Capitol Skies

The Newsletter of the Madison Astronomical Society

Summer Solstice Issue, June 2025

M51, the Whirlpool Galaxy, by MAS Member Ralph Lyon

From the President's Desk

By Laurence Mohr

MAS is gearing up for two of its major public outreach events. All MAS members are invited to participate in these events, so mark your calendars!

On Saturday, August 16th, we will sponsor our annual star party at Dane County's Donald Park, which is southeast of Mt. Horeb, just off Highway 92. The event is held near the "Pop's Knoll" picnic area and begins at 8:00 pm. More details to follow.

And it is never too early to start planning for one of the nation's biggest public star parties, Moon Over Monona Terrace (MOMT). MAS's premier public event, MOMT will be held on Friday, October 3rd.

This year's edition will be a little longer than in the past, running from 7:00-10:00 pm. Saturn and Neptune will be close neighbors in the evening sky, and the Moon will be a waxing gibbous (87%). As usual, there will be an indoor option for the event in case the weather does not cooperate. There will not be a rain date.

The evening's schedule will allow for an extra lecture at 9:30 pm that will be more adult-oriented. In addition to the lectures, we would also like to feature a laser-pointer constellation tour. There will be the usual children's activity area and the Lake Vista Café will be open.

As always, we will be seeking volunteers to distribute information about MAS and MOMT, help guests find the telescope showing the sky object they want to see, give all-age-friendly presentations, and to operate telescopes or electronically assisted astronomy (EAA) rigs.

Anyone who participated in last year's MOMT is encouraged to share your ideas to make the next MOMT a big success. Please contact me if you would like to add your 2 cents. We will have our next planning meeting via Zoom on September 3rd at 3:00 pm. For those of us who plan to run an EAA rig, we can also schedule a technical dry run at Monona Terrace to iron out all the bugs before the day of the show.

I look forward to hearing from you!

Capitol Skies Contributors

Our newsletter is growing! We've gone from a trim Winter Solstice 2024 issue of 8 pages, to a slightly heavier Spring Equinox 2025 issue of 14 pages. This issue, Summer Solstice 2025, looks like it will weigh in at 18 pages. We believe that growth bodes well. So, what, or better, *who* do we have to thank for this?

First off, the *CS* editorial Committee: Jack Fitzmier (Chair), Bob Hamers, Alex Langoussis, John Rummel, Alex Samuel, Rob Strabala, and Rick Wayne. They brainstorm forthcoming issues and also provide content for some of our "regular" columns: AL Observing Programs, Member Profile, Tech Corner, Upcoming Programs, and Photo Tutorials.

They also help recruit other MAS members to participate. This quarter's contributors include: Craig Jewel, Laurence Mohr, Jurgen Patau, Keith Swartz, Phyllis Wax, and Chris Zeltner. Without them, there would be no newsletter. So, when you bump into them at an MAS event, thank them. Their good work is enriching our club!

We repeat a standing invitation: If you would like to participate in *CS*, drop Jack Fitzmier a line (jfitzmier@gmail.com). Offer to review a book, tell a favorite observing tale, write an equipment review, promote an upcoming astro event, lend us a hand with design, or (like Phyllis!), send us a poem! We'd love to have you join our crew.

Make Plans! The Annual MAS Picnic

By Chris Zeltner

The MAS annual picnic is Saturday, September 20, 2025 (rain date is Sunday, September 21). Things start about 3:00 pm and we eat at about 5:00 pm. This is a great time. We all get together to eat and visit. If the sky is clear, we finish off the day with a star party.

The club provides the brats, burgers, buns and hot dogs. There will be water, but if you want a different beverage, you can bring that. There will be a grill set up so you can cook something if you want.

The side dishes and desserts are pot luck. We have some pretty good cooks in the club.

It is a good idea to bring a chair for yourself. I hope to see many of you there.

Book Review

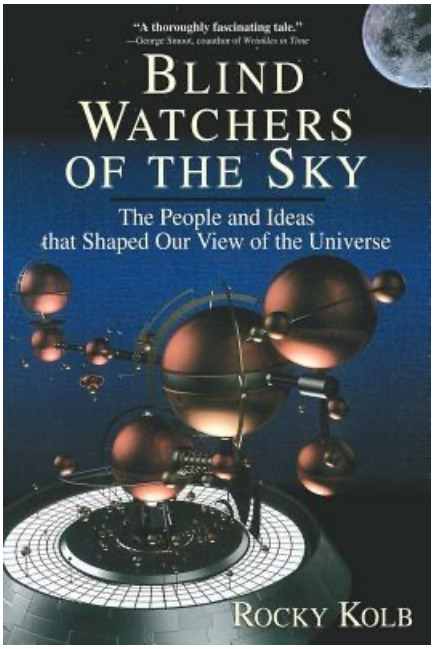
Blind Watchers Of The Sky: The People and Ideas that Shaped Our View Of The Universe
by Edward "Rocky" Kolb (Helix Books, 1996)
Reviewed by Craig Jewell

Rocky Kolb's history of modern astronomy starts in what some might consider a footnote of the field, with an in-depth look at the life and discoveries of Tycho Brahe. Chapter one starts on the night of November 11, 1572, when Brahe looked up and saw something in the night sky that wasn't there before. He first believed he found a comet, but we now know he saw Tycho's star (SN 1572), a supernova in the constellation of Cassiopeia.

Before Brahe's discovery, the night sky was understood by Aristotle to be perfect and unchanging. The Catholic church readily adopted this Aristotelian idea, since it conformed to their beliefs that the heavens were exactly as God created it.

Brahe's discovery splintered the celestial spheres. The supernova of 1572 couldn't be ignored. The author recounts previous supernovas in 1006 and 1054 were noted by many cultures on other continents. However, European history described them as comets, not stars, since comets were believed by Aristotle, and therefore the Church, to be an atmospheric phenomenon. Brahe's discovery challenged the unchanging version of heaven and helped usher in a modern era of astronomy. Five years later Brahe shattered the crystalline sphere theory when he discovered a comet. Using parallax, he proved the comet was beyond the orbit of Venus and the tail always pointed away from the sun, so therefore comets must orbit the sun.

Kolb examines other facts about Brahe that fascinated me. He was born into Danish royalty. He lost the tip of his nose in a duel over mathematics. He attempted to combine the Copernican model and the Ptolemaic model of the solar system into the Tychonic system, compromising both models by having the moon and the sun orbit the earth, but all the other planets orbit the sun. He employed Johannes Kepler (but regularly argued with him and periodically fired and rehired him) and assigned him the seemingly impossible task of determining the orbit of Mars. This work led directly to Kepler's first law.



Throughout the book, the author offhandedly explains the math of these discoveries along the way – for non experts. In 200 B.C., the Greek astronomer Eratosthenes measured the shadow of a stick in a hole in the ground at Noon in both Aswan and Alexandria and determined the Earth to have a 3750-mile radius (not too far off!). From here, Kolb illustrates how we can determine the distance to the moon and the sun based on this measurement. He takes the math further, recounting how Henretta Leavitt determined the intrinsic luminosity of Cepheid variable stars, which Edwin Hubble used to discover the distance to other galaxies. Kolb reminds us that these are the mathematical legacies of utilizing a hole in the ground in 200 B.C.

From here, Kolb launches the reader on a captivating journey of the stars and invokes a regard for the scientists who helped us understand them as we do today. The author reminds the reader time and again, the debt owed to those such as Kepler, Galileo, Newton, Halley, Herschel, Einstein, Hubble, among others. Along the way, he makes use of humor and an uncomplicated tone which makes this work accessible to the layperson. From astronomy's early origins to the present, Kolb invokes the importance of persistent curiosity - especially when breaking through the barriers of authority and tradition.

Blind Watchers Of The Sky balances astronomical science and history in a way that deepens one's appreciation for the people who dared to question our place in the universe and the methods they built upon to get us where we are today. If the history of astronomy interests you, this is perhaps the most enjoyable and accessible book on the subject that I've read to date. I recommend keeping it next to your reading chair for those cloudy nights.

The Madison Astronomical Society was founded in 1935 as a "lay group with the common desire to know more about the mystery of the universe."

No special preparation is needed to join the ranks of the MAS. The only requirement is a genuine interest in any phase of astronomical observation or study. Our members are amateurs with skill levels from novice to experienced observers.

