The Lunar Observer

A Publication of the Lunar Section of ALPO

David Teske, editor
Coordinator, Lunar Topographic Studies Section Program

APRIL 2025

In This Issue

Lunar Reflections

Greetings to all. Many thanks to all who have contributed to this issue of *The Lunar Observer*. I hope that you find this issue interesting. In this issue, there are short articles in Lunar Topographic Studies by:

- Howard Eskildsen about the region from Stöfler to Heraclitus.
- Alberto Anunziato brought us interesting articles about possible volcanic craters in the area near Copernicus and Flamsteed P, and look at the play of light and shadow near Mercator and an usual landform south of Mare Cognitum.
- Robert Reeves gave a very interesting report on a large accumulation of historic lunar exploration data.
- We welcome a new contributor this month, Michael Machleb of Berlin, Germany. He provided insights on lunar imaging. We welcome Michael and look forward to more interesting articles!
- Anthony Harding shared his trials and tribulations of observing and imaging the March 14, 2025 total lunar eclipse.
- David Teske tried peering over the northeast limb of the Moon to check out that libration zone with his small telescope.
- Darryl Wilson observed and imaged the eclipse at thermal infrared wavelengths and provided the first of many reports on the eclipse.

Several people contributed to the images and drawings to the Recent Topographic Studies. Along with the lunar landforms, several people submitted great images of the March 14, 2025 eclipse. Many thanks to all who contributed.

As always, Tony Cook has provided in depth studies in Lunar Geologic Change.

Many thanks to all who contributed, and to all interested in *The Lunar Observer*!

Please try to zoom the ALPO anual meeting on July 25-26, 2025. See page 8 for details.

Our next Focus-On article features Volcanic Lunar Features. Please get images, drawings and articles to Alberto Anunziato and David Teske by April 20, 2025.

Clear skies,
-David Teske

Online readers, click on images for hyperlinks

Edited by David Teske: david.teske@alpo-astronomy.org
2162 Enon Road, Louisville, Mississippi, USA
Back issues: http://www.alpo-astronomy.org/

Lunar Topographic Studies

Coordinator – David Teske - david.teske@alpo-astronomy.org
Assistant Coordinator– Alberto Anunziato albertoanunziato@yahoo.com.ar
Assistant Coordinator-Wayne Bailey– wayne.bailey@alpo-astronomy.org
Website: http://www.alpo-astronomy.org/

Observations Received

Name	Location and Organization	Image/Article
Alberto Anunziato	Paraná, Argentina	Article: *Are Flamsteed P and Some Secondary Copernicus Craters of Volcanic Origin?, article and drawing A Play of Chiaroscuro Northeast of Mercator A* and *A Very Rare Landform South of Mare Cognitum.*
Sergio Babino	Montevideo, Uruguay	Images of Copernicus (2).
Maurice Collins	Palmerston North, New Zealand	Images of the Total Lunar Eclipse (3), the 5.27 day-old Moon, the 7.28-day-old Moon, the 10.3 day-old Moon, Gassendi and Ptolemaeus.
Walter Ricardo Elias	Oro Verde, Argentina, AEA	Images of Mare Imbrium, Alphonsus and Tycho.
Howard Eskildsen	Ocala, Florida, USA	Images of Mons Mouton, the Lunar X and article, images *Stöfler to Heraclitus* and the Total Lunar Eclipse (22).
Lawrence Garrett	Fairfax, Vermont, USA	Images of the Total Lunar Eclipse (2).
Jeff Grainger	South Cumbria, UK	Images of Mare Australe, Bullialdus, Clavius-Tycho, Northeast Limb, North Limb, Plato, Sinus Medii and Tycho.
Anthony Harding	Northeast Indiana, USA	Article and image *One Observer's Lunar Experience.*
Richard Hill	Loudon Observatory, Tucson, Arizona, USA	Images of Mare Crisium showing Blue Ghost Landing Site
Dylan Hilligoss, Steve Rifkin, Stanley M. Max	Towson University Observatory, Towson, Maryland, USA	Image of the Full Moon.
Michael Machleb	Berlin, Germany	Image of the First Quarter Moon, article and image *Playful Amateurs Or: Imaging Our Moon as a Suburban Amateur Astronomer*.

Lunar Topographic Studies

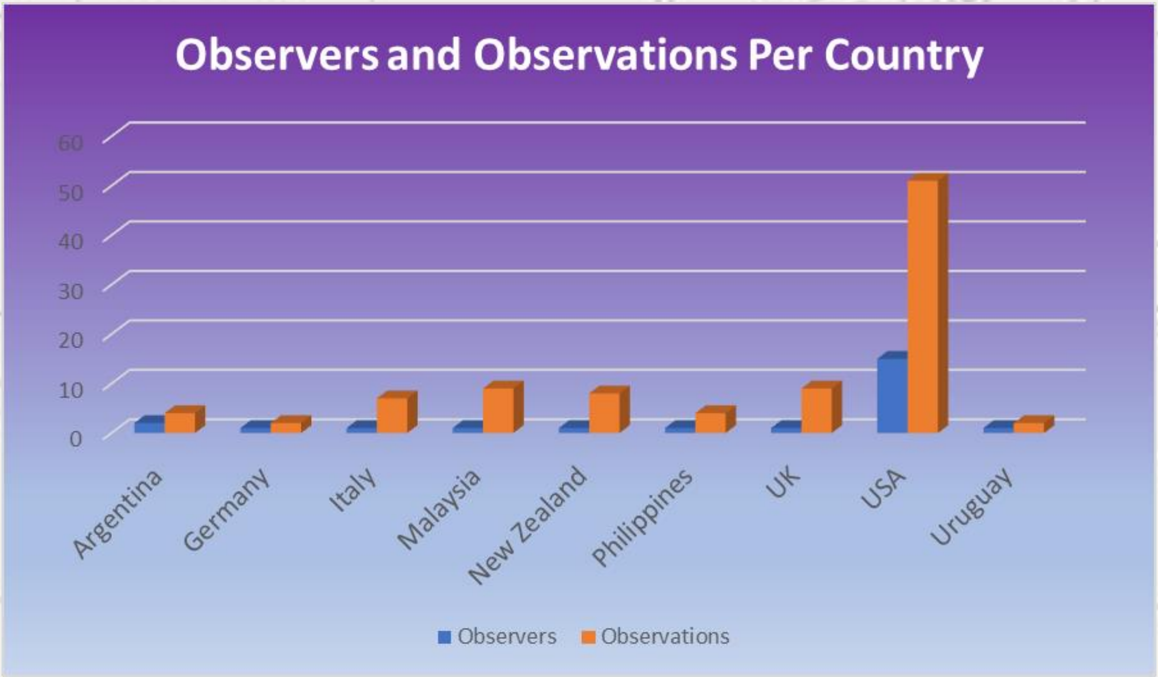
Coordinator – David Teske - david.teske@alpo-astronomy.org
Assistant Coordinator– Alberto Anunziato albertoanunziato@yahoo.com.ar
Assistant Coordinator-Wayne Bailey– wayne.bailey@alpo-astronomy.org
Website: http://www.alpo-astronomy.org/

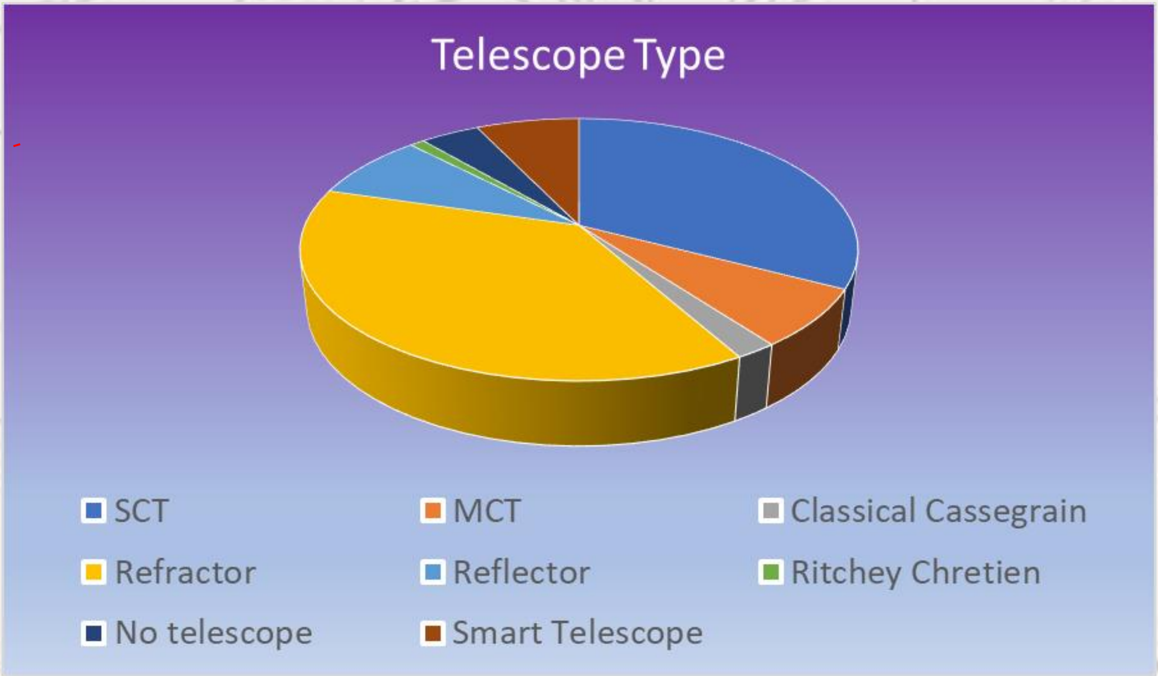
Observations Received

Name	Location and Organization	Image/Article
Luigi Morrone	Agerola, Italy	Images of Atlas, Posidonius, Mare Crisium, Langrenus, Janssen, Bürg and Carrel.
John O'Neal	Statesville, North Carolina, USA	Images of the Total Lunar Eclipse (3).
Robert Reeves	San Antonio, Texas, USA	Article *An Accidental Keeper of Lunar History*.
Guido Santacana	San Juan, Puerto Rico, USA	Images of Capuanus (2), Shiller and Gassendi.
Gregory T. Shanos	Sarasota, Florida, USA	Images of the Total Lunar Eclipse (7).
Michael Sweetman	Sky Crest Observatory, Tucson, Arizonia, USA	Images of Deslandres and Hesiodus.
Michael Teoh	Ipoh, Perak, Malaysia	Images of Mersenius, Moretus, Aristarchus, Scheiner, Waxing Gibbous Moon, Schickard, South Pole, Schiller and Gassendi.
David Teske	Louisville, Mississippi, USA	Image of Mercator, article and image *Small Telescope Lunar Musings: East of Crisium*.
Peter Benedict "Sky" Tubalina	Manila, Philippines, Astro Tourism, Phillipines	Images of the 1 day-old Moon, a grazing lunar occultation and the Full Moon.
Paul Walker	Middlebury, Vermont, USA	Images of the Total Lunar Eclipse (2).
Darryl Wilson	Marshall, Virginia, USA	Article and images (4) *First Look at the March 14, 2025 Lunar Eclipse at Thermal Infrared*

April 2025 *The Lunar Observer* By the Numbers

This month there were 96 observations by 24 contributors in 9 countries.





ALPO 2025 Conference: Call for Papers

Tim Robertson & Ken Poshedly, ALPO Conference coordinators

Overview

Due to the success of attracting more and more viewers and participants to our online conferences, the 2025 Conference of the ALPO will once more be held online, this time on Friday and Saturday, July 25 and 26.
The ALPO conference times will be:

- Friday from 1 p.m. to 5 p.m. Eastern Time (10 a.m. to 2 p.m. Pacific Time)
- Saturday from 1 p.m. to 6 p.m. Eastern Time (10 a.m. to 3 p.m. Pacific Time).
- The ALPO Conference is free and open to all via two different streaming methods:
- The free online conferencing software application, Zoom.
- On the ALPO YouTube channel at *https://www.youtube.com/channel/UCEmixiL-d5k2Fx27Ijfk41A*

Those who plan to present papers or presentations must (1) be members of the ALPO, (2) use Zoom, and (3) have it already installed on their computer prior to the conference dates. Zoom is free and available at *https://zoom.us/*
Those who have not yet joined the ALPO may do so online. Digital ALPO memberships start at only $22 a year. To join online, go to *http://www.astroleague.org/store/index.phpmain_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.
There will be different Zoom meeting hyperlinks to access the conference each of the two days of the conference. Both links will be posted on social media and e-mailed to those who wish to receive it that way on Thursday, July 27. The Zoom virtual (online) "meeting room" will open 15 minutes prior to the beginning of each day's activities. Those individuals wishing to attend via Zoom should contact Tim Robertson at *cometman@cometman.net* as soon as possible.

Conference Agenda

The conference will consist of initial welcoming remarks and general announcements at the beginning each day, followed by papers and research findings on astronomy-related topics presented by ALPO members.
Following a break after the last astronomy talk on Saturday will be presentation of the Walter Haas Observing Award. A Peggy Haas Service Award may also be awarded.
A keynote speaker will then follow the awards presentations on Saturday. The selection of a keynote speaker is in progress and the final decision will be announced in the summer issue of this Journal (JALPO66-3).

Presentation Guidelines

All presentations should be no more than 15 minutes in length; the preferred method is 12 minutes for the presentation itself plus 3 minutes for follow-up questions. The preferred format is Microsoft PowerPoint.
Send all PowerPoint files of the presentations to Tim Robertson at *cometman@cometman.net* .

Suggested Topics

Participants are encouraged to present research papers and experience reports concerning various aspects of Earth-based observational astronomy including 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, deteriorating observing conditions brought about by possible global warming, etc.

Information about paper presentations, the keynote speaker and other conference data will be published in this Journal and online as details are learned.

Lunar X Predictions for 2024-2028

5 Year Lunar "X" and "V" Schedule * **

	2024	2025	2026	2027	2028
Jan	18: 0830	6: 1645	25: 1630	15: 0015	4: 0830
Feb	16: 2345	5: 0800	24: 0730	13: 1530	3: 0015
Mar	17: 1400	6: 2300	25: 2145	15: 0600	3: 1500
Apr	16: 0300	5: 1300	24: 1100	13: 1930	2: 0430
					1: 1700
May	15: 1600	5: 0130	23: 2245	13: 0730	31: 0400
Jun	14: 0400	3: 1330	22: 0945	11: 1830	29: 1430
Jul	13: 1430	3: 0015	21: 2000	11: 0500	29: 0030
		1: 1100			
Aug	12: 0130	30: 2130	20: 0630	9: 1530	27: 1100
Sep	10: 1230	29: 0900	18: 1730	8: 0200	25: 2245
Oct	10: 0015	28: 2115	18: 0530	7: 1400	25: 1130
Nov	8: 1245	27: 1045	16: 1900	6: 0300	24: 0145
Dec	8: 0230	27: 0115	16: 0930	5: 1730	23: 1645

* All times are listed as the day of the month and then the hour in **UT**

** All times are approximations based on LTVT calculations. They are accurate to ± 1 hour.

Submitted by Greg Shanos.

Are Flamsteed P and Some Secondary Copernicus Craters of Volcanic Origin?

Alberto Anunziato

I know the title sounds provocative, and it is somewhat so. But being an amateur, I'm going to raise some observational concerns, which coincided with my recent reading of "Secrets of the Moon: Understanding and Analyzing the Lunar Surface" (2022, CRC Press, New York), by Gilbert Fielder. I hope I'm not guilty of geological errors; I'll limit myself to presenting the author's thesis regarding the craters that have caught my attention. Fielder's work leans toward expanding the list of selenographic features related to volcanism (for example, attributing volcanic origin to the wrinkle ridges), which is clearly controversial given the current state of the art in lunar geology.

The craters mentioned in the title appear in chapter 43 of the book, whose title poses the question: "Are there ring dykes on the Moon?" We must bear in mind that the physical conditions of the lava eruption zone will influence the type and shape of the volcanic formation that the eruption will produce. Similarly, the shape of the magma chamber and lava duct will determine the shape of the relief resulting from the eruption. On Earth, "ring dykes" are relatively common: a circular magma chamber leads to "sub-circular crystal fracturing" that would allow magma to rise. The existence of this volcanic formation has not been proven on the Moon, and its geological conditions are less conducive to its formation, but "with the early Moon in free rotation and close to the Earth (and with the widespread grid fracturing discussed earlier), very strong tidal pressures on pockets of magma in the hot mantle, pushing up on a cool crust, would have generated conditions that might have induced ring fracturing. Magmas would have risen, preferentially, along the joints and fractures of the early grid system to create ring complexes that tended to be both sub-circular and polygonal" (page 199). This "Lunar Grid System" (which Fielder defines in the glossary at the end of the book as "a moon-wide fracture system revealed on the surface as respective families of lineaments") would have been generated in an early stage of the Moon's development, facilitated (among other causes) by the greater proximity of the Earth and, consequently, greater gravitational tidal forces. Today, the paradigm that explains the major lineaments of the Moon's surface in terms of basins and rings has prevailed.

Beyond the validity of Fielder's main hypothesis, there is one hypothesis that could be valid independently of the macrotheoretical model: the extrusion of lava from circular magma chambers would have generated "ring dykes," circular complexes that on the Moon would take the form of what we call "ghost craters." For Fielder, not all "ghost craters" (normal craters flooded by liquid lava to the point of almost erasing them from the surface, leaving only the remains of part of their walls) are what he calls "ghost rings" or "elementary rings." These are not craters but volcanic landforms originating from the extrusion of lava from circular fractures. On pages 181-183, he analyzes the supposed differences between the two, using as an example several craters considered flooded, in which "melting of the walls by heating them from underneath is unlikely to leave an elementary ring with a smooth rim of uniform shape and height".

Among these examples, I selected Flamsteed P, a fairly conspicuous crater that looks more like a series of mountain arches than a crater (IMAGE 1 and its detail, IMAGE 2). Of course, this is a personal observation that coincides, almost by chance, with what Fielder points out. The readers can verify for themselves whether the characteristics Fielder attributes to Flamsteed P as an "elementary ring" to distinguish it from ghost craters are discernible: "a smooth rim of uniform shape and height" and "the wall segments of Flamsteed P are lighter-toned than the lunabase." Flamsteed P seems to carry less weight, at least in my opinion as a visual observer, than the case we will analyze below, which has more specific weight.

***Image 1, Copernicus** (and arrow pointing at Flamsteed P), Sergio Babino, Montevideo, Uruguay. 2018 May 26 22:45 UT. 81 mm refractor telescope, Baader Moon and Skyglow filter, ZWO ASI17MM camera.*

***Image 2 (below)** is a close-up of Flamsteed P in Image 1.*

Lunar Topographic Studies

Are Flamsteed P and Some Copernicus Secondary Craters of Volcanic Origin?

Have you ever wondered about the strange shape of the arcuate chain of secondary craters in Copernicus near Stadius? (IMAGE 3 and its detail, IMAGE 4). I've always found this alignment of craters strange. Produced by a catastrophic event, we would expect them to be aligned in a "catena"—a straight chain of craters—or in a random pattern, but not in an arcuate chain. It's true that the craters appear to coincide with the Copernicus rays, but it's peculiar that the largest ones appear to have been the product of boulders that fell "at the same time." What is Fielder saying? "the small craters do have a tendency to define circles that might well be regarded as elementary rings, and this might be suggestive of fracture origins of both the elementary rings and these small craters" (page 203).

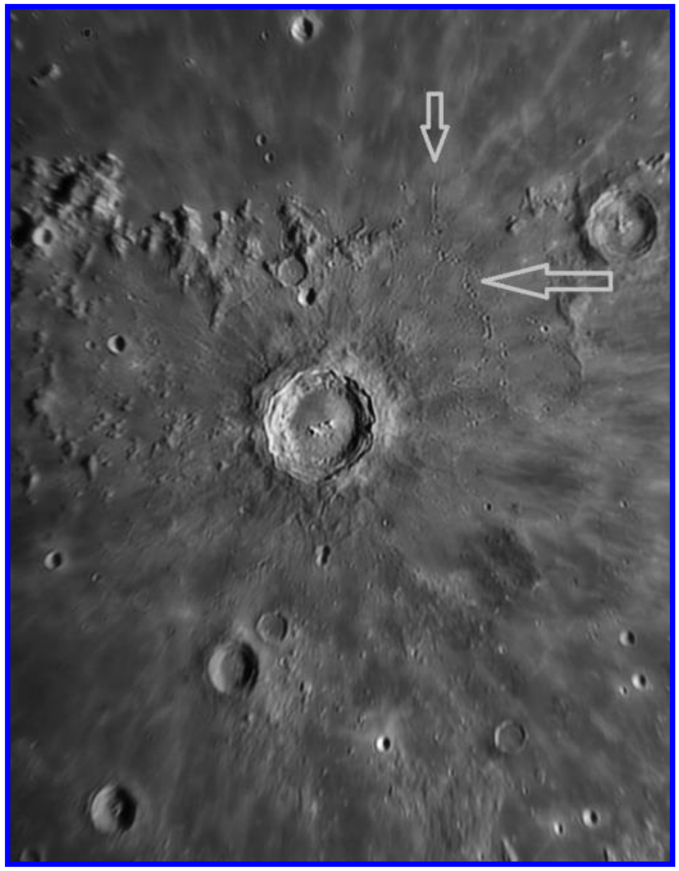
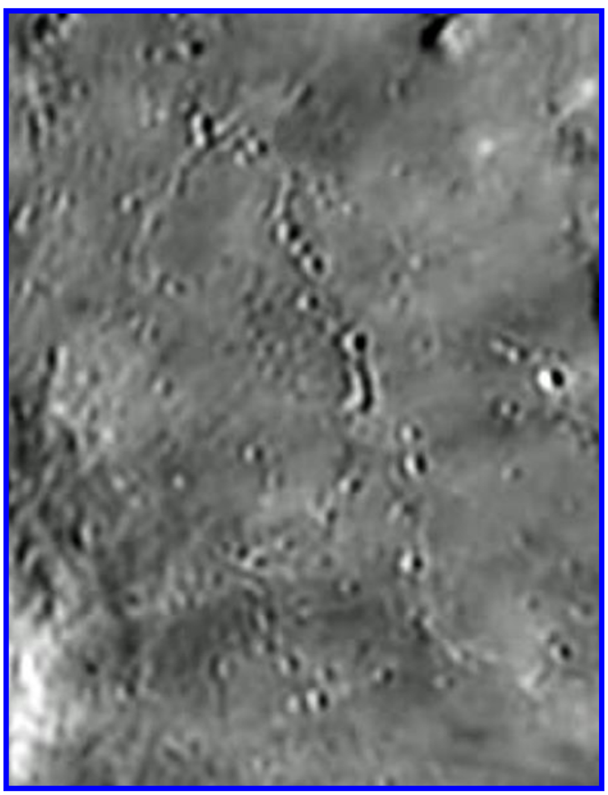


***Image 1, Copernicus**, Sergio Babino, Montevideo, Uruguay, SLA LIADA. 2018 February 26 00:37 UT. 203 mm catadrioptic telescope, ZWO ASI17MM camera. Below, **Image 4,** is a close-up of image 3.*

Not only is the arcuate alignment of these craters considered by Fielder to be evidence of their volcanic origin, but the elongated shape of the craters themselves would also indicate that they followed underground fractures (for Fielder, the elongated shape is usually an indicator of the crater's endogenous origin). In the case of aligned secondary impacts, the impact angle (it seems to me) is not usually of the type that generates elongated craters. We quote Fielder once again: "E. Shoemaker proposed that the elongated craters around Copernicus were secondary impact craters, but that the elongations there were the result of elongated blocks of rock that had been detached and ejected from the Copernicus impact site. I cannot accept that hypothesis, for I consider that in the chaos of a major impact, it is unreasonable to suppose that such blocks could land with their major axes remaining closely aligned" (page 204).



As the ancient Greek skeptics said, I suspend judgment. I can't agree with either of the two hypotheses, which are equally feasible: a strange alignment of peculiar blocks ejected by Copernicus, or endocraters originating from underlying fractures, probably formed in the chaos of the impact that generated Copernicus, as would have occurred at Tycho according to Fielder—that is, volcanic modification of an impact crater. What is certain is that it is an interesting field of research for the future.

Before closing, do you see the chain of craters indicated by the smaller arrow in IMAGE 3? What do you think? Are they impact craters in chains, or are they volcanic craters, since they appear to have the rounded shape of collapse craters and are not superimposed on one another? I think these types of chains of small craters are quite common and could be endocraters. We'll probably return to this topic later.

Stöfler to Heraclitus

Howard Eskildsen

South and a little east of the Lunar X lie the battered craters Stöfler, the flat floored crater on the upper half of the image, and Heraclitus, the battered crater with a notable central ridge as seen in the lower right of the photo. A dark crater on its lower left, Heraclitus D, looks like a gaping mouth, and on the opposite side of Heraclitus, two craters appear like ears attached to it. Cuvier is on the lower right and Licetus on the upper margin of Heraclitus. The group reminds me of a mouse, so I t like to think of it as a "hidden Mickey."

Just above the midline of the image, a once-round, flat-floored crater, Stöfler, has damage from later impacts. It is fun to try to imagine just how many and in what order the later impacts occurred. Two of the more notable craters that deform its margin are Faraday and Fernelius. Faraday, on the lower right margin of Stöfler, has had multiple subsequent impacts crater its rim and interior. Fernelius has had also had subsequent erosion by impacts but to a lesser degree.

Due to the poor seeing conditions, I imaged with my small aperture, Meade ETX-125, and was quite pleased with the results. I have had it over 20 years, and it was a gift from my wife.

Heraclitus, Stofler 2025/03/07 00:12 UT, Seeing 6/10, Transparency 6/6
Meade ETX-125, 1900 mm fl, F-15, 2X Barlow, DMK 41AU2.AS, No filters
Howard Eskildsen, Ocala, Florida, USA

A Play of Chiaroscuro Northeast of Mercator A

Alberto Anunziato

IMAGE 1 is a subjective image of a play of light and shadow that I observed for the first time on the surface of the Moon. The crater is Mercator A, a crater included in ALPO's list of Bright Ray Craters. I didn't know this fact at the time of the observation (in fact, I know nothing about this 9 km diameter crater), but I noted in my observation log that it probably was. Truth be told, attributing to a bright ray the bright band that appears to run from Mercator A to the south wall of Mercator (which is the twin crater of Campanus, forming the pareidolia of a telescope) seemed absurd at the time of the observation, since the illumination was oblique near the terminator. The odd thing is that the shadow cast by Mercator's south wall and the mountainous extension Elger refers to in “The Moon” ("The W. wall extends on the S. far beyond the limits of the formation, and terminates in a brilliant mountain mass 6,000 feet in height") is interrupted in the central region, which appears bright but with a subdued brightness. The shadow on the sides of the bright area is very dark, while the bright central area seemed covered by a veil—not a shadow, but as if a thin dark veil had been drawn over the bright area Elger refers to: "On the plain W. of Mercator is a remarkable little crater standing on a light area." This area on the edge of Palus Epidemiarum is mountainous, as observed in the brightness related to height.

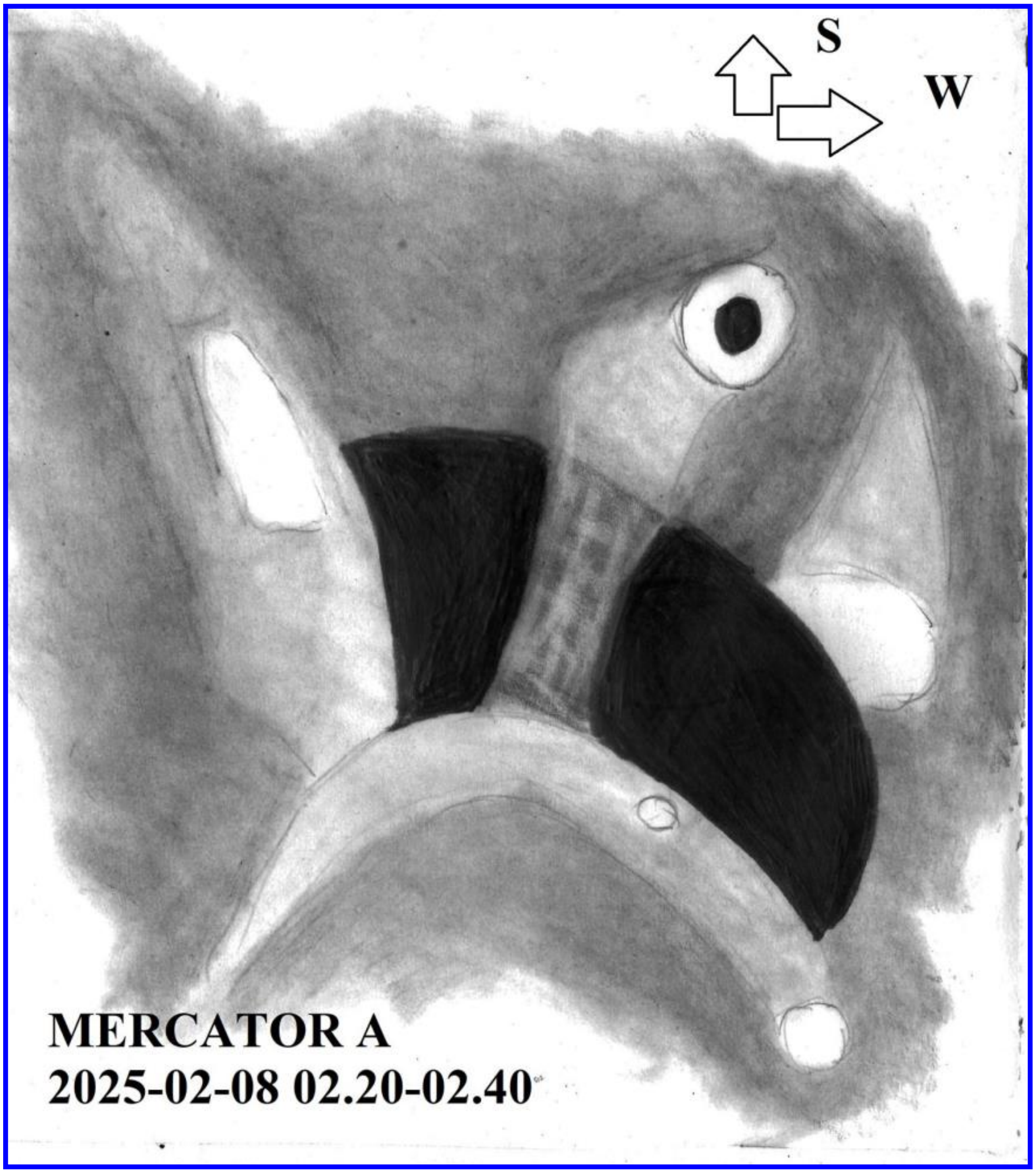


Image 1, Mercator A, *Alberto Anunziato, Paraná, Argentina. 2025 February 08, 02:20-02:40 UT. Meade EX105 Maksutov-Cassegrain telescope, 154x.*

Lunar Topographic Studies
A Play of Chiaroscuro Northeast of Mercator A

This is clearly demonstrated in IMAGE 2, where we see our area with higher resolution and it clearly looks like some kind of mountain range located at the center of the shadow cast by Mercator and its prolongation (which can be verified using the relief analysis tools of the LROC Quickmap). The beautiful effect of a veiled brightness surrounded by shadows is more faintly perceived in IMAGE 2 and its detail in IMAGE 3. The lower resolution of my telescope probably hid the mountainous appearance we see in David Teske's IMAGE 2 (which I took from his contribution to Focus On Mare Nectaris a few months ago), and it ended up looking like a veiled band. A nice observing experience in this strange area that combines the brightness of a bright ray and that of a mountainous area reflecting the first rays of the Sun.

