

## Highlights of the July Sky...

1<sup>st</sup>

**DAWN:** A waning gibbous Moon and Mars are 6° apart.

6<sup>th</sup>

**Last Quarter Moon**  
3:51 am EDT

9<sup>th</sup>

**PM:** Venus and Regulus, the brightest star in Leo, are less than 1° apart.

10<sup>th</sup>

**DAWN:** A thin waning crescent Moon is in the Hyades and about ½° from Aldebaran.

**PM:** Jupiter is stationary and located 2° to the right of Zubenelgenubi (Alpha Librae).

13<sup>th</sup>

**New Moon**  
10:48 pm EDT

15<sup>th</sup>

**DUSK:** A waxing crescent Moon and Venus, less than 2° apart, trail Regulus by about 5° as they descend in the west.

19<sup>th</sup>

**First Quarter Moon**  
3:52 pm EDT

20<sup>th</sup>

**PM:** A waxing gibbous Moon, Jupiter, and Zubenelgenubi (Alpha Librae) form a compact triangle in the southwest.

24<sup>th</sup>

**PM:** A waxing gibbous Moon is near Saturn.

27<sup>th</sup>

**Full Moon**  
4:20 pm EDT

**PM:** Mars at opposition and 7° to the lower right of the Moon.

31<sup>st</sup>

**PM:** Mars comes closer to Earth than it has since 2003. It reaches a maximum magnitude of -2.8 and will be 24.3" in angular diameter.

# Prime Focus

A Publication of the Kalamazoo Astronomical Society

★ ★ ★ July 2018 ★ ★ ★

## This Month's KAS Events

**Observing Session: Saturday, July 7 @ 9:30 pm**  
*Jupiter, Saturn & Summer Nebulae - Kalamazoo Nature Center*

**Field Trip: Friday, July 13 - Monday, July 16**  
*Cherry Springs State Park, PA - See Page 7 for Details*

**General Meeting: Friday, July 13 @ 7:00 pm**  
*Kalamazoo Area Math & Science Center - See Page 10 for Details*

**Observing Session: Saturday, July 21 @ 9:30 pm**  
*The Moon & Saturn - Kalamazoo Nature Center*

**Mars Watch 2018: July 27 & July 28 @ 8:00 pm**  
*Kalamazoo Nature Center - See Pages 4 & 5 for Details*

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# June Meeting Minutes

The general meeting of the Kalamazoo Astronomical Society was brought to order by President Richard Bell on Friday, June 1, 2018 at 7:10 pm EDT. Approximately 42 members and guests were in attendance at the Kalamazoo Area Math & Science Center (KAMSC). The meeting convened in room 440, since the temperature in the presentation center was in excess of 90° F.

Richard began his President's Report by encouraging members to complete one (or more) of the Astronomical League's Observing Programs. Copies of some of the easier programs were made available (several more can be found on the [A.L. website](#)). A field trip is being planned to Cherry Springs State Park in Pennsylvania this July (see page 7 for details). The Kindleberger Festival is on July 14<sup>th</sup> and volunteers are needed (see page 9). Finally, Richard asked members to help distribute posters and fliers for *Mars Watch* on July 27<sup>th</sup> & 28<sup>th</sup> (see pages 4 and 5).

Our special guest speaker was Dr. Zachary Constan, the outreach coordinator for MSU's National Superconducting Cyclotron Laboratory (NSCL). The title of his presentation was *14 Billion Years of Nuclei*. After reviewing the Scientific Method, Dr. Constan said one of the big questions in nuclear astrophysics is where did the matter that makes up the solar system (and us) come from? This first required a review of the basic structure of an atom. Dr. Constan then showed a [Periodic Table of the Elements](#), which displayed the 118 currently known elements. However, any element after 92 (uranium) is human made and not naturally occurring. To understand where all the naturally occurring elements came from, we must start from the very beginning.