Madison Astronomical Society members are active in sharing the pleasures of astronomy with the public, acting as a resource for students and teachers, and exchanging information at Society meetings which occur monthly. The Society continues to pursue its original goal to "promote the science of astronomy and to educate the public in the wonders of the universe." For more information about the Society, please visit us on the web at madisonastro.org.

Star Party Etiquette

By Chris Zeltner

With summer and warm weather here, we will hopefully be getting out to stargaze at YRS or somewhere else more often. When we are observing with others, it is important to remember to do our best to be aware of how much light we are using. By limiting the amount of light we use, we are improving our night vision. This is important, as the more dark adapted your eyes, the better you can see the stars. Using a dim red light is the best way to stay dark adapted.

It takes 30 minutes to become 90 percent dark adapted, and several hours to become fully dark adapted. With experience, you will find that the more you are dark adapted, the more you can see in the dark. Once you have adjusted to the dark, you will be able to see fainter objects and more detail. This makes for a much better night of observing. Unfortunately, it only takes a flash of light to undo your efforts to adapt. Then you have to start over.

This is why dim red light is the standard for star parties. The light from your phone, a laser pointer, the screen of a computer or tablet can undo hours of caution in a second. People who do

visual observing may be more concerned about this, but the same lights that are a problem for visual can also mess up astrophotographers. I know astrophotographers that are very careful of all stray light. They put in a lot of time and effort to get just the right conditions for their pictures.

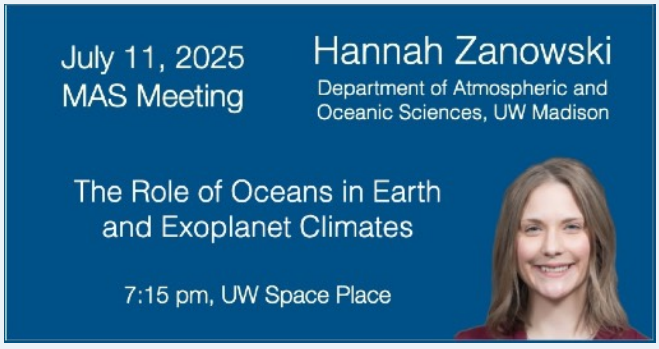
You can do some easy and inexpensive things to keep stray light from bothering yourself and those with whom you are observing. Be aware of your car lights. Try to get to your observing site before dark. Try to park with your headlights facing out and use parking lights if you can.

Use a dim red headlight or flashlight. Try not to use anything brighter unless you have no choice. If you need to use more light, check with your fellow observing partners to make sure you are not bothering them. If you are using a dim red headlight, it is best to only have it on when you need to use it. Leaving them on and forgetting them can become a problem for people. These dim red lights should be true red and not red-orange or other off-red colors that some of these lights produce.

There are several ways to contain the light you are using. Use the night vision setting on your screen. Keep the brightness level low. Use a piece of red film to cover screens and flashlights. I have seen and used a box or tub to put my tablet in. It also works to put a heavy towel over the screen and just lift it a little. This also helps keep the tablet clean and dry since Wisconsin gets quite a lot of dew. Covering screens and equipment that are not in use is a very good idea.

I am hoping for many clear dark nights stargazing with my friends. I hope to see many of you out there with me.

July 11, 2025 Meeting



Hannah Zanowski is an assistant professor in the Department of Atmospheric and Oceanic Sciences (AOS) at UW-Madison. Zanowski uses climate models to do her research, which has three major focuses: present and future Arctic Ocean change, the physical oceanography of the Archean (4-2.5 billion years ago), and ocean circulation and heat transport on exoplanets.

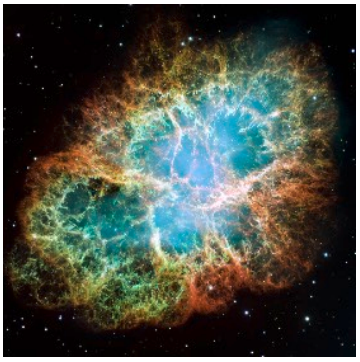
"In this talk, I will give a broad overview of the fundamental role the ocean plays—and has played—in Earth's history, from the evolution of early life to the climate we know today. In doing so, I will provide a crash course in physical oceanography, and I will draw from this body of knowledge, as well as recent research in my lab, to help us understand how oceans could behave on exoplanets, including their role in modulating climate and habitability."

Upcoming MAS Meeting Talks

Aug 8, 2025	UW's **Kate Greier** on black holes and quasars.
Sept 12, 2025	MAS member **Sam Warful** on aurora photography.
Oct 10, 2025	Astronomical League President **Chuck Allen** on the universe's distance scale.

Astronomical League Observing Program: The Messier Objects

By Jack Fitzmier, Astronomical League Liaison



Messier 1, The Crab Nebula
Supernova Remnant

Messier 13, The Hercules
Globular Cluster

Messier 16, The Eagle Nebula
Emission Nebula

Messier 27, The Dumbbell Nebula
Planetary Nebula

Messier 45, The Pleiades
Open Cluster / Asterism

This quarter we feature the Astronomical League's Messier Observing Programs. First, a bit of history. Charles Messier (1730 - 1817) was a French astronomer who began his career assisting the Astronomer of the French Navy. He was assigned the task of keeping careful records of astronomical observations taken by the Astronomer. In the process, he himself became a keen observer and eventually developed a particular interest in finding comets. He discovered thirteen over the course of his long career, which led France's King Louis XV to give Messier the nickname "the comet ferret." Messier was made a member of the Royal Society of London in 1764 and himself became the Astronomer of the French Navy in 1771.

Charles Messier (image from Wikipedia - public domain)

In his search for comets, Messier stumbled upon scores of nebulous objects that might well have been comets. But comets move in the night sky, and after repeated observations, Messier realized that most of the nebulous objects he found did *not* move. So in order to avoid mistaking one of these "stationary" objects for a comet, he began to list them. He called the list the *Catalogue des Nebuleuses et das Amas d'Etoiles*, or the *Catalog of Nebulae and Star Clusters*. Today we know it as the Messier Catalog.

Messier's Catalog went through several iterations, first listing 45 objects (in 1774), then 70 (in 1780), and finally 102 (in 1784). The modern Messier Catalog (not finalized until 1967) contains 110 objects, the final number being established after careful study of Messier's personal notes and papers. The Catalog contains 40 galaxies, 29 globular clusters, 27 open clusters, 10 nebulae, and 4 "wildcard" objects: a supernova remnant, a star cloud in our own Milky Way, a double star, and an asterism.

Messier 51, The Whirlpool Galaxy
Spiral Galaxy and Companion

At left are some public domain examples from the Hubble Space Telescope image library.

The AL sponsors 3 Messier observing programs. The Binocular Messier Observing Program requires the observer to locate and describe 50 of the 110 Messier objects. The lists of targets varies a bit depending on the size of your binoculars. But regardless of your instrument, this is a wonderful place to start observing Messiers. The Messier Observing Program (one of the most popular AL Observing Programs) requires the observer to find and describe all 110 Messiers using a telescope. And there is a bit of a catch: Go-to, computer aided scopes of any kind are prohibited. This is a manual enterprise, and if you complete it, I can guarantee you that you will know how to star hop! Finally, there is a newer program , the Imaging — Messier Observing Program. Image all 110 Messiers (go-to scopes are OK) by any method. This would provide a perfect workout for a Seestar or Dwarf! Messier gazing and imaging is very rewarding. I'd encourage you to give it a try.

If you are interested in exploring one of these programs or have further questions feel free to contact me at jfitzmier@gmail.com.

Astronomical League President to visit MAS

At the October 10th, 2025 MAS meeting, Astronomical League president **Chuck Allen** will be our guest speaker. Chuck will give a talk about the universe's distance scale. Afterward, Chuck and Jack (our own AL representative) will also be happy to speak to MAS members about the benefits of League membership.

MAS Field Trip: Remote Dark Sky Camping in Nebraska

By John Rummel

Over Memorial Day week, several MAS members made an informal excursion to Nebraska's Merritt Reservoir State Recreation Area for some camping under radically dark skies.

Merritt Reservoir is the location of the Nebraska Star Party, held every year during the new moon window nearest to the end of July or beginning of August. Though I've never been to the star party, I've been visiting Merritt for the past 7 years to take advantage of the dark skies and nearly perfect conditions for astronomy. This year I decided to put the word out to the club to see who wanted to join me.

