Highlights of the May Sky. . .

- - - 3rd - - -

DAWN: The Moon is nearly 7° to Saturn's lower left.

Last Quarter Moon
3:51 pm EDT

- - - 4th - - -

DAWN: Moon, Jupiter, and Saturn form a wide triangle.

- - - 11th - - -

New Moon
3:01 pm EDT

- - - 12th - - -

DUSK: An ultra-thin waxing crescent Moon and Venus are 1° apart. Look *very* low on the WNW horizon.

- - - 13th - - -

DUSK: The Moon is 3° left of Mercury.

- - - 15th - - -

DUSK: The Moon and Mars are 2.5° apart in Gemini.

- - - 16th - - -

DUSK: The Moon is 3.5° to the lower left of Pollux.

- - - 17th - - -

PM: The Moon is 2.5° to the upper right of the Beehive Cluster (M44) in Cancer.

- - - 19th - - -

First Quarter Moon
3:13 pm EDT

PM: The Moon is 5° above Regulus in Leo.

- - - 23rd - - -

PM: The Moon and Spica, in Virgo, are separated by 8°.

- - - 26th - - -

DAWN: Partial lunar eclipse in progress at moonset.

Full Moon
7:14 am EDT

PM: The Moon is 7° left of Antares in Scorpius.

Prime Focus

A Publication of the Kalamazoo Astronomical Society

★ ★ ★ May 2021 ★ ★ ★

This Months KAS Events

Board Meeting: Sunday, May 2 @ 5:00 pm

Held on Zoom • All Members Welcome to Attend

General Meeting: Friday, May 7 @ 7:00 pm

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

Member Observing: Saturday, May 8 @ 9:00 pm

Galaxies of the Virgo Cluster - Kalamazoo Nature Center

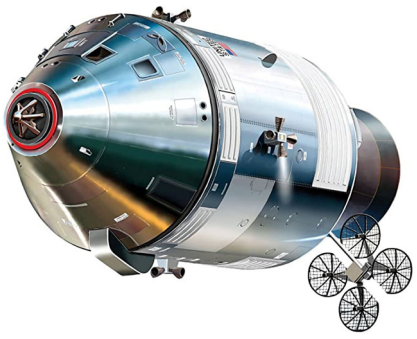
Astrophoto SIG: Friday, May 21 @ 7:00 pm

Held on Zoom • Click to Register • See Page 4 for Details

Member Observing: Saturday, May 22 @ 9:00 pm

Moon & Double Stars of Spring - Kalamazoo Nature Center

Inside the Newsletter. . .



April Meeting Minutes

The general meeting of the Kalamazoo Astronomical Society was brought to order by President Richard Bell on April 9, 2021 at 7:06 pm EDT. Over 117 members and guests attended via Zoom and live on YouTube. In addition to West Michigan, members and guests joined us from all across the U.S. and Canada. These include: Arizona, British Columbia, California, Delaware, Florida, Georgia, Idaho, Indiana, New York, North Carolina, Oklahoma, Ontario, Texas, and Wisconsin.

Our special guest speaker was Dr. Timothy C. Beers, the Grace-Rupley Professor of Physics at the University of Notre Dame. It was noted that Dr. Beers last joined us in April 2005 when he was at Michigan State University. The title of his second presentation for the KAS was *Putting Together the Pieces of the Milky Way – Now with Pictures!* Dr. Beers noted that research discussed in his presentation was done in collaboration with Deokkeun An from Ewha Womans University in Seoul, South Korea.

William Herschel, with the assistance of his sister Caroline, attempted to create a map of the Milky Way in 1785. Herschel counted stars in 683 different direction in the sky. This resulted in an irregular disk shape with the Sun located near center. Today's astronomers have mapped out the Milky Way with more accuracy. The galactic center is surround by the nuclear bulge, an oval-shaped collection of older stars. The bulge, in turn, is surrounded by both a thin and thick disk composed of spiral arms. The Sun is in the thin disk about ⅔ from the galactic center. A spherical halo surrounds the entire disk and is made up of a loose collection of stars and globular clusters. Dr. Beers has spent the past 35 years studying lone stars in the halo, but this is challenging since telescopes must peer through the Milky Way's disk.

