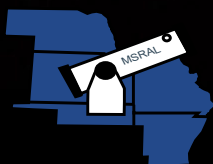


# ***The Prairie Astronomer***

**October 2020 Volume 61, Issue #10**

**October Program:  
Roving Mars with  
Curiosity** Dr. Patricia Craig

## **A Flight Over Jupiter**



**Night Sky Network**



The Newsletter of the Prairie Astronomy Club

# *The Prairie Astronomer*



## NEXT MEETING AND PROGRAM

October 27, 7:30pm: Roving Mars with Curiosity - via Zoom

Dr. Patricia Craig will highlight the major discoveries and innovations of the Mars Science Lab (MSL) Curiosity rover as well as trials and tribulations along the way. She'll also briefly discuss the much-anticipated Mars2020 Perseverance rover, set to land on Mars in February, 2021.

Dr. Patricia Craig earned her Ph.D. in Space and Planetary Sciences in 2012 from the University of Arkansas. She then spent 5 years in Houston at NASA's Johnson Space Center and the Lunar and Planetary Institute doing research on the soil on Mars. Her research focused on how water-bearing minerals are transformed by changing climate conditions and how they might be suitable to support microbial life. In 2015, she joined the Mars Science Lab Curiosity rover team, helping to operate one of the instruments on the Rover and interpreting the data it sends back. In 2017, she took an adjunct professor position at the Horry-Georgetown Technical College while maintaining her Mars Rover work. She currently lives and works in Myrtle Beach, SC, where she teaches, tutors, and continues her research of martian soil.

## FUTURE PROGRAMS

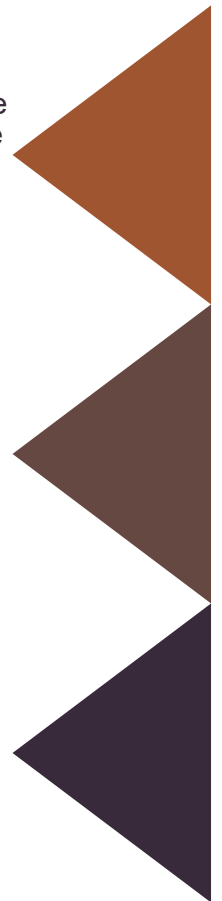
November - How to Buy a Telescope

December - To be announced

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Cover: Citizen scientist Kevin M. Gill created the video using data from the spacecraft's JunoCam instrument. The sequence combines 41 JunoCam still images digitally projected onto a sphere, with a virtual "camera" providing views of Jupiter from different angles as the spacecraft speeds by. See page 7 for details.



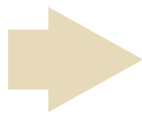
# CALENDAR

PAC Meeting  
 Tuesday, October 27, 2020, 7:30pm via Zoom  
 Zoom invitation will be sent on the 26<sup>th</sup>.  
 Election of Club Officers

PAC Meeting  
 Tuesday, November 24, 2020, 7:30pm

PAC Meeting  
 Tuesday, December 29, 2020, 7:30pm

**IMPORTANT:  
 ELECTION OF  
 CLUB OFFICERS**



Election of Club Officers will occur at the October meeting. If you're interested in running for office, please review the offices and duties article on page 23 of the September newsletter.

## 2020 STAR PARTY DATES

	Date	Date
January	17	<b>24</b>
February	14	<b>21</b>
March	13	<b>20</b>
April	17	<b>24</b>
May	15	<b>22</b>
June	12	<b>19</b>
July	10	<b>17</b>
August	14	<b>21</b>
September	11	<b>18</b>
October	9	<b>16</b>
November	6	<b>13</b>
December	11	<b>27</b>

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

## CLUB OFFICERS

President	Bob Kacvinsky kacvinskyb@yahoo.com
Vice President	Rick Brown rickbrown2000@gmail.com
2nd VP (Program Chair)	James Quach jamesq@utexas.edu
Secretary	Bill Lohrberg wmlohberger89@gmail.com
Club Observing Chair	Jim Kvasnicka jim.kvasnicka@yahoo.com
Outreach Coordinator	Mike Kearns mkearns@neb.rr.com
Website and Newsletter Editor	Mark Dahmke mark@dahmke.com



Shop through Amazon Smile to automatically donate to PAC:  
[smile.amazon.com/ch/47-6044523](https://smile.amazon.com/ch/47-6044523)



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

# The President's Message

*Bob Kacvinsky*



Wishing you well, safe, and finding smoke-free nights. The beautiful sunsets and sunrises unfortunately have also brought haze and poor seeing and transparency at the eyepieces. Hopefully things will get better soon.

Our September club star parties had a similar fate. Although the Lunar Party hosted by Jim Kvasnicka had 5 new members attending. The moon, Saturn, and Jupiter were about all we could see. Thanks to Jim, Dan Delzell, and myself for helping everyone set up their telescopes, aligning mirrors, telrads, finders, and helping to get the EQ orientations done. We are hoping to continue these "Lunar Parties" each quarter focusing on providing those with new equipment a chance to work with an experienced observer. Special thanks to the 10 members who attended the evening.

Our special speaker for the October 27<sup>th</sup> 7:30 PM PAC meeting will be Dr. Patricia Craig, Professor at Horry-Georgetown Technical College. The title of her talk is "Roving Mars with Curiosity." Dr. Craig has spent several years on the Mars Curiosity Rover Team working instruments that are analyzing Mars soils for evidence of microbial life or conditions that could support it. She spent 5 years in Houston at the NASA Johnson Space Center and the Lunar and Planetary Institute doing research on the soils on Mars. She will highlight discoveries and innovations of the Mars Science Lab on Curiosity rover as well as trials and tribulations along the way. She plans to give us some updates on the plans for the Mars2020 Perseverance rover set to land next February. Special thanks to Jack Dunn for helping

