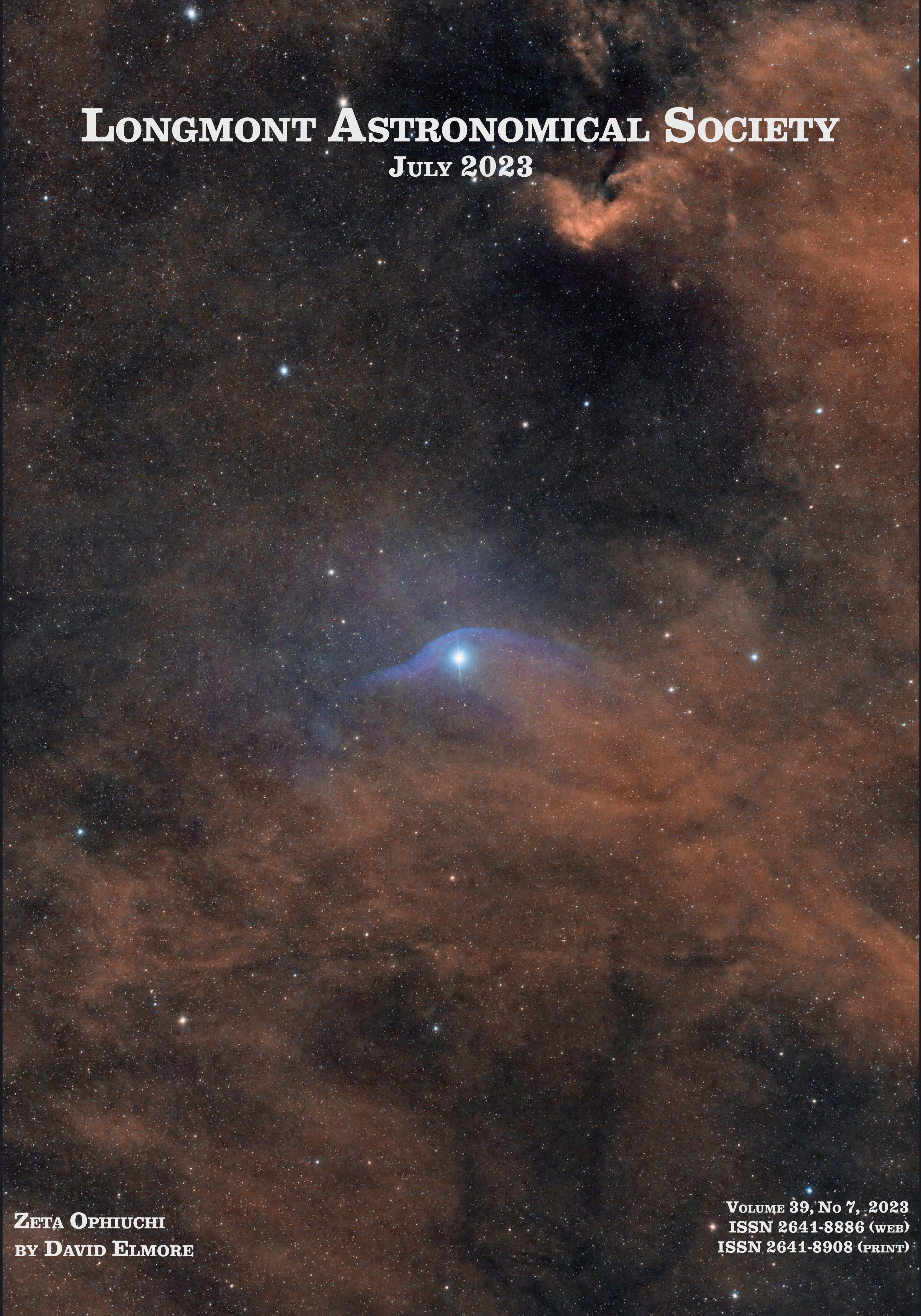
Longmont Astronomical Society

July 2023



Zeta Ophiuchi
by David Elmore

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LAS Meeting Thursday, July 20 at 7 pm
"Open Forum"

Brief Description:

The meeting this month is "open forum". LAS members are invited to give a 5 to 10 minute presentation on an astronomy related topic. Tell everyone about:

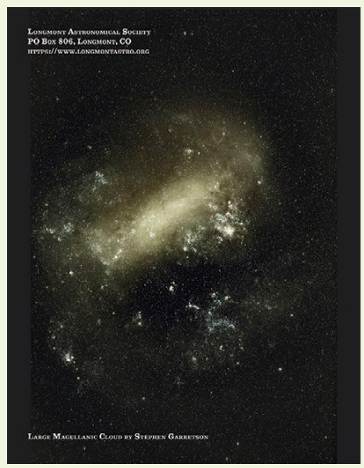
- Some telescope equipment you purchased recently
- A trip you have taken to some historic observatory; a new dark sky location that you have visited
- Show everyone an image you have taken, what equipment you used, how you processed it.
- If you are interested in astronomy history share some of the stories that you found interesting. About anything astronomy related that interests you will probably interest others as well

You may present in-person or via Zoom. Not mandatory but it would be helpful if you let Vern know that you are interested in presenting and the topic (email: vern@raben.com) before the meeting.

Front Cover: Zeta Ophiuchi by David Elmore

The star in the center of this field is zeta Ophiuchi is a very young and very massive star that is rapidly exhausting its nuclear fuel heading towards a super nova explosion. The star is moving relative to the gas and dust around it and forms a shock wave. The shock wave is exciting Oxygen atoms to emit teal colored light. The whole area is a region of red hydrogen emission. Sulfur II is included as yellow. The entire frame is just a part of the huge Sh2-27 region in the Milky Way. Only 4 exposures in each H-alpha, Oxygen III and Sulfur II for a total of 2 hours of exposure time. Borg 107FL refractor with ASI6200mm camera. Taken from David's observatory at Dark Sky New Mexico.

Back Cover: LMC by Stephen Garretson



This is a shot of the Large Magellanic Cloud taken from San Pedro de Atacama during the 2018 adventure Tally, David, MJ and Stephen had. He used the saved previous image as a start point, as he could not find the original subs. This was shot with Stephen's Canon 6D and Canon 70-200 zoom lens on a Sky Guider Pro. The 3 Xs [Blur, Star, Noise] filters and some additional tweaking were applied.

About LAS

The Longmont Astronomical Society Newsletter ISSN 2641-8886 (web) and ISSN 2641-8908 (print) is published monthly by the Longmont Astronomical Society, P. O. Box 806, Longmont, Colorado. Newsletter Editor is Vern Raben. Our website URL is https://www.longmontastro.org and the webmaster is Sarah Detty. The Longmont Astronomical Society is a 501 c(3), non-profit corporation which was established in 1987.

The Longmont Astronomical Society is affiliated with the Astronomical League (https://www.astroleague.org). The Astronomical League is an umbrella organization of amateur astronomy societies in the United States.

Contents

LAS Officers and Board Members in 2023

Vern Raben, President
Hunter Morrison, Vice President
Eileen Hall-McKim, Secretary
Bruce Lamoreaux, Treasurer

Board Members:
David Elmore, Gary Garzone,
Mike Hotka, Brian Kimball, and Tally O'Donnell

Appointed Positions 2023

Sarah Detty, Webmaster; Bruce Lamoreaux, Library Telescope Coordinator; Bill Tschumy, Public Outreach Coordinator;
Vern Raben, Newsletter Editor; Eileen Hall-McKim, Newsletter Archives;

Planets in July

Mercury

Mercury is barely visible the last 3 days on July about 8:50 pm, just above the mountains in the west at magnitude +0.1 and a disk of 6.5 arc sec across.

Venus

Venus drops lower and lower into the bright evening twilight in the WNW before it disappears around the 3rd week this month. It is around -4.5 magnitude in brightness and increases in size from 34 to 51 arc sec across.

Mars

Mars continues getting smaller and dimmer. It is 4.2 arc sec across on the 1st and 4.0 arc sec across by the 31st. It dims slightly from +1.7 magnitude in apparent brightness to +1.8 magnitude by the end of the month.

Jupiter

Jupiter is becoming fairly high up in the SE before sunrise. It is magnitude -2.3 in brightness and the disc increases to 40 arc sec across. You may observe the Great Red Spot at mid transit at the following times this month:

- July 7 at 3:27 am at 20°altitude
- July 12 at 4:07 am at 31° altitude
- July 17 at 3:16 am at 25°altitude
- July 19 at 4:54 am at 45°altitude
- July 24 at 4:03 am at 39°altitude
- July 29 at 3:12 am at 32° altitude
- July 31 at 4:50 am at 52°altitude

Saturn

On July 1st Saturn rises about midnight. Best time to observe or image then is around 5 am when it is high up on meridian. It brightens from +0.8 magnitude on the 1st to +0.6 this month. It's disk is about 18 arc sec across.

Uranus

It is visible in the eastern sky before sunrise in constellation Aries. It is magnitude 5.8 in brightness and the disk is 3.5 arc sec across.

Neptune

Neptune is visible in the SSE before sunrise in constellation Pisces. It is about magnitude 7.9 in brightness and the disc is 2.3 arc sec across.

Lunar Phases in July

- Full moon: July 3 at 5:40 am
- Third quarter: July 9 at 7:49 pm
- New moon: July 17 at 12:33 pm
- First quarter: July 26 at 9:33 am

Bright Nebula in July

- IC 4592 in Scorpius mag 3.9
- IC 4605 in Scorpius, mag 4.7
- IC 4604, Rho Ophiuchi in Ophiuchus mag 5.1
- M16, Eagle Nebula, in Sagittarius mag 6
- M17 Omega Nebula in Cygnus mag 6
- M8 Lagoon Nebula in Sagittarius mag 6.3
- M20 Trifid Nebula in Sagittarius mag 6.3
- NGC 6990 in Sagitarius mag 7.0

Galaxies in July

- M81, Bode's Galaxy, in Ursa Major, mag 6.8
- M94 Spiral Galaxy in Cannes Venatici, mag 7.9
- M82, Cigar Galaxy, in Ursa Major, mag 8.0
- M106 spiral galaxy in Canes Venatici mag 8.3
- M49 elliptical galaxy in Virgo, mag 8.4
- M51, Whirlpool Galaxy in Canes Venatici, mag 8.4
- M64, Black Eye Galaxy in Coma, mag 8.4
- M101, Pinwheel Galaxy in Ursa Major, mag 8.4