The tool we use to describe the chemical evolution of our galaxy (and the universe) is [Fe/H], a measure of the iron to hydrogen elemental abundance ratio in stars, relative to this ratio in our Sun, in powers of 10. For example, [Fe/H] = 0 means a ratio of iron to hydrogen abundance equal to that in our Sun (10^0 = 1), while [Fe/H] = -4 refers to a metal-poor star with an iron to hydrogen abundance ratio equal to 1/10,000 (=10^{-4}) of that in our Sun. Iron was chosen because there are millions of lines from this element in the Sun's spectrum. To astronomers a metal is any element heavier than helium. The first generation of stars formed less than ~300 million years after the Big Bang, and had iron and heavy element abundances approaching zero, since the early universe fused a portion of the lightest element hydrogen only up through helium. This is because the expanding universe had cooled and become too dilute to allow for any but the minutest amounts of helium to fuse into heavier elements, such as carbon.

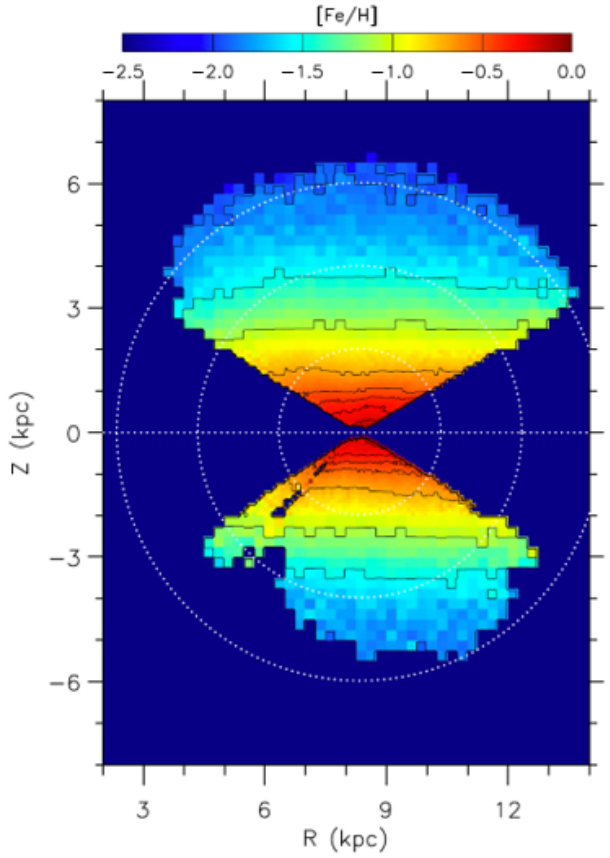
Dr. Timothy Beers, from the University of Notre Dame, was our guest speaker for the April General Meeting.

Dr. Beers said the first stars were huge, up to 1,000 times more massive than the Sun. These stars were short-lived and exploded as supernovae, producing the first metals that "polluted" gas clouds around that region. Since then, successive generations of massive stars have formed and died, seeding more metal rich star forming clouds with every generation. In the past 9.1 billion years metals have become heavier and more abundant, so the stars that form in those regions have higher percentages of those metals. Dr. Beers estimates that enough time in the universe has gone by to go through 20 to 50 generations of stars before the Sun formed.

Dr. Beers wants to understand the chemistry of the early universe so he's is interested in studying stars with an Fe/H of -5.2 and -4.0, that's 1/160,000 to 1/10,000 the metallicity (or heavy element content) of the Sun. The catch is that they are extremely rare. Just a few years ago, Dr. Beers and Dr. Deokkeun found a star with an [Fe/H] < -7.1 (~10 million times lower than the Sun).

The technology to search for and gather the data that Dr. Beers seeks has advanced significantly in the past few decades. Initial spectrographs could only collect data on one star at a time, which each exposure lasting 20 to 40 minutes. The Sloan Digital Sky Survey, for example, uses a spectrograph equipped with multiple slits. This gives it the ability to collect data on 100 to 1,000 stars at a time. The Large Sky Area Multi-Object Fibre Spectroscopic Telescope (LAMOST) in Hebei Province, China can collect 4,000 individual stellar spectra in a single night.

The result of this wealth of data was a new understanding of the galactic halo. Dr. Beers found evidence that, depending on how far away from the plane of the Galaxy you look, the distribution of stellar metallicity shifted (see image at the top of page 3). Basically, the more you move away from the galactic plane the rarer metal content in stars becomes. This was interpreted as a superposition of inner and outer halo populations. Using data from the ESA's Gaia mission, which has measured distances, proper motions, and radial velocities of 1.7 billion stars, structures in the motions of stars that have never been observed before were discovered. One such structure was dubbed the "Gaia Sausage." Other stars were apart of a "Splashed Dish," meaning stars above a section of the galactic disk contained stars with similar metallicities. These stars could have been pushed out of the disk by some interaction with a dwarf galaxy. On the other hand, there is



the "Metal Weak Thick Disk" with stars as metal-poor as those in the halo. These all provide hints, but with no understanding. This is similar to blind men inspecting an elephant, with each observer reaching different conclusions based on the section they're examining. Another analogy is having many pieces of a puzzle without a picture of the final result on the box.

