2020, *BAAS* 52(1), 769.

## Around the League

### VOLUNTEERS NEEDED

The Astronomical League needs a coordinator for one or more of our Observing Programs. If you have been working on your personal Observing Awards and are ready to volunteer as a coordinator, please send an email to Aaron Clevenson at [aaron@clevenson.org](mailto:aaron@clevenson.org). In mid-April we will be interviewing volunteers for the Urban Observing Program and potentially others.

### CALL FOR AWARD SUBMISSIONS

Applications/nominations for all League awards must be received no later than **March 31, 2024, at 11:59 p.m. CDT** (except for Fleming and Horkheimer/Parker imaging awards which are extended to **April 30** due to the eclipse). Award rules appear on the "Awards" page at [www.astroleague.org](http://www.astroleague.org).

**Submissions are not complete until you receive an email from the League vice president confirming receipt.**

### LEAGUE YOUTH AWARDS

**National Young Astronomer Award** – U.S. citizens or U.S. school enrollees under the age of 19 who are engaged in astronomy-related research, academic scholarship, or equipment design may apply. League membership is not required. The top two winners receive expenses-paid trips to the League's national convention (U.S. travel only)

and receive Explore Scientific telescope prizes.

Email the application, research paper, and a photo of the nominee to [NYAA@astroleague.org](mailto:NYAA@astroleague.org).

**Service Award** – League members under the age of 19 who are engaged in service to the League, clubs, schools, and/or the astronomy community may apply for the Horkheimer/Smith Youth Service Award. Club or regional officers may nominate. The winner receives a plaque, a cash prize, and an expenses-paid trip to the League's national convention (U.S. travel only). Email the application and a photo of the nominee to [HorkheimerService@astroleague.org](mailto:HorkheimerService@astroleague.org).

**Imaging Award** – League members under the age of 19 who engage in astronomical imaging may apply for the Horkheimer/Parker Youth Imaging Award. Club or regional officers may nominate. The winner receives a plaque. The top three finishers receive cash prizes. Email the application, image, and a photo of the nominee to [HorkheimerParker@astroleague.org](mailto:HorkheimerParker@astroleague.org).

**Journalism Award** – League members ages 8 to 14 may seek the Horkheimer/O'Meara Youth Journalism Award by submitting a 250-word science essay. The winner receives a plaque. The top three finishers receive cash prizes. Email the application, essay, and a photo of the nominee to [HorkheimerJournalism@astroleague.org](mailto:HorkheimerJournalism@astroleague.org).

### LEAGUE AWARDS

The following League awards are open to all League members regardless of age. Winners receive award plaques.

**Mabel Sterns Award** – Club officers may nominate their newsletter editor for the Mabel Sterns Award by emailing a copy of the club's newsletter as a PDF file, or by emailing a link to an online newsletter, to [sternsnewsletter@astroleague.org](mailto:sternsnewsletter@astroleague.org) along with a nomination cover letter (PDF) that includes the name, address, and photo of the nominee.

**Webmaster Award** – Club officers may nominate their webmaster for the Webmaster Award by emailing their club website link to [webmasteraward@astroleague.org](mailto:webmasteraward@astroleague.org) along with a nomination cover letter (PDF) that includes the name, address, and photo of the nominee.

**Williamina Fleming Imaging Awards** – These awards, sponsored by Explore Scientific, are open to female League members 19 years of age or older in four categories: Deep Sky (>500 mm excluding Solar System), Solar System (>500 mm), Rich Field (201–500 mm), and Wide Field (200 mm or less). Email the form, a photo of the entrant, and up to three JPEG attachments **not exceeding a total of 25 megabytes** to [flemingaward@astroleague.org](mailto:flemingaward@astroleague.org).

**TelescopeTrader Sketching Award** – Members may apply by emailing one sketch as a high-resolution JPEG file (10 megabytes maximum) along with a photo of the applicant to [\[astroleague.org\]\(http://astroleague.org\). Cash prizes are awarded to the top three winners.](mailto:Sketch@</a></p></div><div data-bbox=)

### CALL FOR OFFICER NOMINATIONS

Nominations for League **president, vice president, and treasurer** for terms beginning September 1, 2024, must be received by nominating committee co-chair John Goss at [gossjohn@gmail.com](mailto:gossjohn@gmail.com) no later than **March 31, 2024, at 11:59 p.m. CDT**. The duties of each office appear in the League bylaws (see League website under "About Us"). Nominations should be accompanied by a background statement of 250 words indicating qualifications and/or reasons for seeking the position and a photo of the nominee, both for inclusion in the *Reflector* and on the ballots.

### LIBRARY TELESCOPE GIVEAWAY

The League's annual Library Telescope Giveaway drawing will take place in July. The League gives away up to 11 Library Telescopes (4.5-inch Star-Blast reflectors), one to a club in each of its ten regions and one to a member-at-large. Winners then place the telescopes with local libraries. This is an excellent recruitment tool for new and younger members for winning clubs. Applications may be found on the League website at [www.astroleague.org/library-telescope-program](http://www.astroleague.org/library-telescope-program) and must be received no later than June 30, 2024.

### DELAWARE ASTRONOMICAL SOCIETY BOOK CLUB

The Delaware Astronomical Society Book Club meets monthly on the last Thursday of the Month via Zoom. Guests are welcome. Zoom links are emailed in advance of the meeting. Visit [delastro.org/members/das-book-club](http://delastro.org/members/das-book-club) for more information. Upcoming events include:

**March 28, 2024, 7 p.m. EDT:** We will be discussing *Armageddon – 2419 A.D.*, a novella by Philip Francis Nowlan, which introduced the character Buck Rogers in the August 1928 issue of *Amazing Stories*. Nowlan's granddaughter, Diane McDevitt, will join us to discuss her grandfather's life, work, and his iconic character.

**April 25, 2024, 7 p.m. EDT:** Peter Bellersby will join us for a discussion of his book *The Globemakers: The Curious Story of an Ancient Craft*.

**May 30, 2024, 7 p.m. EDT:** Nico Carver, DAS member and dedicated deep-sky astrophotographer, will lead our discussion of *Catchers of the Light* by Stefan Hughes. *Catchers of the Light* tells the true stories of the men and women who first photographed the heavens.

### LIBRARY TELESCOPE CONTEST WINNER!

As president of a Kansas astronomy club, I got involved in the Library Telescope Program in 2019 by entering the contest offered by the Astronomical League. I won a 114 mm Zhumell telescope and donated it to a local library. This was the first telescope available in Kansas at a public library for patrons to check out like a book. Fast forward to 2023, and after reaching the term limits of the