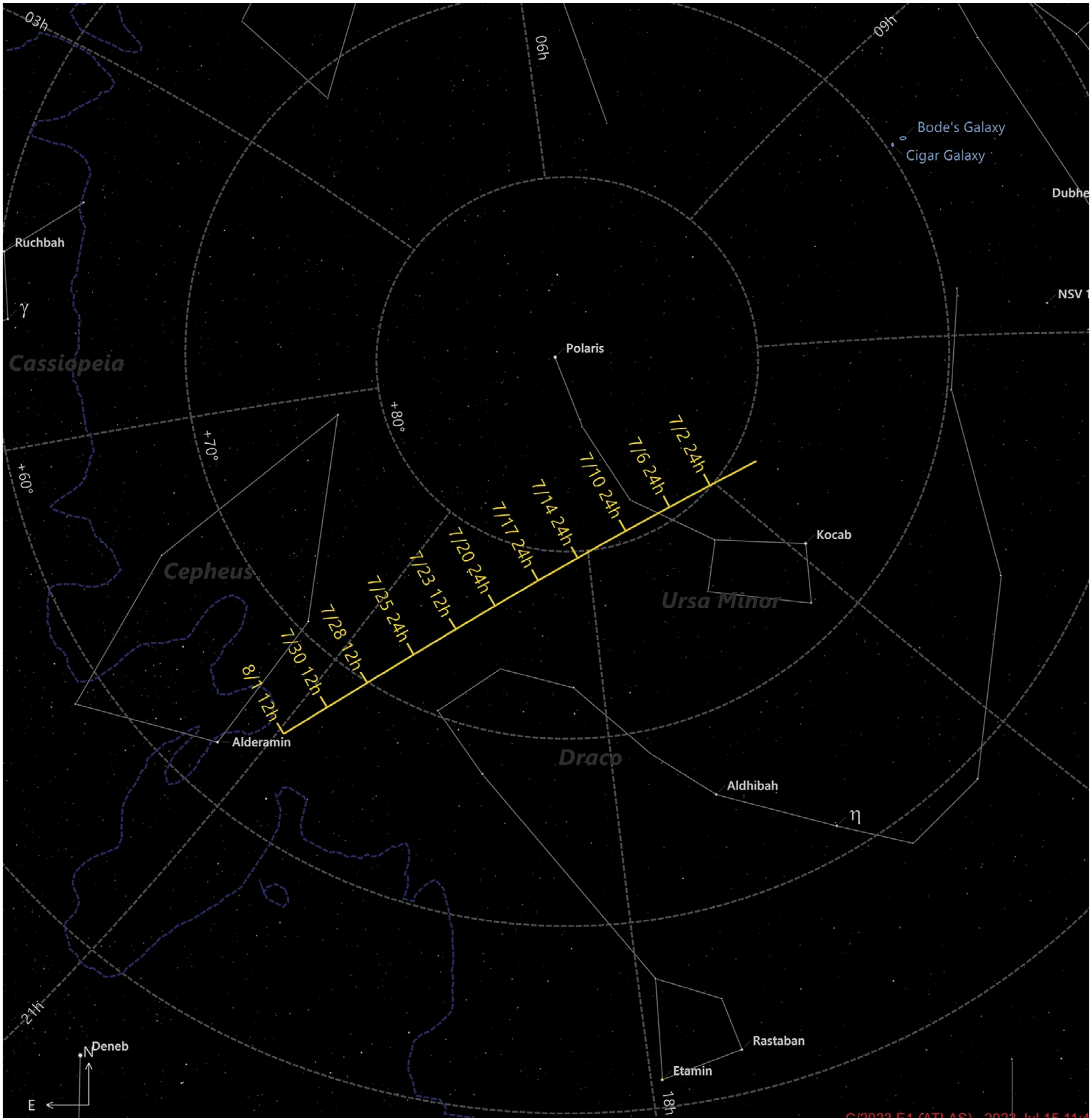
Globular Clusters in July

- M4 in Scorpius, mag 5.6
- M5 in Serpens, mag 5.7
- M13 in Hercules, mag 5.8
- M3 in Canes Venatici, mag 6.3
- M15 in Pegasus, mag 6.3
- M92 in Hercules, mag 6.4
- M2 in Aquarius, mag 6.6
- M10 in Ophiuchus, mag 6.6
- M12 in Ophiuchus, mag 6.7
- M53 in Coma, mag 7.7

Planetary Nebula in July

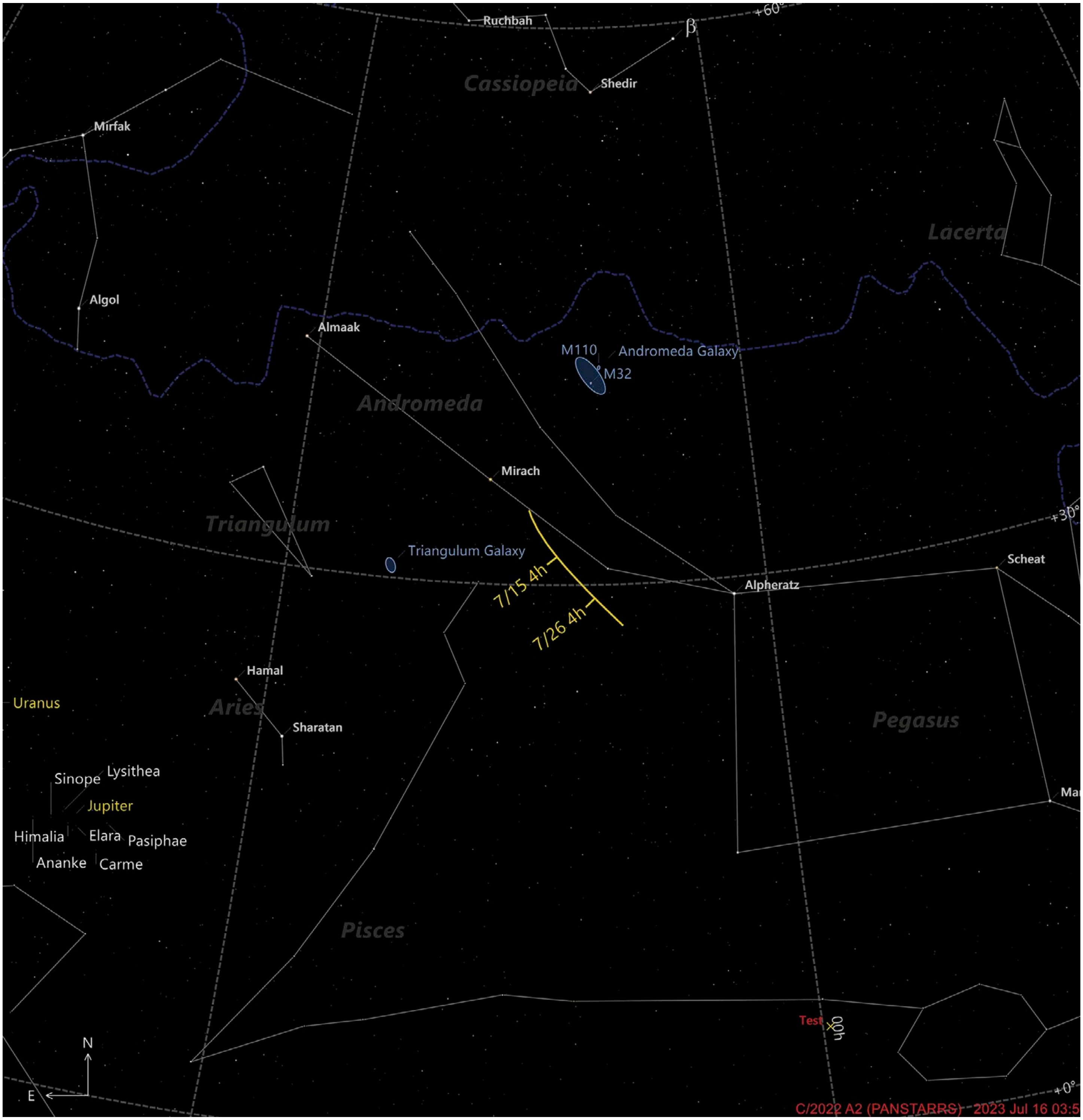
- M27, Dumbbell Nebula in Vulpecula, mag 7.1
- NGC6572 in Ophiuchus, mag 8.0
- NGC6543, Cat's Eye Nebula in Draco, mag 8.1
- NGC7027 in Cygnus, mag 8.5
- M57, Ring Nebula in Lyra, mag 8.8
- NGC6210 in Hercules, mag 8.8

Comet C/2023 E1 (ATLAS)



Date	Optimal time	RA	Dec	Constellation	Magnitude	Size (arc min)
July 1	3:39am	14h54m41.6s	+79°47'18"	Ursa Minor	9.9	3.2
July 7	10:54 pm	16h16m10.2s	+80°38'45"	Ursa Minor	9.9	3.4
July 13	11:27 pm	17h55m35.2s	+79°57'52"	Draco	9.9	3.7
July 19	12:27 am	19h20m43.1s	+77°13'50"	Draco	10.0	3.9
July 25	01:00 am	20h18m28.3s	+72°30'33"	Draco	10.1	4.3
July 31	4:17 am	20h55m57.3s	+65°41'16"	Cepheus	10.3	4.7

Comet C/2022 A2 (PANSTARRS)

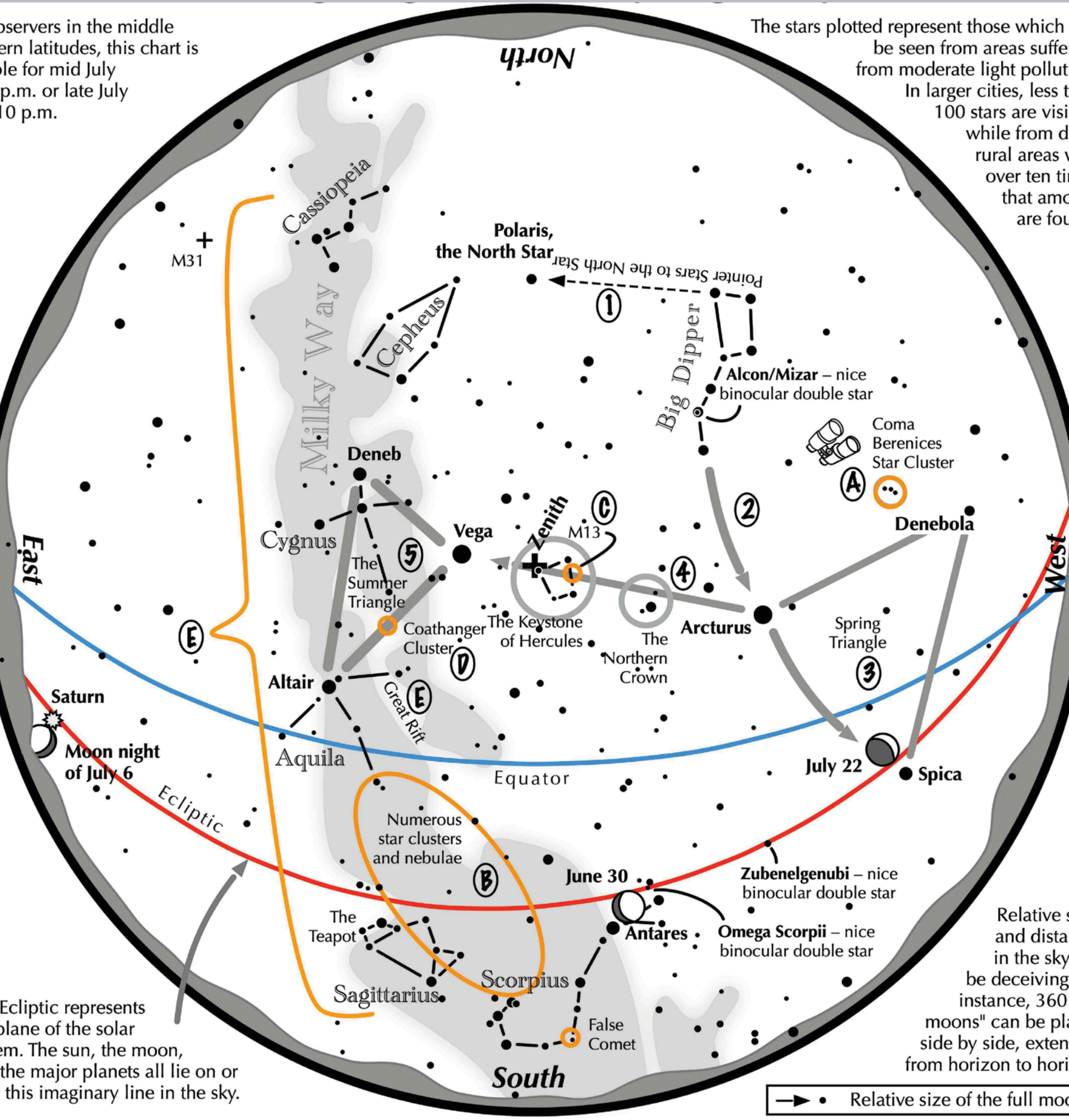


Date	Optimal time	RA	Dec	Constellation	Magnitude	Size (arc min)
July 1	3:49 am	00h59m42.1s	+33°38'13"	Pisces	11.9	1.7
July 7	3:41am	00h57m25.4s	+32°47'44"	Pisces	12.0	1.7
July 13	3:48 am	00h54m04.4s	+31°49'40"	Pisces	12.0	1.7
July 19	3:53 am	00h49m36.4s	+30°42'24"	Andromeda	12.0	1.8
July 25	3:59 am	00h44m00.2s	+29°24'12"	Andromeda	12.1	1.8
July 31	4:24 am	00h37m15.9s	+27°53'12"	Andromeda	12.1	1.9

Navigating the mid July Night Sky by John Goss

For observers in the middle northern latitudes, this chart is suitable for mid July at 11 p.m. or late July near 10 p.m.

