

Longmont Astronomical Society

The background of the entire page is a deep space photograph. It features a vast field of stars of various colors, including white, yellow, and blue. In the center-right portion of the image, there is a large, glowing red nebula with a complex, irregular shape, resembling a running chicken. The nebula's color is a vibrant, slightly dark red, and it stands out against the darker background of the star field.

NGC 2944, "Running Chicken Nebula"
by Tally O'Donnell

Vol. 33, No. 6 - ISSN 2641-8886 (web) - ISSN 2641-8908 (print) - June 2019

Notes from the President: Bill Tschumy

The weather has turned warmer and I hope that means more of you are getting out to observe and/or image. I know I'm enjoying it.

We have had some good public events this past month and more are coming in June. Please check our Events calendar and help out if you can.

I'm going to try to schedule semi-regular dark sky events this summer at Owl Hollow on the weekend nearest the new moon. This is a great time for club members to get together, enjoy each others company and learn from one another. If you are a new member and need some help learning to use your scope, this will be a great time to do so.

Our general meeting in May was a great success. Dr. Hal Levinson gave a fascinating and engaging talk about the Lucy mission to study the Trojan asteroids of Jupiter. We will try to get him back in the future to talk about some other interesting topics he alluded to.

The meeting in June will once again be at the First Evangelical Lutheran Church. We are still working on a permanent meeting site.

Next LAS Meeting - "Solar Magnetic Variability"

Dr. Ricky Egeland of NCAR

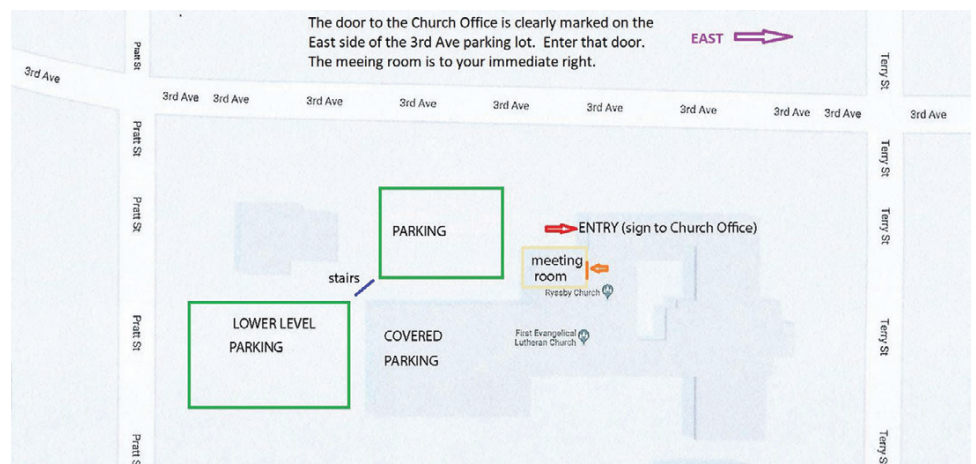
The Sun is a giant magnet with a dynamic surface, showing varying amounts of magnetic features at any given time, most notably changing with the 11-year solar cycle. These varying magnetic features produce very small color-dependent variations in the brightness of the Sun, which allows us to use brightness changes as a proxy for the Sun's magnetism. The same principle applies to other more distant stars, allowing us to study their magnetic variability. I will discuss proxy observations of solar and stellar magnetism as well as the feasibility of observing stellar spectra on an amateur budget.



In 2017 I obtained my Ph.D. in physics from Montana State University with my dissertation "Long-term Variability of the Sun in the Context of Solar-Analog Stars." I am currently an NCAR Advanced Study Program Postdoctoral Fellow working at the High Altitude Observatory in Boulder, Colorado. My research is on long-term solar and stellar magnetic variability and the stellar dynamo.

Meeting Location and Time

Meeting begins at 7 pm at the First Evangelical Lutheran Church, 3rd & Terry, Longmont



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About LAS

The Longmont Astronomical Society Newsletter ISSN 2641-8886 (web) - ISSN 2641-8908 (print) is published monthly by the Longmont Astronomical Society, P. O. Box 806, Longmont, Colorado. Newsletter Editor is Vern Raben. The LAS website URL is <https://www.longmontastro.org>

The Longmont Astronomical Society is a 501 c(3), non-profit corporation which was established in 1987. Our main goal is to promote local amateur astronomy. This is accomplished through regular monthly meetings, star parties and public observing sessions.

Regular meetings are held every month (except December) on the third Thursday. The current location is at the First Evangelical Lutheran Church, 3rd Avenue and Terry Street, Longmont, CO. Meetings are open to the public and begin at 7:00 PM.

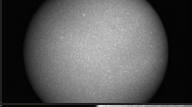
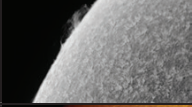
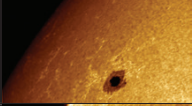





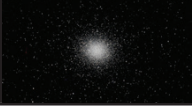
A broad spectrum of topics are covered at the meetings and include such things as deep sky observing, planetary imaging, narrow band imaging, equipment discussions and demonstrations just to name a few. These subjects are presented by both club members as well as special guests who are professional astronomers or experts in a particular field.

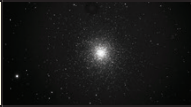






The Longmont Astronomical Society is affiliated with the Astronomical League (<https://www.astroleague.org>). The Astronomical League is an umbrella organization of amateur astronomy societies in the United States.



Image Contributors and Details

Page	Image	Author	Scope	Camera	Description
Front		Tally O'Donnell	Meade 70mm F/5 astrograph & ES102CF@ F7	Canon6D (rgb) ASI1600MM Ha and OIII filters	"Running Chicken" RGB is 23 subs at 300 sec; HOO is 12@300 seconds for Ha and 14@300 sec for OIII (May 7)
10		Brian Kimball	5" APO refractor scope	Imaging Source DMK41	Sun in Calcium K Lunt B1800 calcium K module (May 3)
11		Brian Kimball	Lunt LS100 ha scope	Imaging Source DMK41	Big Prominence H-Alpha B3400 blocking filter (May 3)
11		Brian Kimball	5" APO refractor scope	Imaging Source DMK41	AR 2740 in white light (May 5)
11		Brian Kimball	Lunt LS100 H-alpha scope	Imaging Source DMK41	AR 2740 in H-Alpha B3400 blocking filter (May 5)
12		Gary Garzone	Celestron 14 in HD scope	SBIG STI	Saturn (May 26)
12		Gary Garzone	Celestron 14 in HD scope F7.7	SBIG STL 11000	"M27 Dumbbell Nebula" (May 12)
13		Gary Garzone	Celestron 14 in HD scope	SBIG STL 11000	"M57 Ring Nebula" (May 12)
13		Gary Garzone	Telephoto 135 mm	Canon EOS T3i	"Setting up at Owl Hollow" (May 5)
14-15 Center		M. J. Post	Celestron C8 with Hyperstar	QHY 183M	"NGC 2070 Tarantula Nebula" in SHO; used PI's SCNR to remove greenish tint - from Atacama (May 4)
16		M. J. Post	C8 and Hyperstar	QHY 183C	"M104 Sombrero Galaxy" 9@100 sec from Atacama (May 7)
16		M. J. Post	Celestron 11 in. RASA	SX-694M	"M1 Crab Nebula" in HOO 3@300 sec in O3; 9@300 sec in Ha (May 12)
17		M. J. Post			"NGC 7000 North American Nebula" (May 20)
17		M. J. Post			"IC 4592, Blue Horse" 25@100 sec; (May 7)
18		Stephen Garetson	William Optics FLT 132 APO & Flat 68 II	ASI ZWO 1600 MM	Crescent Nebula in HOO 23@300 sec in Ha; 18@300 sec in OIII (May 15)
19		Martin Butley			M87 and Jet (May 9)
20		Jim Pollock	CPC-1100 on Alt/Az Mount F7 focal red.	Canon 6Dii	Omega Centauri and M61 41@30 sec (May 3)

Page	Image	Author	Scope	Camera	Description
20		Glenn Frank	Celestron 9.25 with F6.3 focal reducer	ZWO ASI1600MM	M13 30@60 sec (May 12)
21		David Elmore	Meade LX75 8" F/4 Schmidt Newtonian	ASI 1600MM Pro	"M81 and M82 Galaxies" 21@300 sec in H-alpha and 14@300 sec in OIII (May 6)
21		David Elmore	Borg 55FS 200mm focal length F/3.6	Canon 6D (modified)	"Cygnus Mosaic" Mosaic of 4 images; 6@300 sec for Sadr field 3@300 sec for other 3 fields (May 1)
22		Tally O'Donnell	William Optics RedCat 51	Canon 6D	"Antares Region" 6@120 sec (May 17)
Back		M. J. Post	Celestron C8 and Hyperstar	QHY 183C	"NGC 5128, Centaurus A" 20@100 sec (May 7)

Solar System Highlights

Mercury

Mercury is not visible by naked eye this month.