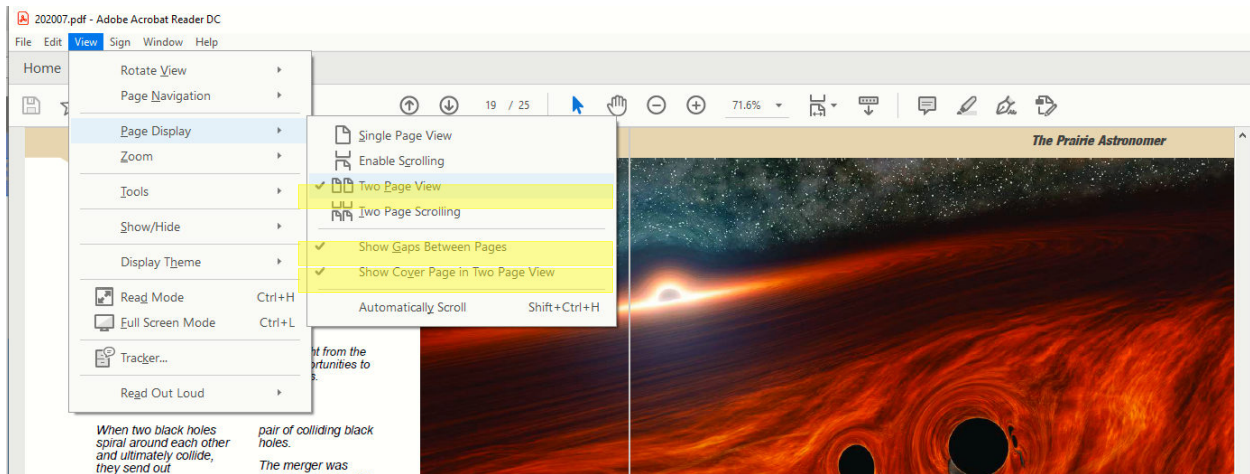
us line up such a notable speaker.

The October meeting will be brief with the main focus on electing your officers for the 2020-2021 PAC year. Please give serious consideration to volunteering for one of the office positions. We could really use your input and fresh ideas as we plan for the transition out of the COVID-19 world back to some sense of reality and public viewing. Please help us to make your Astronomy Club better.

If you have suggestions, ideas, recommendations for future meeting programs please let one of your Board members know. We look forward to your input.

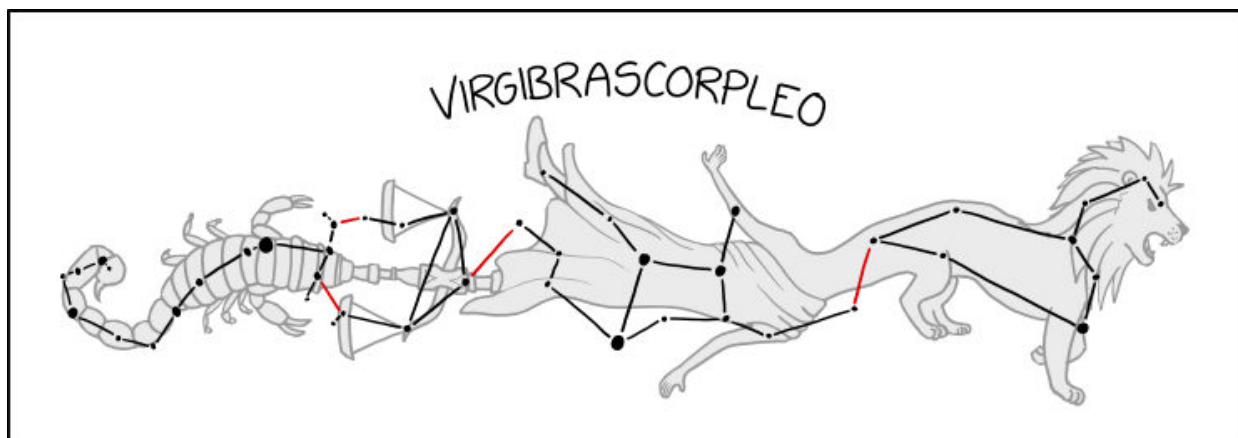
# New Newsletter Format

## How to Adjust Adobe Acrobat Settings for Two Page View



To view this newsletter in magazine spread format in Acrobat, select **View ->Page Display->Two Page View**. Acrobat will then show two pages side by side. Also make sure the checkboxes “Show Cover Page in Two Page View” and “Show Gaps Between Pages” are checked.

*If you have it setup correctly, the cover page will be displayed by itself and subsequent pages will be side by side with the odd numbered pages on the left.*



I GOT KICKED OUT OF THE INTERNATIONAL ASTRONOMICAL UNION FOR ADDING EXTRA LINES BETWEEN THE CONSTELLATIONS TO CREATE A MONSTROSITY.

# Meeting Minutes

Bill Lohrberg

PAC meeting minutes  
September 29, 2020 as  
recorded by Bill Lohrberg

PAC meeting via Zoom  
President Bob Kacvinsky  
hosting with 18  
participants at time of start  
7:34pm.

Bob began the meeting  
with a welcome and he  
presented an abbreviated  
observing report for Jim  
Kvasnicka recovering from  
surgery. (notes that more  
detailed October  
observing report can be  
found on the PAC  
newsletter)

- Planets for October:  
Mars up earlier in the  
evening now high enough  
around 10pm, Saturn, and  
Jupiter visible to the south  
after sunset,
- Highlight on the double  
star program – again,  
check newsletter for more  
details
- Orionid Meteor shower  
–peaks around third week  
of October (estimated  
average at around 15 per  
hour)
- Messiers: Still much to  
see in Sagittarius including  
small star cloud, some

open clusters, Eagle  
nebula, Swan nebula etc.

- Other non-M objects:  
NGC 7009 Saturn nebula,  
Helix Nebula in Aquarius,  
galaxies in Pegasus,  
bright open cluster 7510  
in Cepheus to name a  
few
- Bob displayed Brett's  
photo of Comet Neowise  
alongside scanned slide  
of Comet Hale-Bopp from  
1997. Noted how similar  
the 2 are in brightness  
but how the ion trail  
showed in both, Neowise  
more of a red color, and  
Hale-Bopp more blue.

## In the news

- Previously an  
announcement went out  
for the Artemis webinar,  
however we were unable  
to meet some legal  
requirements so instead  
on Sept 15 there was a  
webinar release hosted  
by Dynetics describing  
the history and process  
for making the lunar  
lander and habitat for the  
Artemis program.

## Announcements

- Hyde still on hold until  
further notice, stay tuned  
for any changes or  
updates
- Upcoming star parties,  
October 9 and 16 at the  
farm
- Lunar observing party  
was held, good turnout, 6  
telescopes, new  
members attending with  
several others, Dan  
Delzell, Jim Kvasnicka  
and Bob were there to  
help with collimating and  
orienting some of the new  
members, and some  
were logging a dozen or  
more items for the AL  
lunar program.
- Bob again thanked  
everyone for continued  
patience.