The stars plotted represent those which can be seen from areas suffering from moderate light pollution. In larger cities, less than 100 stars are visible, while from dark, rural areas well over ten times that amount are found.



The Ecliptic represents the plane of the solar system. The sun, the moon, and the major planets all lie on or near this imaginary line in the sky.

Relative sizes and distances in the sky can be deceiving. For instance, 360 "full moons" can be placed side by side, extending from horizon to horizon.

Relative size of the full moon.

Navigating the mid July night sky: Simply start with what you know or with what you can easily find.

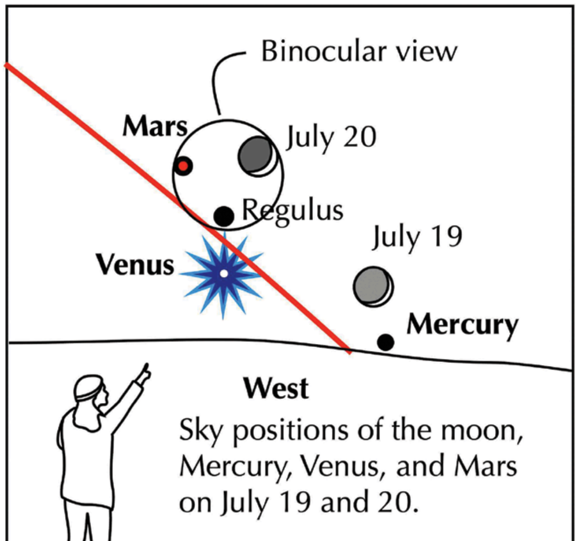
1. Extend a line north from the two stars at the tip of the Big Dipper's bowl. It passes by Polaris, the North Star.
2. Follow the arc of the Dipper's handle. It first intersects Arcturus, the brightest star in the July evening sky, then continues to Spica. Arcturus, Spica, and Denebola form the Spring Triangle, a large equilateral triangle.
3. To the northeast of Arcturus shines another star of similar brightness, Vega. Draw a line from Arcturus to Vega. It first meets "The
4. Northern Crown," then the "Keystone of Hercules." A dark sky is needed to see these two dim stellar configurations.
5. High in the East lies the Summer Triangle stars of Vega, Altair, and Deneb.

Binocular Highlights

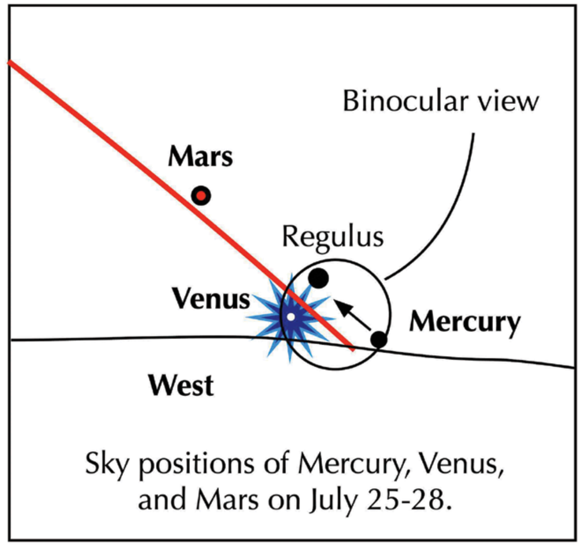
A: Between Denebola and the tip of the Big Dipper's handle, lie the stars of the Coma Berenices Star Cluster.
B: Between the bright stars Antares and Altair, hides an area containing many star clusters and nebulae.
C: On the western side of the Keystone glows the Great Hercules Cluster, containing nearly 1 million stars.
D: 40% of the way between Altair and Vega, twinkles the "Coathanger," a group of stars outlining a coathanger.
E: Sweep along the Milky Way for an astounding number of faint glows and dark bays, including the Great Rift.

Astronomical League *www.astroleague.org/outreach; duplication is allowed and encouraged for all free distribution.*

If you can see only one celestial show in the evening this July, see this one.

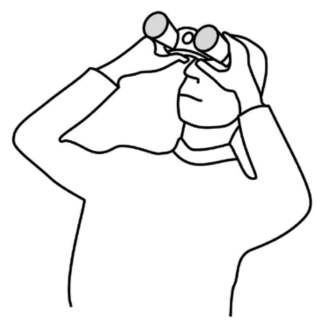


Sky positions of the moon, Mercury, Venus, and Mars on July 19 and 20.



Sky positions of Mercury, Venus, and Mars on July 25-28.

All the rocky planets, all at once!



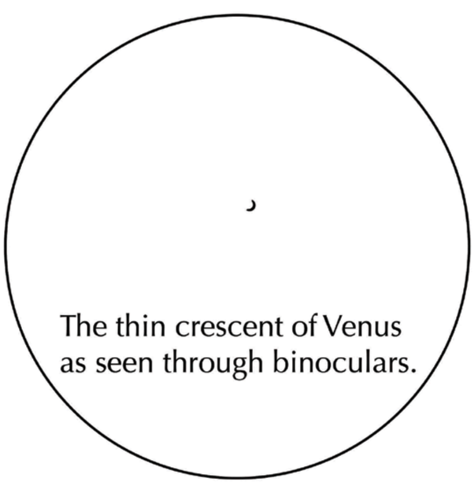
On the evenings of July 19 and 20, look towards the west 30 minutes after sunset.

• Brilliant Venus will be seen as a tiny crescent in steadily held binoculars.

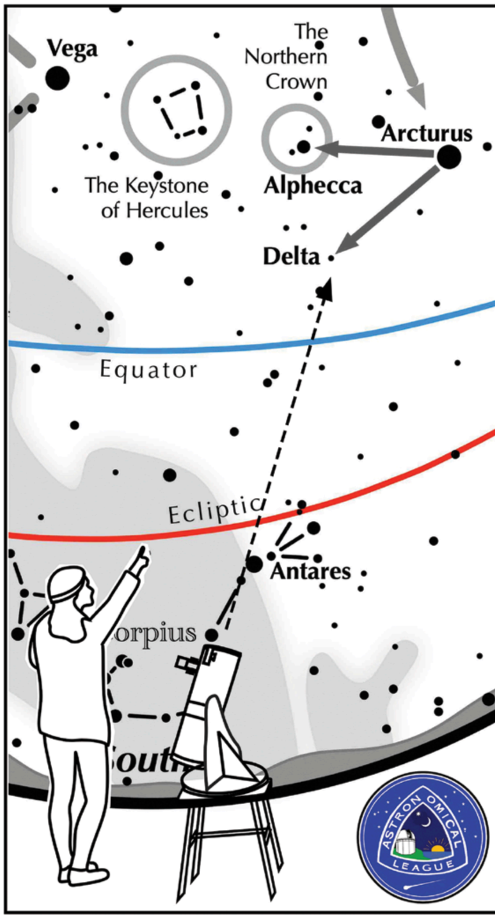
• On the first evening, the thin crescent moon, full with earthshine, hangs above Mercury. The little planet might be lost in the bright twilight.

• On July 20, the moon forms a triangle with Regulus and Mars. Venus sinks below them. Mars, having lost its splendor from last fall, might be difficult to spot in the bright twilight. Binoculars will help.

• Mercury climbs somewhat higher over the remaining evenings in July. On July 28, it lies directly next to Regulus, which has dropped much closer to the horizon. Venus may lie too close to the horizon to be spotted. Because of their low alititude, very clear skies and a low horizon are needed to see this.



The thin crescent of Venus as seen through binoculars.



Other Suns: Delta Serpentis

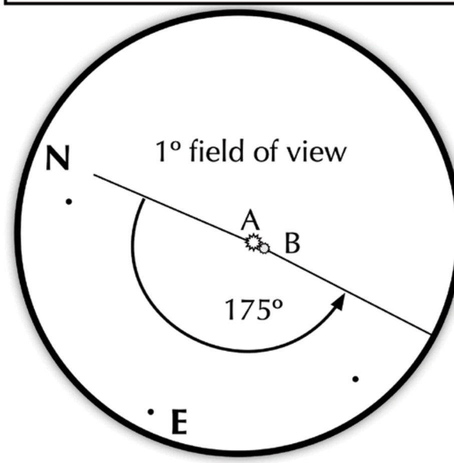
How to find Delta Serpentis on a July evening

Find bright Arcturus, nearly overhead. To its northeast is a similarly bright star, Vega. One-third the distance between the two is Alphecca. Delta Serpentis lies the same distance from Arcturus as Alphecca, but to the southeast.

Suggested magnification: >60x
Suggested aperture: >3 inches

Delta Serpentis

A-B separation: 4 sec
A magnitude: 4.2
B magnitude: 5.2
Position Angle: 175°
A & B colors: white



NGC 6210 by Gary Garzone on June 30

Secretary Notes Thursday, June 15, 2023
by Eileen Hall-McKim

I. Introduction

The June LAS in-person/hybrid monthly meeting was held on June 15th at the Longmont Lutheran Church. President Vern Raben began the meeting with self-introductions by all members attending in person. Fifteen members attended in person and 10 by Zoom.

II. Main Presentation

The main presentation for the June meeting "Life and Climate on Mars: Past, Present and Future" was given by Dr. Bruce Jakosky, Laboratory for Atmospheric and Space Physics, University of Colorado. Dr. Jakosky has been a Mars researcher since being an undergraduate working on the Viking spacecraft mission in the 1970s. He has been at the University of Colorado for more than 40 years, as a researcher and as a professor. He has written more than 300 papers for the scientific literature, and is author or co-author of three books on life in the universe. He led the MAVEN spacecraft mission to explore Mars' upper atmosphere and climate evolution from its inception in 2003 through seven years of operation in orbit at Mars, and is now heavily involved in planning future Mars' exploration.