Venus

Venus is not visible by naked eye this month either.

Mars

Mars is visible in constellation Gemini until the 27th; it then moves into constellation Cancer. Best time to view it is around 9:30 to 9:40 pm. It is magnitude 1.8 in brightness. Its disk decreases from 3.8 arc sec to 3.6 arc sec.

Jupiter

Jupiter is at opposition with the Earth on June 10. It is in constellation Ophiuchus; it is magnitude -2.6 in brightness and its disk is 46 arc sec across.

The Great Red Spot should cross the center of Jupiter's disk at the following times assuming a GRS longitude of 303° (see <http://jupos.privat.t-online.de/rGrs.htm>).

Date	Time	Altitude
June 2	3:02 am	26°
June 5	12:30 am	28°
June 7	2:08 am	28°

Date	Time	Altitude
June 9	11:37 pm	26°
June 12	1:15 am	29°
June 14	2:53 am	22°
June 14	10:44 pm	23°
June 17	12:22 am	29°
June 19	2:00 am	25°
June 19	9:51 pm	20°
June 21	11:29 pm	28°
June 24	1:07 am	27°
June 26	10:37 pm	27°
June 29	12:15 am	29°
July 1	1:53 am	21°

Saturn

Saturn is in constellation Sagittarius. It increases in brightness from magnitude +0.3 to 0.1 this month. Its disk is 18 arc sec across. Best time to view early in the month is around 3:30 am and at the end 1:30 am. Saturn is at opposition with earth next month on July 9th.

Uranus

Uranus is in constellation Aries. It is magnitude 5.9 in brightness and its disk is 3.4 arc sec across. Best time to view is about 4 am

Neptune

Neptune is in constellation Aquarius; it is magnitude 7.9 in brightness and disk is 2.2 arc sec across.

Moon



New moon: June 3 at 4:02 am

First quarter: June 8 at 23:59 pm

Full moon: June 17 at 2:31 am

Third quarter: June 25 at 3:46 am

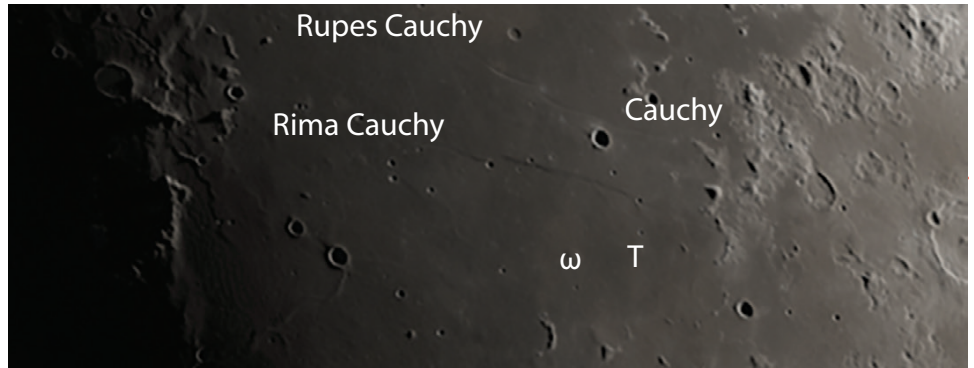
Moon by Brian Kimball

Lunar Highlights - June 8 at 9 pm

You'll notice the two prominent craters Hercules and Atlas in your eyepiece when you look at the northern part of the moon. Crater Atlas on the west (right) is 54 miles across and has central peaks, rilles, and a fractured floor. Crater Hercules on the east (left) has multiple terraces; it is about 43 miles across.



Rupes Cauchy is a 130 mile long and 2 1/2 mile wide rille (narrow channel) north and east of crater Cauchy. Southwest of that crater is Rupes Cauchy, a 75 mile long cliff. Just south of Rupes Cauchy are two impressive volcanic domes Tau (T) and Omega (ω).



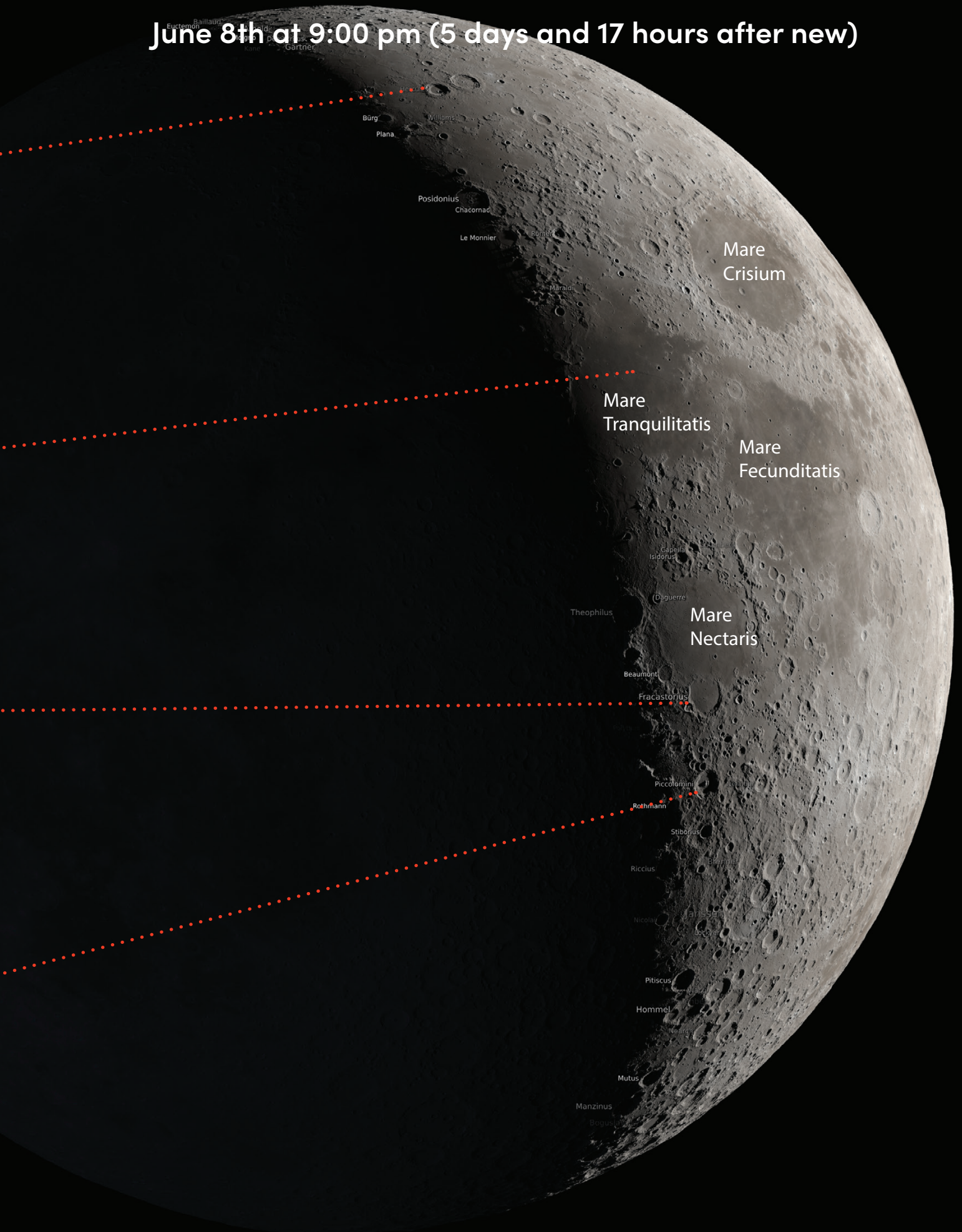
Long ago crater Fracastorius apparently subsided along its north side allowing lava to flow in from Mare Nectaris. A few mounds are visible to mark the northern boundary. There is no central peak. If you have large telescope and good seeing you might spot a rille running east west just south of the center.



Piccolomini is 84 miles across and has a relatively smooth floor, a complex central peak, and well defined rim. The central peak rises nearly 15 thousand feet above the crater floor.



