The Lunar Observer

A publication of the Lunar Section of ALPO

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Back issues: http://www.alpo-astronomy.org/

October 2020

Online readers, click on images for hyperlinks

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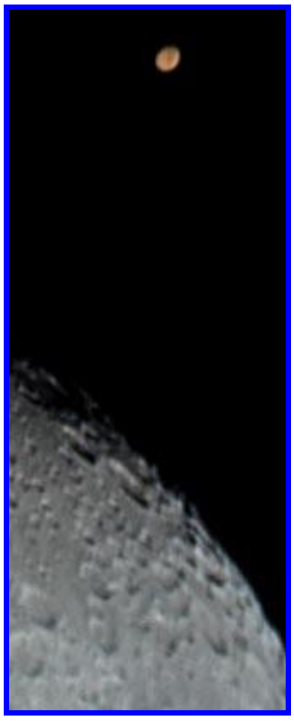

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Mars Attacks!

This month the members of ALPO will focus their attention on the opposition of Mars. This will be our best view of Mars for many years to come, so steal a look at the Red Planet while gazing at the Moon! I really should title this **Moon Attacks Mars,** as we have a number of wonderful images of conjunctions and even occultations of Mars by the Moon. Check out the Recent Topographic Studies for these images.

This issue of The Lunar Observer contains articles on the Moon from Alberto Anunziato, Howard Eskildsen, Rik Hill and David Teske. Also, there are many crisp images of the Moon to study. Tony Cook has another very detailed look at Lunar Geologic Change Detection. October 20, 2020 is the deadline for submissions for the next Focus-On article. In the northern hemisphere, the autumn is a most pleasant time to get out and enjoy the fall skies. Be safe out there and clear skies.

2020 ALPO Conference Announcement

Due to the continuing nearly worldwide quarantining caused by the Corovid-19 pandemic and a possible second wave of infections, the ALPO board of directors has voted to follow the example of many other organizations and will hold the 2020 ALPO Conference online via Zoom, the web conferencing software now commonly used for audio and/or video meetings and other such gatherings.

The dates will be Friday and Saturday, October 2 and 3, 2020. The conference will also be Live Streamed on the ALPO YouTube channel.

As a "virtual" event, this year's ALPO conference will NOT be an in-person event at the University of North Georgia as originally planned. This way, you can participate from the comfort of your own home or office.

The conference times for both days will be from 10 a.m. to 2 p.m. Pacific Time (1 p.m. to 5 p.m. Eastern Time) and allow for seven paper presentation sessions each day. All presentations be limited to approximately 15 minutes each with a few minutes left for audience questions.

The ALPO board of directors meeting will be held on Friday, October 2, at 4 p.m. PT (7 p.m. ET).

The ALPO Conference is open to anyone to attend, however, all presenters must be current members of the ALPO. Digital memberships start at only $18 a year. To join online, go to http://www.astroleague.org/store/index.php?main_page=product_info&cPath=10&products_id=39, then scroll to the bottom of that page, select your membership type, click on "Add to Cart" and proceed from there.

Following a break after the last paper presentation on Saturday afternoon, October 3, will be presentation of the annual Walter Haas Observer Award. This will be followed by our keynote speaker at 4 p.m. PT (7 p.m. ET). With the award presentation and keynote speech usually occurring at the traditional Saturday evening dinner, we suggest that you enjoy your own meal during these last two conference events.

The only hardware required along with your computer are a webcam and microphone. If you will be using a laptop computer, both are already built in to your system. Those with desktop computers can obtain an inexpensive webcam with built-in microphone from either your local computer retailer or online. Then familiarize yourself with their operation now so you are comfortable with enabling and disabling the video and muting and unmuting the microphone in time for our conference.

All attendees must already have Zoom installed on their computer prior to the conference dates.
Zoom is free and available at https://zoom.us/

The Zoom links will be posted on social media and e-mailed out to those who wish to receive it that way on Thursday, October 1. There will be a separate Zoom meeting set up for each day. The Zoom virtual (online) meeting room will open 15 minutes prior to the beginning of each day's activities.

Participants are encouraged to submit research papers, presentations and experience reports concerning various aspects of Earth-based observational solar system astronomy. Suggested topics for papers and presentations include the following:
• New or ongoing observing programs and studies, specifically, how those programs were designed, implemented and continue to function.
• Results of personal or group studies of solar system or extra-solar system bodies.
• New or ongoing activities involving astronomical instrumentation, construction or improvement.
• Challenges faced by Earth-based observers such as changing interest levels, observing conditions, the SpaceX "Starlink" artificial satellite program, etc.

Those individuals wishing to present a paper should submit their request to Tim Robertson at cometman@cometman.net no later than Monday, September 21, along with a brief bio and summary of their presentation. Microsoft PowerPoint is the preferred method of visual presentation along with an audio explanation.

A follow-up announcement to this one will be issued soon with more details as they develop.

Lunar Calendar October 2020

Date	Time UT	Event
October 1	2105	Full Moon
1		North limb most exposed +6.6°
3	0300	Mars 0.7° north of Moon, occultation SE South America, SW Africa
3	1700	Moon at apogee, 406,322 km
4	0900	Uranus 3° north of Moon
8	2000	Moon 0.02° south of M35
10	0039	Last Quarter Moon
10		Moon at greatest northern declination +24.5°
11		West limb most exposed, -7.7°
15		South limb most exposed -6.6°
16	1931	New Moon, lunation 1210
17	0000	Moon at perigee, 356,912 km, large tides
22	1700	Jupiter 2° north of Moon
22		Moon at greatest southern declination -27.7°
23		East limb most exposed +7.7°
23	0400	Saturn 3° north of Moon
23	1323	First Quarter Moon
28		North limb most exposed +7.7°
29	1600	Mars 3° north of Moon
30	1900	Moon at apogee, 406,394 km
31	1300	Uranus 3° north of Moon
31	1449	Full Moon, smallest of 2020

The Lunar Observer welcomes all lunar related images, drawings, articles, reviews of equipment and reviews of books. You do not have to be a member of ALPO to submit material, though membership is highly encouraged. Please see below for membership and near the end of *The Lunar Observer* for submission guidelines.

Comments and suggestions? Please send to David Teske, contact information page 1. Need a hard copy, please contact David Teske.

AN INVITATION TO JOIN THE A.L.P.O.

The Lunar Observer is a publication of the Association of Lunar and Planetary Observers that is available for access and participation by non- members free of charge, but there is more to the A.L.P.O. than a monthly lunar newsletter. If you are a nonmember you are invited to join our organization for its many other advantages.

We have sections devoted to the observation of all types of bodies found in our solar system. Section coordinators collect and study members' observations, correspond with observers, encourage beginners, and contribute reports to our Journal at appropriate intervals.

Our quarterly journal, *The Journal of the Association of Lunar and Planetary Observers-The Strolling Astronomer*, contains the results of the many observing programs which we sponsor including the drawings and images produced by individual amateurs. Additional information about the A.L.P.O. and its Journal is on-line at: **http://www.alpo-astronomy.org.** I invite you to spend a few minutes browsing the Section Pages to learn more about the fine work being done by your fellow amateur astronomers.

To learn more about membership in the A.L.P.O. go to: **http://www.alpo- astronomy.org/main/member.html** which now also provides links so that you can enroll and pay your membership dues online.

Lunar Topographic Studies

Acting Coordinator – David Teske - david.teske@alpo-astronomy.org
Assistant Coordinator – William Dembowski - dembowski@zone-vx.com
Assistant Coordinator – Jerry Hubbell – jerry.hubbell@alpo-astronomy.org
Assistant Coordinator-Wayne Bailey– wayne.bailey@alpo-astronomy.org
Website: http://www.alpo-astronomy.org/

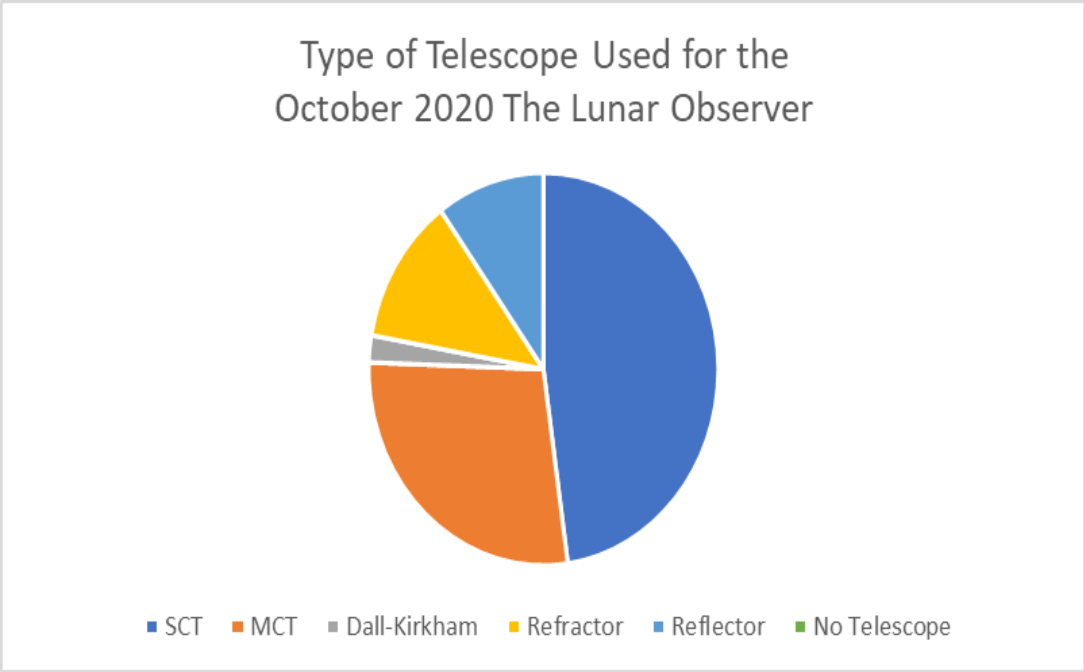
Observations Received

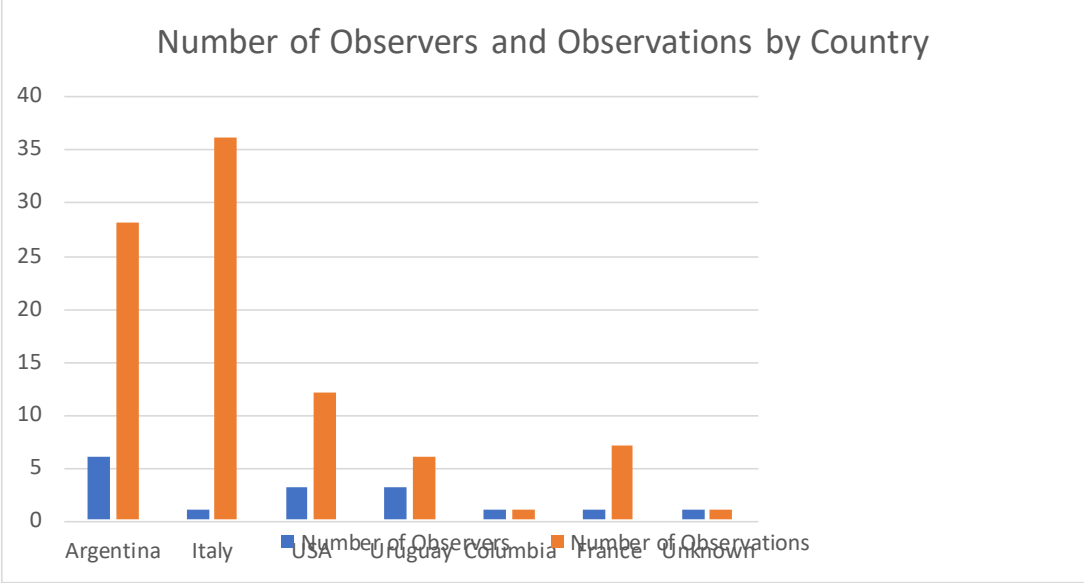
Name	Location and Organization	Article/image
Alberto Anunziato	Oro Verde, Argentina	Article and image *Philolaus, Land of Adventure.*
Sergio Babino	Montevideo, Uruguay	Images of the Moon and Mars.
Ariel Cappelletti	Córdoba, Argentina, SLA	Images of Clavius, Copernicus, Eratosthenes, Gassendi, Montes Alpes and Tycho.
Francisco Alsina Cardinalli	Oro Verde, Argentina, SLA	Images of Sinus Iridum and Anaxagoras.
Jairo Chavez	Popayán, Colombia	Image of the Full Moon.
Michel Deconinck	Aquarellia Observatory, Artignosc-sur-Verdon Provence, France	Pastels of the Moon-Mars conjunction, Archimedes, Aristarchus, Fracastorius, Mare Frigoris, Messier and Schiller
Howard Eskildsen	Ocala, Florida, USA	Article and image of *Mare Humorum Region*, image of Marius and the northwest Moon.
Diego Etchevers	Montevideo, Uruguay	Image of the Moon and Jupiter.
Desiré Godoy	Oro Verde, Argentina, SLA	Images of Parrot and Eudoxus.
Isbel Gonzalez	Roselle, New Jersey, USA	Images of Plato to Aristoteles, Altai to Theophilus, Maurolycus to Piccolomini, Copernicus, Plato to Anaxagoras and Tycho.
Guilherme Grassmann		Image of occultation of Mars by Moon.
Rik Hill	Tucson, Arizona, USA	Image and article Northland.
Richard Martin	Pando, Uruguay	Images of the Moon and Mars conjunction (3).
Raúl Roberto Podestá	SLA, Formosa, Argentina	Images of the Moon and Mars occultation (7).
Sid, Leandro	AEA, Oro Verde, Argentina	Images of the Moon and Mars Conjunction (2), Picard, waxing gibbous Moon, Proclus (3), Gassendi and Herodotus.
David Teske	Louisville, Mississippi, USA	Article and image *Follow those Rays.*
Fabio Verza	SNdR Luna UAI - Italy	Images of the Aepinus (2), de la Rue, Condorcet, Cleomedes, Geminus, Langrenus, Mare Crisium (2), Mare Humboldtianum, Mercurius, Messala, Messier (3), Petermann, Petavius, Xenophanes, Aristoteles, Atlas, Copernicus (2), Endymion, Eudoxus, Janssen, Julius Caesar, Lacus Mortis, Lacus Spei, Mare Marginis, Maurolycus, Posidonius, Theophilus, Plato and Sinus Iridum.

Many thanks for all these observations, images, and drawings.

October 2020 *The Lunar Observer*
By the Numbers

This month there were 91 observations by 16 observers from 7 countries.





SUBMISSION THROUGH THE ALPO IMAGE ARCHIVE

ALPO's archives go back many years and preserve the many observations and reports made by amateur astronomers. ALPO's galleries allow you to see on-line the thumbnail images of the submitted pictures/observations, as well as full size versions. It now is as simple as sending an email to include your images in the archives. Simply attach the image to an email addressed to

lunar@alpo-astronomy.org (lunar images).

It is helpful if the filenames follow the naming convention :

FEATURE-NAME_YYYY-MM-DD-HHMM.ext

YYYY {0..9} Year

MM {0..9} Month

DD {0..9} Day

HH {0..9} Hour (UT)

MM {0..9} Minute (UT)

.ext (file type extension)

(NO spaces or special characters other than "_" or "-". Spaces within a feature name should be replaced by "-".)
As an example the following file name would be a valid filename:

Sinus-Iridum_2018-04-25-0916.jpg
(Feature Sinus Iridum, Year 2018, Month April, Day 25, UT Time 09 hr16 min)

Additional information requested for lunar images (next page) should, if possible, be included on the image. Alternatively, include the information in the submittal e-mail, and/or in the file name (in which case, the coordinator will superimpose it on the image before archiving). As always, additional commentary is always welcome and should be included in the submittal email, or attached as a separate file.

If the filename does not conform to the standard, the staff member who uploads the image into the data base will make the changes prior to uploading the image(s). However, use of the recommended format, reduces the effort to post the images significantly. Observers who submit digital versions of drawings should scan their images at a resolution of 72 dpi and save the file as a 8 1/2"x 11" or A4 sized picture.

Finally a word to the type and size of the submitted images. It is recommended that the image type of the file submitted be jpg. Other file types (such as png, bmp or tif) may be submitted, but may be converted to jpg at the discretion of the coordinator. Use the minimum file size that retains image detail (use jpg quality settings. Most single frame images are adequately represented at 200-300 kB). However, images intended for photometric analysis should be submitted as tif or bmp files to avoid lossy compression.

Images may still be submitted directly to the coordinators (as described on the next page). However, since all images submitted through the on-line gallery will be automatically forwarded to the coordinators, it has the advantage of not changing if coordinators change.

When submitting observations to the A.L.P.O. Lunar Section

In addition to information specifically related to the observing program being addressed, the following data should be included:

Name and location of observer
Name of feature
Date and time (UT) of observation (use month name or specify mm-dd-yyyy-hhmm or yyyy-mm-dd-hhmm)
Filter (if used)
Size and type of telescope used Magnification (for sketches)
Medium employed (for photos and electronic images)
Orientation of image: (North/South - East/West)
Seeing: 0 to 10 (0-Worst 10-Best)
Transparency: 1 to 6

Resolution appropriate to the image detail is preferred-it is not necessary to reduce the size of images. *Additional commentary accompanying images is always welcome.* **Items in bold are required. Submissions lacking this basic information will be discarded.**

Digitally submitted images should be sent to:
David Teske – david.teske@alpo-astronomy.org
Jerry Hubbell –jerry.hubbell@alpo-astronomy.org
Wayne Bailey—wayne.bailey@alpo-astronomy.org

Hard copy submissions should be mailed to David Teske at the address on page one.

CALL FOR OBSERVATIONS: FOCUS ON: Lunar 100

Focus on is a bi-monthly series of articles, which includes observations received for a specific feature or class of features. The subject for the November 2020 edition will be the Lunar 100 numbers 31-40. Observations at all phases and of all kinds (electronic or film based images, drawings, etc.) are welcomed and invited. Keep in mind that observations do not have to be recent ones, so search your files and/or add these features to your observing list and send your favorites to (both):
Jerry Hubbell –jerry.hubbell@alpo-astronomy.org
David Teske – david.teske@alpo-astronomy.org

Deadline for inclusion in the Lunar 100 numbers 31-40 article is October. 20, 2020

FUTURE FOCUS ON ARTICLES:

In order to provide more lead time for contributors the following future targets have been selected: The next series of three will concentrate on subjects of the Selected Areas Program.

Subject	TLO Issue	Deadline
Lunar 100 (numbers 31-40)	**November 2020**	**October 20, 2020**
Lunar 100 (numbers 41-50)	**January 2021**	**December 21, 2020**

Focus-On Announcement

We are pleased to announce the future Focus-On topics. These will be based on the Lunar 100 by Charles Wood. Every other month starting in May 2020 , the Focus-On articles will explore ten of the Lunar 100 targets. Targets 31-40 will be featured in the November 2020 *The Lunar Observer*. Submissions of articles, drawings, images, etc. due by October 20, 2020 to David Teske and Jerry Hubbell.