Bonnie Tiedt was the first to jump on the bandwagon and the two of us originally decided that May 26—Memorial Day—would be the perfect time to begin the trip. It was close to new moon but more importantly, it marked the end of the busy holiday weekend so we figured the park would be emptying out as we arrived.

Weather interfered with our planned start date so we didn't arrive until Wednesday or Thursday of the week instead. No matter, Rick arrived first and secured some choice campsites and the weather cooperated beautifully. I only stayed Thursday and Friday nights but others stayed a full four days. Despite some wildfire smoke warnings, the nights were transparent and the seeing was good. The others instantly appreciated the value of driving 11 hours each way to get to these skies!

Quick 20-second exposure of our observing location at Merritt with the Milky Way just rising in the background. Photo by John Rummel.

Joining me on the trip were the aforementioned Bonnie, plus Bob Hamers, Rick Wayne, and John Wunderlin. Dave Leiphart arrived as I was leaving on Saturday and he, Bonnie and Rick stayed for an additional two nights.

I don't plan to abandon my solo efforts to continue to visit Merritt but there's already talk amongst the group about arranging another group trip.

If you don't mind even larger groups, you might want to look at the Nebraska Star Party, scheduled this year for July 20-25. More info about the star party can be found here. If interested in another MAS group trip, you can let me know here.

From left, Wilfred the dog, Bonnie Tiedt, Bob Hamers, John Wunderlin, John Rummel, and Rick Wayne. Photo by Rick Wayne.

Bonnie Tiedt, Rick Wayne, and Dave Leiphart. Photo by Bonnie Tiedt.

Want MAS branded merch? Visit our store at Madison Top Company. Men's and women's apparel, a mug and a ball cap currently available. Each purchase puts a tiny donation back in MAS's general fund to help us in our nonprofit mission to educate the public about astronomy.

https://madison-top-company.printavo.com/merch/madison-astronomical-society/ or just click here.

MAS Merch!

“Oh, no! It doesn't fit!”: Rebuilding My Telescope

By Keith Swartz

When I was in high school, I made the largest scope that would fit in the back seat of the car I had back then. I assembled a 10-inch f/5 Newtonian with a wooden tube 54 inches long. The tube and dobsonian mount are all homemade...well, with stuff purchased from the lumberyard and hardware store. The mirrors, mirror mounts, focuser and viewfinder were all purchased. For many years the scope fit fine in our family minivan, but now I have a small car. And my telescope doesn’t fit. I could have bought a bigger car, but I thought that my money would be better spent on rebuilding the tube to make it more compact. Of course, another option is to get a smaller scope, but I felt that it would be a step backwards. Plus I wanted to make the assembly more lightweight, make the mirrors more accessible for cleaning, and reduce thermal currents. My old tube often took a long time to cool off. When I looked at a bright star out of focus, I could watch the turbulence of the air’s convection currents inside the tube.

Original wooden tube assembly.

I considered several styles for the new tube— assemble/ disassemble, unroll hinged sections, etc. I decided on a box within a box. The smaller inside box slides out and is rigidly secured to the outside box using cam locks similar to ones you see on sash windows. The boxes overlap twelve inches for good rigidity.

“Box within a box” redesign

To shield the mirrors from dew, the top is a waterproof marker board. I can draw or write messages like “Welcome to Moon Over Monona Terrace!” As long as the scope is not pointed too high, the flat surface works well as a small table for my iPad or small star charts. Try that with a round tube!

The view finder is removable and stores inside. The focuser also stores inside by folding on a hinge. Compartments inside store my zoom eyepiece, a Barlow lens, filters, laser collimator, and, of course, a Sharpie marker. I have everything I need inside the box.

I included some special features to make my scope easier to use. I added hand knobs to the mirror alignment bolts and screws so that I could align the mirrors without tools. The solar filter is held on by Velcro. The cover for the secondary mirror doubles as a storage pouch for lens caps, which I Velcro onto the inside of the stand while observing.

An artist friend of mine painted the circles on the altitude bearings. I wanted to showcase interesting objects that are up a lot, so one side shows the barred spiral galaxy M109, which is near the bowl of the Big Dipper. The other side features the planetary nebula NGC 6826, the Blinking Nebula in Cygnus, with its bright central star. The altitude bearings are offset from the centerline to perfectly balance the scope in any position.

The best thing about rebuilding the tube was using my creativity. I made many sketches of many ideas, which was great fun. Setup time is a bit longer than with my old tube, but takes only a few minutes more. I enjoy my same old telescope even though I now have a small car.

Click here to contact Keith.

Looking down the tube.

View finder, focuser and eyepiece in storage position

Yay! It fits!

Artist’s rendition of M109 on the bearing.

In 2020 MAS members—including Keith—shared their telescopes at a “Moon Over Monona Terrace” event. See it here: Youtube Link. -Ed.

A Note from the Editor

By Jack Fitzmier

An innocent Madisonian might be forgiven for thinking that MAS is monthly meetings, period. Announcements about our Space Place gatherings are splashed on our website and on our Facebook page and, since the pandemic, we put a lot of energy into making our monthly presentations available on our Youtube channel.

I'd suggest that this month's *Capitol Skies* presents evidence that we are far more than enjoyable Friday evenings on Park Street. In early April we celebrated our 90th anniversary with a fantastic Gala event attended by over 100 guests (see John's article). Not many clubs can boast that achievement! In March, April, and May we hosted public outreach events all across South Central Wisconsin (see Rick's report). And we are in the planning stages of two of our largest annual outreach efforts — the Donald Park event and the annual (and spectacular) Moon Over Monona Terrace event (see Laurence's column). In addition to regularly scheduled star parties at our YRS dark sky site, some of our members hanker for even darker skies. Check out John's report on the May Nebraska Dark Sky Getaway. Our membership is growing, we are refurbishing the infrastructure at YRS, with plans for additional renovations (see Jurgen's report). The Astronomical League has noticed us, too: Chuck Allen, the National AL President, will be our guest speaker at the October meeting. Even our newsletter is attracting the attention of MAS members' "friends and family."

In last month's issue, Jordan Konisky contributed an article about how he has successfully adjusted his observing arrangements to better suit his current circumstances. In that same issue, I invited readers (naively assuming they would be MAS members) to contribute material to *CS*. Within a few days, I was delighted to hear from Phyllis Wax, Jordan's sister-in-law. Turns out Jordan's astronomical "outreach" to his family has inspired the muses! See Phyllis's poem, "The Astronomer's Gift," on page 13**.** Thanks Phyllis! And bravo to Jordan, for his gift to all of us.

Like I said: More than Friday meetings!

90th Anniversary Gala Officially a Total Blast

By John Rummel

On April 5th, MAS celebrated its 90th birthday with a grand party we called the **Anniversary Gala**. This event, which had been meticulously planned for nearly a year, was a resounding success. The gala was held at the magnificent Usona Institute at Promega Corporation in Fitchburg. Usona is conveniently located just a stone's throw away from the historic observatory, now officially known as the Bell-Burnell. Originally built in 1880 on Observatory Hill, right beside Washburn, the observatory served as the UW Student Observatory. In 1960, the building was graciously donated to the Madison Astronomical Society and relocated to Fitchburg, where it stands on Promega property to this day. Many gala attendees had the privilege of exploring the observatory and learning about its rich history, as well as the ongoing research that takes place there thanks to Promega's comprehensive renovation and restoration efforts.

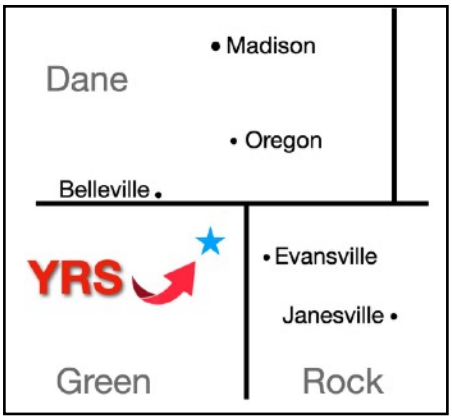
The Gala was a harmonious blend of historical threads: the contemporary incarnation of an observatory and a venerable club, connected through time to the University of Wisconsin-Madison and the Promega Corporation. The gala's guest list included a who's who of current and former members, spanning time from the 1950s to the present day.