Elementary particles like protons and neutrons were created about  $10^{-3}$  second after the Big Bang when high energy gamma-rays combined and converted their energy into matter. All the electrons that exist in the Universe today were made in the first 4 seconds after the Big Bang. About 2 minutes later, protons and neutrons could link to form



**Dr. Zachary Constan, outreach coordinator at MSU's National Superconducting Cyclotron Laboratory, was our guest speaker at the June 1<sup>st</sup> general meeting.**

deuterium which, by end of next minute, was fused into helium. This Big Bang Nucleosynthesis continued for at least another 20 minutes while the Universe was still hot and dense enough. At this point the composition of the Universe was mostly hydrogen nuclei (~75%), helium (~25%), with trace amounts of lithium and beryllium. Today's Universe contains a variety of "metals" - elements heavier than hydrogen and helium - but these were not forged during the Big Bang. Some of these metals would have to wait for the first formation of stars.

The Sun generates its energy by fusing hydrogen nuclei into helium nuclei in the core. Only in the core is it dense and hot enough for protons to move so fast that they fuse together when they collide. One helium nucleus contains 0.7% less mass than four hydrogen nuclei (protons). The missing mass was converted into energy according to Einstein's famous equation:  $E = mc^2$ . The Sun will eventually exhaust the hydrogen in the core and fuse helium nuclei into carbon and oxygen nuclei. Stars more massive than the Sun will be able to fuse elements all the way up to iron. Therefore, elements 6 (carbon) to 26 (iron) are fused in the cores of stars.

Even more complex elements are created by red giant stars in the slow neutron capture or s-process. Free neutrons are created by nuclear reactions in a red giant. A stable nucleus of iron-58 ( $^{58}\text{Fe}$ ) absorbs a neutron. The new nucleus ( $^{59}\text{Fe}$ ) is neutron-rich and unstable (radioactive). This unstable nucleus becomes stable by beta decay, turning a neutron into a proton. The final nucleus cobalt-59 ( $^{59}\text{Co}$ ) has more protons and thus is a heavier element than the original nucleus. The new stable nucleus absorbs a neutron and continues the process. Still more heavy elements are made in the rapid neutron capture or r-process. This is similar to the s-process but, as the name suggests, is much faster. The exact site of r-process is still unconfirmed. However, due to the conditions necessary (high neutron density, high temperature) core collapse (type II) supernovae and neutron star mergers (kilonova) are the most likely candidates. Taken together, the r- and s-processes account for almost the entire abundance of elements heavier than iron.

Dr. Constan spent the rest of his presentation discussing the [Facility for Rare Isotope Beams](#) (FRIB). MSU has been chosen as the site for FRIB: a \$730 million U.S. Department of Energy project to design and establish a world-leading laboratory over the next decade. Civil construction is ongoing and will be completed by 2022 at the latest. FRIB will help us to understand stellar nucleosynthesis in detail. The public is invited to get behind the scenes at the FRIB and NSCL during an open house on Saturday, August 18<sup>th</sup>. The event will run from 11am to 5pm.

Ellen Comiskey shared the only observing report after the snack break. She and Joe were visiting family in Sun City, Arizona recently and they spent a couple of good nights stargazing. Under current events, we discussed the passing of Apollo and Skylab astronaut [Alan Bean](#). The meeting concluded at 9:10 pm.

# BOARD Meeting Minutes

The KAS Board met on June 24, 2018 at Sunnyside Church. President Richard Bell called the meeting to order at 5:37 pm (the customary start time of 5pm delayed due to scheduling conflicts). Members present were Joe Comiskey, Jean DeMott, Lydia Hoff, Scott Macfarlane, Jack Price, Don Stilwell, and Roger Williams.

There was no treasurer's report at this meeting, since Rich Mather could not be present. Richard reported that he had asked Rich on these kinds of circumstances to get the information to Don in time for him to deliver the report.

Richard gave a quick review of planned summer events. Public Observing Sessions are scheduled for July 7<sup>th</sup> and 21<sup>st</sup> and for August 4<sup>th</sup> and 11<sup>th</sup>. The general meeting on July 13<sup>th</sup> will be Gadget Night, with the program also including reports from Mike Sinclair's students about their high altitude balloon-launch project. A special event, *Mars Watch 2018*, is planned for July 27<sup>th</sup> and 28<sup>th</sup> at the Kalamazoo Nature Center (see pages 4 and 5 for details). The Perseid Potluck Picnic is planned for August 11<sup>th</sup> at 6pm.