L	FEATURE NAME	SIGNIFICANCE	RUKL CHART
31	Taruntius	Young floor-fractured crater	37
32	Arago Alpha & Beta	Volcanic domes	35
33	Serpentine Ridge	Basin inner-ring segment	24
34	Lacus Mortis	Strange crater with rille & ridge	14
35	Triesnecker Rilles	Rille family	33
36	Grimaldi basin	A small two-ring basin	39
37	Bailly	Barely discernible basin	71
38	Sabine and Ritter	Possible twin impacts	35
39	Schickard	Crater floor with Orientale basin ejecta	62
40	Janssen Rille	Rare example of highland rille	67, 68

Explore the Lunar 100 on the link below:

https://www.skyandtelescope.com/observing/celestial-objects-to-watch/the-lunar-100/

The Lunar 100: Features 1-10	May 2020 Issue – Due April 20, 2020
The Lunar 100: Features 11-20	July 2020 Issue – Due June 20, 2020
The Lunar 100: Features 21-30	September 2020 Issue – Due August 20, 2020
The Lunar 100: Features 31-40	November 2020 Issue – Due October 20, 2020
The Lunar 100: Features 41-50	January 2021 Issue – Due December 20, 2020
The Lunar 100: Features 51-60	March 2021 Issue – Due February 20, 2021
The Lunar 100: Features 61-70	May 2021 Issue – Due April 20, 2021
The Lunar 100: Features 71-80	July 2021 Issue – Due June 20, 2021
The Lunar 100: Features 81-90	September 2021 Issue – Due August 20, 2021
The Lunar 100: Features 91-100	November 2021 Issue – Due October 20, 2021

Jerry Hubbell –jerry.hubbell@alpo-astronomy.org
David Teske – david.teske@alpo-astronomy.org

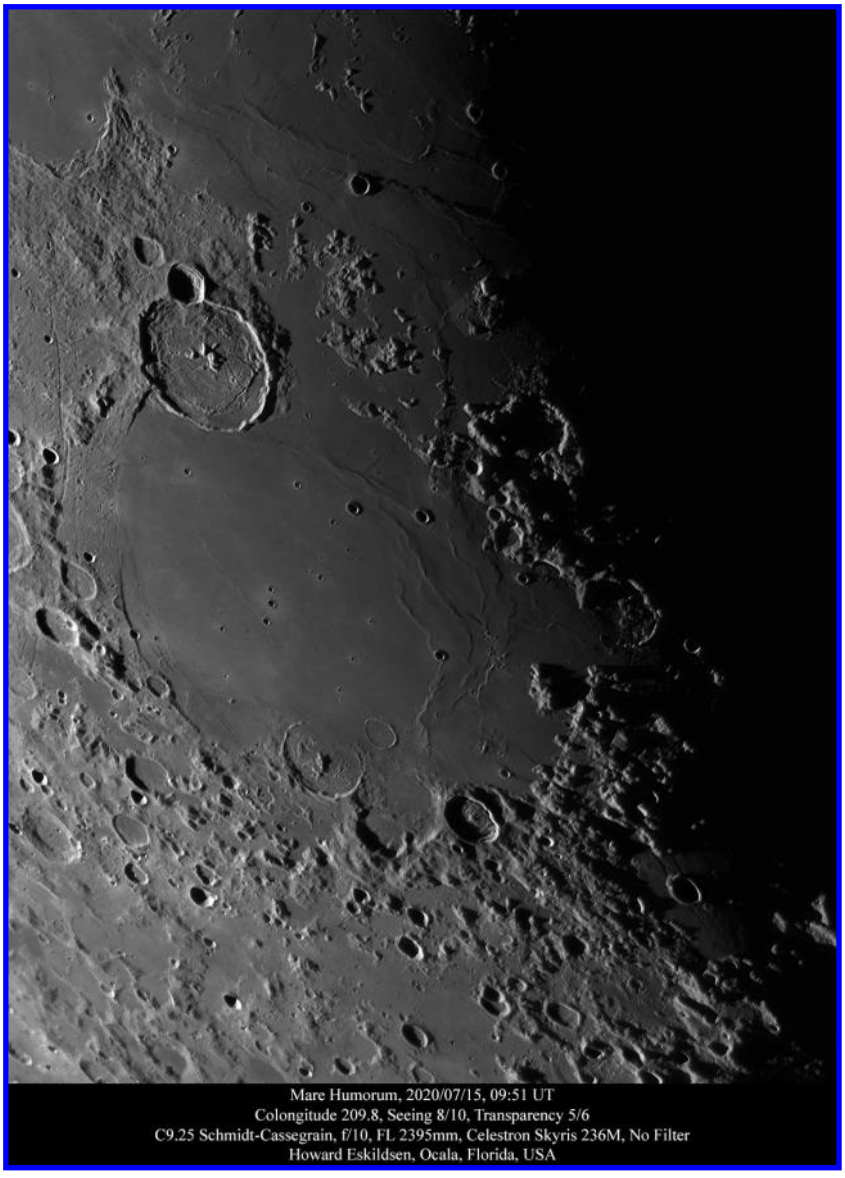
Mare Humorum Region

Howard Eskildsen

The upper left image is dominated by two tilted craters of similar size, Letronne and Gassendi, which have differing levels of basaltic filling. The crescent of Letronne's crater wall disappears under the Procellarum mare lava flows with its central peaks peering just above the basalt. A wrinkle ridge skirts the peaks' western margin. To its southeast, Gassendi tilts in the opposite direction towards the Mare Humorum. Lava invades Gassendi's southernmost interior, but the rim is intact. The floor has been fractured and elevated with multiple rilles coursing about its floor. Rimae Mersenius courses about 230 km vertically, left of Gassendi and Mare Humorum.

The upper central image is crossed by wrinkle ridges that are in turn breached by the sinuous Rimae Herigonius. These channels may have carried some of the last of the basalt flows into northern Humorum. I wonder if any lava tubes might still be present along their course, somewhere below the surface.

Mare Humorum dominates the central part of the image with notable wrinkle ridges along its eastern margin. On the western side, Rupes Liebig rises up to 580 meters above the mare, however, farther north a subtle wrinkle ridge, passing east of Rupes Liebig, intersects the western edge of Mare Humorum. At this area, LROC QuickMap measurements reveal that the mare margin is over 100 meters higher than the outside adjacent area, raising the question of an overthrust fault there. At the possible overthrust area, the mare is nearly 50 meters higher than at the mid-Rupes Liebig area, and the outside adjacent area is 820 meters lower near the "overthrust" than at the rupes. It is certainly strange to see this change in elevation of the western mare relative to its immediately surrounding terrain and raises questions as to how it came to be.



Mare Humorum, 2020/07/15, 09:51 UT
Colongitude 209.8, Seeing 8/10, Transparency 5/6
C9.25 Schmidt-Cassegrain, f/10, FL 2395mm, Celestron Skyris 236M, No Filter
Howard Eskildsen, Ocala, Florida, USA

To the south, Doppelmayer mirrors Gassendi and tilts into Humorum, but parts of its northeastern rim have been completely covered by the basalt. Nearby, all that remains of Puiseux is a thin rim and a hint of a central peak poking through the lava. Vitello shows the fractured floor of its shadowy interior, devoid of mare lava flows. Rupes Kelvin and Promontorium Kelvin lie at the southeastern margin of the mare, and to the north, badly battered craters Hippalus and Agatharchides lurk in the shadows of the setting Sun.

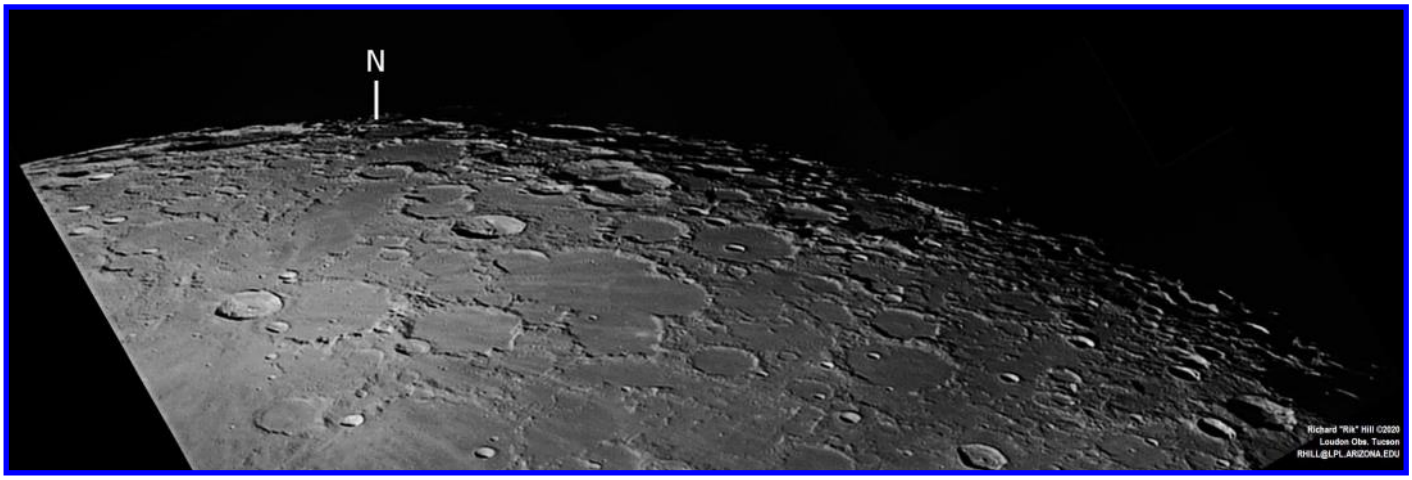
South of the mare, Palmieri reveals rilles crossing its floor, and in the opposite corner, the ring of Ramsden gleams in the last rays of sunlight, seemingly nestled among its namesake rilles.

Northland

Rik Hill

What we are getting here is a pretty good look at the north polar regions of the Moon during a relatively favorable libration. The location of the pole itself is denoted by the "N" marker so we can begin our exploration with that. There is a large foreshortened crater just to the left of the marker. This is Hermite (114 km diameter). To the immediate lower right of the marker is Peary (77 km) and just a little further to the lower left is Byrd (97 km) both north pole explorers on Earth. On the near edge of Byrd is a very nicely defined crater Gioja (43 km) on the edge of that crater directly under the marker. Farther down and slightly left, we see a well-defined fairly recent crater (within the last billion years) with a faint but well defined ray system, Anaxagoras (53 km).

Over to the right Anaxagoras overlaps an old crater, Goldschmidt (124 km) and farther right is Barrow (95 km), a crater that should be watched for interesting shadow play at sunrise. Edging a little further right is a large cloverleaf shaped feature, Meton that is the merge of four craters with the central plain listed as 126 km with each of the side lobes having their own satellite designations and diameters. Meton is listed as 3.9-4.5 billion years old (b.y.o.) and is one of the more distinctive features on the north end of the moon. Just above this is the much younger crater Scoresby (58 km) and less than 3.2 b.y.o. To the upper right of this is a large crater with a distinctive small fresh crater on its floor, Baillaud (94 km) sort of a double crater with Euctemon (68 km) adjacent to the upper left. Both of these craters may also be as old as 4.5 billion years! To the lower left is another similar crater with a small satellite crater on its floor, Arnold (99 km). Then down in the lower right corner, above the name tag, is our last crater, Strabo (56 km). You can see some of the terracing as the sun sets on this *impact* crater named for the man who was known for his commentary on *volcanism*!



Meton North, *Richard Hill, Loudon Observatory, Tucson Arizona, USA. 06 August 2020 07:24 UT, colongitude 121.1°. 6 inch Dynamax Schmidt-Cassegrain telescope, 2x barlow, 665 nm filter, Skyris 132 M camera. Seeing 7-8/10.*

Philolaus, Land of Adventure

Alberto Anunziato

This image belongs to an observing session that we did from the most important observatory in my province, Entre Ríos (Argentina), the Galileo Galilei Observatory, of our friend César Fornari. More than 4 years ago this image was relegated, probably because half is in black. It therefore has something melancholic about it. The panorama of the lunar north in the terminator is extremely interesting. Starting with Mare Imbrium, we have the almost twin craters Le Verrier and Helicon, in Sinus Iridum is the brightest point of the scene, the Promontorium Laplace (2600 meters high), towards the terminator we find the Montes Recti shining like a jewel in the oblique sunlight revealing its brightest points, as well as the Montes Teneriffe, almost completely covered by shadows. The thin strip of Mare Frigoris shows an intricate network of dorsa. Going towards the pole we find the highlight of this image, the Copernican crater Philolaus (71 km diameter): a deep crater with terraced walls (which are not very well distinguished) and twin central peaks (easier to see). As Peter Grego puts it: "Low illumination will reveal that Philolaus is superimposed upon a larger, more ancient and eroded crater to its southwest" (The Moon and How to Observe It", page 157). Going to the left we have a series of craters of very different ages, the Pre-Nectarian Anaximenes, which, due to its proximity to the limbus, appears very elongated, the Eratosthenian Carpenter, very deep and with pronounced terraces, but to the left come two other very old and eroded craters, the Pre-Nectarian Anaximander and J. Herschel, and on the left edge we find Pythagoras, another Eratosthenian crater with high terrace walls, a double central peak and a floor covered by lava.

Pascal Lee, in "Philolaus Crater: Exploring Candidate Lava Tubes And Skylights Near The Lunar North Pole" at NASA's Lunar Science for Landed Missions Workshop 2018, highlighted the enormous importance of Philolaus: it would have a possible lava tube that is located in the north polar region: "We report here on the identification of candidate lava tubes skylights along sections of discontinuous sinuous rilles in the impact melt deposits on the floor of Philolaus Crater in the North Polar region of the Moon. The finding is of significance because: a) Philolaus Crater is of Copernican age and the impact melt deposits on its central Eastern floor are among the youngest lava flows known on the Moon; and b): Philolaus Crater's candidate skylights represent potential access points to a large near polar network of subsurface cavities. Relatively young age, proximity to the pole, and large subsurface void space mean optimal conditions for potentially accessing cold-trapped subsurface volatiles". Philolaus is a land for adventure: "Exploration of Philolaus' relatively young and little modified lava tubes might give access to well-preserved volcanic volatiles and cold-trapped subsurface H_2O ice. Exploring Philolaus' skylights and lava tubes would also help prepare for the exploration of analogous features on Mars. Landing Site Characterization Relatively smooth landing areas are available on the floor of Philolaus Crater near the candidate lava tube skylights sites. Earth is directly visible from most locations of Philolaus' impact melt deposits above the potential lava tube network". Pascal Lee did think it right. See you on Philolaus!

Philolaus, *Alberto Anunziato, Oro Verde, Argentina. 30 April 2016 05:50 UT. Meade LX 200 10 inch Schmidt-Cassegrain telescope, QHY5-II camera.*

Follow Those Rays

David Teske

In this view of the northwest Moon we see rays of many craters, as this is imaged in the afternoon Sun. Rays are pulverized rock fragments that are sprayed out from relatively recent impacts. Over the long course of lunar time, these rays gradually fade way. Craters of Copernican age (1.1 billion years old or younger) have rays, but older craters, of Eratosthenian period (1.1 to 3.2 billion years old) or older do not have rays as they have been eroded by the constant pelting of micrometeorites and a steady bombardment of solar wind.

Off the center right (east) side of the image, we see some of the magnificent rays of Kepler. In the upper center, we see Aristarchus and its rays on full display. Towards the lower left (southwest), the dominant crater that has bright rays is the crater Glushko. Perhaps my favorite "ray" is not a ray at all. Towards the bottom center of this image is Gamma Reiner, which appears bright and flat like a ray. Rather than being made of pulverized rock shot out by a crater impact, this pulverized, bright rock is the site of one of the strongest lunar magnetic fields. Perhaps these magnetic fields keep the solar wind from weathering the rock so much. Look carefully at Gamma Reiner, as it has tails of ray material that tail off to its north and south.

I bring your attention to two very mysterious crater rays in this image. First, to the west of Aristarchus are the ancient, large, degraded craters Eddington, Struve and Russell. Just north of Russell are three rays that trace back to the limb of the Moon. These are from a crater on the lunar far side! The crater on the other side is the crater Ohm. The rays of Ohm extend some 1,130 km across the highland on the lunar far side and then continue through the middle of Russell, as well as north and south of Russell. The northern ray is most visible and extends onto Oceanus Procellarum.

A second mysterious crater ray is very near this location. At about 10:00 from Aristarchus, three quarters the way across Oceanus Procellarum is the rayed crater Lichtenberg. At 20 km in diameter, Lichtenberg is a young Copernican age crater because of its bright rays. Investigating closely, these rays are bright and normal except that they are missing to the southeast of Lichtenberg. The most likely cause for this is dark lavas emerged after the formation on Lichtenberg and covered its rays. This indicates that there were still major lava eruptions long after the major basins were flooded between 3.8 and 2.5 billion years ago. Since the rays are younger than 1 billion years old, the lavas must be younger than that, apparently the youngest on the Moon. These Lichtenberg lavas are very young at 900 million years old. Even though these lavas are "young", life on Earth at the time was single-celled bacteria.

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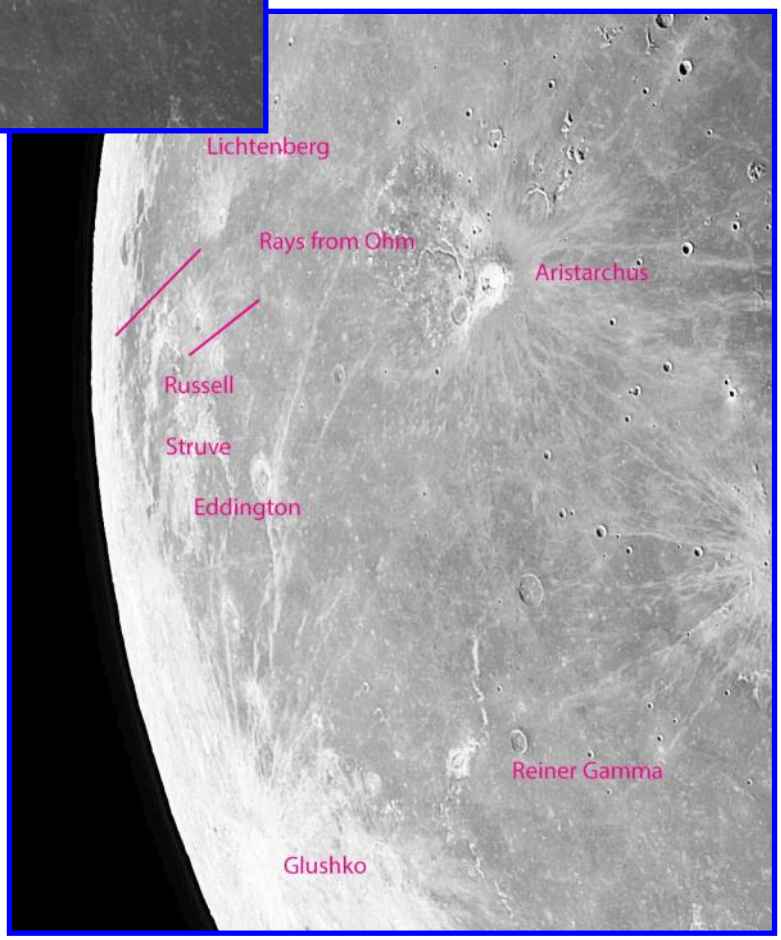
Wood, Charles. 2003. The Moon: A Personal View. Sky Publishing Corp. Cambridge.

Wood, Charles. 2020. "Peering Over the Limb, Exploring the Moon". Sky and Telescope, June 2020 pages 52-53.

Northwest Moon, *David Teske, Louisville, Mississippi, USA. 10 September 2020 10:02 UT colongitude 183.8°. 4 inch f/15 refractor telescope, IR block filter, ZWO ASI 120 mm/s camera, Firecapture, Registax, Photoshop. Seeing 8/10.*



A Load of Bullialdus

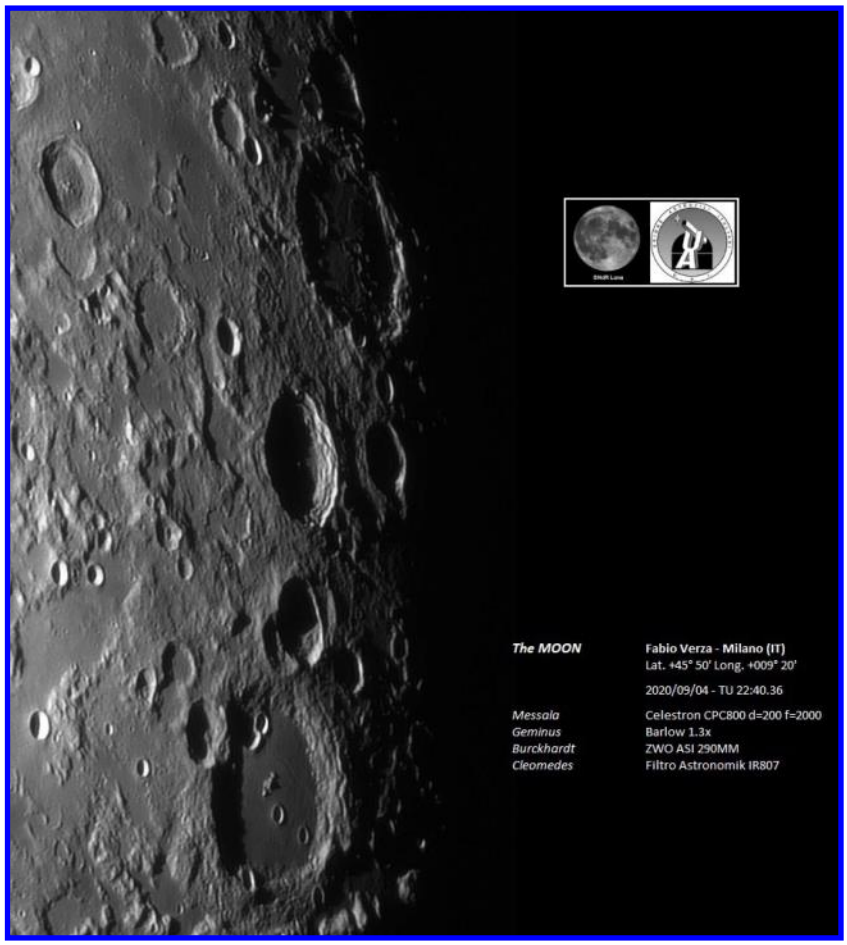
Rik Hill

A little over 10 days after new moon you get the terminator cutting through the great crater, Gassendi (114 km) on the left side of this image. It presents a very dramatic sight during sunrise but even more so as the rising Sun reveals the tortured floor of this crater in the succeeding days. Here we see the central peaks nicely lighted along with the western wall. Beyond this, to the west (left), we see several more mountain tops illuminated in the morning light. North of the crater we see the overlapping shadow filled crater Gassendi A (33 km). Moving east and north we see an isolated crater, Herigonius (15 km) and west of it, due north of Gassendi, Rima Herigonius.

