

# *The Prairie Astronomer*

May 2019 Volume 60, Issue #5

*Wrinkle Ridges  
on the Moon*



**Night Sky Network**



The Newsletter of the Prairie Astronomy Club

# ***The Prairie Astronomer***

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**NEXT PAC MEETING: May 28 at 6:30pm  
at Dino's**

## **PROGRAM**

This month's meeting is the club dinner at Dino's. May 28th at 6:30 (hour earlier than normal meeting time).

## **FUTURE PROGRAMS (Tentative)**

June: Solar Star Party

July: The History of PAC

August: NSP Review

September: to be determined

October: Club Viewing Night

November: How to Buy a Telescope


December: Club Holiday Gathering

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*Cover:*

*Scientists have discovered these wrinkle ridges in a region of the Moon called Mare Frigoris. These ridges add to evidence that the Moon has an actively changing surface. This image was taken by NASA's Lunar Reconnaissance Orbiter (LRO).*



The Prairie Astronomy Club:  
Fifty Years of Amateur Astronomy

**Buy the book! The Prairie Astronomy Club: Fifty Years of Amateur Astronomy.**  
Order online from [Amazon](https://www.amazon.com) or [lulu.com](https://www.lulu.com).

COMPILED AND EDITED BY MARK DAHMKE

# EVENTS

PAC Meeting  
 Tuesday May 28, 2019, 7:30pm  
 Annual Club Dinner

PAC Meeting  
 Tuesday June 25, 2019, 7:30pm  
 Program: Solar Star Party

Outreach Events - July 20. See Meeting Minutes.

Nebraska Star Party  
 Merritt Reservoir, Valentine, Nebraska  
 July 28 - August 2, 2019

PAC Meeting  
 Tuesday August 27, 2019, 7:30pm  
 Program: NSP Review

## 2019 STAR PARTY DATES



Photo by Brian Sivill

	Star Party Date	Star Party Date
January	Dec 28	<b>Jan 4</b>
February	Jan 25	<b>Feb 1</b>
March	Mar 1	<b>Mar 8</b>
April	Mar 29	<b>Apr 5</b>
May	Apr 26	<b>May 31</b>
June	Jun 21	<b>Jun 28</b>
July	Jul 26	<b>Aug 2</b>
NSP	<b>July 28 - Aug 2</b>	
August	Aug 23	<b>Aug 30</b>
September	Sep 20	<b>Sep 27</b>
October	Oct 18	<b>Oct 25</b>
November	Nov 22	<b>Nov 29</b>
December	Dec 20	<b>Dec 27</b>

Dates in **BOLD** are closest to the New Moon.



## PAC E-MAIL:

[info@prairieastronomyclub.org](mailto:info@prairieastronomyclub.org)

## PAC-LIST:

Subscribe through [GoogleGroups](#).  
 To post messages to the list, send to the address:

[pac-list@googlegroups.com](mailto:pac-list@googlegroups.com)

## ADDRESS

The Prairie Astronomer  
 c/o The Prairie Astronomy Club, Inc.  
 P.O. Box 5585  
 Lincoln, NE 68505-0585

## WEBSITES

- [www.prairieastronomyclub.org](http://www.prairieastronomyclub.org)
- <https://nightsky.jpl.nasa.gov>
- [www.hydeobservatory.info](http://www.hydeobservatory.info)
- [www.nebraskastarparty.org](http://www.nebraskastarparty.org)
- [www.OmahaAstro.com](http://www.OmahaAstro.com)
- [Panhandleastronomyclub.com](http://Panhandleastronomyclub.com)
- [www.universetoday.com/](http://www.universetoday.com/)
- [www.planetary.org/home/](http://www.planetary.org/home/)
- <http://www.darksky.org/>



**Night Sky Network**

## Meeting Minutes

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Minutes PAC meeting 4-30-19 as recorded by Bill Lohrberg

President Bob Kacvinsky called the meeting to order at 7:30 15 club members present – no visitors

Jim Kvasnicka presented the observing report for May

- Club star party dates May 3, May 24, and May 31 at the club observing site in Cortland, with backup/alternate site at Branched Oak Observatory.
- Planets Mars and Mercury setting after dusk, evening Jupiter, Saturn rises after midnight, Venus visible at dawn, Uranus to be 1.4 degrees north of Venus May 18.
- Messier list 49,51,61,63,64,85,94,101,102,104
- NGC 4179, 4211, 4244, 4281, 4517, 4631, 4656

Bob discussed notable news events in astronomy:

- More revelations of discovery from data gathered by the Cassini Saturn probe - moons picking up material from rings.
- The Israeli moon lander Beresheet unfortunately crashed attempting its landing on the moon.
- Bob noted that statistically 1 out of 3 missions result in failure, shared a video of several failed attempts – launches, landings of the past.
- Observable with binoculars or small telescopes - Asteroid Pallas was at opposition April 6<sup>th</sup>, and asteroid Iris April 5<sup>th</sup>. A house sized asteroid named 2019 GC6 flew past earth at a mere 136,000 mile distance on April 18<sup>th</sup>

Upcoming Events and announcements

- Lee Thomas announced that Hyde remains closed and gave a brief update on the status of roof repair. At this time the City has begun process and review of evaluation and estimates for repair. Projected reopening date conservatively estimated to be into July pending this process of review.