Image 2, Mare Nubium, *David Teske, Louisville, Mississippi, USA. 2022 March 13 02:29 UT, colongitude 29.1˚. 3.5 inch Questar Maksutov-Cassegrain telescope, IR block filter, ZWO ASI120MM/s camera. Seeing 8/10.*

Image 3, Mercator, *a close-up of Image 2.*

An Accidental Keeper of Lunar History

Robert Reeves

When I was young and the Apollo program to explore the Moon had not yet started, the premier photographic atlas for lunar studies was the famous Kuiper Photographic Lunar Atlas released by the University of Chicago in 1960. The red boxed Atlas is a prized historical artifact today. It wasn't until follow TLO contributor Rik Hill and I visited Ewen Whitaker, one of the Atlas' authors, in Tucson several years before his passing that I finally saw a copy of the Kuiper Atlas. Sitting on the floor of the "Moon room" in Whitaker's house, I leafed through Whitaker's personal copy and was enthralled with the history of the Atlas but totally shocked at the low resolution the images in this famous work. I routinely discard Moon images that are an order of magnitude better than the plates in the Kuiper Atlas. But in the early 1960s as America cast an eye at landing a man on the Moon by the end of the decade, the Kuiper Atlas was the best we had.

To satisfy the need for higher resolution images for Apollo mission planning, NASA developed several robotic missions. Initially, the Surveyor program planned for both a reconnaissance orbiter and a robotic lander. As the Surveyor program grew more complex, the orbiter was cancelled. In 1962 and 1963, three Ranger hard landers were equipped with television cameras to record the surface moments before impact. However, Ranger 3, 4, and 5 either missed the Moon or failed enroute. In 1964 and 1965, television equipped Ranger 7, 8, and 9 reached the Moon and beamed back high-resolution images orders of magnitude better than Earth-based lunar photography. Although the final images showed details as small as a meter, the football field-sized of view was a mere fraction of a percentage of the Moon's visible face.

To gather wide-field high resolution images to chart potential Apollo landing sites, the Lunar Orbiter project was initiated to place up to six camera-equipped satellites in low lunar orbit. Television cameras lacked sufficient resolution, so a film photographic system was employed. However, the Lunar Orbiters were on a one-way trip to the Moon and the film could not be returned to Earth for processing. The Boeing company was chosen as the prime contractor with the Eastman Kodak company providing the photographic system. Though the Boeing proposal was not the lowest bid, the Kodak photo system utilized a dry development method and a stunningly high-resolution film scanning system developed by the Columbia Broadcasting System (CBS) to radio the images back to Earth. Other contractor proposals using liquid film developer were deemed too risky in the weightlessness of space.

The Lunar Orbiter spacecraft evolved into a 5.5-foot high 850-pound spacecraft comprised of the 150-pound Kodak photography module topped by four fuel tanks carrying 262 pounds of fuel to power a repurposed Apollo Lunar Module reaction control engine that would insert the craft into lunar orbit. Four solar panels and twin antenna booms spanned 12 feet across the craft's base.

The camera system carried 260 feet of 70mm Kodak SO-243 High-Definition Aerial Film. Amazingly, the camera lenses were not custom made but were commercially available units. The wide field lens was an 80mm f/2.8 Schneider Kreuznach made in (West) Germany and the narrow field lens was a Pacific Optical 610mm f/5.6. Both lenses projected their focus onto different portions of the same film strip. Shutter speeds of /25th. 1/50th, or 1/100th of a second could be selected. After development, the film was scanned by 5.6 micron flying spot at 286 lines per millimeter. It took the film scanner 48 minutes to scan each exposure and relay the signal to NASA's 85-foot-diameter Deep Space Communications antennas spread around the world.

Lunar images were prepared by Eastman Kodak by playing the recording of segments of the film scans on a kinescope that was then photographed on 35mm film. The individual 35mm strips were then manually aligned and rephotographed on a master 9 ½-inch negative. NASA's Langley Research Center in Hampton, Virginia then printed the final 20x24-inch prints on glossy paper. The U. S. Army Corps of Engineers through their mapping division also printed each lunar photo on double weight matte paper.

To NASA's surprise, all five Lunar Orbiter satellites were successful. Mission 1, 2, 3 satisfied the need for Apollo site selection and missions 4 and 5 were released for lunar science and mapped 99% of the Moon's globe. Between August 1966 and August 1967, the Lunar Orbiter project revealed the geology and form of the Moon on an unprecedented scale. The Kuiper Lunar Atlas was like looking at the Moon through foggy glasses while the exquisite Lunar Orbiter photos were like examining Luna under a microscope.

It was not until decades after the Lunar Orbiters flew that it was revealed that the photographic system was not specifically designed for Lunar Orbiter. Kodak secretly used the same photographic system it had perfected years before for the Air Force's Samos reconnaissance satellites flown in the early 1960s. For security, a cover story stated that it was designed for Lunar Orbiter. The film development and scanning system proved too slow for use in an Earth-orbiting spy satellite but was perfect to reveal the Moon in astounding detail.

When the Lunar Orbiter missions flew, I was stationed at the Yorktown Naval Weapons Station near Hampton, Virginia where the project was managed. The Hampton newspaper continuously showed photos and articles about the locally managed Lunar Orbiter project, and I marveled at each new release showing a part of the Moon in unimaginable detail compared to traditional earthbound views.

When the Apollo program ended in the early 1970s, NASA moved on to the Skylab program and development of the Space Shuttle. The massive archive of thousands of Lunar Orbiter photos at the Manned Spacecraft Center (now the Johnson Space Center) were unceremoniously thrown in the dumpster. Several lunar scientists subsequently rescued them from the trash and the archive became the core of the Lunar and Planetary Institute (LPI) in Houston. Fast forward three decades, and I visited the Lunar and Planetary Institute several times and greatly admired the amazing Lunar Orbiter photographs.

Fast forward another two decades and the Lunar and Planetary Institute decided they no longer needed the Lunar Orbiter print archive and they were going to scrap it. The Corpus Christi, Texas, astronomy club found out about this and sent several trailers to the Institute and rescued the print archive again. After sorting the images into several complete sets, they were presented to Texas A&M University. Many of the several thousand remaining prints were freely offered to anyone who wanted them.

The remains of the archive came to my attention about a year ago and I travelled to Corpus Christi ands picked up several hundred pounds of prints. After sorting them, I found I had about half of all images taken by the Lunar Orbiter 2, 3, 4, and 5 missions. The keeper stack was three feet high, and the stack of duplicates was equally high. A week of woodworking created a massive custom cabinet to safely store the lunar bounty.

In January, the Corpus Christi astronomy club contacted me to say that Texas A&M only wanted a single set on images, and I could have the remainders. Once transported to my office, the new stack of images was as tall as I am. The process of sorting and cataloging the new archive will likely take until summer, but it is apparent that I now have at least 80 percent of the images taken by Lunar Orbiters 2, 3, 4, and 5. Curiously, there are no images from Lunar Orbiter 1. My suspicion is the mission 1 images may have been hauled to dump 50 years ago before they could be rescued and moved to the LPI.

I spend hours examining these historical images and it is thrilling to hold in my hands the very images used to select Apollo landing sites. One image, frame II-87-h1 had several overlays taped to it outlining an area requesting an enlargement of selected areas. Curious about why such a request was issued, I checked the central coordinates of Lunar Orbiter II frame 87. It was Tranquility Base, the Apollo 11 landing site! I realized I may have the actual Lunar Orbiter print used for the Apollo 11 landing site selection.

Sadly, the spectacular groundbreaking images like the edge-on view of Copernicus crater dubbed the "Picture of the century" by the press in 1967, or the Lunar Orbiter 4 image of the Orientale Basin that redefined lunar geology, are missing from my collection. But so many of my lunar friends lay before me is needle sharp detail.

All original Lunar Orbiter images are now available online as high-resolution scans at https://www.lpi.usra.edu/resources/lunarorbiter/

As a lifelong lover of the Moon, and author of three books about the Moon, I am stunned that fate has selected me to be the accidental keeper of this historic lunar archive. I treasure it and it will become an heirloom in my family.

01 LO 2 and 3.jpg
The stack of Lunar Orbiter 2 and 3 prints stands more than knee high. Photos by Robert Reeves

02 LO 34 and 5.jpg

The waist high stack of 20x24-inch Lunar Orbiter 4 and 5 prints are guarded by Rusti, the famous Moon cat.

03 Rusti.jpg

Rusti peeks from behind a massive pile of Lunar Orbiter prints.

04 Lunar Orbiter.jpg
All five of NASA's Lunar Orbiter missions flown in 1966 and 1967 were successful. Photo by NASA

05 camera system.jpg
The Lunar Orbiter camera system was originally developed by the Eastman Kodak company for the Air Force Samos reconnaissance satellite in the early 1960s. Photo by the Eastman Kodak company

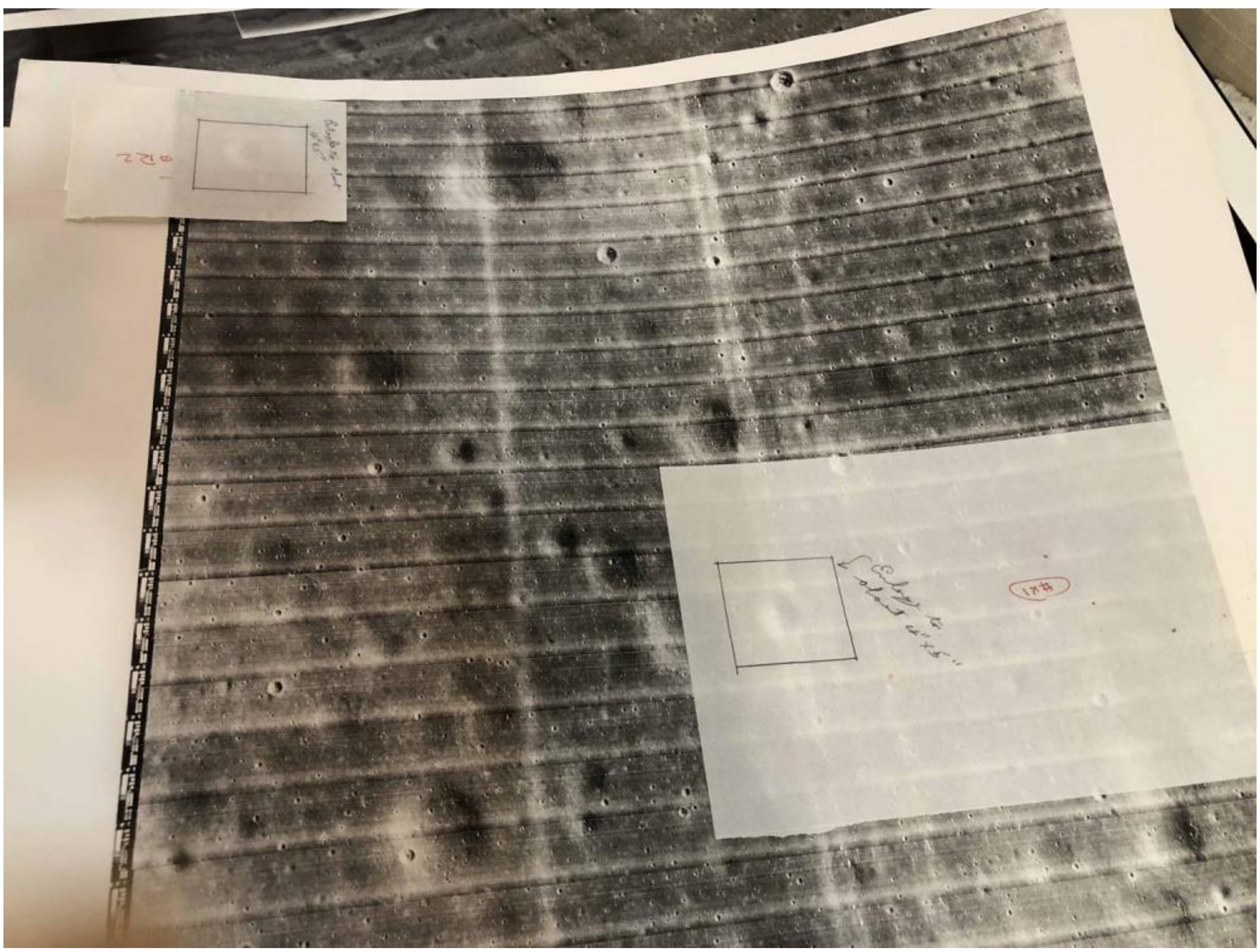
06 sumary.jpg
This project summation shows the success of the Lunar Orbiter project. Graphic by Robert Reeves

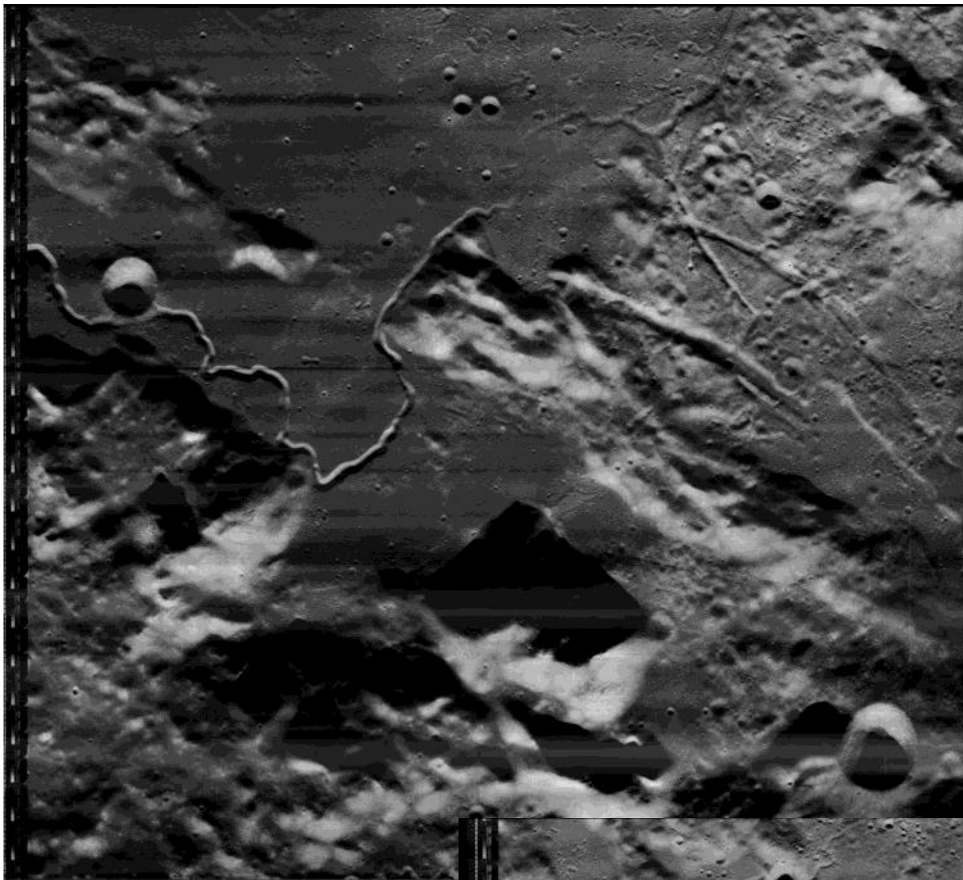
1	**10 Aug 1966**	**50x1850 km**	**Apollo site selection**	**212 frames**
2	**6 Nov 1966**	**50x1850 km**	**Apollo site selection**	**206 frames**
3	**4 Feb 1967**	**50x1850 km**	**Apollo site selection**	**182 frames**
4	**7 May 1967**	**2700x6000 km**	**Science mapping**	**163 frames**
5	**1 Aug 1967**	**100x6000 km**	**Science mapping**	**212 frames**
6	**Cancelled, but could have finished mapping the far side for $13 million**			

Mission 1 motion sensor failed. Boeing lowered the orbit without authorization and all "h" frames were smeared.
Mission 4 apperture door stuck open and fogged the M frames. Howard Pohn used a coffee cup and pencils to model spacecraft attitude and save the remaining frames

1650 images secured. Site 2 became Tranquility Base
18 micrometeor strikes encountered
Radiation level safe for astronauts
"Mascons" detected

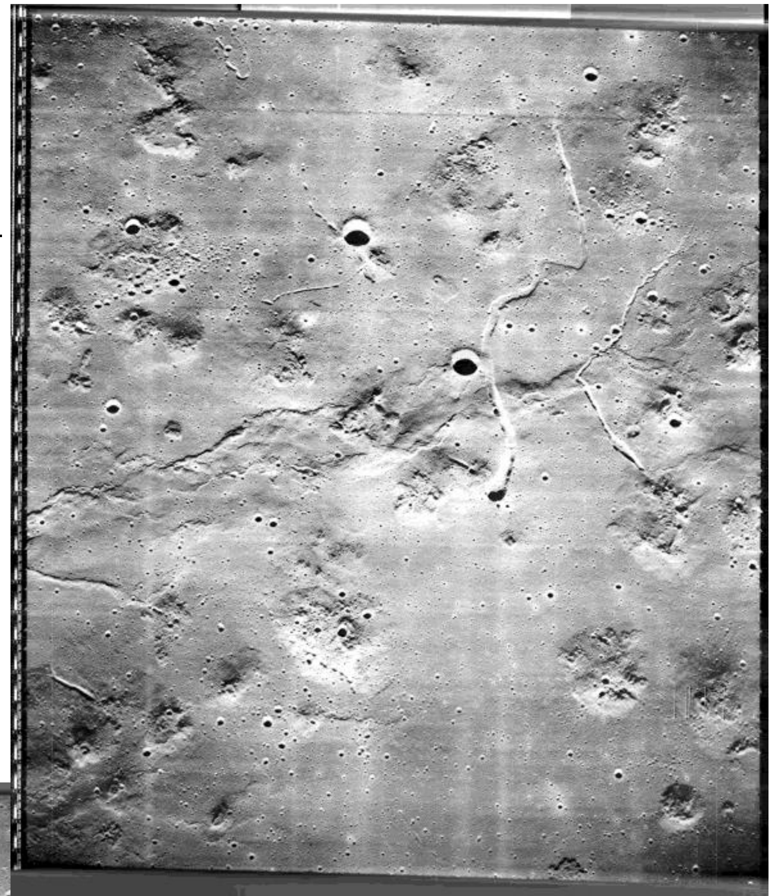
07 II-87-h1
The author's collection includes frame II-87-h2 containing overlays requesting enlargements of that was to be the Apollo 11 landing site. Photo by Robert Reeves





08 5106_med.jpg
The northern bend of Rima Hadly, chosen as the Apollo 15 landing site, is detailed in frame V-106-M. Image by NASA

09 5202_med.jpg
Schroter's Valley and Cobra head, the volcanic pit that flowed lava through the valley, is detailed in frame V-202-M. Image by NASA



10 5212_med.jpg
The fascinating Marius Hills are detailed in frame V-212-M. Image by NASA

11 5095_med.jpg
The volcanic pits within Rima Hyginus are detailed in frame V-095-M. Image by NASA

Playful Amateurs Or: Imaging Our Moon as a Suburban Amateur Astronomer

Michael Machleb

As you might know, when professional duties – in my situation in the field of social work, pedagogy and further education - contribute to an increased need for compensatory activity with recreational potential, there are several choices to be made. So after an interval of twenty years I (re-)started experimenting in practical amateur astronomy, weather and workloads permitting, of course.

With a refractor (Vixen Achromat 4inch, f/10), set up on the balcony (and stored away again), this meant observing the moon and the planets visually. As time went by, initiated by articles in CCD-Astronomy, the wish became irresistible to take images by own means (SX-Framestore, later SX-H9). For years to come this combination is my working horse, following the motto every telescope has got its own sky. These instruments provided opportunities to get accustomed to the intricacies of imaging the moon: changing atmospheric conditions (seeing), (re-)adjustment of focus by hand, results of ocular projection in comparison to Barlow. In addition to that there grew a sense of how to create own workflows in raw data processing, playing around with different software designs and options, either OSS (diverse Linux-based applications) or proprietary (Astroart, Pixinsight).

Among a lot of inevitably (less than) average results, there were moments when favorite atmospheric conditions, observing practice, and processing experiences came together contributing to what could result in some feeling of success: image combinations which revealed regional details with some quality.

For comparison and deeper learning to see, publications from Viscardy to Dragesco were studied, masterly contributions of French young amateurs admired. Also, I navigated through the photographic atlases of K. C. Pau and Alan Chu, finally I came across Harold Hill´s remarkable drawings.

Nevertheless, using CCD meant retaining the limit of taking single images, hoping to find raw variants, which could be combined presenting the promising parts where details popped up. Without knowing discussions about lucky imaging, I came about to minimize single exposures, followed by adding the best raws by hand (in Fitswork or Gimp) but that was it.

Meanwhile CMOS reached our shores and so I took the chance to experiment with small pixels and video-based stacking (with SharpCap, AS!).

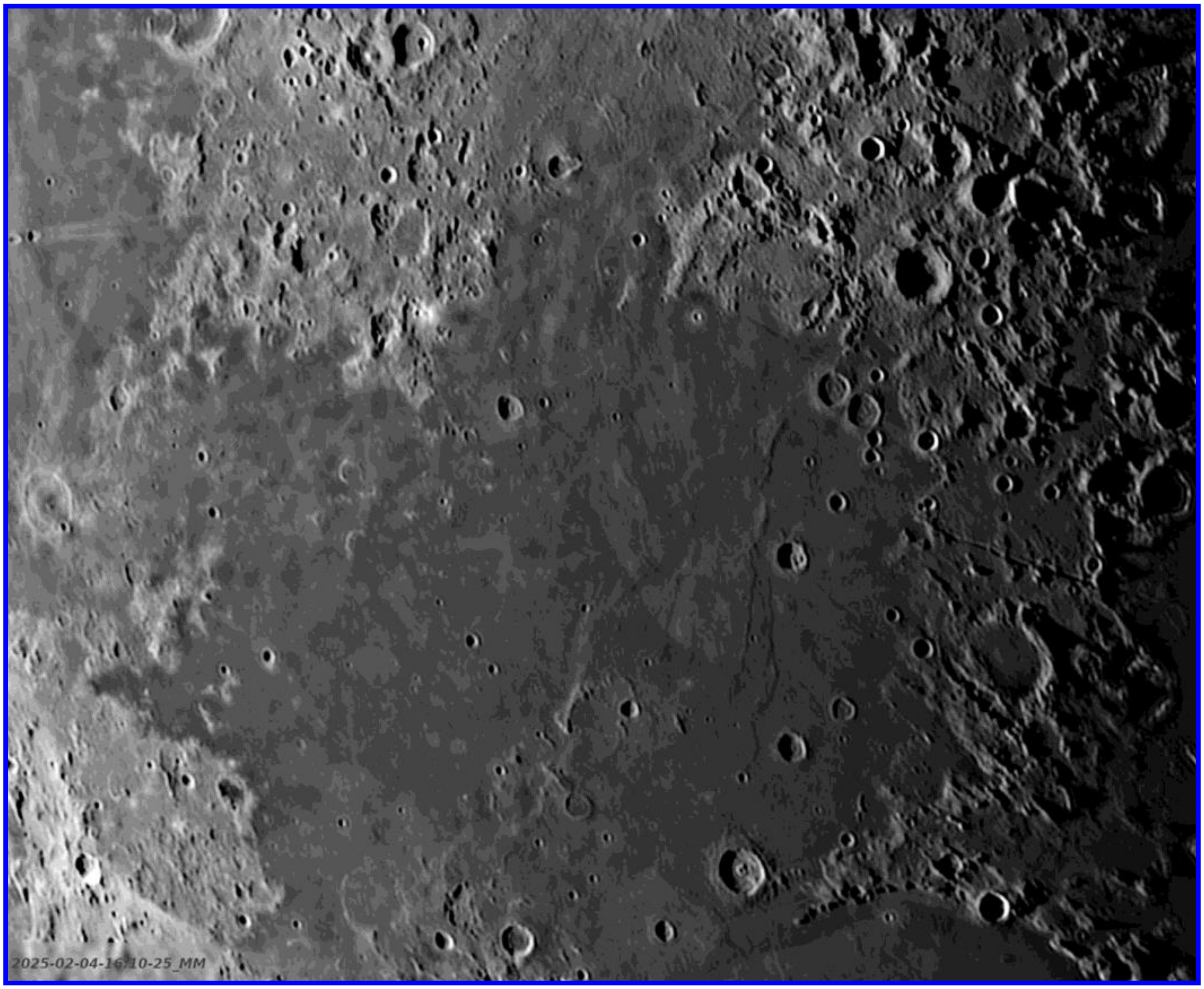
With my contribution to TLO I would like to offer some recent observations, product of an ongoing learning process, in which amateur practice of playing around with technical opportunities goes together with the joy to watch our moon close up, and from time to time trying to catch a little bit more of her secrets.

Striving for excellent results and comparisons is appreciated. In contrast the following material is meant to encourage and remind all of us to acknowledge the ambivalent process of doing amateur astronomy, not least because this mélange of hands-on practice and constantly getting unexpected findings helps to keep alive that sense of receiving some sort of gifts, whenever heavenly objects paint on our sensors.

The region I chose to promote here is drawn from a whole moon imaging project consisting of images done with two refractors (Tak FS-60Q with 2x Barlow, and TS SD102, f/7) mounted side by side, where each one was used as imaging device (with ASI 183MM) and the respective other for visual control and adjustment. The intention here is to use both of them as components in creating some sort of virtual binocular device which may be described by 80mm aperture and f/13.5.

The tricky, playful part was then to try to combine the best results in a way so that the most of implicit details could be drawn from the raw material. One series of images was done intentionally under-sampled, whereas the other series of images resulted in a more adapted aspect ratio (regarding pixel size, focal length, in primary focus).

Remarkable enough, at least for city locations early in the year, the atmospheric conditions during that observing session February 4th 2025 were extraordinarily good and stable and as the moon stood as high as could be wished, some unexpected results were possible. Here a cutout of the moon total is given presenting the Mare Tranquillitatis region. (The seemingly old-fashioned upside-down, left-to-right mode of presentation is chosen for comparability with other images.)



At first, I followed customary practice to process the raw images, which are summed up in Autostakkert (best 30-40% as *.tif) in a way to accentuate as much as possible the crater-mountain profiles near the terminator.

But then curiosity arose, as there seemed to be more in it, and starting with Arago alpha/beta a closer inspection began to find out whether other small formations might reveal themselves in this combined image. To be able to discern feeble traces the regional studies at another amateur-observatory (Hofmann/Paech) provided some guidance where parts of Tranquillitatis are captured, even though limited so far to certain regions.

Here is an inverted and annotated version of this frame where formations or places are marked, with four extended domes additionally contrast enhanced, and some other specs on which my interest focused now.

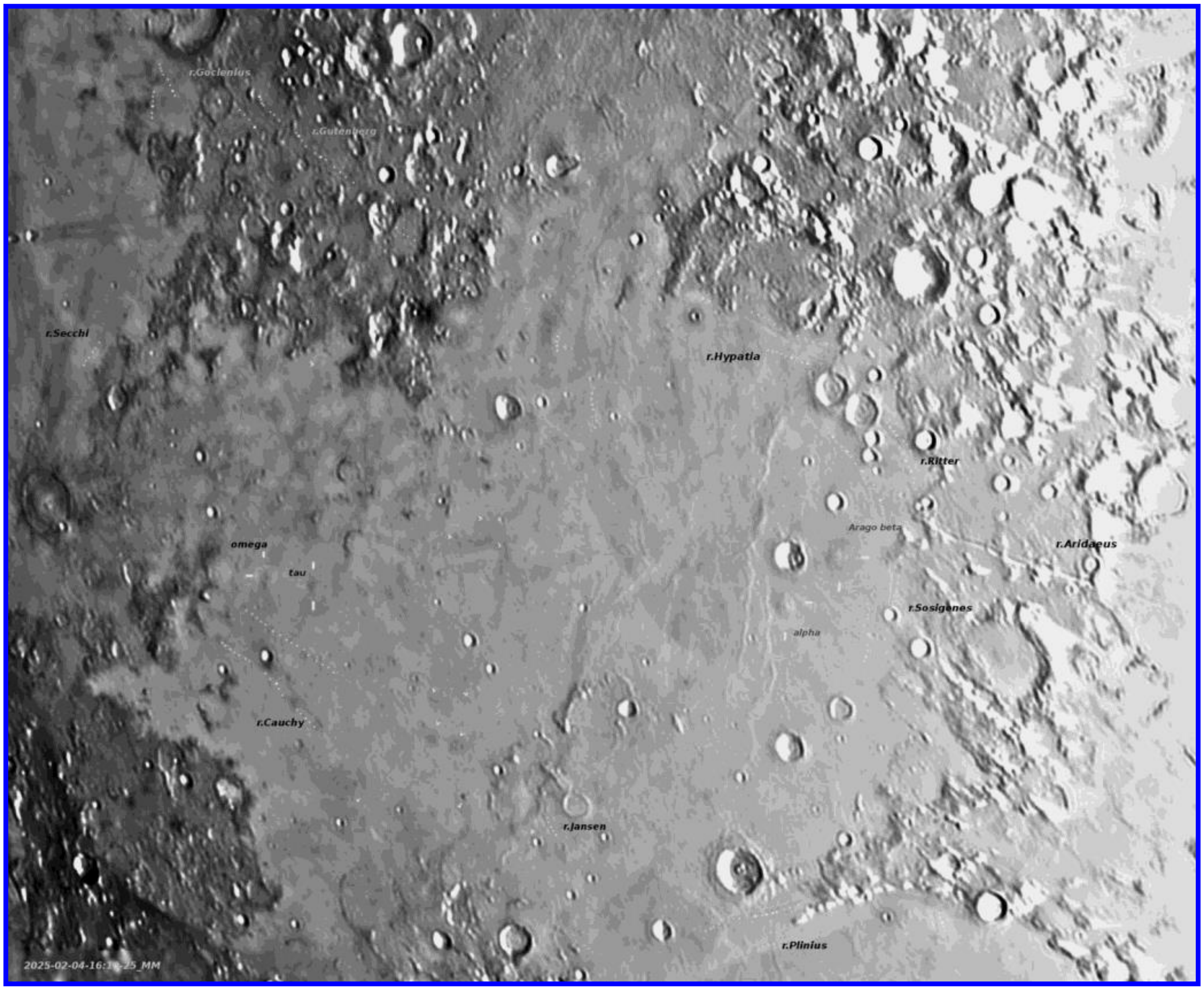


Image 1, Mare Tranquillitatis, *Michael Machleb, Berlin, Germany, 2025 February 04. North is down, west is right. This image is inverted from image 1 and annotated. See text for details.*

Crossing the resolution limit an imaging system is capable to produce, the search for small features is haunted by the ambivalence between visibility and wishful thinking. When comparing images of my own production with results taken with two to three times aperture, I cross-checked which detail could be found, indicating some real features.