John Reinert gave a  
Treasurers update

- Checking balance and  
total month's balance  
given
- Rolled the smaller CD  
at end of August getting  
.03 percent interest rate
- Post office box is paid
- Received several  
membership renewals

and newest student membership Mia Peterson was added

- The N990 was filed middle of September
- Updated roster readied to go the Astronomical League

### **Nominations for club officers were announced**

- President Bob Kacvinsky nominated by Ron Veys, seconded by another.
- First Vice President Rick Brown nominated by Brian

Sivill and seconded by Ron Veys

- 2<sup>nd</sup> Vice President James Quach nominated by Bill Lohrberg, & seconded by Jim White,
- Secretary Bill Lohrberg, nominated by one (unidentified)
- Treasurer John Reinert nominated by Ron Veys

Nominations remain open until the election in October. All members

are eligible and can even nominate themselves.

With no further business the meeting was adjourned to the program "The Darkest Secrets of the Universe" presentation by Dr. Raja Guhathakurta - Co-Chair, Professor, and Astronomer Department of Astronomy and Astrophysics, University of California Santa Cruz.

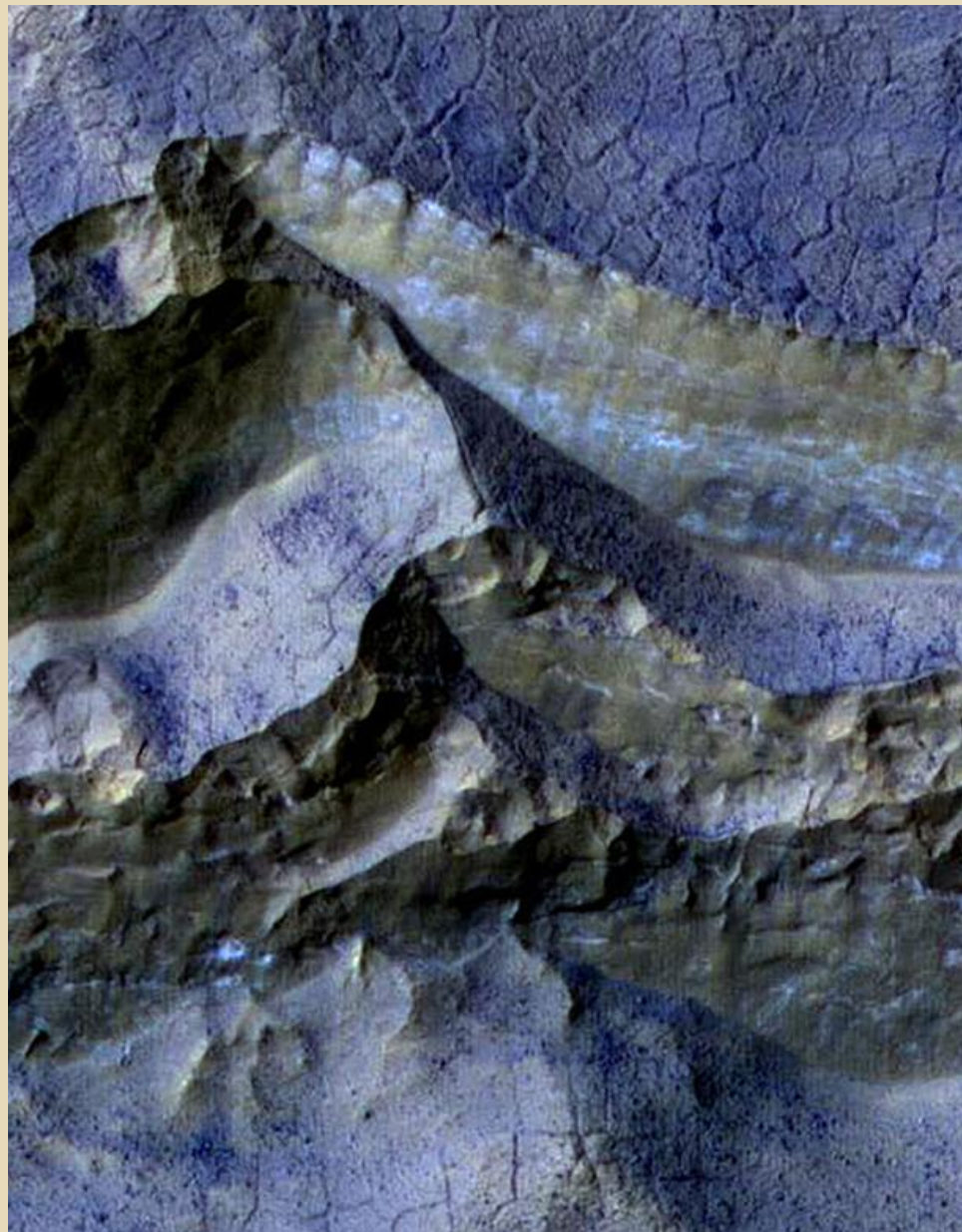
## Cliffs of Ancient Ice

*Scientists have come to realize that, just below the surface, about one third of Mars is covered in ice. We study this ice to learn about Mars' ancient climate and astronauts' future water supplies.*

*Sometimes we see the buried ice because cliffs form like the one in this image. On the brownish, dusty cliff wall, the faint light-blue-colored ice shows through. Some of these cliffs change before our eyes and boulders of ice can tumble downhill. We take repeat images of these scenes to check for changes like this.*

*Image credit: NASA/JPL-Caltech/University of Arizona*

[Read more...](#)



# A Flight Over Jupiter

Ride along with the Juno spacecraft as it performed its 27th close flyby of Jupiter on June 2, 2020.



*Image credit: Image data: NASA/JPL-Caltech/SwRI/MSSS, Image processing by Kevin M. Gill © CC BY, Music by Vangelis*

## [Click here for animation](#)

*This video uses images from NASA's Juno mission to recreate what it might have looked like to ride along with the Juno spacecraft as it performed its 27th close flyby of Jupiter on June 2, 2020.*

*During the closest approach of this pass, the Juno spacecraft came within approximately 2,100 miles (3,400 kilometers) of Jupiter's cloud tops. At that point, Jupiter's powerful gravity accelerated the spacecraft to tremendous speed — about 130,000*

*mph (209,000 kilometers per hour) relative to the planet.*

*Citizen scientist Kevin M. Gill created the video using data from the spacecraft's JunoCam instrument. The sequence combines 41 JunoCam still images digitally projected onto a sphere,*



# Jupiter, continued.

with a virtual "camera" providing views of Jupiter from different angles as the spacecraft speeds by.

The original JunoCam images were taken on June 2, 2020, between 2:47 a.m. PDT (5:47 a.m. EDT) and 4:25 a.m. PDT (7:25 a.m. EDT).

JunoCam's raw images are available for the public to peruse and process into image products at

<https://missionjuno.swri.edu/junocam/processing>. More information about NASA citizen science can be found at <https://science.nasa.gov/citizenscience> and <https://>

[www.nasa.gov/solve/opportunities/citizenscience](http://www.nasa.gov/solve/opportunities/citizenscience).

