Highlights of the March Sky. . .

- - - 2nd - - -

DAWN: A waning gibbous Moon is less than 5° above Spica in Virgo.

PM: Mars will be within 2° of the Pleiades (M45) for the next few days.

- - - 5th - - -

DAWN: About 22' separate Jupiter and Mercury. Look low above the east-southeastern horizon.

DAWN: The Moon is 5° to the upper right of Antares in Scorpius.

Last Quarter Moon
8:32 pm EST

- - - 13th - - -

New Moon
5:23 am EST

- - - 18th - - -

DUSK: A waxing crescent Moon, Mars, Aldebaran (in Taurus), and the Pleiades form a parallelogram.

- - - 19th - - -

DUSK: The Moon forms a triangle with Aldebaran and Mars.

- - - 21st - - -

First Quarter Moon
10:41 am EDT

- - - 22th - - -

PM: A waxing gibbous Moon is about 6° to the lower right of Pollux in Gemini.

- - - 23rd - - -

PM: The Moon is near the Beehive Cluster (M44).

- - - 25th - - -

PM: The Moon is about 4° to the left of Regulus in Leo.

- - - 28th - - -

Full Moon
1:48 pm EDT

Prime Focus

A Publication of the Kalamazoo Astronomical Society

★ ★ ★ March 2021 ★ ★ ★

This Months KAS Events

General Meeting: Friday, March 5 @ 7:00 pm

Held on Zoom • Click to Register • See Page 10 for Details

Member Observing: Saturday, March 13 @ 7:00 pm

Messier Marathon - Richland Township Park - See Page 9 for Details

Board Meeting: Sunday, March 14 @ 5:00 pm

Held on Zoom • All Members Welcome to Attend

Introduction to Amateur Astronomy Series Concludes

Held on Zoom • See Page 4 for Dates, Times & Topics

Inside the Newsletter. . .

February Meeting Minutes

The general meeting of the Kalamazoo Astronomical Society was brought to order by President Richard Bell on Friday, February 5, 2021 at 7:10 pm EST with over 100 members and guests attending via Zoom and YouTube. This is our highest attended Zoom meeting thus far. Richard wasted no time in opening the meeting by introducing our guest speaker. Dr. Jessie Christiansen is an astrophysicist with the NASA Exoplanet Science Institute at Caltech, where she searches for, characterizes and catalogues planets orbiting other stars. She now works on NASA's Transiting Exoplanet Survey Satellite (TESS) mission. She joined us from Cleveland, Ohio.

In the weeks leading up to her presentation, Dr. Christiansen asked KAS members to submit their favorite science fiction planets. Some of the requests that she received were new and her presentation was tailored to our requests. She opened her talk with an image of a fictional planet requested by Kevin Jung. Superimposed over the planet Vulcan, a *Star Trek* favorite, was a familiar starship.

Humankind speculated about the existence of planets orbiting other Suns for hundreds if not thousands of years before their existence was finally confirmed. Our history of discussing other worlds has been a mixture of story, philosophy and science. The debate if Earth was alone or part of a collective, in philosophy and story, is not new. More than 2500 years ago, Greeks speculated that there could be other earths. It was purely speculative, but Aristotle and Plato are known to have argued whether Earth was singular or infinite in its uniqueness. In 1300 CE, Dante explored concentric spheres around Earth, including Mercury, Venus, Jupiter, and Saturn. In 1592, Renaissance mathematician Giordano Bruno speculated that countless solar systems like ours exist. The 1700s were a high point in literature for writing about the Moon. The 1800s became populated with many works about Mars. Supposed observations of the canals of Mars really sparked the public's interest in imagining the potential of that world.

After thousands of years of speculation and storytelling, there still had been no good scientific way to test the idea of planets around other stars. The mechanics of trying to look at a really, really faint object next to a really, really bright one is a difficult problem to solve. It was not until 1952 that Otto Struve suggested that observing a star's radial velocity could help deduce if potential planets orbiting it might "nudge" the star's movement predictably. He suggested that while the star pulls its planets, the planets also tug on their parent star. And if we could just measure that wobble produced by this interaction, it would be evidence of a planet's existence. The problem with the theory was that the planet would have to be a very large one (like Jupiter) and be right next to the star. The orbit would need to be close enough that this massive planet would orbit in just a few days. Struve's theory went unnoticed as scientists doubted that systems like this could even exist, let alone be observed. It wasn't until four decades later that the first real evidence presented itself.

Dr. Jessie Christiansen, from Caltech, was our special guest speaker for the February General Meeting.

While we waited for scientific evidence, humans invented and depicted many new and now iconic sci-fi worlds - mysterious planets with exotic landscapes, orbiting alien star systems. When our technology finally caught up with our imaginations, what we found was even more extraordinary than what we had imagined. The first exoplanet orbiting another sun-like star was discovered in 1995, and it was exactly as Struve had suggested, and by using his proposed method. The planet was a large, Jupiter-sized planet orbiting extremely close to its host star with a period only a few days!