The key to solving the Milky Way puzzle is photometric metallicity estimates. By choosing the right narrowband filters that are centered on the prominent metallic lines such as the calcium K & H lines, magnesium, and the G Band (a molecular feature involving carbon) you can determine the metallicity of all stars as opposed to pre-selected stars. It then becomes much easier to find the very rare examples without having selected them beforehand. Dr. Beers shared a few examples of using photometry (instead of spectroscopy) to measure the metallicity of millions of stars from the thin disk to the outer galactic halo, along with their distribution for a given rotational velocity.

Finally, Dr. Beers is hoping to collect even more data on stellar populations with the SkyMapper Survey, a 1.3-meter telescope at Siding Spring Observatory near Coonabarabran, Australia, in the near future. He is also looking forward to the Vera C. Rubin Observatory, an 8.4-meter telescope that will image the entire available sky every few nights. However, they will not be using narrowband filters for photometric measurements. Dr. Beers promised to send us a copy of a paper he and Dr. An are currently working on that details their latest results. [Dr. Beers' presentation is available for viewing on our YouTube Channel.]

A brief "graduation ceremony" video for the 222 people (including many families) that attended all five parts of the *Introduction to Amateur Astronomy* lecture series was played. Richard summarized the overwhelming success of this installment of the series. (See his column in last month's issue of *Prime Focus* to learn more.) One more award presentation was then held. McKenzie & Aaron Roman both completed the Astronomical League Lunar and Binocular Lunar Observing Awards together. They shared their certificates and showed off their Moon pins. Congratulations and we hope other members follow suite and complete an A.L. Observing Program over the spring and summer.

Richard reported that the Remote Telescope Training Video is complete. All members are welcome to view it, but you must ask for the link since it's unlisted for security reasons. There are still some remaining issues to solve with the RT. The Takahashi FSQ-106 appears to need collimation as stars in one corner of the field are out of focus. Autofocusing with the narrowband filters always fails, and the standard shutdown routine (built into ACP) only parks the telescope and disconnects the cameras (it doesn't power down the telescope or close the roof). Richard also mentioned that we're now offering mentorship for Remote Telescope Users, especially if they're intimidated to use the telescope for the first time. Mike Patton reported that the proposed grow house near Arizona Sky Village has been voted down 5-2, so we avoided that potential light pollution source.

Richard's next project is to complete the new version of the *Owl Observatory User's Guide*. Richard and Pete Mumbower talked about starting the KAS Astrophotography SIG. (They established a date of May 21st after the meeting.) See page 4 to learn more about the AP-SIG. Richard concluded his President's Report with an update on the record membership and sharing a tweet by March speaker Dr. Jessie Christiansen wearing the "Yes, there really is a Kalamazoo!" T-Shirt.

Under Observing & Imaging Reports, Aaron had noted being able to split the double star Zeta[1] (ζ^1) Cancri (Tegmine), separated by only 1 arc second, with his 10-inch reflector. Richard reported working on M3 and M81 with the Remote Telescope. Pete Mumbower shared another spectacular image, this time of the Hickson 44 galaxy group in Leo. Mike Sinclair noted that he hates Pete!

Under Astronomical News, Ingenuity is scheduled to perform its first flight on Mars during the coming weekend. (It was postponed until April 14th and was successful). Mike Sinclair reported on the recent news in physics concerning the muon (a heavier version of an electron). Recent results from Fermi Lab discovered that muon behavior doesn't match what the standard model of quantum mechanics predicts. If confirmed, this would add another force to the standard model (associated with the Weak Force).

After summarizing events for the rest of April and early May, Richard made a special announcement about the June meeting. Dr. John C. Mather, Senior Project Scientist for the James Webb Space Telescope and co-winner of the 2006 Nobel Prize in Physics, will be our very special guest speaker. Register now and be sure to join us. The meeting adjourned at 9:15 pm.

Observations

by **Richard S. Bell**

Two-thirds of the Apollo 11 crew have now passed into history. I was saddened to hear about the passing of Michael Collins on April 28th, but he packed in quite a life during his 90 years on Earth. Please be sure to see the article (from NASA) on page 6 about the life and accomplishments of this true hero and explorer.