More information about Juno is at <http://www.nasa.gov/juno> and <http://missionjuno.swri.edu>.

[View all Images](#)

## Astrophotos

Canon Rebel T7i with 13mm Rokinon fisheye lens, at the Dorothy Lord Ranch  
By Brett Boller





*Rick Johnson*

# ARP 23

Arp 23 is a one-armed spiral galaxy in Canes Venatici. It is also known as NGC 4618. Oddly there are two one-armed spirals in the image but only the larger made it into Arp's atlas. The smaller is NGC 4625. Redshift puts Arp 23 at 36 million light-years distant while two Tully-Fisher measurements at NED say 25 million light-years. NED classifies it as SB(rs)m HII while the NGC Project says simply SBm and Seligman agrees with NED. The galaxy was discovered by William Herschel on April 9, 1787. It made the original Herschel 400 list. My notes from April 28, 1984 with my 10" f/5 at up to 150 power on an excellent night read:

"Bright with little detail seen, Didn't note the ringtail even though a great night. Other galaxies in the field may have distracted me, especially the one to the north (NGC 4625 I now know) which seemed bright enough to be plotted on the Tiron Atlas but was not."

NGC 4625 was discovered by William Herschel on April 9, 1787, the same night as NGC 4625 but is in neither of the Herschel 400 observing programs. It is classified as SAB(rs)m pec by NED and Seligman and SBm/P by The NGC Project. It too appears to be a one-armed spiral but didn't make Arp's list like NGC 4618 did. The two are

considered an interacting pair so at about the same distance. Very long exposures in UV light show that the stars of Arp 20 extend to and wrap around NGC 4625 proving they are an interacting pair. Is this interaction the cause of both having only one main arm? See <http://cseligman.com/text/atlas/ngc46.htm#4625> for more on this interaction and deep images of the pair.

Arp's image: [http://ned.ipac.caltech.edu/level5/Arp/Figures/big\\_arp23.jpeg](http://ned.ipac.caltech.edu/level5/Arp/Figures/big_arp23.jpeg)

# *The Mantrap Skies Image Catalog*

*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).*



# November Observing

*Jim Kvasnicka*



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

## Planets

**Jupiter:** Shines at -2.0 magnitude with a disk 34.5" wide.

**Saturn:** At magnitude +0.6 with a disk 15.7" wide, the rings are tilted 22°.

**Mars:** Fades in brightness to magnitude -1.2 with a disk 14.8" wide.

**Uranus and Neptune:** Look for Uranus in Aries and Neptune in Aquarius.

**Venus:** Bright in the ESE pre-dawn sky at magnitude -3.9.

**Mercury:** Visible all month below Venus, look for a small crescent.

## Meteor Showers

**Leonids:** Peaks the night of November 16-17. There will be no Moon to interfere.

## Messier List

**M27:** The Dumbbell Nebula in Vulpecula.

**M30:** Class V globular cluster in Capricornus.

**M56:** Class X globular cluster in Lyra.

**M57:** The Ring Nebula in Lyra.

**M71:** Class XII globular cluster in Sagitta.

**M72:** Class IX globular cluster in Aquarius.

**M73:** Asterism in Aquarius.

**Last Month:** M11, M16, M17, M18, M24, M25, M26, M55, M75

**Next Month:** M2, M15, M29, M31, M32, M39, M110

## NGC and other Deep Sky Objects

**NGC 7662:** The Blue Snowball in Andromeda.

**NGC 128:** Elongated galaxy in Pisces.

**NGC 253:** The Silver Coin Galaxy in Sculptor.

**NGC 288:** Class X globular cluster in Sculptor.

**NGC 457:** The E. T. Cluster in Cassiopeia.

## Double Star Program List

**Iota Trianguli:** Yellow primary with a pale blue secondary.

**Gamma Arietis:** Two equal white stars.

**Lambda Arietis:** Yellow and pale blue stars.

**65 Piscium:** Yellow pair.

**Psi 1 Piscium:** Equal bluish white pair.

**Zeta Piscium:** White primary with a secondary.

**Alpha Piscium:** Close white pair.

**Gamma Andromedae:** Almach, gold and greenish blue pair.

## Challenge Object

**NGC 7782 Group:** NGC 7782 is the brightest in a group of five galaxies that include NGC 7778, NGC 7779, NGC 7780, and NGC 7781.

# Focus on Observing

## Galaxy Groups and Clusters Observing Program

*Jim Kvasnicka*

This program of 250 galaxy groups and clusters is designed for detailed visual and/or CCD observation.

Most of the galaxy groups and clusters of this observing program are visually accessible with a 12.5" telescope, although there are some galaxies in the groups and clusters that are beyond almost all amateur observers.

To participate in this program you will need to purchase the Observe Galaxy Groups and Cluster observing guide from the Astronomical League Bookstore. This guide is written to support the program.

There are two categories of search methods, Manual and Device Aided. To be considered for the Manual all objects must be located manually. There are two methods of observing, visual and imaging.

Of the 250 objects listed in the Galaxy Groups & Clusters Guide, you need to observe 120 objects. The 120 objects need to be from the following groups:

30 Galaxy Trios, 30 Hickson Galaxy Groups, 30 Additional Galaxy Groups, and 30 Abell Galaxy Clusters.

You can use your own observing logs to record

your observations. Your observations should include: object name, date and time, power, seeing, telescope used, filters used, latitude and longitude, and your observing notes.

Once you complete the Galaxy Groups & Clusters Observing Program you will need to submit your observing logs to me for review. I will contact the program chair for approval. Once I receive your certificate and pin I will present them to you at the next PAC meeting.



# Astrophotos



James Quach Photography ©2020

Milky Way at Merritt Reservoir by James Quach. Canon 5D Mark III, Samyang 14mm f/2.8 ED, @f/2.8, 30 seconds, ISO 2500



James Quach Photography ©2020

*Milky Way at Merritt Reservoir by James Quach. Canon 5D Mark III, Samyang 14mm f/2.8 ED, @f/2.8, 30 seconds, ISO 2500*

# Pan-STARRS Releases Largest Digital Sky Survey to the World

*The asteroid, which is being studied by NASA's OSIRIS-REx, shows some surprising activity on its surface, and scientists are beginning to understand what might be causing it.*

The Pan-STARRS project at the University of Hawaii Institute for Astronomy is publicly releasing the world's largest digital sky survey today, via the Space Telescope Science Institute (STScI) in Baltimore, Maryland.