Life and Climate on Mars: Past, Present and Future
Dr. Bruce Jakosky

Mars is the closest planet to us that holds the potential to have had life in the past, to have it in the present, or possibly to have it in the future. In this presentation, Dr. Jakosky discusses the history of the climate and habitability of Mars, the current exploration program that has as a major goal searching for evidence of life, and the potential for a future climate to be able to support life.

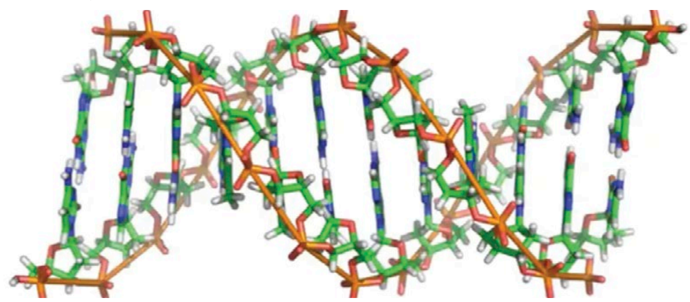
Mars is often in the public eye and is presented in many aspects of our lives; the media images following space missions such as Curiosity and Perseverance, prospects presented to the public on the future development of space travel and exploration, and through entertainment of movies and games. Focusing on the science however brings us to the most frequent questions on Mars - life and climate.

Life on Mars is the overarching question about Mars today

- Has Mars ever been habitable?
- Has Mars ever had life, past or present?
- When will humans go to Mars?
- What is the future of Mars' climate?
- Can Mars be '"teraformed" to look more like Earth's environment?
- Whether or not there is life or not, either way an important question

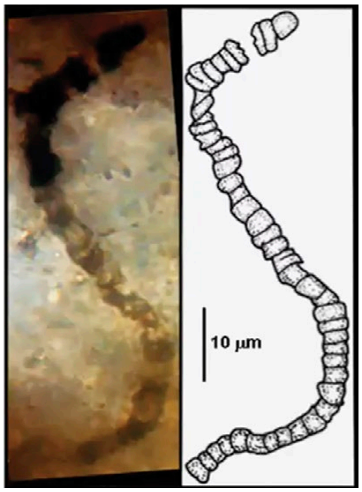
Life on Earth guides our thinking about life elsewhere

- All life on Earth represents only a single independent example of life

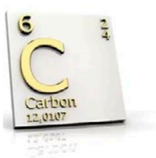


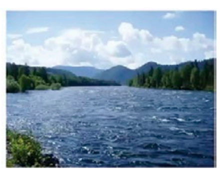
- We have only one example to look at - our own
- Life can thrive in what we consider to be extreme environments such as Yellowstone; if those same lifeforms were brought to our environment they would die just as quickly as we would die in their environment

- Life began on Earth very quickly after it became possible; Earth formed 4.5 billions years ago, it cooled off probably to the point life could exist by around 4.3 billion years ago, that's when liquid water became stable and abundant
- Fossil of microbe that is 3.5 billion years old; artist sketch next to it. This is the oldest fossil that is unambiguous, evidence exists for life back to 4 billion years ago
- What all this tells us is that life began very quickly after Earth formed and the elements required are relatively simple



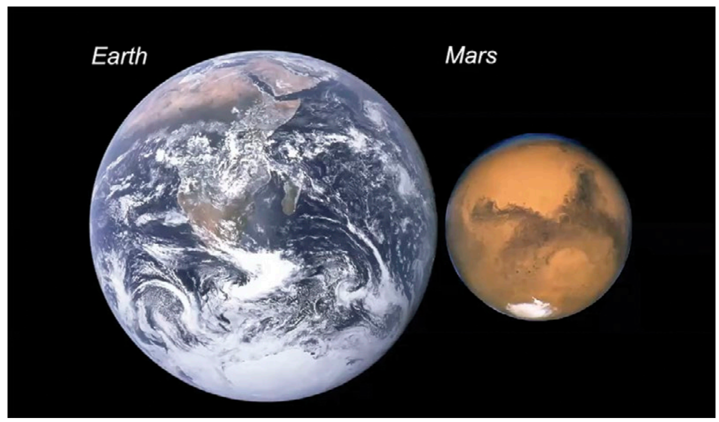
The environmental requirements for life are thought to be pretty simple



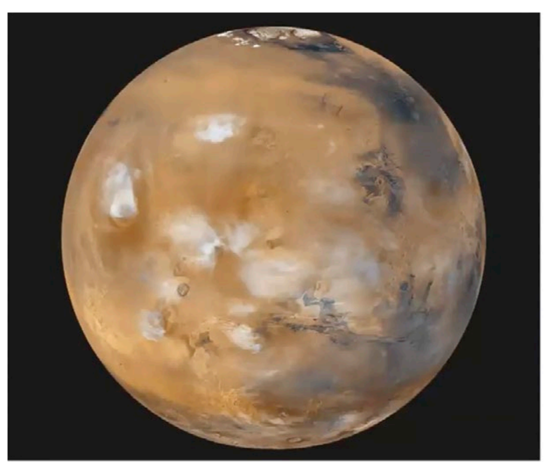


- Access to the biogenic element (carbon, hydrogen, nitrogen, oxygen) those are abundant in our atmosphere, but also in our geological environment there is: calcium, magnesium, iron, manganese, potassium, phosphorus; 22 elements that are utilized by life but need to be able to find them; not hard to meet this requirement- available wherever there is a geologically active environment and water to move them around
- A source of energy to drive metabolism (The Sun) but also by chemicals; chemical reactions between water and rocks that can give off energy, then used by organism to support their metabolism. Anywhere energy is available that can be tapped into by organisms, you can support life
- Liquid water - need a medium in which life can exist; something to allow nutrients to diffuse in to an organism and waste product to diffuse away, something to provide the basic structure. Liquids could be in the form of other elements, but we know that water is a very good solvent and is abundant in the solar system and the universe
- Same is true with carbon: it forms the same sort of chemical bonds when it combines with oxygen and makes CO2, it is very mobile. Silicon (Si) sits right below carbon in the periodic table. When silicon combines with oxygen it forms quartz. Life on Earth chose carbon as its basis rather than silicon even though silicon is 10,000 x more abundant
- What sort of forms can life be in? We do not know the limits of which life can exist, temperature ranges, salinity, pressure requirement: we know a range of possibilities and characteristics within which life can exist, but need to find other examples of life to be able to answer that question

Earth and Mars in comparison:



- Earth lots of blue, elements in the rocks vs Mars dry, red landscape, blue not water but clouds, hard to imagine much liquid water
- Mars is a cold and dry planet today
- Mars is 1.5 times farther away from Sun than the Earth
- Average temperature ~220 (Kelvin) 50+ K below the freezing temperature of water- hard to imagine there would be liquid water especially enough to sustain life



Seen here in the form of atmospheric clouds

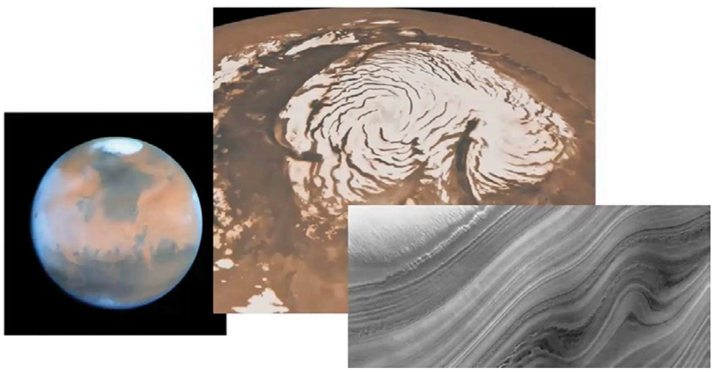
•Only trace amounts of water are present in the atmosphere
- Water ice can be seen in the form of clouds

- 10,000 times more water in the Earth's atmosphere than in Mars atmosphere
- Unlike the Earth, the weather on Mars is driven by air-borne dust

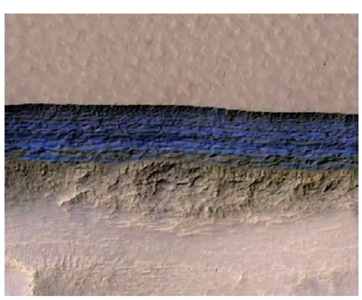
Dust Devil Local Dust Storm Global Dust Storm

- We see dust devils, local dust storms and global dust storms on Mars, similar to those on Earth

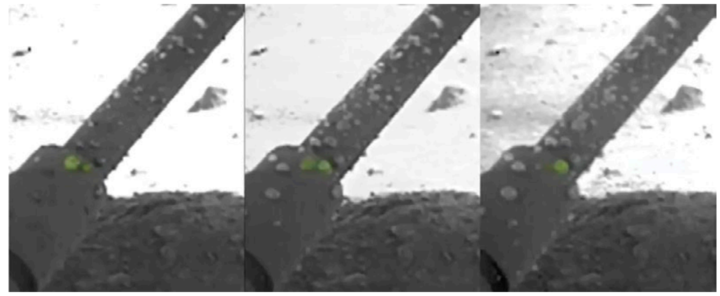
Water ice is found on Mars



- We do see a lot of evidence for water on Mars however it is not in the atmosphere but it is abundant in the polar ice caps
- We see valleys, with exposed dust, not as bright as snow on Earth so we know that there is a lot of dust mixed in with it
- Alternating layers tells us something about the climate change that went on
- We also see ice found in "massive" buried mid-latitude deposits; blue in image is predominately water ice. We see this exposed beneath the surface where there are scarps



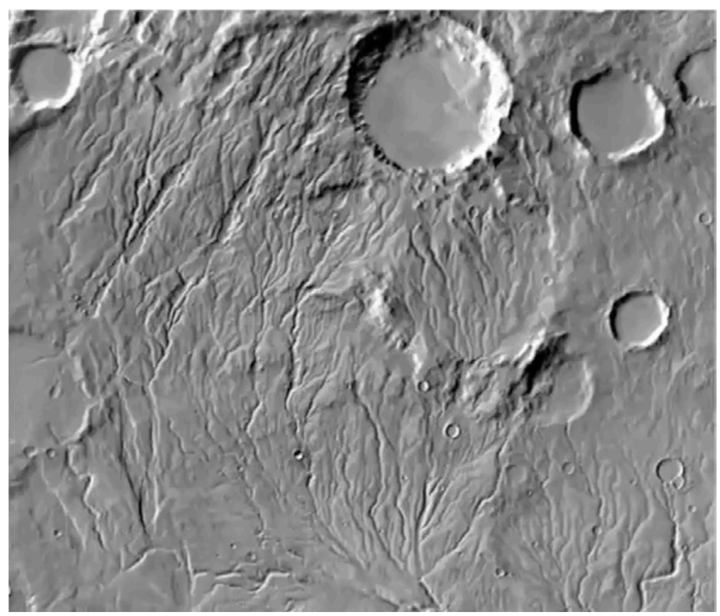
- If laid out flat would be a layer 20-30 meters thick; much less than Earth's ocean which is about 4 km thick, but still fair amount of water
- Could be liquid water on Mars today; trace amounts of liquid water could be widespread today, as seen as "droplets" on the Phoenix lander strut, stabilized by the presence of a chemical called perchlorates; can see in images it evolves over time