The Center for Disease Control (CDC) unveiled updated COVID-19 guidelines on April 27th. They released a infographic along with their new guidelines. I won't bother to summarize the entire thing, but here's the one most relevant to us:

In my view, this gives us the go ahead to startup the 2021 season of Public Observing Sessions. The big question, of course, is can we trust unvaccinated people to wear a mask during the sessions? We will be discussing this at our next board meeting on May 2nd at 5pm and you're welcome to join us and offer your viewpoint. I'm trying to maintain a level, unbiased view. I've got to admit though, I'm very anxious to share our new Leonard James Ashby Telescope in Owl Observatory. We installed the main telescope in September 2019 and still have not been able to share it with very many members and the public.

If the Board does give the go-ahead, then I'll be good to go for the first session on June 5th. I received my first vaccination (Pfizer) on April 14th and am scheduled to receive the second on May 5th. Hopefully I won't have any adverse reactions since I'm looking forward to our guest speaker at the general meeting on May 7th. Dr. Eric Bell (no relation) will present *When Worlds Collide - Galaxy Collisions and Their Aftermath*. Dr. Bell, like Dr. Timothy Beers, was one of the scheduled speakers last year. We outright canceled the April meeting last year, but decided to postpone Dr. Bell's talk last May. He offered to give it via Zoom, but I was unfamiliar with it and unsure how many members would virtually attend.

The Kalamazoo School Board voted on April 22nd for in-person learning next Fall. Hopefully this means we'll be able to return to KAMSC in September, but we'll have to be in wait-and-see mode until sometime this summer.

To your right is a column about the new KAS Astrophoto SIG we'll be starting on May 21st. As noted, it is open to anyone interested in astrophotography no matter their skill level. It won't be conducted like a class (i.e., start with the basics, instead we'll jump around). Please be sure to attend the first meeting, since we'll be organizing the SIG.

Astrophotography

Special Interest Group

Featured speakers at general meetings cover a wide variety of topics to pique the interest of the membership at-large. However, more and more members have a growing interest in astrophotography, where the hobby of amateur astronomy meets the art of photography. This hobby within a hobby has grown dramatically over the past couple of decades thanks to digital cameras and numerous other accessories and software. The time seems right for the KAS to form an Astrophotography Special Interest Group (SIG).

All KAS members interested in astrophotography are encouraged to participate and share their knowledge, so that we all may grow into better sky shooters! No experience or special equipment is required to participate. We plan to cover a wide variety of topics on all forms of astrophotography and at all skill levels.

Here is a brief list of benefits the new KAS Astrophoto SIG will have:

- Sharing our most recent images.
- Discuss/review the latest equipment.
- Software tutorials/demonstrations.
- Processing demonstrations and workshops.
- Occasional talks by noted astrophotographers.
- Joint meetings with other Astrophoto SIGs.

For our first-ever gathering, we will discuss business pertinent to the organization of the SIG (i.e., a permanent meeting date and time, plus frequency of meetings). KAS astrophotographers will also have the opportunity to introduce themselves and share what equipment they use to capture the heavens.

Friday, May 21st @ 7:00 pm

Held Online via Zoom • ***Click Here to Register***

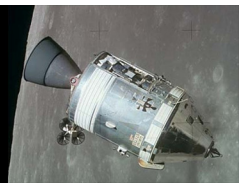
Orion Nebula Deep Field

The Great Nebula in Orion (M42 & M43) is 1,344 light-years away, making it the nearest region of *massive* star formation to the solar system. The nebula's mass is estimated to contain enough material to create 10,000 sun-like stars. Below (north) of the Orion Nebula, is the Running Man Nebula (NGC 1977). All the nebulosity shown above is part of the much larger Orion Molecular Cloud Complex.

This image was taken with the Takahashi FSQ-106EDX3 and STX-16803 CCD camera that is part of the KAS Remote Telescope. It is the first color image from the Tak released publicly. Total exposure time is 11.65-hours through Astrodon LRGB Gen2 E-Series Tru-Balance filters (Luminance: 28×30-sec., 15×300-sec., 16×600-secs. Red, Green Blue: 15×600-sec. each).

Images were acquired by Richard Bell on January 5, 6, 8, 13, 16 and February 9, 2021. Calibration, alignment, and stacking was done in PixInsight by Pete Mumbower.