Furthermore, my interest then turned to science. So, I researched about recent contributions to the scientific discussion about surface features and geological (selenological) history. As concerning domes there is the comprehensive study by Lena et al., but for our purpose the survey of Qiao et al. should be mentioned because one illustration stimulated a further visualization step: an adjusted map of dome distribution blended over my own (liminal) version of Tranquillitatis.

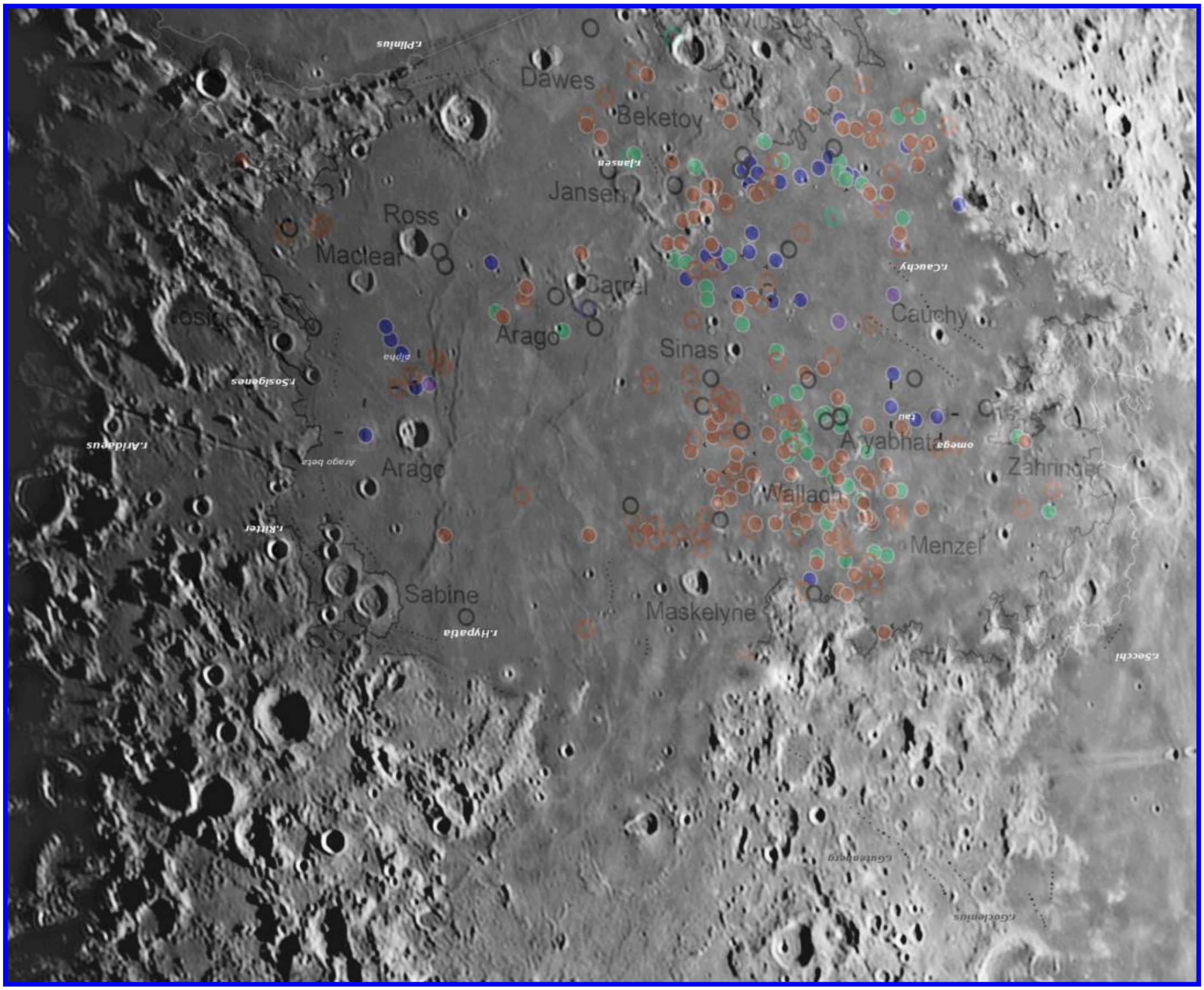


Image 3, Mare Tranquillitatis, *Michael Machleb, Berlin, Germany, 2025 February 04. North is up, west is right. Domes are labeled by Qiao et al. See text for details.*

This provided further insight into the function of scaling: on one side my recent results allowed wider and deeper views on lunar surface features by observations from my home base. However, on a different level of reconnaissance efforts this picture seems to tell us, how the study of surface details from orbit also proceeds along layers of discovery and recognition about what might be the case up there.

---

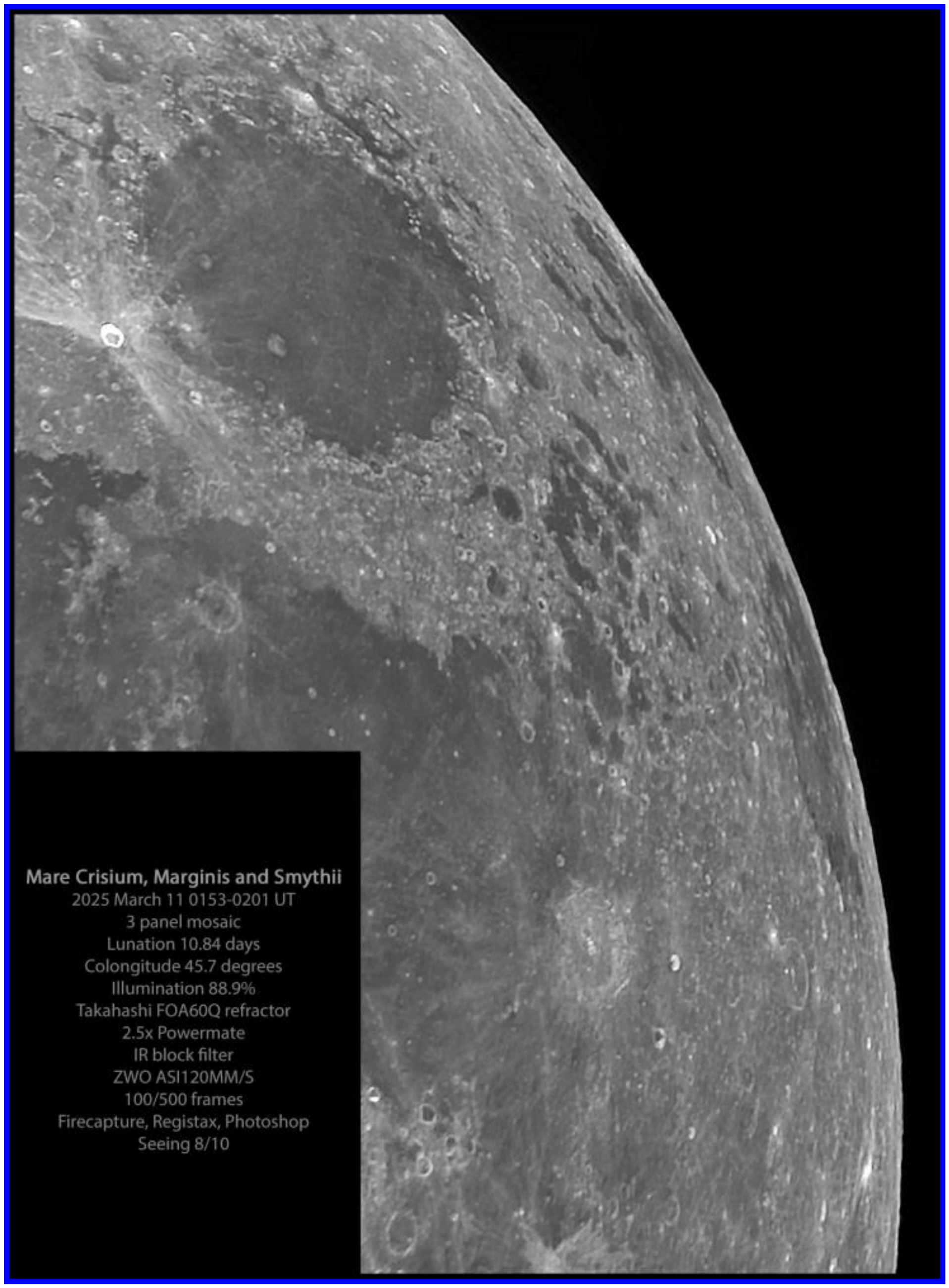
1 George Viscardy (1985), Atlas-Guide Photographique de la Lune;
Jean Dragesco (1995), High Resolution astrophotography;
Harold Hill (1991), A portfolio of lunar drawings;
Alan Chu (2011), Photographic Moonbook (v. 3.5): http://www.alanchuhk.com/Moonbook_3v5.pdf or also https://forum.hkas.org.hk/Web/Moonbook_3v5.pdf (26.3.2025)
Kwok Pau's atlas: http://lunaratlas.blogspot.com/2016/09/photographic-lunar-atlas-is-returned.html (26.3.2025, link currently not working for me).

2 Cumulative effects of the built-in extender module combined with Barlow (also Tak) are not discussed here, as this seemed not to deteriorate image quality in central parts of the raw images where the moon was placed.

3 http://www.chamaeleon-observatory-onjala.de/mondatlas-en/index-en.htm (26.3.2025).

Small Telescope Lunar Musings
East of Crisium
David Teske

With good libration, it is good to see what is on “the other side” of the Moon. I am always captivated by this area of the Moon as it has so many interesting features. First off, southeast of Mare Crisium is the very foreshortened but obviously circular Mare Smythii. Named after William Henry Smyth, a British astronomer who lived from 1788-1865, it is pretty cool to have an entire mare named after a person (Mare Humboldtianum is another one). Close inspection reveals that the floor of Mare Smythii has light and dark colored lavas, indicating different lava flows. Coming in with a surface area of 105,000 km^2, it is between the size of the countries of Guatemala and Cuba. Heading north along the lunar limb, on the way to Mare Marginis, we see the crater Neper. This crater has a bright white central peak standing above its dark lava floor. Neper has a diameter of 137 km. As the Moon liberates, you can see Neper in profile and see just how shallow the craters are. Neper is just a little smaller than the famous farside crater Tsiolkovskiy crater. Tsiolkovskiy stands out on the far side as the area is almost all highlands and the basalt of this crater makes it stand out. Mare Marginis is just north of Neper. This very irregularly shaped mare has a diameter of about 360 km and a surface area of 62,000 km^2, about the size of Lithuania or Sri Lanka. I like observing Mare Marginis with good libration to try to detect the very elusive Mare Marginis Swirls. Coming in at number 100 on Charles Woods’ Lunar 100 list, these are so hard to see because they are faint and in the libration zone. I have yet to see a good Earth-bound image of these swirls. Maybe, just maybe, they are visible in my image near the northwest edge of Mare Marginis. What do you think?

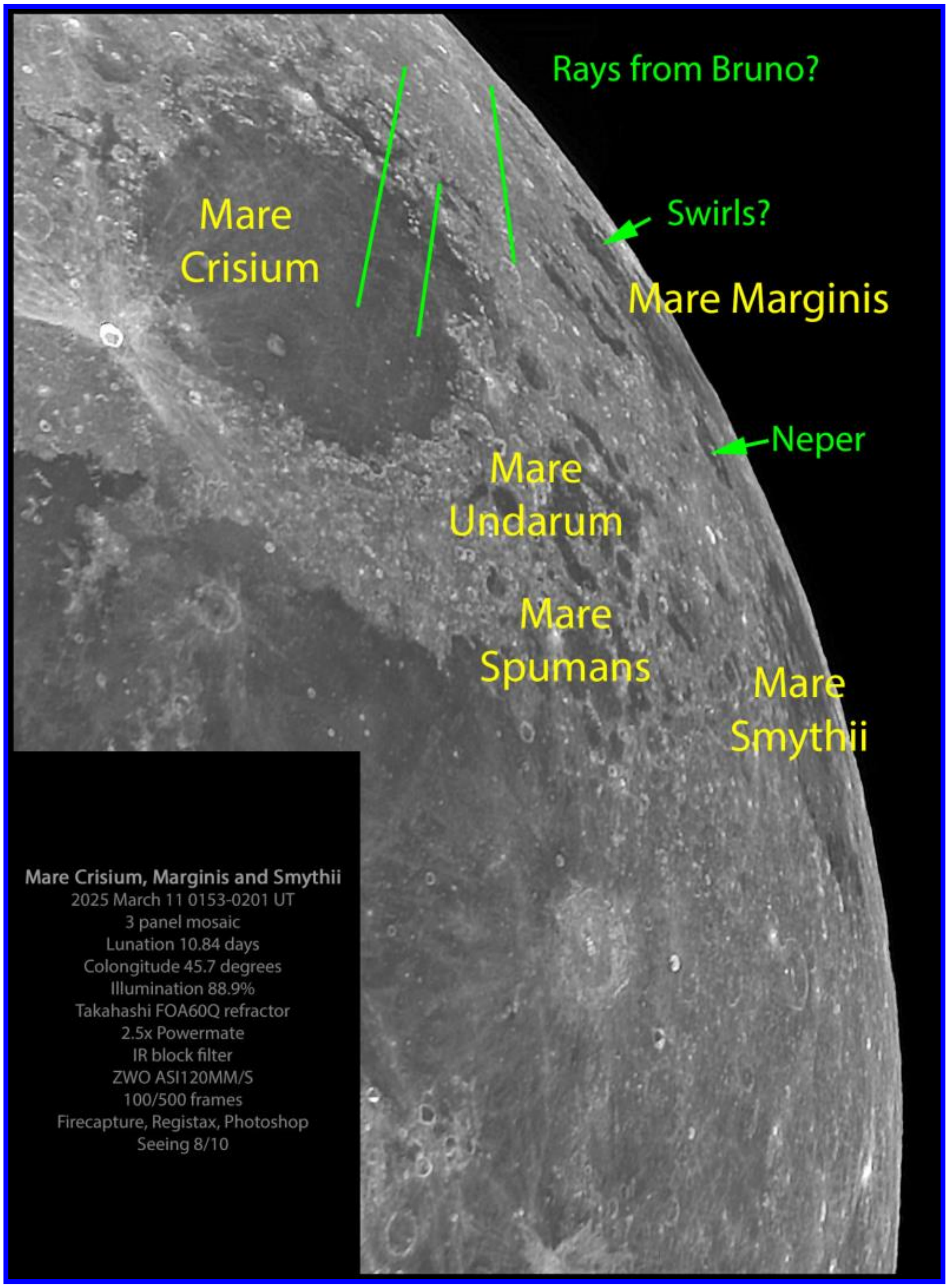


Mare Crisium, Marginis and Smythii, *David Teske, Louisville, Mississippi, USA. 2025 March 11 01:53-02:01 UT, colongitude 45.7˚. Takahashi FOA60Q refractor, 2.5x barlow, IR block filter, ZWO ASI120MM/S camera. Seeing 8/10.*

Lunar Topographic Studies
Small Telescope Lunar Musings: East of Crisium

Just southeast of Mare Crisium, there is an irregular patch of lava called Mare Undarum, the 'Sea of Waves". It is made of several eroded and flooded craters. Being small, it has a surface area of 21,000 km^2, about the size of Isreal. Just south of this is another irregular basalt patch, Mare Spumans, the "Foaming Sea". With a surface area of 16,000 km^2, it is a little bit larger than the state of Connecticut. It seems this is just a flooded bay of Mare Fecunditatis.

Our last stop is way, way east of Mare Crisium, well onto the lunar far-side. This is the crater Giordano Bruno, which is well on the lunar far-side. I first read about this crater in 1979 when the magazine Star and Sky featured this crater. At the time, there was serious discussion that the formation of this crater was witnessed by several monks in Canterbury on 18 June 1178. Enter the Space Age, and sure enough, there was a young crater roughly in the location the monks reported. But, though very young, the crater Giordano Bruno is not that young, perhaps a few tens of millions of years old. However, some of the rays of this remarkable crater do cross Mare Crisium. Like the Mare Marginis Swirl, did I catch them with the small refractor?



Mare Crisium, Marginis and Smythii, *David Teske, Louisville, Mississippi, USA. 2025 March 11 01:53-02:01 UT, colongitude 45.7˚. Takahashi FOA60Q refractor, 2.5x barlow, IR block filter, ZWO ASI120MM/S camera. Seeing 8/10.*

A Very Rare Landform South of Mare Cognitum

Alberto Anunziato

Observing with no method other than scanning the vicinity of the terminator in search of unusual relief areas is an impressionistic and unmethodical approach, but for an observer, it's an interesting way to gain insight into the visible surface of our satellite. Often, this insight comes after investigating what seems odd at first glance. This wasn't the case here, because no knowledge was gain. What we see in IMAGE 1 caught our attention: a small mountainous area on the southern shore of Mare Cognitum, in which bright spots were visible (which should be interpreted as elevated areas, because they also cast shadows). These spots seemed to have defined boundaries, like a plateau, its edges defined by a thin shadow to the west and a slight difference in hue on the eastern edge. There was also a kind of small central elevation with what could be a peak, which appears as a bright spot. All of this was visible quite clearly, like a self-contained relief area.

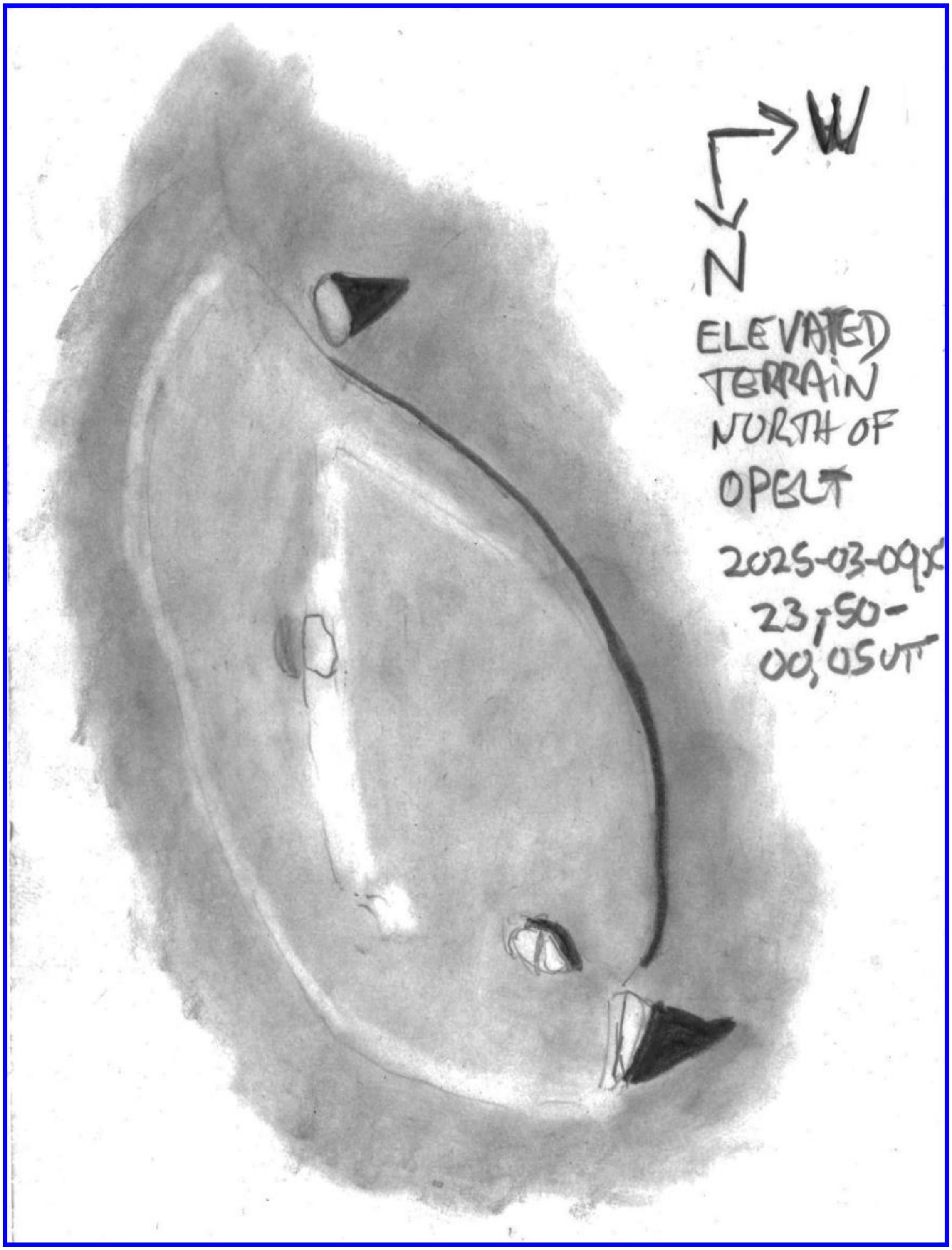


Image 1, Elevated Terrain North of Opelt, *Alberto Anunziato, Paraná, Argentina. 2025 March 09, 23:50-00:05 UT. Meade EX105 Maksutov-Cassegrain telescope, 154x.*

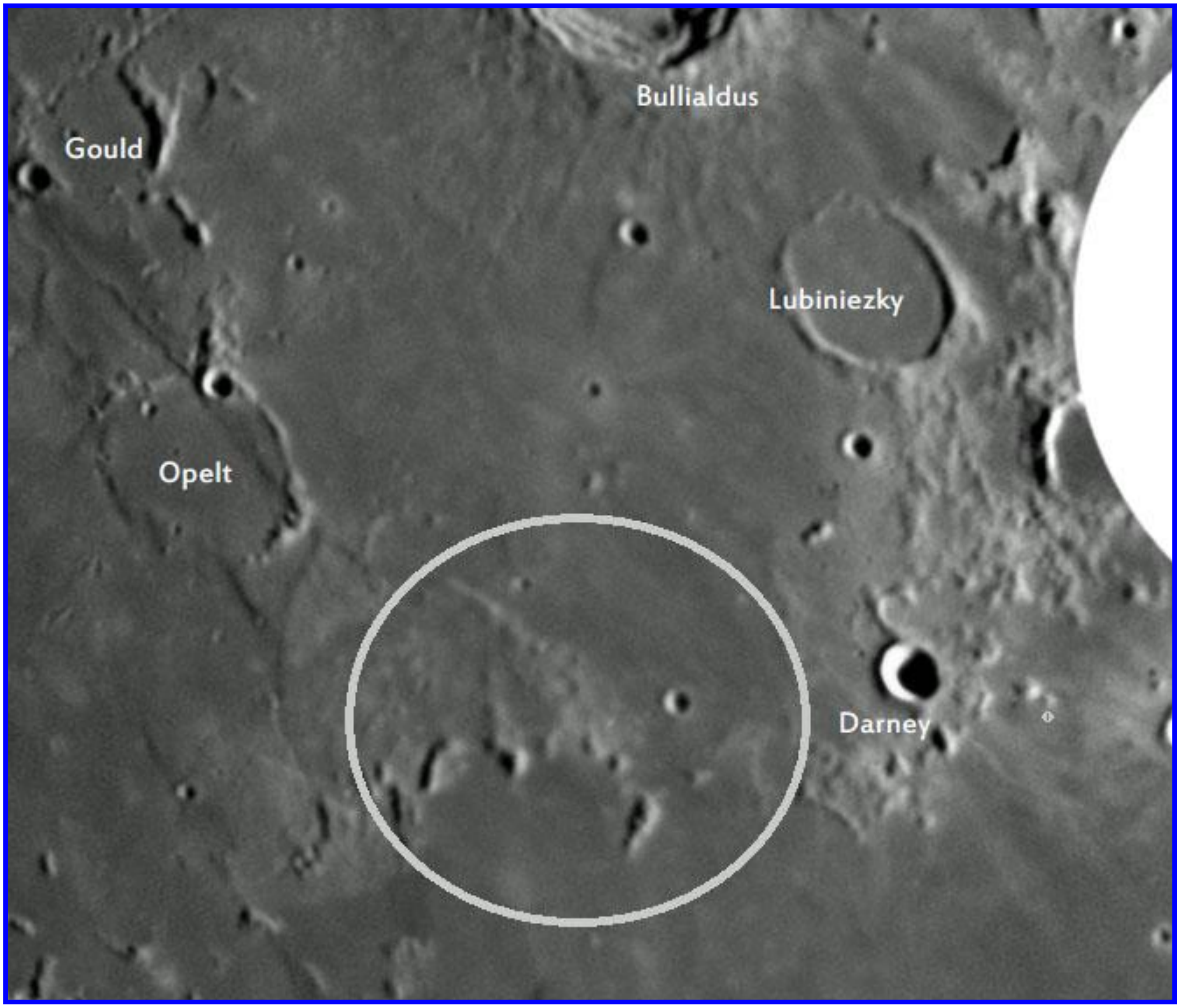
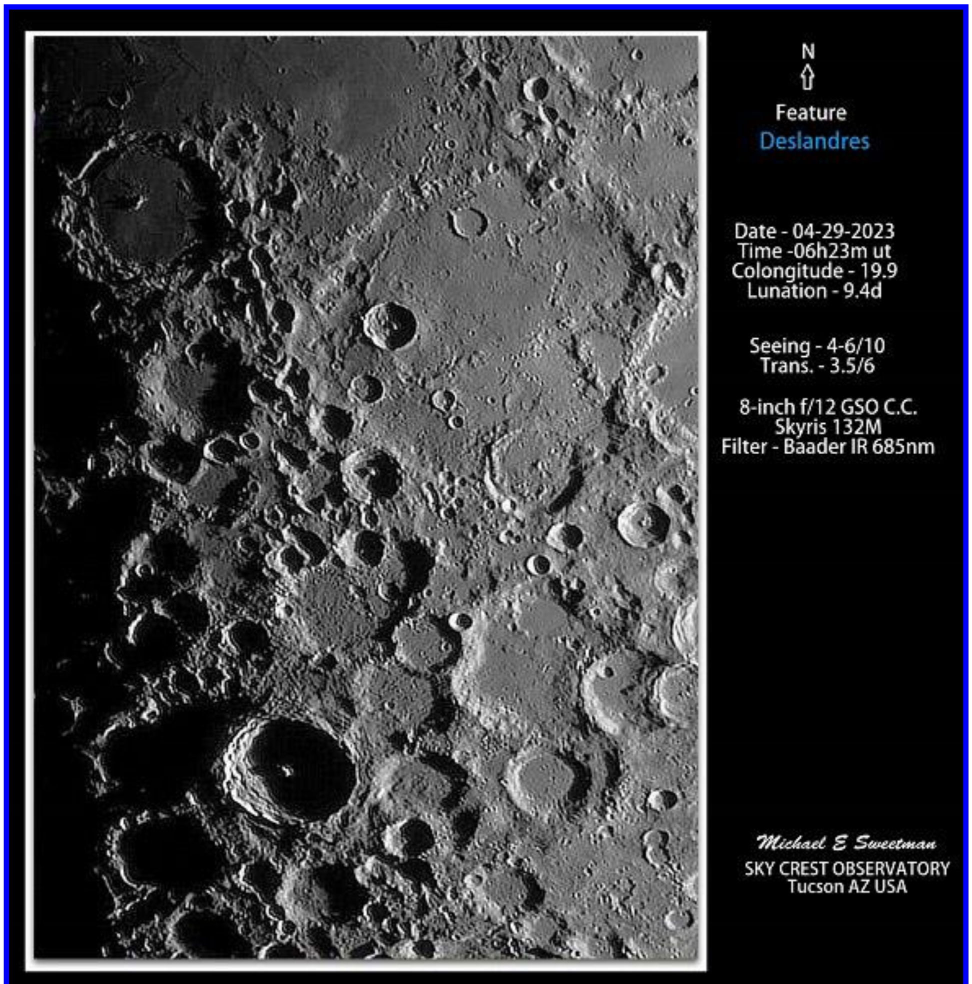


Image 2, South Mare Cognitum, *Kwok Pau Photographic Lunar Atlas for Moon Observers, Volume 2, page 184.*

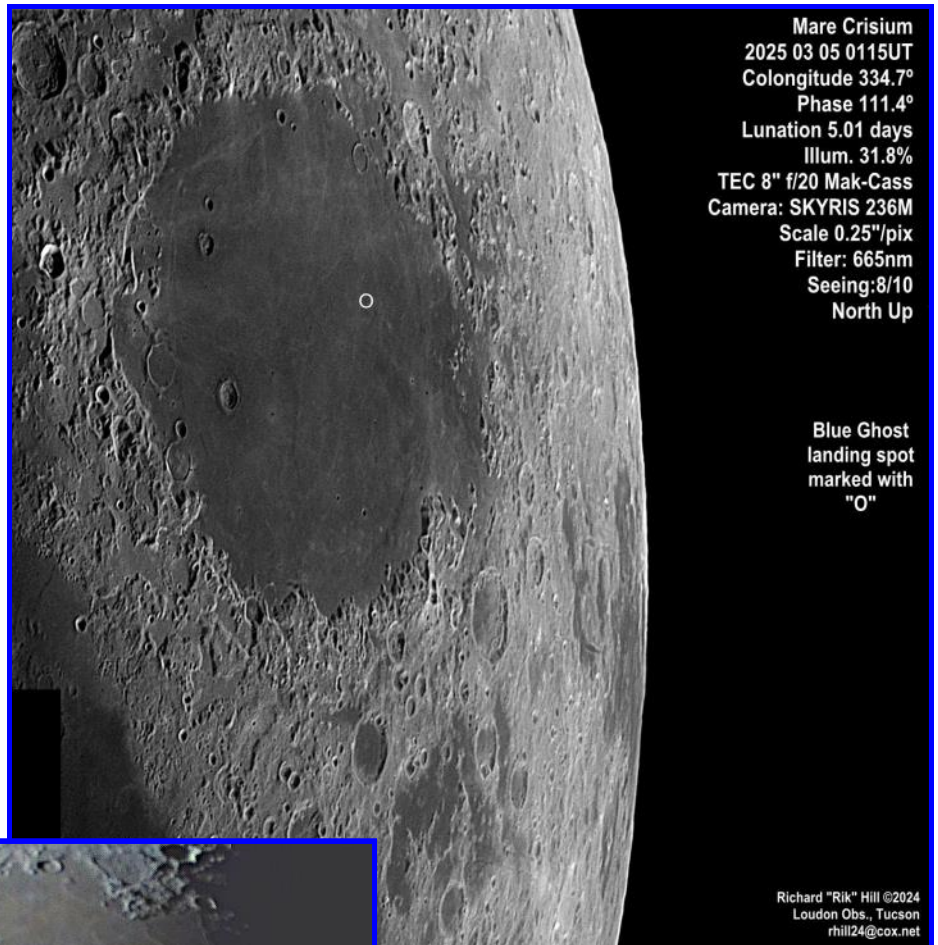
The next day I had a hard time finding the area in the atlas, the best way to see it is on page 184 of Volume 2 of Kwok Pau's Photographic Lunar Atlas for Moon Observers, from which we extracted IMAGE 2. There are similarities with what we observed, for example, in the bright areas that are apparently remnants of the relief flooded by lava, but in IMAGE 1 the raised area seems more defined and wider than IMAGE 1, especially on the northern edge (lower in the images). I tried to be as precise as possible in my observations and drawings. I think that IMAGE 1 is really what I saw, while IMAGE 2 shows the reality of the area, similar but not identical to IMAGE 1. There is no visually visible relief that does not appear in Pau's image; this can be corroborated with the LROC Quickmap. It's also difficult to locate in IMAGE 2 what appears to be a bright peak casting a sharp shadow on the southern edge of IMAGE 1. Was I so inaccurate in my drawing of what I saw? It seems like the most obvious solution, but I'm not convinced (or don't want to admit it). That's why I'm sharing this area, which seems to be more in my imagination than on the Moon.