In the middle of the image is a ravaged old crater, Agatharchides (51 km). Next to it to the right is the larger Agatharchides P (66 km) with a thin north-south rima cutting through it, Rima Agatharchides. This rima connects on the southern end with one of the three larger rimae that curve down through the image to the bottom. These rimae are the Rimae Hippalus, a large system of rimae that curve around the eastern shores of Mare Humorum with Hippalus (60 km) crater itself in the middle, bisected by one of the rima. Between Agatharchides and Hippalus is another crater that is worth a look. It is the diamond shaped crater Loewy (27 km) on the shores of Mare Humorum. Its western wall was breached and the crater flooded by mare basalt during the formation of Mare Humorum.

East of the southern end of the rimae is the nicely terraced crater Campanus (49 km) with the northern half of Mercator (49 km) showing to the right of it. Now we move north to the isolated crater König (24 km) with two sides flattened due to landslides into the crater. Then further north is the large crater Bullialdus (63 km) with beautifully terraced walls. The twin craters below are Bullialdus A (26 km) and Bullialdus B (21 km). These two with König and Bullialdus itself, make a very identifiable configuration when you scan across this region.

Bullialdus to Gassendi, *Richard Hill, Loudon Observatory, Tucson Arizona, USA. 04 April 2020 03:57 UT, co-longitude 41.7°. 6 inch Dynamax Schmidt-Cassegrain telescope, 2x barlow, 665 nm filter, Skyris 132 M camera. Seeing 7-8/10.*

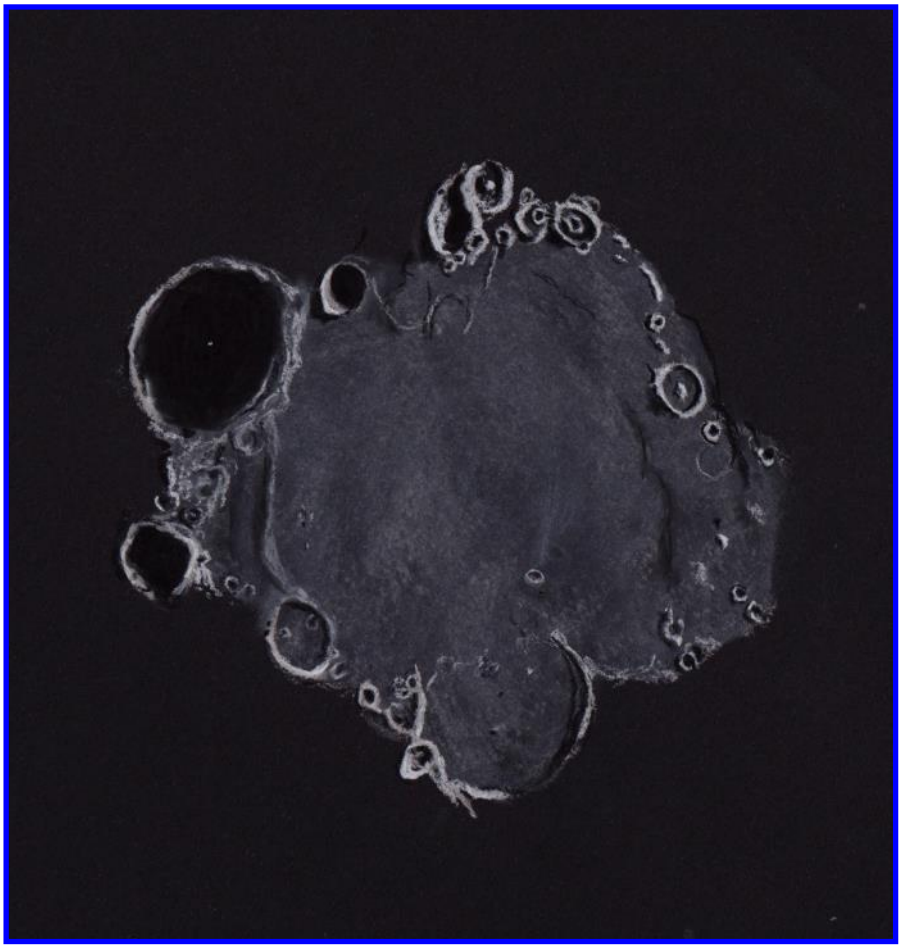


Messala, *Fabio Verza, SNdR Luna UAI - Italy Milan, Italy. 04 September 2020 22:40 UT. Celestron CPC800 8 inch, f/10 Schmidt-Cassegrain telescope, 1.3 x barlow, Astronomik IR 807 filter, ZWO ASI 290 MM camera.*

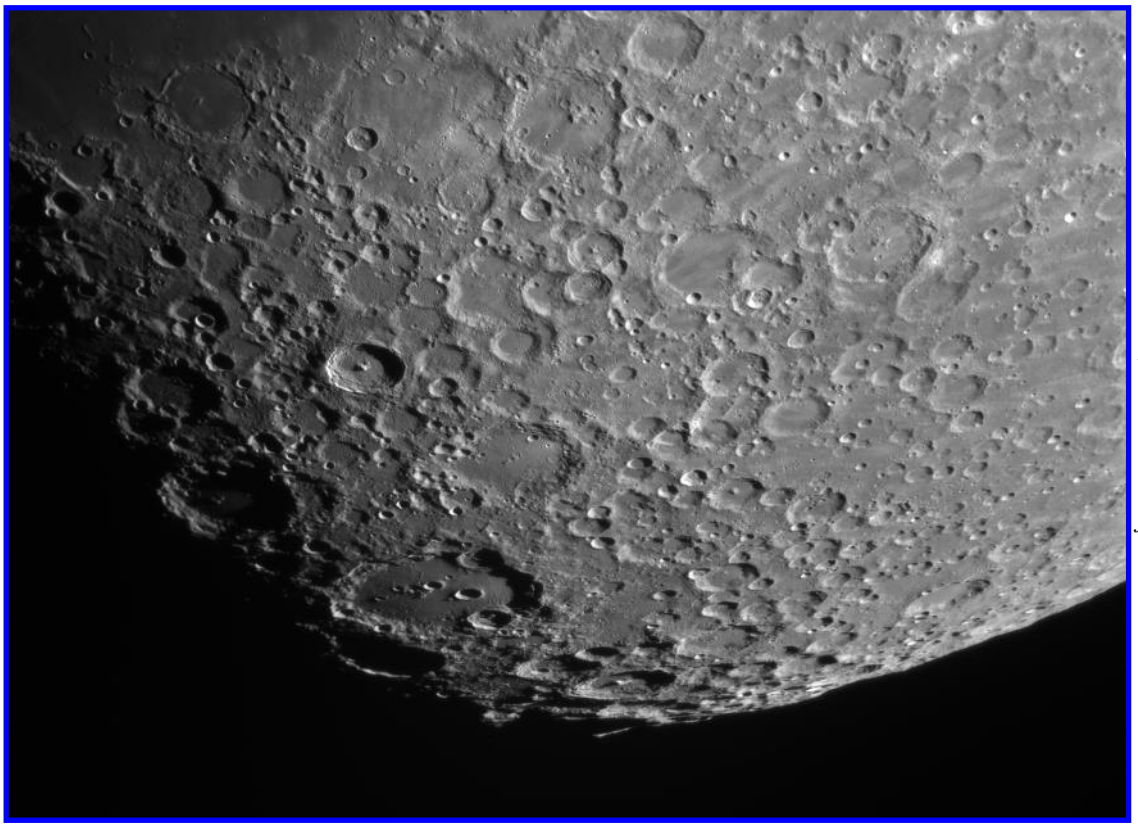
Picard*, Leandro Sid, AEA, Oro Verde, Argentina. 21 September 2020 23:06 UT. 1250 mm x 90 mm Meade Star-Navigator NG 90 Maksutov-Cassegrain telescope, Samsung Galaxy J7 Prime 2 camera.*

Archimedes, *Michel Deconinck, Aquarellia Observatory, Artignosc-sur-Verdon Provence, France. 17 April 2017 05:00 to 07:00 UT. Bresser refractor telescope, 152 mm f/8, Nagler zoom eyepiece, 5 mm, 240 x. Pastel.*

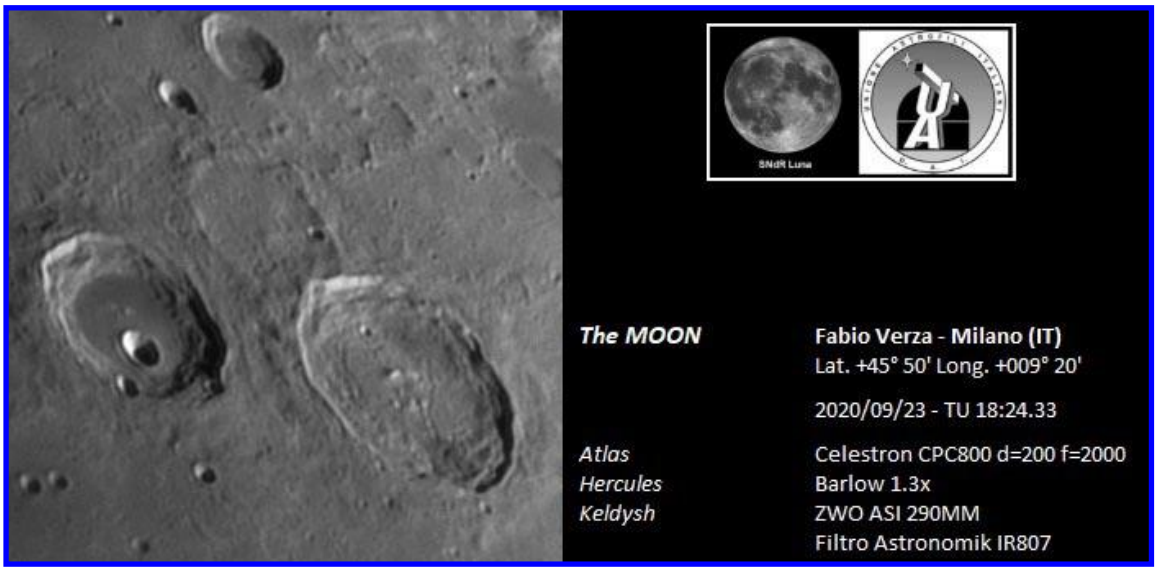
Altai-Theophilus, *Isbel Gonzalez, Roselle, New Jersey, USA. 06 September 2020 05:47 UT. 102 mm Meade Maksutov-Cassegrain telescope, ZWO ASI 120 MC-S camera.*



Fracastorius, *Michel Deconinck, Aquarellia Observatory, Artignosc-sur-Verdon Provence, France. 09 May 2019 20:00 UT. Takahashi Mewlon 210 mm CRS telescope f/10, Bressler 26 mm eyepiece, 96 x. Pastel.*



Clavius and Tycho, *Ariel Cappelletti, Córdoba, Argentina, SLA. 07 November 2019 23:44 UT. 200 mm reflector telescope, IR filter, ZWO ASI 1600 camera.*

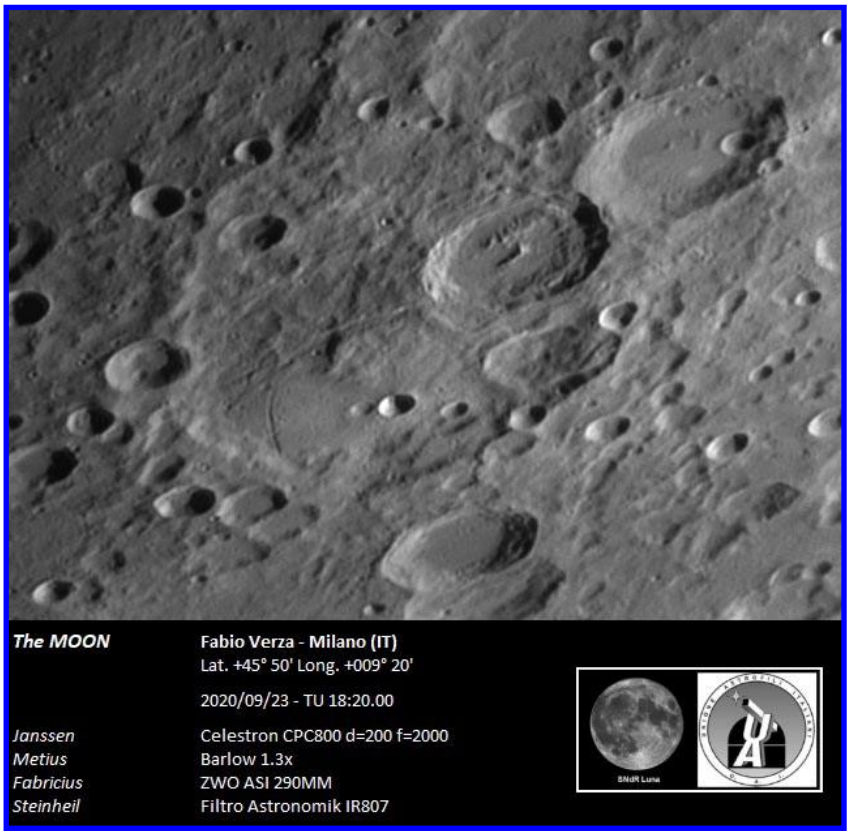


Atlas, *Fabio Verza, SNdR Luna UAI - Italy Milan, Italy. 23 September 2020 17:24 UT. Celestron CPC800 8 inch, f/10 Schmidt-Cassegrain telescope, 1.3 x barlow, Astronomik IR 807 filter, ZWO ASI 290 MM camera.*

Philolaus, *Fabio Verza, SNdR Luna UAI - Italy Milan, Italy. 27 September 2020 20:31 UT. Celestron CPC800 8 inch, f/10 Schmidt-Cassegrain telescope, 1.3 x barlow, Astronomik IR 807 filter, ZWO ASI 290 MM camera.*

Maurolycus to Piccolomini, *Isbel Gonzalez, Roselle, New Jersey, USA. 06 September 2020 05:45 UT. 102 mm Meade Maksutov-Cassegrain telescope, ZWO ASI 120 MC-S camera.*

Aristarchus, *Michel Deconinck, Aquarellia Observatory, Artignosc-sur-Verdon Provence, France. 10 September 2014. Bresser refractor telescope, 102 mm f/10, Delos 10 mm eyepiece, 100 x. Pastel.*



Janssen, *Fabio Verza, SNdR Luna UAI - Italy Milan, Italy. 23 September 2020 18:20 UT. Celestron CPC800 8 inch, f/10 Schmidt-Cassegrain telescope, 1.3 x barlow, Astronomik IR 807 filter, ZWO ASI 290 MM camera.*

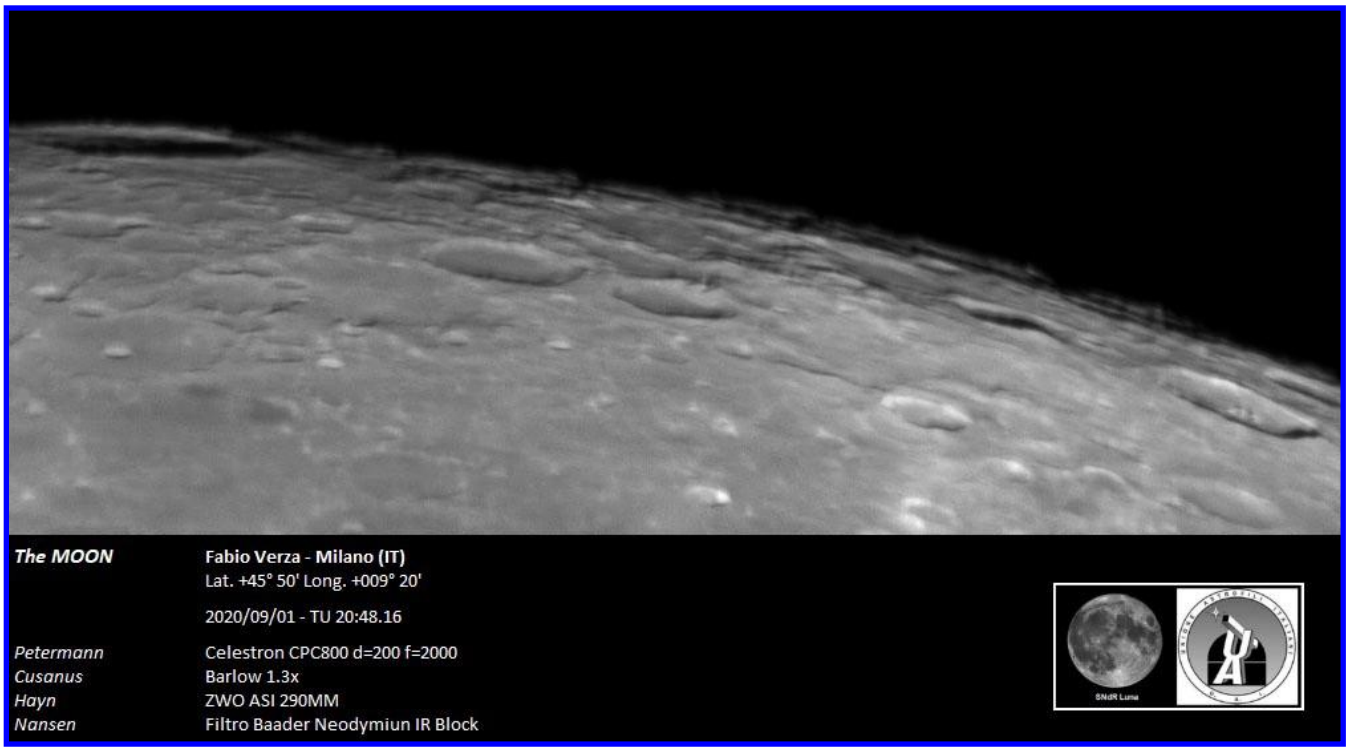
Messier, *Fabio Verza, SNdR Luna UAI - Italy Milan, Italy. 27 September 2020 20:44 UT. Celestron CPC800 8 inch, f/10 Schmidt-Cassegrain telescope, 1.3 x barlow, Astronomik IR 807 filter, ZWO ASI 290 MM camera.*

Mare Frigoris, *Michel Deconinck, Aquarellia Observatory, Artignosc-sur-Verdon Provence, France. 25 March 2019 20:00 UT. Takahashi Mewlon 210 mm CRS telescope f/10, Ethos 13 mm eyepiece, 192x. Pastel.*

Plato to Aristoteles, *Isbel Gonzalez, Roselle, New Jersey, USA. 06 September 2020 05:01 UT. 102 mm Meade Maksutov-Cassegrain telescope, ZWO ASI 120 MC-S camera.*

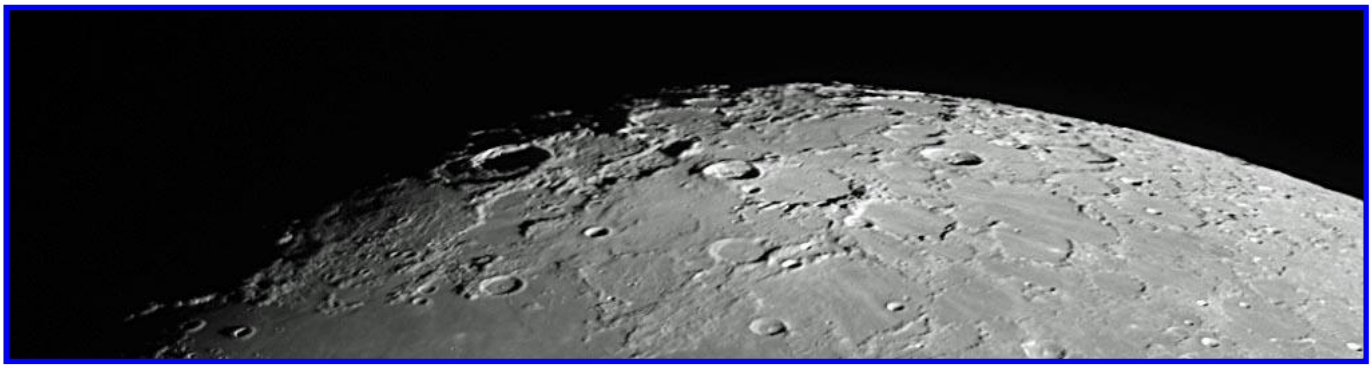
Messier, *Michel Deconinck, Aquarellia Observatory, Artignosc-sur-Verdon Provence, France. 19 August 2015 20:00 UT. Bresser refractor telescope, 102 mm f/10, Delos 10 mm eyepiece, 100 x and Omegon 5 mm eyepiece, 200 x. Pastel.*

Plato to Anaxagoras, *Isbel Gonzalez, Roselle, New Jersey, USA. 06 September 2020 05:48 UT. 102 mm Meade Maksutov-Cassegrain telescope, ZWO ASI 120 MC-S camera.*