- MSRAL in Kansas City June 14<sup>th</sup> through 16<sup>th</sup>. Bob asked for show of hands for those planning to attend – 4 or more members present raised hands.
  - Nebraska Star Party July 28<sup>th</sup> through August 2<sup>nd</sup>, no club meeting in July
  - Many outreach events on July 20<sup>th</sup> including Indian caves – at least 4 or 5 volunteering, Homestead National monument Beatrice, Solar observing Centennial Mall Lincoln – Dave Churilla and Jim Kvasnicka volunteering, others encouraged to help out wherever they can.
  - John Reinert announced the PAC audit was completed on March 30<sup>th</sup> with help from Dan Delzell, and Lee Taylor, some notable expenses were the concrete slab purchase for Branched Oak Observatory site, and income from Amazon Smile account in the amount of \$49 was raised. John also pointed out CD rates will change and we'll continue to keep an eye on these and other variations. A summary sheet was passed around for view by club members.
  - The May 28<sup>th</sup> club meeting/dinner will take place at Dino's Restaurant rather than at Hyde
  - Bob announced there will be a series of training events for youth in the lead-up program who will be volunteering with us at the July 20<sup>th</sup> centennial mall in Lincoln solar observing, as well as some future club outreach events – fall dates to be determined and alternative sites pending availability of Hyde Observatory.
- Bob introduced Julie Allen – Founder of the lead up program to present an introduction and background of the organization and how PAC can help play a vital role in achieving its goals.

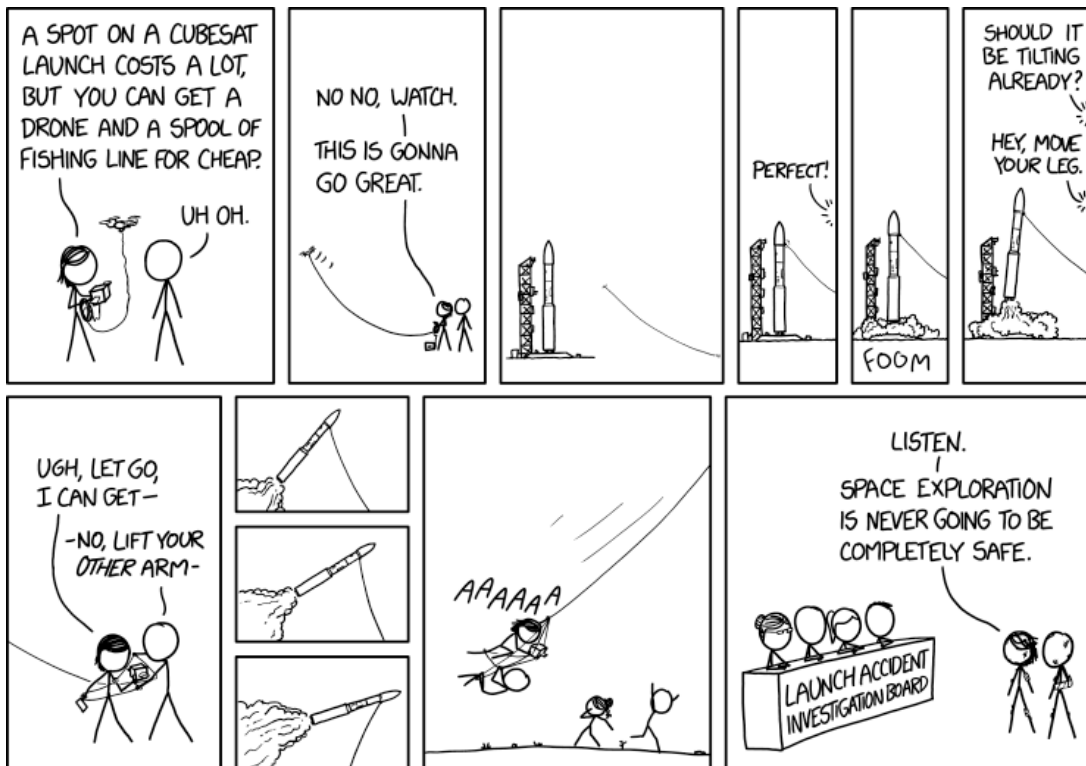
## Hyde Observatory Volunteer Appreciation Night



The annual Hyde Volunteer Appreciation Night was hosted by Zach Thompson at Mueller Planetarium.

Ruth Grady and Ethan Johnson received the Hyde Volunteer of the Year Award, presented by Lee Thomas.

After the awards were presented, Zach ran the full-dome show "Black Holes" narrated by John de Lancie.



xkcd.com

## The President's Message

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Bob Kacvinsky

The cold, snow, wind, and winter are finally behind us and spring is in full swing with showers, storms, wind, clouds and rain. Ugh. It has now been October since I have looked into an eyepiece, the longest absence period I can remember in my 30 years of observing.

We just rescheduled an outing with Lincoln East Astronomy students for the 3<sup>rd</sup> time, but the good news is that it will clear out at some point with beautiful evenings and skies.

**Our next club meeting on May 28<sup>th</sup> will be our annual dinner social at Dino's Restaurant on 84<sup>th</sup> S of Van Dorn beginning at 6:30 PM.** This is a social activity, so bring the spouse and enjoy getting to know more about each other. Dinner and drinks are your choice and cost.

On the weekend of June 14-16<sup>th</sup> is the Mid-States Regional Astronomical League's summer meeting in Kansas City, Mo. After several years of being held in the southern states, Kansas City will be a nice opportunity to participate. The program starts Friday evening with a Star BQ at Timber Creek and Star Gazing through the 30" telescope at Powell Observatory. Saturday will include presentations and an evening banquet. Sunday morning will conclude by 11 AM with 2 additional presentations.