***Deslandres**, Michael Sweetman, Sky Crest Observatory, Tucson, Arizona, USA. 2023 April 29 06:23 UT, colongitude 19.9˚. 8 inch f/12 GSO Classical Cassegrain, Baader IR 685 nm filter, SKYRIS 132M camera. Seeing 4-6/10, transparency 3.5/6.*

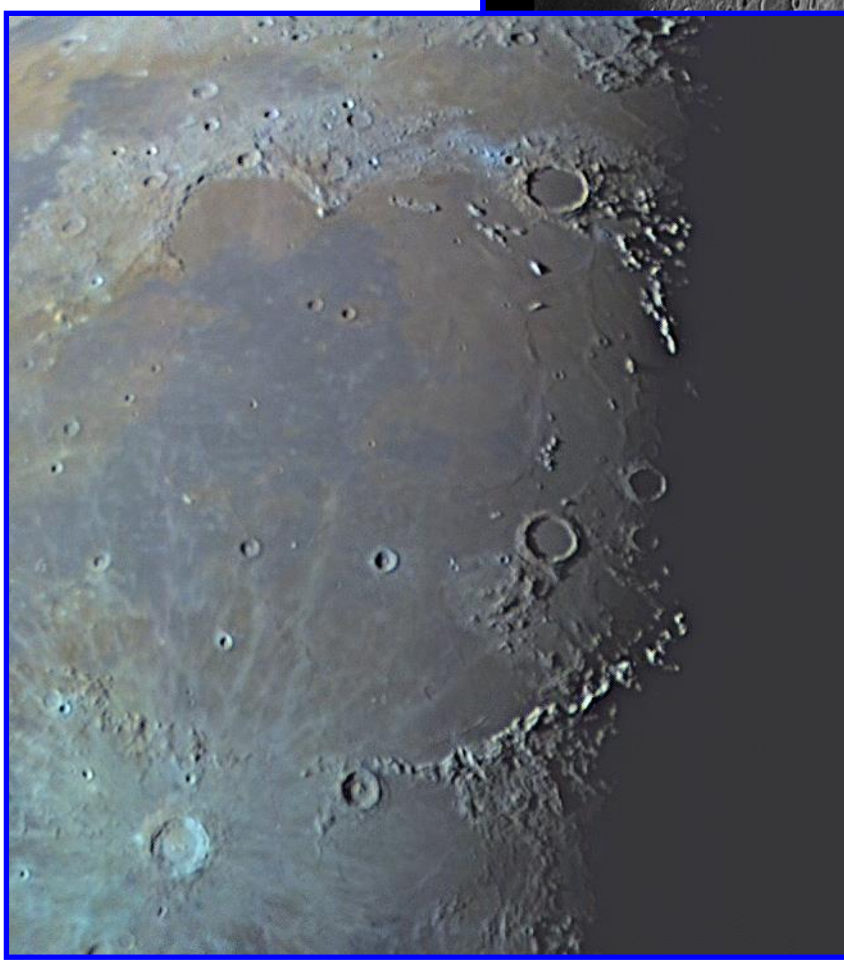


***Atlas, Hercules and Endymion,** Luigi Morrone, Agerola, Italy. 2025 March 05 17:44 UT. Celestron 14 inch Edge HD Schmidt-Cassegrain telescope, FFC Baader barlow, Optolong red filter, Fornax 52 mount, Player One Saturn-M SQR (IMX533) camera.*

Recent Topographic Studies

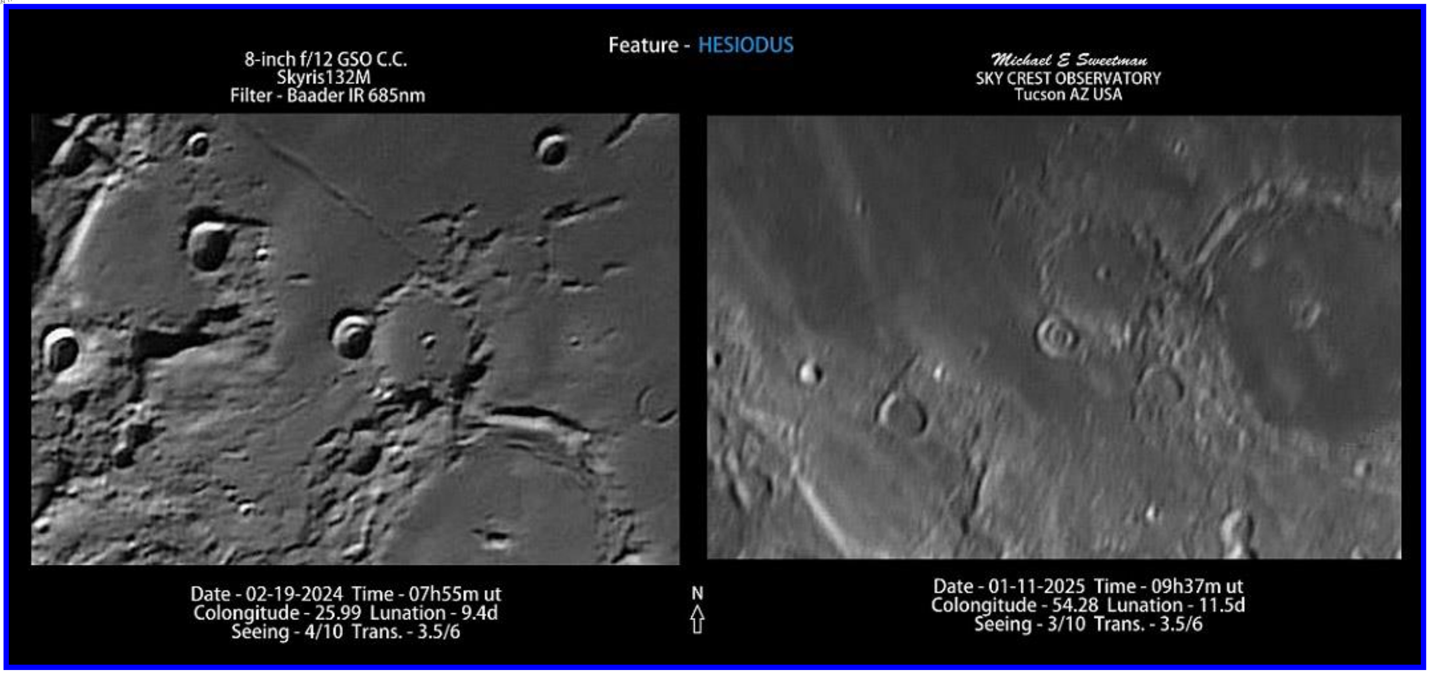


Mare Crisium showing the landing site of the Blue Ghost, *Richard Hill, Loudon Observatory, Tucson, Arizona, USA. 2025 March 05 01:15 UT, colongitude 334.1˚. TEC 8 inch f/20 Maksutov-Cassegrain telescope, 665 nm filter, SKYRIS 236M camera. Seeing 8/10.*

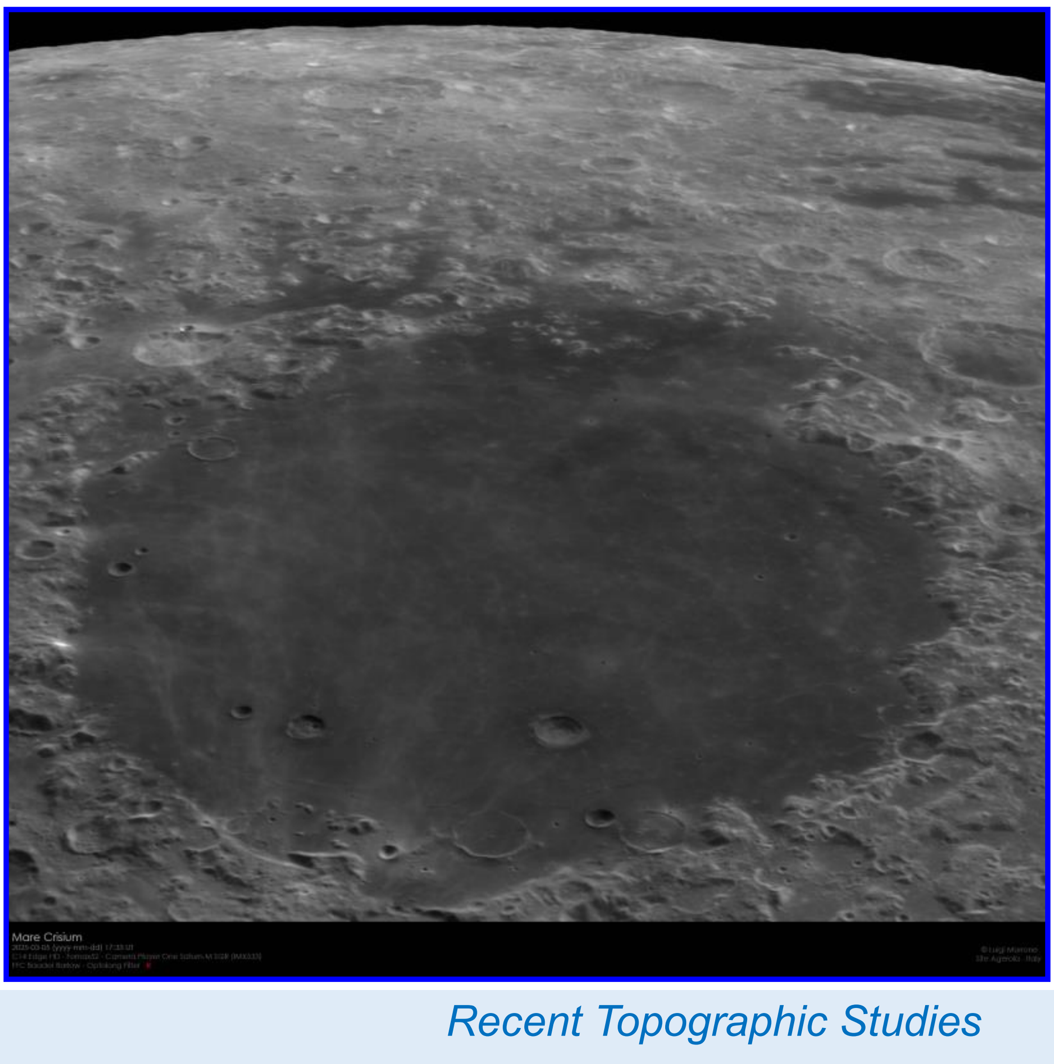


Mare Imbrium, *Walter Ricardo Elias, Oro Verde, Argentina. 2025 February 20 04:13 UT. Sky Watcher 150/750 mm reflector telescope, QHY5 IIC camera.*

Recent Topographic Studies

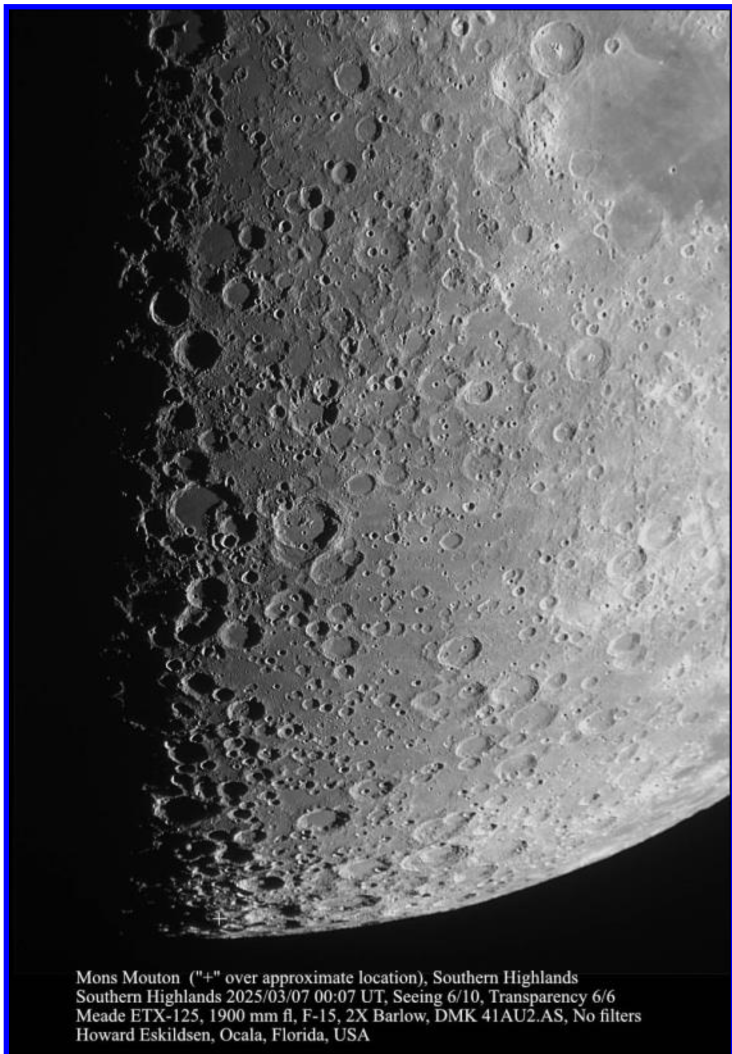


***Hesiodus**, Michael Sweetman, Sky Crest Observatory, Tucson, Arizonia, USA. 2024 February 19 07:55 UT, colongitude 25.99˚ and 2025 January 11 09:37 UT, colongitude 54.28˚. 8 inch f/12 GSO Classical Cassegrain, Baader IR 685 nm filter, SKYRIS 132M camera. Seeing 4/10, transparency 3.5/6.*



***Mare Crisium,** Luigi Morrone, Agerola, Italy. 2025 March 05 17:33 UT. Celestron 14 inch Edge HD Schmidt-Cassegrain telescope, FFC Baader barlow, Optolong red filter, Fornax 52 mount, Player One Saturn-M SQR (IMX533) camera. North is left, west is down.*

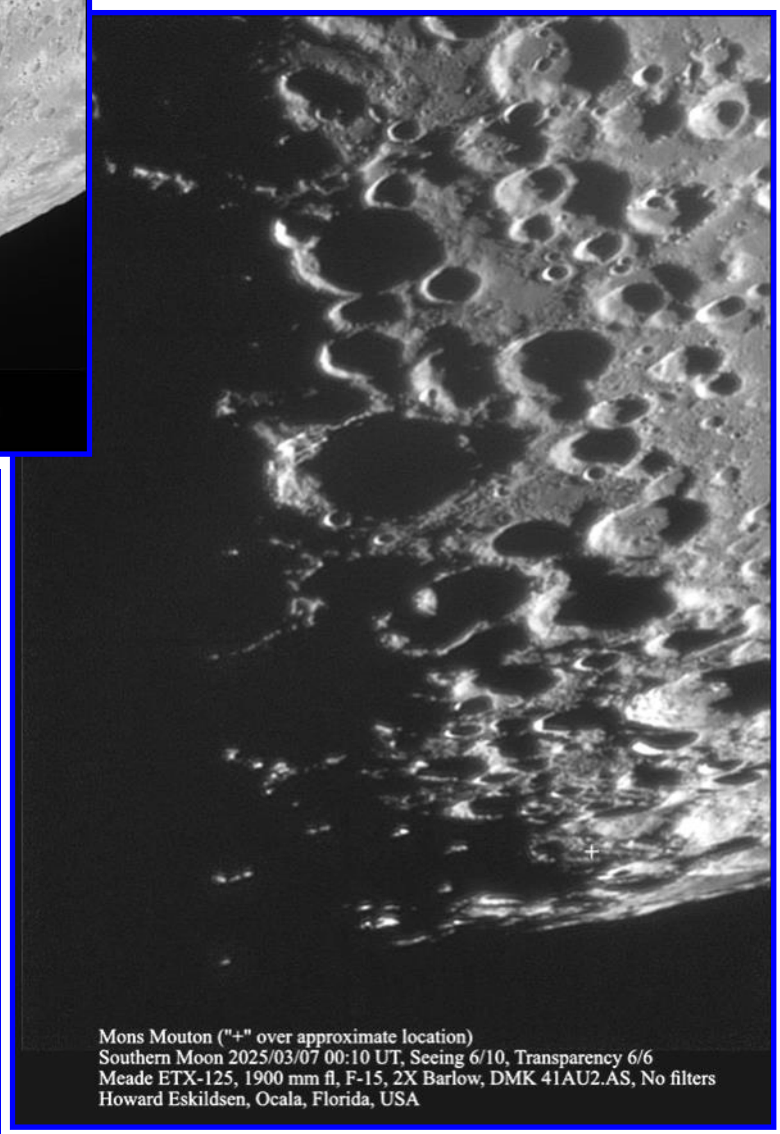
Recent Topographic Studies



Mons Mouton, *Howard Eskildsen, Ocala, Florida, USA. 2025 March 07 00:10 UT. Meade ETX125 Maksutov-Cassegrain telescope, 1900 mm focal length, f/15, 2x barlow, DMK41AUU2.AS camera. Seeing 6/10, transparency 6/6. Howard adds: "*These were taken during less than ideal seeing so I used my Meade ETX-125 telescope, and I was pleasantly surprised at how the images turned out. One shows most of the Southern Highlands, while the other is a close-up view. They were taken the same day that IM-2 landed and tipped over in a crater near Mons Mouton. The approximate location of the intended landing area is marked on both images with a "+"."

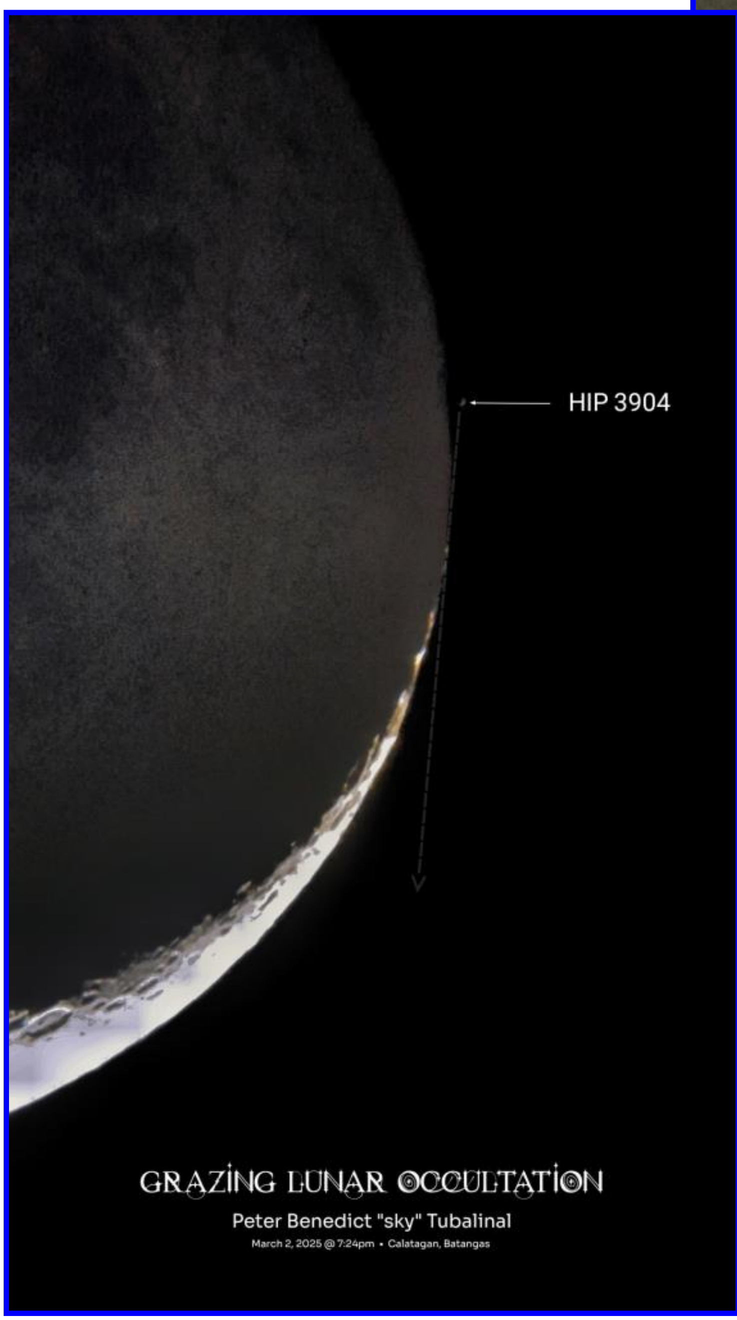
Far left is a close-up of this image.

Left is an image with the same setup three minutes later.

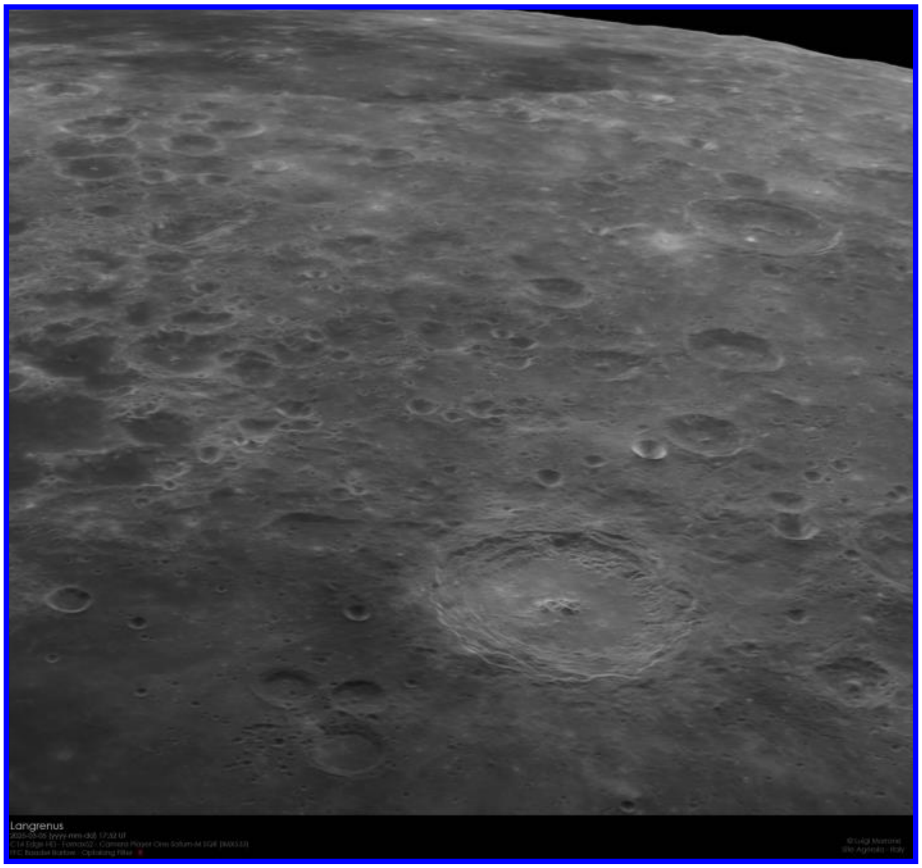


Recent Topographic Studies

Lunar Occultation of HIP3904, *Peter Benedict "Sky" Tubalina, Manila, Philippines, Astro Tourism Philippines. 2025 March 2 11:24 UT. Celestron NexStar 8i XLT Schmidt-Cassegrain telescope, ELux Plossl 25 mm eyepiece, Vivo V27 5G phone afocaled to the eyepiece.*

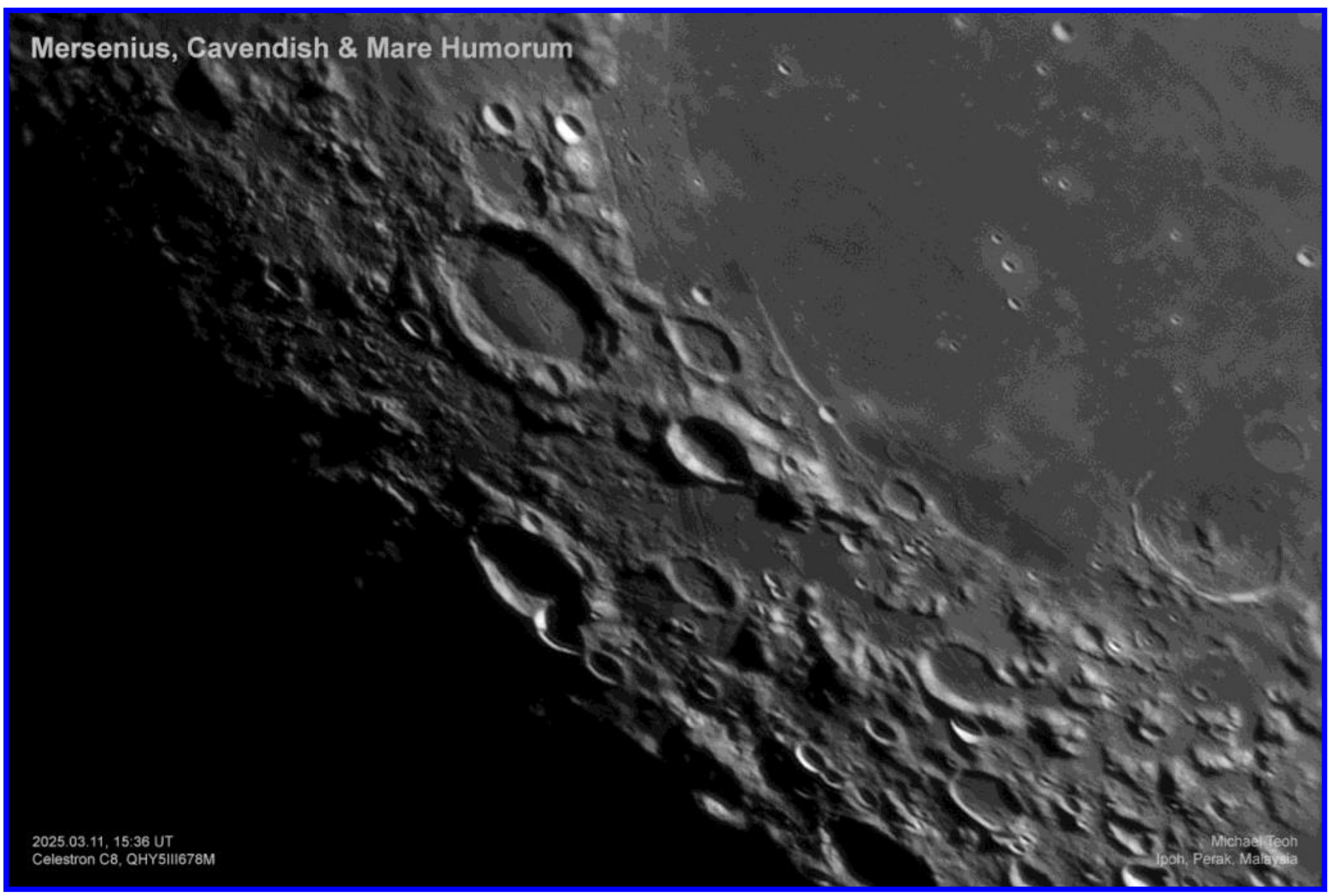


Recent Topographic Studies



Langrenus, *Luigi Morrone, Agerola, Italy. 2025 March 05 17:52 UT. Celestron 14 inch Edge HD Schmidt-Cassegrain telescope, FFC Baader barlow, Optolong red filter, Fornax 52 mount, Player One Saturn-M SQR (IMX533) camera.*