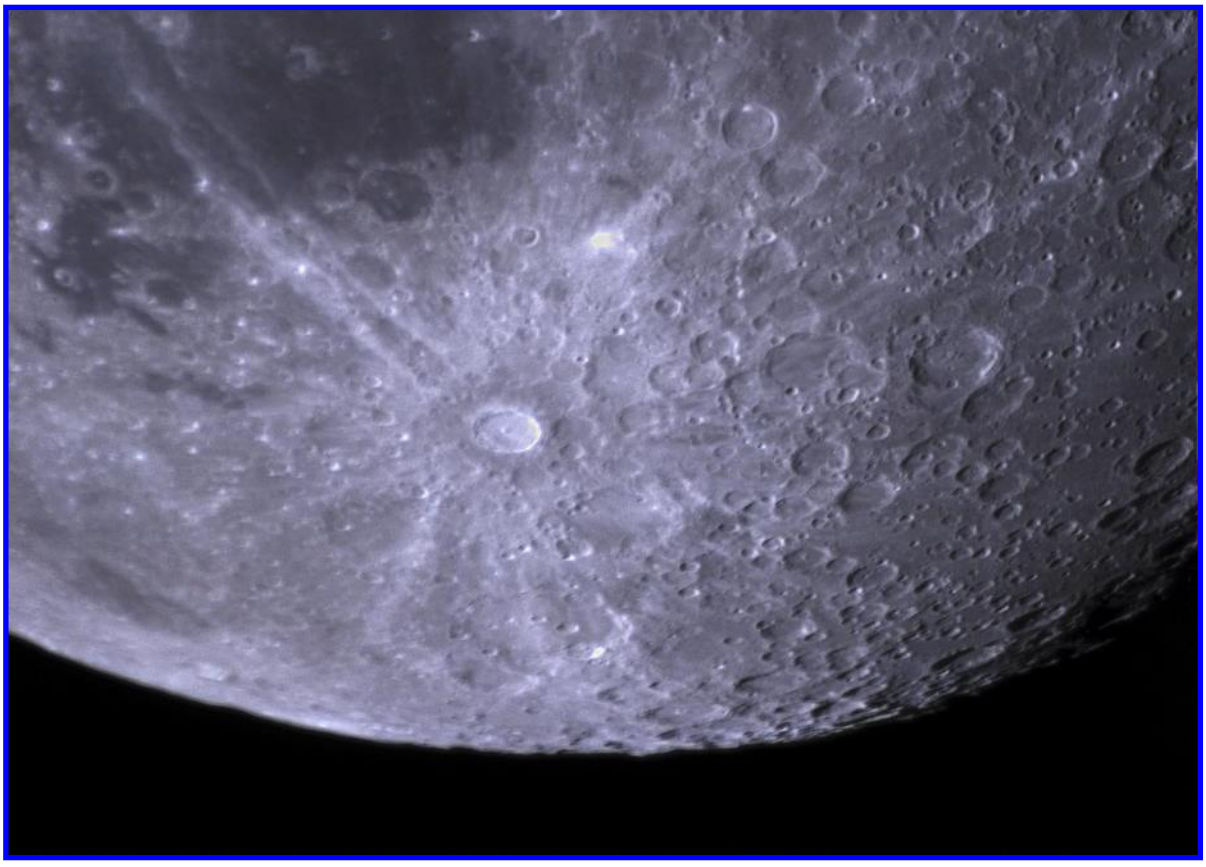


Petermann, *Fabio Verza, SNdR Luna UAI - Italy Milan, Italy. 01 September 2020 20:48 UT. Celestron CPC800 8 inch, f/10 Schmidt-Cassegrain telescope, 1.3 x barlow, Neodymiun IR block filter, ZWO ASI 290 MM camera.*

Anaxagoras, *Francisco Alsina Cardinalli , Oro Verde, Argentina, SLA. 28 August 2020 23:26 UT. 200 mm refractor telescope, 742 nm filter, QHY5-II camera.*



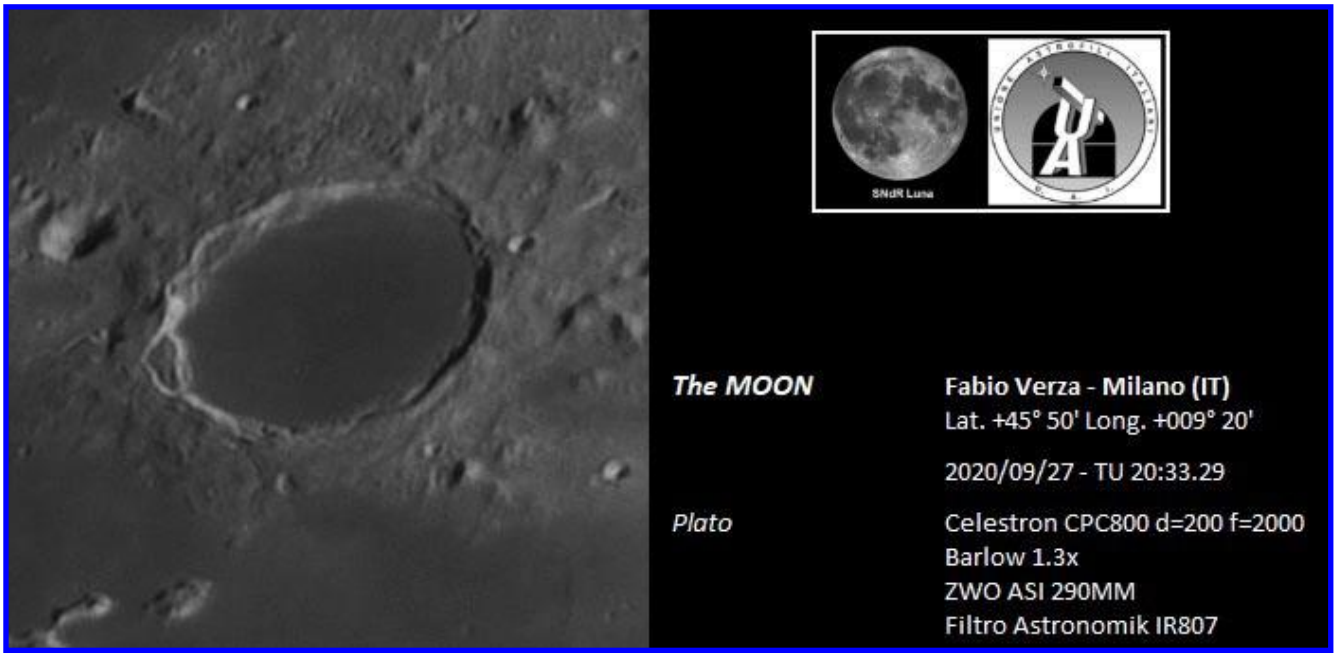
Schiller, *Michel Deconinck, Aquarellia Observatory, Artignosc-sur-Verdon Provence, France. 02 August 2020 01:30 UT. Bresser refractor telescope, 152 mm f/8, Omegon zoom eyepiece, 12 mm, 100 x. Pastel.*

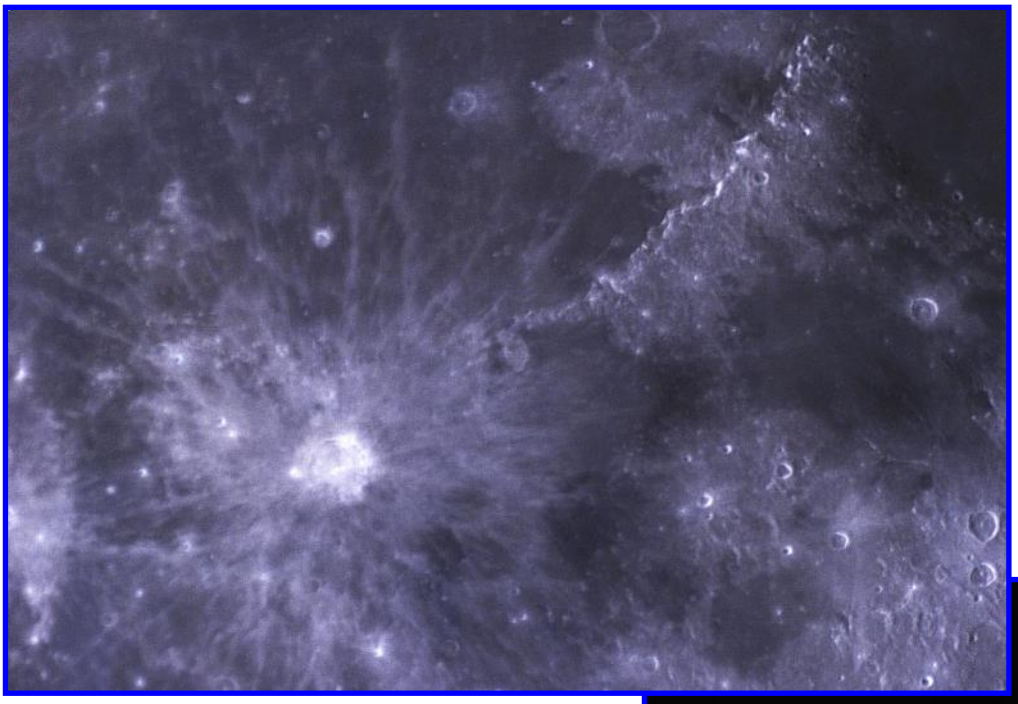


Tycho, *Isbel Gonzalez, Roselle, New Jersey, USA. 06 September 2020 05:46 UT. 102 mm Meade Maksutov-Cassegrain telescope, ZWO ASI 120 MC-S camera.*

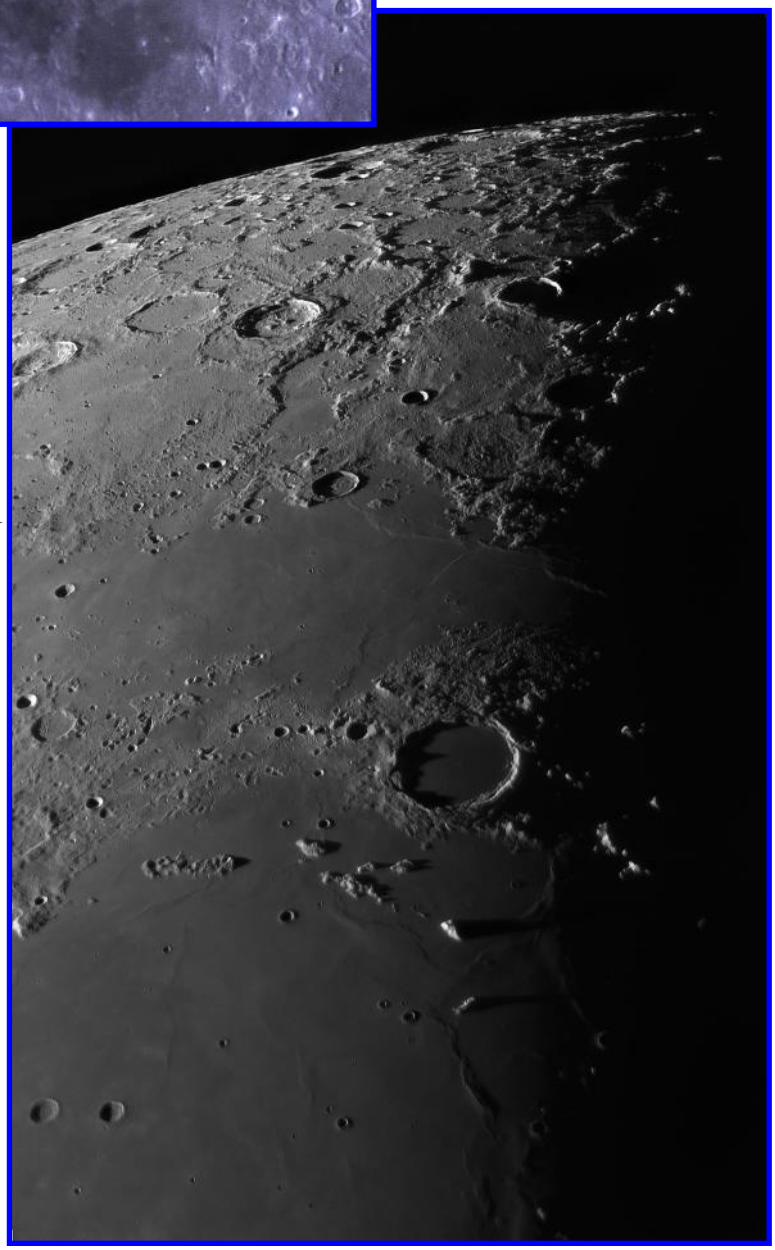
Copernicus, *Fabio Verza, SNdR Luna UAI - Italy Milan, Italy. 26 September 2020 21:26 UT. Celestron CPC800 8 inch, f/10 Schmidt-Cassegrain telescope, 1.3 x barlow, Astronomik IR 807 filter, ZWO ASI 290 MM camera.*

Plato, *Fabio Verza, SNdR Luna UAI - Italy Milan, Italy. 27 September 2020 20:33 UT. Celestron CPC800 8 inch, f/10 Schmidt-Cassegrain telescope, 1.3 x barlow, Astronomik IR 807 filter, ZWO ASI 290 MM camera.*



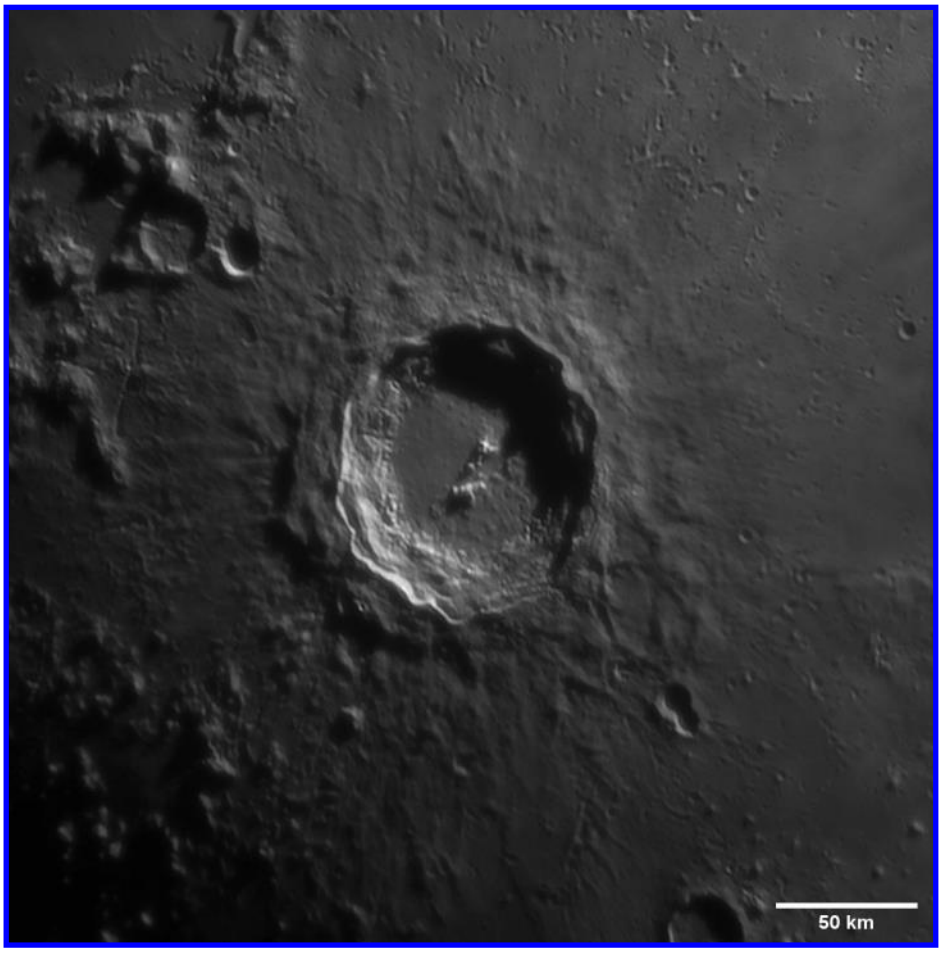


Copernicus, *Isbel Gonzalez, Roselle, New Jersey, USA. 06 September 2020 05:47 UT. 102 mm Meade Maksutov-Cassegrain telescope, ZWO ASI 120 MC-S camera.*



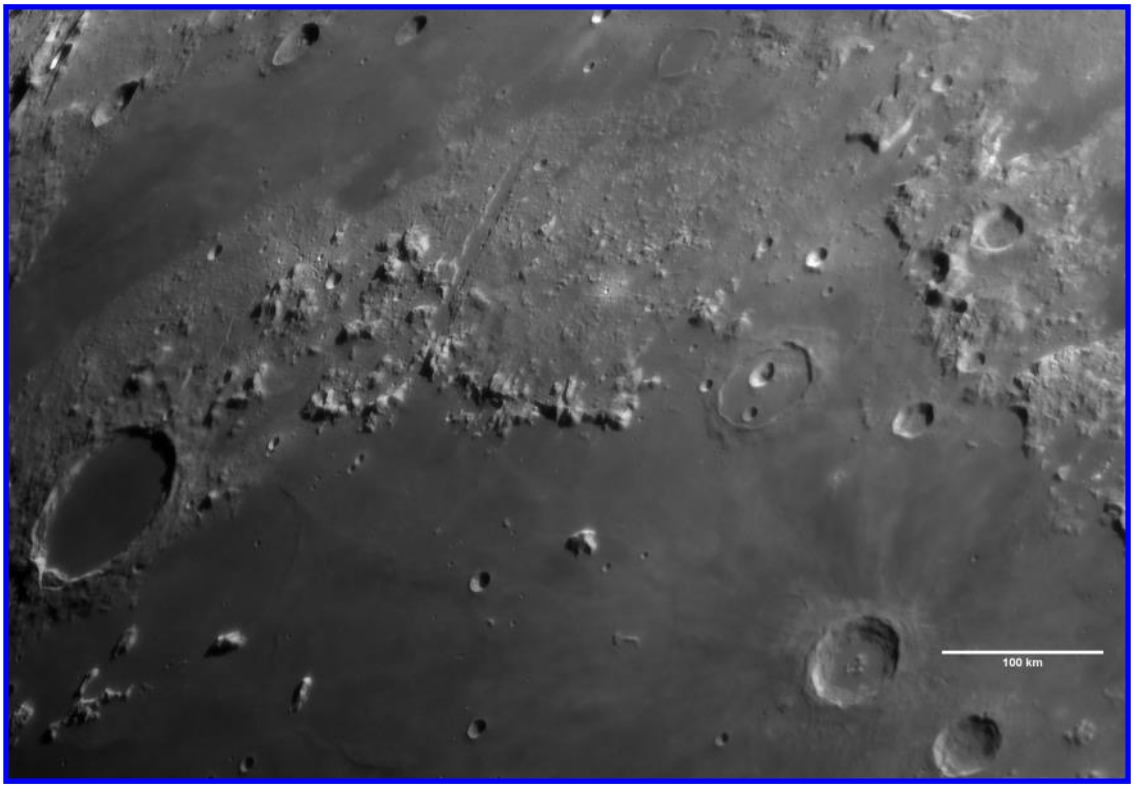
Northwest Moon, *Howard Eskildsen, Ocala, Florida, USA. 13 July 2020 09:57 UT, colongitude 185.4°. Celestron 9.25 inch Schmidt-Cassegrain telescope, f/10, fl 2,395 mm, Celestron Skyris 236 M camera. Seeing 8/10, transparency 5/6.*

Northwestern Moon shows the contrast of the rugged northern highlands with the mare basalt filled Mare Frigoris, Plato, and northern Mare Imbrium. Two central peaks rise from the floor of Philolaus in the heavily cratered highlands.