"The Pan-STARRS1 Surveys allow anyone to access millions of images and use the database and catalogs containing precision measurements of billions of stars and galaxies," said Dr. Ken Chambers, Director of the Pan-STARRS Observatories. "Pan-STARRS has made discoveries from Near Earth Objects and Kuiper Belt Objects in the Solar System to lonely planets between the stars; it has mapped the dust in three dimensions in our galaxy and found new streams of stars; and it has found new kinds of exploding stars

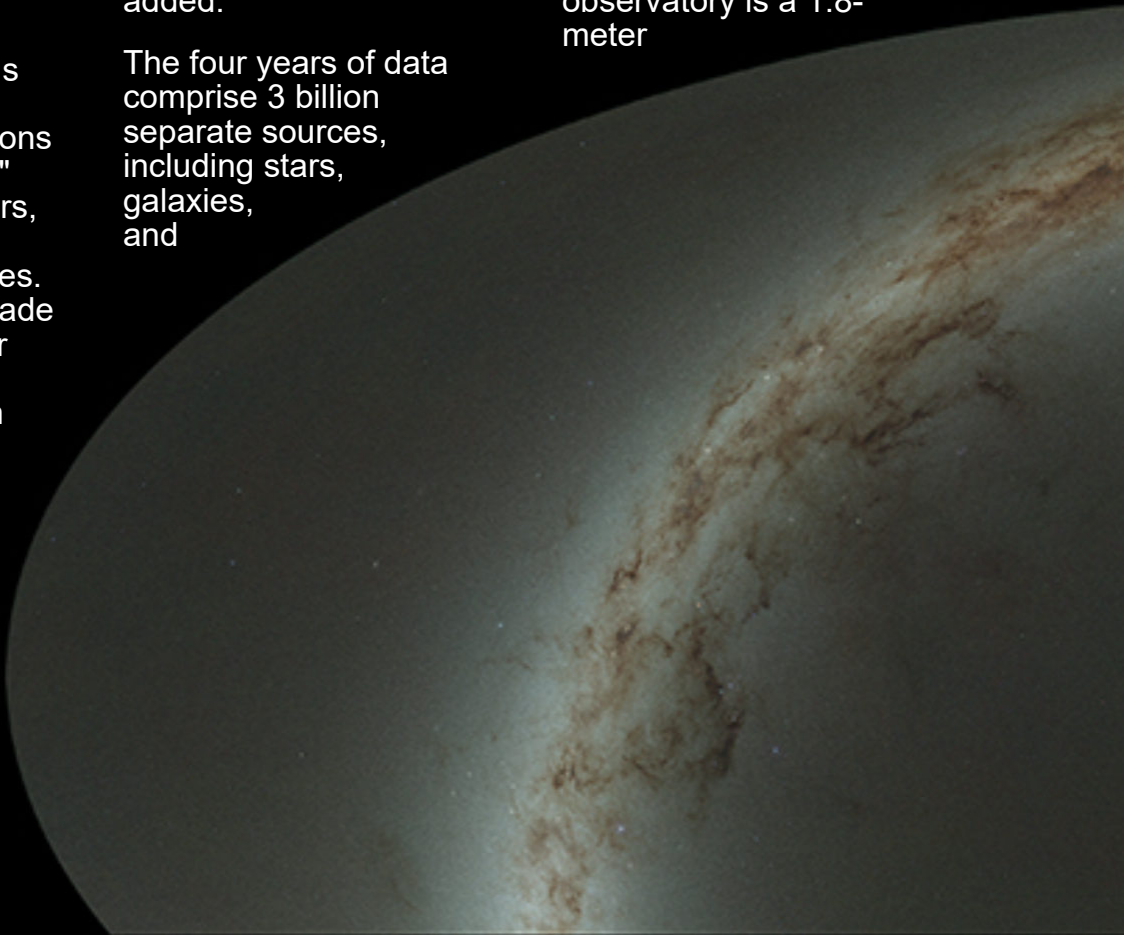
and distant quasars in the early universe."

"With this release we anticipate that scientists - as well as students and even casual users - around the world will make many new discoveries about the universe from the wealth of data collected by Pan-STARRS," Chambers added.

The four years of data comprise 3 billion separate sources, including stars, galaxies, and

various other objects. The immense collection contains 2 petabytes of data, which is equivalent to one billion selfies, or one hundred times the total content of Wikipedia.

The first Panoramic Survey Telescope & Rapid Response System (Pan-STARRS) observatory is a 1.8-meter





telescope at the summit of Haleakalā, on Maui. In May 2010, it embarked on a digital sky survey of the sky in visible and near infrared light. This was the first survey to observe the entire sky visible from Hawaii multiple times in many colors of light, with the goal of finding moving, transient, and variable objects, including asteroids that could potentially threaten the Earth. The survey took approximately four years to complete, and scanned the sky 12 times in each of five filters.

"Achieving the high quality of the Pan-STARRS1 measurements and maintaining it over such an enormous quantity of data was a unique computational challenge and the results are a tribute to the

dedicated efforts of our small team of scientists at the UH IfA and our collaborators who worked to process and calibrate the extraordinary volume of raw image data," said Dr. Eugene Magnier, lead of the Pan-STARRS Image Processing team.