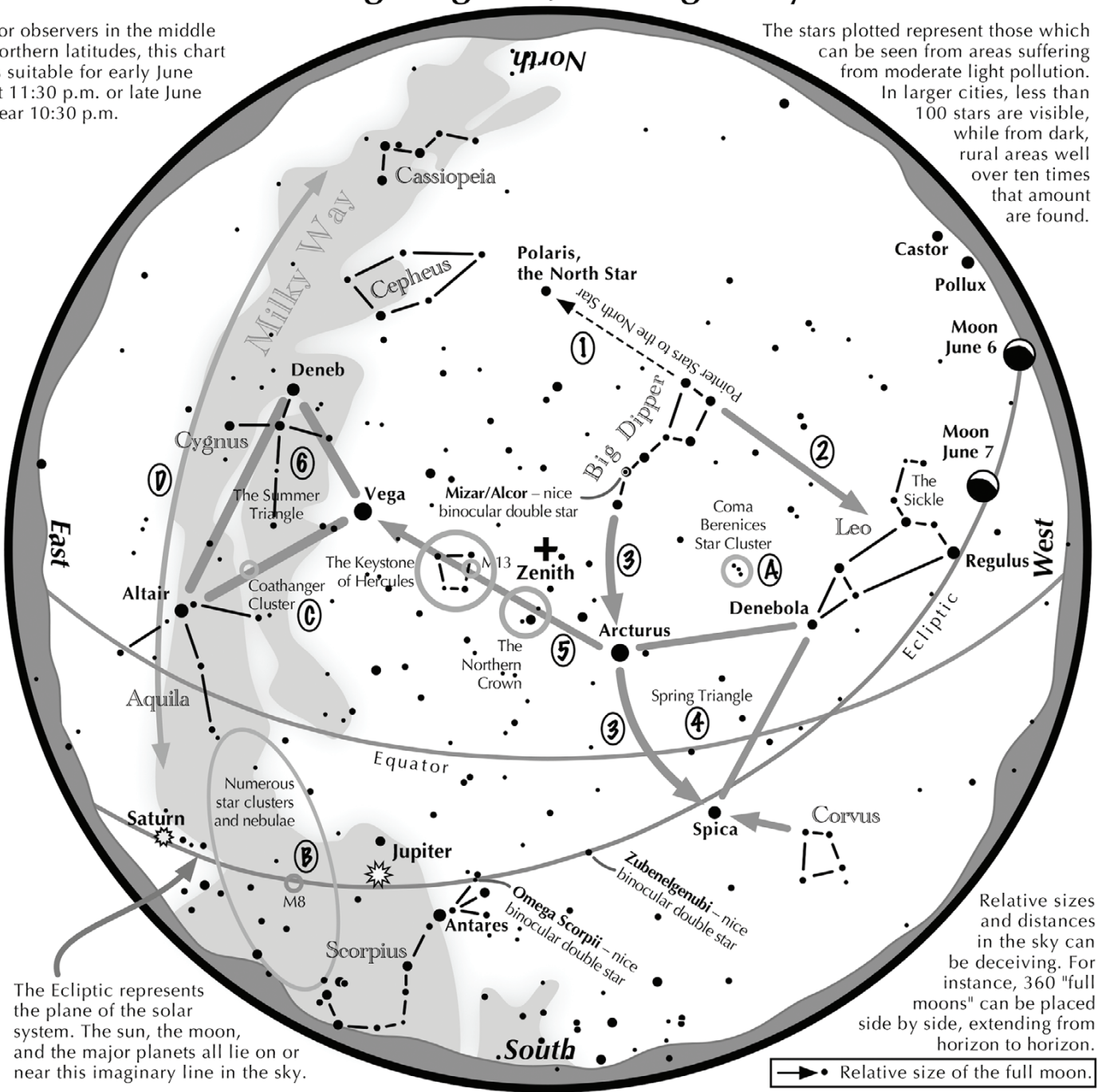
June 8th at 9:00 pm (5 days and 17 hours after new)



Navigating the June Night Sky

For observers in the middle northern latitudes, this chart is suitable for early June at 11:30 p.m. or late June near 10:30 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 June 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 Draw another line in the opposite direction. It strikes the constellation Leo high in the west.
- 3 Follow the arc of the Dipper's handle. It first intersects Arcturus, the brightest star in the June evening sky, then Spica.
- 4 Arcturus, Spica, and Denebola form the Spring Triangle, a large equilateral triangle.
- 5 To the northeast of Arcturus shines another star of the same brightness, Vega. Draw a line from Arcturus to Vega. It first meets "The Northern Crown," then the "Keystone of Hercules." A dark sky is needed to see these two dim stellar configurations.
- 6 High in the east are the three bright stars of the Summer Triangle: 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 of Antares and Altair, hides an area containing many star clusters and nebulae.
- C: 40% of the way between Altair and Vega, twinkles the "Coathanger," a group of stars outlining a coathanger.
- D. Sweep along the Milky Way for an astounding number of faint glows and dark bays.

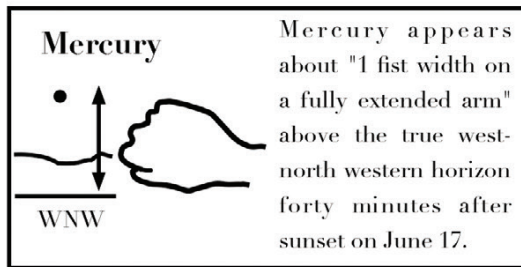
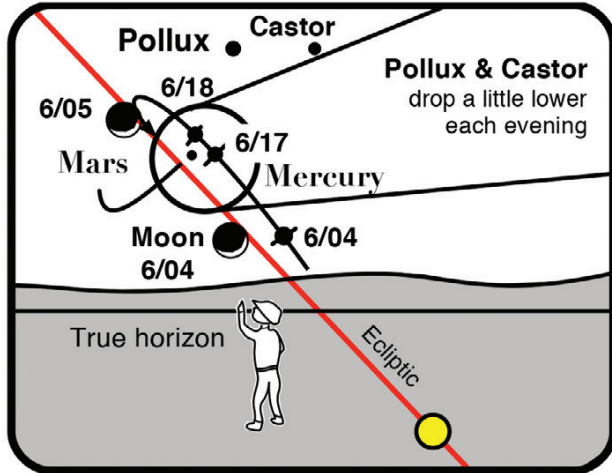
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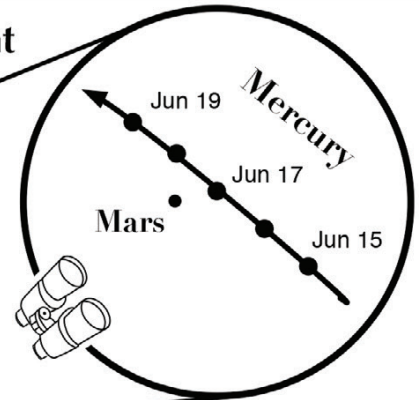


If you can observe only one celestial event this month, see this one:

Mercury, Mars, Pollux, and Castor
forty minutes after sunset in the west-northwest



View through
10x50 binoculars
forty minutes
after sunset



Mercury meets Mars in the evening twilight

The solar system's two smallest planets have a meet up in mid June in the bright evening twilight. First, look in the west-northwest 40 minutes after sunset beginning on June 4. The thin crescent moon will be just a few degrees above the horizon with Mercury to its right. Use binoculars to spot both. Place moon on the far left side of the field, and Mercury should lie at the far right side or just beyond.

Over the next two weeks Mercury climbs higher while dimming all the while. On the evening of June 17, the smallest planet lies next to the next smallest, Mars. Binoculars will likely be needed to pick them out of the bright twilight. The following evening finds the brighter Mercury just above the tougher-to-see Mars.

After June 22, Mercury, Mars, Castor, and Pollux will be too difficult to spot in binoculars as they all drop closer to the horizon.

From Our Newsletter Archives

June 2009

Dr. Suzanne Metlay was the speaker at the June 18, 2009 meeting at Front Range Community College. Her topic was "Your Eyes on the Sky – NEOs, Satellites & More – How amateur astronomers aid discovery and do much of the detailed work to confirm orbits". Dr. Suzanne Metlay is operations director of Secure World Foundation, a private non-profit organization dedicated to improving space governance.