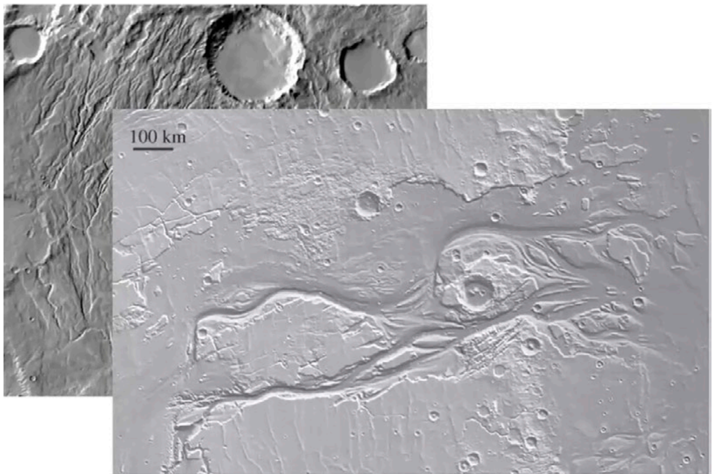
- Perchlorates, incredible salty, allows for process that sucks water out of the atmosphere and dissolved it into liquid state; perchlorates were abundant at the landing site, they are globally distributed, so there could be trace amounts of water distributed around the planet below the surface maybe 5 cm deep. But question remains - is it enough to support life? Water activity (humidity) on Mars is lower than any organism on Earth can exist, but does this mean organisms can't exist elsewhere?- We don't know

Liquid water was present on Mars in earlier times

- On the older surfaces, where we see more impact craters, we see what looks like branching river valleys, combining and coalescing together into bigger valleys, this requires water to be more abundant, more stable than it is today, this landform requires a regular flow to form

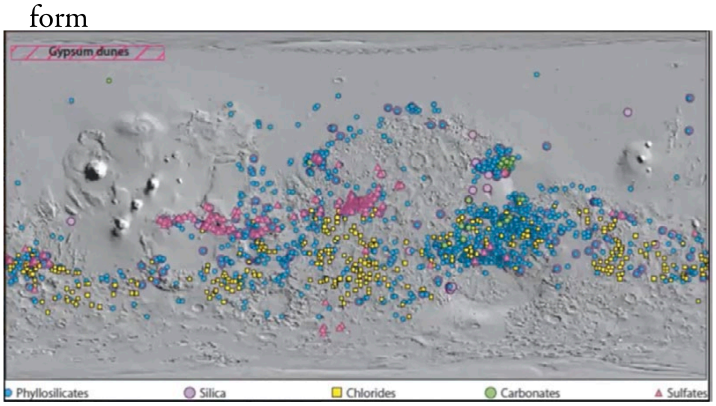


- During the middle periods, we see different style of channels - flood channels- flowing around impact crater, this crater filled with water nearly 200 km across, a lot of water flowing through there creating small island; water appears to have come up from beneath the surface and blurbed up and flowed across the surface, where did the water go? Is there any water left in the crust today? These are current questions.



- Curiosity Rover is exploring the Gale impact crater, where it is believed there was a lake at one time, that is why the mission went there; this is where we see layers of stones that are mud stones, debris that has been cemented together by liquid water, so this is convincing evidence there was a lake here, standing inside the crater probably about 3 billion years ago.

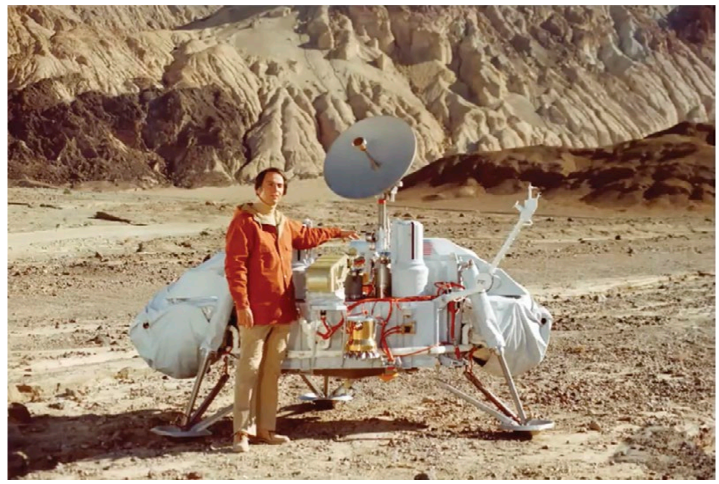
- Gypsum dunes map of all the places on Mars where mineral compounds have formed that require liquid water to form



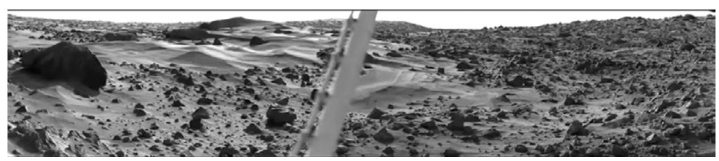
- The blue dots (phyllosilicates) have liquid water in them
- All the rest require liquid water in order to form
- We see abundant evidence that liquid water on Mars has been widespread both spatially and through time, and that water formed these landforms and deposits
- Believed to have been a more abundant and potent greenhouse gas at one time and higher temperatures

Has there ever been life on Mars?
Searching for Evidence

Either in past when evidence shows that water was abundant or in the present, this strengthens the possibility that life did or is exiting on Mars. There are three ways we are searching for life on Mars, two in the past one in the future. Viking lander (1976)



Carl Sagan poses in desert with Viking Lander



Viking Lander on Mars

(1) Viking Biology Experiments designed to look for different mechanisms for metabolism. Three different approaches to looking for evidence of ongoing metabolism were used:

- Is C taken up from CO2 (Carbon Assimilation)
- Is C taken up from nutrients? (Labeled Release)
- Are gases given off when nutrients are added? (Gas Exchange)

All of these experiments initially showed a positive result. They gave the response that was predicted if there was life. So they ran a control, this time heated the dirt to sterilize in case there was life and ran it again. The first and third gave same result, no change, so they concluded there was no life. The second one - labeled release experiment – added nutrients, then looked for Carbon that was given off; when nutrients were added Carbon was indeed given off, but when they heated it first, they detected no Carbon given off, so end conclusion was no life components found.

The scientist who built the experiment contended until dying day life was detected and possible there

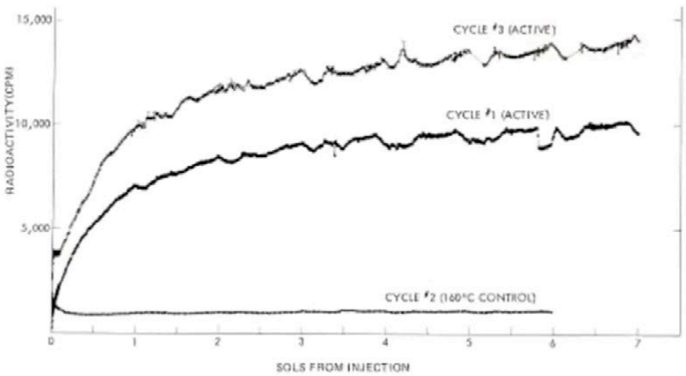
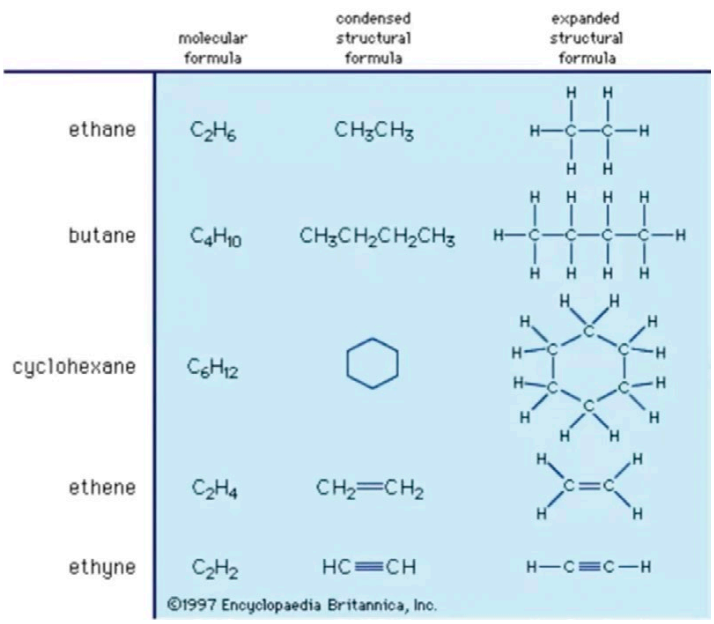


Fig. 3. Viking 1 LR data.

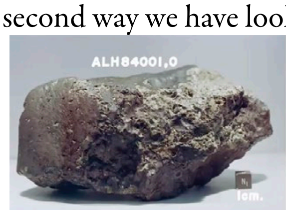
Viking Biology Experiments



Did the Viking find organics in the soil?

- Viking also had a spectrometer; If life were present, organic molecules should be present in the soil
- No organics were detected in abundance that are required for life using the Viking mass spectrometer
- Bottom line, from these Viking experiments majority conclusion made was that there is not compelling evidence for life on Mars

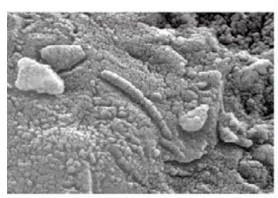
(2) Analyzing Martian meteorites found in Antarctica is the second way we have looked for life



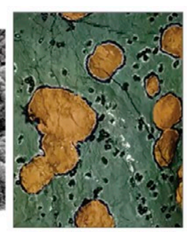
- ALH84001 Martian meteorite found 1984 at Allan Hills has been analyzed
- Meteorites are found on the ice in Antarctica during expeditions. Roughly 30,000 meteorites in all have been collected in Antarctica; 2,000 meteorites have been collected in other ways.
- Other examples of Mars meteorites Zagami, some made into jewelry

Note: This sample is ~10 carat = 2 g

- How do we know these meteorites come from Mars?
  1. They are young volcanic rocks, so had to come from a planet that was geological active relatively late in solar system history
  2. The oxygen isotope composition, absolutely, completely and uniquely rules out the Earth or Moon, this leaves Venus or Mars as place of origin
  3. We now have ~300 meteorites from Mars, a couple of them have a component of gas implanted into the rock by the impact of the asteroid that sent it off into space, the gas is identical in composition with the Mars atmosphere and distinct from any other gas we know of in the solar system
- Possible fossil life in ALH84001?