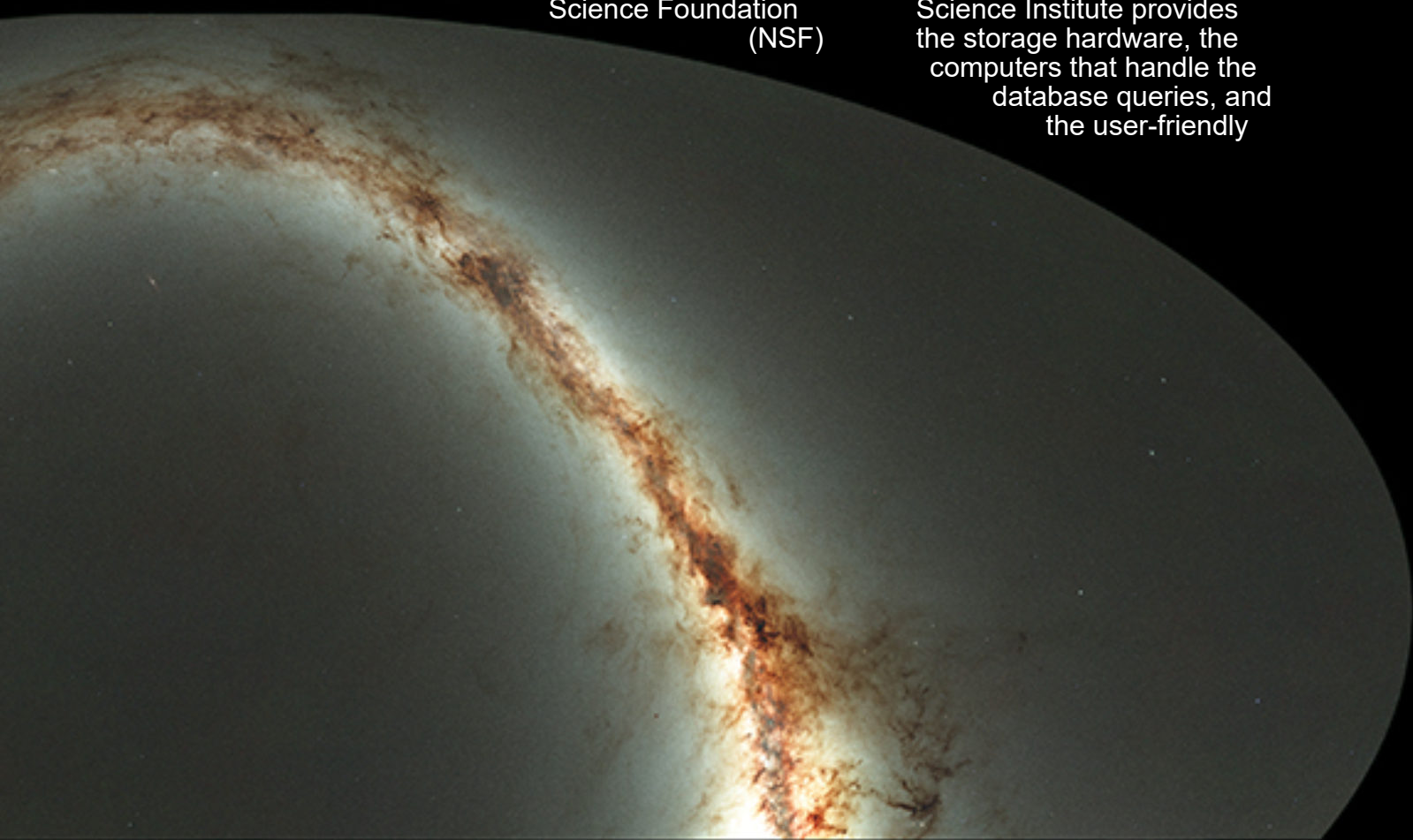
This research program was undertaken by the PS1 Science Consortium -- a collaboration among 10 research institutions in four countries with support from NASA and the National Science Foundation (NSF). Consortium observations for the sky survey, mapping everything visible from Hawaii, were completed in April 2014. This data is now being released publicly.

"It's great to see the Pan-STARRS1 data release supported by the National Science Foundation (NSF)

now made available to the general astronomical community," said Nigel Sharp, program director in NSF's astronomical sciences division. "I am impressed by the work the team invested to make the best-calibrated and best-characterized data set they could. I eagerly anticipate the science from mining these data."

The roll-out is being done in two stages. Today's release is the "Static Sky," which is the average of each of those individual epochs. For every object, there's an average value for its position, its brightness, and its colors. In 2017, the second set of data will be released, providing a catalog that gives the information and images for each individual epoch.

The Space Telescope Science Institute provides the storage hardware, the computers that handle the database queries, and the user-friendly



# Pan-STARRS, continued.

interfaces to access the data.

"The cooperation between STScI and the Pan-STARRS team at the University of Hawaii has been essential to ensuring that this initial data release is successful," explained Dr. Marc Postman, Head of the Community Missions office at STScI, and liaison between STScI and the PS1 Consortium. "STScI was a natural partner to host the Pan-STARRS public archive given its extensive experience serving

astronomy data to the international community. In advance of the release of the Pan-STARRS data, STScI staff helped perform checks of data quality, helped write archive user documentation, tested and installed the local data storage and database query system, and designed, built and deployed the web-based user interfaces to the archive system."

The survey data resides in the Mikulski Archive for Space Telescopes (MAST), which serves as

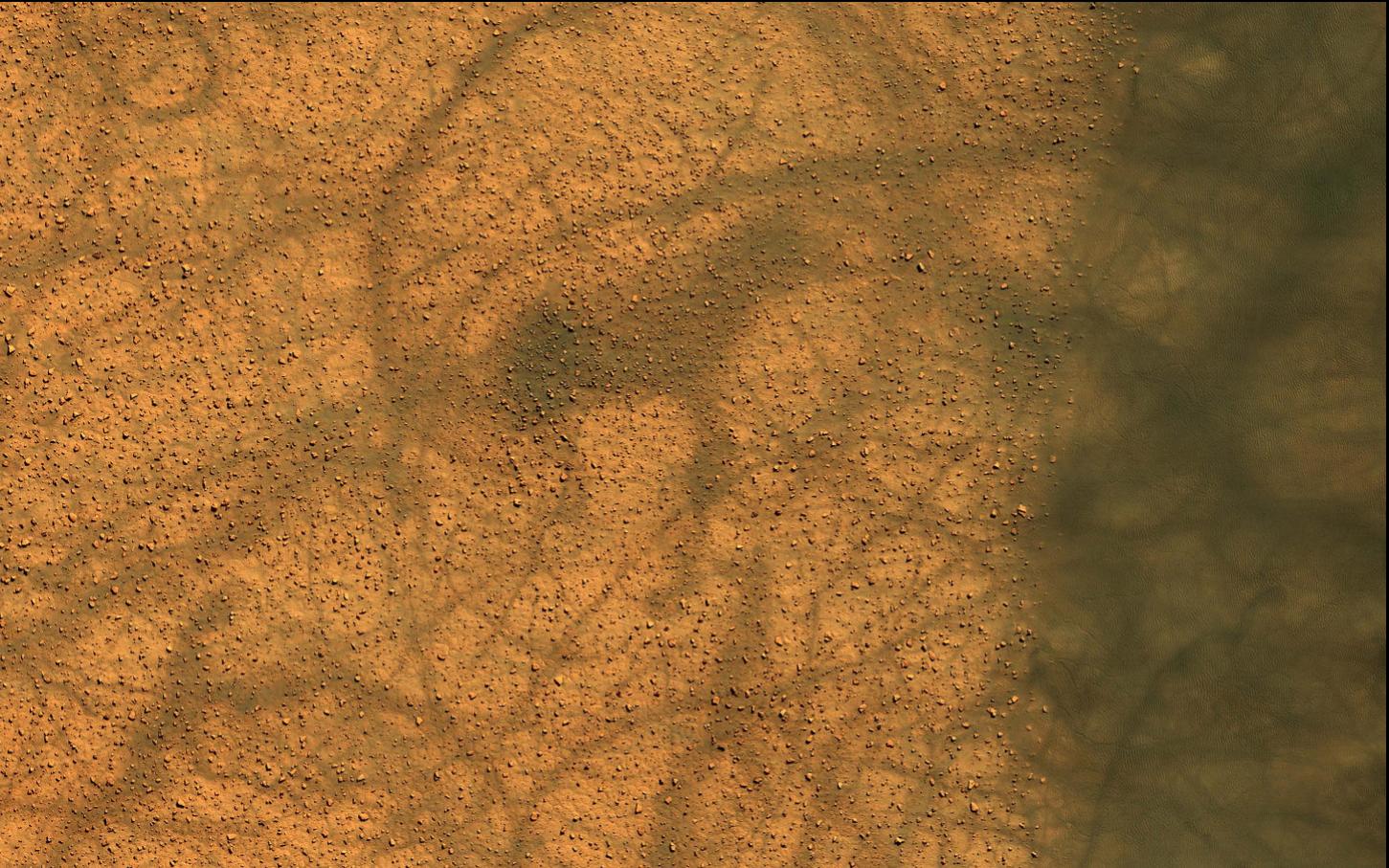
NASA's repository for all of its optical and ultraviolet-light observations, some of which date to the early 1970s. It includes all of the observational data from such space astrophysics missions as Hubble, Kepler, GALEX, and a wide variety of other telescopes, as well as several all-sky surveys. Pan-STARRS marks the nineteenth mission to be archived in MAST.