June 1999

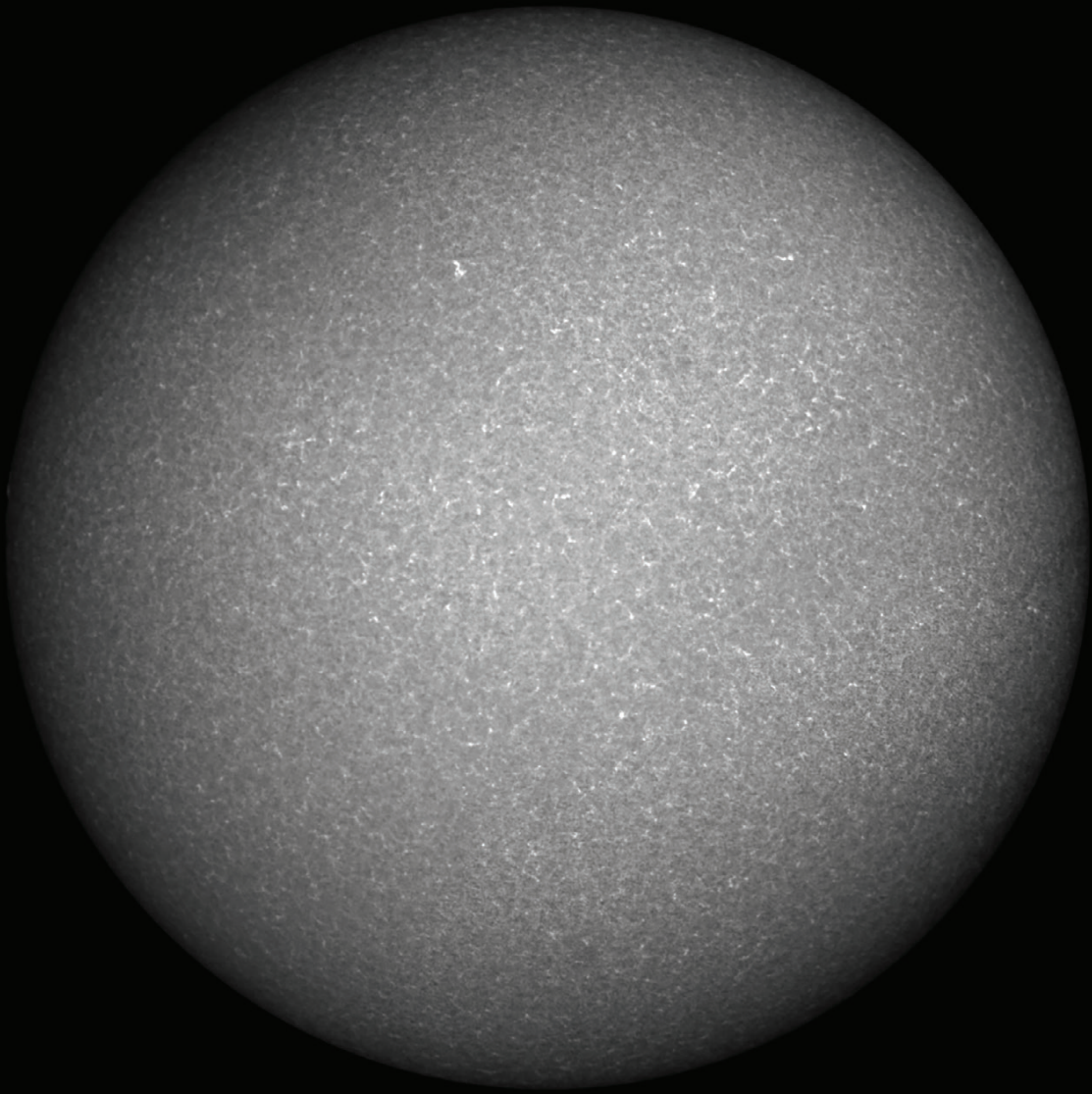
Copies of updated By-Laws were distributed by the meeting and discussed by LAS president, Leigh Pearson. There will be a vote in July. Leigh also talked about the trip to Little Thompson Observatory. LTO is on high school grounds. The scope was donated by a benefactor in California.

Dave Street spoke to members about ways to view the eclipse in Romania.

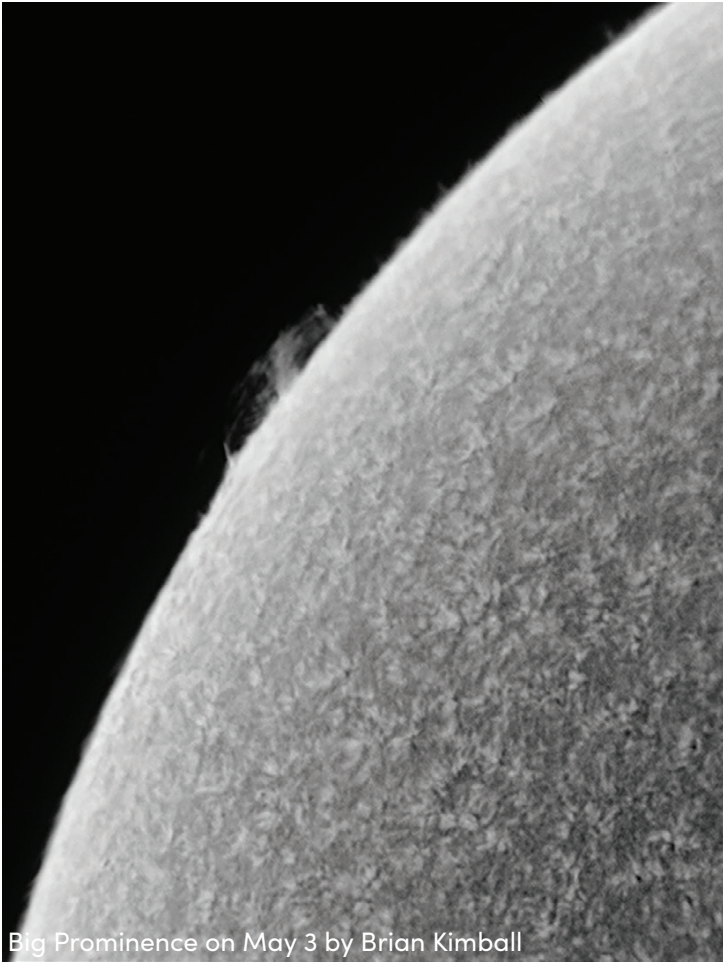
Steve Lynch talked about his recent family trip to Victoria, B. C. They visited the Dominion Observatory Star Party. Observatory mirror was made by Jerry Wilkinson.

June 1989

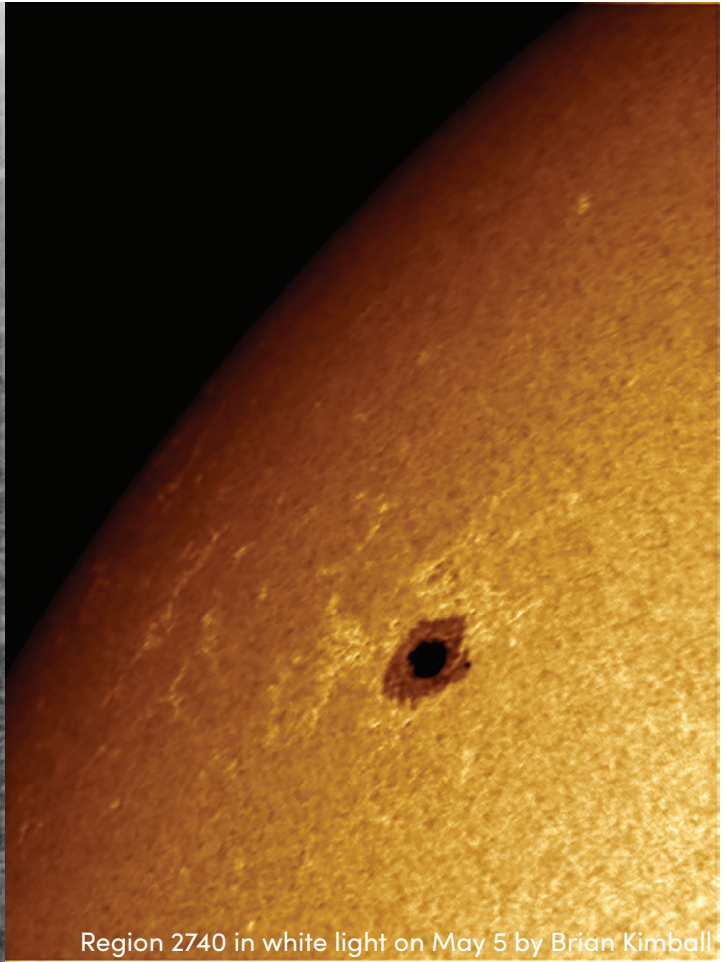
No LAS Newsletter was published for June 1989.