So, what planets have been discovered since and how do they compare to our imagined worlds? NASA maintains a database and has currently logged over 4,000 confirmed exoplanets. Dr. Christiansen discussed her role in helping to catalogue these new discoveries. While making an entry, she noted that it was the star "40 Eri." 40 Eridani is a triple star system in the constellation Eridanus. There is a Neptune-like planet orbiting 40 Eri A. *Star Trek's* Vulcan is a rocky planet unlike the one discovered, but as Dr. Christiansen excitedly pointed out, planetary systems are often crowded places and that the probability of there being a rocky planet orbiting 40 Eri A is good…and that Mr. Spock's home planet could, very well be a real!

Since 40 Eri A is not a good analogy for Vulcan, Dr. Christiansen wanted to find a planet in the database that better represented the science fiction icon. Kepler-62f is a rocky planet around a star like 40 Eri A. It is the most Vulcan-like planet that we have discovered so far. Dr. Christiansen was not satisfied with just Vulcan, though. In *Star Trek* there are 938 named planets throughout the series. Of the 938 fictional planets, 51 orbit stars that exist in reality. Of those 51 stars named in the series, 7 have been confirmed to host planets in real life. One of those host stars is Tau Ceti, which in real life has four planets around it (two of those planets in the habitable zone). In the *Star Trek* universe, it also has four planets! So, on that note, the writers of the show got it right.

The first planet to show up in cinema on film was Altair IV (recommended by Jack Beertema, Becky Csia, Rick Frantz,

and David Randell). Altair is the brightest star in the constellation Aquila, but at present there are no known planets around this star. However, HD219314 in Cassiopeia has 6 planets around it and is an easy star to find.

In science fiction, most representations of planets are not that exotic for production reasons. Most imagined worlds are fairly earth-centric. In Dr. Who, planets are represented as follows: 80% Earth, Earth-like and Earth-ish and only 20% of the episodes feature uninhabitable worlds. This is emblematic of science fiction as we are only able to imagine so much. Interestingly though, 55 Cancri e is one of the more bizarre planets found in reality but kind of like on the episode "Midnight" in Dr. Who which is speculated to be a diamond planet.

There are many planets in the NASA catalogue that are analogous to sci-fi counterparts: Kepler-47d is as close to a Gallifrey analogy (thanks to Karen Woodworth for the recommendation). It is a rocky planet orbiting a binary star system. Kepler-10b, the first rocky planet found outside the solar system, is a lava world like Mustafar as seen in *Star Wars*. Kepler-22b has a very thick atmosphere in habitable zone with the density of water. Kevin Costner's *Waterworld* could look like this planet. Kepler-16b is in a circumbinary orbit around yellow and red stars, similar to Tatooine, Luke Skywalker's home planet in *Star Wars*. Mike Sinclair asked about the planet Arrakis in the novel *Dune* as it is depicted orbiting a red giant star. HD212771 is a red giant star with planets orbiting it. And finally, the furthest planet from Earth discovered (through a micro-lensing technique) is OGLE-2015-BLG-0051L b which resides in the heart of the Milky Way Galaxy, 26,000 light-years away. Could this be Vormir, Marvel's center of celestial existence?

So, of all these planets, none of them are Earth-like. Brown dwarf stars are very good at making rocky planets but have a radiation field that may not be compatible to life. Of course, this harsh radiation field was exactly what gave Superman his power when he left Krypton for Earth (submitted by Randy Matson). So, Kepler-186f is the right temperature and size to be an earth-ish planet, but it is orbiting an M dwarf star. Kepler-452b is as close Kepler got to Earth-like planet. Unfortunately, it is about 1.5 times Earth's size, putting it right at the theoretical limit for habitability (at least as we know it). Interestingly, Kepler-452b may not even exist as there is so much noise in the data that it is hard to tell.

Dr. Christiansen shared her published discovery of Kepler-2138, a star with 5 planets orbiting in a 3:2 resonance. She was proud to announce that her discovery was assisted by 5 citizen scientists and that their names are shared in the publication. Others interested in exoplanet research can participate in Planet Hunters at Zooniverse. Dr. Christiansen closed her talk with an introduction to TESS (Transiting Exoplanet Survey Satellite) which, by performing a whole sky survey, will look for nearby exoplanets.

Richard thanked our guest speaker and promised to send her a "Yes, there really is a Kalamazoo!" T-shirt. He then moved onto the President's Report. Aaron Roman was presented with 3 Astronomical League Observing Awards: Northern Constellation Hunter, Solar System, and Binocular Messier Observing Award. Richard then noted that the flat-field

Aaron Roman holds up one of the three A.L. Observing Pins he was recently awarded.

screen for the Remote Telescope is still on order. He also announced that a new version of the *Remote Telescope User's Guide* has been sent out to all users and that a training video was still in the works.