For more details and registration information go to <http://www.askc.org/MSRAL-2019-registration>

This July marks the 50<sup>th</sup> anniversary of the first Apollo moon landing. There are several celebrations and activities across our area that we are being invited to attend. Libraries have designated this summer as the "Year of the Universe" and we have had several Lincoln and surrounding town libraries request presentations during June and July. If you would be interested in helping out please let me know. I have a 45 minute PowerPoint presentation already put together that you can use. It features photos of our Solar System and different types of Deep Sky Objects.

July 20<sup>th</sup> is the designated Saturday when many Moon Landing programs are scheduled and we would really like everyone who can to help to participate. In the afternoon of July 20<sup>th</sup> at Nebraska Historical Museum downtown in partnership with the Nebraska Lead Up Program we will set up for solar observing from 1-4 PM. Anyone with a solar shield or telescope are asked to help out.

During the evening of July 20<sup>th</sup> there are two large observing programs planned. The first will be at Indian Caves State Park

south of Nemaha, NE (along Missouri River) with the potential of several thousand attending.

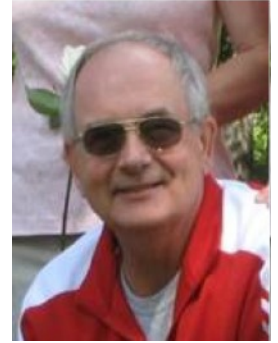
We will really need anyone with a telescope to consider helping out with this event.

The third activity on the evening of July 20<sup>th</sup> will be the Moon Landing celebration at the Homestead Memorial west of Beatrice. We have set up several times for the memorial and they appreciate our help with enhancing their programs. We could really use 3-5 telescopes to help with this program.

If you can help with any of these programs, please drop me a note or let one of the club officers know. This is an exciting time to share our hobby and the love of "What's Up There."

Dark and Clear Skies to You,  
Bob Kacvinsky

President, Prairie Astronomy Club  
Cell/Text: 402-499-1816  
kacvinskyb@yahoo.com



Rick Johnson, a founding member of the Prairie Astronomy Club, passed away in January, 2019. His legacy lives on through his comprehensive catalog of over 1600 images at [www.mantrapskies.com](http://www.mantrapskies.com).



Arp 5 / NGC 3664 is in southwestern Leo, 80 light-years distant. Arp put it in his category for low surface brightness spirals. Arp had no comment on this one. He also apparently missed NGC 3664A about 6.5 minutes to the south. It too is very weird. Redshifts of the two are nearly identical. All the literature I've seen say they are interacting and the cause of the severe distortion both show. Assuming they are both at the same distance their separation is only about 140 thousand light years. These aren't very big galaxies.

Arp 5 is classed as SB(s)m pec while the companion NGC 3664A is listed as (R)SB(s)m: It looks more like a train wreck to me. Though one piece of the mess turns out to be a 19.7th magnitude asteroid trail. Just to the NE of the trail is a red spot among the blue. That is another

galaxy SDSS J112426.03+031315.3, distance unknown but likely far beyond NGC 3664A. So it isn't quite as weird as it first appears. Still, it is pretty torn up. Arp 5 was discovered by Wilhelm Tempel on March 14, 1879.

There are three other asteroids in the image including the "brilliant" 15.8 magnitude Deflotte. It was discovered in 1933 but has no naming citation so I don't know the source of the name. All are marked on the annotated image.

Sorry about the stars. Tube currents due to no time to let the scope settle before clouds were due to roll in. So I started imaging as soon as I could open the roof, which was delayed by rain. I hoped I'd get back and redo the L frames but never happened so processed these. There are ways of fixing this but

they are time-consuming so just went with the triangular stars due to tube currents. The brilliant star at the very left edge of my frame is SAO 118847 a magnitude 7, A2 star. So while it is super bright in my image it is fainter than can be seen by most with the naked eye even under very dark skies.

Arp's image

[http://ned.ipac.caltech.edu/level/5/Arp/Figures/big\\_arp5.jpeg](http://ned.ipac.caltech.edu/level/5/Arp/Figures/big_arp5.jpeg)

Sloan image

<http://astronamerica.awardspace.com/SDSS-26/NGC3664-64A.php>

### Help Wanted: Newsletter Editor

By Mark Dahmke

I took over editing the PAC newsletter in December, 2001. I enjoy working on it, but feel that it's time to find a new editor.

It usually takes from two to three hours per month to build a newsletter, depending on how much material is sent to me and if there are any press releases of interest on NASA websites. You'll need to have some experience with desktop publishing, graphics, image editing and page layout. I use Serif's Page Plus, but you could use Adobe Illustrator or equivalent desktop publishing package. MS Word is not sufficient because it lacks many of the capabilities needed for desktop publishing. PAC has a license for Page Plus. Prior newsletter editing experience would be helpful. If you're interested, please contact me.



*Arp 5 / NGC 3664 by Rick Johnson*



## Study Finds New Wrinkles on Earth's Moon

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Billions of years ago, Earth's Moon formed vast basins called "mare" (pronounced MAR-ay). Scientists have long assumed these basins were dead, still places where the last geologic activity occurred long before dinosaurs roamed Earth.

But a survey of more than 12,000 images reveals that at least one lunar mare has been cracking and shifting as much as other parts of the Moon - and may even be doing so today. The study adds to a growing understanding that the Moon is an actively changing world.