The first follow-up item was the Robotic Telescope Project Update. Dave Miller of Observatory Solutions was still working on a few items, one of which was an alert system that would e-mail a warning in the event of a problem requiring immediate attention (e.g., the roof could not be closed). Unfortunately, tending to the last of these problems will coincide with the necessary "monsoon season" shutdown for Piishii Observatory. Regarding 2018 outreach efforts, Jack had double-checked with the Kindleberger Festival (July 14<sup>th</sup>) and confirmed the details. Volunteers are needed (see page 9 for details).

In New Business, Richard noted that the meeting of area clubs dubbed "Quadruple Conjunction" would be hosted by KAS in 2019. Richard suggested that we have a daytime program, since our viewing conditions at the Kalamazoo Nature Center are not much to show a visitor. Aiming for a weekend near full moon would minimize the chances that we would interfere with the other clubs' viewing schedules. After some discussion, the Board suggested September 14, 2019, from 12 – 4 pm. Jean and Don favored a picnic lunch. Richard agreed to run this date past KNC and Dave DeBruyn from the GRAAA. The next item was maintenance of Owl Observatory. Jean said that the thermal blanket used to cover the telescope was breaking into small particles and generating a mess all over the room. After discussion of alternatives, the Board voted to replace the current cover with an inexpensive tarp and bungee cord, or something similar. Another problem with Owl Observatory was mice. Richard counseled against using poison, since in the past that had resulted in rodent carcasses in the building. Jean suggested trying an electronic repeller based on ultrasonic waves, and the consensus was to acquire one of these along with the tarp.

In the next item of New Business, Richard asked the Board for authority to send members a letter soliciting contributions for Owl Observatory upgrades. The details of the amount to be raised and the use to which it would be put were not specified as yet. While the Board agreed that improvements were needed to make Owl Observatory more suited to public viewing, they were hesitant to start the process before more information was in hand. It was moved by Jack and seconded by Lydia to ask for a draft of the letter, to be prepared during the summer, giving details of the work to be done and the costs involved. The Board will then consider the draft in September. The motion passed.

The final item of New Business (and the major subject of discussion of the meeting) was a review of the guidelines for use of the KAS Remote Telescope in Piishii Observatory. Considerable time and effort was expended in adjusting the nuances of language. The subject most discussed was the proper way to specify ownership and use of the data coming from the telescope. Jean was also concerned about being very specific in the language used to describe the method of appointment and role of the Training Administrator and the setting of standards. Some changes in wording were suggested for consideration at the next meeting of the Remote Telescope Committee.

The meeting was adjourned at 8:17 pm. The next meeting was set for Sunnyside on September 16, 2018 at 5pm.

*Respectfully submitted by Roger Williams*

— In Memoriam —

## Alan Otterson

November 15, 1951 - May 15, 2018

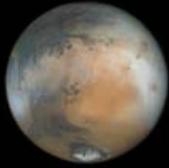


Alan Duane Otterson, 66, passed away peacefully on May 15, 2018 after a difficult illness.

Alan was born in Vicksburg on Nov. 15, 1951. He graduated from Vicksburg High School, attended KVCC, and served in the U.S. Air Force before marrying his true love, Cathy (Hinz) Otterson, on Aug. 24, 1989. They were married for 28 years.

Alan was an enthusiastic amateur photographer, composer and astronomer. He first joined the KAS in 1969 and maintained his membership until 1995. Alan re-joined in 2008 and published an article about his observatory in Three Rivers in the [September 2008](#) issue of *Prime Focus*. Alan relocated to Albuquerque, New Mexico in 2011 and maintained his membership for a brief time. Alan was also a long-time member of the Albuquerque Astronomical Society and frequent poster on the Cloudy Nights Forum.

Alan is survived by his wife Cathy, his sister Joyce Otterson Levesque, and his nephews Mark and Scott Beadles. He is preceded in death by his parents, George (Gene) Otterson and Ora Bea (Wintz) Otterson.



Oppositions of Mars, when the Red Planet is opposite the Sun in the sky as viewed from Earth, occur every 26 months. Thanks to Mars' slightly elliptical orbit, it comes especially close to Earth every 15 or 17 years. These occurrences are referred to as *perihelic oppositions* — meaning Mars reaches its perihelion (closest point to the Sun) and opposition at almost the same time.