In general news, Richard asked everyone to create or update a Member Profile for the website. Since we are currently paying for the Zoom Webinar service, Richard invited members to give presentation such as mirror or eyepiece cleaning and astrophotography. Members were even encouraged to design a T-shirt for the upcoming online KAS clothing store. Clothing could be KAS themed or feature general astronomy designs. We're also looking for the best site to host our clothing store. Thoughts are welcome.

Observation Reports: Aaron is working on the A.L. Double Star Observing Program and shared a sample page from the previous months observing. Pete Mumbower asked Richard if he had any success observing Sirius B (close orbiting white dwarf companion to the star Sirius in Canis Major). Richard said that despite his best attempt, he was unable to make the observation using the 16-inch Leonard James Ashby Telescope in Owl Observatory. He said that he has been chasing this observation for 25 years, and plans to keep trying. Roger Williams shared that he has been able to see it before with a 10-inch Newtonian (but noted that just the diffraction pattern from the 'scope could mask the secondary star; it is that faint). Pete Mumbower shared a recent image of the Horsehead Nebula. Don Stillwell shared that he has visually observed it once with 114mm (some were skeptical).

Astronomical News and Events: Mike Sinclair was excited to share that one of his past students, Eric Berger, just published *Lift Off: Elon Musk and the Desperate Early Days that Launched SpaceX*. He just received a signed (and commented) first edition copy and was looking forward to reading it.

In conclusion Richard closed out the meeting by reminding members of upcoming activities such as the *Introduction to Amateur Astronomy* lecture series and February Freeze Out. Kevin Jung invited members to submit images to share on the KAS Instagram page. And finally, Dr. Pascal Lee will be giving March's presentation *N~1: Alone in the Milky Way*. The meeting adjourned at 9:07 pm EST with a few members staying on afterword to hang out.

bservations

by Richard S. Bell

NASA's fifth Martian rover, Perseverance, touched down on the Red Planet at 3:55 pm EST on February 18th. As with the previous four rovers, I was able celebrate with the mission scientists and engineers (and other space exploration enthusiasts around the world) via NASA TV. Hopefully, by now, you've seen the unprecedented and incredible video of the rover's entry, decent, and landing at Jezero Crater. If not, here's a link to it on YouTube. Play it on the largest screen you have!

Perseverance (or Percy for short) and Curiosity are identical in their dimensions, but Percy has more mass (1,026 kg vs. 899 kg) and several upgrades. One is with its wheels. They have a larger diameter, but with smaller treads. This will hopefully reduce the damage that Curiosity's wheels have endured and lessen the chance of Percy getting stuck in fine Martian sand. One of the biggest upgrades to the rover is its ability to collect samples. Percy's underside houses a sample collecting system, which will allow it to collect rock cores that will eventually be returned to Earth for study. To learn more about Percy and its mission, download the 72-page press kit.

Percy may get to roam free on the Red Planet, but the KAS is still stuck on Zoom back on Earth. We've made the most it though. At least 70 members and guests have attended meetings since December. Between Zoom and the live YouTube stream, about 115 people attended the February meeting. We've got another excellent guest speaker planned for the March 5th meeting, so please register and join us on Zoom. The last Online Viewing Session of the season on February 6th was the most successful of the bunch. We hit the Zoom meeting limit of 100 for the first time, and an additional 50 or so people joined us on YouTube. Some have asked why we didn't scheduled a session for March, since we could squeeze in one more before daylight time begins. The answer is simple: If I'm the only one hosting, then four is plenty. We may try to do some unscheduled online sessions with the Remote Telescope this month and/or next. This time, we'll have members select all the targets!

The online version of the *Introduction to Amateur Astronomy* lecture series continues to be highly successful. About 400 people around the world Zoomed in for each of the webinars on the February 6th and 20th. Many of the attendees have been very generous in their support. To date, we've raised $1,074.23 in donations. Several Miller Planispheres have been sold through or SkyShop and we received some commissions from sales on Orion Telescopes & Binoculars website. And, to my astonishment, several attendees (most of which live outside the state) have become KAS members! I'm very, very pleased to announce that, because of these new members and high retention of current members, **we now have over 200 memberships for the first time in our organization's history**! The lecture series concludes this month. Check out the schedule at right and join us!

Introduction to Amateur Astronomy

The five-part lecture series that will help you become a star-hopping skymaster concludes this month! Please register if you haven't done so already. Here are the final topics:

Part 4 — March 6th:

Telescope Tutorial

Sooner or later, every amateur astronomer faces the decision of purchasing a first telescope. There are literally hundreds of choices today! What's the difference between a refractor and reflector? Which telescope is the right one for you? To make this daunting task easier, we'll compare several of the top telescopes available today and tell you which ones to avoid. We'll also look at the countless array of accessories available for your telescope. If you already have a telescope but need help then bring it along.

Part 5 — March 20th:

The Art of Astrophotography

Astrophotography is the art of photographing the night sky. In the past few years that art has undergone a revolution as digital cameras have overtaken their film counterparts. In some ways this has made the field more technical, but in many ways shooting the sky is easier than ever! We'll start with the basics like using a stationary photographic tripod and work our way up to imaging with sophisticated CCD cameras. Constellation patterns, the Milky Way, the night-to-night motion of the planets, bright comets, northern lights, and perhaps a meteor all await you.