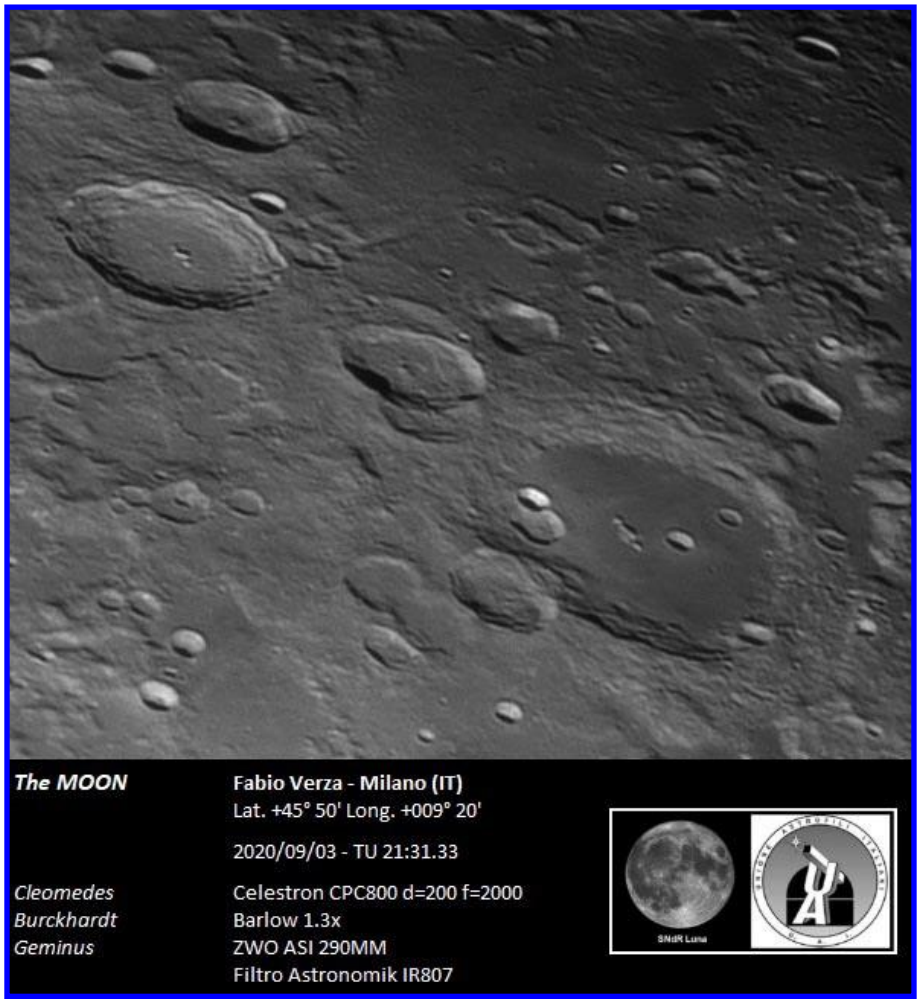


Copernicus, *Ariel Cappelletti, Córdoba, Argentina, SLA. 02 June 2020 23:40 UT. 254 mm reflector telescope, ZWO ASI 178 mc camera.*

De la Rue, *Fabio Verza, SNdR Luna UAI - Italy Milan, Italy. 04 September 2020 22:44 UT. Celestron CPC800 8 inch, f/10 Schmidt-Cassegrain telescope, 1.3 x barlow, Astronomik IR 807 filter, ZWO ASI 290 MM camera.*



Montes Alpes, *Ariel Cappelletti, Córdoba, Argentina, SLA. 02 June 2020 23:10 UT. 254 mm reflector telescope, ZWO ASI 178 mc camera.*



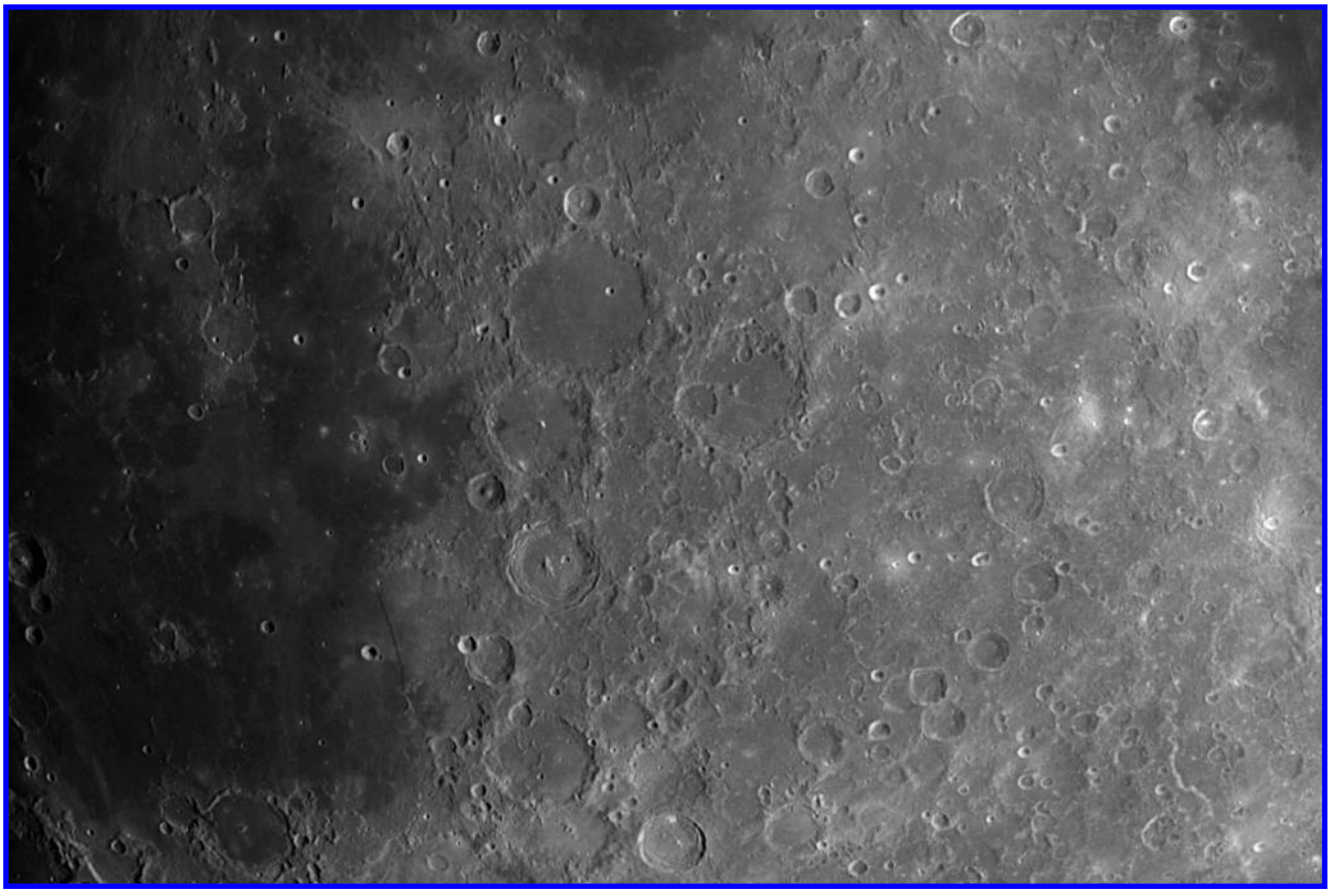
Cleomedes, *Fabio Verza, SNdR Luna UAI - Italy Milan, Italy. 03 September 2020 21:31 UT. Celestron CPC800 8 inch, f/10 Schmidt-Cassegrain telescope, 1.3 x barlow, Astronomik IR 807 filter, ZWO ASI 290 MM camera.*

Langrenus, *Fabio Verza, SNdR Luna UAI - Italy Milan, Italy. 03 September 2020 21:40 UT. Celestron CPC800 8 inch, f/10 Schmidt-Cassegrain telescope, 1.3 x barlow, Astronomik IR 807 filter, ZWO ASI 290 MM camera.*

Sinus Iridum, *Francisco Alsina Cardinalli , Oro Verde, Argentina, SLA. 28 August 2020 23:21 UT. 200 mm refractor telescope, 742 nm filter, QHY5-II camera.*

Mare Crisium, *Fabio Verza, SNdR Luna UAI - Italy Milan, Italy. 04 September 2020 22:48 UT. Celestron CPC800 8 inch, f/10 Schmidt-Cassegrain telescope, 1.3 x barlow, Astronomik IR 807 filter, ZWO ASI 290 MM camera.*

Parrot, *Desiré Godoy, Oro Verde, Argentina, SLA. 28 August 2020 23:41 UT. 200 mm refractor telescope, 742 nm filter, QHY5-II camera.*

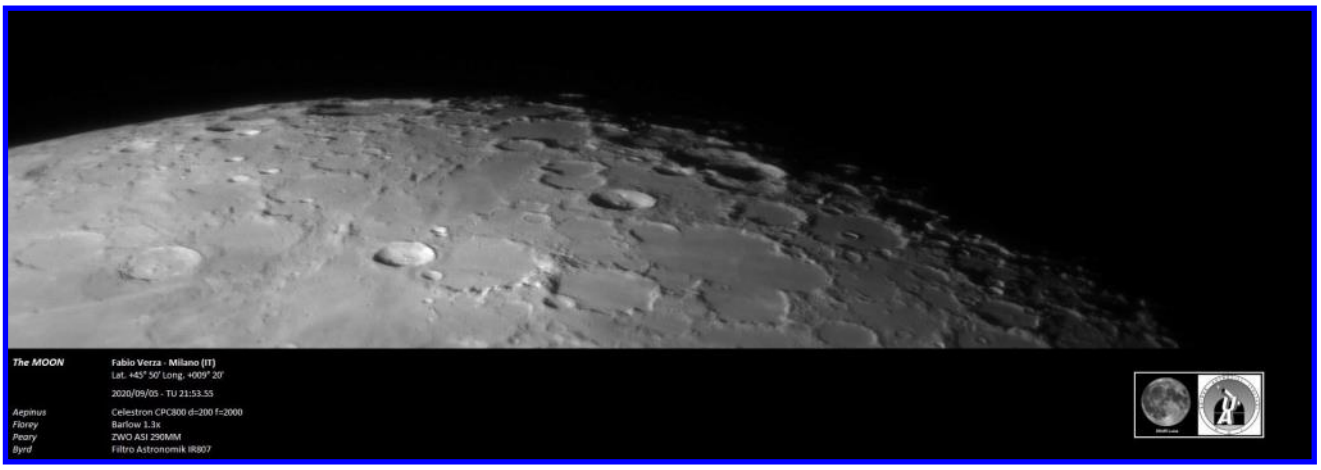


***Proclus**, Leandro Sid, AEA, Oro Verde, Argentina. 23 September 2020 01:18 UT. 1250 mm x 90 mm Meade Star-Navigator NG 90 Maksutov-Cassegrain telescope, Samsung Galaxy J7 Prime 2 camera.*

Leandro writes:

"Pink patch is observed in northwest direction inside the crater Proclus. This event was observed in period of 00:41 UTC to 01:24 UTC, September 23, 2020. Paraná, Argentina."

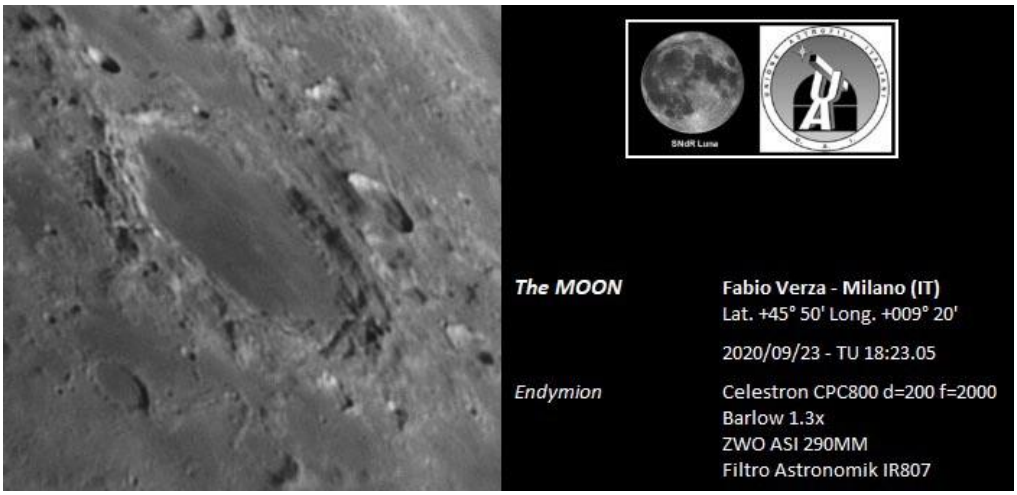
***Aristoteles,** Fabio Verza, SNdR Luna UAI - Italy Milan, Italy. 23 September 2020 17:48 UT. Celestron CPC800 8 inch, f/10 Schmidt-Cassegrain telescope, 1.3 x barlow, Astronomik IR 807 filter, ZWO ASI 290 MM camera.*



Aepinus, *Fabio Verza, SNdR Luna UAI - Italy Milan, Italy. 05 September 2020 21:53 UT. Celestron CPC800 8 inch, f/10 Schmidt-Cassegrain telescope, 1.3 x barlow, Astronomik IR 807 filter, ZWO ASI 290 MM camera.*

Eudoxus *Desiré Godoy, Oro Verde, Argentina, SLA. 28 August 2020 23:45 UT. 200 mm refractor telescope, 742 nm filter, QHY5-II camera.*

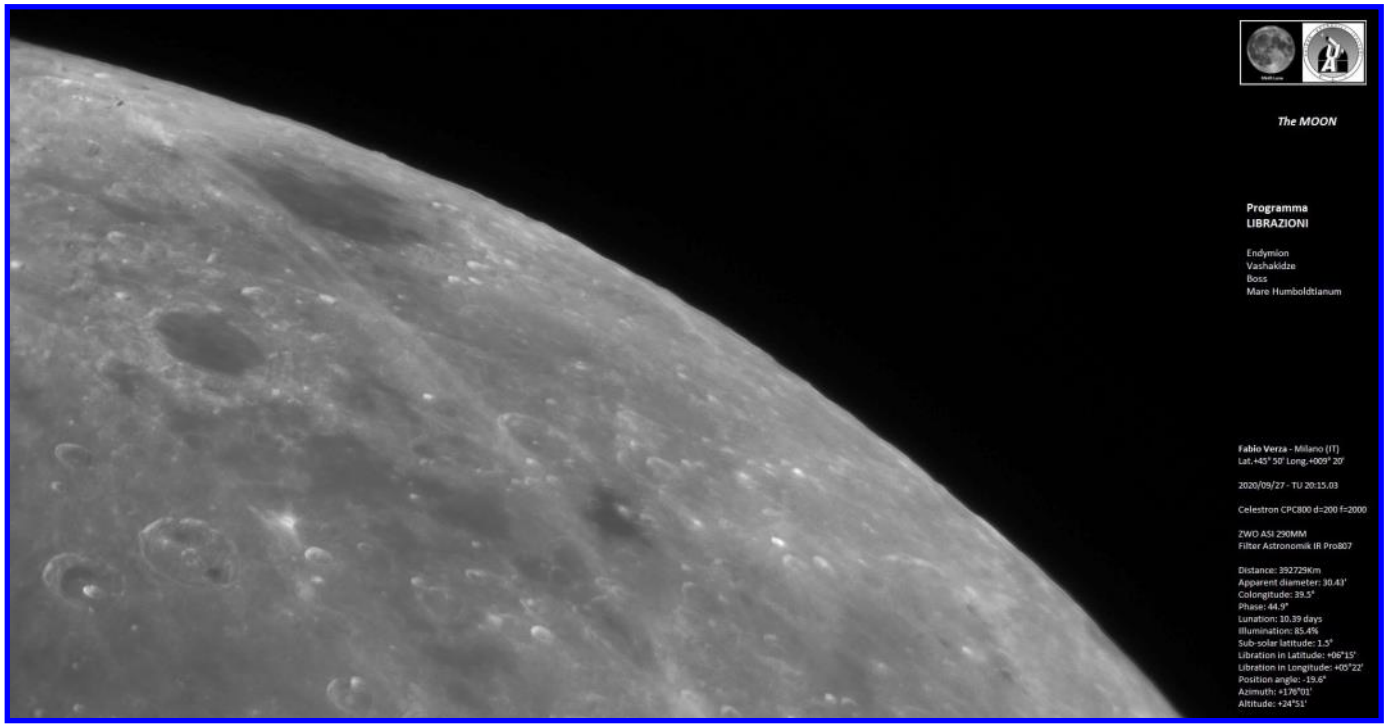
Endymion, *Fabio Verza, SNdR Luna UAI - Italy Milan, Italy. 23 September 2020 18:23 UT. Celestron CPC800 8 inch, f/10 Schmidt-Cassegrain telescope, 1.3 x barlow, Astronomik IR 807 filter, ZWO ASI 290 MM camera.*



Copernicus, *Fabio Verza, SNdR Luna UAI - Italy Milan, Italy. 27 September 2020 20:40 UT. Celestron CPC800 8 inch, f/10 Schmidt-Cassegrain telescope, 1.3 x barlow, Astronomik IR 807 filter, ZWO ASI 290 MM camera.*

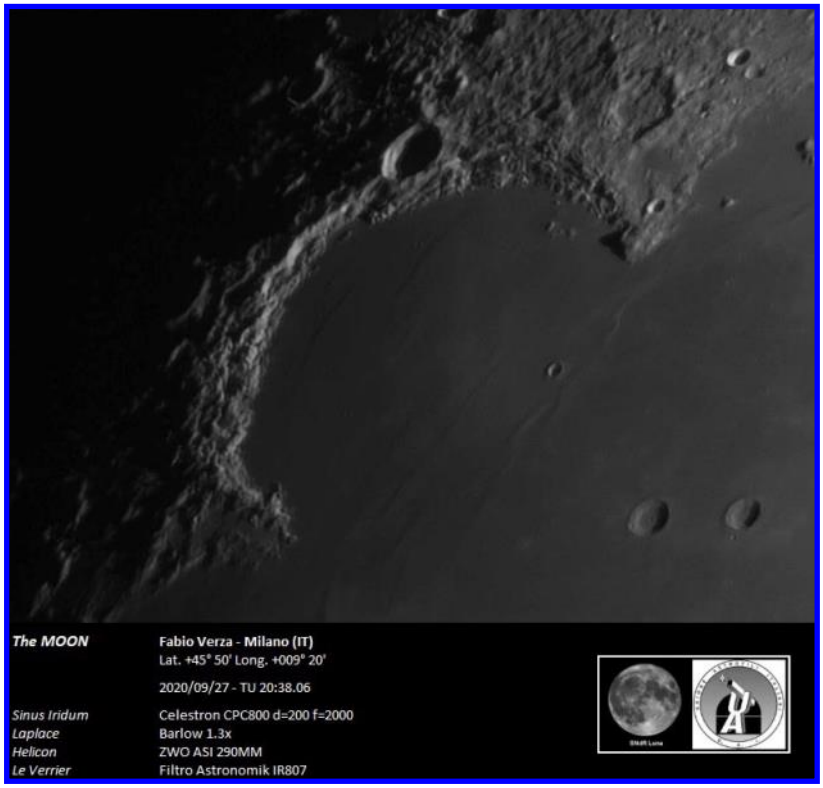
Lacus Mortis, *Fabio Verza, SNdR Luna UAI - Italy Milan, Italy. 23 September 2020 17:02 UT. Celestron CPC800 8 inch, f/10 Schmidt-Cassegrain telescope, 1.3 x barlow, Astronomik IR 807 filter, ZWO ASI 290 MM camera.*

Endymion, *Fabio Verza, SNdR Luna UAI - Italy Milan, Italy. 27 September 2020 20:15 UT. Celestron CPC800 8 inch, f/10 Schmidt-Cassegrain telescope, 1.3 x barlow, Astronomik IR 807 filter, ZWO ASI 290 MM camera.*



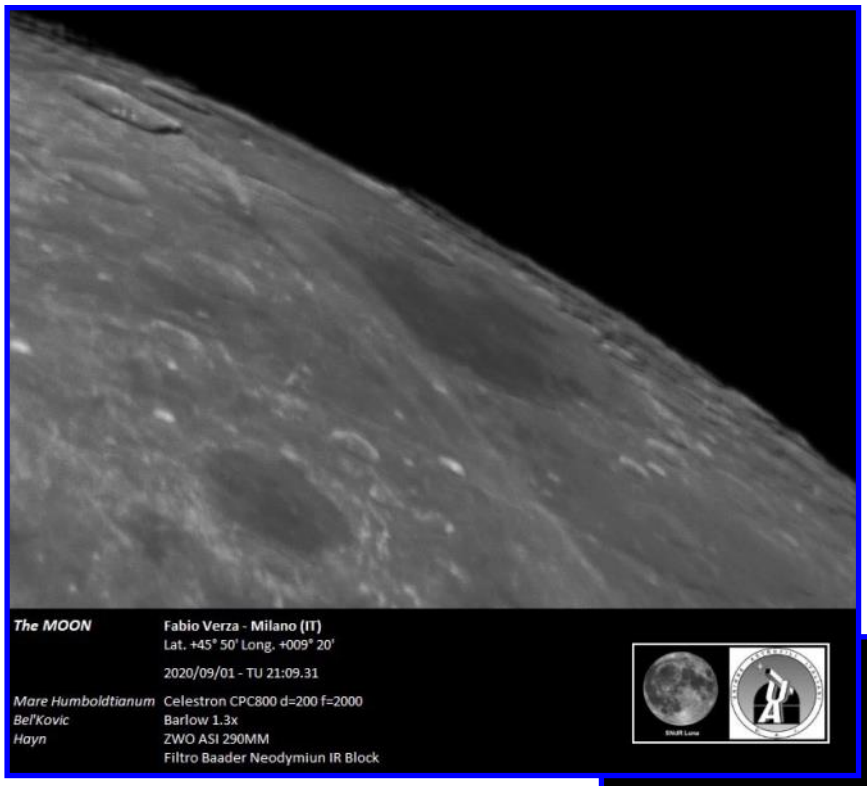
Lacus Spei, *Fabio Verza, SNdR Luna UAI - Italy Milan, Italy. 26 September 2020 21:29 UT, colongitude 28.0º. Celestron CPC800 8 inch, f/10 Schmidt-Cassegrain telescope, 1.3 x barlow, Astronomik IR 807 filter, ZWO ASI 290 MM camera.*