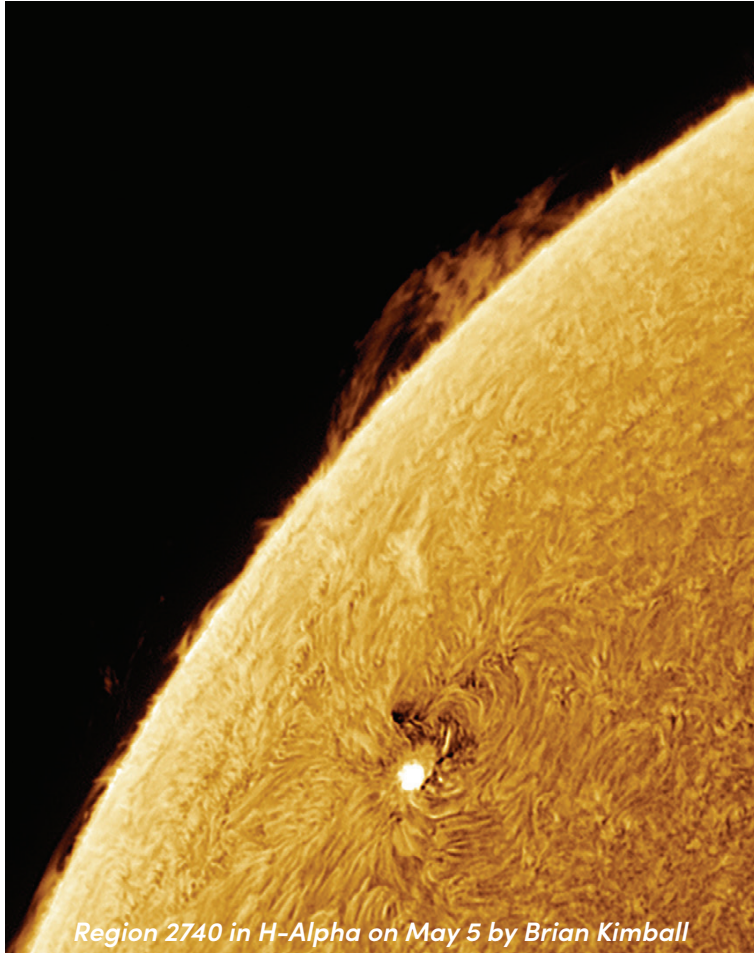
Sun in Calcium K by Brian Kimball



Big Prominence on May 3 by Brian Kimball



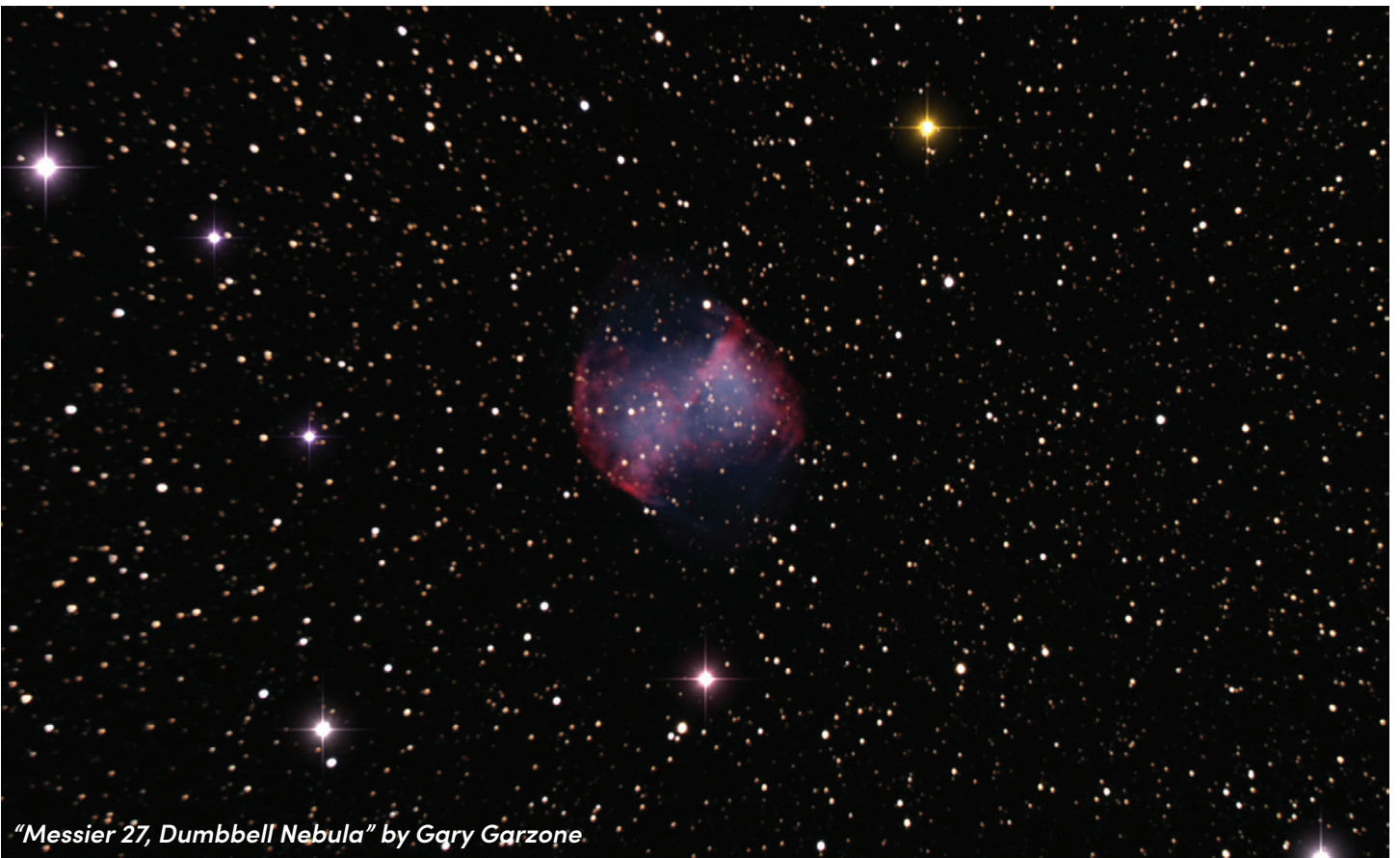
Region 2740 in white light on May 5 by Brian Kimball



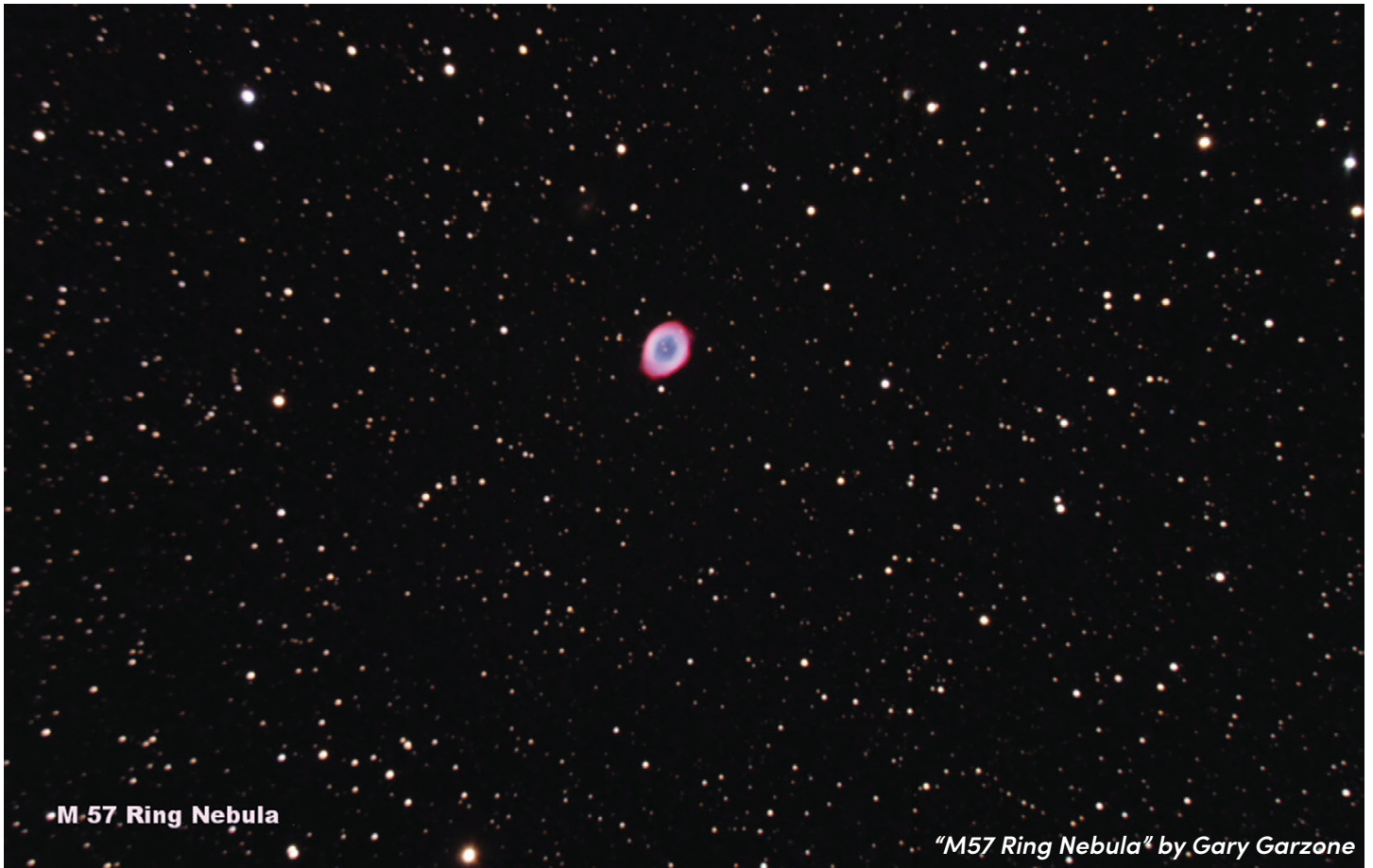
Region 2740 in H-Alpha on May 5 by Brian Kimball