Taken by NASA's Lunar Reconnaissance Orbiter Camera (LROC), the images reveal "wrinkle ridges" - curved hills and shallow trenches created by a lunar surface that is contracting as the Moon loses heat and shrinks. The features are described in a study published in *Icarus* on March 7, 2019, and led by Nathan Williams, a post-doctoral researcher at NASA's Jet Propulsion Laboratory in Pasadena, California.

Previous research has found similar surface features in the Moon's highlands, but wrinkle ridges have never been seen in basins before now. For this study, Williams and his co-authors focused on a region near the Moon's north pole

called Mare Frigoris, or the Cold Sea.

The study estimates that some of the ridges emerged in the last billion years, while others may be no older than 40 million years old. That's relatively fresh in geologic terms; previous studies have estimated these basins all stopped contracting about 1.2 billion years ago.

Both Earth and its Moon experience what's known as tectonics, processes that push up mountains, rip apart land masses and create quakes. On Earth, these processes occur constantly as the planet's mantle causes pieces of crust, called plates, to shift against one another. The Moon doesn't have tectonic plates; instead, its tectonic action occurs as the Moon slowly loses heat from when it was formed nearly 4.5 billion years ago. The heat loss causes its interior to shrink, crinkling the surface and creating distinctive features like those identified in the study.

"The Moon is still quaking and shaking from its own internal processes," Williams said. "It's been losing heat over billions of years, shrinking and becoming denser."

The effect is similar to a car tire in winter: As the temperature drops, air inside

the tire contracts and creates a squishier surface.

### Evidence of a Shrinking Moon

The Moon's tectonic action is especially visible in Mare Frigoris. By poring over more than 12,000 images taken by LRO's camera, Williams and his co-authors identified thousands of tectonically created features.

As the ground under Mare Frigoris shifts, it pushes up wrinkle ridges, which typically snake along the ground for several miles. The longest ones stretch about 250 miles (400 kilometers) - greater than the distance between New York City and Washington, D.C. - and rise as much as 1,000 feet (333 meters). Tectonic pushing and pulling of the lunar crust also sculpted curved hills called lobate scarps and shallow trenches known as graben.

Geologists can date them by studying another common lunar feature: impact craters. The longer a surface is struck by meteors, the more debris gets flung up from the impacts and covers nearby terrain, altering the landscape in a process called "impact gardening."

Craters collect more debris the longer they are around. The smaller they are, the less time they take to fill: Craters smaller than the size of a football field would typically fill to the brim in under a billion years. LROC's images revealed crisp tectonic features like the wrinkle ridges that formed after - and cut through - small, unfilled craters. That allowed Williams and his co-authors to deduce that the ridges emerged within the past billion years or so.

#### From Moonquakes to Marsquakes

Studying seismic activity on the Moon isn't new. The Apollo astronauts brought several seismometers to the lunar surface, which recorded thousands of moonquakes between 1969 and 1977. The vast majority were quakes that occurred deep in the Moon's interior; a smaller number

were determined to be of shallow depth, occurring in the lunar crust.

A new paper in Nature Geoscience takes another look at these shallow moonquakes and establishes connections to some very young surface features called lobate thrust fault scarps. This opens the door to looking for similar connections with young wrinkle ridges described in the Icarus study.

Scientists - including Williams - now hope to glean similar science from Mars. NASA's InSight lander recently detected what is likely its first marsquake, along with several other seismic signals. The way a quake's seismic waves travel inside a planet can tell geologists about how rocky bodies are layered. That, in turn, can deepen our understanding of how Earth,

its Moon and Mars first formed.

NASA's Lunar Reconnaissance Orbiter was built and is operated by the agency's Goddard Space Flight Center in Greenbelt, Maryland. Goddard manages the LRO mission for the Science Mission Directorate at NASA Headquarters in Washington.

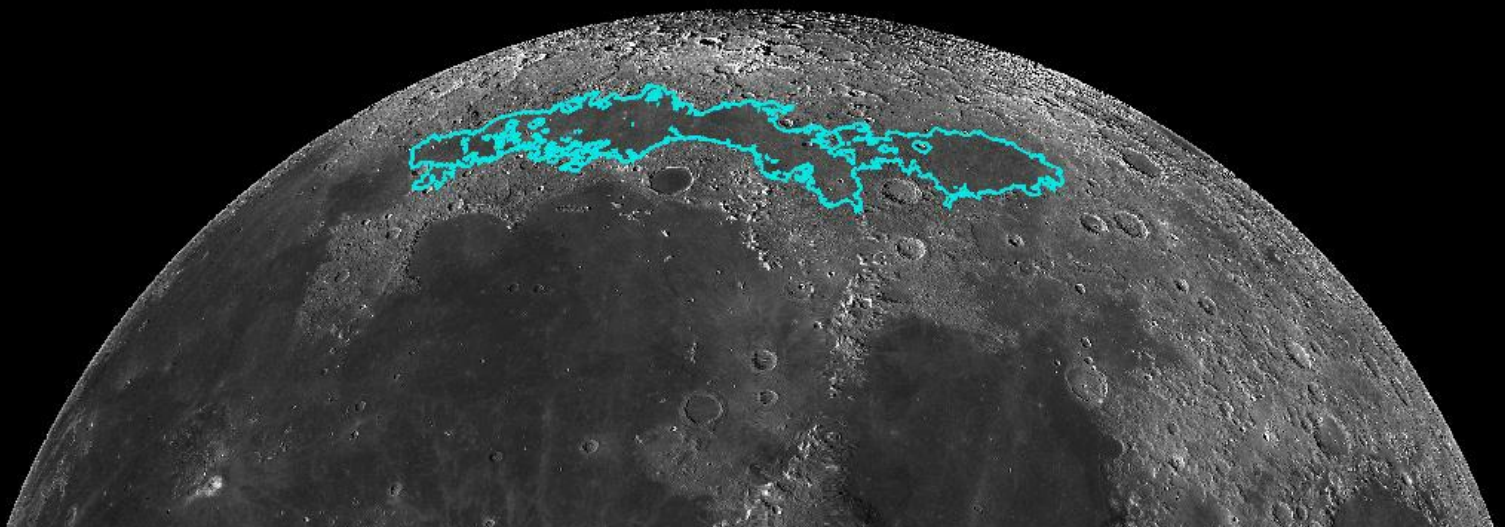
NASA's Jet Propulsion Laboratory in Pasadena, California, leads the InSight mission.