Time: **1:00 pm - 3:00 pm**

Location: **Online via Zoom**

Please visit the *Introduction to Amateur Astronomy* web page for more information on the entire series.

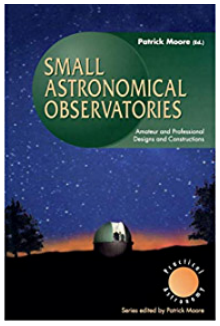
KAS Member Observatories

Part 8: Dave Woolf's Hawk Observatory

After a long hiatus from astronomy, my interest was rekindled by one of my best friends in Ohio, Don Barnes, also a *Sky & Telescope* contributor. We would spend hours stargazing from the local state park, or from the parking lot in front of Perkins Observatory, he with his little Celestron C -90 (now my guide scope) and me with my unwieldy Stans and Streiffe 3-inch f/14 refractor.

After moving back to Michigan, I purchased a 10-inch Meade LX200 from Rider's Hobby Shop and soon after, joined the Muskegon Astronomical Society. After spending months toting it around Oceana county, setting up in corn fields and a Christmas Tree farm, I began thinking about a permanent home so I wouldn't have to continually set it up.

The MAS had recently constructed a 16 × 20 foot roll-off roof observatory at their site. Their president, Dennis Allen, mentioned that it was based on his own observatory that housed his new 24-inch Dobsonian. Dennis was kind enough to invite me up for some stargazing and I took notes. In fact, that very observatory is the first one documented in ***Small Astronomical Observatories*** by Patrick Moore.



The design is basically a tiny 10 × 12 foot steel pole barn with a roof that rolls off on a C-channel track. As it turned out, a teacher colleague had purchased a farm in Shelby, MI and gave me permission to build my observatory on a very sandy hill overlooking US-31. I decided that instead of a poured floor, I would make a standard joist floor so it could stand slightly above ground level, and be disassembled for moving if necessary.

Fortunately, my father was available to help. First, the treated 4×4 posts went in. I rented a power auger, a good idea since the hills were so sandy you would auger out a hole

and the sand would pour right back in and fill 1/3 of it. Brutal, but nice when done. Next the floor went in — 2×6 joists supporting marine plywood. The walls next.

My home church had supplied the steel — leftover from their bus garage, built in the 70's. Unbeknownst to me, my friend had leased out the same field to a farmer who, most disappointingly, treated it with liquid manure. Needless to say, this made the work sheer misery, and we left the site for the day with a ripping headache.

For the roof track, I used cold rolled steel c-channel. I used a pair of 2×6's to mount the eight 4-inch wheels to carry the roof, and made "A-frame" trusses to support the sheet steel roof. The roof is latched on with 6 chain binders. The roof steel was new. A couple of my students helped attach the roof steel. A local construction firm sold me a length of 6-inch steel water pipe for a pier, which I later filled with nice Lake Michigan sand, and a fellow church member welded me a home-made equatorial wedge.

Per Dennis' design, the door is split, with the top half attached to the roof to fold in to clear the mounted telescope. Triangular corner tables help to stabilize the front wall. I obtained some indoor/outdoor carpeting for the floor. Power was supplied by a deep cycle marine battery.

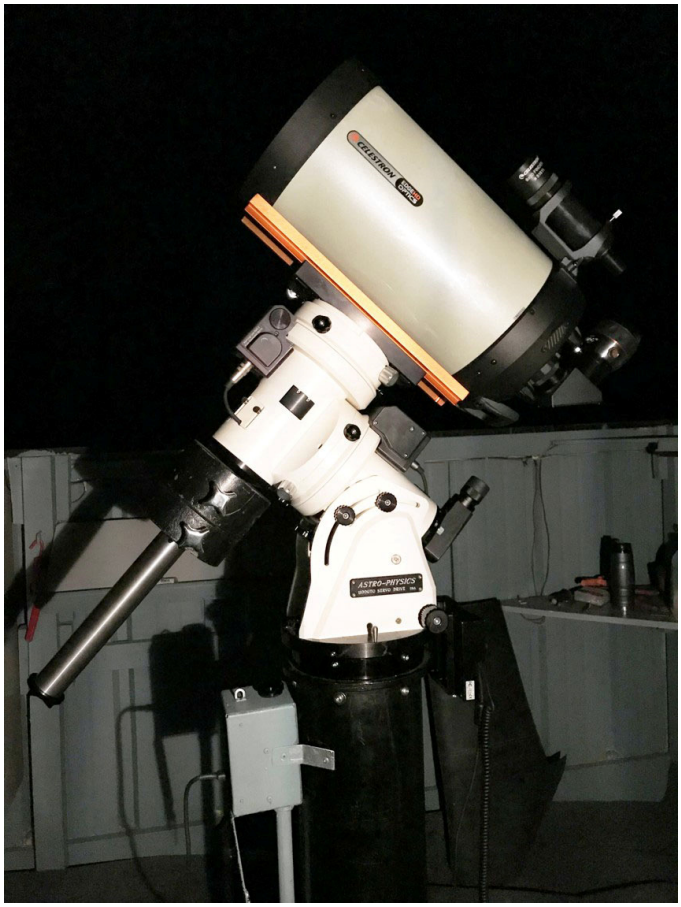
A few years later, my job moved. Another school friend gave me permission to erect the observatory on her back 40. In 2001, the observatory was disassembled, strapped to a bobcat trailer and moved to where it stands today in Hickory Corners, about 15 miles from Kalamazoo. Influenced by the avian name for our club's Owl Observatory, I christened mine "Hawk Observatory" for the red-shouldered hawk that circled above as I reassembled it.