Saturn by Gary Garzone



"Messier 27, Dumbbell Nebula" by Gary Garzone



•M 57 Ring Nebula

"M57 Ring Nebula" by Gary Garzone



"Setting up at Owl Hollow" by Gary Garzone



"NGC 2070 Tarantula Nebula" in H α " by M. J. Post





"M104 Sombrero Galaxy" by M. J. Post

"M1 Crab Nebula" by M. J. Post



"NGC 7000 , North American Nebula" by M. J. Post



"NGC 5170, Blue Horse Nebula" by M. J. Post



"Crescent Nebula" by Stephen Garretson



"M87" by Martin Butley

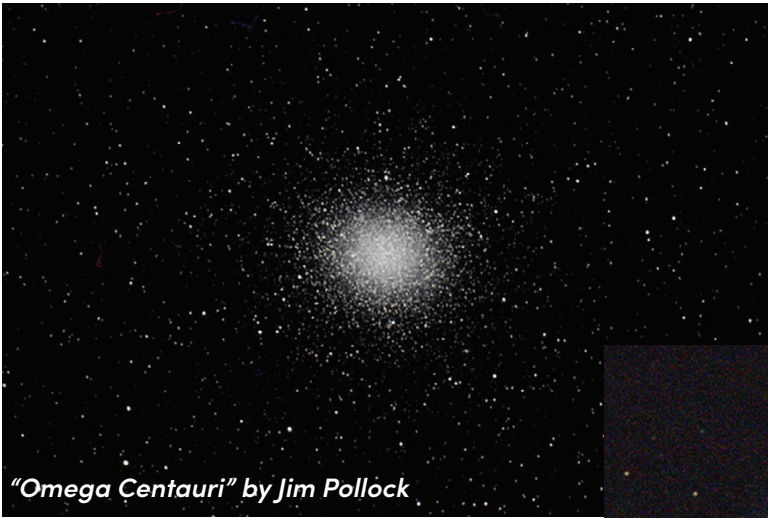
Photograph of the jet from the super massive black hole in Messier 87.

There are two full field images, each with M87 in the center, but the images are stretched differently.

The combined image on the right has been dynamic cropped on the center of each image and combined them in PixelMath so that the jet can be seen against the fainter backdrop of M87 at about two o'clock.



"M87 jet" by Martin Butley



"Omega Centauri" by Jim Pollock



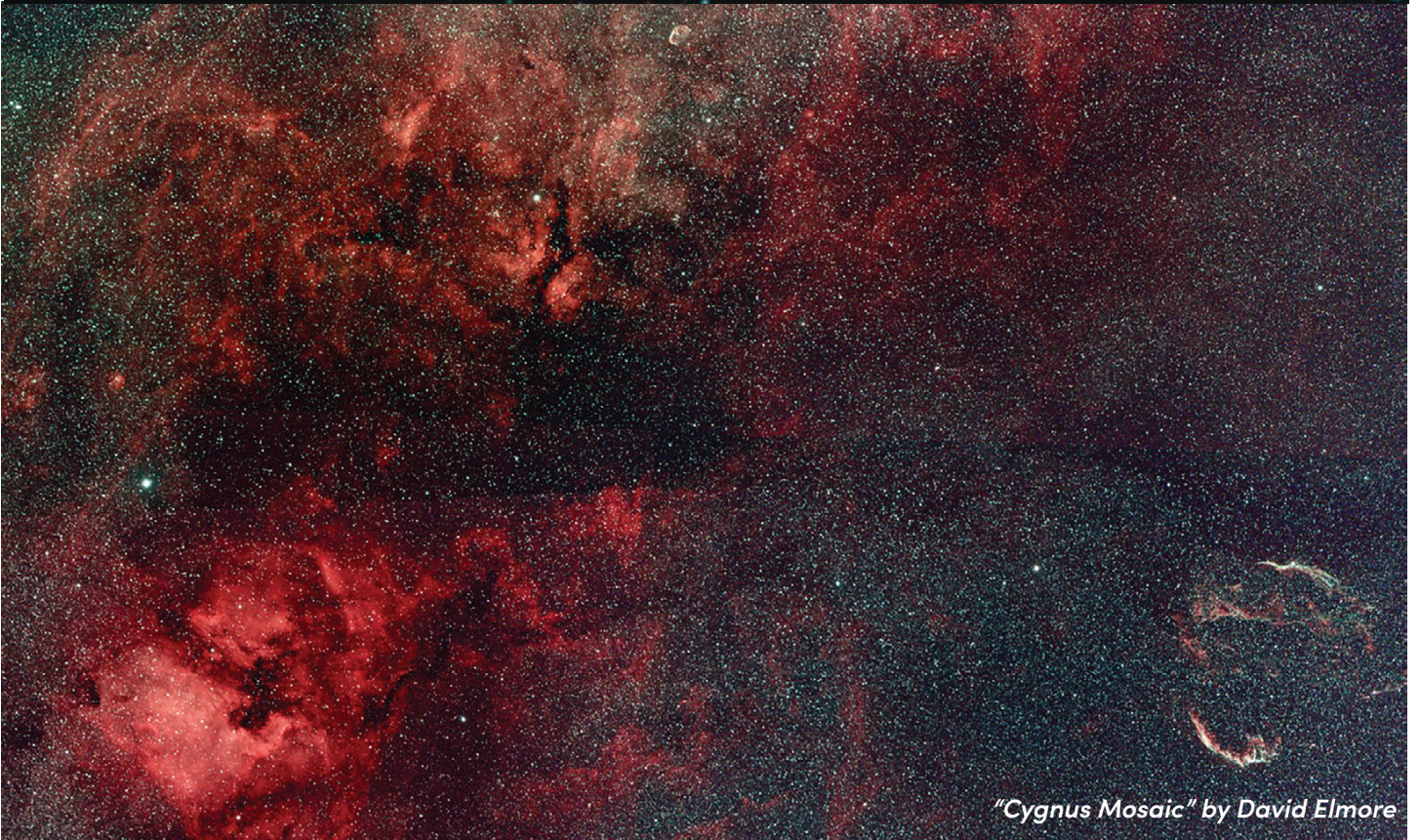
M61 by Jim Pollock



M13 by Glenn Frank



M81 and M82 Galaxies by David Elmore



"Cygnus Mosaic" by David Elmore



"Antares Region" by Tally O'Donnell

Minutes of the May 16 LAS Meeting by Vern Raben

May 16, 2019

1900 hours MDT

Location: First Lutheran Church,
3rd and Terry Street,
Longmont, Colorado.

Bill Tschumy, President, opened
the meeting.

Introductions: New members and visitors:

Ferona, Oliver, Murray, and Aiden.

Introductions: Officers and Board members:

- President: Bill Tschumy
- Vice President: Stephen Garretson
- Treasurer: Marty Butley
- Vern Raben, Board Member
- David Elmore, Board Member
- Tally O'Donnell, Board Member
- Brian Kimball, Board Member
- Gary Garzone, Board Member

Announcements

We had a successful star party at
"Owl Hollow". Bill would like to
continue having more new moon
star parties at that location this
summer. The site near Keota still
has lots of lights from oil opera-
tions; Owl Hollow is preferred for
now.

The event at Sandstone Ranch was
well attended with 35-50 people
there. Lights were not a problem
this time; the site is as good as it
has been in the past.

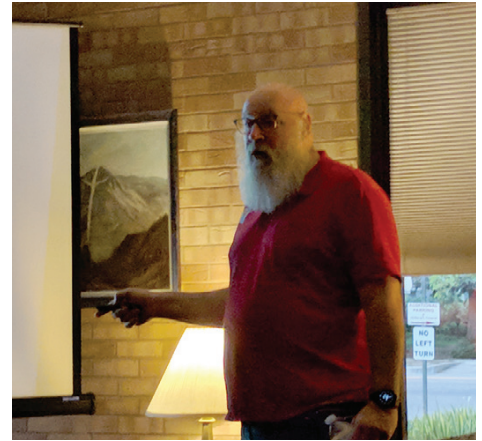
Last Saturday at Rabbit Mountain
it rained just before the event so
not many people came -- only 5;
we had 6 scopes set up. Seeing
was very good, moon was fabu-
lous to view near the terminator.

There will be a solar viewing event
on June 1 at Louisville Public Li-
brary from 10 am to noon. This is
during "Taste of Louisville" so some
down town streets will be blocked
off. Parking is available in the
underground parking area below
the library.

Upcoming monthly star party at
Rabbit Mounting on June 8th 8:30
pm to 10:30 pm. LAS members
may observe until midnight.

The Great Sand Dunes National
Park in southeastern Colorado has
been designated a "Dark Sky Park"
by the International Dark Sky Asso-
ciation.