Three perihelic oppositions have taken place in my lifetime (so far). The first was on August 10, 1971. I was unable to enjoy that one since I was 10 days old! The next took place on September 27, 1988. That one I was able to appreciate and observe with my trusty Jason 60mm refractor. Many of you will recall the last perihelic opposition of Mars on August 27, 2003. The Red Planet came closer to Earth than it had since the year 57,617 BCE! Mars reached a maximum angular diameter of 25.13".

That opposition and the ensuing media hype allowed us to have one of (if not *the*) most successful event in KAS history: *Mars Watch 2003*. Well over 1,000 people attended the first of our two-day event. From what I heard, both parking lots at the Nature Center were filled, cars were parked up and down the long driveway, and some people even had to park on North Westnedge itself and walk back to the observing area. I personally recall talking to people that were in line for approximately 3-hours waiting to view Mars through the observatory's 12-inch telescope!

The next perihelic opposition will take place on July 27<sup>th</sup>. Mars won't come as close as it did during the historic 2003 opposition, but the difference is negligible. Mars' maximum angular diameter this time around will be 24.3" - a difference of only 1"! Let's put that into perspective: 1" =  $\frac{1}{3600}^\circ$  and 1° is equal to the diameter of your pinky finger held out at arm's length. In other words, the most seasoned observers in the world wouldn't notice the difference. The media hype

will almost certainly be less than it was 15 years ago, but we're planning a two-day *Mars Watch* again. It'll be held at the Kalamazoo Nature Center on Friday, July 27<sup>th</sup> and Saturday, July 28<sup>th</sup>. Both nights will begin inside the Nature Center's Interpretive Center at 8pm with snacks, displays, and Mars-themed presentations. The indoor activities will go on regardless of weather conditions but observing the Red Planet itself will depend on clear skies (on both Earth *and* Mars...more on that in a minute).

Our friend, Dave DeBruyn, from the Grand Rapids Amateur Astronomical Association, will present *Mars in 2018 and Beyond, We Are on Our Way* on Friday night. Dave's talk will highlight the past, present and future exploration of the Red Planet. Yours truly will present *Observing Mars: Then & Now* on Saturday night. My talk will cover the early and colorful history of Mars observations and how you can best observe the Red Planet for yourself. Naturally, we'll need assistance from the KAS membership. Jean DeMott will need help with snacks and we'll need multiple volunteers with telescopes on both nights. I plan these special events long before seeking the assistance of the membership, but I know I can count on you. When it comes to the big events, you haven't let me down yet!

The observing portion of *Mars Watch 2018* may be in trouble thanks to a massive dust storm now in progress. Observers spotted a bright yellow dust cloud over the dark albedo feature Mare Acidalium in Mars' northern hemisphere on May 31<sup>st</sup>. The storm spread quickly thereafter but, as I type this, has not become global like the massive dust storm in 2001 but does extend around the planet. The 2001 storm ruined our views of Mars during observing sessions in late June and July. We feared this would happen during the much-anticipated opposition of 2003, but Mars' atmosphere stayed remarkably clear. Recent observations suggest the dust is beginning to settle. Let's hope, but more dust storms are possible - especially as Mars moves closer to the Sun. In fact, this dust storm is a little unusual. Instead of occurring at the height of summer in the southern hemisphere, as in 2001 and 2005, the current storm erupted in the northern hemisphere at the beginning of Fall.

I'll have much more to say about observing the Red Planet in my talk, but here are some quick pointers: a 4-inch refractor or 6-reflector is the minimum aperture needed to do Mars justice. Both should be well collimated and preferably set upon an equatorial mount with a clock drive. That way you're free to observe Mars and not keep it manually centered in the eyepiece. Colored filters can also be of benefit. A #25 red will help bring out dark surface features. An #80A blue filter will help reveal clouds and limb hazes.

If the dust continues to settle but dust storms persist on a regional level, that could be something to look forward to seeing during *Mars Watch 2018*. Either way, there will be plenty of activities inside. Mark your calendars and please join us on one or both nights.



Ace planetary imager [Damian Peach](#) obtained this image of Mars on June 26<sup>th</sup>. He said Mars was unrecognizable due to it being enshrouded in a planet-wide dust storm. The inset image on the right shows how this region would appear minus the thick obscuring dust.