Remembering Michael Collins



Former NASA astronaut Michael Collins, who flew on the Gemini 10 and Apollo 11 missions, passed away on April 28, 2021 at the age of 90.

The nation lost a true pioneer and lifelong advocate for exploration in astronaut Michael Collins. As pilot of the Apollo 11 command module – some called him "the loneliest man in history" – while his colleagues walked on the Moon for the first time, he helped our nation achieve a defining milestone. He also distinguished himself in the Gemini Program and as an Air Force pilot.

Michael remained a tireless promoter of space. "Exploration is not a choice, really, it's an imperative," he said. Intensely thoughtful about his experience in orbit, he added, "What would be worth recording is what kind of civilization we Earthlings created and whether or not we ventured out into other parts of the Galaxy."

In a statement, his family said, "Mike always faced the challenges of life with grace and humility, and faced this, his final challenge, in the same way. We will miss him terribly. Yet we also know how lucky Mike felt to have lived the life he did."

During the 1969 Apollo 11 mission, Collins remained in lunar orbit while fellow crewmembers Neil Armstrong and Buzz Aldrin descended to the Moon's surface in the lunar module. On July 20th, they became the first men to step onto the surface of another planetary body. Collins, orbiting 65 miles above them, was momentarily almost forgotten as the world's attention focused on his two crewmates below. But after the crew's safe return, their 16 days in quarantine and the tours afterwards that brought millions to welcome them home, it became clear to even the most uncaring observer that this was very much a three-man crew.

Michael Collins orbited the Moon in the command module *Columbia* during the historic Apollo 11 mission in July 1969. Credits: NASA

The plaque left on the Moon that said, "We came in peace for all mankind," was signed by Armstrong, Aldrin, Collins and President Richard M. Nixon.

Michael Collins was born October 31, 1930 in Rome, Italy. He graduated from Saint Albans School in Washington, D.C., and graduated from the U.S. Military Academy at West Point in 1952.

He chose an Air Force career. He was a fighter pilot and from 1959 to 1963 served as a test pilot at Edwards Air Force Base in California. He logged more than 4,200 hours of flying time.

Collins was a member of the third group of NASA astronauts, selected in October 1963. His first flight was as pilot of Gemini 10, a three-day mission launched July 18, 1966.

The flight, commanded by John Young, set an altitude record. The rocket of an Agena target-docking vehicle with which they had docked boosted them into an altitude of 476 miles.

Later they rendezvoused with a second Agena. Collins became the third U.S. spacewalker when he retrieved a micrometeorite detection device from that Agena.

Including the Apollo 11 mission, Collins logged 266 hours in space. He also served as CAPCOM (capsule communicator) for Apollo 8, relaying information between mission control and the crew.

Collins retired from the Air Force as a major general and left NASA in 1970 and became assistant secretary of state for public affairs. In 1971 he joined the Smithsonian Institution as director of the National Air and Space Museum. His responsibilities included planning and construction of a new museum building. It was completed on time and under budget. It opened to the public in 1976.

He became vice president of LTV Aerospace and Defense Company in 1980. He left that post in 1985 to start his own company. He was an independent consultant writing and lecturing about space.

He wrote several books: *Carrying the Fire* in 1974, *Flying to the Moon and Other Strange Places* in 1976, *Liftoff: The Story of America's Adventure in Space* in 1988 and *Mission to Mars* in 1990.

Collins was awarded honorary degrees form six universities. Decorations and awards he received included the Presidential Medal for Freedom, the Robert J. Collier Trophy, the Robert H. Goddard Memorial Trophy and the Harmon International Trophy.

NASA Night Sky Notes...