The data can be accessed at <http://panstarrs.stsci.edu>.



*The Pan-STARRS Observatory on Haleakala, Maui, opens at sunset to begin a night of mapping the sky. Credit: Photo by Rob Ratkowskiv*

# Dust Devil Dance



*Dune fields in the high southern latitudes of Mars tell a mostly similar story during local summer. The dark dunes grow warmer than the surrounding bright plains because they absorb more sunlight.*

*Dust devils form over the warm dunes but then dance out over the plains, spinning and performing pirouettes and leaving conspicuous dark tracks as bright dust is lifted from the surface. Loops in the tracks can often be used to discern the direction traveled by the dust devils, where in some cases, one track clearly overprints the other.*

*The map is projected here at a scale of 25 centimeters (9.8 inches) per pixel.*

*(The original image scale is 24.9 centimeters [9.8 inches] per pixel [with 1 x 1 binning]; objects on the order of 75 centimeters [29.5 inches] across are resolved.) North is up.*

*The University of Arizona, in Tucson, operates HiRISE, which was built by Ball Aerospace & Technologies Corp., in Boulder, Colorado. NASA's Jet Propulsion Laboratory, a division of Caltech in Pasadena, California, manages the Mars Reconnaissance Orbiter Project for NASA's Science Mission Directorate, Washington.*

*Image credit: NASA/JPL-Caltech/ University of Arizona*

# NASA's Perseverance Rover Will Peer Beneath Mars' Surface

*The agency's newest rover will use the first ground-penetrating radar instrument on the Martian surface to help search for signs of past microbial life.*

After touching down on the Red Planet Feb. 18, 2021, NASA's Mars 2020 Perseverance rover will scour Jezero Crater to help us understand its geologic history and search for signs of past microbial life. But the six-wheeled robot won't be looking just at the surface of Mars: The rover will peer deep below it with a ground-penetrating radar called RIMFAX.

Unlike similar instruments aboard Mars orbiters, which study the planet from space, RIMFAX will be the first ground-penetrating radar set on the surface of Mars. This will give scientists much higher-resolution data than space-borne radars can provide while focusing on the specific areas that Perseverance will explore. Taking a more focused look at this terrain will help the rover's team understand

how features in Jezero Crater formed over time.

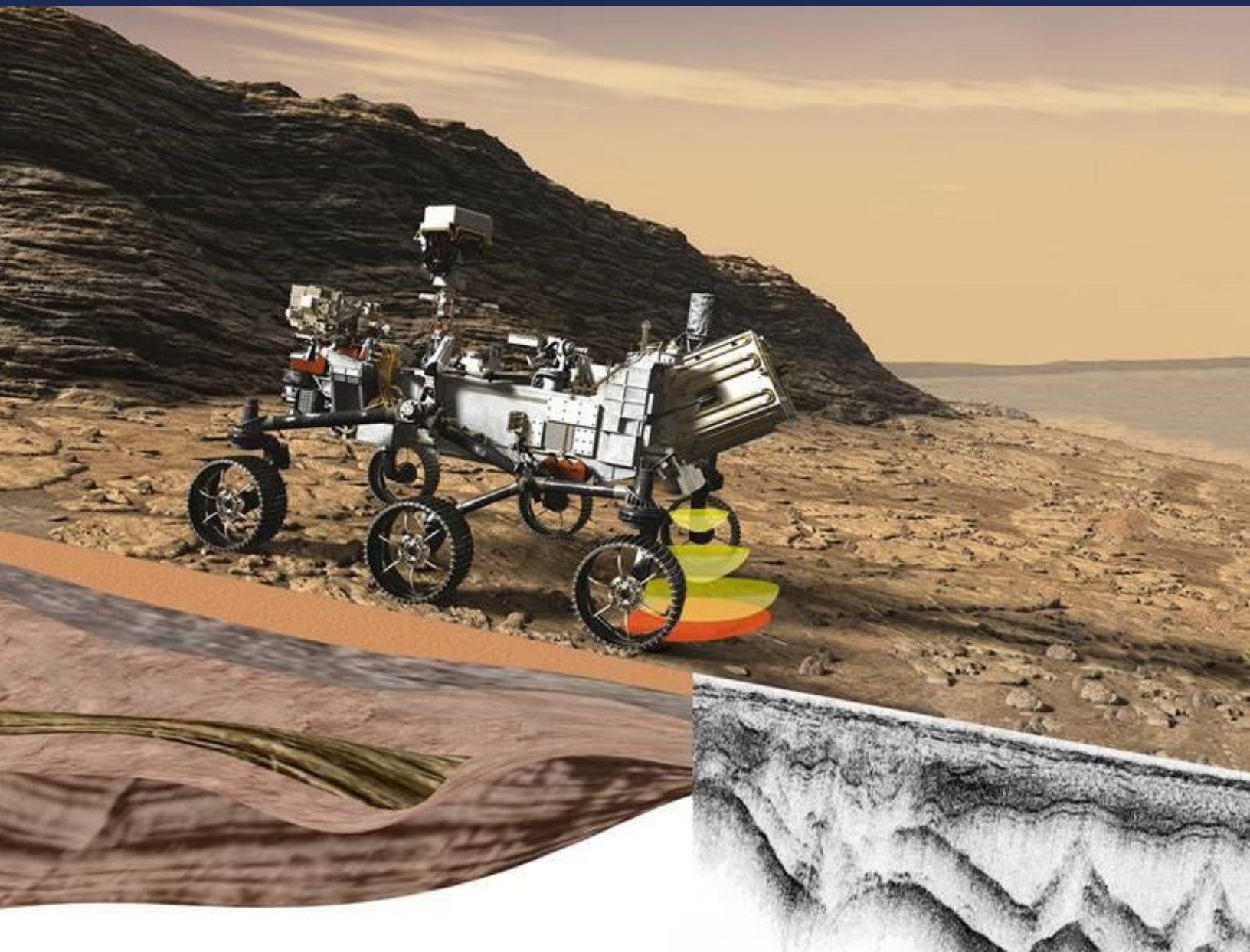
Short for Radar Imager for Mars' Subsurface Experiment, RIMFAX can provide a highly detailed view of subsurface structures down to at least 30 feet (10 meters) underground. In doing so, the instrument will reveal hidden layers of geology and help find clues to past environments on Mars, especially those that may have provided the conditions necessary for supporting life.