# **Mars** Watch

*presented by the*

**Kalamazoo Astronomical Society**

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## ***See the Red Planet at its Best!***

A special event will occur in late July when the Red Planet Mars reaches opposition (opposite the Sun in the sky). Mars is at opposition every 26 months, however, due to the nature of Mars' elliptical orbit, the Red Planet comes especially close to Earth every 15 or 17 years.

Astronomers call these special occurrences *perihelic oppositions*, in reference to the fact that Mars will be in close proximity to the Sun and Earth. The last perihelic opposition took place in 2003 and will not occur again until 2035.

The KAS will celebrate the close approach of the Red Planet with a special two-day *MarsWatch* event and you are invited!

Each evening's activities will begin indoors at the Nature Center's Interpretive Center with snacks, displays, and special Mars-themed presentations. Afterward, if weather permits, the event will move outdoors to Owl Observatory for viewing of the Red Planet through KAS member telescopes.



**Friday, July 27<sup>th</sup> & Saturday, July 28<sup>th</sup>**

**Kalamazoo Nature Center - Gates Open at 8pm**



# New Study Doubles the Milky Way's Diameter

by Peter Christoforou

Although it has long been known that the [Milky Way Galaxy](#) has a distinct spiral structure, our position within the Galaxy has thus far precluded astronomers from determining the diameter of the Galaxy with any degree of accuracy. Various models of what the Milky Way might look like when seen from outside of the galaxy have all yielded size estimates of around 100,000 light-years, but a new study has just doubled this value to about 200,000 light-years.

Like other spiral galaxies, the Milky Way consists of a relatively flat disk that is composed of a spiral structure, with the whole being surrounded by a sparsely populated outer halo. Like other spiral galaxies, the bulk of the Milky Way's [stars](#) are concentrated in the disk, which rapidly transitions into the halo, with the drop off point representing rough boundary of the disk.

Traditionally, the diameter of spiral galaxies is measured from the center of the disc to the point where the stellar population begins to thin out. However, in the case of our home galaxy, the exact distance from the center to the drop off point is not clearly visible, hence the need to use mathematical and theoretical modelling to determine the Galaxy's diameter.

Clearly, a more accurate way to measure the Milky Way's diameter was required. Fortunately, since the bulk of the stars in the disk is much younger than the average age of halo stars, teams of researchers from the Instituto de Astrofísica de Canarias and at the National Astronomical Observatories of Beijing, hit on the idea of using spectroscopy to determine which distant stars belong to the disk, and which belong to the halo.

Working in concert, the two teams obtained spectra from a total of 4,600 stars, the idea being to use the stars' individual chemical compositions to determine their age. As a rule, the younger a star is the more complex its [chemical composition](#) becomes, since each successive generation of stars contain progressively heavier elements. Thus, by separating the sample stars into discrete populations, the researchers found that young, chemically mature stars occur up to about 81,000 light-years further from the galactic center that was thought possible just a decade ago.

Martín López Corredoira, who is the lead author of the study that was published in the journal *Astronomy and Astrophysics* on May 7<sup>th</sup> this year, commented, "[certainly] one would expect the existence of stars at very far distances from the galactic center, as part of the halo. However, as far as we know, nobody could previously say that stars [farther than 81,000 light-years from the galactic center] are confirmed spectroscopically to belong to the disk."

Nonetheless, and even though the disk tapers off into the halo at a greater distance from the galactic center than was

thought possible, the additional 100,000 light-years added to the Galaxy's girth adds almost no additional mass to the disk. When viewed objectively, the small number of stars that are now added to the galaxy's disk represent less than the proverbial drop of water in a vast ocean, meaning that the mass of Milky Way's disk remains unaffected in any meaningful way. In essence, no stars were added to the Milky Way; its existing stellar populations are now just rearranged somewhat differently.

Interestingly, even though the Milky Way's diameter had grown by 100,000 light-years in about a decade, it is still smaller than the [Andromeda Galaxy](#), which measures 220,000 light-years across from edge to edge.

Article used with permission. Visit [Astronomy Trek](#) for news, facts, entertainment, and much more.