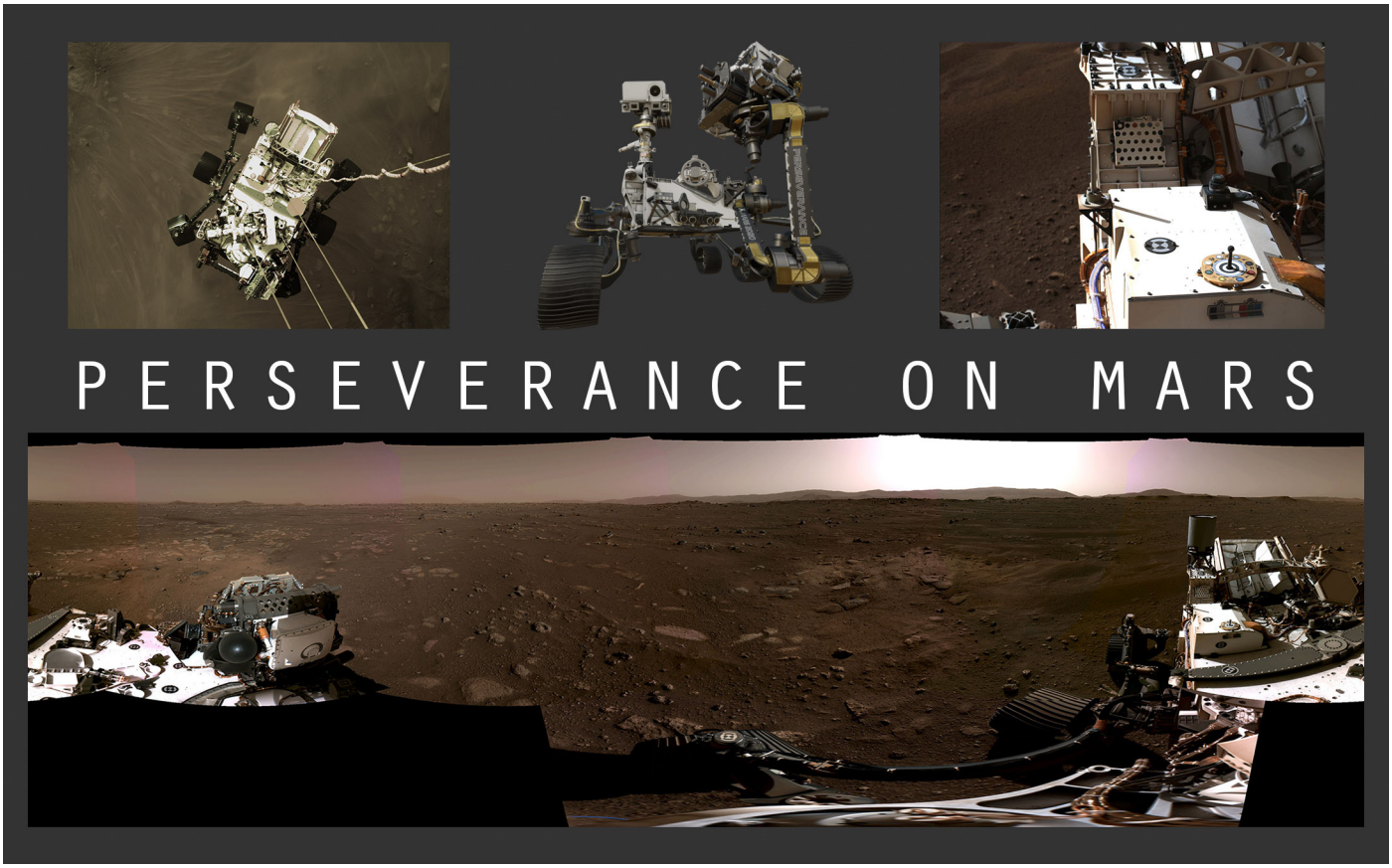
One change that was made was to raise the walls by a foot. This makes a better wind break and you can stand all the way up under the roof trusses. The site is off the road, so getting there in winter requires parking on the road, or a 4-wheel drive. Fortunately, my son just sold me his.