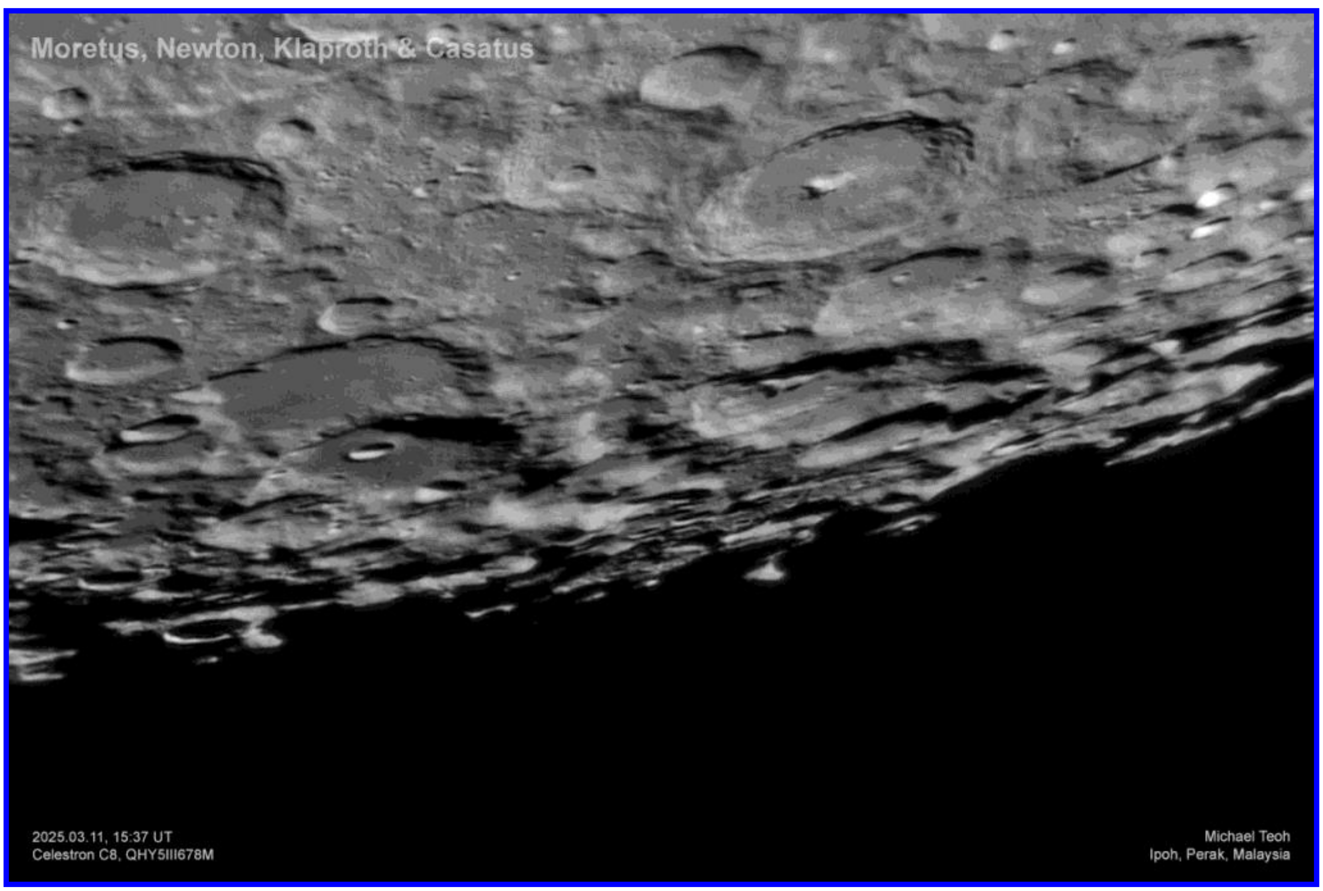
Mersenius*, Michael Teoh, Ipoh, Perak, Malaysia. 2025 March 11 15:36 UT. Celestron 8 inch Schmidt-Cassegrain telescope, QHY5III678M camera.*



Recent Topographic Studies

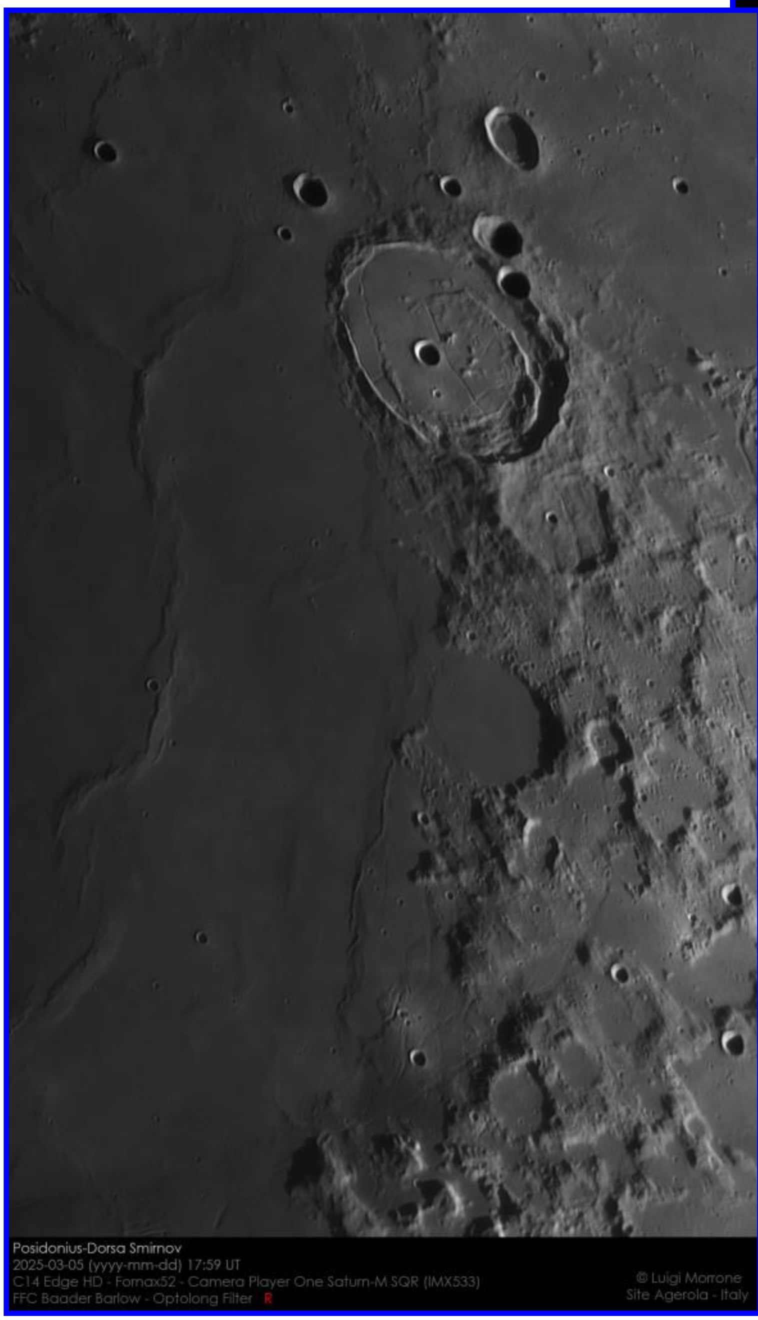
Janssen, *Luigi Morrone, Agerola, Italy. 2025 March 05 17:54 UT. Celestron 14 inch Edge HD Schmidt-Cassegrain telescope, FFC Baader barlow, Optolong red filter, Fornax 52 mount, Player One Saturn-M SQR (IMX533) camera.*

Moretus*, Michael Teoh, Ipoh, Perak, Malaysia. 2025 March 11 15:37 UT. Celestron 8 inch Schmidt-Cassegrain telescope, QHY5III678M camera.*



Recent Topographic Studies

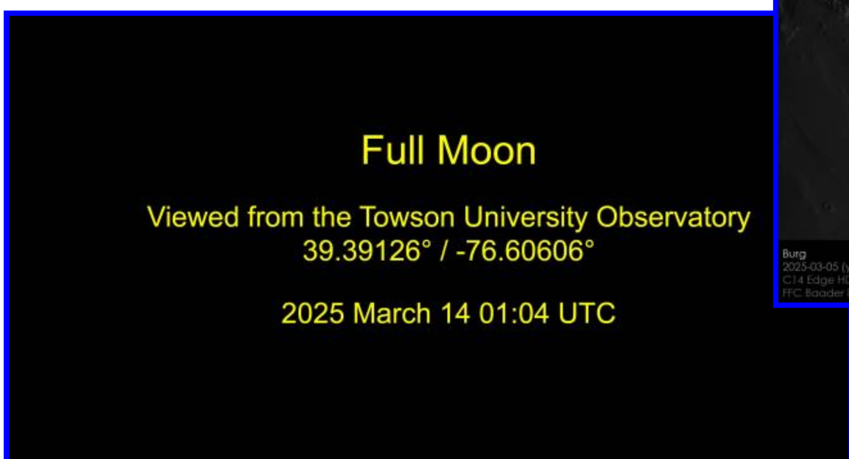
***One Day-Old Moon,** Peter Benedict "Sky" Tubalina, Manila, Philippines, Astro Tourism Philippines. 2025 March 01 10:00 UT. Celestron NexStar 8i XLT Schmidt-Cassegrain telescope, ELux Plossl 25 mm eyepiece, Vivo V27 5G phone afocaled to the eyepiece.*



***Posidonius and Dorsa Smirnov,** Luigi Morrone, Agerola, Italy. 2025 March 05 17:59 UT. Celestron Edge 14 inch HD Schmidt-Cassegrain telescope, FFC Baader barlow, Optolong red filter, Fornax 52 mount, Player One Saturn-M SQR (IMX533) camera.*

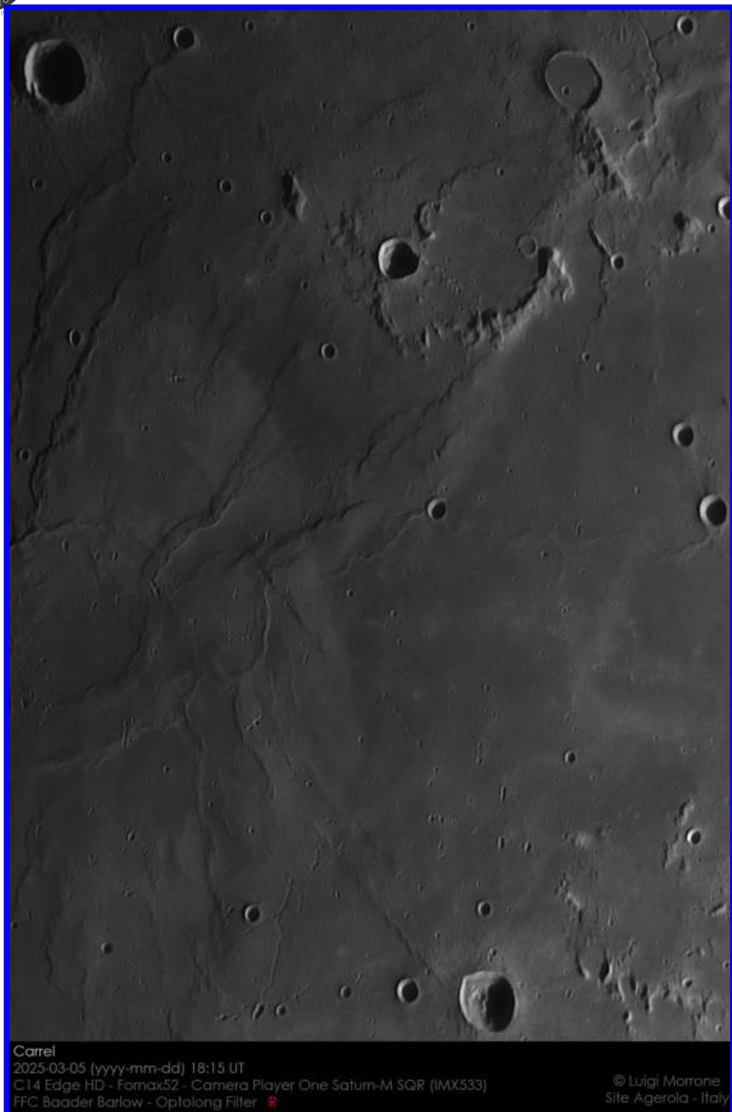
Recent Topographic Studies

Bürg, *Luigi Morrone, Agerola, Italy. 2025 March 05 18:02 UT. Celestron 14 inch Edge HD Schmidt-Cassegrain telescope, FFC Baader barlow, Optolong red filter, Fornax 52 mount, Player One Saturn-M SQR (IMX533) camera.*

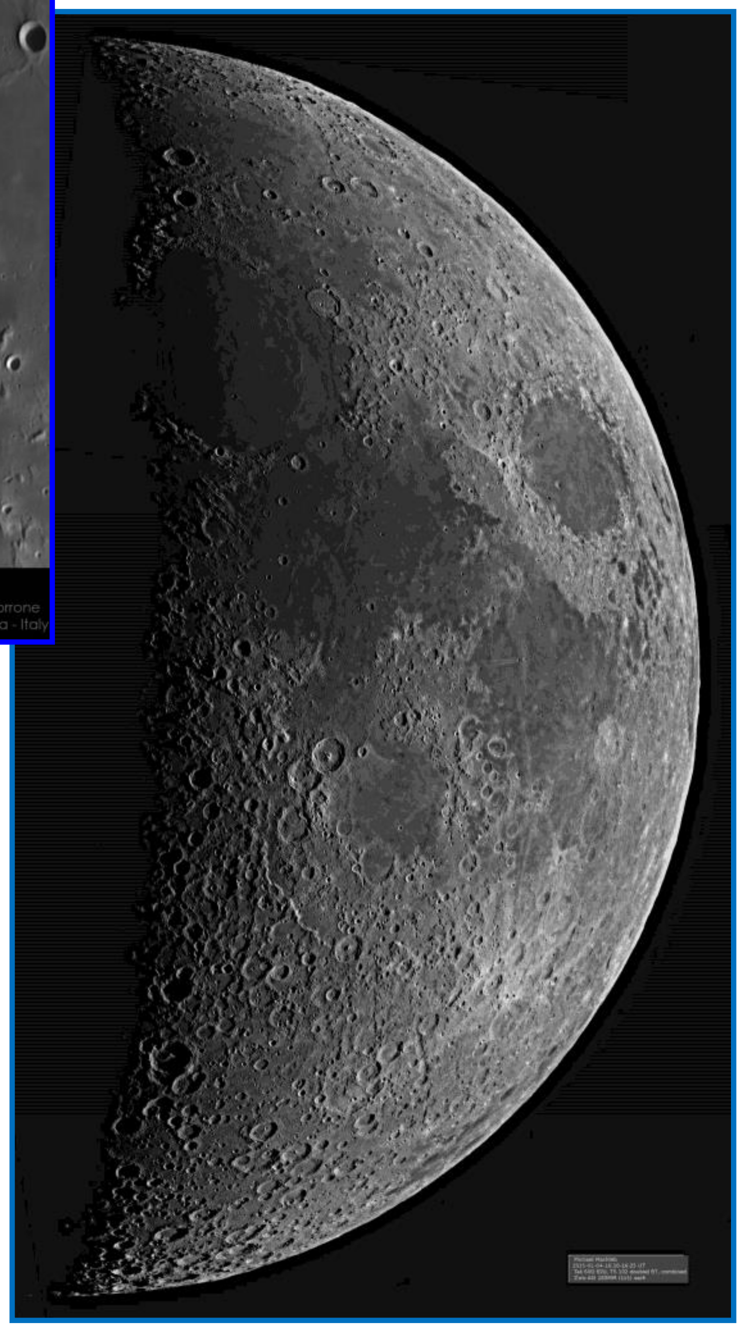


Full Moon, *Dylan Hilligoss, Steve Rifkin and Stanley M. Max, Towson University Observatory, Towson, Maryland, USA. 2025 March 14 01:04 UT. 400 mm Ritcher Chretien telescope, 3200 mm effective focal length, 40 mm eyepiece, 80 x, iPhone 15 Pro max camera.*

Recent Topographic Studies



Carrel, *Luigi Morrone, Agerola, Italy. 2025 March 05 18:15 UT. Celestron 14 inch Edge HD Schmidt-Cassegrain telescope, FFC Baader barlow, Optolong red filter, Fornax 52 mount, Player One Saturn-M SQR (IMX533) camera.*



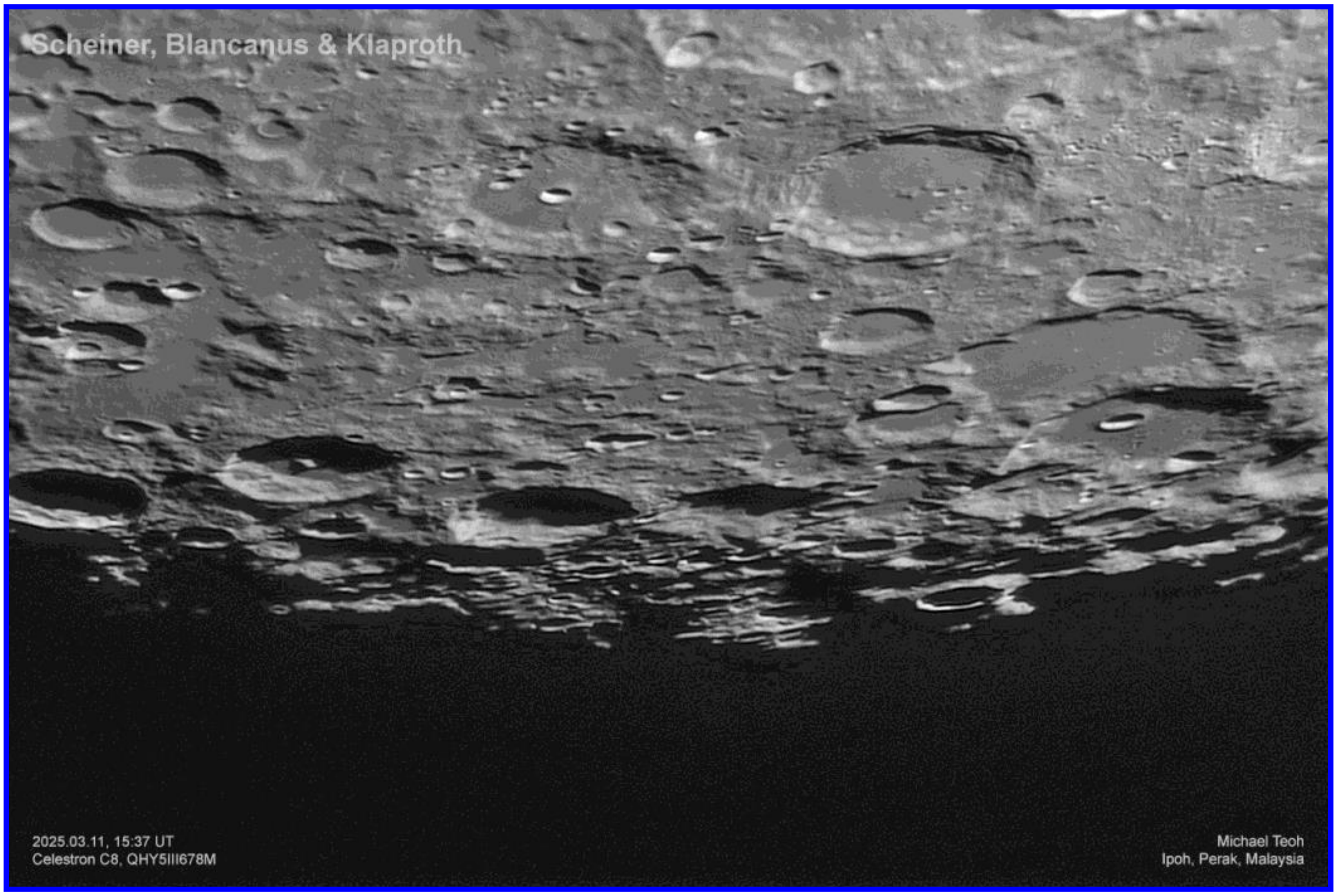
First Quarter Moon, *Michael Machleb, Berlin, Germany. 2025 February 04 16:10-1625 UT. Takahashi 60 Q refractor telescope with 2x barlow, f/20 and TS Optics Photoline 102 mm, SD ED APO, f/4, ZWO ASI183 MM camera.*

Recent Topographic Studies

***Aristarchus**, Michael Teoh, Ipoh, Perak, Malaysia. 2025 March 11 15:35 UT. Celestron 8 inch Schmidt-Cassegrain telescope, QHY5III678M camera.*

***Full Wolf Moon Moon,** Peter Benedict "Sky" Tubalina, Manila, Philippines, Astro Tourism Philippines. 2025 March 14 13:02 UT. Celestron NexStar 8i XLT Schmidt-Cassegrain telescope, ELux Plossl 25 mm eyepiece, Vivo V27 5G phone afocaled to the eyepiece. Peter adds:* "I was able to catch a little of that lunar eclipse feeling as seen in the image. ... however it wasn't from the Earth's shadow that caused this but from the lamp post. I waited for Luna to slightly move behind the lamp post and took that shot to produce the partial lunar eclipse effect. "

Recent Topographic Studies



***Scheiner, Blancanus and Klaproth**, Michael Teoh, Ipoh, Perak, Malaysia. 2025 March 11 15:37 UT. Celestron 8 inch Schmidt-Cassegrain telescope, QHY5III678M camera.*

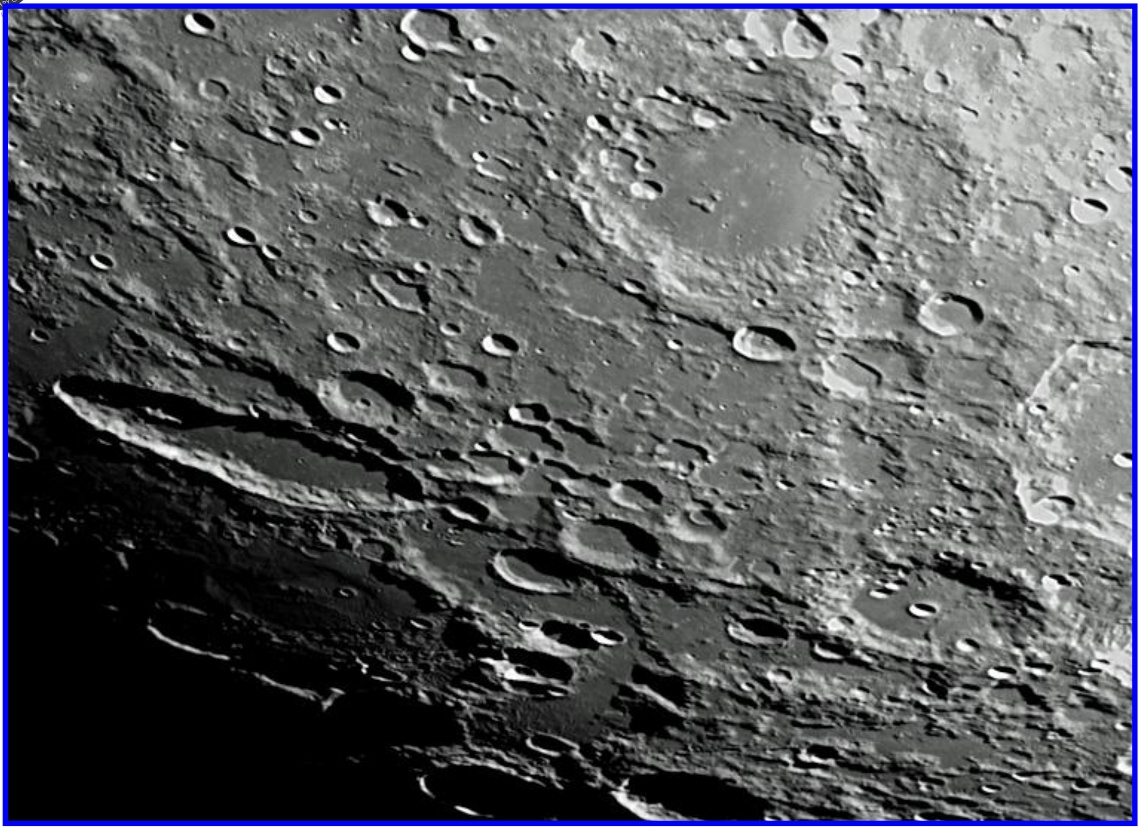
***Capuanus and Hainzel,** Guido Santacana, San Juan, Puerto Rico, USA. 2025 March 11 03:12 UT. Celestar 8 inch Schmidt-Cassegrain telescope, ZWO ASI224MC camera. Seeing 8/10, transparency 4/6.*

Recent Topographic Studies

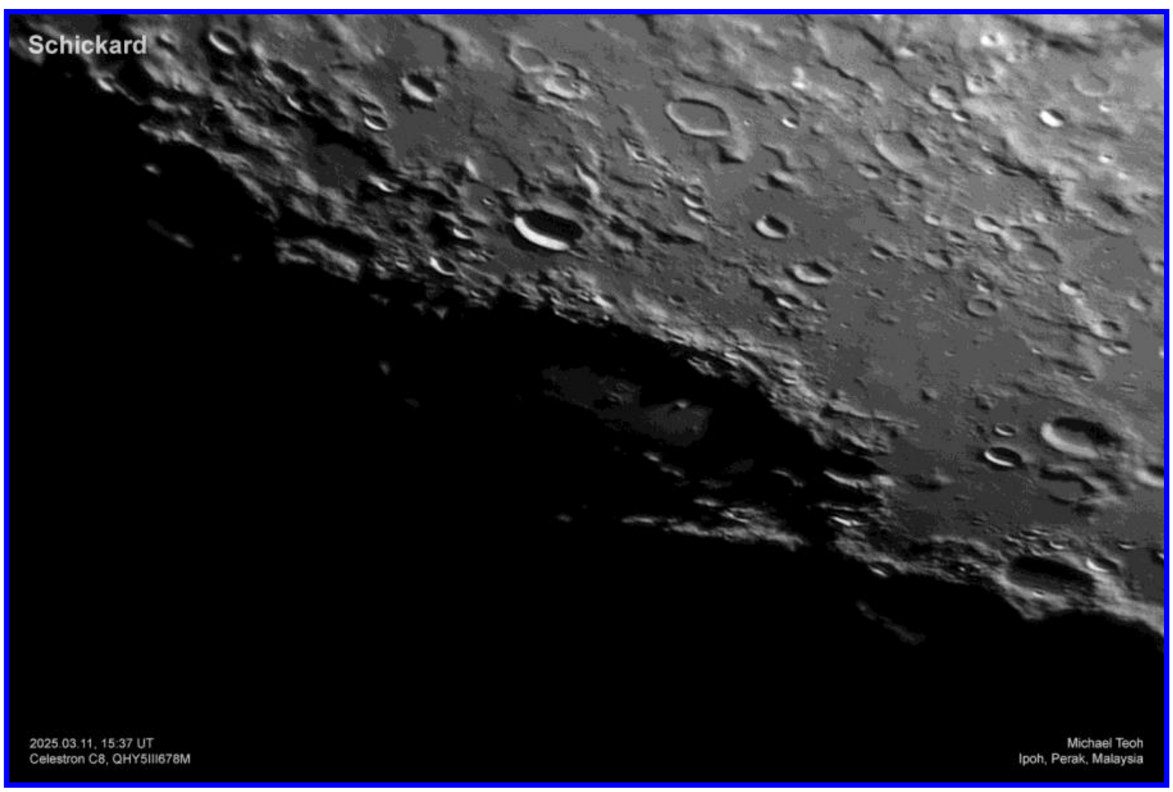
***Waxing Gibbous Moon**, Michael Teoh, Ipoh, Perak, Malaysia. 2025 March 11 14:38 UT. Sky-Watcher Evoguide 50DX refractor Schmidt-Cassegrain telescope, QHY5III678M camera.*

***Gassendi,** Maurice Collins, Palmerston North, New Zealand. 2025 March 10 08:44 UT. SkyWatcher 80 ED refractor telescope, 3x barlow, QHY5III462C camera.*

Recent Topographic Studies



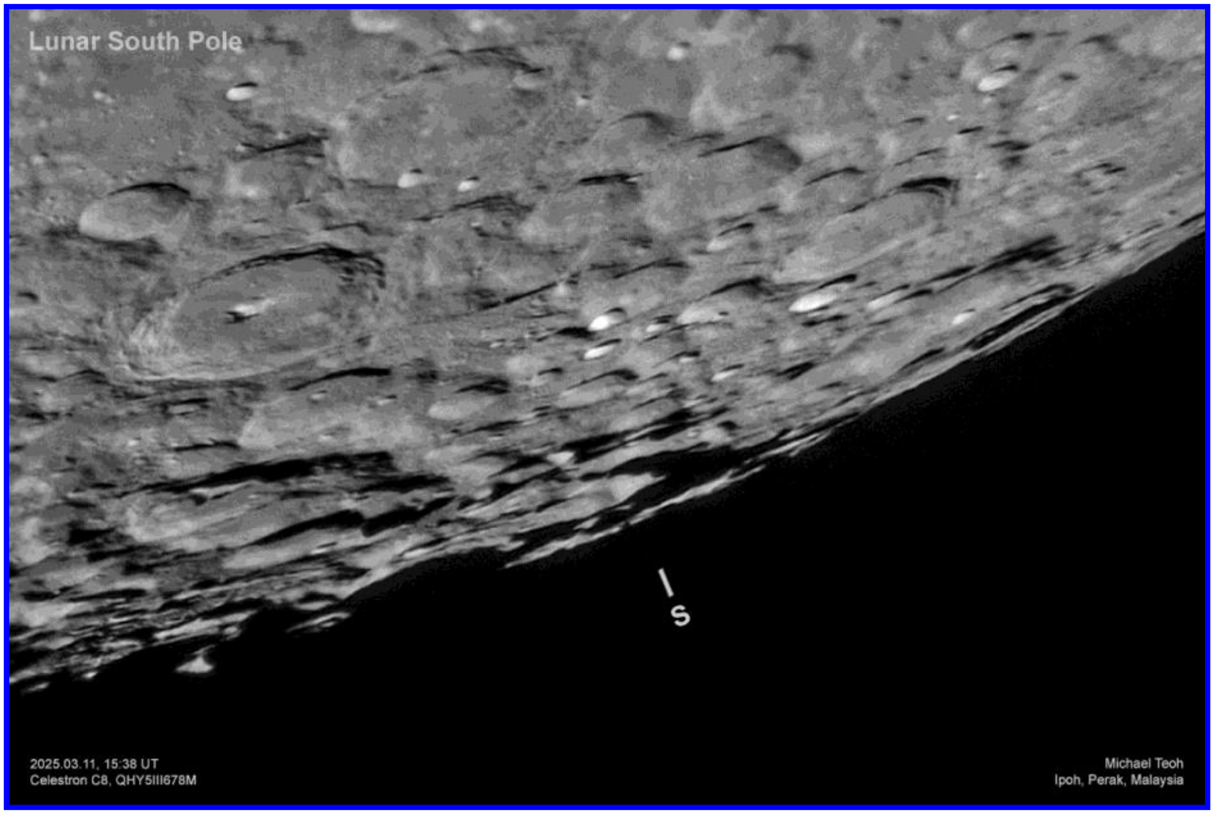
Schiller, *Guido Santacana, San Juan, Puerto Rico, USA. 2025 March 11 03:10 UT. Celestar 8 inch Schmidt-Cassegrain telescope, 2x barlow, ZWO ASI224MC camera. Seeing 8/10, transparency 4/6.*