Cake photo by Jan Duschack

The success of the Gala was made possible by the support of the MAS board, the generous donation of the Usona venue by Promega CEO Bill Linton, and the exceptional efforts of the Gala Committee: Jack Fitzmier, Bonnie Tiedt, Rita Hampton, Rob Strabala, and John Rummel. A three-page spread of photos from the gala starts on the next page.

What is YRS?

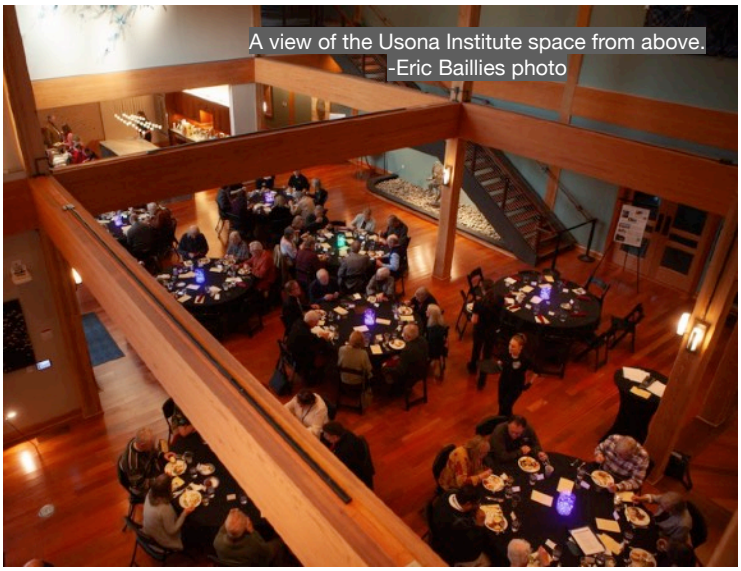
YRS stands for ***Y**anna **R**esearch **S**tation*, which is our Society's dark sky site. It is in northeastern Green County, about a 30 minute drive south of Madison. It has a heated and air conditioned clubhouse, a pit-toilet, several observatories, and plenty of concrete pads with electrical service for setting up equipment. There is no water available on site. It is for MAS members and their guests, and it is where we hold our star parties and other events. The address is N7847 Kelly Rd, Brooklyn, WI 53521 Click here for Google Maps directions.



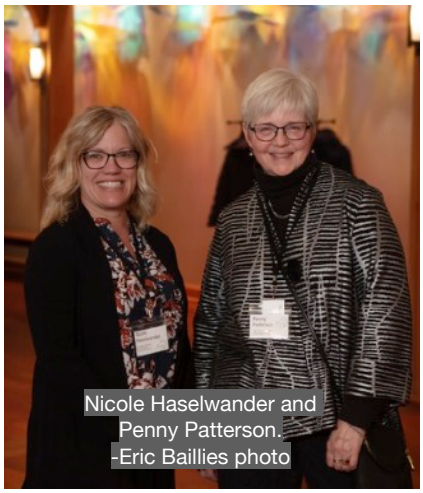
MAS 90th Anniversary Gala!


John Rummel chatting with Doris Koster and family.
-Eric Baillies photo


Norman Goeschko, Jurgen and Jean Patau, Chris Zeltner (standing), Jeff Shokler, Avtar Roopra, and Craig Jewell.
-Eric Baillies photo


A view of the Usona Institute space from above.
-Eric Baillies photo

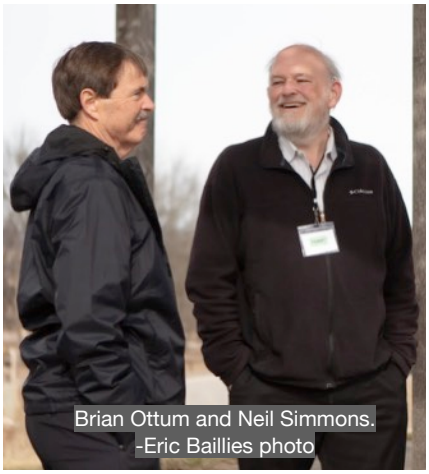

Eric Thiede and Angela Spindler. Eric's membership goes back to the mid-60s.
-Jeff Stewart photo


Nicole Haselwander and Penny Patterson.
-Eric Baillies photo

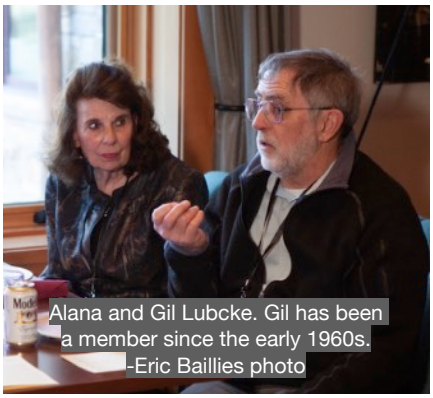

Norm Goeschko, Pam and Craig Jewell, and Jack Fitzmier.
-Kevin Santulis photo


Jim Lattis, Chris and Walt Zeltner, Bob Aloisi, Dick Wieboldt, Terry Genske, and Cindy Lind.
-Eric Baillies photo


Cynthia and Ken Mandl. Cynthia's membership goes back to the mid-1960s.
-Eric Baillies photo


Brian Ottum and Neil Simmons.
-Eric Baillies photo


Rita Hampton and Jeanne Hamers.
-Eric Baillies photo



Alana and Gil Lubcke. Gil has been a member since the early 1960s.
-Eric Baillies photo

Doris Koster reads an account of her and her late-husband Art's days in the MAS, dating back to 1959. (Doris's daughter Virginia Krueger looks on).
-Kevin Santulis photo

Bonnie Tiedt, Tom Reuter, and Carol Santulis.
-Eric Baillies photo

Doug and Jan Duschack having their picture taken by an unknown guest.
-Eric Baillies photo

Jean and Jurgen Patau.
-Eric Baillies photo

John Rummel and Bonnie Tiedt.
-Eric Baillies photo

Bob and Jeanne Hamers.
-Eric Baillies photo

Jack Fitzmier and Zach Holcomb.
-Rob Strabala photo (w/ Zach's phone)

Bill Linton receiving the Patron Membership award from MAS president Laurence Mohr.
-Eric Baillies photo

Explorer Post members Adam Korbitz, Mark Clear, Brian Ottum, and Tim Baker.
-Jan Duschack photo

John Rummel sharing a historical tidbit about the old MAS observatory.
-Neil Robinson photo

Avtar Roopra, Jeff Shokler, and Neil Robinson.
-Eric Baillies photo

Ray and Ann Fey.
-Eric Baillies photo

Bill Linton, Penny Patterson and John Rummel.
-Eric Baillies photo

The sheer beauty of the Usona interior left guests feeling very spoiled.
-Eric Baillies photo

After the gala was over, this group headed back up to the Bell-Burnell for some lunar observing.
-Zach Holcomb photo

Paul and Patty Fritschel standing beside the pier of the old Oscar Mayer shed observatory.
-Eric Baillies photo

A group of gala goers enjoys a tour inside the Bell-Burnell dome.
-Eric Baillies photo

Dan Hyslop, Frank Ranallo, Martin Mika, and Dave Leiphart.
-Eric Baillies photo

Kevin Santulis and Virginia Krueger.
-Eric Baillies photo

MAS Member Spotlight (Double Star Edition): Carol & Kevin Santulis

By Alex Samuel

Tell us about yourselves.

Carol earned a Bachelor of General Studies with an emphasis in the sciences from Louisiana State University and also earned a Bachelor of Science in Interior Design from the University of Wisconsin. Kevin earned his Bachelor of Arts degree in Political Science/History at the University of Pittsburgh and retired in 2016 as VP of Operations at WPS Military Health Division.

Outside of astronomy, what are your interests?

Carol enjoys gardening and photography. Kevin enjoys playing the guitar.

How did you become interested in astronomy?

Carol used to hang out on Friday nights when the LSU Observatory was open to students back in 1975. Kevin always had a strong interest in the sciences in college and had minors in chemistry and physics.

In 2005 we had a trip to Flagstaff, Arizona and learned about dark sky cities. We did a tour of Lowell Observatory and attended our first star party there and we were blown away with some of the observations. But it was not till we built a house in 2009 over the hill from Yanna Research Station and said "There is an astronomy club nearby, we really should join." That year we vacationed in Oceanside California, right down the street from OPT (Oceanside Photo and Telescope). We had to visit and came out with our first scope, a Celestron 8SE. It was the perfect starter scope for us.