Since then, many upgrades were made, including a replacing the decaying door, installing a fold-down chart table, a photovoltaic system to charge a 100 amp-hour battery, and switched red lights installed above every table. A large cabinet on the east wall holds references and accessories. I weather sealed it to keep out field or thatch ants, having discovered the hard way that they not only bite, but spit in formic acid just for effect. A bug bomb took care of them. Now for the post beetles that love to bore holes in my track support...

A new pier was installed last spring with a levelling system and adapter plate to accommodate the new Astro-Physics 1100GTO mount that carries either a TeleVue NP-101is, or a 9.25-inch Celestron Edge HD. A power center with three USB outlets was installed on the north side of the pier. The wires run through a conduit under the floor to an enclosure, otherwise rodents chew on them. Over the years, what was once a plowed field is turning into a grove. I removed a willow tree that grew to block my view of Polaris. For years, my daughter, Sonnet, had been climbing that tree with a bow saw and removing offending branches. More trees have reduced my horizon, especially in the northeast, but that's tolerable as the photography is best near the zenith.

One caveat is that the site is a few hundred yards from an active pig farm. What can I say? Beggars for dark-ish sites can't be choosers. If I hosted a star party, it would most likely be called "Smellafane." However, if you care to brave it, I welcome visitors! At the time of this writing, my days off are Tuesday and Wednesday. I'd love some company out there under the stars! Contact me at go4itbass@gmail.com.





NASA Night Sky Notes...

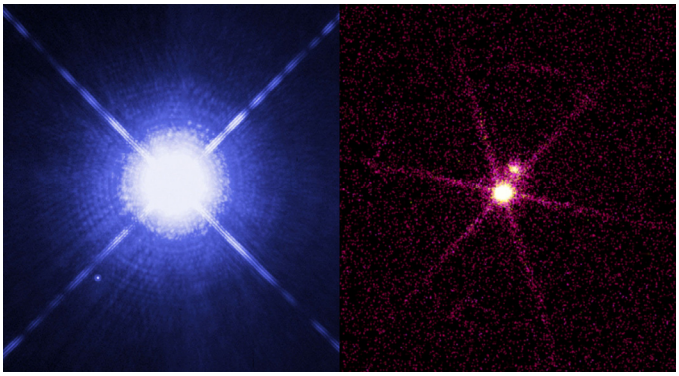
Taking the Dog Stars for A Springtime Walk

by **David Prosper**

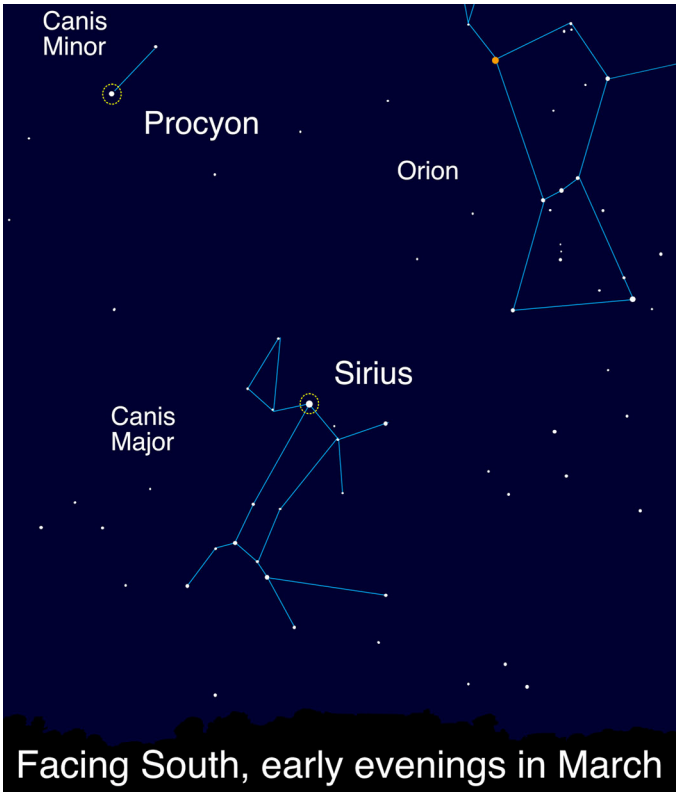
March skies feature many dazzling stars and constellations, glimmering high in the night, but two of the brightest stars are the focus of our attention this month: Sirius and Procyon, the dog stars!

Sirius is the brightest star in the nighttime sky, in large part because it is one of the closest stars to our solar system at 8.6 light years away. Compared to our Sun, Sirius possesses twice the mass and is much younger. Sirius is estimated to be several hundred million years old, just a fraction of the Sun's 4.6 billion years. Near Sirius - around the width of a hand with fingers splayed out, held away at arm's length - you'll find Procyon, the 8th brightest star in the night sky. Procyon is another one of our Sun's closest neighbors, though a little farther away than Sirius, 11.5 light years away. While less massive than Sirius, it is much older and unusually luminous for a star of its type, leading astronomers to suspect that it may "soon" – at some point millions of years from now – swell into a giant star as it nears the end of its stellar life.