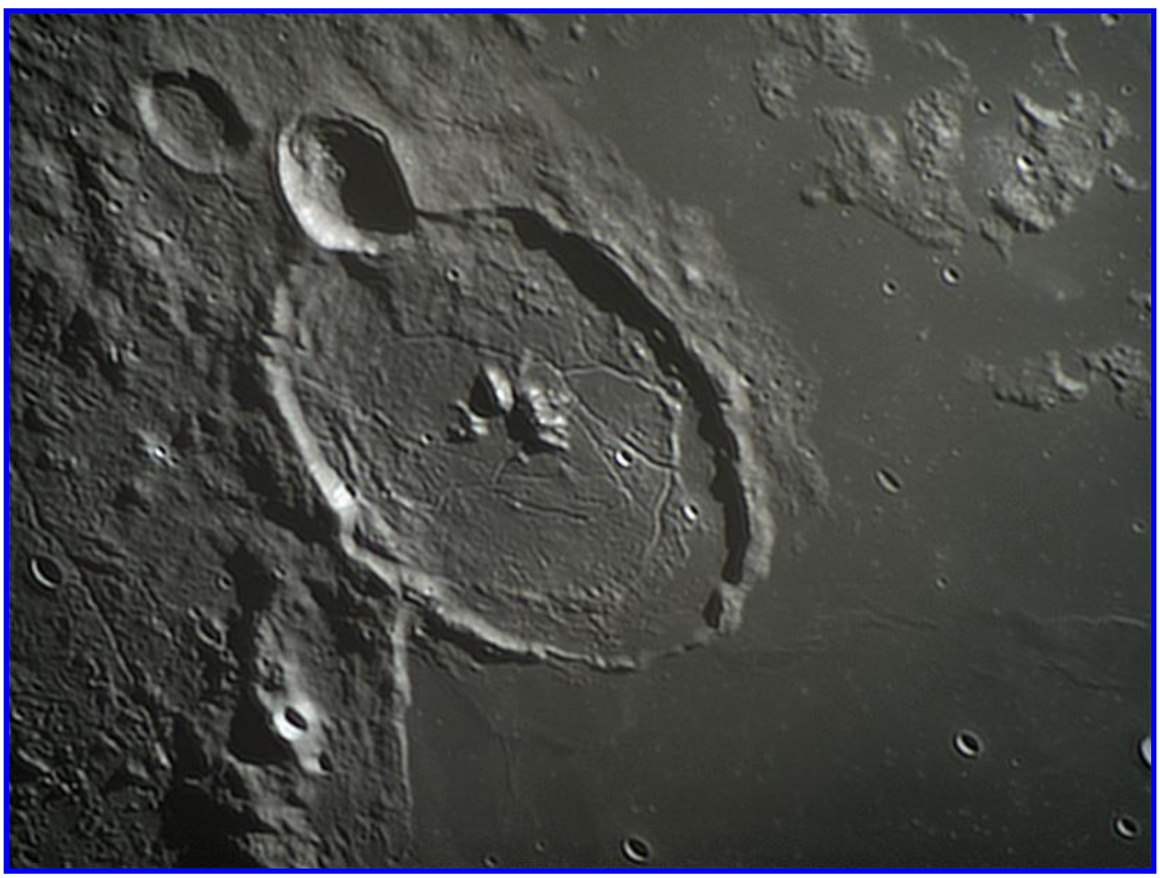


Schickard*, Michael Teoh, Ipoh, Perak, Malaysia. 2025 March 11 15:37 UT. Celestron 8 inch Schmidt-Cassegrain telescope, QHY5III678M camera.*

Recent Topographic Studies

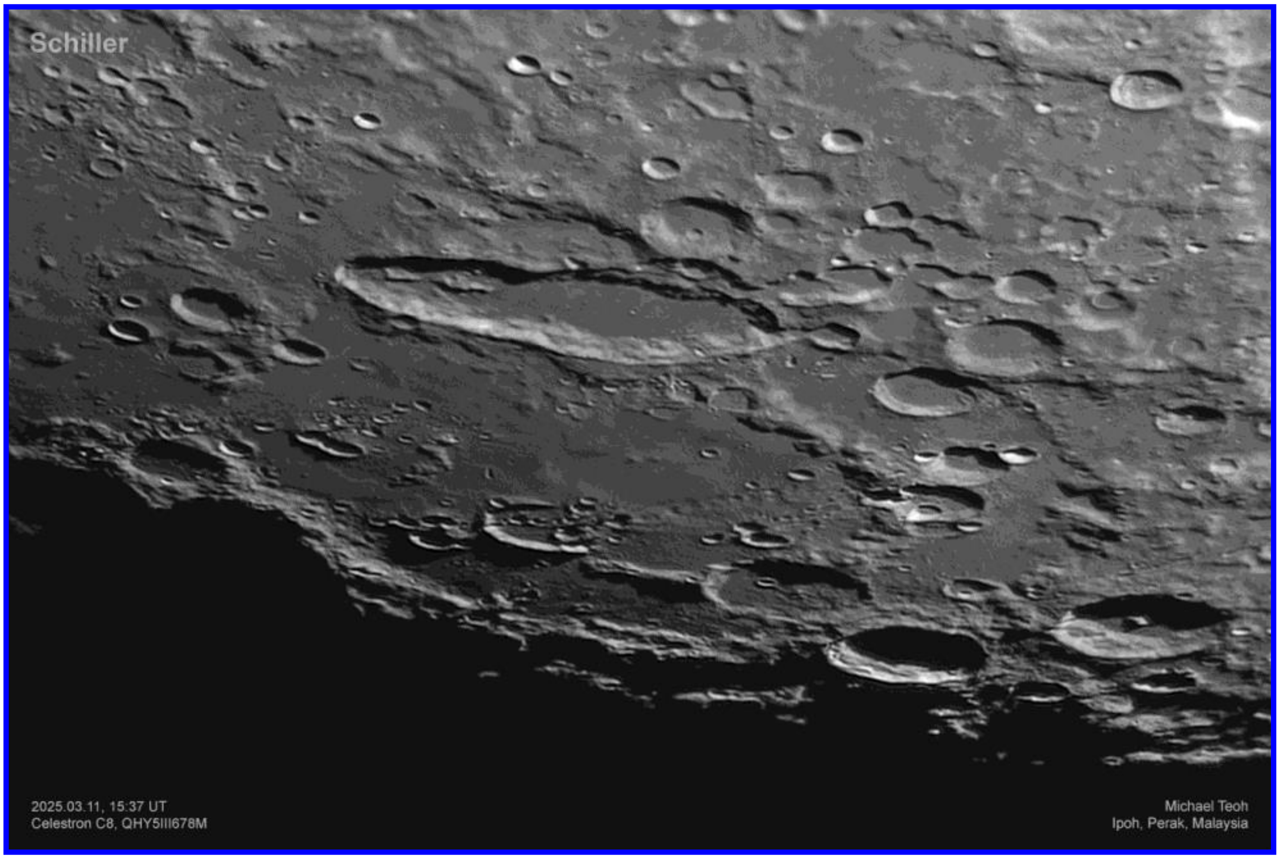
__South Pole__, Michael Teoh, Ipoh, Perak, Malaysia. 2025 March 11 15:38 UT. Celestron 8 inch Schmidt-Cassegrain telescope, QHY5III678M camera.





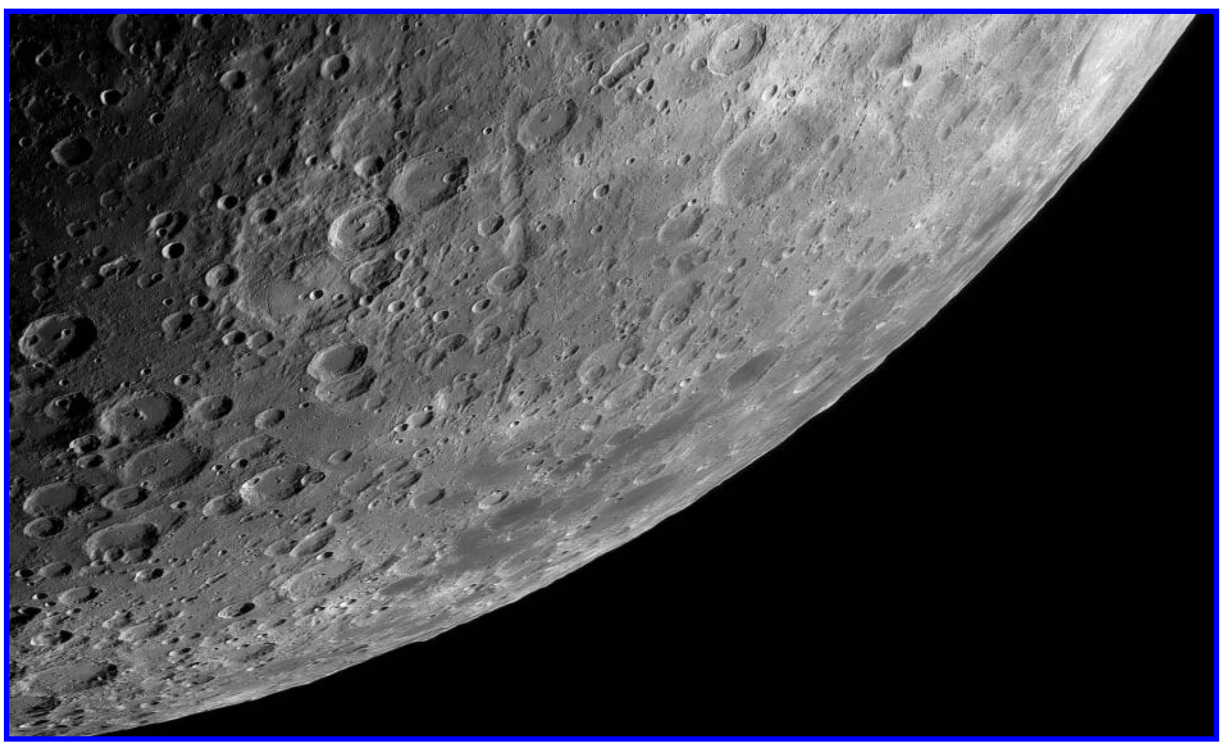
__Gassendi,__ Guido Santacana, San Juan, Puerto Rico, USA. 2025 March 11 02:48 UT. Celestar 8 inch Schmidt-Cassegrain telescope, 2x barlow, ZWO ASI224MC camera. Seeing 8/10, transparency 4/6.

Recent Topographic Studies



***Schiller**, Michael Teoh, Ipoh, Perak, Malaysia. 2025 March 11 15:37 UT. Celestron 8 inch Schmidt-Cassegrain telescope, QHY5III678M camera.*

***Mare Australe,** Jeff Grainger, South Cumbria, United Kingdom. 2025 March 05 18:44 UT. Celestron 11 Edge HD Schmidt-Cassegrain telescope, 685 nm IR filter, ZWO ASI678 Mono camera.*



Recent Topographic Studies

***Gassendi**, Michael Teoh, Ipoh, Perak, Malaysia. 2025 March 11 15:39 UT. Celestron 8 inch Schmidt-Cassegrain telescope, QHY5III678M camera.*

***Bullialdus,** Jeff Grainger, South Cumbria, United Kingdom. 2025 March 09 19:18 UT. Celestron 11 Edge HD Schmidt-Cassegrain telescope, 685 nm IR filter, ZWO ASI678 Mono camera.*

Recent Topographic Studies

***Capuanus,** Guido Santacana, San Juan, Puerto Rico, USA. 2025 March 11 03:04 UT. Celestar 8 inch Schmidt-Cassegrain telescope, 2x barlow, ZWO ASI224MC camera. Seeing 8/10, transparency 4/6.*

***Clavius and Tycho,** Jeff Grainger, South Cumbria, United Kingdom. 2025 March 09 19:06 UT. Celestron 11 Edge HD Schmidt-Cassegrain telescope, 685 nm IR filter, ZWO ASI678 Mono camera.*

Recent Topographic Studies

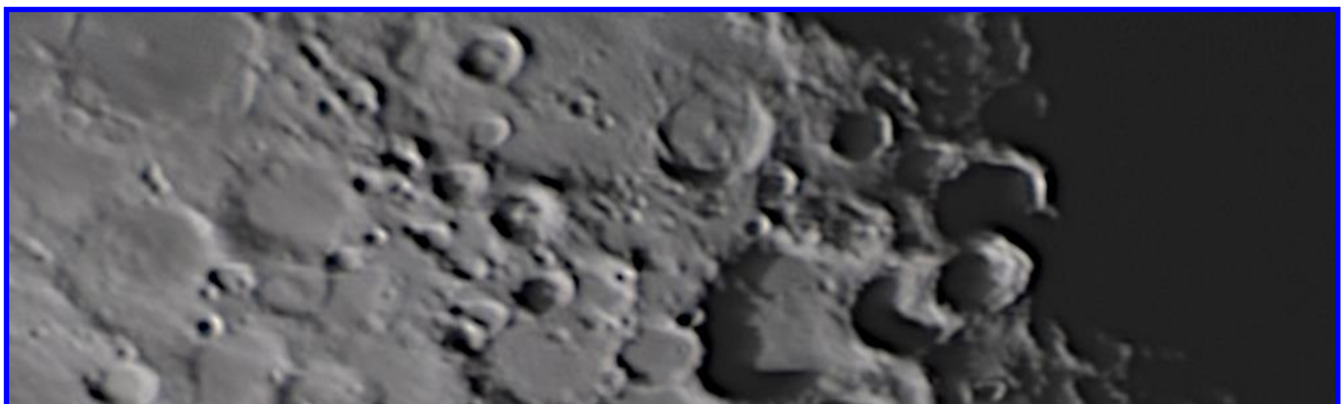
Northeast limb, *Jeff Grainger, South Cumbria, United Kingdom. 2025 March 05 19:11 UT. Celestron 11 Edge HD Schmidt-Cassegrain telescope, 685 nm IR filter, ZWO ASI678 Mono camera.*

Alphonsus, *Walter Ricardo Elias, Oro Verde, Argentina. 2025 February 20 04:53 UT. Sky Watcher 150/750 mm reflector telescope, 3x barlow, QHY5 IIC camera.*

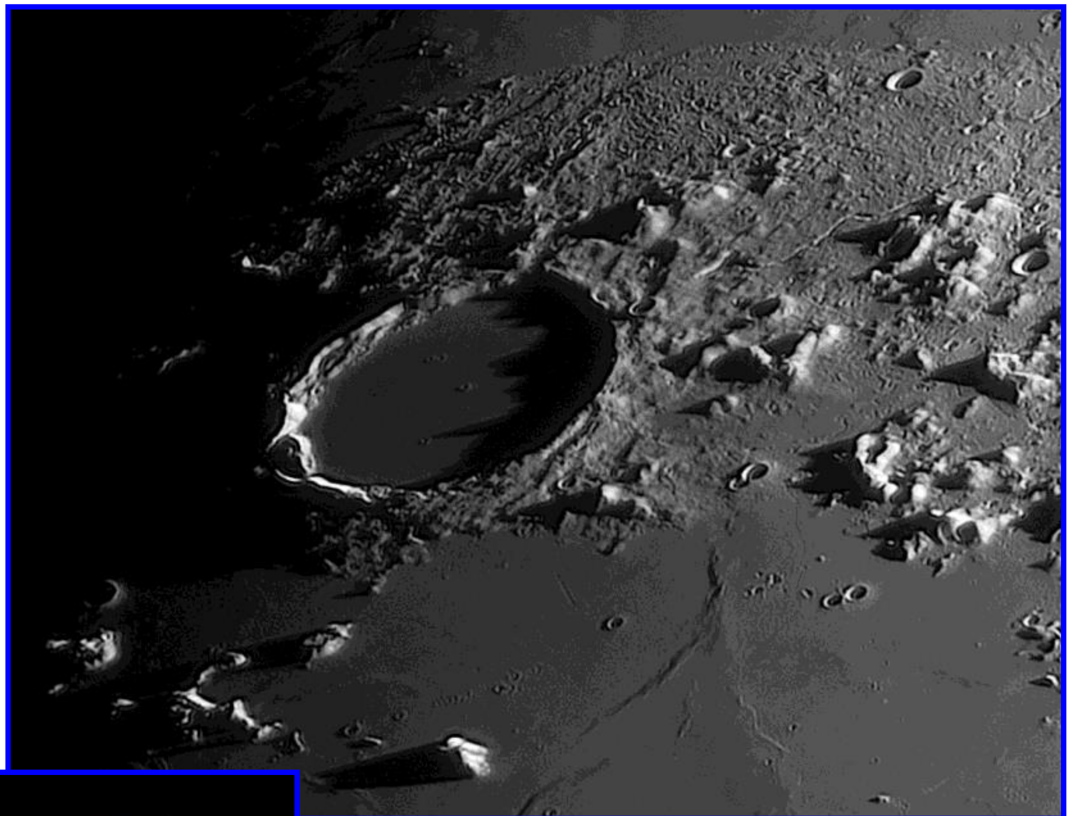
Recent Topographic Studies

***North Moon,** Jeff Grainger, South Cumbria, United Kingdom. 2025 February 05 19:21 UT. Celestron 11 Edge HD Schmidt-Cassegrain telescope, 685 nm IR filter, ZWO ASI678 Mono camera.*

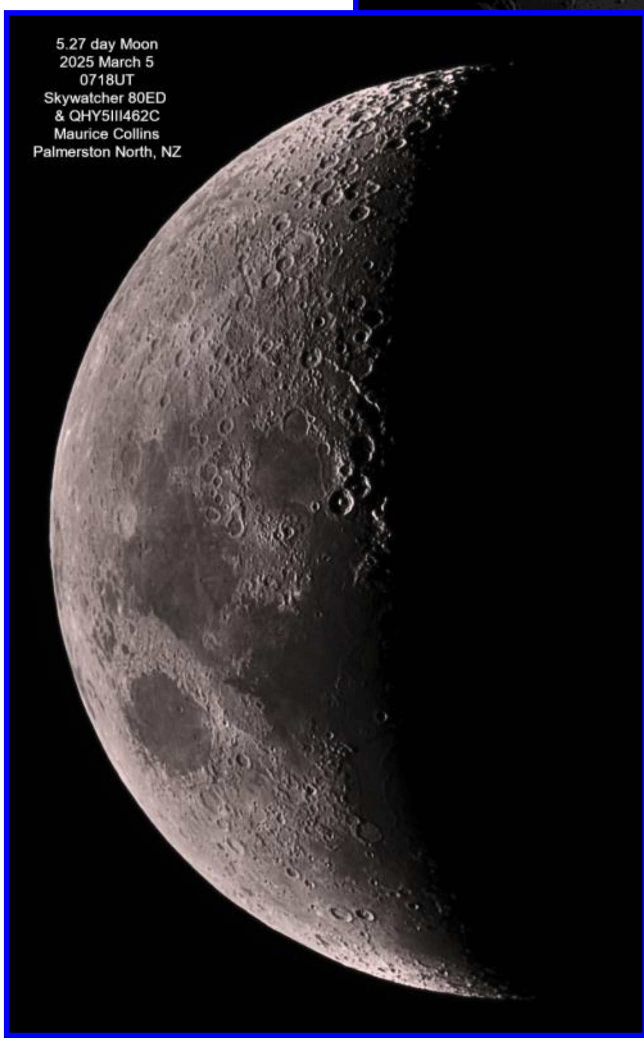
***Tycho,** Walter Ricardo Elias, Oro Verde, Argentina. 2025 February 20 05:08 UT. Sky Watcher 150/750 mm reflector telescope, 3x barlow, QHY5 IIC camera.*



Recent Topographic Studies

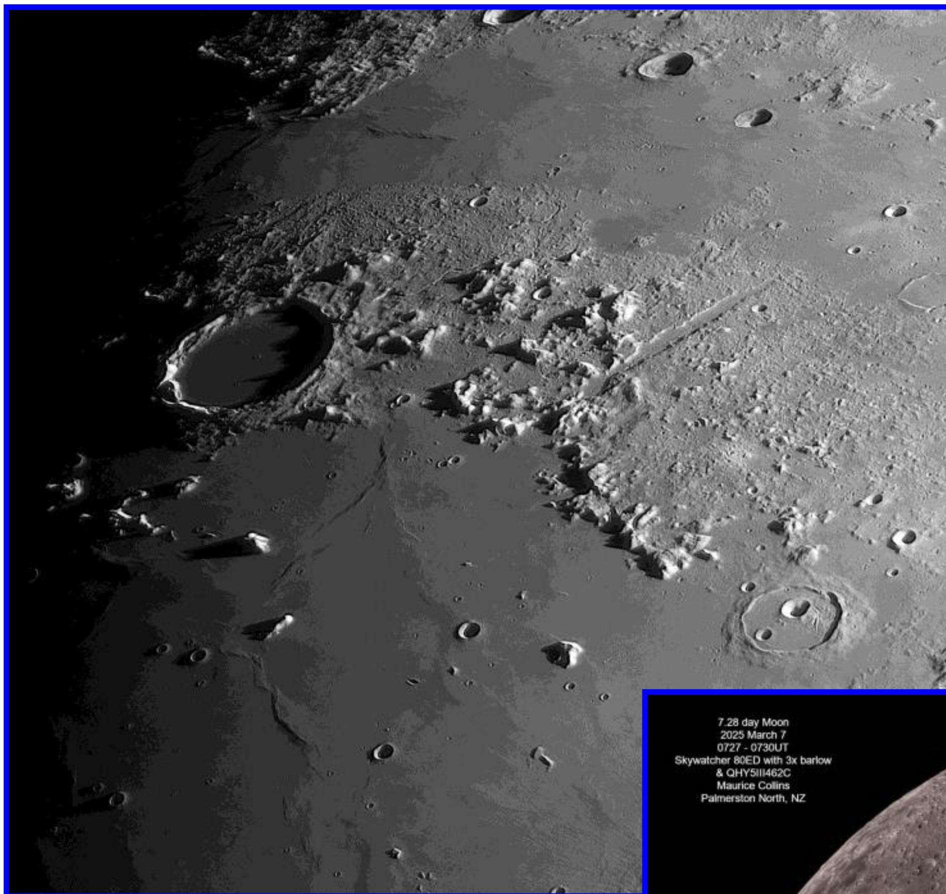


Plato close-up, *Jeff Grainger, South Cumbria, United Kingdom. 2025 February 06 18:47 UT. Celestron 11 Edge HD Schmidt-Cassegrain telescope, 685 nm IR filter, ZWO ASI678 Mono camera.*



5.27 Day-Old Moon, *Maurice Collins, Palmerston North, New Zealand. 2025 March 05 07:18 UT. SkyWatcher 80 ED refractor telescope, QHY5III462C camera. North is down, west is right.*

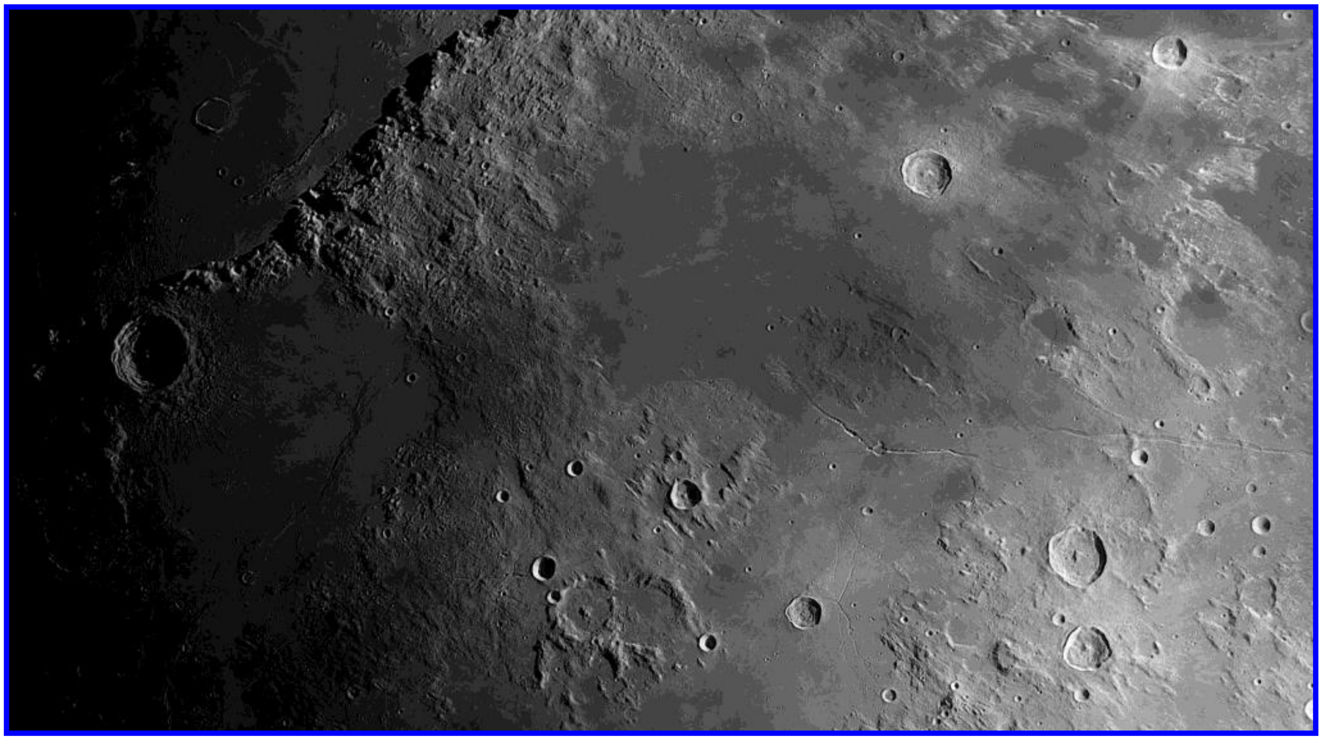
Recent Topographic Studies



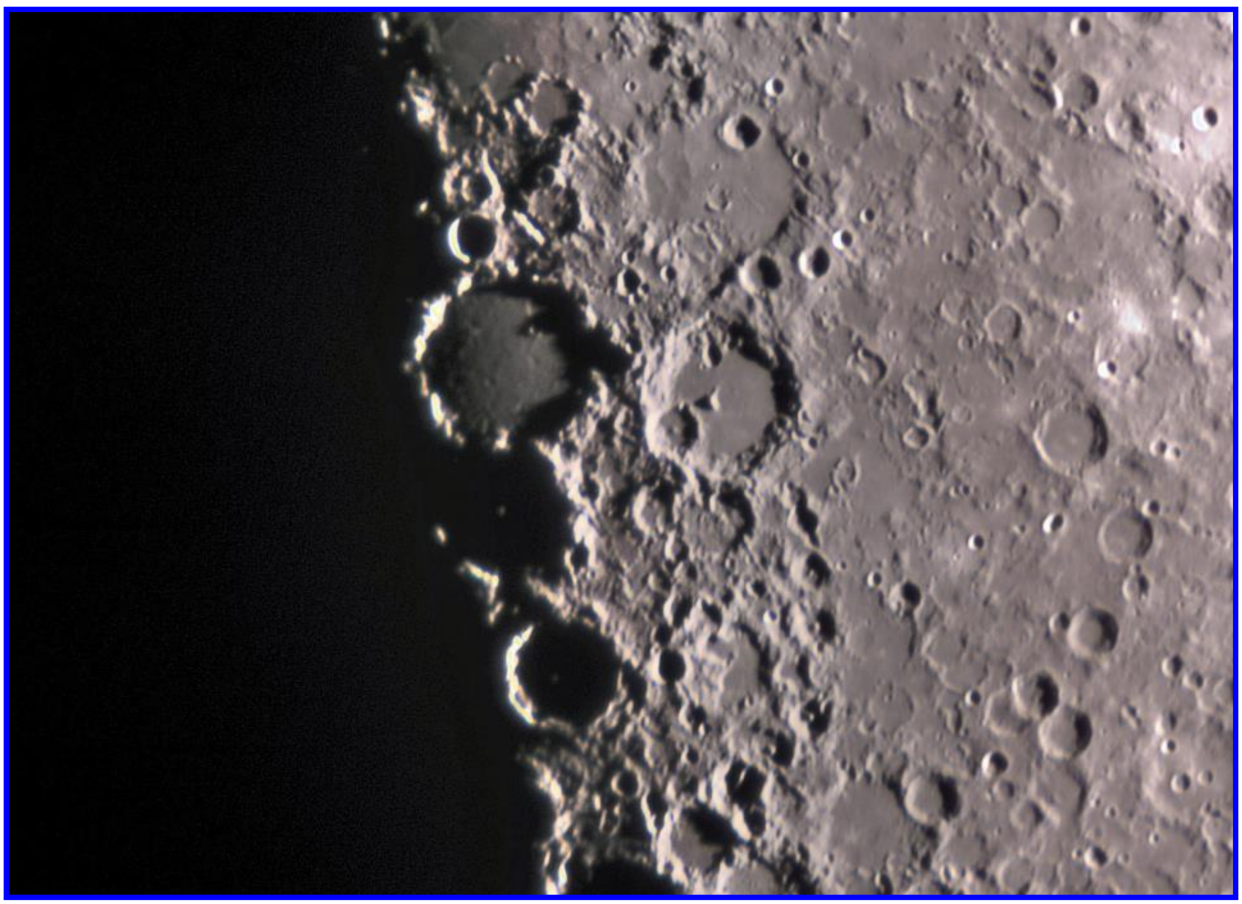
Plato, *Jeff Grainger, South Cumbria, United Kingdom. 2025 February 06 18:47 UT. Celestron 11 Edge HD Schmidt-Cassegrain telescope, 685 nm IR filter, ZWO ASI678 Mono camera.*