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## Cherry Springs GETAWAY

Friday, July 13<sup>th</sup> — Monday, July 16<sup>th</sup>

[Cherry Springs State Park](#) is an amateur astronomer's haven! It is located in Potter County, Pennsylvania, about 10 miles to the southeast of Coudersport (the nearest town, population 3,000) or about an 8-hour drive from Kalamazoo. Cherry Springs is 82 acres in size and is surrounded by the 262,000-acre Susquehannock State Forest. The observing field is at the top of a 2,300-foot-high mountain. In 2000, the Pennsylvania Department of Conservation and Natural Resources (DCNR) declared Cherry Springs the state's first Dark Sky Park.

The park has become a very popular destination for amateur astronomers over the past 18 years. They allow amateurs to camp on the Overnight Astronomy Observation Field, which offers concrete pads and electricity. You can even rent an observatory; you just need to supply the telescope. The camping fee is \$15 per night per vehicle (for up to 5 people). You only need to register when you arrive onsite. There's a bulletin board with the current fees and a fee payment envelope. However, you can also purchase a "Galaxy Pass" for \$65. That allows you to have access to the observing area for the rest of the year rather than paying the per night set-up fee. The passes can be purchased in person at the Lyman Run State Park office or ordered by credit card over the phone (814-435-5010).

As of this writing, five KAS members are planning to make the trip. Would you like to join us? There are activities for the whole family. In addition to the darkest skies east of the Mississippi, these are just some of the activities available within 10-miles of the park: hiking, biking, boating, fishing, and swimming. The dates shown above are just a suggestion. You can arrive earlier or stay later, just hope for clear skies!