Sinus Iridum, *Fabio Verza, SNdR Luna UAI - Italy Milan, Italy. 27 September 2020 20:38 UT. Celestron CPC800 8 inch, f/10 Schmidt-Cassegrain telescope, 1.3 x barlow, Astronomik IR 807 filter, ZWO ASI 290 MM camera.*



Xenophanes, *Fabio Verza, SNdR Luna UAI - Italy Milan, Italy. 01 September 2020 20:44 UT. Celestron CPC800 8 inch, f/10 Schmidt-Cassegrain telescope, 1.3 x barlow, Baader Neodymiun IR block filter, ZWO ASI 290 MM camera.*

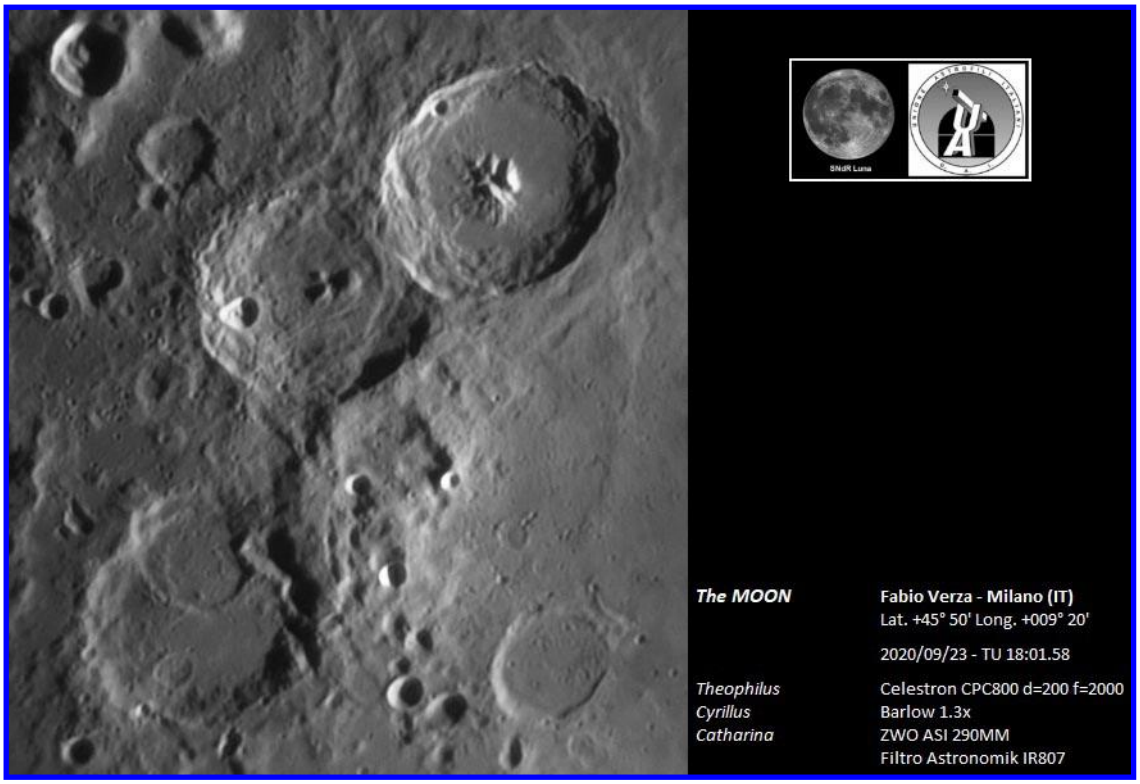
Waxing Gibbous Moon*, Leandro Sid, AEA, Oro Verde, Argentina. 23 September 2020 01:22 UT. 1250 mm x 90 mm Meade StarNavigator NG 90 Maksutov-Cassegrain telescope, Samsung Galaxy J7 Prime 2 camera.*



Mare Humboldtianum, *Fabio Verza, SNdR Luna UAI - Italy Milan, Italy. 01 September 2020 21:09 UT. Celestron CPC800 8 inch, f/10 Schmidt-Cassegrain telescope, 1.3 x barlow, Neodymium IR block filter, ZWO ASI 290 MM camera.*

Gassendi*, Leandro Sid, AEA, Oro Verde, Argentina. 29 September 2020 02:24 UT. 1250 mm x 90 mm Meade StarNavigator NG 90 Maksutov-Cassegrain telescope, Samsung Galaxy J7 Prime 2 camera.*

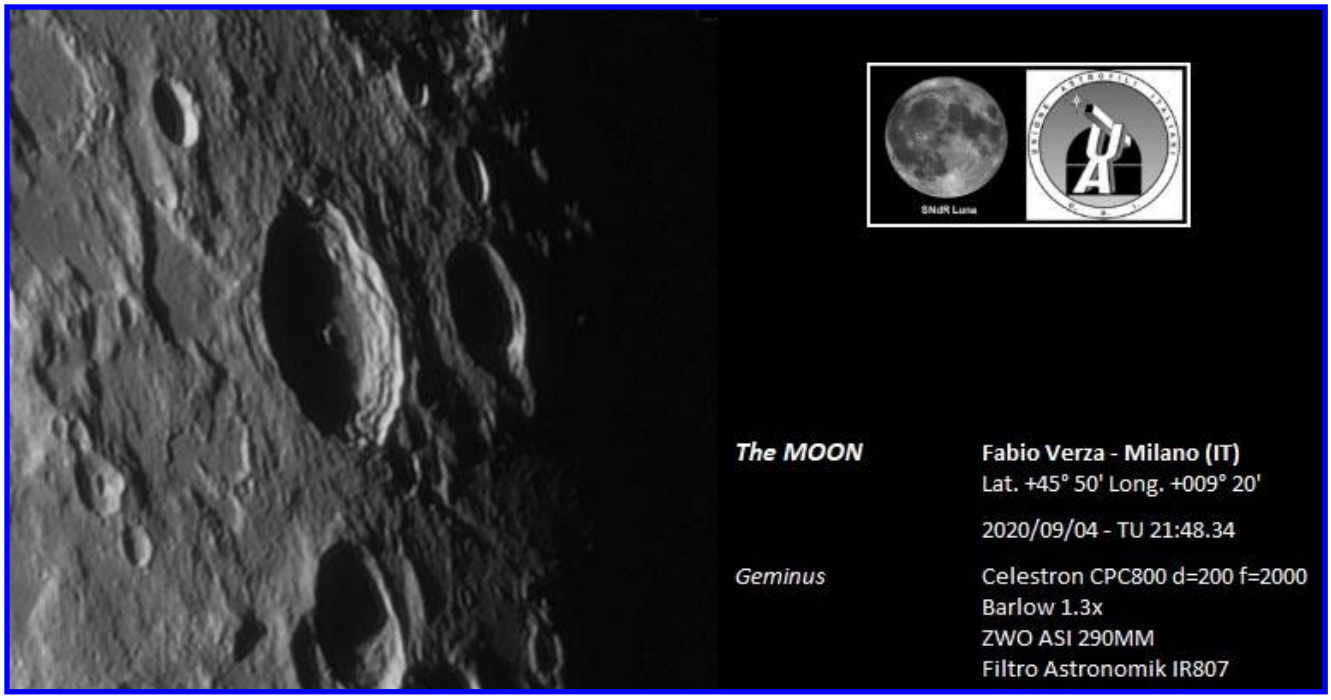
Mare Marginis, *Fabio Verza, SNdR Luna UAI - Italy Milan, Italy. 23 September 2020 17:25 UT, colongitude 349.1°. Celestron CPC800 8 inch, f/10 Schmidt-Cassegrain telescope, 1.3 x barlow, Astronomik IR 807 filter, ZWO ASI 290 MM camera.*



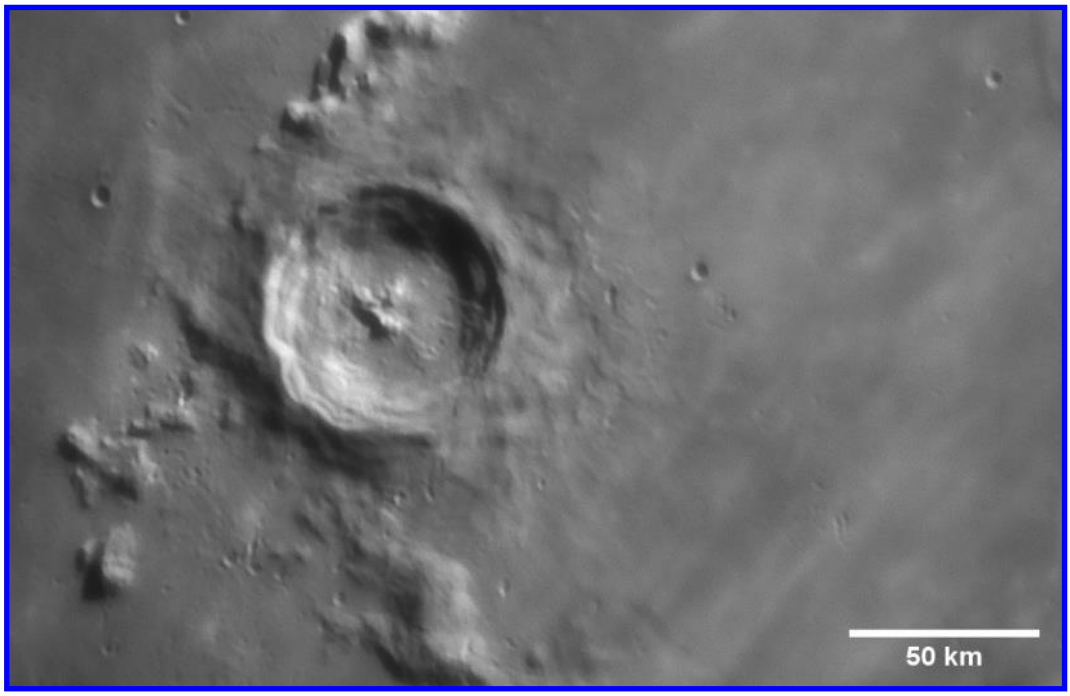
Theophilus, *Fabio Verza, SNdR Luna UAI - Italy Milan, Italy. 23 September 2020 18:01 UT. Celestron CPC800 8 inch, f/10 Schmidt-Cassegrain telescope, 1.3 x barlow, Astronomik IR 807 filter, ZWO ASI 290 MM camera.*

Tycho, *Ariel Cappelletti, Córdoba, Argentina, SLA. 16 April 2019 23:15 UT. 200 mm reflector telescope, IR filter, ZWO ASI 178 mc camera.*

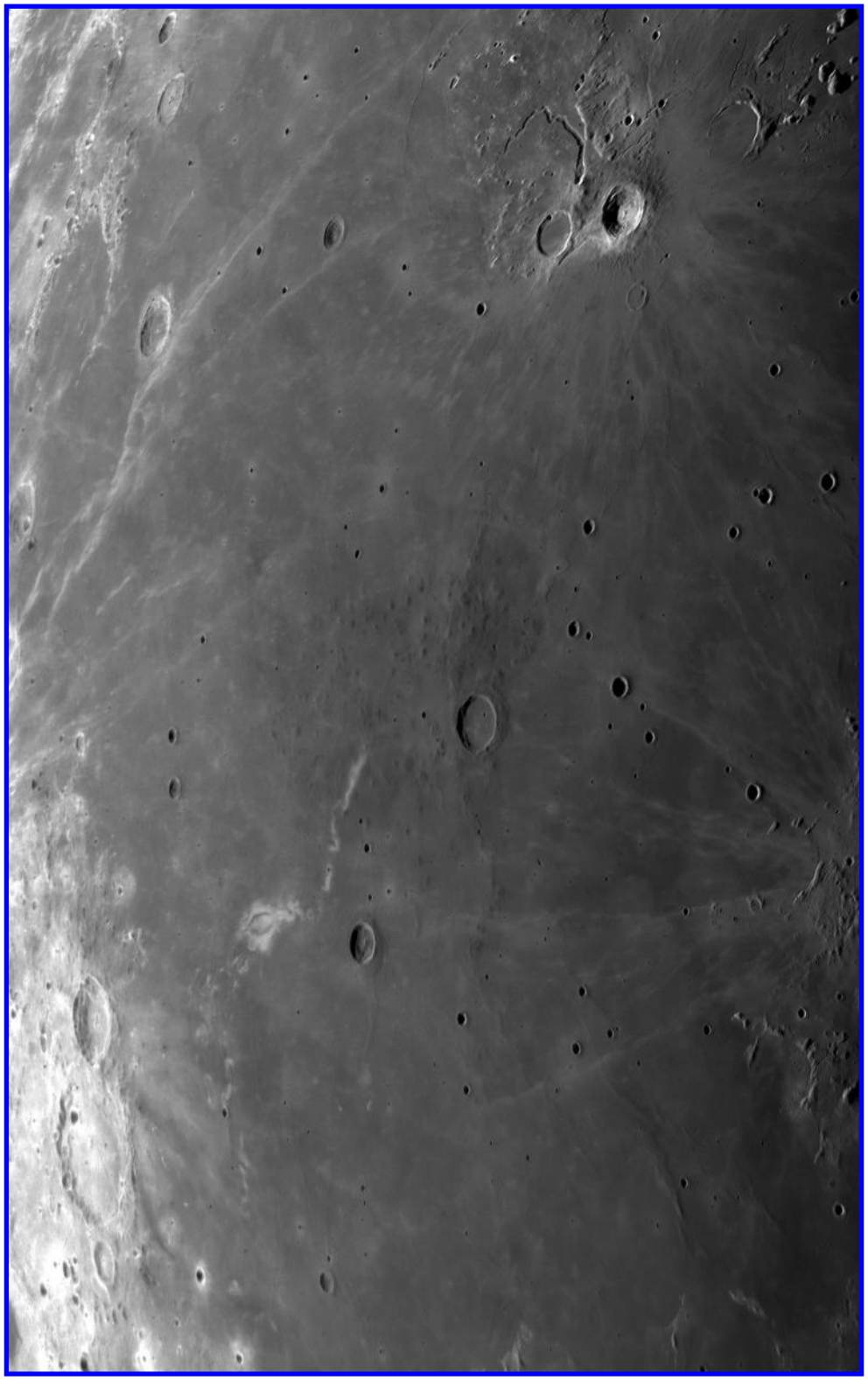
Geminus, *Fabio Verza, SNdR Luna UAI - Italy Milan, Italy. 04 September 2020 21:48 UT. Celestron CPC800 8 inch, f/10 Schmidt-Cassegrain telescope, 1.3 x barlow, Astronomik IR 807 filter, ZWO ASI 290 MM camera.*



Eratosthenes, *Ariel Cappelletti, Córdoba, Argentina, SLA. 02 June 2020 23:30 UT. 254 mm reflector telescope, ZWO ASI 178 mc camera.*



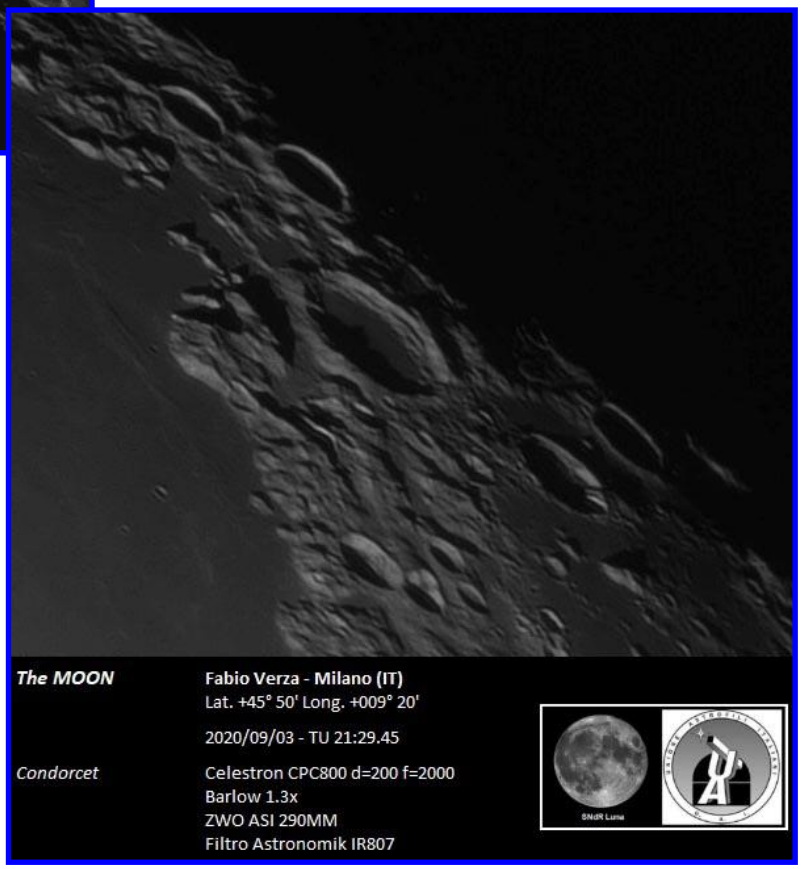
Mare Crisium, *Fabio Verza, SNdR Luna UAI - Italy Milan, Italy. 03 September 2020 21:27 UT. Celestron CPC800 8 inch, f/10 Schmidt-Cassegrain telescope, 1.3 x barlow, Astronomik IR 807 filter, ZWO ASI 290 MM camera.*



Aristarchus, Marius and Reiner, *Howard Eskildsen, Ocala, Florida, USA. 15 July 2020 09:52 UT, colongitude 209.8°. Celestron 9.25 inch Schmidt-Cassegrain telescope, f/10, fl 2,395 mm, Celestron Skyris 236 M camera. Seeing 8/10, transparency 5/6.*

I had originally intended to crop this to feature the Marius Hills and the dome of Herodotus Gamma. However, it shows several different lunar terrains, including the rills of Prinz and the Aristarchus plateau to volcanic domes of Marius Hills, rays from multiple craters, and the enigmatic lunar swirl, Reiner Gamma. I just had to show the full image.