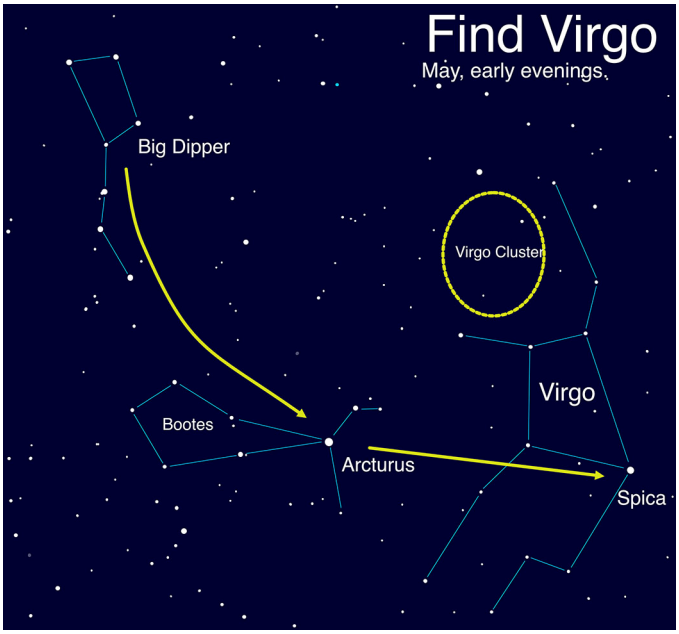
Virgo's Galactic Harvest

by **David Prosper**

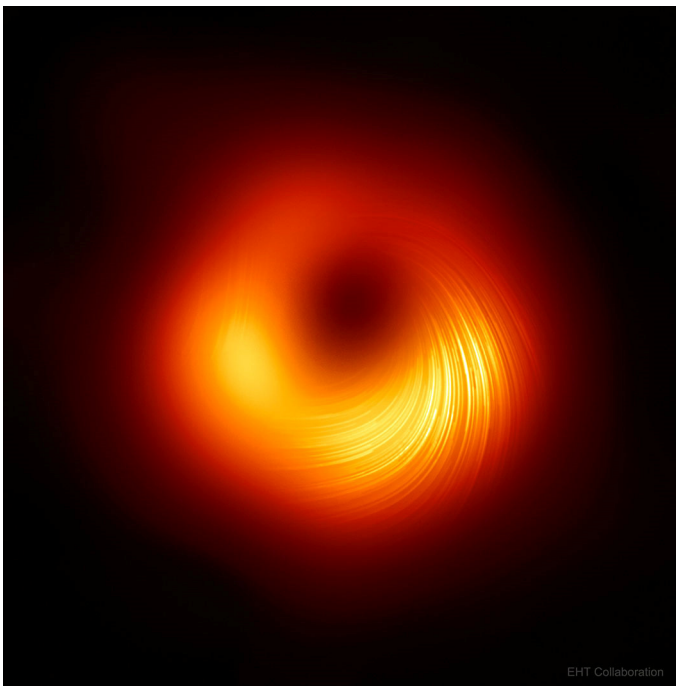
May is a good month for fans of galaxies, since the constellation Virgo is up after sunset and for most of the night, following Leo across the night sky. Featured in some ancient societies as a goddess of agriculture and fertility, Virgo offers a bounty of galaxies as its celestial harvest for curious stargazers and professional astronomers alike.

Virgo is the second-largest constellation and largest in the Zodiac, and easily spotted once you know how to spot Spica, its brightest star. How can you find it? Look to the North and start with the Big Dipper! Follow the general curve of the Dipper's handle away from its "ladle" and towards the bright red-orange star Arcturus, in Boötes – and from there continue straight until you meet the next bright star, Spica! This particular star-hopping trick is summed up by the famous phrase, "arc to Arcturus, and spike to Spica."

This large constellation is home to the Virgo Cluster, a massive group of galaxies. While the individual stars in Virgo are a part of our own galaxy, known as the Milky Way, the Virgo Cluster's members exist far beyond our own galaxy's borders. Teeming with around 2,000 known members, this massive group of galaxies are all gravitationally bound to each other, and are themselves members of the even larger Virgo Supercluster of galaxies, a sort of "super-group" made up of groups of galaxies. Our own Milky Way is a member of the "Local Group" of galaxies, which in turn is *also* a member of the Virgo Supercluster! In a sense, when we gaze upon the galaxies of the Virgo Cluster, we are looking at some of our most distant cosmic neighbors. At an average distance of over 65 million light years away, the light from these galaxies first started towards our planet when the dinosaurs were enjoying their last moments as Earth's dominant land animals! Dark clear skies and a telescope with a mirror of six inches or more will reveal many of the cluster's brightest and largest members, and it lends itself well to stunning astrophotos.



Find Virgo by "arcing to Arcturus, then spiking on to Spica." Please note that in this illustration, the location of the Virgo Cluster is approximate - the borders are not exact.