Do you have a favorite telescope or piece of equipment you like to use? What do you enjoy most about it?

Wide field astrophotography is now Carol's favorite hobby.

Carol: "I have four scopes, but the two I use the most are my Redcat

51 on the harmonic drive AM5 mount with a ASI2600MC Pro cooled camera and controlled by the ASIAir. I have an auto-focuser and have not yet installed the automatic camera rotator. The other scope I use even more is the Seestar S50 smart scope. They are both 250mm focal length, but the field of view is so different because of the difference in camera sensor size. The little Seestar is the scope that comes out anytime there is only a couple hours of clear skies and I don't want to set up the bigger scope. It is just pure fun! The 20 second exposures can still be processed in PixInsight for an image that is better than the Seestar can process internally."

Spaghetti Nebula 12.8 hrs, Redcat 51, AM5 mount, ASI2600MC camera with the Antlia ALP-T dual band filter, ASIAir controller.

Are there any specific projects that you're currently working on?

Carol: "I have some nice images of some very faint targets and currently have several integrated flux nebula projects going when there is no moon. I used to think five hours was a lot on a target, but now I aim for 30 hours on some of these fainter targets. Learning PixInsight has actually been the hardest thing I have had to learn, but the time investment has really paid off. If there are no clear skies, there is always reprocessing old data in PixInsight to pull out more detail."

Have you had any memorable observing experiences or "Wow!" moments when stargazing?

Carol: "My favorite was witnessing the Mifflin meteor of 2010. I was sitting outside looking for meteors. Then WOW! The Mifflin meteorite created a fireball equivalent to 20 tons of TNT. It was so huge and bright, then exploded and rained down near the town of Mifflin in southwest Wisconsin. I have watched a documentary of it a couple of times…so cool!"

Do you have any advice for new members of MAS?

We love coming to MAS meeting and outreach events. Like most clubs, you get out of it what you put in. We find it very rewarding working with MAS.

To contact Alex, or make a suggestion for a future member profile, click here.

Tech Corner: Color Cameras and the Bayer Matrix

By Bob Hamers

If you've ever used a color camera for astrophotography, you've probably heard about the *Bayer Matrix*.

Most color cameras—whether they're dedicated astro-cams, SLRs, mirrorless cameras, or cell-phone cameras — make color images by placing red, green, and blue filters over a single monochrome sensor. This color filter array ("CFA") or "Bayer Matrix", usually consists of a square (2x2) array of four filters: one each of red and blue, and two of green (since the human eye is most sensitive in the green). [Figure 1]

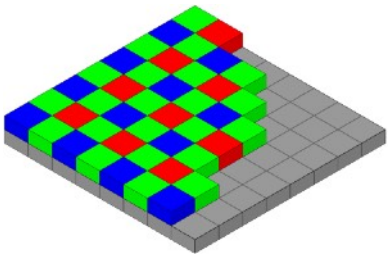


Figure 1: This image shows how color cameras operate by having R,G, and B filters in front of a monochrome sensor array. The 2x2 arrangement of red, green, and blue filters is called the Bayer matrix (image from Wikipedia).

A color camera sensor with 6000x4000 pixels, for example, actually captures four interleaved 3000 x 2000-pixel images: a red image, a blue image, and two green images.

Why should you care about the Bayer Matrix? Since the R, G and B pixels on the "color" sensor are not in exactly the same locations as one another, the four images one would get by from simply taking the R, G, G, and B pixels are ever-so-slightly *shifted* from one another, and the image needs to be "debayered" to create a full-color image. With ordinary photography, issues like this are all taken care of behind-the-scenes in the camera's software. But for astro-imaging it's important to calibrate images and we frequently need greater control of the process. For example, the very rapid variations in intensity around stars can lead to odd artifacts, such as color fringing, if not handled properly.

As an example, let's look closely at a full-color image of a bird (an Indigo Bunting). I chose this image because there are very sharp changes in color on a few-pixel scale. Panel "b" shows the greatly magnified boundary between the green leaves and the top of the bird's head. Panel "c" shows an even more magnified view, while panel "d" shows the raw camera output of exactly the same region. In the "raw" image (Panel "d") the 2x2 checkerboard pattern of the Bayer matrix appears, and I've labeled the pixels according to their respective color of the filter used to record the intensity at each location. [Figure 2]

The process of going from this "raw" or "bayered" image in panel "d" to the color image in panel "c" is called "debayering". Since the R,G, and B pixels in the raw image are measured at different locations on the sensor, debayering involves taking the R,G, and B pixels in the bayered image and *estimating* what the intensities of R, G, and B would have been *if one had been able to measure all three colors at identical locations in the image*. An important point is that estimating the intensities at locations other than where they were actually measured depends on what assumptions are made about the images themselves.

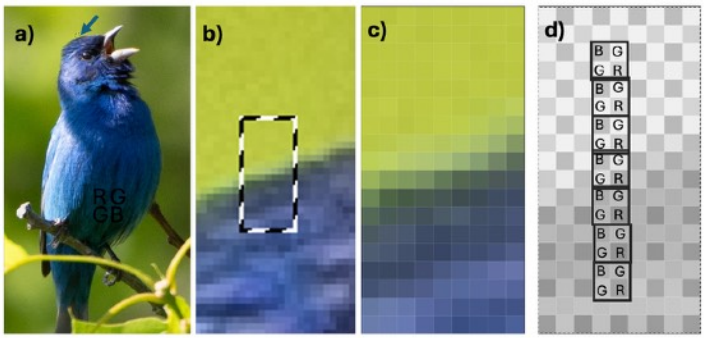


Figure 2: A color picture from a Canon camera. The arrow points to a small region enlarged in panel "b". Panel "c" shows an even more enlarged region, now showing the individual pixels. Panel "d" shows the "raw" image of the same region, showing the checkerboard pattern of the Bayer matrix of the raw image.

As one very simple example of debayering, consider a small section of raw image, as shown below. One particular pixel, labeled B_{32} is highlighted. At this pixel we've only measured the intensity of Blue light. But we'd like to turn it into full color, so we need to estimate what is the intensity of green and red at this same location. [Figure 3]

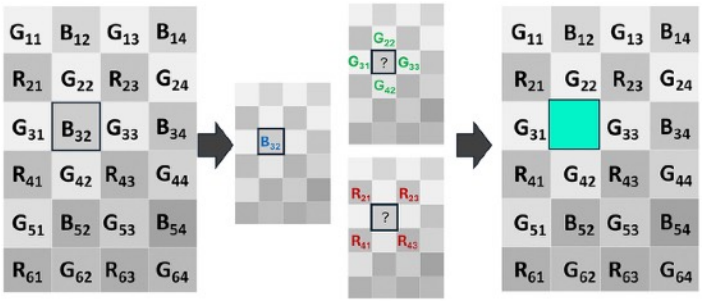


Figure 3: Debayering of one pixel, labeled B32. While we have measured only blue at this pixel, we estimate the intensity of red and green by looking at adjacent pixels. Once we estimate R and G at this pixel, we can create a full-color pixel at this same location.

We can estimate these by looking at a local neighborhood of points, as depicted in the middle panel. For example, there are four nearby green pixels, immediately above, below, to the left, and to the right of B_{32}. And there are red pixels along adjacent diagonals.

We can estimate the intensity of all three colors at this one pixel as follows [Figure 4]:

Figure 4

$$B_{32} = B_{32}$$ (this we know exactly, because we measured Blue at exactly this location)

$$G_{32} = \frac{G_{31}+G_{33}+G_{22}+G_{42}}{4}$$ (this is an estimate based on the nearest-neighbor green pixels)

$$R_{32} = \frac{R_{21}+R_{23}+R_{41}+R_{43}}{4}$$ (this is an estimate based on the nearest-neighbor red pixels)

We now have values of R,G, and B at this *same location*, and so we can give it an actual color – here I've arbitrarily colored it greenish blue. We've just "debayered" one pixel!

Continued top of next page.