For more information on LRO, visit:

<https://www.nasa.gov/lro>

For more information about InSight, visit:

<https://mars.nasa.gov/insight/>



**This article is distributed by NASA Night Sky Network**

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**Jupiter** stakes its claim as the king of the planets in June, shining bright all night. **Saturn** trails behind Jupiter, and the **Moon** passes by both planets mid-month. **Mercury** puts on its best evening appearance in 2019 late in the month, outshining nearby **Mars** at sunset.

Jupiter is visible almost the entire evening this month. Earth will be between Jupiter and the Sun on June 10, meaning Jupiter is at **opposition**. On that date, Jupiter rises in the east as the Sun sets in the west, remaining visible the entire night. Jupiter will be one of the brightest objects in the night sky, shining at magnitude -2.6. Its four largest moons and cloud bands are easily spotted with even a small telescope.

What if your sky is cloudy or you don't have a telescope? See far more of Jupiter than we can observe from Earth with NASA's **Juno** mission! Juno has been orbiting Jupiter since 2016, swooping mere thousands of

miles above its cloud tops in its extremely elliptical polar orbits, which take the probe over 5 million miles away at its furthest point! These extreme orbits minimize Juno's exposure to Jupiter's powerful radiation as it studies the gas giant's internal structure, especially its intense magnetic fields. Juno's hardy JunoCam instrument takes incredible photos of Jupiter's raging storms during its flybys. All of the images are available to the public, and citizen scientists are doing amazing things with them. You can too! Find out more at [bit.ly/JunoCam](http://bit.ly/JunoCam)

**Saturn** rises about two hours after Jupiter and is visible before midnight. The ringed planet rises earlier each evening as its own opposition approaches in July. The **Moon** appears near both gas giants mid-month. The Moon's tour begins on June 16 as it approaches Jupiter, and its visit ends on June 19 after swinging past Saturn.

**Mercury** is back in evening skies

and will be highest after sunset on June 23, just two days after the summer solstice! Spot it low in the western horizon, close to the much dimmer and redder **Mars**. This is your best chance this year to spot Mercury in the evening, and nearly your last chance to see Mars, too! The two smallest planets of our solar system pass close to each other the evenings of June 17-18, coming within just  $\frac{1}{4}$  degree, or half the width of a full Moon, making for a potentially great landscape photo at twilight.

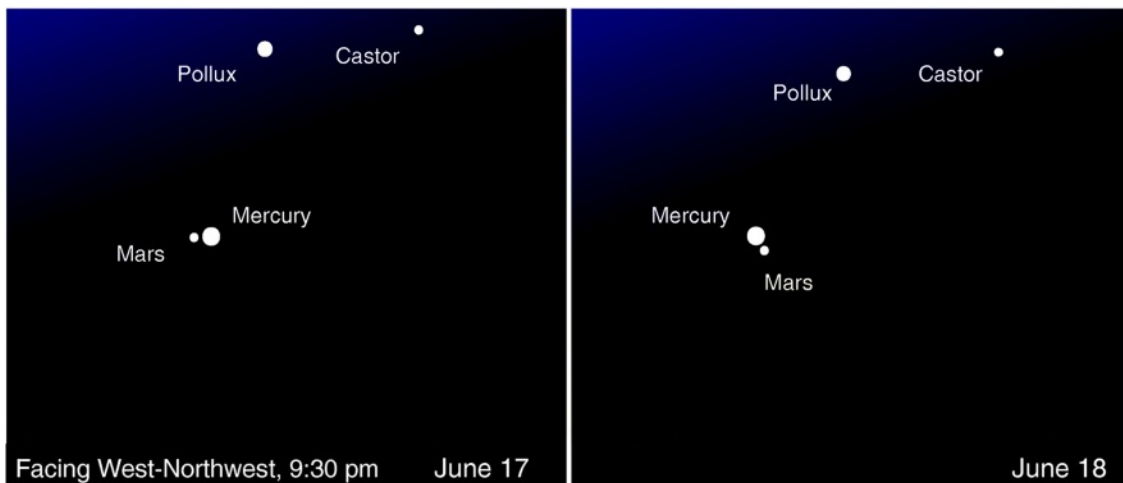
Discover more about NASA's current and future missions at [nasa.gov](http://nasa.gov)





*A giant storm in Jupiter's north polar region, captured by JunoCam on February 4, 2019. Image processing performed by citizen scientists Gerald Eichstädt and Seán Doran.*

Source: [bit.ly/JupiterSpiral](https://bit.ly/JupiterSpiral)



*Mars and Mercury after sunset the evenings of June 17-18, 2019. Image created with assistance from [Stellarium](https://www.stellarium.org/).*

## June Observing: What to View

Jim Kvasnicka

This is a partial list of objects visible for the upcoming month.