Sirius and Procyon are nicknamed the "Dog Stars," an apt name as they are the brightest stars in their respective constellations – Canis Major and Canis Minor – whose names translate to "Big Dog" and "Little Dog." Not everyone sees them as canine companions. As two of the brightest stars in the sky, they feature prominently in the sky stories of cultures around the world. Sirius also captures the imaginations of people today: when rising or setting near the horizon, its brilliance mixes with our atmosphere's turbulence, causing the star's light to shimmer with wildly flickering color. This vivid, eerie sight was an indication to ancient peoples of changes in the seasons, and even triggers UFO reports in the modern era!



Sirius A and B imaged by two different space telescopes, revealing dramatically different views! Hubble's image *(left)* shows Sirius A shining brightly in visible light, with diminutive Sirius B a tiny dot. However, in Chandra's image *(right)* tiny Sirius B is dramatically brighter in X-rays! The "Universe in a Different Light" activity highlights more surprising views of some familiar objects. *NASA, ESA, H. Bond (STScI), and M. Barstow (University of Leicester) (left); NASA/SAO/CXC (right)*



Sirius and Procyon, the loyal hunting dogs of nearby Orion the Hunter! What other stories can you imagine for these stars? Learn about "Legends in the Sky" and create your own with this activity. *Image created with assistance from Stellarium.*

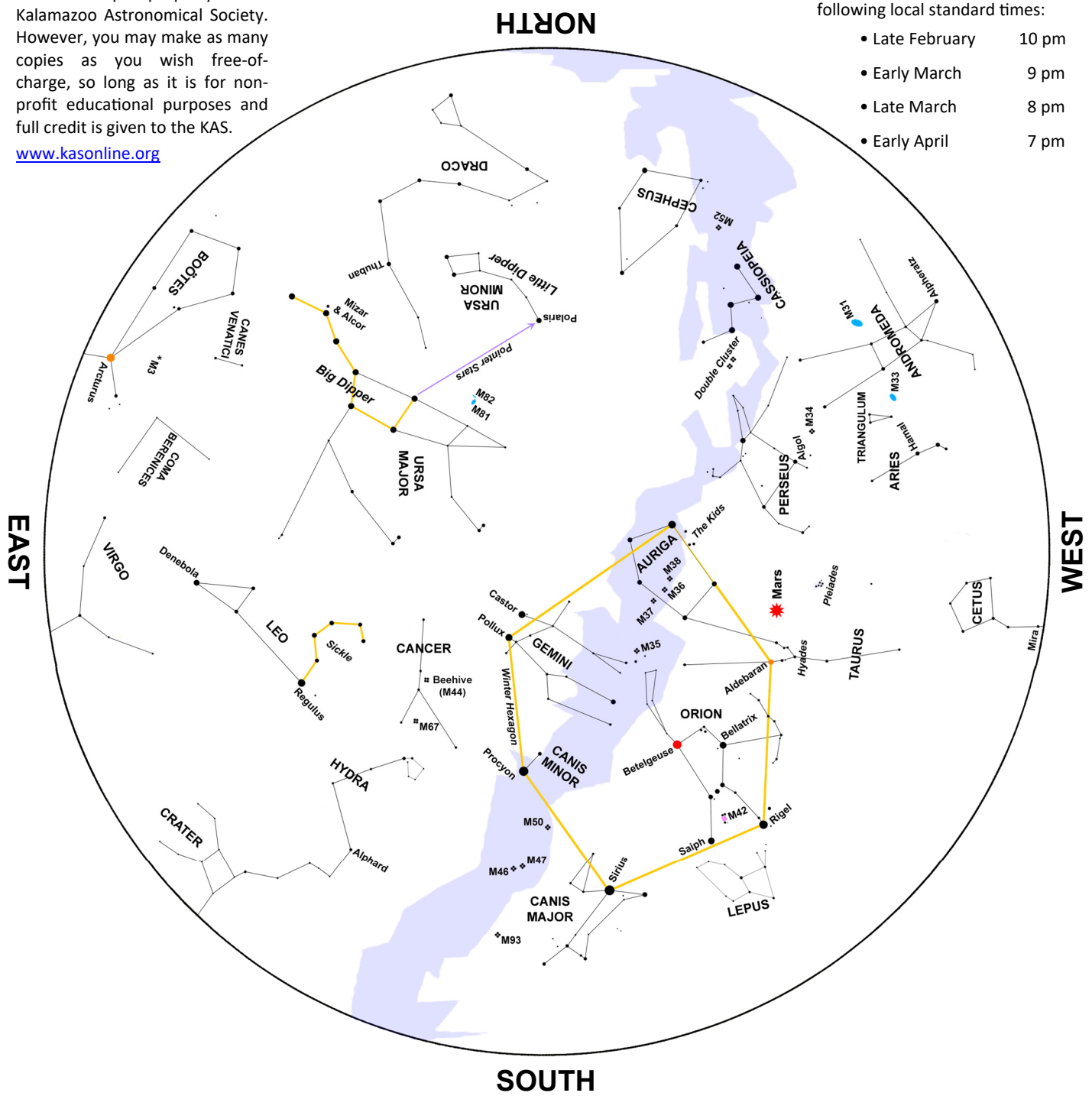
Both of these bright stars have unseen companions: tiny, dense white dwarf stars, the remnants of supermassive companion stars. Interestingly, both of these dim companions were inferred from careful studies of their parent stars' movements in the 1800s, before they were ever directly observed! They are a challenging observation, even with a large telescope, since their parent stars are so very bright that their light overwhelms the much dimmer light of their tiny companions. The white dwarf stars, just like their parent stars, have differences: Sirius B is younger, brighter, and more energetic than Procyon B. Careful observations of these nearby systems over hundreds of years have helped advance the fields of: astrometry, the precise measurement of stars; stellar evolution; and astroseismology, the study of the internal structure of stars via their oscillations. Discover more about our stellar neighborhood at nasa.gov!