Using similar equations we estimate the intensity of R,G, and B at all the locations in the full image, and thereby recreate a full-color image at the full resolution of the original raw image. Because debayering involves estimating the intensities of R, G, and/or B at pixel locations where we didn't actually measure them, there are different ways of estimating, and so there are different debayering algorithms that you can often choose. If the intensities and colors are changing slowly, a very simply "bi-linear interpolation" like I used above would work fine. Near stars, however, there are very rapid changes in intensity, and so more elaborate ways of debayering the image might be better. Different interpolation methods are frequently available in common astro-imaging software packages like Pixinsight and Astropixel Processor. Some examples include bi-linear interpolation, superpixel, Lanczos-3, and "VND" (variable number of gradients). Because debayering inherently estimates intensities at locations that we didn't directly measure, there's not necessarily one particular method that will necessarily be better than others in all circumstances – each method will have its strengths and weaknesses, and you'll need to compare them with your own images to determine what works best for you.

If you are calibrating your images using darks, lights, and/or bias images, it's important to do the calibration *before* debayering the images, because the calibration steps all involve pixel-by-pixel corrections to the image and these can only be done accurately on the original raw image.

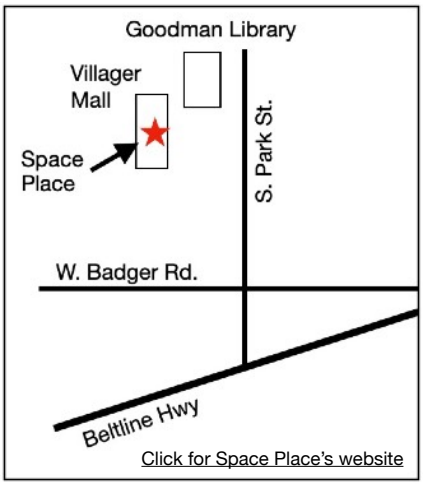
Frequently Asked Questions

Where does MAS meet?
We meet at UW Space Place, located in the Villager Mall (right behind the Goodman Library), a block north of the Beltline Highway at 2300 S. Park St., Madison. Space Place is located downstairs on the lower level of the Atrium. Elevators are located on the left side of the lobby. Space Place has a classroom setting for our meetings as well as a museum that highlights the UW's role in space science and astronomy. (See map below)

When does MAS meet?
Our regularly scheduled meetings are on the 2nd Friday of each month. In addition, we schedule occasional star parties, outreach events, and special presentations that are open to the public.

What happens at MAS meetings?
Most meetings start with a newcomer orientation at 6:45, a social time from 7-7:15, announcements and welcome visitors at 7:15, and the main presentation at 7:30.

What are the presentations like?
Our presentations are of two main types: talks by our own members about the stuff we do (observing, photography, gear, etc.) and presentations by astronomers and other professionals about their research.



UW Space Place

Do I need any special knowledge to be a member?
Not at all. Our members are men, women, and young people of all ages, from all walks of life, with education levels from "barely made it through high school algebra" to advanced degrees. All you need is a curiosity about the universe and a desire to learn.

What is MAS's address?
You can find us on the web at **https://madisonastro.org/**. Mailing address is PO Box 5585, Madison, WI 53705.

The Astronomer's Gift

By Phyllis Wax

We swatted away mosquitoes
as we sat outside and chatted.
The little kids chased fireflies.
Dusk fell.

And all the while he was setting up the telescope,
aiming it, deciding which lens would work best.

Then we each took a turn viewing the moon.
Some had to climb a stepstool to see.

As the sky darkened he re-aimed,
then re-focused the instrument. Over
and over, he re-aimed, re-focused.

One by one each of us again leaned in
close to the eyepiece, cried out
or gasped or aahed

at the four Galilean moons of Jupiter,
two tiny sparks on each side,
and later, at Saturn's icy rings.

That night he widened the world
for all of us.

Originally published in *Your Daily Poem* in May 2020. For the wonderful MAS story behind this poem, see Jack's Editor's Note on page 7.

Treasurer's Report

By Jurgen Patau, MAS Treasurer

Though I serve as the Treasurer of MAS, my "office" comes with two hats: Treasurer and Membership Director. In this issue of *Capitol Skies*, I'd like to address our financial circumstances. To put it another way, I hope to answer the questionWhat does MAS do with your dues?" In the Fall issue of *CS*, I'll provide a report on our growing membership (complete with an analysis of why I think we are growing) as well as a few words about how the Treasurer/ Membership Director works with the MAS Board of Directors.

So, how is MAS doing, both financially and member-wise? The short version: We are currently financially comfortable and our membership has grown by over 50% in 8 years. We've enhanced our member benefits, and through dues and the generosity of our members, we've made significant upgrades to Yanna Research Station (YRS), our observing site. We have the resources to maintain and plan future upgrades to YRS and the observing resources our members want.

Here is a high-level 10-year overview of MAS resources and membership:

	Q1 (Jan-Mar) Numbers as of Mar 31			Q2 (Apr-Jun) Numbers as of Jun 30			Q3 (Jul-Sep) Numbers as of Sep 30			Q4 (Oct-Dec) Numbers as of Dec 31		
	Balance	Members	# AL	Balance	Members	# AL	Balance	Members	# AL	Balance	Members	# AL
2015				$26,034.42	---	---	$24,106.62	---	---	$25,280.54	---	---
2016	$25,505.89	---	---	$25,217.72	---	---	$24,761.33	103	---	$26,528.73	83	---
2017	$26,436.04	90	---	$26,594.78	96	---	$26,375.19	105	---	$28,790.25	97	---
2018	$29,019.57	106	---	$29,032.34	115	---	$31,347.47	124	---	$33,578.93	104	---
2019	$33,212.97	106	---	$33,260.61	110	---	$34,747.58	114	---	$35,265.13	96	---
2020	$35,725.74	105	---	$35,605.66	108	---	$38,929.91	114	---	$39,695.75	115	---
2021	$40,083.08	124	---	$40,209.11	131	---	$43,154.30	137	---	$41,074.54	112	---
2022	$41,166.54	120	---	$40,317.76	127	---	$42,460.67	131	---	$43,733.08	117	---
2023	$52,278.47	124	---	$53,239.69	130	---	$17,837.56	134	---	$21,499.13	115	---
2024	$22,259.44	125	---	$21,966.53	133	---	$25,775.73	138	---	$26,386.11	130	55
2025	$32,118.78	140	60									

MAS Financial History

Summary report detailing **end-of-quarter** financial balances and memberships
Note: MAS fiscal year (FY) is October 1—Sep 30

I will address our membership growth in September, but for now, what happens to the money you entrust to MAS?

How money flows out and where it goes

The most significant expenditures in my tenure have been the two-phase YRS infrastructure upgrade project. It was driven by overloaded electrical circuits and too few observing pads (six, which shared one power outlet) in the observing area. Planning started in 2019. Phase 1, completed in 2022, upgraded the clubhouse electrical panel to handle many more circuits. It cost $2,525. Phase 2, completed in 2023, was the YRS pad-upgrade project. It removed several structures, replaced six concrete observing pads with 14 larger ones (each with its own dedicated power), gave each building its own power circuit and rewired the entire site in conduit to prevent any cascading power failures. It cost $37,610. Both phases were done by professional contractors because each was way too big to be done by volunteers. These projects were made possible by the extremely generous fund-raising response by our members, who donated over $10,000 to make sure we could afford both phases and remain financially sound. The final result? Pre-upgrade, we had 6 6'x6' pads with a single 15-amp circuit supplying power to all six. Post-upgrade we have 14 7'x7' pads, each with its own dedicated 15-amp service. (A Milwaukee club member visited us last year and raved about YRS's infrastructure.)

> "MAS is financially sound, growing at a manageable pace, and poised for whatever the future brings."

Currently we are doing major repairs to YRS buildings and grounds, under the leadership of our Observatory Director, Dave Leiphart. While the labor is volunteer "sweat equity" (continuing the tradition that helped build YRS originally), we have to purchase the construction materials and purchase trees that will eventually grow into effective light shields. In the future, we have plans to "rationalize" our club-owned observing equipment so that they meet the evolving needs of members. We also hope to bring internet access to YRS when an ISP brings those capabilities to Kelly Road. And we are working on a new web presence which, among other features, hopefully will enable online membership

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enrollment and renewals (yay! – no more checks, stamps and envelopes!). We want to make sure we have the resources to support those projects.

In 2024 we rejoined the Astronomical League (AL – MAS was one of its founding members but dropped out some years ago). This benefit is funded by members who join the AL at a special club rate, which MAS channels to the AL. This benefit has minimal impact on MAS finances. However, the AL and MAS have different fiscal (budget) years, and that adds complexity to the annual MAS membership renewal process. (Thanks to Jack Fitzmier for his work helping us to rejoin the AL.)