Structures that look like fossilized terrestrial microbes



Chemical disequilibrium (seen in layering of minerals)

Ordered structure in magnetite grains

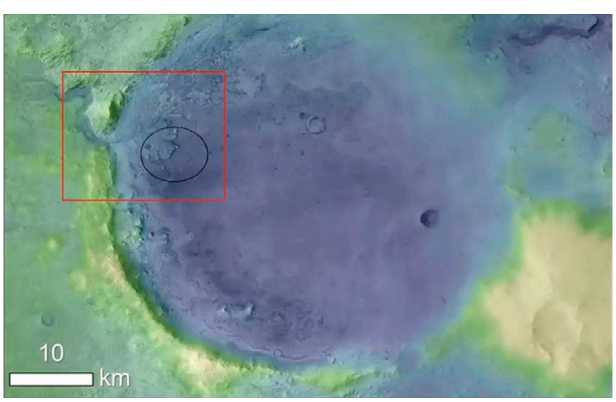
- Structures were found in the fossil that look like fossilized terrestrial microbes
- Chemical disequilibrium (seen in layering of minerals) holes in the rock filled with carbon bearing minerals, brown, black and white, has layering
- Found ordered structure in magnetite grains perfectly ordered, similar to finding magnetite rings in terrestrial samples formed by bacteria
- In 1996 paper put out by Johnson Space Center argued that this is evidence for life

- Five years and 500 laboratories around the world until a consensus was reached by scientists that the structures found not fossilized lifeforms, but geologically formed
- Didn't prove or disprove, but determined this was not evidence for life

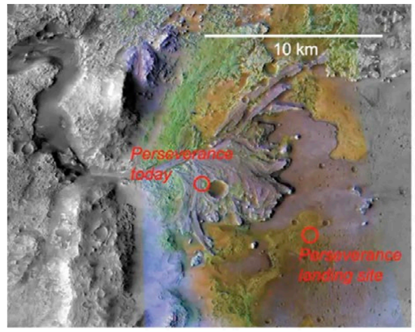
(3) Analyzing Return Samples from Mars is the third

way we will search for life on Mars in the near future. Best way is to go to the places where we think there has been liquid water, and that life could have formed or existed and collect samples of rocks that may contain a memory of that time, and bring them back to Earth. Perseverance Rover is currently collecting samples to return to Earth. They will be brought back by a rocket in 2031.

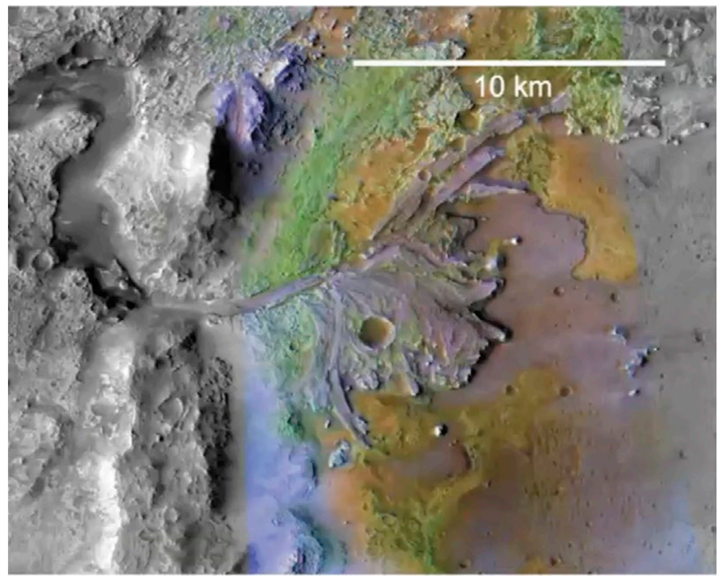
- Perseverance Rover landed in Jezero Impact Crater in 2021



- Jezero Crater is thought to be the site of an ancient standing lake

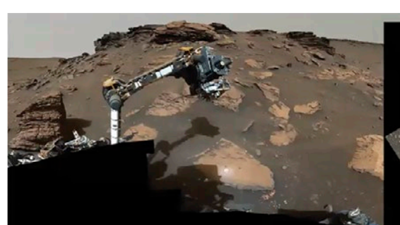


- Delta deposits show where water entered crater and dropped sediment



- Perseverance is currently at the lake, has laid down about a dozen samples as a backup in case the Rover dies and we can't get to it, right now it is still collecting samples

Organic molecules detected from Curiosity and Perseverance Rovers

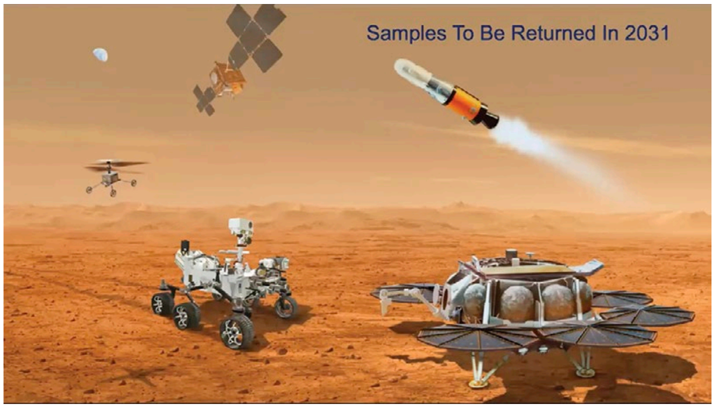


Perseverance Work Area With Sedimentary Rocks At Skinner Ridge

Sample Location At Nearby Wildcat Ridge

- Perseverance working with sedimentary rocks at Skinner Ridge
- Sample location at nearby Wildcat Ridge
- Organic molecules by themselves are not a unique indicator of life
- Current thinking is that the organic molecules are from

interesting chemistry, organic molecules can also be formed by non-biological processes

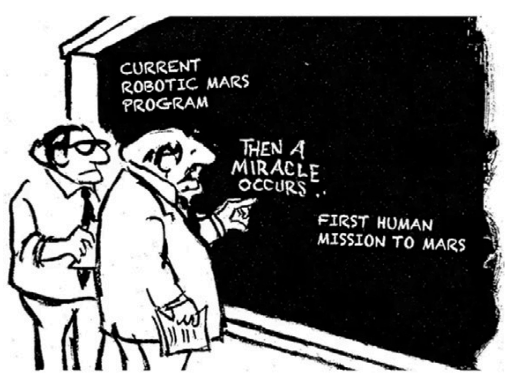


Samples from Mars to be returned in 2031

- Samples returned will go straight into the receiving facility in the case there are living organisms - we definitely do not want to contaminate the Earth
- Analysis in laboratories to look for life and also look at the geological history of Mars
- That is next 10 years, what about further into future?

The Future of Life on Mars: Human Missions to Mars

- Have a lot of work to do, with estimates of costs of $200-400 billion, this is comparable to Artemis Moon Mission ($100 billion) Apollo Program to the Moon– in todays dollars= ($275 Billion) so it is in line with what we are willing to spend
- It is not going to be easy, we must decide if we really want to do this. There is some serious planning going on to go to Mars, but still not enough interest to carry though, at this time, do not have the will or commitment necessary



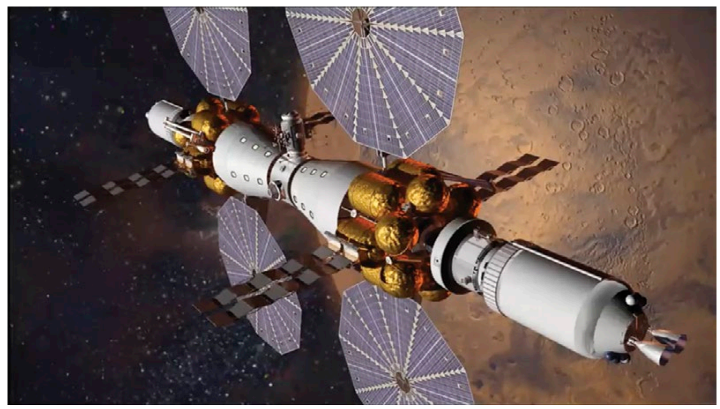
"I think you need to be more explicit here in step 2"

- Current college age students may be first humans to go

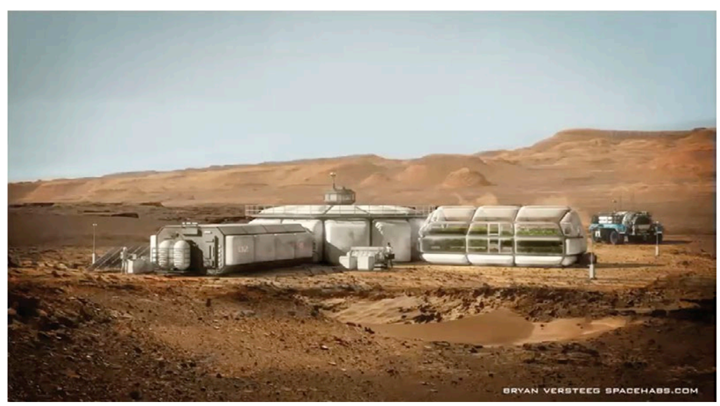
What are current proposed "plans" for getting and staying there?

- Elon Musk proposed SpaceX "Starship" concept

- Lockheed Martin's "Mars Base Camp Concept" Orion Space Craft, crew compartment- this doesn't get us on the ground but is designed to get us there and back



- Scientific Outpost on Mars? Architecture NASA is putting together consists of two proposed missions: one is short stay of 30 days and another is a long stay of 300 days, all driven by the orbital geometry of the planets, need to get there and back, can't go in straight line but must orbit around the Sun, either way will need a habitat



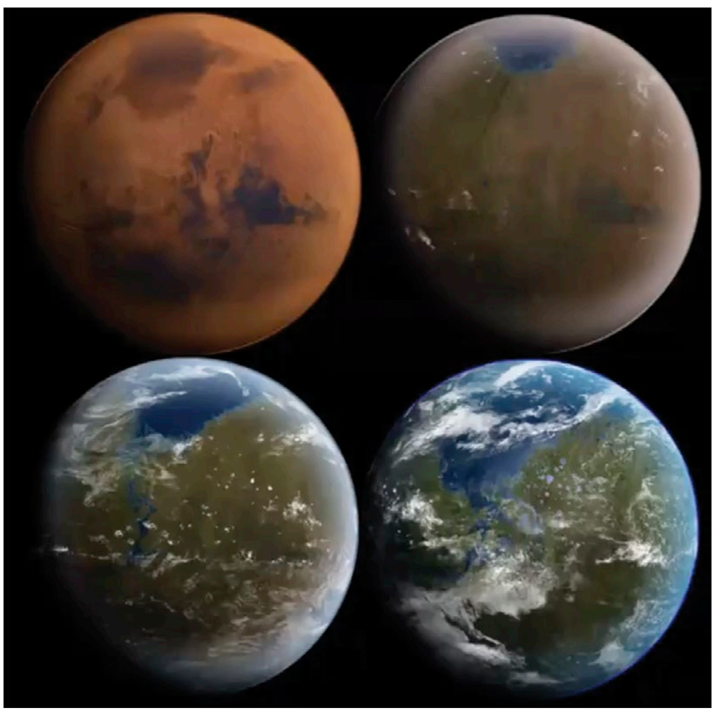
- Cities on Mars? Very difficult, challenging environment to imagine, many problems to overcome, will have to live underground, inside a habitat or in spacesuit, can this happen by mid-century? It will happen but no time frame at this time

City On Mars?

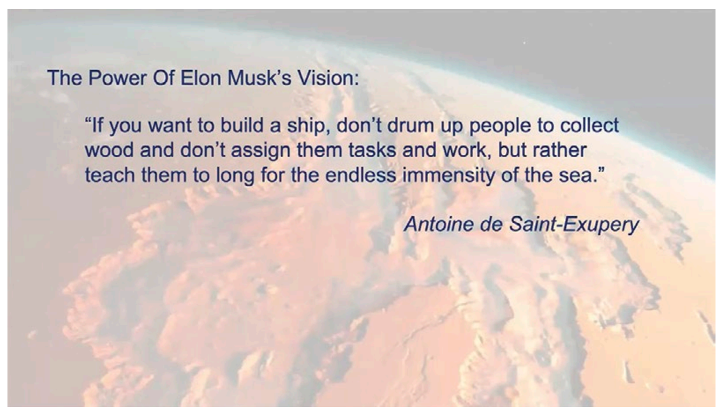
"Mars ain't the kind of place to raise your kids." -- Elton John (Rocket Man)

- First human mission to Mars? Once we get a starship in orbit around the Earth we can get a realistic estimate of what it would take, but first we have to get it to the Moon. Elon Musk and NASA have committed to use the SpaceX Starship as the lunar lander for the astronauts, if we can do that, then we can talk about going to Mars

Can we find and mobilize enough CO2 to terraform Mars?