"We take an image of the subsurface directly beneath the rover," said Svein-Erik Hamran, the instrument's principal investigator, with the University of Oslo in Norway. "We can do a 3D model of the subsurface - of the different layers - and determine the geological structures underneath."

While Mars is a frigid desert today, scientists suspect that microbes may have lived in Jezero during wetter times



*Perseverance's Radar Imager for Mars' Subsurface Experiment (RIMFAX) uses radar waves to probe the ground, revealing the unexplored world that lies beneath the Martian surface. Image credit: NASA/JPL-Caltech/FFI*



# Perseverance, continued.

billions of years ago and that evidence of such ancient life may be preserved in sediments in the crater. Information from RIMFAX will help pinpoint areas for deeper study by instruments on the rover that search for chemical, mineral, and textural clues found within rocks that may be signs of past microbial life. Ultimately, the team will collect dozens of drill-core samples with Perseverance, seal them in tubes that will be deposited on the surface for return to Earth by future missions. That way, these first samples from another planet can be studied in laboratories with equipment too large to take to Mars.

## Traveling Back in Time

Scientists believe the 28-mile-wide (45-kilometer-wide) Jezero Crater formed when a large object collided with Mars, kicking up rocks from deep in the planet's crust. More than 3.5 billion years ago, river channels spilled into the crater, creating a lake that was home to a fan-shaped river delta.

Hamran hopes RIMFAX will shed light on how the delta formed. "This is not so easy, based on surface

images only, because you have this dust covering everything, so you may not necessarily see all the changes in geology."

He and his science team will stack successive radar soundings to create a two-dimensional subsurface image of the crater floor. Eventually, data will be combined with images from a camera on the rover to create a 3D topographical image.

The instrument employs the same type of ground-penetrating radar used here on Earth to find buried utilities, underground caverns, and the like. In fact, Hamran uses it to study glaciers. Tens of millions of miles away on Mars, however, he and his colleagues will be relying on Perseverance to do the work as it roams through Jezero Crater. "We do some measurements while we are stationary," he said, "but most measurements will actually be gathered while the rover is driving."

## More About the Mission

A key objective for Perseverance's mission on Mars is astrobiology, including the search for signs of ancient microbial

life. The rover will characterize the planet's ancient climate and geology, pave the way for human exploration of the Red Planet, and be the first mission to collect and cache Martian rock and regolith (broken rock and dust).

Subsequent missions, currently under consideration by NASA in cooperation with ESA (the European Space Agency), would send spacecraft to Mars to collect these cached samples from the surface and return them to Earth for in-depth analysis.

The Mars 2020 mission is part of a larger program that includes missions to the Moon as a way to prepare for human exploration of the Red Planet. Charged with returning astronauts to the Moon by 2024, NASA will establish a sustained human presence on and around the Moon by 2028 through NASA's Artemis lunar exploration plans.

JPL, which is managed for NASA by Caltech in Pasadena, California, built and manages operations of the Perseverance and Curiosity rovers.

# Astrophotos

*Canon Rebel T7i with 13mm Rokinon fisheye lens, at the Dorothy Lord Ranch..  
About 45 minutes to an hour on each star trail photo. By Brett Boller.*



# From the Archives

October, 1973

## --THE PRESIDENT'S REPORT--

I took a look at Mars on the night of Oct. 15, but couldn't see any detail on the surface of the red planet. I left the scope (the club's 12 $\frac{1}{2}$  inch) out for an hour, hoping that the optics would cool down a bit and stabilize with the temperature of the night air, but it didn't help any. Was there another dust storm on the surface of Mars? I took a look at the Moon and decided that either the seeing that night was poor or that the dust was not on Mars but maybe on the optics of the telescope. Has anyone else taken a look at Mars? Lets have some reports at the meeting.

We need some more "assistant program chairmen". Here is the schedule so far. Oct. Prof. Moore, Nov. Larry Stepp, Dec. Dave Knisley, Jan.???, Feb. Brian Rugg, March ???, April ???, May Merton Springle, June Norman Frehrichs, July ???, Aug. ???, Sept. ???.

Now lets hear from the rest of you. We need some empty spaces filled in. Here's your chance to have that special program you always wanted. Lets have some more volunteers at the meeting!

Earl Moser  
President

## --OBSERVING REPORT--

Again this month I will bother the club about Comet Kohoutek, even though I'm beginning to feel we ought to leave it alone since it looks more and more like it wasnt meant to be found.

As of this writing I've gotten up three times in the sub dawn hours only to be thwarted three times by fog, moon light, crud in the atmosphere, and a miserable comet that insists on being where it is not plotted! The thing is now approx. eighth magnitude which makes the hunt even more frustrating. But I shall avail, this thing is not going to get the best of me. Hopefully by the meeting I'll be able to report about this idiotic hunk of nothing. (Oh, I'll also mention that I'm not the only one involved in this endeavor, John Bruce, Steve Roper, and Lee Thomas have also lost their sleep over comet Kohoutek.)

Now to get our minds off this I'll mention a nice deep sky object. NGC 7479 (55 in Norton's list of bright nebulae) is a large yet faint barred spiral in Pegasus. Try for it just two degrees south of Alpha Pegasus.

Brian Rugg  
Observing Chairman



## 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

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

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