7.28 Day-Old Moon, *Maurice Collins, Palmerston North, New Zealand. 2025 March 07 07:27-07:30 UT. SkyWatcher 80 ED refractor telescope, 3x barlow, QHY5III462C camera. North is down, west is right.*

Recent Topographic Studies

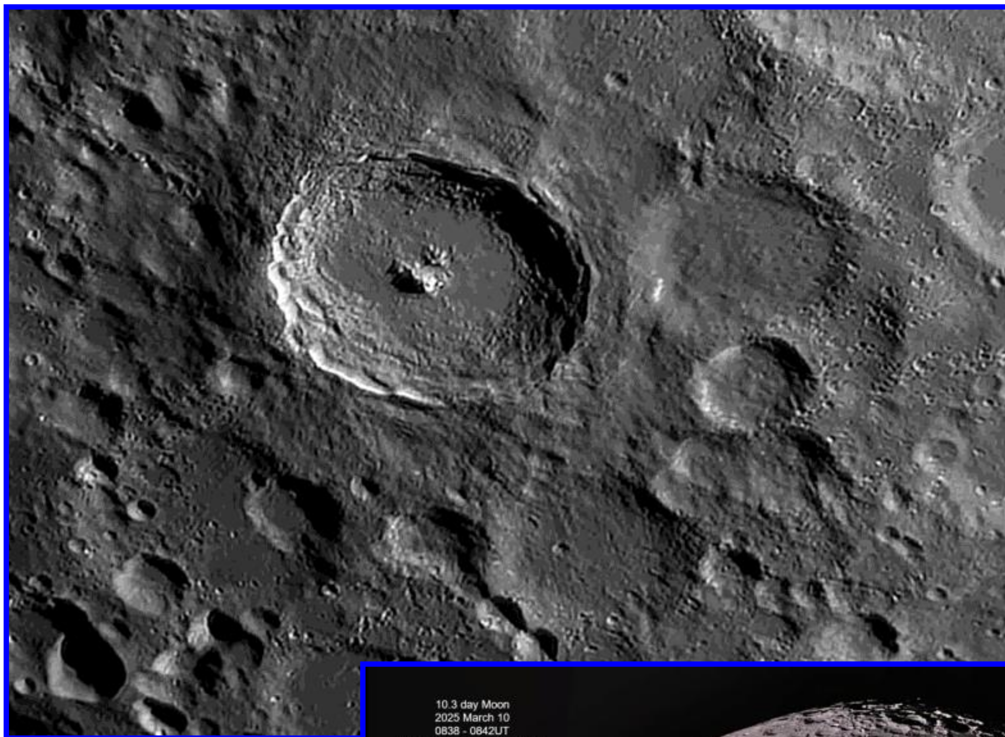


Sinus Medii, *Jeff Grainger, South Cumbria, United Kingdom. 2025 February 06 19:06 UT. Celestron 11 Edge HD Schmidt-Cassegrain telescope, 685 nm IR filter, ZWO ASI678 Mono camera.*



Ptolemaeus, *Maurice Collins, Palmerston North, New Zealand. 2025 March 07 08:59 UT. SkyWatcher 80 ED refractor telescope, 5x barlow, QHY5III462C camera.*

Recent Topographic Studies



Tycho, *Jeff Grainger, South Cumbria, United Kingdom. 2025 March 09 19:09 UT. Celestron 11 Edge HD Schmidt-Cassegrain telescope, 685 nm IR filter, ZWO ASI678 Mono camera.*

10.3 Day-Old Moon, *Maurice Collins, Palmerston North, New Zealand. 2025 March 07 08:38-08:42 UT. SkyWatcher 80 ED refractor telescope, 3x barlow, QHY5III462C camera. North is down, west is right.*

Recent Topographic Studies

Total Lunar Eclipse, *Maurice Collins, Palmerston North, New Zealand. 2025 March 14 07:27 UT. Canon 1200D with 250 mm lens, f/5.6, 1/4 second, ISO 3200.*

Total Lunar Eclipse*, John O'Neal , Statesville, North Carolina, USA. 2025 March 14 07:19 UT. 102 mm Lunt refractor telescope, ZWO ASI071 MC Pro camera.*

Recent Topographic Studies

Total Lunar Eclipse 2025 March 14

Total Lunar Eclipse, *Maurice Collins, Palmerston North, New Zealand. 2025 March 14 07:36 UT. Canon 1200D with 250 mm lens, f/5.6, 1/4 second, ISO 3200.*

Total Lunar Eclipse*, John O'Neal , Statesville, North Carolina, USA. 2025 March 14 07:33 UT. 102 mm Lunt refractor telescope, ZWO ASI071 MC Pro camera.*

Recent Topographic Studies

Total Lunar Eclipse 2025 March 14

Total Lunar Eclipse, *Maurice Collins, Palmerston North, New Zealand. 2025 March 14 07:24 UT. Canon 1200D with 250 mm lens, f/5.6, 1/4 second, ISO 3200.*

Total Lunar Eclipse, *Gregory T. Shanos, Sarasota, Florida, USA. 2025 March 14 07:17 UT. SeeStar50 smart telescope.*

Recent Topographic Studies

Total Lunar Eclipse 2025 March 14

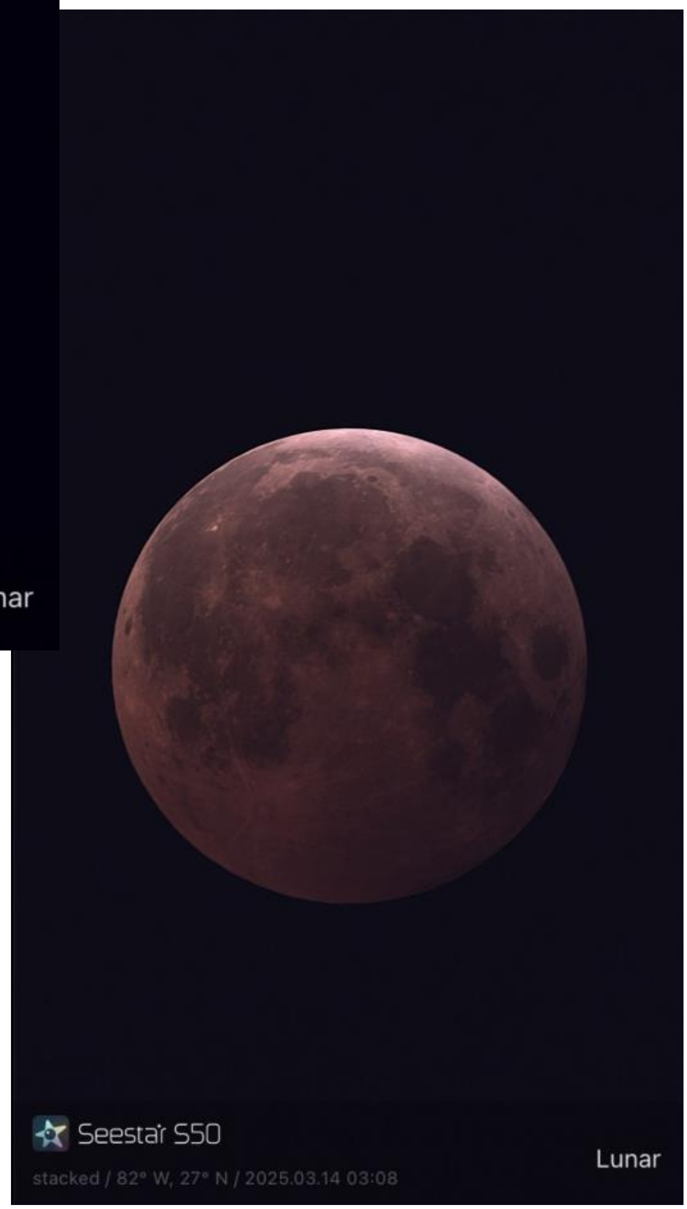
Total Lunar Eclipse, *Lawrence Garrett, Fairfax, Vermont, USA. 2025 March 14 06:57 UT. 6 inch f/8 Orion Skyquest reflector telescope, Sony Nex 5r camera. Seeing 7/10, transparency 6/6.*

Total Lunar Eclipse*, John O'Neal , Statesville, North Carolina, USA. 2025 March 14 07:54 UT. Canon 60Da, 300 mm f/5.6 camera.*

Recent Topographic Studies

Total Lunar Eclipse 2025 March 14

Total Lunar Eclipse, *Gregory T. Shanos, Sarasota, Florida, USA. 2025 March 14 07:04 UT. SeeStar50 smart telescope.*



Total Lunar Eclipse, *Gregory T. Shanos, Sarasota, Florida, USA. 2025 March 14 07:08 UT. SeeStar50 smart telescope.*

Recent Topographic Studies

Total Lunar Eclipse 2025 March 14

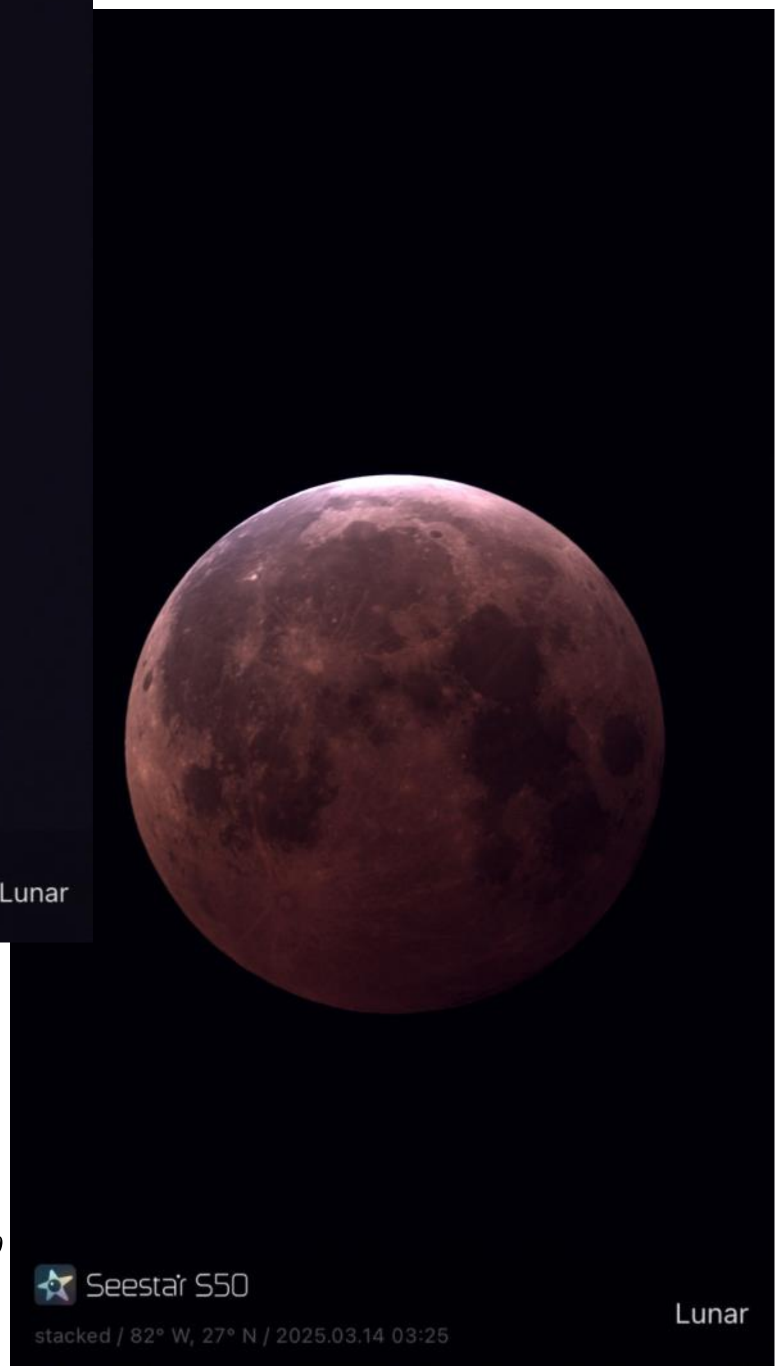
Total Lunar Eclipse, *Gregory T. Shanos, Sarasota, Florida, USA. 2025 March 14 07:14 UT. SeeStar50 smart telescope.*

Total Lunar Eclipse, *Gregory T. Shanos, Sarasota, Florida, USA. 2025 March 14 07:17 UT. SeeStar50 smart telescope.*

Recent Topographic Studies

Total Lunar Eclipse 2025 March 14

Total Lunar Eclipse, *Gregory T. Shanos, Sarasota, Florida, USA. 2025 March 14 07:17 UT. SeeStar50 smart telescope.*



Total Lunar Eclipse, *Gregory T. Shanos, Sarasota, Florida, USA. 2025 March 14 07:25 UT. SeeStar50 smart telescope.*

Total Lunar Eclipse, *Lawrence Garrett, Fairfax, Vermont, USA. 2025 March 14 06:40 UT. 6 inch f/8 Orion Skyquest reflector telescope, Sony Nex 5r camera. Seeing 7/10, transparency 6/6. This shows the "ozone fridge" According to spaceweather.com, 2025 March 17,* "The blue light is caused by ozone. During a lunar eclipse, most of the light illuminating the Moon passes through Earth's stratosphere, which is reddened by scattering. However, light passing through the upper stratosphere penetrates the ozone layer, which absorbs red light and actually makes the passing light ray bluer. The blue "ozone fringe" is visible only during the first and last moments of totality. Often, photographers don't even realize they have caught it."

Recent Topographic Studies

Total Lunar Eclipse 2025 March 14

Total Lunar Eclipse*, Paul Walker, Middlebury, Vermont, USA. 2025 March 14 06:19 UT. 10 inch f/4 Newtonian reflector telescope, 1000 mm focal length, Canon XTi camera. Paul adds:* "This was taken shortly before the total phase of the eclipse. The image is slightly cropped. The bluish "ozone fringe" is visible to the upper right, between the last part of the penumbra and the orange umbra. I could easily see this visually in my "big" 10" f/5.6 Newtonian at ~90x. I did not detect this color with the unaided eye or with 20x90 binoculars. The best view overall was through the 20x90's. There was a curved string of moderately bright stars to the west that could be viewed in the same field as the Moon early part of totally."

Total Lunar Eclipse*, Paul Walker, Middlebury, Vermont, USA. 2025 March 14 07:11 UT. 10 inch f/4 Newtonian reflector telescope, 1000 mm focal length, Canon XTi camera. Paul adds:* This image was taken close to mid-eclipse. The image is slightly cropped. It was fairly busy but good night with viewing and imaging the eclipse. Also, 16 minutes after I taking this image, with my IOTA hat on, I recorded the 16km asteroid 6576 Kievtech occult the 15th mag. star UCAC4-513-052191 for 2.0 seconds. The predicted maximum duration was only 1.13 sec making this a bit of an interesting event."

Recent Topographic Studies

Total Lunar Eclipse 2025 March 14

Total Lunar Eclipse, *Howard Eskildsen, Ocala, Florida, USA. 2025 March 14 04:44 UT. 6 inch f/8 refractor telescope, Canon EOS 60D camera. Seeing 6/10, transparency 3/6.*

Total Lunar Eclipse, *Howard Eskildsen, Ocala, Florida, USA. 2025 March 14 05:06 UT. 6 inch f/8 refractor telescope, Canon EOS 60D camera. Seeing 6/10, transparency 3/6.*

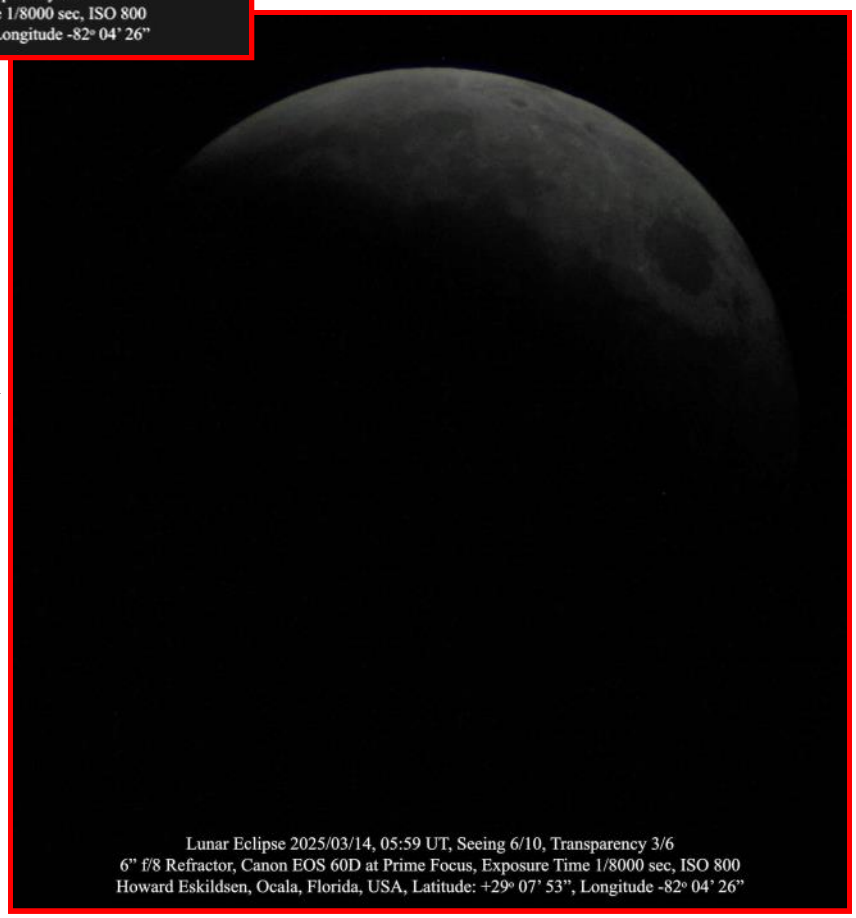
Total Lunar Eclipse, *Howard Eskildsen, Ocala, Florida, USA. 2025 March 14 05:17 UT. 6 inch f/8 refractor telescope, Canon EOS 60D camera. Seeing 6/10, transparency 3/6.*

Total Lunar Eclipse, *Howard Eskildsen, Ocala, Florida, USA. 2025 March 14 05:30 UT. 6 inch f/8 refractor telescope, Canon EOS 60D camera. Seeing 6/10, transparency 3/6.*

Recent Topographic Studies

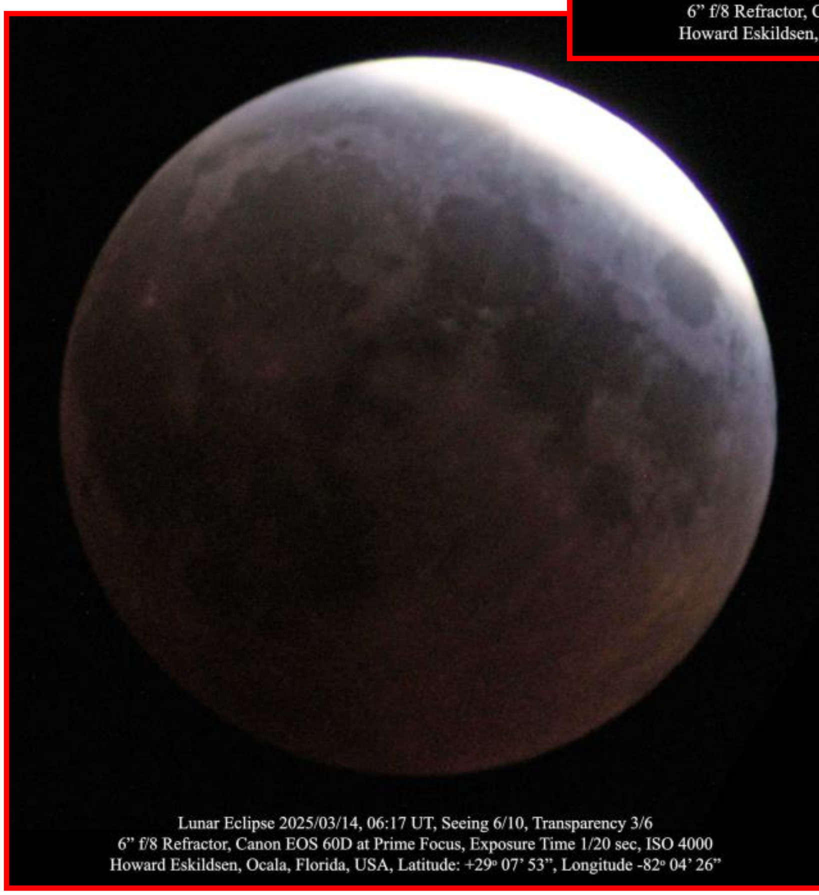
Total Lunar Eclipse 2025 March 14

Total Lunar Eclipse, *Howard Eskildsen, Ocala, Florida, USA. 2025 March 14 05:46 UT. 6 inch f/8 refractor telescope, Canon EOS 60D camera. Seeing 6/10, transparency 3/6.*



Total Lunar Eclipse, *Howard Eskildsen, Ocala, Florida, USA. 2025 March 14 05:59 UT. 6 inch f/8 refractor telescope, Canon EOS 60D camera. Seeing 6/10, transparency 3/6.*

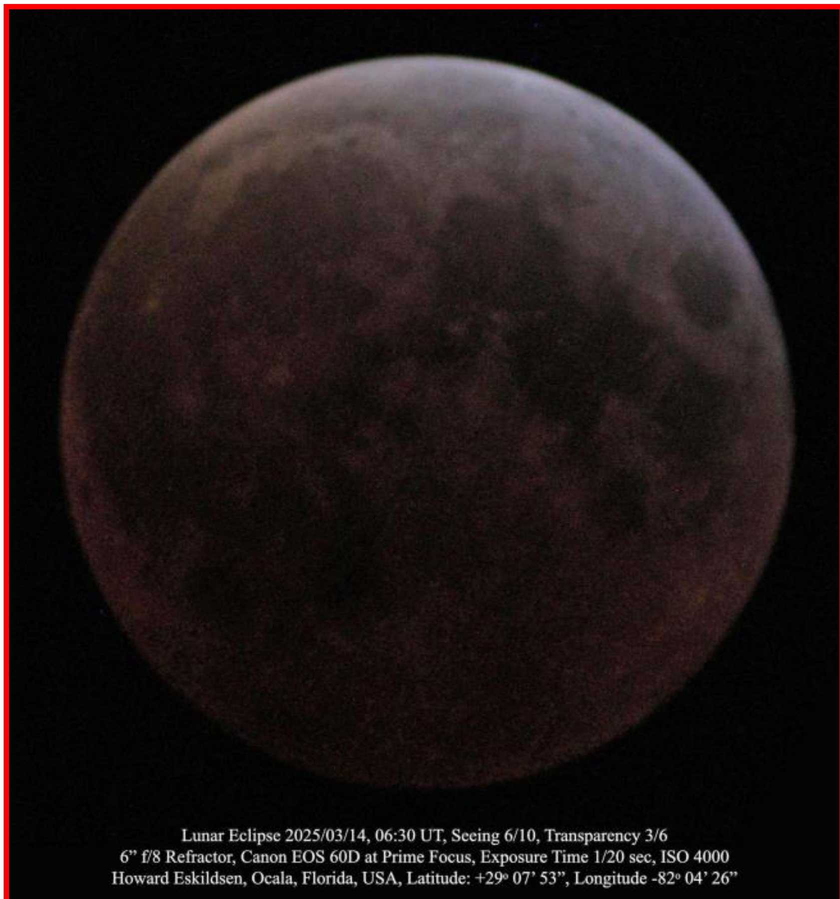
Total Lunar Eclipse, *Howard Eskildsen, Ocala, Florida, USA. 2025 March 14 06:00 UT. 6 inch f/8 refractor telescope, Canon EOS 60D camera. Seeing 6/10, transparency 3/6.*



Total Lunar Eclipse, *Howard Eskildsen, Ocala, Florida, USA. 2025 March 14 06:17 UT. 6 inch f/8 refractor telescope, Canon EOS 60D camera. Seeing 6/10, transparency 3/6.*

Recent Topographic Studies

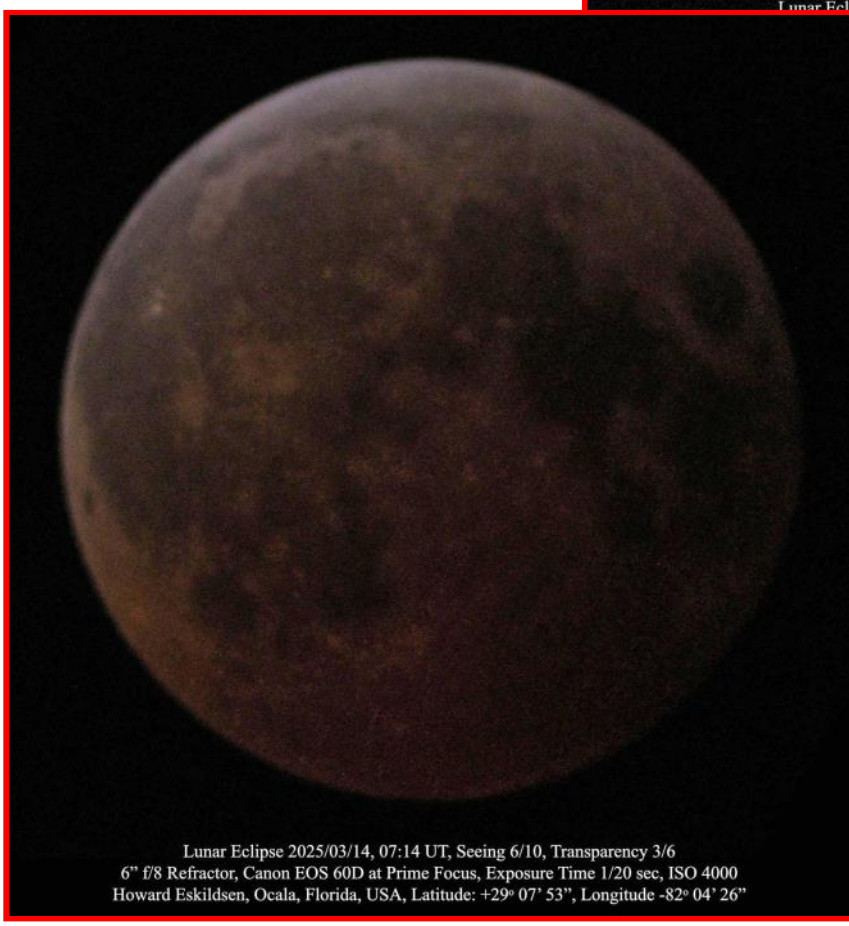
Total Lunar Eclipse 2025 March 14



Total Lunar Eclipse, *Howard Eskildsen, Ocala, Florida, USA. 2025 March 14 06:30 UT. 6 inch f/8 refractor telescope, Canon EOS 60D camera. Seeing 6/10, transparency 3/6.*

Total Lunar Eclipse, *Howard Eskildsen, Ocala, Florida, USA. 2025 March 14 06:44 UT. 6 inch f/8 refractor telescope, Canon EOS 60D camera. Seeing 6/10, transparency 3/6.*

Total Lunar Eclipse, *Howard Eskildsen, Ocala, Florida, USA. 2025 March 14 07:00 UT. 6 inch f/8 refractor telescope, Canon EOS 60D camera. Seeing 6/10, transparency 3/6.*

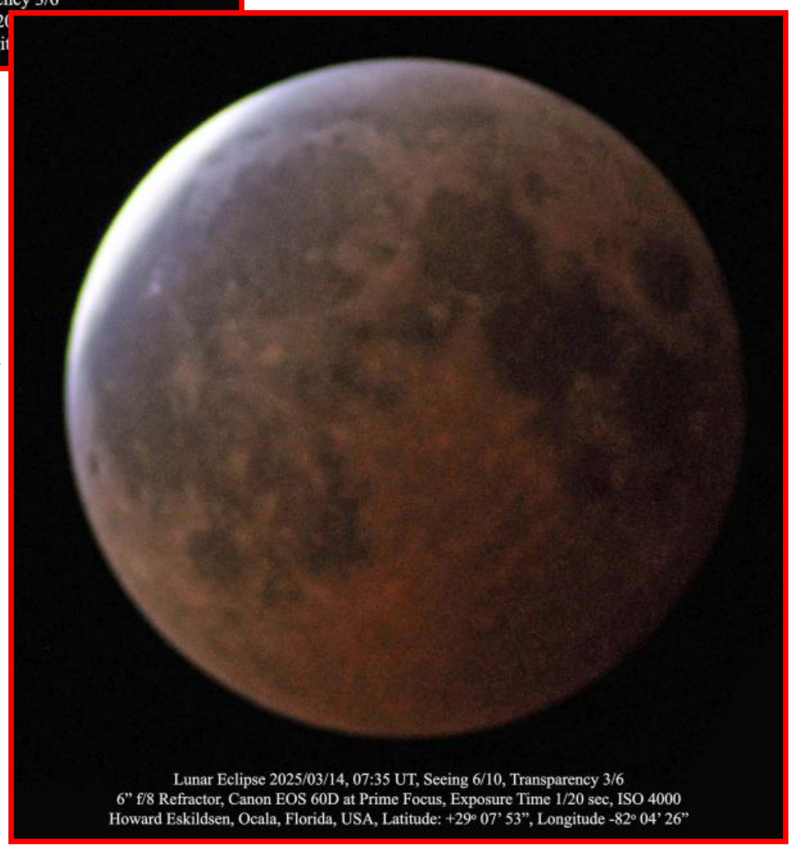


Total Lunar Eclipse, *Howard Eskildsen, Ocala, Florida, USA. 2025 March 14 07:14 UT. 6 inch f/8 refractor telescope, Canon EOS 60D camera. Seeing 6/10, transparency 3/6.*

Recent Topographic Studies

Total Lunar Eclipse 2025 March 14

Total Lunar Eclipse, *Howard Eskildsen, Ocala, Florida, USA. 2025 March 14 07:30UT. 6 inch f/8 refractor telescope, Canon EOS 60D camera. Seeing 6/10, transparency 3/6.*



Total Lunar Eclipse, *Howard Eskildsen, Ocala, Florida, USA. 2025 March 14 07:35 UT. 6 inch f/8 refractor telescope, Canon EOS 60D camera. Seeing 6/10, transparency 3/6.*