The first image of a black hole's event horizon was taken in the center of one of the most prominent galaxies in Virgo, M87! This follow up image, created by further study of the EHT data, reveals polarization in the radiation around the black hole. Mapping the polarization unveils new insights into how matter flows around and into the black hole - and even hints at how some matter escapes! Credit: Event Horizon Telescope Collaboration

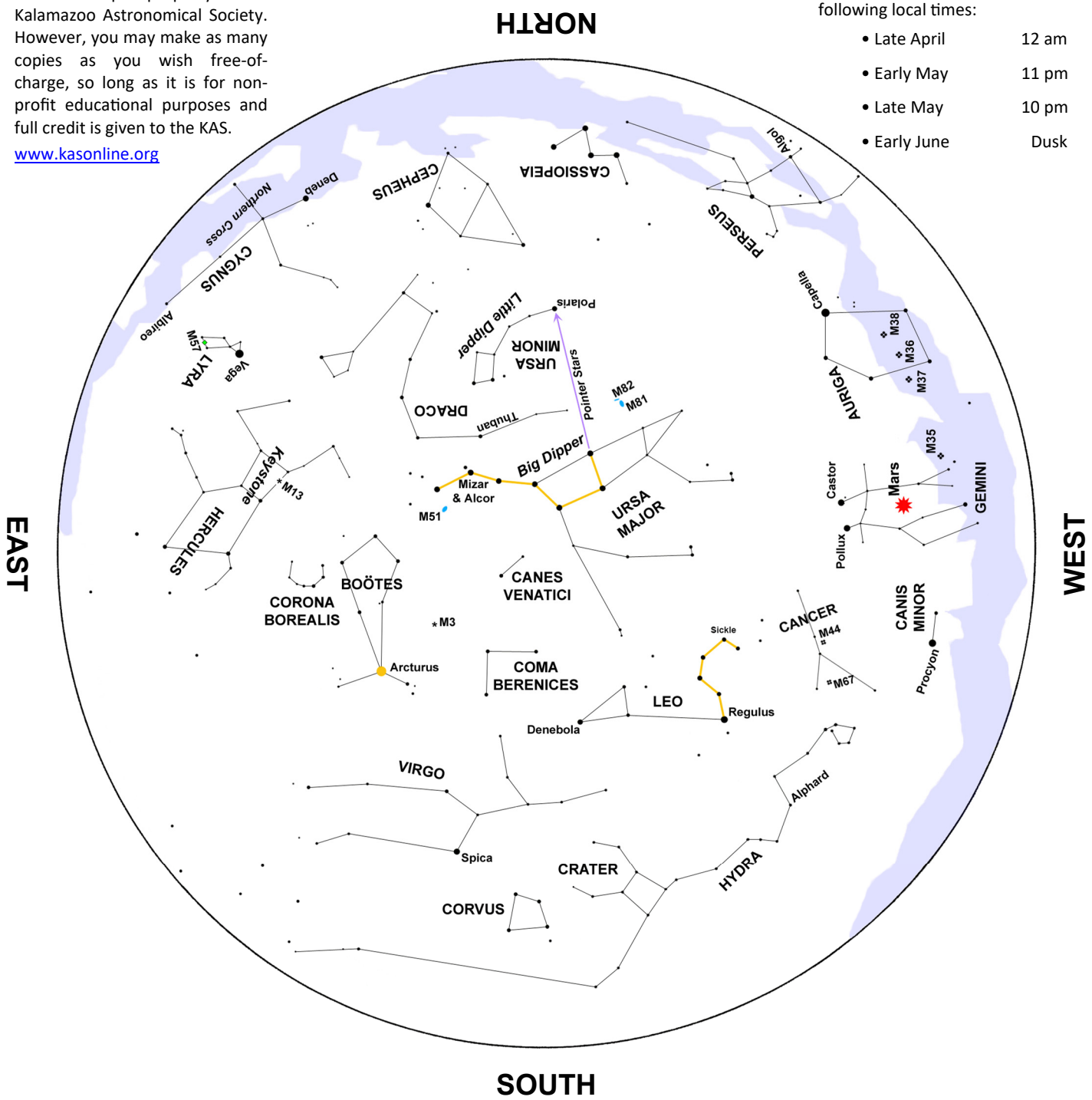
Virgo is naturally host to numerous studies of galaxies and cosmological research, which have revealed much about the structure of our universe and the evolution of stars and galaxies. The "Universe of Galaxies" activity can help you visualize the scale of the universe, starting with our home in the Milky Way Galaxy before heading out to the Local Group, Virgo Cluster and well beyond! You can find it here. You can further explore the science of galaxies across the Universe, along with the latest discoveries and mission news, at nasa.gov.

This article is distributed by NASA Night Sky Network. Visit nightsky.jpl.nasa.gov to find local clubs, events, and more!