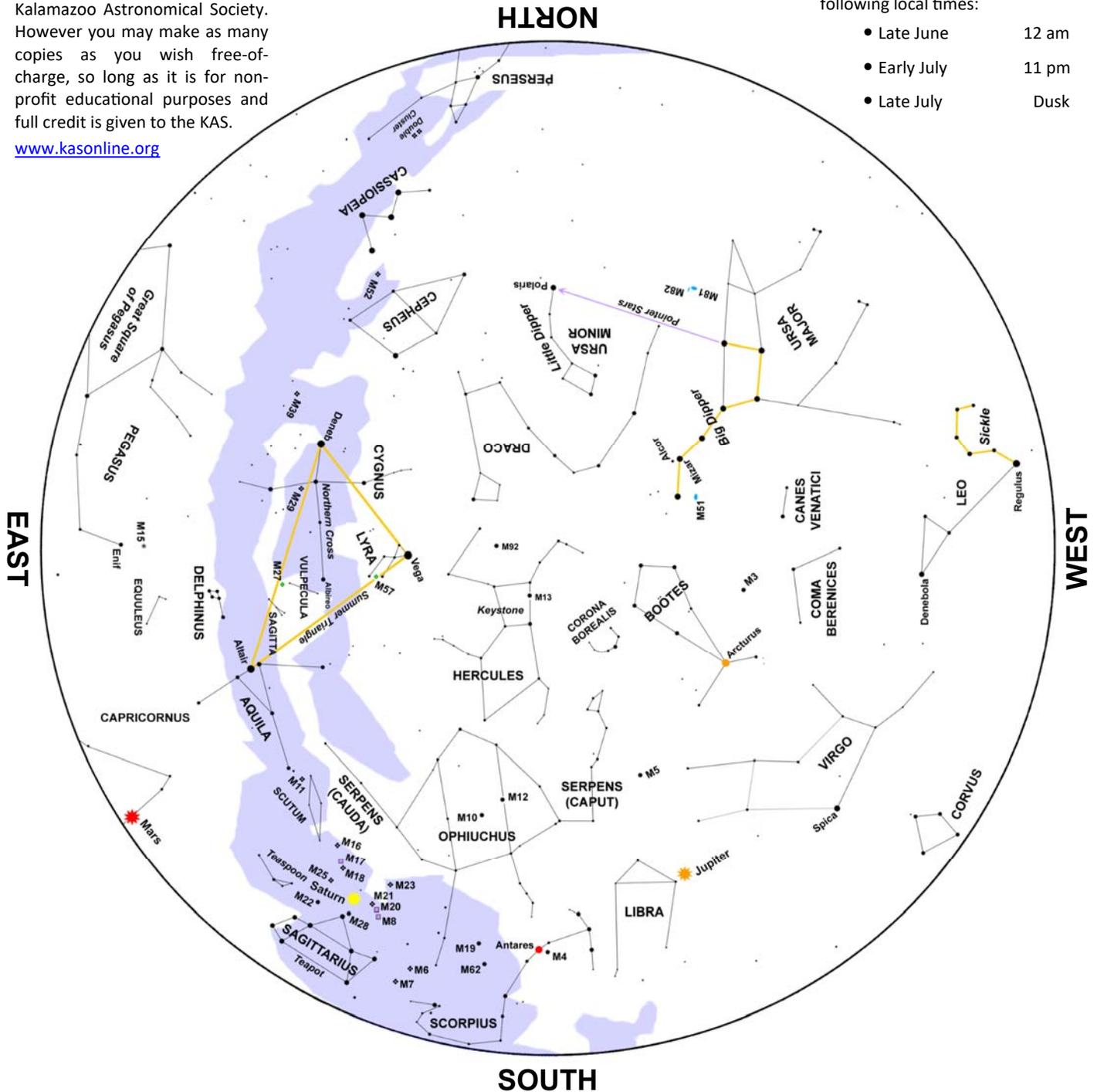
# — July Night Sky —

This star map is property of the Kalamazoo Astronomical Society. However you may make as many copies as you wish free-of-charge, so long as it is for non-profit educational purposes and full credit is given to the KAS.

[www.kasonline.org](http://www.kasonline.org)

This map represents the sky at the following local times:

- Late June 12 am
- Early July 11 pm
- Late July Dusk



**M**ars appears opposite the Sun in our sky this month, shining brighter and appearing larger than it has in 26 months. Some Mars oppositions are much closer than others, owing to the elliptical nature of the Red Planet's orbit.

The 2018 opposition is the best apparition since August 2003. With opposition on

July 27<sup>th</sup> and closest approach on July 31<sup>st</sup>, the disk of Mars will appear larger than that of Saturn for much of the summer, and for a time will even outshine giant Jupiter.

Mars will be larger than 24" in angular diameter between July 23<sup>rd</sup> and August 9<sup>th</sup>, nearly as large as the 2003 opposition

size of 25". Mars will not be as large again until 2035.

On opposition night, Mars will appear as a -2.8 magnitude orange-red star in Capricornus. The Full Moon will be hard to miss 7° to Mars' upper right. Mars reaches its maximum altitude (23°) at 1:50 am on July 28<sup>th</sup>.

## KAS BOARD

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July 2018

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# VOLUNTEERS NEEDED!



The KAS will again participate in the Kindleberger Festival at Kindleberger Park (located just east of Parchment Community Library at 401 S. Riverview Drive). Members are needed to setup and take down a display, help with a hands-on activity, pass out KAS literature, answer questions about the KAS from the public, and share views of the Sun through properly filtered telescopes. Please [contact us](#) if you'd like to lend a helping hand.

**Saturday, July 14<sup>th</sup>, 9am - 3pm | Kindleberger Park**



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— [skyshop.kasonline.org](http://skyshop.kasonline.org) —



## *Public Observing Sessions*



**Saturday, July 7<sup>th</sup>**

*Features: Jupiter, Saturn & Summer Nebulae*



**Saturday, July 21<sup>st</sup>**

*Features: The Moon & Saturn*

*Gates Open: 9:30 pm • Observing Begins: 10:00 pm*

**Kalamazoo Nature Center**

— **7000 N. Westnedge Ave.** —

## General Meeting Preview



# Gadget Night

Today's astronomical marketplace is flooded with telescopes and accessories of all shapes, sizes, and price ranges. However, even with the wealth of goods now available, there are some gadgets that can only be hand crafted. It just goes to show that necessity really is the mother of invention and thankfully amateur astronomers are an ingenious lot.

For our next meeting we invite KAS members to trot out the results of their latest brainstorming. Please feel free to bring along any interesting astronomically themed doodads, doohickeys, and devices you've purchased as well. You won't want to miss this fun and entertaining evening.

**BONUS:** KAMSC students will also share the results of their latest high-altitude balloon launch.

**Friday, July 13 @ 7:00 pm**

***Kalamazoo Area Math & Science Center***

*600 West Vine, Suite 400 • Use Dutton St. Entrance*

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

STAMP