This article is distributed by NASA Night Sky Network. The Night Sky Network program supports astronomy clubs across the USA dedicated to astronomy outreach. Visit nightsky.jpl.nasa.gov to find local clubs, events, and more!

— March Night Sky —

This map represents the sky at the following local standard times:

- Late February 10 pm
- Early March 9 pm
- Late March 8 pm
- Early April 7 pm



Mars strolls past the Pleiades for three evenings beginning on March 2nd. About 2° will separate the Red Planet and Seven Sisters, so they'll be visible together in a pair of 7×50 or 10×50 binoculars. The red-orange hue of Mars adjacent with the blue-white glow of the Pleiades will make for a lovely contrast.

Early risers can enjoy a close conjunction of Jupiter and Mercury at dawn on March 5th. Our solar system's largest and smallest planets will be just under 23′ apart. You'll need a clear view of the east-southeastern horizon. Saturn is about 8° to the upper right of Jupiter. Look south and spot the almost last quarter Moon 5° to the upper right of Antares in Scorpius.

A waxing crescent Moon, Aldebaran (in Taurus, the Bull), Mars, and the Pleiades form a parallelogram on the evening of March 18th. The Moon then forms a narrow triangle with Aldebaran and Mars on the 19th.

A waxing gibbous Moon moves to within 4° of Regulus, in Leo, on March 25th.

Follow the KAS on Instagram

Instagram is a fun photo and video sharing social networking service. KAS members are encouraged and welcome to share their astrophotos, pictures of you and your equipment, family images at astronomical destinations, and much more. Send your images to KAS Member-At-Large Kevin Jung.

— https://www.instagram.com/kzooastro/ —

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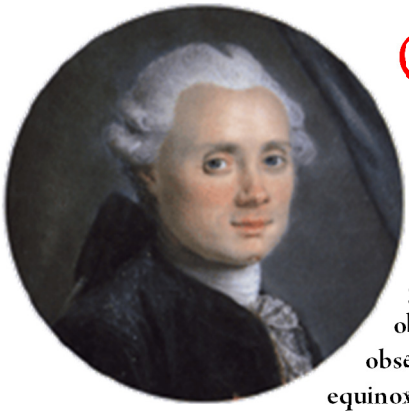

Messier Marathon

The work of comet-hunter and nebulae cataloger Charles Messier comes alive in March of each year as amateur astronomers participate in a one night search for all of the objects in his catalog of nebulae, star clusters and galaxies. By a quirk of fate, we are fortunate that most of the objects Messier and Méchain took 24 years to discover can be observed in one night around the time of the vernal equinox. Members are encouraged to bring a good pair of binoculars or a telescope and participate in this one night race across the sky.

Saturday, March 13th @ 7:00 pm | Richland Township Park - 6996 N. 32nd St.

General Meeting Preview

N~1: Alone in the Milky Way

presented by **Dr. Pascal Lee** SETI Institute

At the heart of the Search for Extraterrestrial Intelligence (SETI) lies the Drake Equation, a mathematically simple yet fascinatingly enigmatic formula proposed by American astronomer and SETI founder Frank Drake. The Drake Equation provides a way to estimate of the number, N, of advanced civilizations present in our galaxy. Although N is often assumed to be a large number - there would be many civilizations in the Milky Way galaxy - large numbers for N are in apparent conflict with observation, a contradiction known as the Fermi Paradox, named after Italian-American physicist and 1938 Nobel Prize winner Enrico Fermi. Dr. Lee examines the state-of-the-art of our knowledge about each term of the Drake Equation, and reaches the surprising conclusion that N might actually be a very small number, close to 1. We could be IT. The implications of N~1 are profound and will be discussed.

Friday, March 5 @ 7:00 pm

Held on Zoom • Click here to Register

Kalamazoo Astronomical Society
c/o KAMSC
600 West Vine, Suite 400
Kalamazoo, MI 49008

STAMP