### Planets

**Mars:** Sets 1¼ hours after the Sun.

**Mercury:** Low in the WNW, on June 17<sup>th</sup> Mercury is just ¼° from Mars.

**Jupiter:** Reaches opposition on June 10<sup>th</sup> at magnitude -2.6 with a disk 46" wide.

**Saturn:** Rises in early evening twilight to end June to the left of the Teapot.

**Neptune and Uranus:** Best seen in the early morning hours.

**Venus:** Rises less than an hour before the Sun at magnitude -3.8.

### Messier List

**M58:** Oval shaped galaxy in Virgo.

**M59:** Hazy oval shaped galaxy in Virgo.

**M60:** Oval shaped galaxy in Virgo.

**M84/M86:** Two oval shaped galaxies in Virgo that fit in the same FOV.

**M87:** Round galaxy in Virgo.

**M88:** Galaxy in Coma Berenices.

**M89/M90:** Galaxies in Virgo that fit in the same FOV.

**M91:** Oval shaped galaxy in Coma Berenices.

**M98:** Elongated galaxy in Coma Berenices.

**M99:** Round galaxy in Coma Berenices.

**M100:** Round galaxy in Coma Berenices.

**Last Month:** M49, M51, M61, M63, M64, M85, M94, M101, M102, M104

**Next Month:** M3, M4, M5, M53, M68, M80, M83

### NGC and other Deep Sky Objects

**NGC 4565:** The Needle Galaxy in Coma Berenices.

**NGC 4710:** Elongated galaxy in Coma Berenices.

**NGC 4725:** Oval shaped galaxy in Coma Berenices.

**NGC 5248:** Oval shaped galaxy in Bootes.

**NGC 5689:** Elongated galaxy in Bootes.



### Double Star Program List

**Sigma Corona Borealis:** Equal pair of bright yellow stars.

**16/17 Draconis:** Pair of white stars.

**Mu Draconis:** Pair of white stars.

**Kappa Herculis:** Yellow pair.

**Alpha Herculis:** Orange and greenish stars.

**Delta Herculis:** Bright white star and blue-purple star.

**Rho Herculis:** Close pair of white stars.

**95 Herculis:** Pair of yellow-white stars.

**Alpha Librae:** Wide pair of yellow stars.

### Challenge Object

**NGC 5898 and NGC 5903:** Galaxy pair in Libra.

If you don't own a telescope there are several observing programs designated for binoculars that you can do. Currently there are four observing programs for binoculars.

- Binocular Messier Observing Program
- Binocular Deep Sky Observing Program
- Binocular Double Star Observing Program
- Binocular Variable Star Observing Program

## **Binocular Messier Observing Program**

To qualify for the Binocular Messier Observing Program you must observe 50 or more of the objects from the Messier list.

## **Binocular Deep Sky Observing Program**

The Binocular Deep Sky Observing Program has 60 selected objects you must observe.

## **Binocular Double Star Observing Program**

You must observe 50 double stars from a list of 120 to choose from.

## **Binocular Variable Star Observing Program**

First you must obtain an AAVSO observer code and make a total of 60 observations from at least 15 different binocular variables.

To record your observations you can use the logs provided on the Astronomical League website or you can use your own. Your observing logs should include: your name, object, date, time, seeing conditions, location, binocular size, and a description of what you observed.

When you complete any of the Binocular Observing Program you will need to submit a copy of your observing logs to me for review. If your logs are accurate and complete I will submit your name to the Binocular Observing Program chair for approval. The chair will mail to me your certificate and pin which I will present to you at our monthly PAC meeting.

If you have any questions regarding any of the Binocular Observing Programs or need help getting started please contact me and I will be glad to help.

## MRO Completes 60,000 Trips Around Mars

NASA's Mars Reconnaissance Orbiter hit a dizzying milestone this morning: It completed 60,000 loops around the Red Planet at 10:39 a.m. PDT (1:39 p.m. EDT). On average, MRO takes 112 minutes to circle Mars, whipping around at about 2 miles per second (3.4 kilometers per second).

Since entering orbit on March 10, 2006, the spacecraft has been collecting daily science about the planet's surface and atmosphere, including detailed views with its High Resolution Imaging Science Experiment camera (HiRISE). HiRISE is powerful enough to see surface features the size of a dining room table from 186 miles (300 kilometers) above the surface.

Meanwhile, MRO is watching the daily weather and probing the subsurface for ice, providing data that can influence the designs of future missions that will take humans to Mars.

But MRO isn't just sending back its own science; it serves in a network of relays that beam data back to Earth from NASA's Mars rovers and landers. Later this month, MRO will hit another milestone: It will have relayed 1 terabit of data, largely from NASA's Curiosity rover. If you've ever enjoyed one of Curiosity's selfies or sprawling landscapes or wondered at its scientific discoveries, MRO probably helped make them possible.

"MRO has given scientists and the public a new perspective of

Mars," said Project Manager Dan Johnston at NASA's Jet Propulsion Laboratory in Pasadena, California, which leads the mission. "We've also supported NASA's fleet of Mars surface missions, allowing them to send their images and discoveries back to scientists on Earth."

### Eyes in the Sky

While rovers and landers can study only their immediate vicinity, orbiters can view wide swaths of the entire planet; MRO can actually target any point on the Martian globe approximately once every two weeks.