Gassendi, *Ariel Cappelletti, Córdoba, Argentina, SLA. 20 April 2019 23:30 UT. 102 mm Maksutov-Cassegrain telescope, ZWO ASI 178 mc camera.*



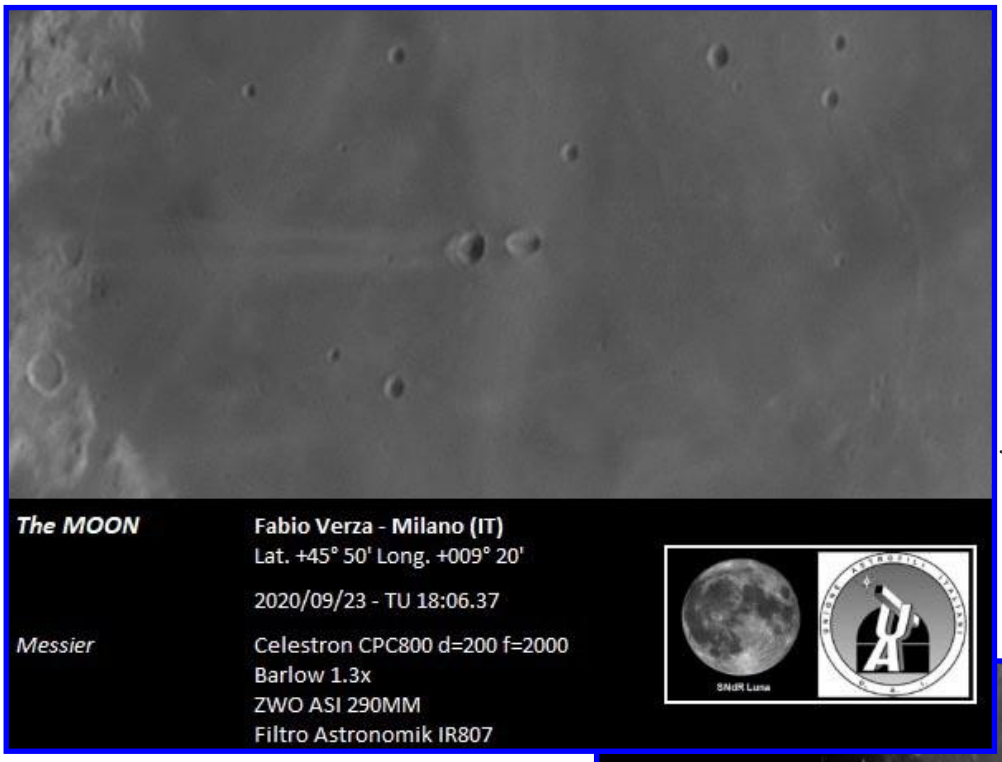
Condorcet, *Fabio Verza, SNdR Luna UAI - Italy Milan, Italy. 03 September 2020 21:29 UT. Celestron CPC800 8 inch, f/10 Schmidt-Cassegrain telescope, 1.3 x barlow, Astronomik IR 807 filter, ZWO ASI 290 MM camera.*

Posidonius to Atlas, *Isbel Gonzalez, Roselle, New Jersey, USA. 06 September 2020 05:46 UT. 102 mm Meade Maksutov-Cassegrain telescope, ZWO ASI 120 MC -S camera.*

Mercurius, *Fabio Verza, SNdR Luna UAI - Italy Milan, Italy. 03 September 2020 21:33 UT. Celestron CPC800 8 inch, f/10 Schmidt-Cassegrain telescope, 1.3 x barlow, Astronomik IR 807 filter, ZWO ASI 290 MM camera.*

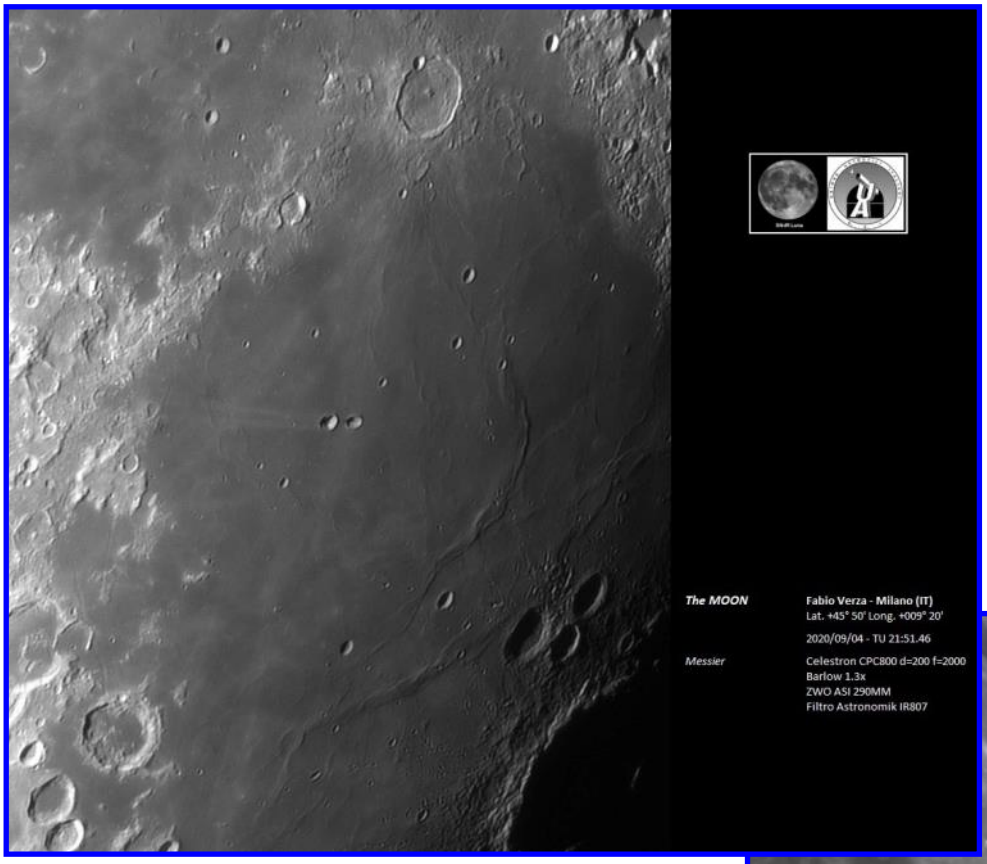
Petavius, *Fabio Verza, SNdR Luna UAI - Italy Milan, Italy. 03 September 2020 21:38 UT. Celestron CPC800 8 inch, f/10 Schmidt-Cassegrain telescope, 1.3 x barlow, Astronomik IR 807 filter, ZWO ASI 290 MM camera.*

Full Moon, *Jario, Chavez, Popayán, Colombia. 03 September 2020 02:01 UT. 114 mm refractor telescope, Moto ES PLAY camera.*



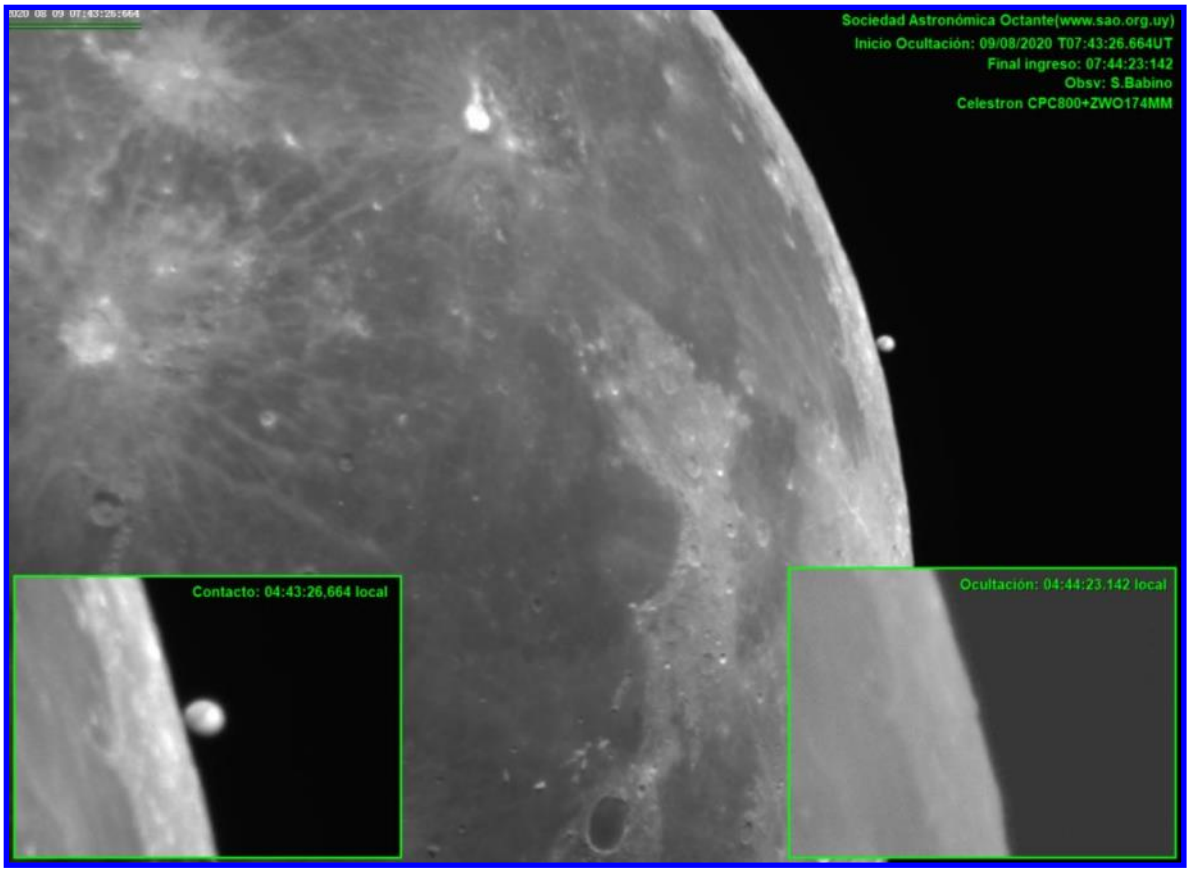
Messier, *Fabio Verza, SNdR Luna UAI - Italy Milan, Italy. 23 September 2020 18:06 UT. Celestron CPC800 8 inch, f/10 Schmidt-Cassegrain telescope, 1.3 x barlow, Astronomik IR 807 filter, ZWO ASI 290 MM camera.*

Herodotus*, Leandro Sid, AEA, Oro Verde, Argentina. 29 September 2020 01:10 UT. 1250 mm x 90 mm Meade StarNavigator NG 90 Maksutov-Cassegrain telescope, Samsung Galaxy J7 Prime 2 camera.*

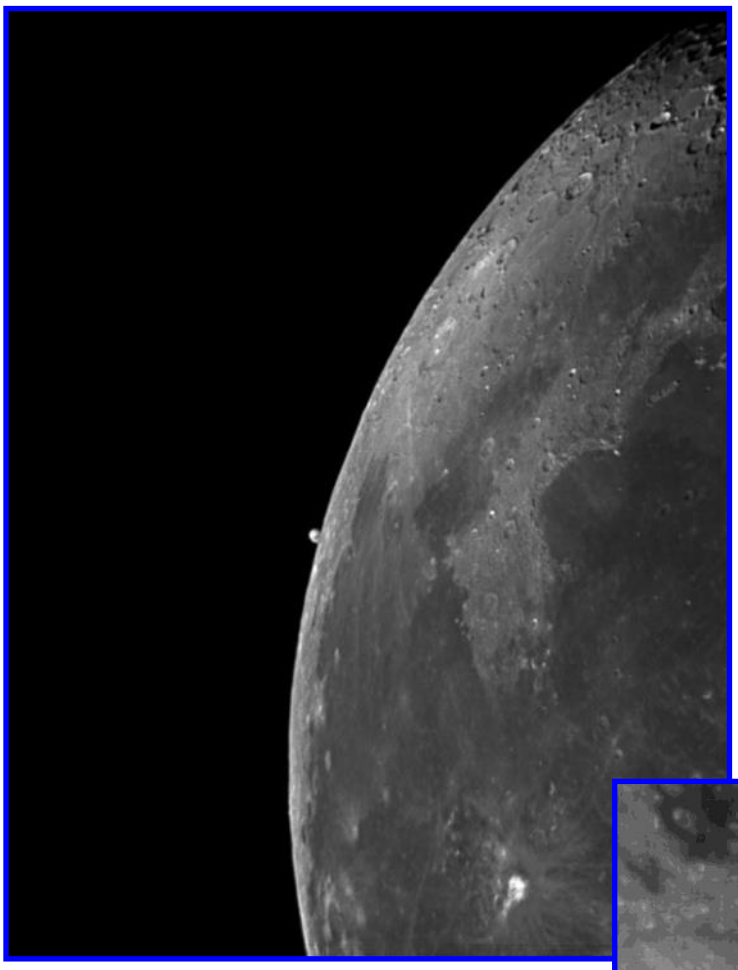


Messier, *Fabio Verza, SNdR Luna UAI - Italy Milan, Italy. 04 September 2020 21:51 UT. Celestron CPC800 8 inch, f/10 Schmidt-Cassegrain telescope, 1.3 x barlow, Astronomik IR 807 filter, ZWO ASI 290 MM camera.*

Proclus*, Leandro Sid, AEA, Oro Verde, Argentina. 29 September 2020 02:36 UT. 1250 mm x 90 mm Meade StarNavigator NG 90 Maksutov-Cassegrain telescope, Samsung Galaxy J7 Prime 2 camera.*



The Moon and Mars Occultation, *Sergio Babino, Montevideo, Uruguay.*
Above, 09 August 2020 07:43 UT. 203 mm Schmidt-Cassegrain telescope, ZWO ASI 174 mm camera.
Below, 09 August 2020 09:02 UT. 130 mm ZWO ASI 174 mm camera.



Moon and Mars Occultation, *Richard Martin, Pando, Uruguay. 09 August 2020 04:45 UT. 130 mm reflector telescope, ZWO ASI 120 mm camera.*

Moon and Mars Conjunction, *Richard Martin, Pando, Uruguay. 06 September 2020 22:27 UT. 130 mm reflector telescope, ZWO ASI 120 mm camera.*

The Moon and Mars, *Raúl Roberto Podestá, SLA, Formosa, Argentina. 09 August 2020. Times are listed. 127 mm Maksutov-Cassegrain telescope, Hokenn CCD imager.*

08:12 UT

08:15 UT

08:17 UT

08:19 UT

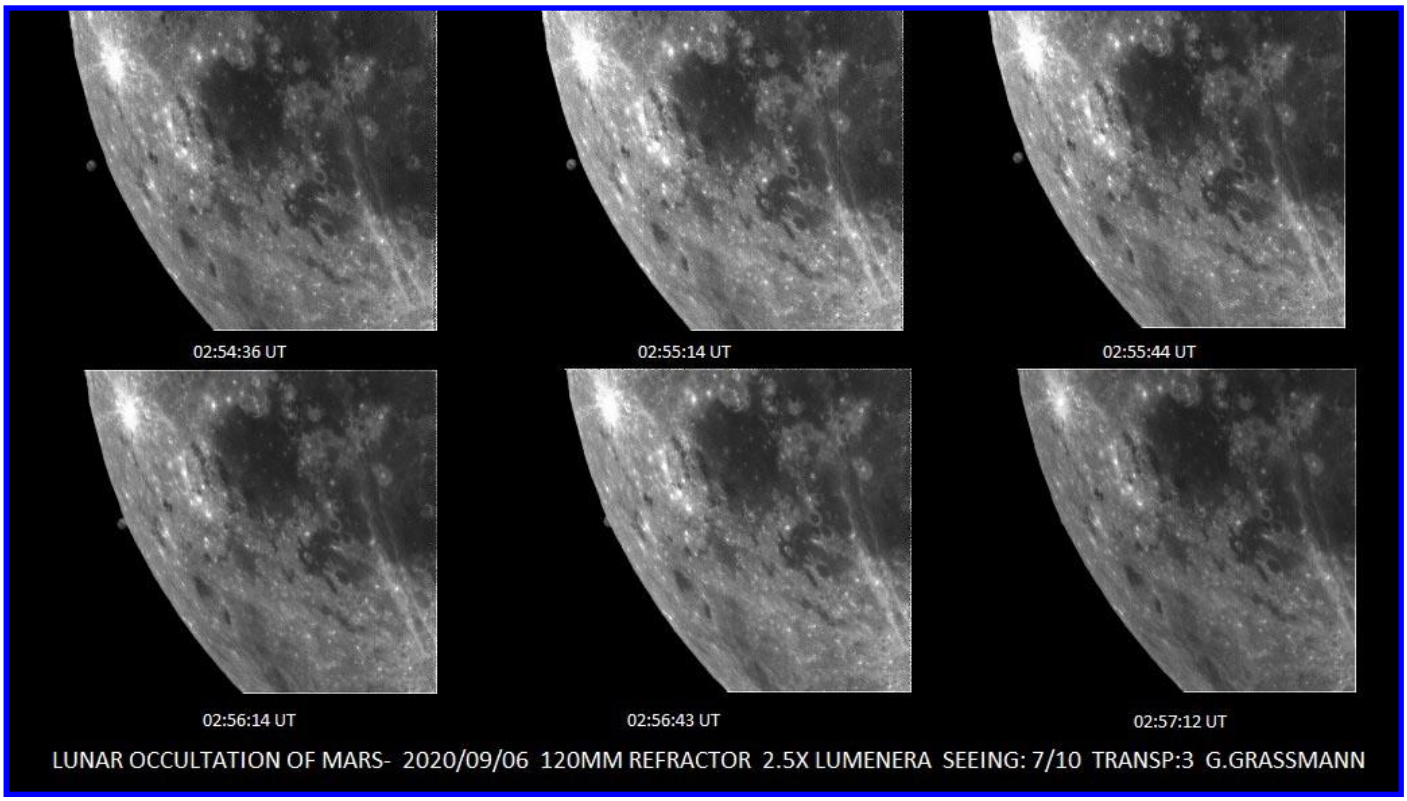
The Moon and Mars, *Raúl Roberto Podestá, SLA, Formosa, Argentina. 09 August 2020. Times are listed. 127 mm Maksutov-Cassegrain telescope, Hokenn CCD imager*

08:20 UT

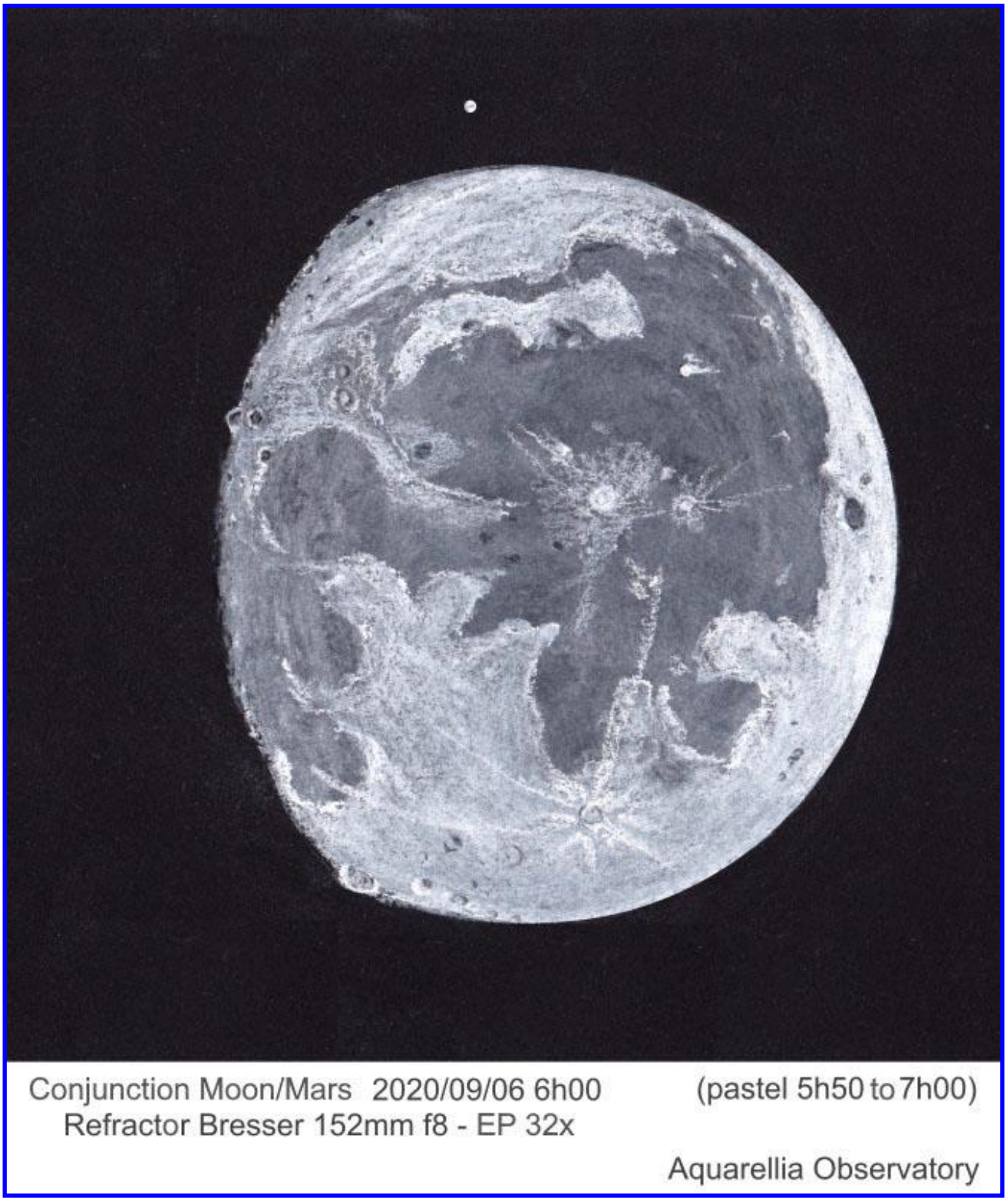
08:21 UT

08:53 UT

***Moon-Mars Conjunction**, Leandro Sid, AEA, Oro Verde, Argentina. 06 September 2020. 1250 mm x 90 mm Meade StarNavigator NG 90 Maksutov-Cassegrain telescope, Sony DSC-W310 camera.*



***Lunar Occultation of Mars,** Guilherme Grassmann, 06 September 2020. 120 mm refractor telescope, 2.5 x Lumenera. Seeing 7/10, transparency 3/6.*



Conjunction of Moon and Mars, *Michel Deconinck, Aquarellia Observatory, Artignosc-sur-Verdon Provence, France. 06 September 2020 05:00 to 07:00 UT. Bresser refractor telescope, 152 mm f/8, 32x. Pastel.*

***Moon-Mars Conjunction**, Leandro Sid, AEA, Oro Verde, Argentina. 06 September 2020 03:04 UT. 1250 mm x 90 mm Meade StarNavigator NG 90 Maksutov-Cassegrain telescope, Samsung J7 Prime camera.*

***Moon and Jupiter Conjunction,** Diego Etchevers, Montevideo, Uruguay. 29 August 2020 01:07 UT. Nikon D850 camera with 100 mm teleconverter. Separation 1°21'23".*

Lunar Geologic Change Detection Program

Coordinator Dr. Anthony Cook- atc@aber.ac.uk
Assistant Coordinator David O. Darling -DOD121252@aol.com

2020 October

Introduction: In the set of observations received in the past month, these have been divided into three sections: Level 1 is a confirmation of observation received for the month in question. Every observer will have all the features observed listed here in one paragraph. Level 2 will be the display of the most relevant image/sketch, or a quote from a report, from each observer, but only if the date/UT corresponds to: similar illumination (±0.5º), similar illumination and topocentric libration report (±1.0º) for a past LTP report, or a Lunar Schedule website request. A brief description will be given of why the observation was made, but no assessment done – that will be up to the reader. Level 3 will highlight reports, using in-depth analysis, which specifically help to explain a past LTP, and may (when time permits) utilize archive repeat illumination material.