Our ongoing costs include Alliant Energy for electricity, State Farm for insurance, and a YRS neighbor for mowing. Since the YRS infrastructure upgrade and the increased use of YRS, our monthly energy charge has gone up. We have MAS Board liability insurance and YRS property insurance. The property insurance **only** covers YRS structures: it does **not** cover personal or club equipment stored at YRS. Homeowners know that the cost of property insurance only goes up. Insurance is a cost we monitor closely because it's about 20% of our annual expenditures. Mowing costs $70 per session, approximately every two weeks when grass is growing. We also have office costs (postage, paper, PO box, etc.), picnics and other collective events, and miscellaneous other Board-approved ad hoc costs.

The MAS Board approves new initiatives and approves the annual budget. In addition, all individual purchases over $1,500 must be approved by the membership. Membership approval of the costs was the final step in approving the YRS infrastructure upgrade project.

MAS celebrated its 90th birthday on April 5, 2025. The Board decided to do it in style and budgeted a subsidy of about a $1,500 (normally banquets are cost-recovery, so normally little to no MAS dollars). The Gala Planning Committee did an outstanding job organizing it. It was held at the Promega Corporation's new Usona Institute building, an amazing contribution by Promega's CEO, Bill Linton. They also made their photographer available and sponsored guided tours of its Bell-Burnell Observatory (formerly MAS's Oscar Mayer Observatory). (Many, many thanks to Bill!) Over 100 people attended. Generous contributions from club members helped defray other banquet expenses which included covering banquet costs for a significant group of specially invited "legacy" (mainly former) attendees who had joined MAS up to 60 years ago. With all that, the banquet cost MAS less than the budgeted amount.

Our Bylaws mandate that we keep a $6,000 reserve fund. It's intended to be used only in an extreme emergency (which we've never faced), including for legal services in the remote possibility that MAS will be dissolved (or merged) in some nebulous future.

When you look at the table on the previous page, mentally subtract $6,000 to see how much we actually have available to spend. And to see the effect of the $10,000 contributions to the YRS infrastructure project , also subtract $10,000 from the amounts starting in Q3 of 2023. That shows how much our current financial stability owes to those contributions.

How money flows in and how it's handled

Our revenue is mostly from membership dues, supplemented by donations from generous members. Renewal retention varies between 80-90%, and almost all renewals are in by December. The donations help us bank money for future projects and are a major reason our resources are growing. 2024's membership-category revision (compressing four options to just two, Student and General, and adjusting rates) potentially affected our finances. However, when renewals started flowing in in October 2024, we were gratified at the loyalty of the former "Regular" members (without observing privileges): almost all renewed in the new General category. Everyone now has all-access privileges to YRS and club equipment after a brief training course.

MAS's membership year runs from October 1 to September 30. The annual membership renewal process is entirely manual. It's based on an Excel membership spreadsheet, mail-merged Word renewal letters, lots of manual paper folding, lots of envelopes and lots of stamps. The more members we get (yea!) the longer the process gets (boo!). The AL membership benefit adds complexity to this process. Renewal letters go out in early September.

We're a 501(c)(3) charitable corporation, so we can accept tax-deductible donations (to the extent allowed by law). It also exempts us from Wisconsin sales tax, especially useful for large projects. To keep it, we file three reports: local, state and federal. We're listed in Charity Navigator if you're curious, but we are small (under $50,000 per year), so it lists only brief information. Some members use donor-advised funds to make contributions.

Our checking account finances day-to-day expenses. We don't invest in the markets; we need predictable investments (yes, we're very conservative) in case we run into emergencies. We invest our savings in CDs, rolling over accrued interest at renewal. During my tenure, the only CDs we've cashed in were for the YRS infrastructure upgrade project.

So, bottom line, we're financially sound, growing at a manageable pace, and poised for whatever the future brings. In the next issue, more thoughts on MAS membership trends and on how the Treasurer works with the MAS Board.

Questions? Comments? Feel free to drop me a line at jrpatau@wisc.edu.

Astroimaging from The Ground Up

By Rick Wayne

Welcome back. Last quarter we discussed planning sunset and sunrise images. Let's step up the difficulty and start taking shots at night. It's Milky Way season, so let's dive in.

NEEDED:

- Camera that can take exposures of at least several seconds
- Tripod or beanbag
- Self-timer in camera or remote control, for shake reduction
- Pixel editor (Photoshop, The GIMP, etc.)
- (Optional) Stacking program (Sequator, Siril, Astro Pixel Processor (APP), PixInsight (PI))

First, of course, you need to take some pictures. The Milky Way is a deep-sky target, heir to the same challenges as telescopic imaging: It's dim, needing a long total exposure time, and it moves while you're trying to image it!

For an excellent discussion of dim targets and the resulting signal/noise challenges that's in depth yet reasonably easy on the math, you can't beat Charlie Bracken's *The Deep-Sky Imaging Primer.* In a nutshell, though: Noise is variation away from the unknowable "true" value of a signal. If the signal is small, it's easy for noise to drown it out. So the simplest answer is always the same: "get more signal".

Noise is not only a grainy appearance to an image. It can be subtler than that. Increase contrast to bring out detail, and we amplify the noise along with the signal. If two adjacent pixels values are farther apart than they "should" be due to noise, amplification will exacerbate the difference, so instead of a nice smooth tonal gradient you get harsh contrast or posterization.

How to fight it? Consider a bucket. We want to know how much water is in it. So we pour it out into a graduated cylinder that measures to the milliliter. Trouble is, some water stays in the bucket, some might spill, etc. That's noise in our measurement, and if we only had 5 ml in the bucket to start with, our error would be a big fraction of the measurement. Fill the bucket, and half an ml here or there makes little difference. Or, if we're stuck with a nearly-empty bucket, we can measure twenty times and average the results. Either way, we'll be close to the "true" value.

Long exposures are filling the bucket before we measure. Stacking is measuring over and over and averaging the result. That's it! Those are the keys to the deep sky kingdom, right there.

We apply this to Milky Way imaging by either using the longest exposures that won't blur due to the Earth's rotation, by shooting a bunch and stacking them, or both.

You can estimate the max exposure time by the 500 Rule (full-frame sensor) or 300 Rule (APS-C). Full-frame, max = 500 /focal length. APS-C, 300/focal length. (This is just a rule of thumb to start with, mind.)

In Nebraska with the MAS peeps in May, I was shooting with a 14mm lens on APS-C, so I reckoned my max at 20 seconds. How much light you'll collect depends on (1) how hard you can drive your sensor — mine gets janky above ISO 1600 — and (2) how big a bucket your lens is. I stopped my Rokinon down to f/4 to fight lens aberrations. [Figure 1]

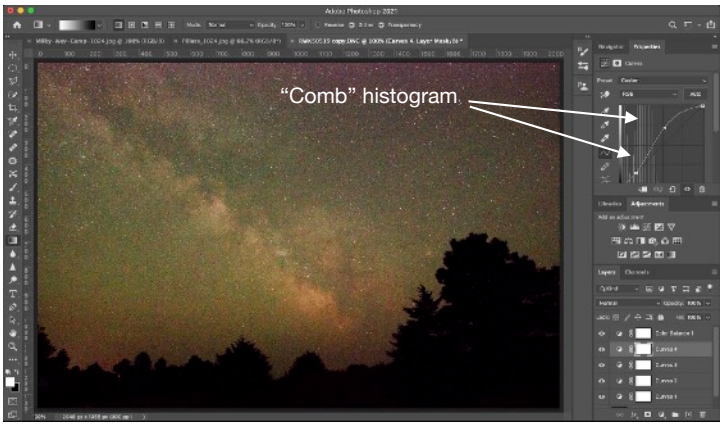

Figure 1: Single stretched frame

Does that fill the bucket enough? Not really. Even my quick stretch (contrast enhancement) shows that there's just not enough snort in this single frame. Note the "comb" effect on the histogram display, separating the smooth curve into vertical lines. That's the telltale sign of an image whose contrast has been flogged past the point where smooth tonality breaks down.

If you have a more-sensitive camera, or a lens with a wider useful aperture, you might be able to fill your bucket up and move on. Don't trust the image on the camera's rear screen, most cameras stretch that automatically. Check the histogram: if it has a big peak at 1/4 to 1/3 of full scale, your bucket is plenty full of photons.