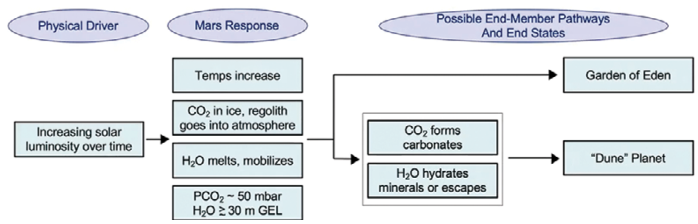


- Have to find enough CO2, which is a greenhouse gas, to mobilize it and put it back into the atmosphere to terraform Mars
- Focusing on CO2 because it is an indigenous compound, lots of it that we think is available; we think there is CO2 ice in the polar caps and CO2 in the ground - chemically bonded to the dirt grains in a process called adsorption; we think there are CO2 bearing minerals (carbonates)
- Some CO2 has been lost to space
- In addition, if we wait, ongoing volcanic out-gassing, is putting out CO2, will also raise temperature, but far in future (1 Billion years)
- The problem is where CO2 is easy to access, easy to mobilize, like in the polar caps, it is not very abundant, and where it is not easy to mobilize - is where it might be abundant
- So if we can mobilize all of the CO2 we might get a few hundred millibars, which is significant- pressure up to 1/3 of that of the Earth, although much of that CO2 is in carbonates; problem is we have to heat those up, they are in the ground and would have to strip-mined. Bottom line: can we terraform Mars? No. Don't believe there is enough accessible CO2 to mobilize to have significant greenhouse warming...not with current technology
- If we rely on Designer Molecules, a new technology, that are very efficient greenhouse gases, like chlorofluorocarbons, that we could manufacture on Mars and put them into the atmosphere and increase greenhouse warming. Concept of designer molecules can't be ruled out, but far enough in the future have to put it into the realm of science fiction



- This concept is what Elon Musk is doing; building up the concept of going to Mars in the mind of the public as a wonderful, possible thing, and getting people engaged and that is what is going to make it happen. The downside of Elon Musk's vision: If we begin to think that the Earth is too polluted and we think we can terraform Mars and "escape" to it rather that trying to fix the problems on Earth. No matter what we do to the Earth's environment it is going to be far easier to fix it than to go to Mars and fix Mars!

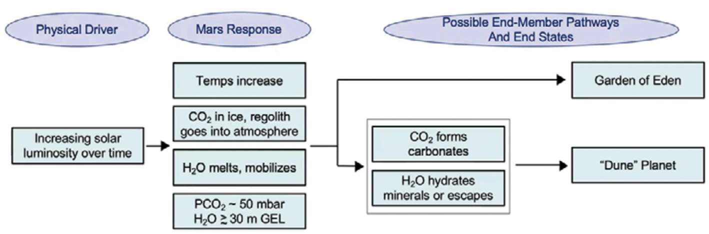
The Far Future Mars: What will happen to Mars over the next 5 billion years?



This is new research results from the last month, has not yet been vetted by the scientific community of possible outcomes for the future on Mars.

On this timescale, the solar luminosity has increased, we know this from studying the stars, it was dimmer in the past. By the time our Sun reaches the end of its main sequence lifetime in 5 billion years, solar luminosity is going to be 3 times what it is today, what happens to future Mars?

- On this timescale the physical driver is increasing solar luminosity over time



Is Mars "self-terraforming", "self-limiting", or somewhere in between?

- The response on Mars is the temperature increases, drives CO2 in ice, regolith goes back into atmosphere; H2O melt, mobilizes; PCO2 ~50 mbar H2O>~ 30 m GEL

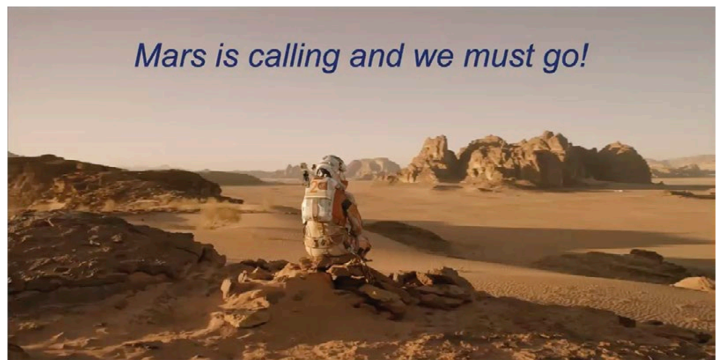
Possible End-Member Pathways and End States – Two different scenarios

- As Mars heats up: melting and mobilizing water all this water, could end up with CO2 pressure 10 times what it is today; with 30 meters of water global equivalent on surface; crater lakes reforming, might get a small ocean in northern highlands. From this can identify two ending scenarios:
- Scenario #1 Could create lush, warm planet – Garden of Eden planet
- Scenario #2 On the other hand - CO2 forms carbonates and H2O hydrates minerals or escapes - becomes a "Dune" planet
- Cannot tell which way it is going to go, do not know what determines end processes
- Between now and then, as Earth goes to a more Venus-like environment, Mars may go to a more Earth-like environment and if there is life there, may spread globally and become a wonderful environment
- Calling this a "self-terraforming" Mars or "self-limiting" Mars, or somewhere in between

Dr. Jakosky ends his presentation with two intriguing quotes:

About the search for life elsewhere:
"There are two possibilities. Maybe we're alone. Maybe we're not. Both are equally frightening." Arthur C. Clarke

About understanding the universe:
"We shall not cease from exploration, and the end of all our exploring will be to arrive where we started and know the place for the first time." T.S. Elliot



Discussion follows with comments and questions asked by members on various topics. Can liquids on Mars be in other forms than H2O? Was the temperature higher when all the water flow formations were formed? Increase in solar wind, what would be effect of this on Mars? How will we get the samples back to Earth? Anything significance about the Moons of Mars? How was the dating done on the Martian meteorite? Why no missions to the ice caps yet? Will there be in the future?

Mars is the closest planet to us that holds the potential to have had life in the past, to have it at the present or to have it in the future. The hottest topics of Mars are often life and climate. We see abundant evidence for the existence of water. Various rover missions have conducted experiments in attempts to determine whether the environment is conducive to lifeforms to begin or to have been sustained in the past. Some form of human habitation of Mars is a real and probable future but with many difficult challenges to overcome. Two possible future scenarios for climate on Mars are primarily driven by increasing solar luminosity heating the planet. Depending on varying environmental factors related to the increased heating, Mars may become a "Garden of Eden" or the "Dunes" planet. Whether or not there is or was life on Mars, either way an important question and tells us a lot about who we are as individuals, as a society and as an ecosystem because it helps us to gain understanding about ourselves and of what widespread life could mean within the universe.

III. Business Meeting

Bruce Lamoreaux monthly Treasurer's report:

Longmont
Astronomical Society

P.O. Box 806
Longmont, CO 80502-0806

LAS Treasurer's Report - Bruce Lamoreaux **6/15/2023**

Main Checking Account (xxx-1587)

Begin Balance:	$ 9,370.00	**5/3/2023**	
Deposits:	$ 385.00	Membership	
Expenses:	$ (5.00)	Bank Charges	
Current Balance:	**$ 9,750.00**	**6/5/2023**	

2-Year Savings Account (xxx-1478) (matures 10/23/23)

Past Balance:	$ 8,135.00	**12/30/2023**	
Interest:	$ 15.00		
Balance:	**$ 8,150.00**	**3/31/2023**	

Telescope Fund (xxx-0165)

Past Balance:	$ 1,100.00	**4/27/2023**	
Deposits:	$ -		
Expenses:	$ -		
Balance	**$ 1,100.00**	**5/30/2023**	

Petty Cash

Past Balance:	$ 50.00		
Deposits:	$ -		
Expenses:	$ -		
Balance	**$ 50.00**		

Total Assets	**$ 19,050.00**	$ 380.00	Up from last report
Active Membership:	**110**		
Student Membership:	**3**		
Total	**113**		

IV. Old/New Business

Upcoming events:

- LAS In-Person/Hybrid Meeting: 7:00pm, July 20th Longmont Lutheran Church
- Rabbit Mountain Boulder Parks and Open Space Program: July 21st 7:00-10:00pm

Astroleague By-Laws Changes

The club has received a Ballot for Astroleague By-Laws Changes:

Members voted yes on two amendments to Articles X and VI

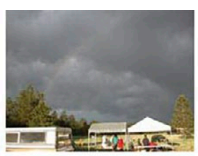
Members voted yes for Astroleague Secretary, Terry Mann

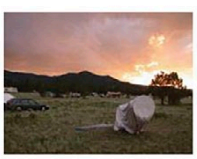
20 years ago July 2003

Report from RMSS
Hello all you starship dreamers! We just got back from star gazing event, RMSS. Three beautiful nights under the stars at 8600 ft for some of the best dark sky anywhere except maybe Fox Park, Wyoming. I love the huge valley they have it in. Beautiful full sky views in the Rockies. We had over 325 people for one of the biggest events for the RMSS. Many great scopes to view from big dob valley as I called it. The Amateur Telescope Makers walk about was way cool as usual and Jim Sapp once again stunned the masses with his spectrograph scope he built out of old beer cans a pair of reading glasses and miscellaneous off the shelf stuff. Jim emptied the cans first and still was able to build this spectrograph, just kidding. Jim is also still amazing us with his ATM work. New member and friend Terry Frazier, war vet, you too also amaze me, wish other people in this world had even half your gumption, or get up and go you have you could teach a few armchair astronomy people on how to apply yourself. I always want to share the pictures so here I go again, keeping it cosmic Tom, wish you could have been there,
Bye, Gary Garzone


Solar Flares


RMSS Give Away


RMSS Rainbow


30 bright sunset


30 ready to go


ATM Walk about


Mars


Jupiter

10 years ago July 2013

From the President, Bill Tschumy:
The July meeting of LAS is tomorrow evening. Our speaker is fellow member Lefty Harris. His talk will be about the production, and writing of his book about the moon from an idea to reality and everything in between.
Here is Lefty's Bio:
"I am Lefty, mild mannered pizza guy by day and super-star gazer/loonie guy by night. I graduated in 1982 from Villanova with a BS in astronomy. I came to CU in the old AG Department in 1982. I've worked at LASP, CASA, and JILA; I received my advanced degrees in 1990. I've worked on the VOYAGER, IUE, IRAS missions. I did something with Neptune's ring in 1982 and made the first study/discovery of 370 morphological and statistical features of Saturn's rings. Also I'm maker of OUT OF THIS WORLD PIZZA. I'm enjoying my 14' Meade Ritchey-Chretien time warping machine. Warping minds when allowed!"