News: Back in August David Teske very kindly forwarded onto me an image of Tycho with the central peak emerging from shadow, taken by Darryl Wilson on 2017 Aug 01 UT 02:08. This is helpful for a Lunar Schedule project to see at what solar altitude, the central peak becomes visible. In Darryl's image the solar altitude was +1.5º, but we know from earlier images that it can become visible at well below +1.0° solar altitude – possibly due to scattered light off the illuminated rim. Nevertheless, it was a useful image as it can be used to show how the central peak brightens over time.

Darryl Davis forwarded me an interesting article from an old edition of the Publication of the Astronomical Society of the Pacific concerning a notch seen on the limb of the Moon during the partial stages of a solar eclipse. Notches of course lead to Bailly's Beads at totality but not during the partial stages. This was seen by some astronomers on a plane at 20,000 feet, near Minneapolis on 1954 Jun 30 at 4:25 local time. When the Sun was only 35% covered by the Moon, and furthermore seen with the naked eye. The article rightly dismisses topography on the Moon but considers some short-term refractive effect in our atmosphere. As the Sun had not completely risen above the local horizon this seems the correct conclusion.

Finally, back in June Dietmar Büttner emailed me a link to a Nature Paper on "Impacts Drive Lunar Rockfalls Over Billions of Years" which shows the locations on the Moon where they have found 136,610 examples of rock falls, the majority of which were induced by impacts, though by studying boulder size distribution they deduced that at least some of these rock falls may have occurred due to non-impact geologically recent seismic activity e.g. in Mare Orientale, Montes Rock, Montes Cordillera, Tsiolkovsky, Pasteur D, Atlas, Aristotles, Milne N, Milne L, and Crookes. Only two of these are known to us as LTP craters: Aristotles and Atlas. Perhaps we should pay some attention to some of the other near side features mentioned.

LTP reports: Three reports have been received, though none are LTP:

Proclus, Römer, Theophilus and Carmichael: On 2020 Sep 23 UT 01:18 Leandro Sid (Argentina – AEA) imaged the region of the Moon that included Mare Crisium and noticed pink color on north western the floor of Proclus. As you can see from Fig 1, once color saturation has been turned up, indeed there is a hint of pink there. However, there is an even stronger color, orange in the crater Römer, some color on the rim of Carmichael, as well as color in Theophilus, Isidoris etc. The chances of LTP breaking out in several very widely separated locations seems extremely unlikely, but it is also odd that color is not present on some other craters. It may be chromatic aberration or atmospheric spectral dispersion, or some form data compression noise or imaging artefact introduced by the smart phone camera, or even a combination of these? If I find out anything more then I will let you know. But I would like to thank Leandro for sending this image in to query.

Figure 1. *The NE part of the Moon as imaged by Leandro Sid (Argentina – AEA) with north towards the top and color saturation increased to 75%.*

Unknown: On 2020 Sep 22 someone from Florida (I'm not giving their name here) emailed me the following: *"Hello. I am an amateur astronomer, frequently on my Orion SkyScanner. Even though I've heard about LTPs for years, my mind was blown when I saw it for myself just yesterday. I am all in. Can I help?"*. I emailed them back for further detail but have not had a reply. This will be given an ALPO/BAA weight of 0 as it is just too vague!

Ptolemaeus: I received the following communication from Alexandre Amorim in Brazil: *"Well, I want to share a curious experience regarding the crater Ptolemaeus. Observer Nelson Travnik (85 years-old) told me about his last (and second time) observation of this crater in 27 Jul 2020, 23:00 UT, about the "kind of glimmering mist lifted & wafted inside the shady hollow of the crater" etc... etc... etc... - as he observed first in 14 Apr 1970 at 00:45 UT (See. #1248 in Cameron Catalog, 1978). I talked to him: Mr. Travnik said: 'ok, it's a beautiful phenomena, but.... it is Normal! Every time near colongitude 1.4° this phenomena occurs. Even in my Astronomy Yearbook for 2020, page 76, I published those dates which the beginning of illumination in Ptolemaeus will be observable in Brazil...'".* We shall update the Lunar Schedule web site to include this colongitude as the effect, although not an LTP it is spectacular, and this crater has been topical in the last few newsletters.

Level 1 – All Reports received for August: Jay Albert (Lake Worth, FL, USA - ALPO) observed: Birt, Copernicus, Hyginus, Mons Piton, Plato, Posidonius, Promontorium Agassiz, Theophilus and Tycho. Alberto Anunziato (Argentina - SLA) observed: Biot, earthshine, and Posidonius A. Walter Elias and other AEA team members (Argentina) imaged: Aristarchus. Valerio Fontani (Italy – UAI) imaged: Mons Pico and Tycho. Desiré Godot (Argentina – SLA) imaged: Eudoxus. Rik Hill (Tucson, AZ, USA - ALPO/BAA) imaged: Endymion and Meton. Trevor Smith (Codnor, UK – BAA) observed: Plato and Plinius.

Level 2 – Example Observations Received :

Aristarchus: On 2020 Aug 02 UT 01:10 Walter Elias and colleagues (AEA) took a nice color image of this region under similar illumination to the following past LTP reports:

On 1963 Nov 29 at UT 01:30-03:00 Fisher (Colefax, CA, USA, 20cm reflector, thin streamers of cloud across sky, but no wind) Aristarchus had a faint pale-yellow tint along the rim and the crater was very bright. No detail seen in in Vallis Schroteri. Yellow spot also seen on the northern limb (Carpenter and Pythagoras?). Both effects had been seen the previous night and were confirmed by friends. Color still present when observing stopped at 03:00 UT. The ALPO/BAA weight=1.

Aristarchus, Herodotus - 1967 Sep 16 UTC 23:50-23:55 observed by Seeliger (Dresden, Germany, 30" reflector, 90, 140x) "Dark streaks on E. (ast. ?) outside walls of both craters. No shadow from Herod. wall. Drawings (wall < 18 deg slope if no shadow normally)." NASA catalog weight=3. NASA catalog ID=#1044. The ALPO/BAA weight=1.

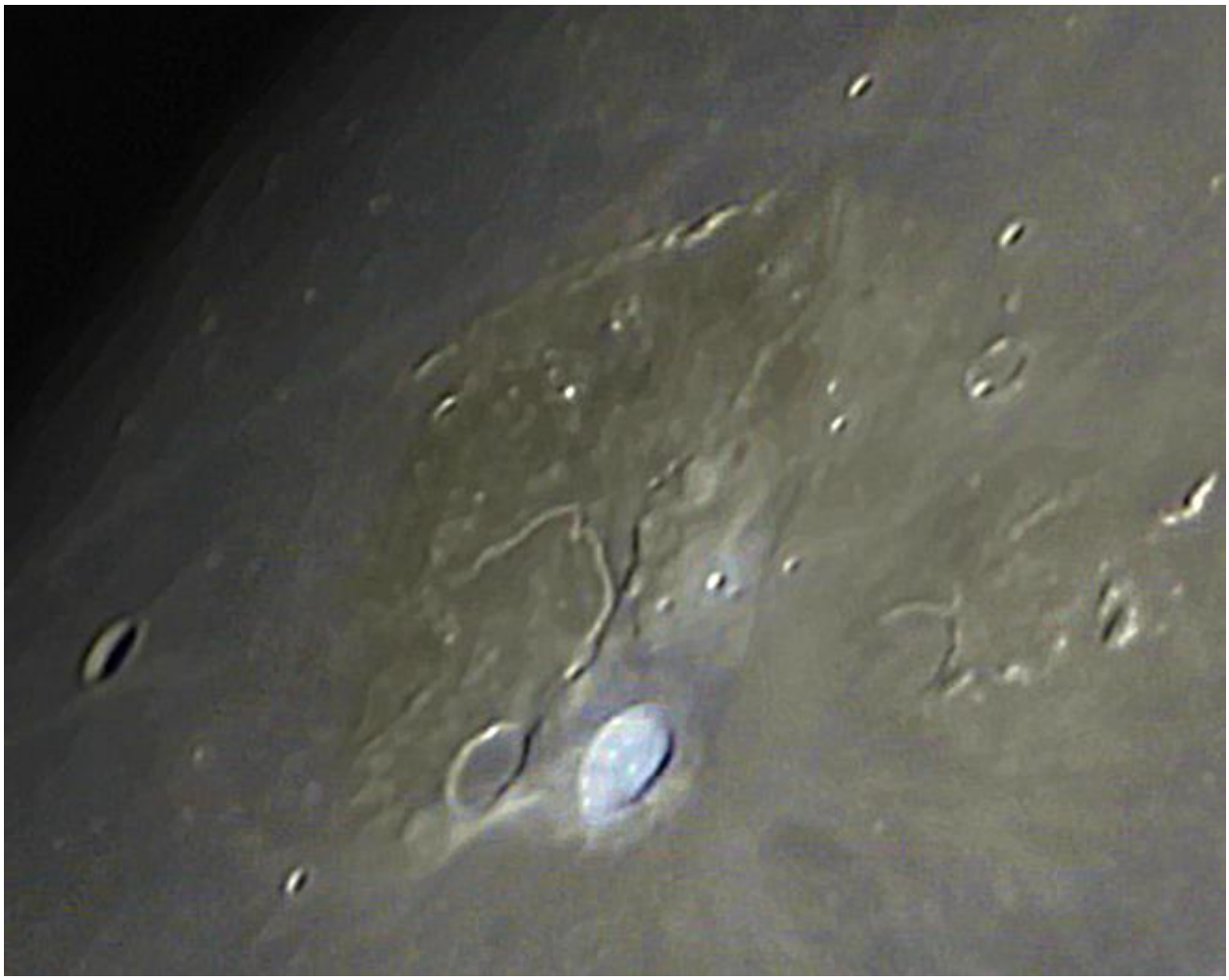


Figure 2. *The Aristarchus region as imaged by AEA observers on 2020 Aug 02 UT 01:10 and orientated with north towards the top. The image has had color saturation increased to 30%.*

The image submitted by the AEA observers shows the nice brownish color of the Aristarchus plateau and some equally blue coloration in the crater itself. With regard to the two repeat illumination events, Fig 2 is what they should have seen if the crater had been normal, but the descriptions differ to what is in the image. We shall leave the weights at 1 for both these past LTPs for now.

Plinius: On 2020 Aug 08 UT 00:30-00:45 Trevor Smith (BAA) observed this crater visually under similar illumination to the following Victorian era report:

Plinius 1889 Sep 13 UT 23:00? Observed by Thury (Geneva, Switzerland) NASA Catalog Event #265, NASA Weight=3. Event described as: "Unusual black spot with intensely white 4" border over CP. Normal aspect is 2 craters. #260 says that Gaudibert saw same thing in Sep. - confirmed". References: Nature 41, 183, 1890 (April). The ALPO/BAA weight=1, this is probably perfectly normal.

Trevor was using a 6-inch, f/5, reflector that had been made in the 1950's by mirror maker: Jim Hysom. Trevor states that no unusual black spots were seen, and everything looked normal! We have covered this LTP before in the 2018 Jan TLO, p25 and shall leave the weight at 1 for now.

Eudoxus: On 2020 Aug 28 UT 23:45 Desiré Godoy (SLA) imaged this crater, using a 20cm refractor, and a QHY5-II camera with a 742nm filter, under similar illumination and similar viewing angle to the following report:

On 1882 Jan 29 at UT 17:00-17:30 an unknown observer noted an unusual shadow in Eudoxus crater. The Cameron 1978 catalog ID=227 and the weight=2. Reference: Sirius Vol 15, 167, 1882. The ALPO/BAA weight=2.

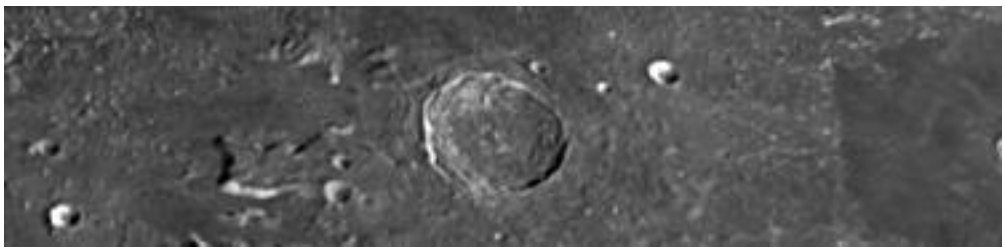


Figure 3. *Eudoxus as imaged by Desiré Godoy (SLA) on 2020 Aug 28 UT 23:45. Orientated with north towards the top.*

As you can see from Fig 3, there is nothing unusual in the shadow appearance in this crater. Alas I cannot find the Sirius journal on-line and so cannot glean much more information about this report. We do not even know in which country the observer was? For now, I shall leave the ALPO/BAA weight at 2.

Level 3 - In Depth Analysis:

Mons Pico: On 2020 Aug 03 UT 21:06 Valerio Fontani (UAI) imaged this mountain after the following Lunar Schedule request:

BAA Request: Any color visible on this mountain? Check with red and blue filters e.g. Wratten 25 and 441, else obtain some color images, taking care to under expose slightly so as not to saturate the mountain. Any sketches, visual descriptions, or images taken, should be emailed to: a t c @ a b e r . a c. u k .

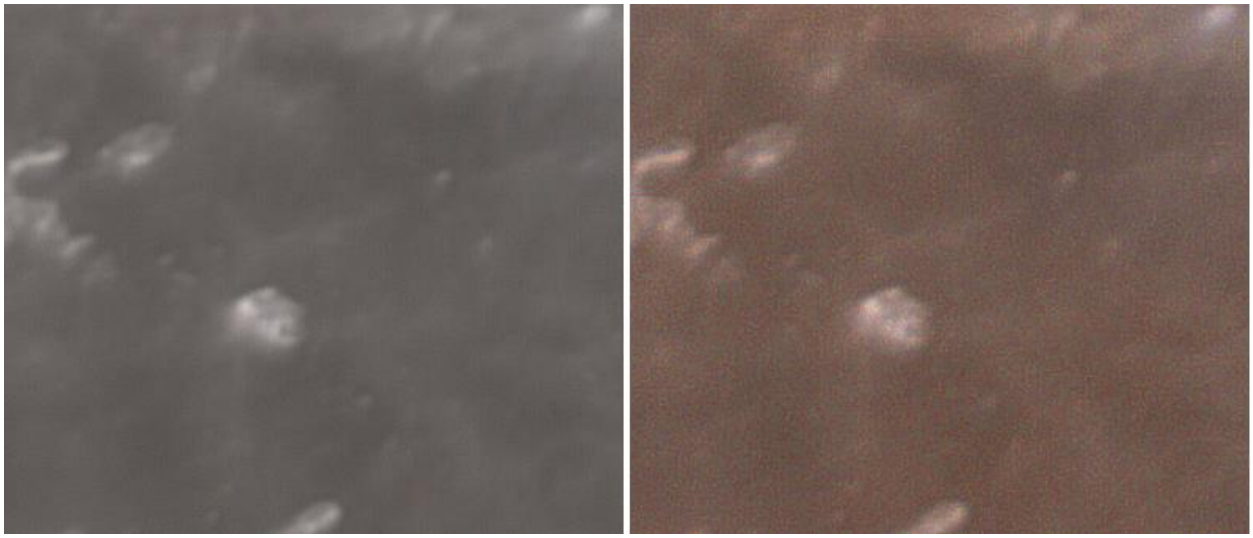


Figure 4. *Mon Pico as imaged by Valerio Fontani (UAI) on 2020 Aug 03 UT 21:06 and orientated with north towards the top.* ***(Left)*** *Section of the original image.* ***(Right)*** *Image with color saturation increased to 70%.*

This actually refers to a LTP from 1996 Dec 24: *"On 1996 Dec 24/25 at 18:12-00:02UT P. Moore (Selsey, UK, using a 15" reflector x250-360, and seeing III) saw a strong orange color on the south wall and floor of Aristarchus. He suspected it to be spurious color but could not detect colors on any other craters. The color remained but at 18:12 UT he suspected a trace on color on Mons Pico but was not sure. However, he reported it to the LTP coordinator of the BAA Lunar Section. The orange in Aristarchus gradually faded and had almost vanished by 00:20UT when seeing was too bad to continue observing. At 02:30UT he was able to re-observe again and there was still a very slight hint of orange in Aristarchus - but he comments that if he had not been looking for it, he might not have noticed. ALPO/BAA weight=2.".* The report by Patrick Moore is mostly about Aristarchus, but the Mons Pico part is really just about a hint of color. I think we can probably reduce the weight to 1 for now, though it is interesting that Valerio's image (Fig 4) shows no color here.

Biot: On 2020 Aug 23 UT 21:45-22:00 Alberto Anunziato (SLA) observed visually this crater under similar illumination to the following report:

On 1969 Jul 19 at UT 16:00-18:01 Azevedo at al. (Joao Pessoa, PB, Brazil, 8" reflector) saw that the west wall of Biot was unusually bright. Had seen it without this condition several months earlier. This was from the Apollo 11 watch. Jose da Silva says that this was not a LTP as the observers were inexperienced. The Cameron 1978 catalog ID=1163 and weight=0. The ALPO/BAA weight=1.

Alberto, using a 105 mm. Maksutov-Cassegrain (Meade EX 105), at x154, found that the west wall of Biot was very bright but that it looked normal, indeed very similar to the west wall of Biot A. We shall therefore lower the weight from 1 to 0 and remove it from the ALPO/BAA LTP catalog.

Mons Piton: On 2020 Aug 26 UT 00:40-01:00 Jay Albert observed visually and at 01:48 imaged this mountain under similar illumination to the following report:

Mt Piton 2001 Sep 24 UT 19:25-19:55 Observed by Marie & Jeremy Cook (Frimley, Surrey, UK) described Mt as the brightest point on the terminator flaring seen on the southern end and red in color. Observers really thought it was normal (not an LTP) to be this bright and the flaring was spurious color. Worth checking out just in case, and also because it looks spectacular. ALPO/BAA weight=1.

Figure 5 *A camera phone image of the vicinity of Mons Piton taken on 2020 Aug 26 UT 00:40-01:00 by Jay Albert (ALPO) and orientated with north towards the top.*

Jay was using a Celestron NexStar Evolution 8" SCT at x51 and x226. The twilight sky was hazy, partly cloudy with fast moving puffs of cumulus and a partial blanket of very thin cirrus above. Transparency was first magnitude and seeing was initially 4, increasing to 5/10 as the wind diminished. Mons Piton was by far the brightest feature on the Moon; perhaps the brightest he had ever seen it. Some flaring was seen at higher power, especially on the south part of the mountain, due to the breeze and mediocre seeing. An image was taken (Fig 5). There was an earlier repeat illumination prediction that was just outside the observing window by 19 min:

On 1987 Jun 04 at UT02:26-03:26 D. Darling (Sun Praire, WI, USA, S=G and T=4) observed that Mons Piton was the brightest object on the Moon that he had ever noted before. Variations seen gave the mountain a "silvery" shine. The abnormal brightness was confirmed by another independent observer. The Cameron 2006 catalog ID=302 and the weight=5. the ALPO/BAA weight=2.

From my own experience I can vouch for the fact that small bright features on the Moon look even brighter at low magnifications, through an eyepiece, as they become point-like. This effect is not always well captured in images as they tend to saturate on the brightest features. I will reduce the weights of both these LTP to 0 and remove them from the ALPO/BAA LTP database.

General Information: For repeat illumination (and a few repeat libration) observations for the coming month - these can be found on the following web site: http://users.aber.ac.uk/atc/lunar_schedule.htm . By re-observing and submitting your observations, only this way can we fully resolve past observational puzzles. To keep yourself busy on cloudy nights, why not try "Spot the Difference" between spacecraft imagery taken on different dates? This can be found on: http://users.aber.ac.uk/atc/tlp/spot_the_difference.htm . If in the unlikely event you do ever see a LTP, firstly read the LTP checklist on http://users.aber.ac.uk/atc/alpo/ltp.htm , and if this does not explain what you are seeing, please give me a call on my cell phone: +44 (0)798 505 5681 and I will alert other observers. Note when telephoning from outside the UK you must not use the (0). When phoning from within the UK please do not use the +44! Twitter LTP alerts can be accessed on https://twitter.com/lunarnaut .

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Key to Images In This Issue

1. Anaxagoras
2. Archimedes
3. Aristarchus
4. Aristoteles
5. Atlas
6. Bullialdus
7. Clavius
8. Cleomedes
9. Condorcet
10. Copernicus
11. De la Rue
12. Endymion
13. Eratosthenes
14. Eudoxus
15. Fracastorius
16. Gassendi
17. Geminus
18. Herodotus
19. Janssen
20. Lacus Mortis
21. Lacus Spei
22. Langrenus
23. Lichtenberg
24. Mare Crisium
26. Mare Frigoris
27. Mare Humboldtianum
28. Mare Humorum
29. Mare Marginis
30. Maurolycus
31. Mercurius
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41. Plato
42. Posidonius
43. Proclus
44. Schiller
45. Sinus Iridum
46. Theophilus
47. Tycho
48. Xenophanes