MRO's aerial perspective also provides scientists a

**Mars Reconnaissance Orbiter**  
BY THE NUMBERS

**13 YEARS** in orbit

**361 TERABITS** of data returned

**1 TERABIT** of data relayed from Mars surface missions

**3 LANDED MISSIONS** tracked during final descent

**60,000** ORBITS

landing site scout for **7 MARS MISSIONS**

**378,000+** images taken

[mars.jpl.nasa.gov/mro](http://mars.jpl.nasa.gov/mro)

Updated May 2019

complementary view of a dynamic planet. As seasons change, they can see avalanches and cloud patterns. HiRISE has imaged CO2 ice sublimating, migrating sand dunes and meteorite strikes reshaping the landscape. With its Mars Climate Sounder instrument and its Mars Color Imager camera, MRO can also study atmospheric events like the massive global dust storm that proved fatal to NASA's Opportunity rover in 2018.

"Mars is our laboratory," said MRO Deputy Project Scientist Leslie Tamppari of JPL. "After more than a decade, we've collected enough data to formulate and test hypotheses to see how they change or hold up over time."

#### Daily Calls to Earth

MRO is one of several orbiters that send data from Mars to Earth each day. The same way MRO is the primary relay for Curiosity, Odyssey (NASA's longest-lived orbiter) is the primary relay for the agency's latest Martian inhabitant, InSight. The Mars Atmosphere and Volatile Evolution (MAVEN) orbiter recently started changing its orbit in preparation to cover the Mars 2020 rover's entry after it lands in February 2021. After data is sent up to an orbiter, it's beamed to giant antennas at one of three locations around Earth, all of which are part of NASA's Deep Space Network.

That relay network is now international. The European

Space Agency's Trace Gas Orbiter has been carrying an ever-increasing share of data sent from the surface. And all of these orbiters are preparing for the arrival of ESA's Rosalind Franklin ExoMars rover, which is scheduled to land the same year as Mars 2020.

#### Mars Landings

Orbiters like MRO and Odyssey are snap-happy, constantly imaging potential landing sites for future missions. But after a site has been selected and a mission is sent to Mars, orbiters play another critical role.

Before a surface mission can begin conducting science, it has to land safely. Successful landings require clocklike precision so that the spacecraft enters the Martian atmosphere at just the right angle, the parachute opens at the right time and sensors detect the rapidly approaching surface.

MRO and other orbiters serve as black boxes, recording data about each landing, which grow more difficult with the sort of added mass that comes with a mission like Mars 2020. Engineers use the data to design safer missions - which will be key to sending astronauts to Mars. With plans to return astronauts to the surface of the Moon by 2024, NASA is looking ahead at humans exploring the Red Planet, too.

NASA's Jet Propulsion Laboratory, a division of Caltech in Pasadena, California,

manages the Mars Reconnaissance Orbiter Project for NASA's Science Mission Directorate in Washington. The University of Arizona in Tucson, operates HiRISE, which was built by Ball Aerospace & Technologies Corp. in Boulder, Colorado. Malin Space Science Systems in San Diego, provided and operates MARCI.



# 2019 MSRAL Convention

The Astronomical Society of Kansas City (ASKC) will host the 2019 Mid-States Region Astronomical League Conference.

Friday, 6/14/2019 - Sunday, 6/16/2019 at Rockhurst University  
Register online: <https://askc.org/events/msral-2019>

## Speakers

Chuck Allen is former President of the Astronomical League.

Jackie Beucher is Vice-President of the Astronomical Society of Kansas City, and Vice-President of the Missouri Chapter of the International Dark Sky Association.

Don Ficken is President of the newly-formed Missouri Chapter of the International Dark Sky Association.

Calen Henderson is a NASA Exoplanet Archive scientist. Calen helps curate the premier online database for exoplanet data and analysis resources. At night, he specializes in using gravitational microlensing to detect and characterize exoplanets, by using the Spitzer and K2 space telescopes.

Nathan Meyer is Vice-President of Strategy and Product Innovation at Cosmosphere, Hutchinson, Kansas.

Doug Wagers is an accomplished astrophotographer and Astronomical Society of Kansas City Board Member.

Jen Winter is President of DayStar Filters. DayStar manufactures ultra-narrow bandpass filters for astronomical use.

Lario Yerino is a retired high school chemistry and physics teacher. He has Ph.D. from Texas A&M University. In 2016 Lario was accepted into a program for teachers through NASA SOFIA. He spent a week in Palmdale, CA where he was permitted to do two night flights on SOFIA.

## Astronomy Artwork and Photography Contest

New this year, MSRAL will sponsor an Astronomy Artwork and Photography Contest, open to all convention attendees. Any visual art media will be accepted. The categories are:

MILKY WAY: Objects in the Milky Way

SOLAR SYSTEM: Sun, Moon, and the planets

DEEP SPACE: Objects outside the Milky Way

Attendees will vote for their favorite in each category. Entries must be submitted at the Registration Desk on Friday, June 14, by 4:00 P.M., or Saturday, June 15, by 11:00 A.M., in order to be eligible. All first place winners will receive special recognition.



*Taken April 19 5am HT (10am CT). 99.8% full moon. Kailua-Kona, Hawaii.*



*April 22, I shot this one just before sunrise. 600mm, f/6.7 at 1/320 sec, ISO 200, hand-held.*



Panasonic Lumix G9 with 20mm f/1.7, ISO 1600



April 23, Orion partially covered by clouds, 8 seconds at f/2.8, 20mm, ISO 200.