30 years ago July 1993

No newsletter was published

Rocky Mountain Star Stare 2023 by Gary Garzone

Gary Garzone writes:
RMSS is always fun, despite the weather at times.
Cloudy mostly for first three nights, did manage few hours till 1:20 then shut down sky opened back up 2:15 till 4 am; dawn breaking; Jupiter was up.
Friday Dew point hit us early night was the problem, everything was getting wet.
Saturday night back to full sky all night up. I made it until dawn again.
Marty Butley had the most amazing set up.
30 scope is the Galaxy hunter. Favorites like M 51, plus M 101 SN seen. Too many objects to name M 13 of course, plus many other GC. Also did most of Sagittarius , best views. Globular Omega Sag. seen few minutes till setting behind mtns. Wind, Rain, Hail clear skies, we had it all, even a rainbow. Lows in the 40 's had winter coat on.

M13 Globular Cluster in Hercules by Gary Garzone on June 30

M101 / SN2023-ixf by Eddie Hunnell on June 26

M20, Trifid Nebula by Jim Pollock on June 20

M101 / SN2023ixf by Jim Pollock on June 20

M57, Ring Nebula by Jim Pollock on June 21

M13 Globular Cluster by Rolando Garcia on June 21

NGC 6254 by M. J. Post on June 10

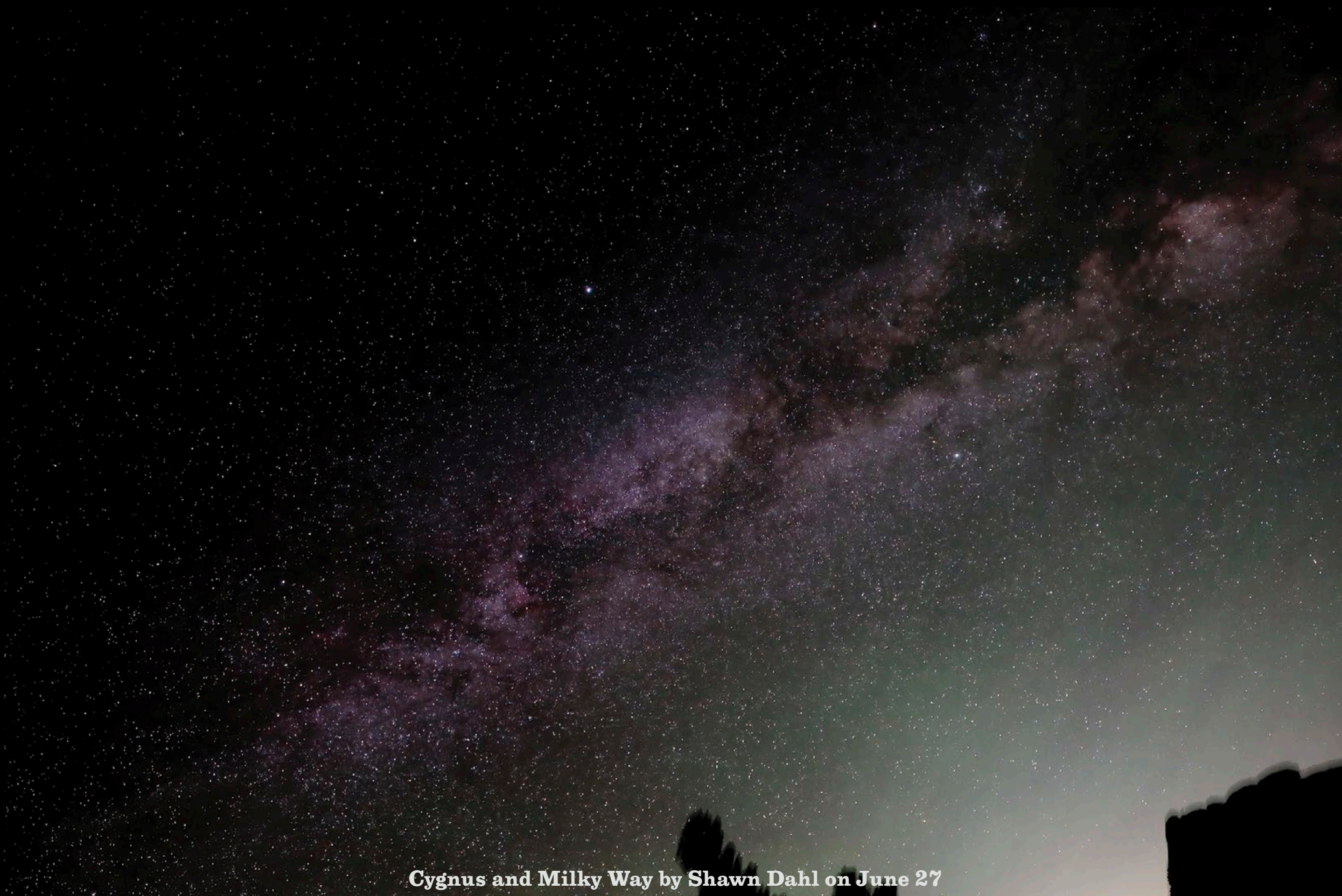
NGC 6366 by M. J. Post on June 10

NGC 6254 by M. J. Post on June 10

NGC 6426 by M. J. Post on June 10

NGC 6517 by M. J. Post on June 10

NGC 6539 by M. J. Post on June 10

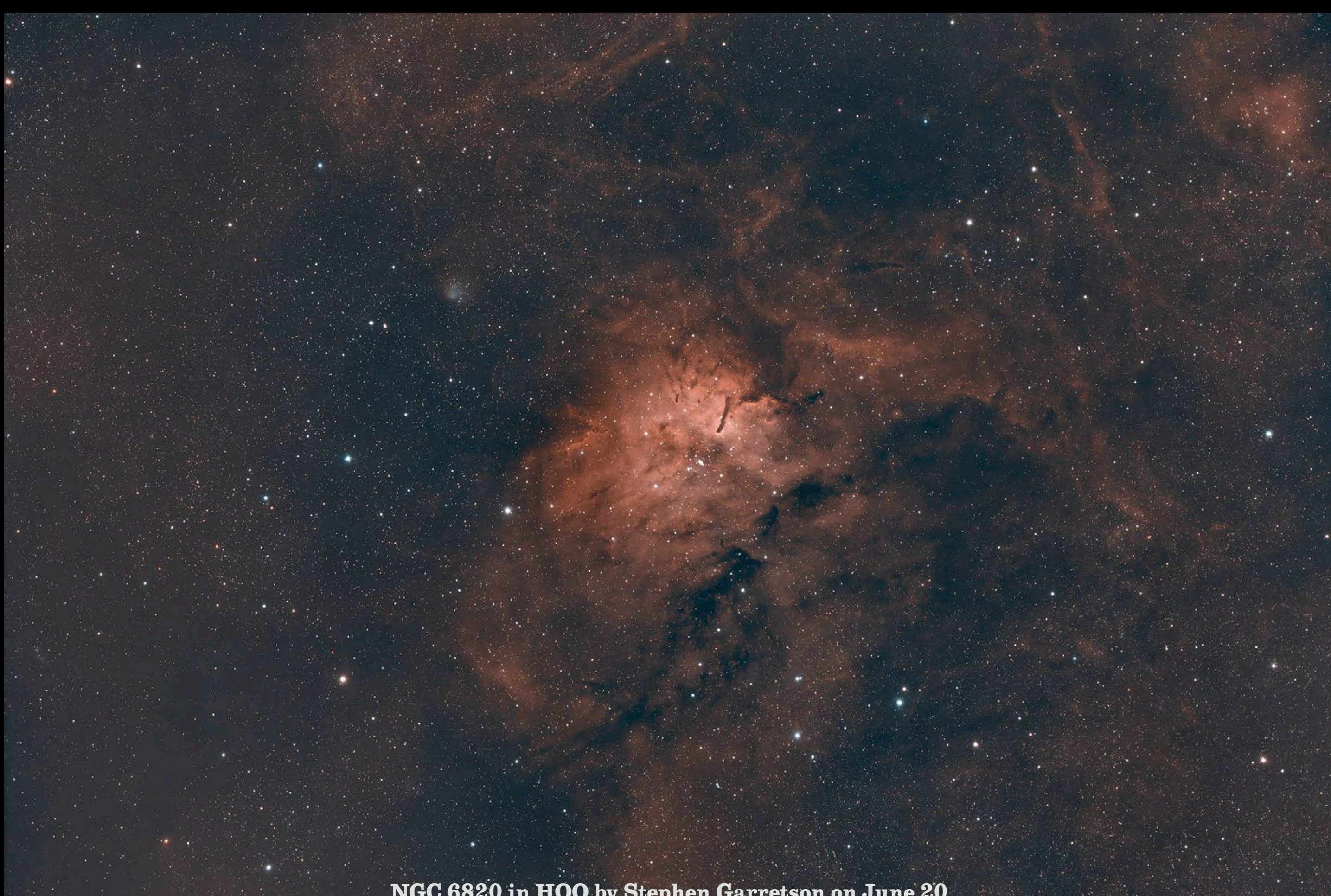


Cygnus and Milky Way by Shawn Dahl on June 27

Moon and Venus at Dusk by Shawn Dahl on June 27

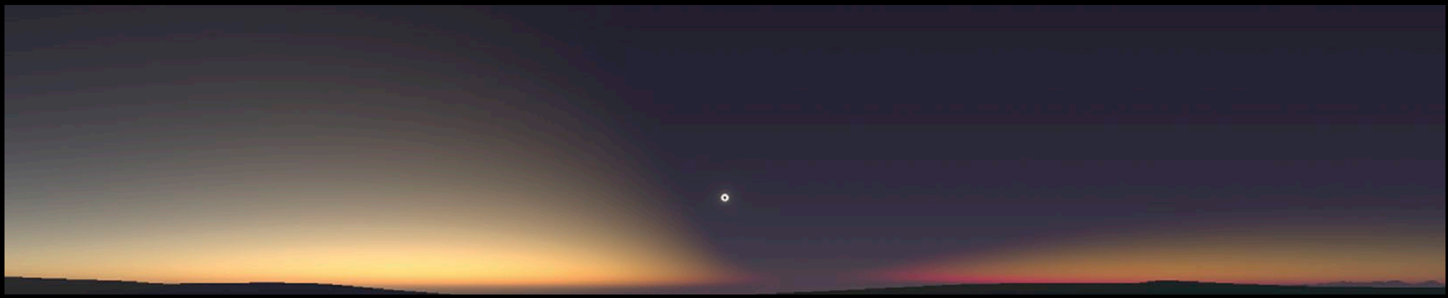
Southern Milky Way by Shawn Dahl on June 27

SH2-134 by Stephen Garretson on June 28



NGC 6820 in HOO by Stephen Garretson on June 20

Thor’s Helmet by Stephen Garretson on June 13



2019 Solar Eclipse Simulation by Steve Albers

Updated version of my 2019 eclipse sky simulations from Chile. The low sun angle helps give a tunnel effect with the shadow. The extra shadowing in the anti-solar direction during mid-totality is related to the very elliptical shape of the shadow (due to low sun elevation angle) as projected onto the Earths’ surface. We can imagine what the path length through the shadow is along various lines of sight while in the atmosphere. There is a longer path length in the anti-solar direction and in the solar direction. Shorter at right angles.

Polarization hopefully is implicitly considered with the Rayleigh and aerosol phase functions being used.

Longmont Astronomical Society
PO Box 806, Longmont, CO
https://www.longmontastro.org

Large Magellanic Cloud by Stephen Garretson