Presentation by Dr. Hal Levin- son, "Lucy: First Mission to Jupiter's Trojan Asteroids"



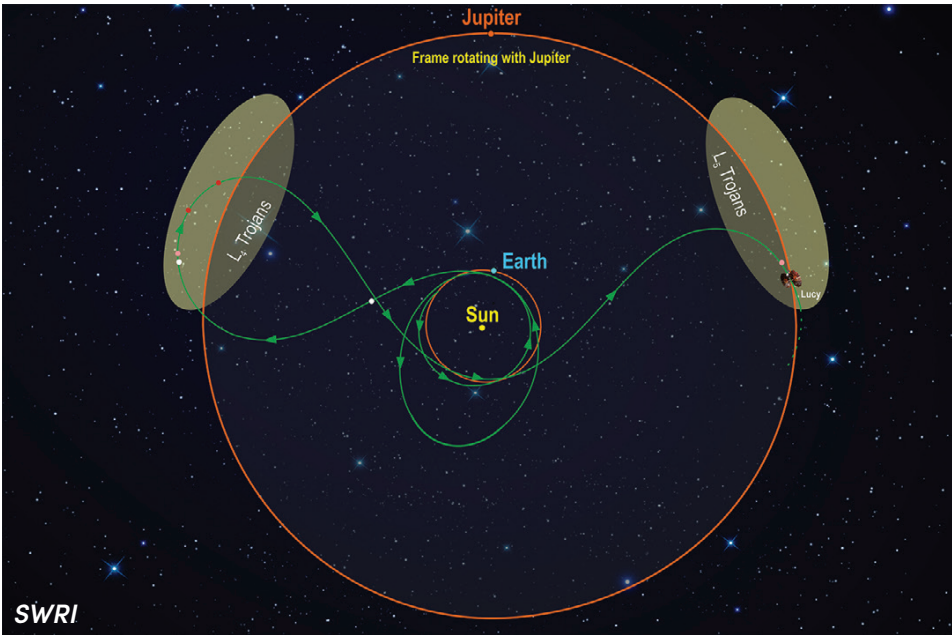
Dr. Hal Levinson is a planetary
scientist working at the Southwest
Research Institute (SWRI) in Boul-
der, CO. He is the principal inves-
tigator on the LUCY mission. He
is co-author of SWIFT, a program
designed to integrate gravitation-
ally interacting bodies with test
particles.



The Lucy mission is funded
through the NASA Discovery
Program. That program funds
missions to answer critical ques-
tions in solar system science. The
missions must be "low cost". Cost
cap for Lucy is \$450 million for de-
velopment (doesn't include costs
for launch and operation). Total
cost is \$918 million through 2033.
Discovery missions are "fun" as
researchers may propose to study
anything in the solar system.



*"Setting up for Sandstone star party" by Bill Tschumy
Left to right: Tally O'Donnell, Bruce Lamoreaux, and David Elmore*



After Lucy is launched in October 2021, it has two close Earth flybys before encountering L4 Trojan targets: (3548) Eurybates (white), (15094) Polymele (pink), (11351) Leucus (red), and (21900) Orus (red) from 2027-2028. There is another Earth flyby visit to get to the L5 targets: (617) Patroclus-Menoetius binary (pink) in 2033. On the way to the L4 in 2025, Lucy will go by the main belt asteroid, (52246) Donaldjohanson (white). Lucy will then continue its orbit between the L4 and L5 clouds every 6 years.

The trojan asteroids are locked forever in orbits at the two Lagrangian points leading and following Jupiter by 60 degrees in its orbit. The Lucy mission will have 5 encounters with trojan asteroids and one main belt asteroid.

There are lots of trojan asteroids (million +), nearly as many as there are main belt asteroids. They are not close together but around 0.1 to 0.2 AU apart.

NASA is spending lots of taxpayer resources studying small bodies in



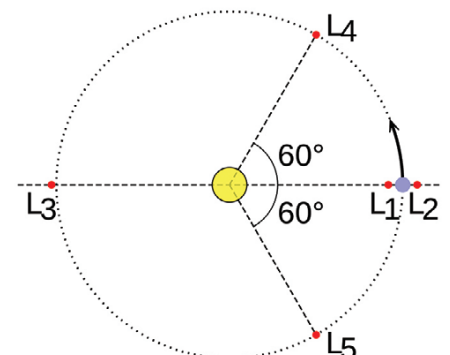
the solar system. Studying small bodies is important as they are material left over after formation of the planets. Planets have evolved a lot after formation. The Trojan asteroids on the other hand are primordial material. An analogy is investigating a crime scene. More can be learned from studying blood spatter on a wall than the body itself.

The Lucy mission is truly one of exploration. We have never visited a trojan asteroid; we do not know what they look like. Planets other than Jupiter have trojan asteroids. Neptune has gas trojans locked in its orbit at its two Lagrangian points.

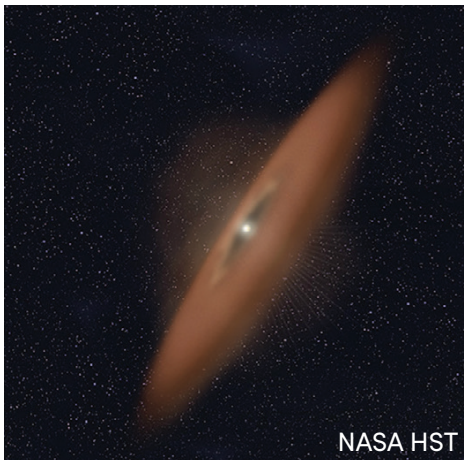
Our studies of trojans show that they are not homogeneous. They have a very different albedo and in fact are quite dark; some have 12 or 13% reflectivity. Others are really -- really, dark; the faintest has a reflectivity of 3%. The aster-

Lagrangian Points

For small objects there are five points in a planet's orbit where gravity and centripetal forces offset each other. The point located 60 degrees ahead (L4) of the planet and the point 60 degrees behind the planet (L5) are stable and small objects may orbit about those points.



oid spectral types of trojan's are D, C, and P. About half the Trojans have a spectral D; about half are spectral type C.

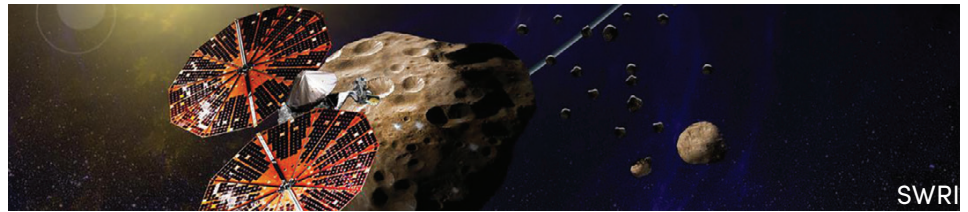


NASA HST

Our ideas about formation of planets in our solar system have changed in the last 5 years. Previously it was thought that the planets were formed by accretion. In the accretion model particles collided with each other which increased gravity and the body was built up in ever increasing layers. Planets were formed with an orbit near their present positions. This is no longer thought to be plausible as it is unstable.

The consensus now is that the objects formed by accretion were only about pebble size. The pebbles migrated toward the star due to gravity. Some of the pebbles then become gravitationally bound as planetesimals (small objects) in the protoplanetary disk. After the initial dissipation of gas and dust of the primordial solar system disks the four giant planets Jupiter, Saturn, Uranus, and Neptune formed in circular orbits objects within 12 to 13 AU from the Sun. There was a disk of material extending to about 38 AU.

As these planets interacted with the planetesimals they scattered



SWRI

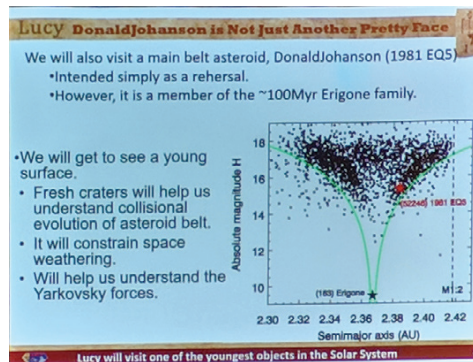
most of them toward the Sun. Energy from this interaction caused Saturn, Neptune, and Uranus to orbit further out. Interaction of Jupiter and Saturn then caused Uranus and Neptune to have even more eccentric orbits. This caused more material to be sent inward (Late Bombardment).

It is hoped that the Lucy mission will verify whether this model (called the Nice model) is true.

Lucy is a flyby mission, typical encounter velocity is 5 to 9 km per second. During the 12 year mission data is collected in about 10 hrs.

Most of the instruments aboard Lucy are clones of the New Horizons mission. Space craft has the largest solar arrays ever flown. It has an articulating scan platform so it can track an object as it flies by it.

Work started in March 2014 in response to a NASA request for proposals. NASA selected 5 of the proposals and gave each group



Above: photo of one of Hal Levinson's slides

\$3 million to prove their proposal could work.

In December 2016 Lucy team submitted a study report with more solid engineering. There was a 9 1/2 hour oral exam in which they were extensively drilled. This is also a test whether or not the team can work under stress.