For the rest of us, it's multi-measurement time. I set my camera to do 20 or so identical exposures. I won't have space here to detail different software, but here are some suggestions:

1. If you're on Windows, try Sequator. It favors simplicity over feature-richness, and has a "freeze ground" feature that saves a lot of hassle (as I, a Mac user, will demonstrate below).
2. Siril is free and is excellent for other deep-sky adventures too. Recommended for all platforms. Watch the videos to learn how to stack and register.
3. Astro Pixel Processor and PixInsight are heavyweight programs. I use and recommend both; APP is much more straightforward to learn and will satisfy most folks' needs for a long time. PI is famously a pain to learn, but is the top program in the field. APP is about $165, PI is about $300 (depending on Euro exchange rates).

Any of these programs will register the stars in your images and stack them. But if you're not using Sequator, you have a new problem! WHY ARE THE TREES BLURRY?! [Figure 2]

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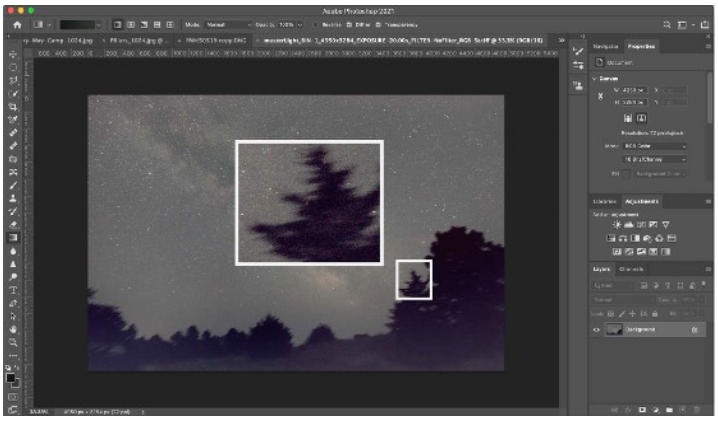


Figure 2: Stacked frames registered on stars, showing foreground blur

Well, in each successive image, the stars had moved a little bit since the previous one. The stacking program registers on the stars, not the edges of the frame, so the sky is sharp. But the ground didn't move, and the averaging process blurs it out. This, by the way, is exactly what happens if you get really clever and use a tracking mount to do an exposure much longer than the 500 or 300 Rule would allow — great sky, but blurry foreground!

Fear not. There is a way. All you need is one good exposure of the foreground, and let the stars trail all they want. So set the exposure time way, way up — to the total of all your sub-exposures, in fact — turn off the tracker, if you have one, and shoot. The reason for the super-long exposure is to make the sky in this "foreground" image look as close as possible to the stacked result from your "sky" images. Then you open your favorite image editor — Photoshop, The GIMP, what have you — on the stacked result and the foreground image. Select the foreground itself (in my case, those trees), copy, and paste into the stacked image. You might have to drag it up and/or around a bit to cover all the blur.

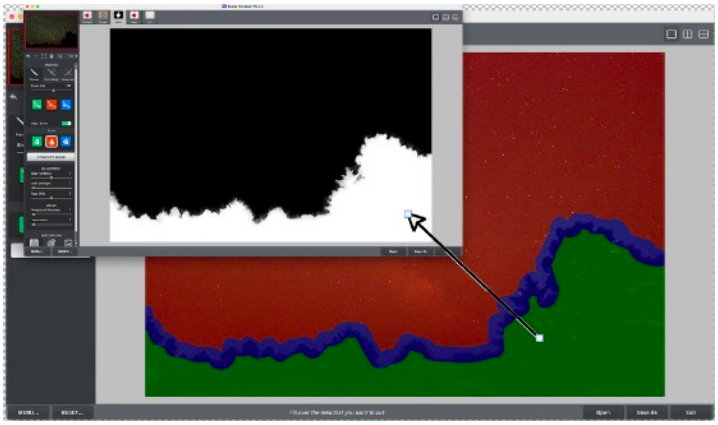


Figure 3: Using Topaz ReMask to extract background from untracked frame

Don't sweat selecting the foreground exactly. That's why you took a long exposure, the sky should blend pretty well, and you can use a tool like Photoshop's Healing Brush tool in your editor to make it better.

In my case, I completely neglected the long exposure, and the two skies did not match AT ALL. Fortunately, I have an old tool called Topaz ReMask (now included in their $199 Photo AI) that uses AI to exactly locate even complex borders. [Figure 3] I copied the black part, pasted onto the stacked image, dragged that layer around a bit till all the blurry trees were covered, and called it good.

Last, but not least, I enhanced the contrast. In Photoshop, I used the Color Sampler tool to lay multiple sample points on the background for live statistics, but all image-editing programs will provide something that will do the job. Aim for a background value of around (35,35,35) by bringing up the black point, then use Levels or Curves tools to crank the contrast till you like it. [Figure 4]

Figure 4: Finished image

That's a speed-run on Milky Way imaging, any of those paragraphs could be its own article! But hopefully that will give you enough to get out there and start shooting and editing.

REFERENCES

Bracken, Charles, *The Deep Sky Imaging Primer*, ISBN 0999470949

Lonely Speck, *How to Photograph The Milky Way* (www.lonelyspeck.com/how-to-make-an-amazing-photo-of-the-milky-way-galaxy/)

Capitol Skies is the quarterly newsletter of the Madison Astronomical Society. Members of the Editorial Committee include Jack Fitzmier (Editor), Bob Hamers, Alex Langoussis, John Rummel, Alex Samuel, Rob Strabala, and Rick Wayne. Interested in contributing? We'd love to have you participate! Contribute an essay, an equipment review, a book review, or another piece of astronomy-related material. And feel free to send comments, feedback, or other ideas along as well. Contact Jack Fitzmier at jfitzmier@gmail.com for more information.

MAS Outreach, Summer 2025

By Rick Wayne

The MAS Outreach team continues to get requests for star parties from interested organizations. Every one I've attended has just been a complete hoot, and I heartily encourage any member to participate. Don't worry if you don't have equipment, or don't consider yourself enough of an expert. Ha ha! It is to laugh, as Daffy Duck would say. The club has great equipment, and Your Humble Correspondent here can't find Auriga even if Martin is standing behind him with a laser pointer. Honest, you'll be fine. You'll learn things. You'll have fun. And you'll hear that precious "Oh my GOD!" from people seeing a great astro view for the first time. Just inject that right into my veins, please!

In March, we visited Horizon School in Sun Prairie. We probably had a hundred VERY EXCITED third-graders, parents, and siblings. Gulp! But in the end they had a good time, and we had a GREAT time. I think the teachers grooved on it most of all.

In April, we put on a show for the town of Waunakee, replacing a "Learn to Stargaze" program that expired when its teacher retired. Not the finest observing conditions, but Frank wowed 'em with his tour of the night sky, then they descended on the scopes to get some pretty good peeks between the clouds.

And in May, we teamed up with the UW-Madison Astronomy Club on Library Mall. We must have had a dozen scopes going, and graduation ceremonies brought big crowds of passersby to marvel at the Moon and Jupiter and a few deep-sky objects we could pick out through the light pollution.

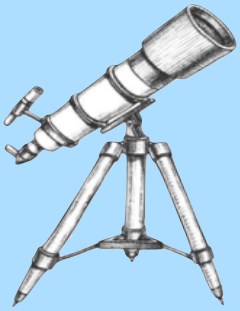
More to come this summer, so come on out and join us!

Contact Rick Wayne to join the committee, or just show up to participate in an event.

Rick Wayne and Stan Howald getting ready for Moon Over Monona Terrace, 2023. Photo by Carol Santulis.

An expectant crowd waits for it to get dark. MAS outreach event at Donald Park, August 2023. Photo by Carol Santulis.

2025 Observing and Outreach Opportunities



Monthly MAS star parties

June 21
July 26
Aug 23
Sept 20
Oct 18

Other opportunities for outreach and observing

Donald Park Star Party	Aug 16
MAS Picnic at YRS	Sept 20 (21)
Moon Over Monona Terrace	Oct 3
Schumacher Farm Park	Oct 25

Outreach events are a blast! To get involved, contact Rick Wayne or reach out to club officers.

Monthly star parties at YRS are open to MAS members and their guests. All events are weather dependent. In advance of a star party or outreach event, keep an eye on the MAS Observers email list. Based on weather conditions, we will post a "Go" or "No Go" decision to the list on the afternoon of the date in question.