— May Night Sky —

This map represents the sky at the following local times:

- Late April 12 am
- Early May 11 pm
- Late May 10 pm
- Early June Dusk



Interested in an observing challenge? A thin sliver of a 1-day old waxing crescent Moon and Venus will be 1° apart at dusk on May 12th. The pair will only be about 7° above the west-northwestern horizon, so you will need a location with an unobstructed view. Bring binoculars along, as they will help you spot Venus first and then the young Moon.

The Moon will be easier to spot the following evening, May 13th. This time you'll find innermost planet Mercury about 3° to the Moon's right.

The Moon, now in a more advanced waxing crescent stage, encounters the Beehive Cluster (M44) in Cancer on May 17th. Only 2° separate Moon and cluster, well within the range of binoculars or a wide-field telescope.

A total lunar eclipse takes place on May 26th. Unfortunately for those of us in West Michigan, the Moon doesn't begin to enter Earth's umbra until 5:45 am EDT. The Moon sets behind the south-western horizon at 6:16 am.

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PST Available for Checkout!

The Kalamazoo Astronomical Society's Coronado Personal Solar Telescope (PST), mounted on the light and ultra-portable Tele Vue Tele-Pod, is available for loan.

If you'd like to observe the Sun in hydrogen alpha and see prominences dance along the solar-limb and filaments crisscross its surface then contact the KAS Equipment Manager, **Arya Jayatilaka**, today:

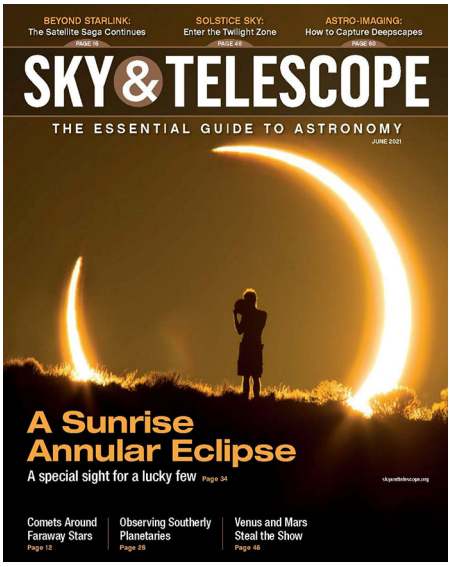
https://www.kasonline.org/loanscopes.html

SKY & TELESCOPE Subscription Discount

One of the many benefits of KAS membership is an **$11 discount** on a one year subscription to the premiere astronomical magazine, *Sky & Telescope*.

A regular one year subscription costs $54.95; you pay only **$43.95**. It's like receiving five free issues!

All discounts are now handled directly through *Sky & Telescope*. You do not need any proof of KAS membership. Simply click here to subscribe at the discounted rate.



Member-Only Observing Sessions

Join your fellow KAS members for a pleasant evening under the stars. To ensure the safety of all that attend, we ask everyone to adhere to the following guidelines:

- All attendees are required to wear a mask or other form of facial covering whenever in close proximity to others.
- Maintain at least 6 feet of physical distancing between other attendees whenever possible.
- Eyepieces and high-touch surfaces (such as focusers) will be sanitized after each use. Members bringing their own equipment are required to provide sanitizing wipes.
- If you have a cough or are feeling ill, please stay at home.

May 8th & 22nd @ 9:00 pm

Kalamazoo Nature Center • 7000 N. Westnedge Ave.

General Meeting Preview

WHEN WORLDS COLLIDE

Galaxy Collisions and Their Aftermath

presented by **Dr. Eric F. Bell**
University of Michigan

Over the last 25 years, it has become clearer and clearer that galaxies collide and merge frequently - the Milky Way could have had tens to hundreds of such collisions over its life, and is experiencing two largish ones right now. The most important of these events are the largest ones, and it is unclear what those collisions and subsequent mergers do to galaxies. The outskirts of galaxies contain critical clues about these largest collisions - the debris from these is spread over huge areas, and is particularly prominent in the distant outskirts of galaxies. We have been working for about a decade to develop a method to measure these outskirts (by imaging individual stars in other galaxies), and use sophisticated computer simulations to use these measurements to measure the largest collision and merger that a galaxy that has had. We use this to determine the collision and merger history of the Andromeda galaxy (M31), and learn about how it shaped Andromeda's disk, bulge and satellite system, including the enigmatic M32 satellite galaxy. We can then use this intuition to discuss what will happen when the Milky Way and Andromeda, in many billions of years, will collide and merge into a single galaxy.

Friday, May 7 @ 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