In the whole history of unmanned space flight there have been only visits to 7 of the main belt asteroids. Lucy will visit 6 objects.

Interested in helping? The Lucy team needs to obtain photometry about some asteroids. Magnitudes are 16-17 so within range of amateur scopes.

To understand shapes and sizes of the asteroids they need volunteers for occultation missions as well. See <http://lucy.swri.edu/getinvolved.html>

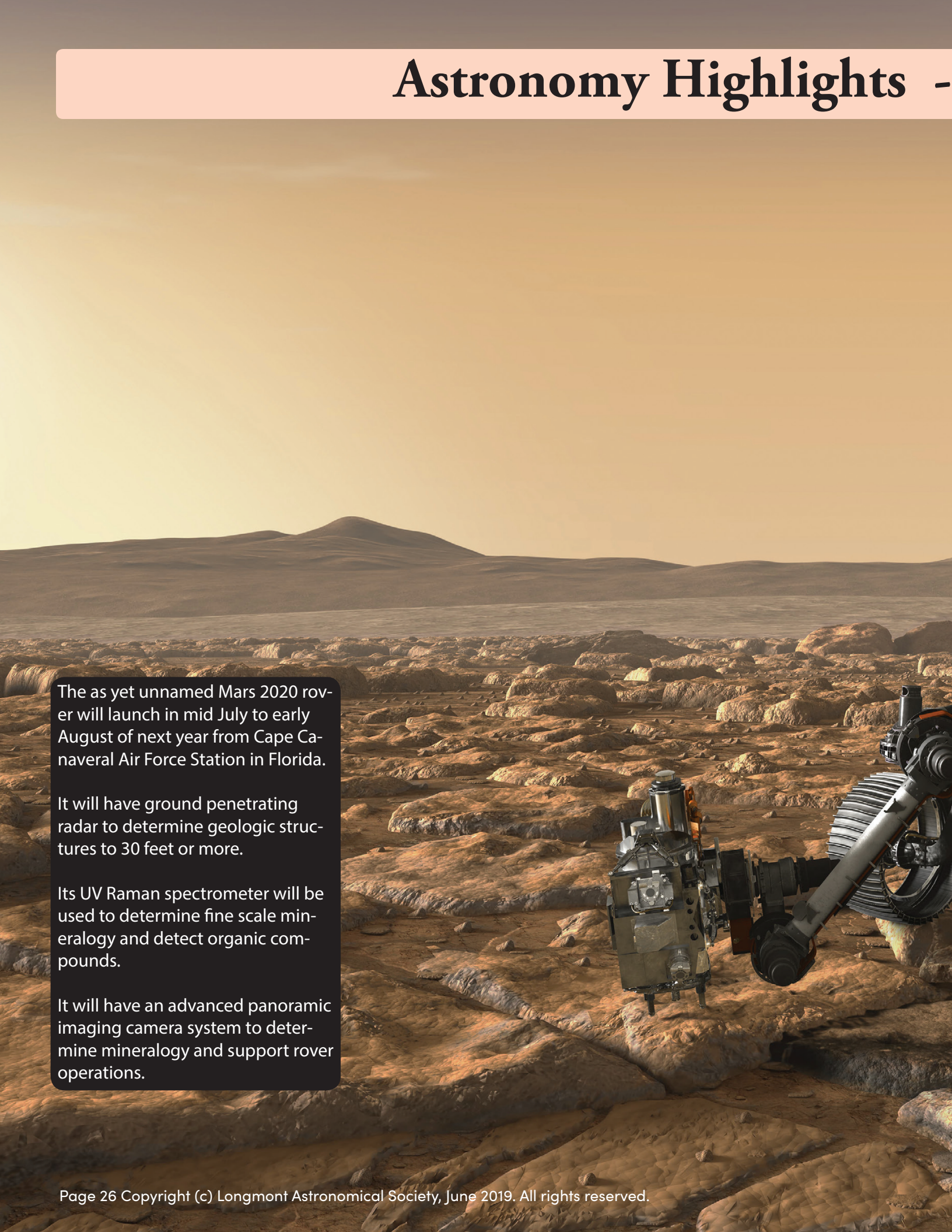
Origin of "trojan asteroid"

In 1772 Italian-French mathematician Joseph-Louis Lagrange obtained solutions of the three-body problem which resulted in 5 possible positions. (See Lagrangian Points below). Conventionally asteroids orbiting near Jupiter's Lagrange points were named after figures from Trojan War in Greek mythology. Asteroids near the L4 had Greek names and those near L5 had Trojan names.

Business Meeting

Oops -- it seems I didn't keep any notes for the business meeting!

Astronomy Highlights -



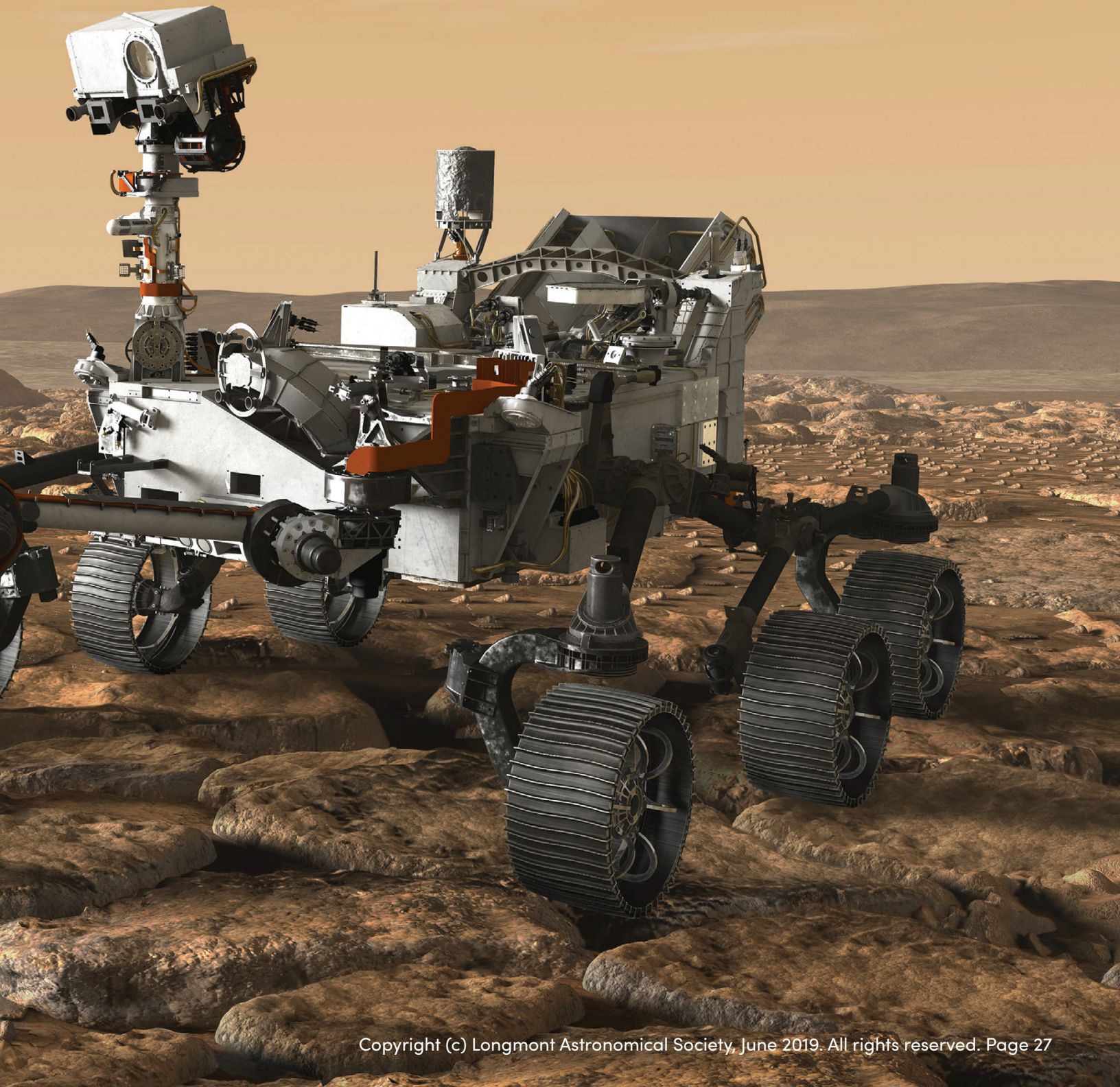
The as yet unnamed Mars 2020 rover will launch in mid July to early August of next year from Cape Canaveral Air Force Station in Florida.

It will have ground penetrating radar to determine geologic structures to 30 feet or more.

Its UV Raman spectrometer will be used to determine fine scale mineralogy and detect organic compounds.

It will have an advanced panoramic imaging camera system to determine mineralogy and support rover operations.

Mars 2020 Rover Mission



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