The southern Milky Way from my condo's parking lot. 15 seconds at f/1.8, ISO 1600.



Orion sinks toward the ocean, 8:30pm HT, April 29. 15 seconds at f/1.7.

Ursa Major above Kailua-Kona. Hawaii, 8 seconds at f/1.8, ISO 1600, 20mm lens.



There are a couple of apologies in order. First, I want to apologize for last months newsletter coming out too late for the April 24th. Gateway show.

I am sorry that most of the burning of the mortgage and the whole sky show that followed was missed by many members. I am sure that some of you were quite surprised when you saw the news on Channel 10 and the pictures in the newspaper the following day. It seemsthat there was some mis-understanding and a lack of cooperation involved with the dead line of the newsletter. An investigation is under way and I hope to avoid this problem in the future.

The secound thing that happened was that a lot of people got "left out" so to speak, at our last meeting. Carroll Moore Closed the Planetarium doors at 7:50 for a 20 minute briefing on the constellations and basic Astronomy. I am sure that you can understand his reasoning in this respect. It would have "blown" the whole show to open the doors for late comers in the middle of his program and allow the hall lights to flood the planetarium. It was entirely my fault for not being outside to welcome late comers and direct them to the lecture room. I am sorry and it won't happen again.

The star party at my place on May 9th. was a partial success. We had a good turnout for a change. There was about 10 club members and 15 girl scouts from Hickmam up on the hill at 9:30. But by 10:00 the clouds came rolling in and the party broke up. We will try again next month. Lets really test our luck and have a star party in June on FRIDAY THE 13th. !

Earl Moser



*PAC President Earl Moser using the club telescope to burn the mortgage for the telescope.*

# 26th Nebraska Star Party - July 28-August 2



Photo Credit: Fred Hultstrand History in Pictures Collection, NDSU, Fargo, N.D.

## The early registration deadline is July 1st!

Join us this summer as families from all over the US and around the world gather in the sparsely populated sand hills of North Central Nebraska to spend a good week under a galaxy of stars.

### NSP Schedule of Events

Sunday: registration and check-in, optional dinner.

Monday: registration and check-in, field school, optional dinner.

Tuesday: registration and check-in, swap meet, field school, free “Cattle Country” hamburger dinner.

Wednesday: Brewer’s Niobrara Canoe or tube float, optional dinner.

Thursday: (All at Valentine High School) field school, registration, swap meet, speaker program, children’s program, dinner on your own.

Friday: public star party at 9pm.

For more information see the [NSP website](#).

**Register online!**

## CLUB MEMBERSHIP INFO

REGULAR MEMBER - \$30.00 per year. Includes club newsletter, and 1 vote at club meetings, plus all other standard club privileges.

FAMILY MEMBER - \$35.00 per year. Same as regular member except gets 2 votes at club meetings.

STUDENT MEMBER - \$10.00 per year with volunteer requirement.

If you renew your membership prior to your annual renewal date, you will receive a 10% discount.

Club members are also eligible for special subscription discounts on Sky & Telescope Magazine.

## CLUB TELESCOPES

*To check out one of the club telescopes, please contact a club officer. Scopes can be checked out at a regular club meeting and kept for one month. Checkout can be extended for another month if there are no other requests for the telescope, but you must notify a club officer in advance.*

100mm Orion refractor: Available  
10 inch Meade Starfinder Dobsonian: Available  
13 inch Truss Dobsonian: Needs repair  
10 inch Zhumell: Needs mount

## CLUB APPAREL



Order club apparel from [cafepress.com](http://cafepress.com):



Shop through Amazon Smile to automatically donate to PAC:



## CLUB OFFICERS

President	Bob Kacvinsky <a href="mailto:kacvinskyb@yahoo.com">kacvinskyb@yahoo.com</a>
Vice President	Rick Brown <a href="mailto:rickerbrown2000@gmail.com">rickerbrown2000@gmail.com</a>
2nd VP (Program Chair)	Christine Parkyn <a href="mailto:cpparky@gmail.com">cpparky@gmail.com</a>
Secretary	Bill Lohrberg <a href="mailto:wmlohrberg89@gmail.com">wmlohrberg89@gmail.com</a>
Treasurer	John Reinert <a href="mailto:jr6@aol.com">jr6@aol.com</a>
Club Observing Chair	Jim Kvasnicka <a href="mailto:jim.kvasnicka@yahoo.com">jim.kvasnicka@yahoo.com</a>
Outreach Coordinator	Mike Kearns <a href="mailto:mkearns@neb.rr.com">mkearns@neb.rr.com</a>
Website and Newsletter Editor	Mark Dahmke <a href="mailto:mark@dahmke.com">mark@dahmke.com</a>

The Prairie Astronomer is published monthly by the Prairie Astronomy Club, Inc. Membership expiration date is listed on the mailing label. Membership dues are: **Regular \$30/yr, Family \$35/yr.** Address all new memberships and renewals to: **The Prairie Astronomy Club, Inc., PO Box 5585, Lincoln, NE 68505-0585.** For other club information, please contact one of the club officers listed to the right. Newsletter comments and articles should be submitted to: **Mark Dahmke, P. O. Box 5585, Lincoln, NE 68505** or [mark@dahmke.com](mailto:mark@dahmke.com), no less than ten days prior to the club meeting. The Prairie Astronomy Club meets the last Tuesday of each month at Hyde Memorial Observatory in Lincoln, NE.