Recent Topographic Studies

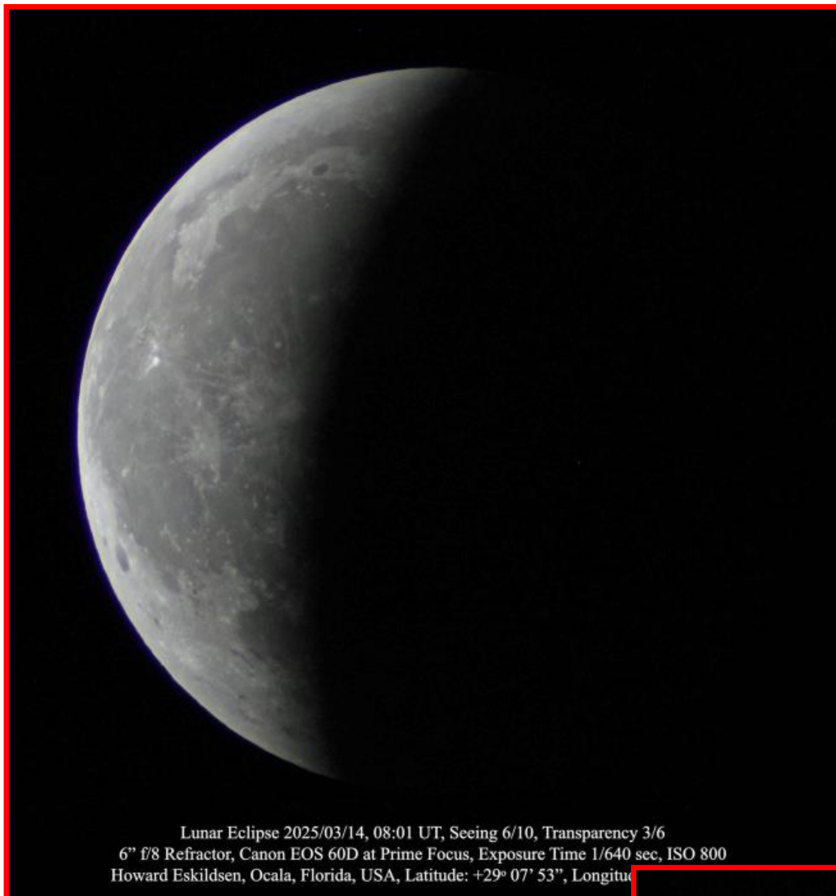
Total Lunar Eclipse 2025 March 14

Total Lunar Eclipse, *Howard Eskildsen, Ocala, Florida, USA. 2025 March 14 07:44 UT. 6 inch f/8 refractor telescope, Canon EOS 60D camera. Seeing 6/10, transparency 3/6.*

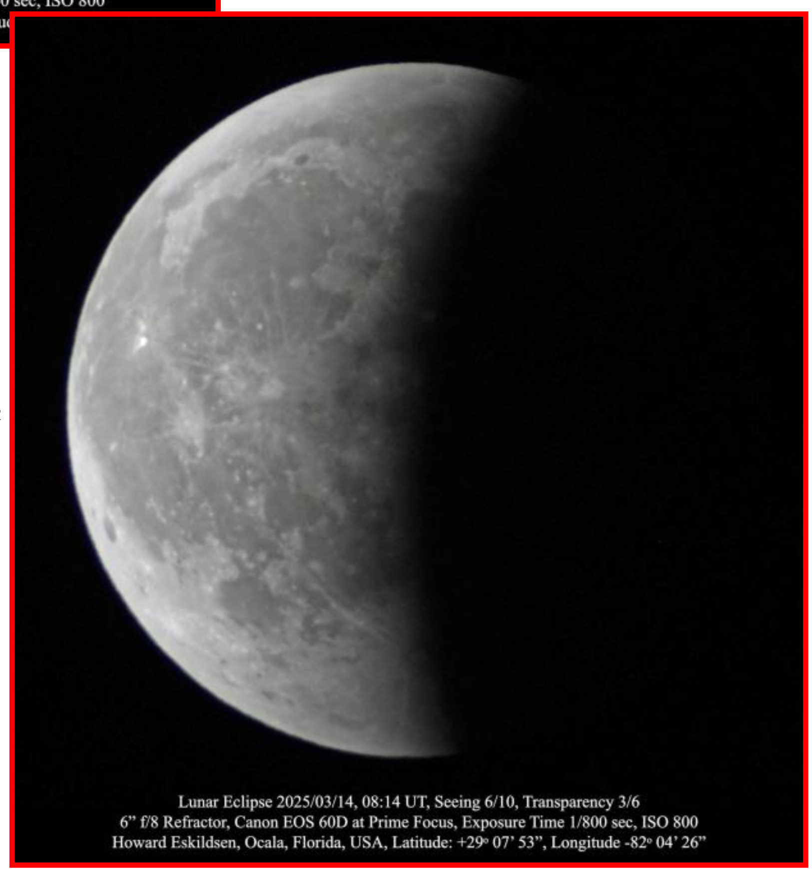
Total Lunar Eclipse, *Howard Eskildsen, Ocala, Florida, USA. 2025 March 14 07:45 UT. 6 inch f/8 refractor telescope, Canon EOS 60D camera. Seeing 6/10, transparency 3/6.*

Recent Topographic Studies

Total Lunar Eclipse 2025 March 14



Total Lunar Eclipse, *Howard Eskildsen, Ocala, Florida, USA. 2025 March 14 08:01 UT. 6 inch f/8 refractor telescope, Canon EOS 60D camera. Seeing 6/10, transparency 3/6.*

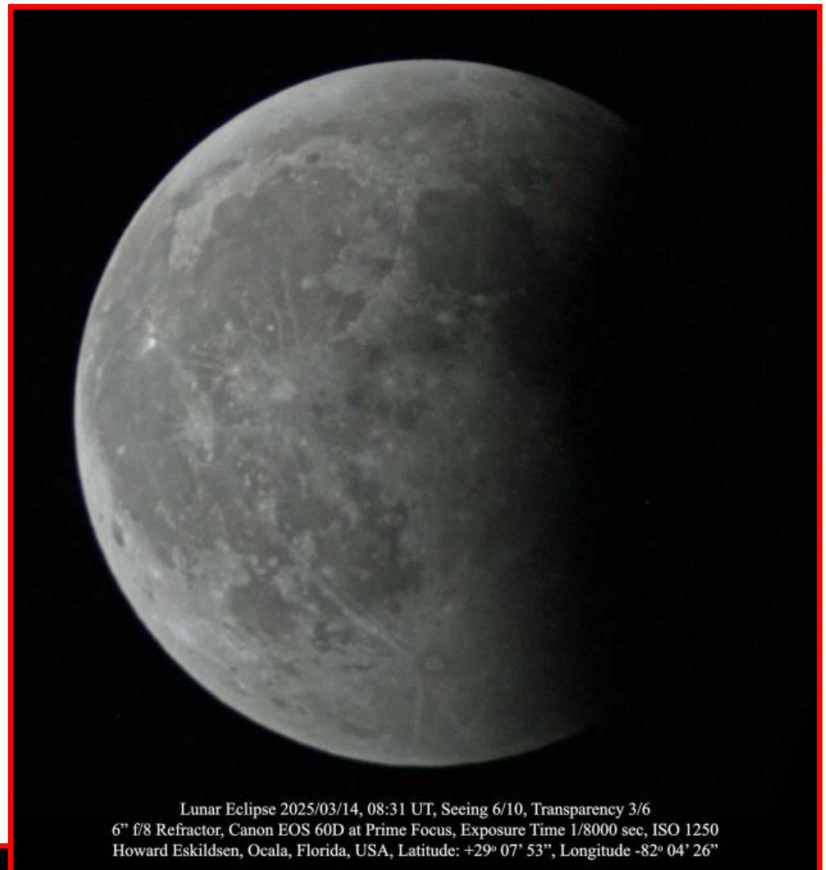


Total Lunar Eclipse, *Howard Eskildsen, Ocala, Florida, USA. 2025 March 14 08:14 UT. 6 inch f/8 refractor telescope, Canon EOS 60D camera. Seeing 6/10, transparency 3/6.*

Recent Topographic Studies

Total Lunar Eclipse 2025 March 14

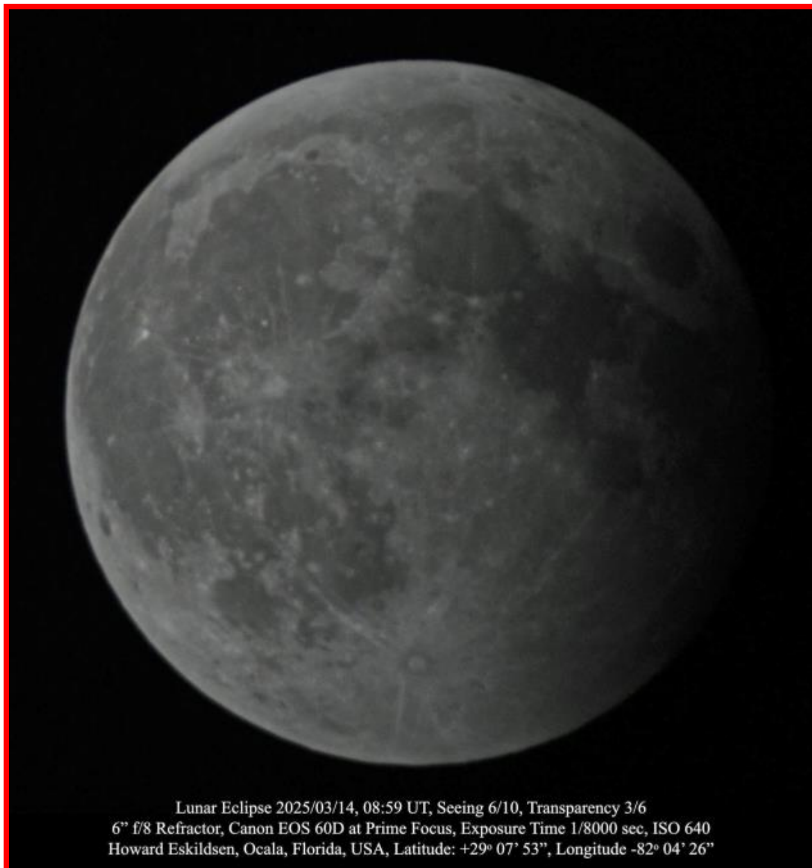
__Total Lunar Eclipse,__ Howard Eskildsen, Ocala, Florida, USA. 2025 March 14 08:31 UT. 6 inch f/8 refractor telescope, Canon EOS 60D camera. Seeing 6/10, transparency 3/6.



__Total Lunar Eclipse,__ Howard Eskildsen, Ocala, Florida, USA. 2025 March 14 08:45 UT. 6 inch f/8 refractor telescope, Canon EOS 60D camera. Seeing 6/10, transparency 3/6.

Recent Topographic Studies

Total Lunar Eclipse 2025 March 14



Total Lunar Eclipse, *Howard Eskildsen, Ocala, Florida, USA. 2025 March 14 08:59 UT. 6 inch f/8 refractor telescope, Canon EOS 60D camera. Seeing 6/10, transparency 3/6.*

Total Lunar Eclipse, *Howard Eskildsen, Ocala, Florida, USA. 2025 March 14 09:15 UT. 6 inch f/8 refractor telescope, Canon EOS 60D camera. Seeing 6/10, transparency 3/6.*

Recent Topographic Studies

Total Lunar Eclipse 2025 March 14

One Observer's Lunar Eclipse Experience

Anthony Harding

I have always found it notoriously difficult to wake up early. However, with the lunar eclipse happening in the dead of night in the wee hours of the morning on March 14th, I had little choice but to set my alarm and drag my recalcitrant old self out of bed to catch it.

I broke out all the equipment and set it next to my deck door before heading off to bed; the AstroTech 115EDT triplet refractor, the equatorial mount, the ZWO ASI533MCPro camera, the tripod-mounted 25x70 binoculars, etc. were placed and ready to be deployed. The plan was to get up and only have to spend a short amount of time setting up before capturing footage. The plan was solid.

When the alarm went off, I forced myself out of bed (no easy task!) and began to set up the equipment outside. Unfortunately, I had misjudged the time for the beginning of the eclipse and found a good chunk of the moon already shrouded in shadow! I raced to finish setting up.

I quickly began taking footage and realized in my half-awake state that I had neglected to install the UV/IR filter on the camera. What's more, I failed to change the settings in the software and was accidentally collecting 8-bit AVI files instead of 16-bit SER files. I cursed myself (and not softly!), and corrected these issues.

I began capturing footage prior to the full phase of the eclipse, allowing 3-10 minutes between captures. Partway through this, I noted that the tracking became much sloppier than expected. Looking for an explanation, I eventually discovered that one of the black cords on the camera was clandestinely dragging along the folding table holding my laptop, causing the mount to work harder to keep up with the target. Ugh. Another correction (and more self-abuse) enabled this to be corrected.

A total of 20 captures were made, a total of about 72GB of raw data. I wanted to make sure I got enough footage to ensure some decent end results. I had hoped to catch some footage of the partial eclipse following the full phase, but some encroaching clouds put an end to that prospect.

During all of this, I was taking frequent breaks to use the binoculars to view the event in between captures. The eclipse was spectacular at every view.

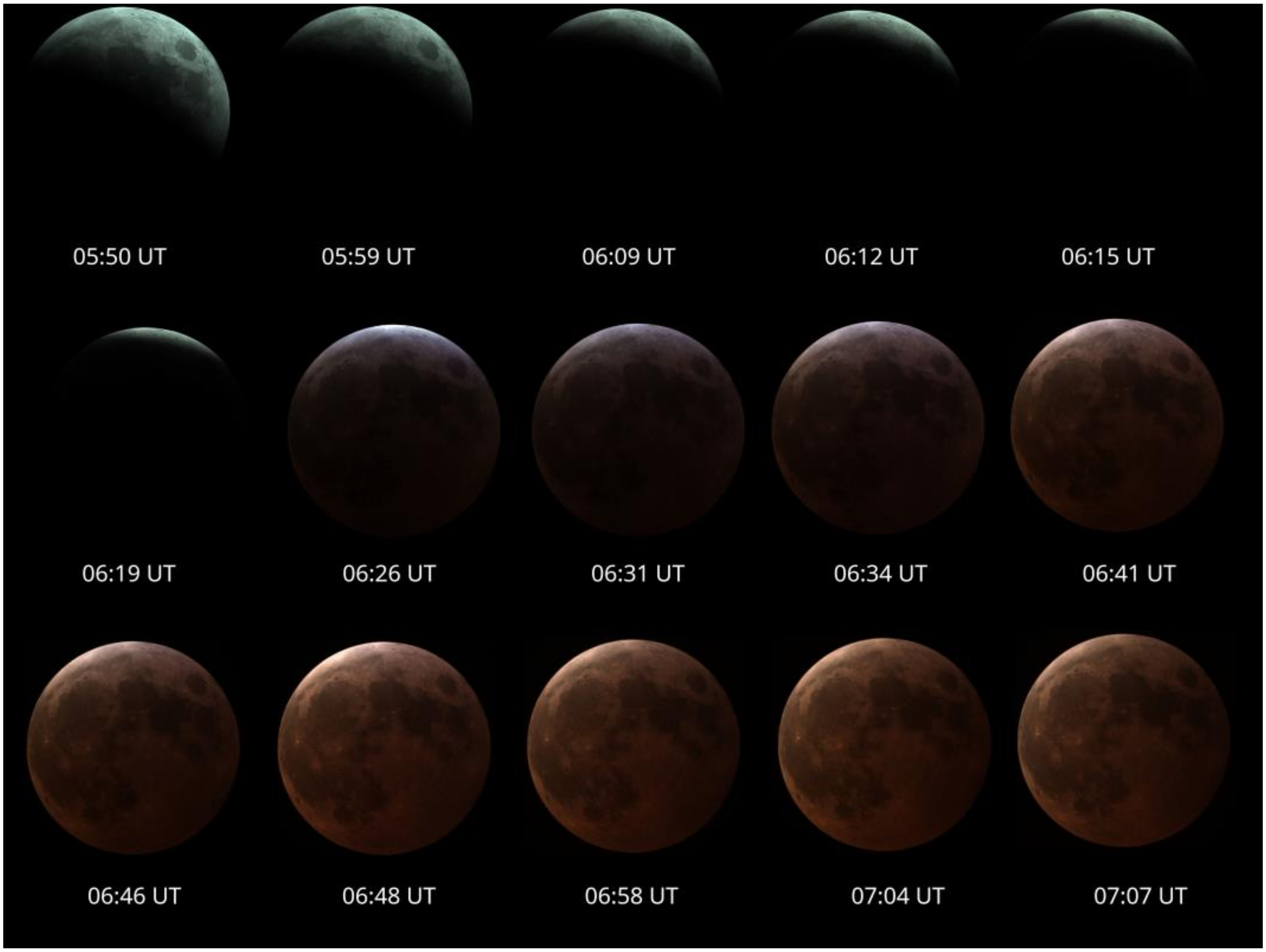
The results of the best of the stacks is presented in the following image, along with corresponding times in UT. The image capture and processing details are thus:

Anthony Harding
2025-03-14 Lunar Eclipse
Northeast Indiana
AstroTech AT115EDT Triplet Refractor (f/7)
Orion EQ-26 Motorized Equatorial Mount
ZWO ASI533MC Pro Color Camera
Baader UV/IR Cut Filter
Footage captured and stacked in ASI Studio
Wavelets applied in Registax
All images are oriented with north up
Seeing: 7/10
Transparency: 4/6

Recent Topographic Studies

Total Lunar Eclipse 2025 March 14

The exact same wavelets were applied to all images, and no color corrections of any kind were made. The images all show the neutral colors captured directly by the camera. This enables an accurate comparison between the 15 final images.



First Look at the March 14, 2025 Lunar Eclipse at Thermal Infrared Wavelengths

Darryl Wilson

The most recent lunar eclipse offered this author an opportunity to collect thermal imagery of the of the moon during rapid cooling of the lunar surface that only happens when the earth blocks the sun in a timeframe of only a few hours. A thermal imager (TE-EV1, i3System.com) with superior ergonomics, better software, and superior electronic capabilities helped make these observations a success.

Weather conditions at the beginning of the penumbral phase were ideal, but steadily deteriorated over the next couple of hours. By the beginning of the umbral phase a thick layer of ground fog reduced visibility and contrast and a thin scattered cloud layer forced intermittent pauses in image collection. Nevertheless, many excellent images were recorded due to the improved ease-of-use of the thermal imaging equipment.

This short paper contains no quantitative analysis of the data that were gathered. At the time of publication deadline, only a fraction of the images have been processed and there has not yet been time to match many interesting thermal features to their visible light counterparts. This work will be the subject of a future paper. Time series analysis of radiative cooling effects will be possible for some features and areas on the lunar surface and these analyses will also be presented. For now, a peek at the imaging results is presented.

Figure 1 is a visible light image of the full disk taken 13 minutes before the start of the eclipse. It is useful as a reference image for comparison of thermal features to visible light features. Although this can be done with reference to existing moon maps, it is advantageous to have a comparison image with the moon at the same libration.

Figure 1, 13 Minutes Before the Start of the Eclipse, *Darryl Wilson, Marshall, Virginia, USA. 2025 March 14 03:43 UT. 3 inch refractor telescope, SKYRIS 274M camera.*

Recent Topographic Studies

Total Lunar Eclipse 2025 March 14

Figure 2 is also a visible light image of the moon. It was taken 34 minutes after the umbral shadow contacted the limb. According to The March 2025 issue of Sky and Telescope, the umbral shadow had crossed Copernicus 9 minutes earlier and Tycho 18 minutes earlier. This image was taken only 3 minutes before the beginning of the thermal image mosaic presented below.

Figure 2, 34 Minutes After the Start of the Umbral Eclipse, *Darryl Wilson, Marshall, Virginia, USA. 2025 March 14 05:43 UT. 3 inch refractor telescope, SKYRIS 274M camera.*

Figure 3 is an image of the umbral shadow crossing the disk 17 minutes later. This image was taken just 1 minute after the last of the thermal mosaic images was collected. Figures 2 and 3 bracket the timeframe of the thermal images.

Figure 3, 51 Minutes After the Start of the Umbral Eclipse, *Darryl Wilson, Marshall, Virginia, USA. 2025 March 14 05:43 UT. 3 inch refractor telescope, SKYRIS 274M camera.*

Figure 4 is a mosaic of 4 thermal images taken from 0546 UT to 0559 UT. Each mosaiced image was actually a coregistered stack of about 60 to 90 individual raw images. Note that the lunar limb is visible against the background sky, even in areas within the umbral shadow. An unexpected characteristic of the image is that there is no easily discernable transition between the umbral shadow and the area in penumbra. Significant radiative cooling on the lunar surface happens on a timescale longer than an hour or two. Of course, we know from thermal imagery of the waning phases that the terminator is approximately in the same location on visible and thermal images. This means that somewhere between 2 hours and 24 hours the surface cools from daytime temperatures to temps so low that an earthbound sensor can no longer detect a signal. This is consistent with results that were published by the LRO science team several years ago.

A first impression is that it looks like a dark gray ball with many bright spots arranged in complicated patterns on the surface. The bright spots are known as hot spots because in thermal images brighter means warmer. Several of the more prominent hot spots are easily identifiable. The most noticeable is Tycho, near the bottom of the disk. The crater rim and the central peak are both well resolved. Copernicus can also be found easily. It has a swirl pattern, more complicated than Tycho. Aristarchus, Langrenus, and a few others are also fairly easy to find. After those, many other hot spots do not seem to correspond to any well-known lunar features. Clearly, something is different about these lunar features, but visible light images provide conflicting and confusing hints as to the cause of their brightness. We'll discuss the reasons in a future article, but if you read "Basic Interpretation and Analysis of Lunar Thermal Images" [JALPO Vol. 63, No. 2, Spring 2021] you may already know.

In summary, this author collected an information-rich data set that will support several future articles based on thermal observables recorded during this eclipse. One topic will be the TE-EV1 itself. A close examination of the thermal mosaic shows seamless merging of the individual images - evidence of the electronic and radiometric quality of the TE-EV1. A future article will describe how to use this imager to collect images of the lunar surface.

References:

"Sky and Telescope", March 2025, p. 48.

"The Lunar Observer", March 2025, p. 7

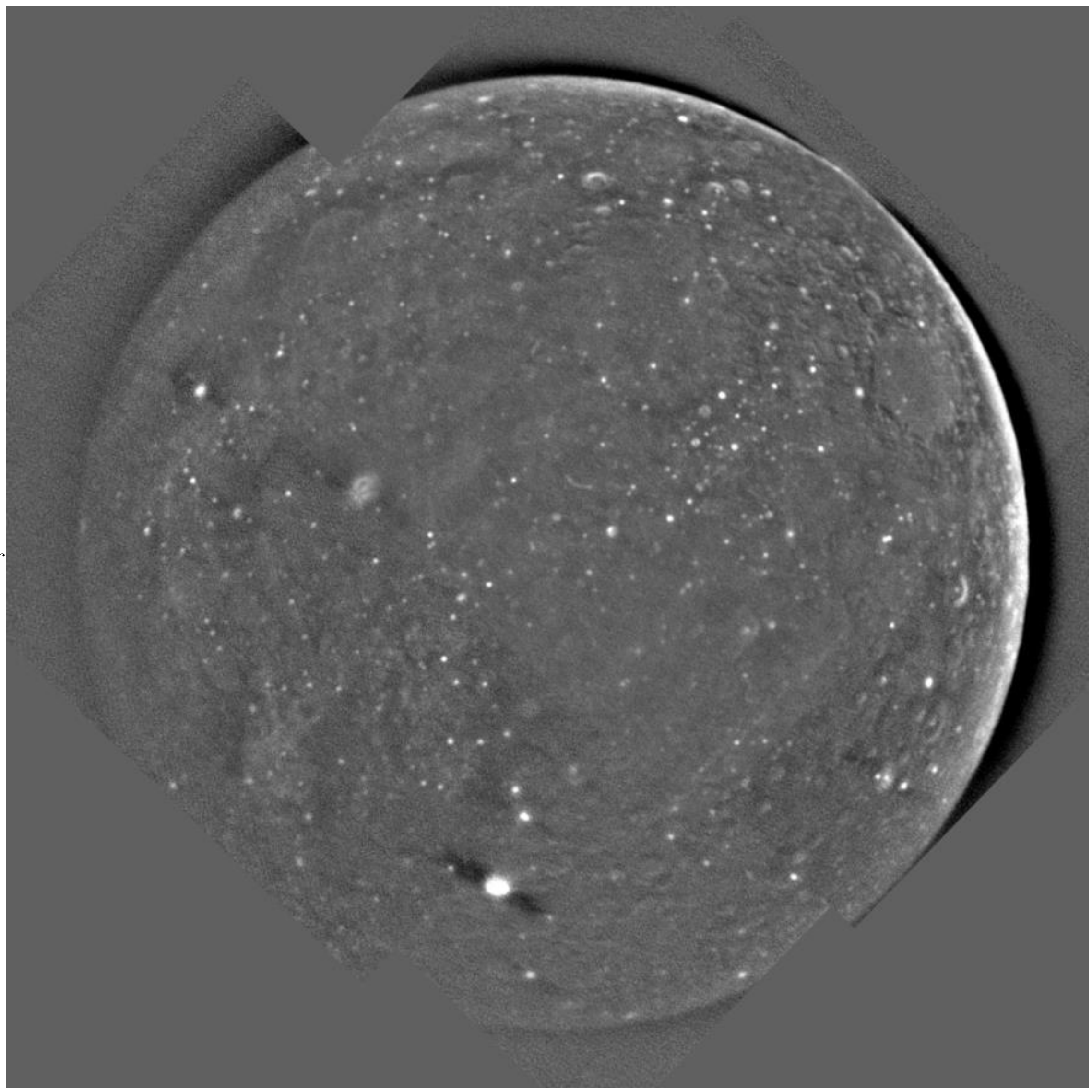


Figure 4, Thermal Infrared Lunar Image, *Darryl Wilson, Marshall, Virginia, USA. 2025 March 14 05:43 UT. Mosaic of 4 images. 12 inch Celestron Newtonian reflector telescope, i3System Thermal Imager..*

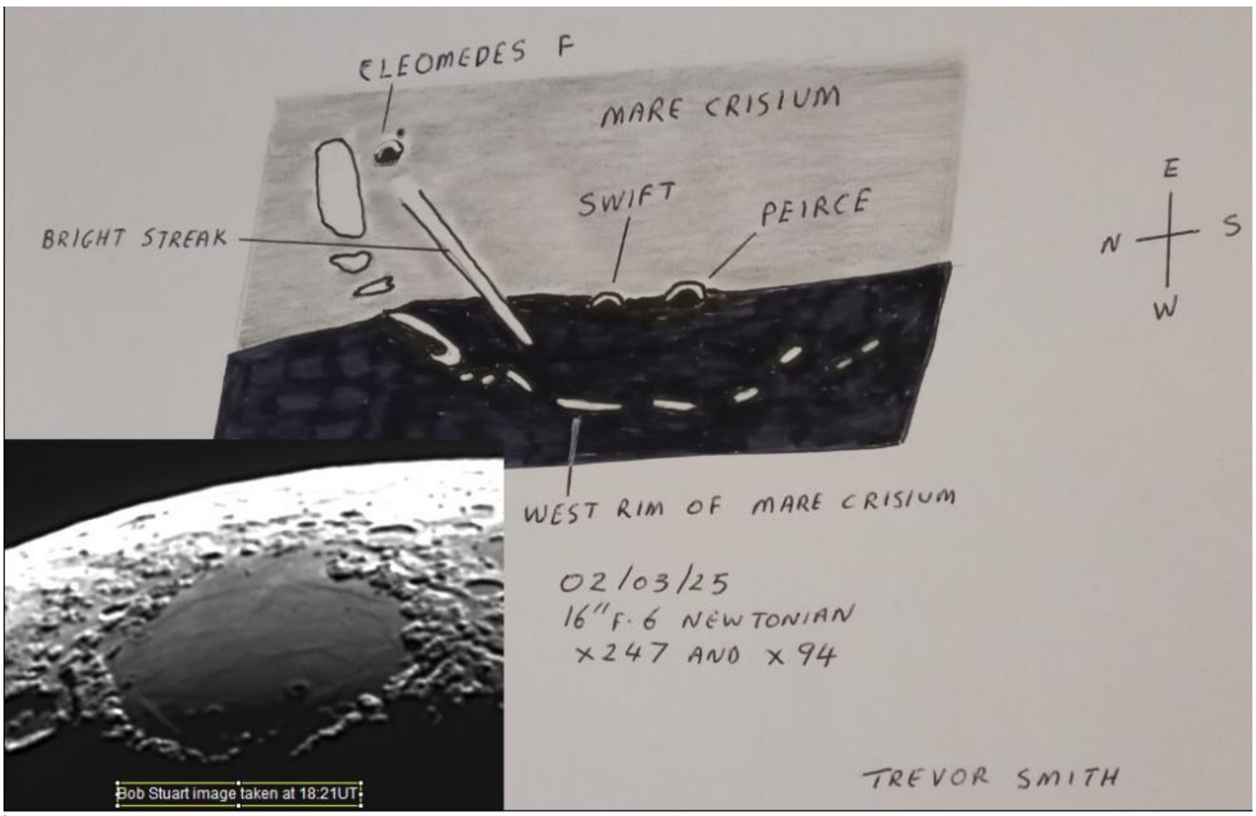
Recent Topographic Studies

Total Lunar Eclipse 2025 March 14

Lunar Geologic Change Detection Program

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

2025 April



1.

***Figure 1** Mare Crisium with north towards the left. Dates and UTs are given in the sketch and image.*

LTP Reports: On 2025 Mar 02 UT 18:36 Trevor Smith noted: To the NW interior floor of Mare Crisium and to NW of Swift was a bright and very noticeable streak orientated in a NE to SW direction, about 70 km in length and 9-10 km wide. He had never noticed this streak before and it was unusually bright and "solid" looking. It is apparently shown on the 21st Century Atlas of the Moon, Map 26 or Rukl and Maps 2A and 2B of the Cambridge Photographic Moon Atlas but nothing like as bright as it was tonight. It might have been a ray from Proclus but was less bright the following night. You can see Trevor’s very interesting sketch in Fig 1 (Centre Left). Just by chance Bob Stuart was imaging that night and we can see Trevor’s bright streak in Fig 1 (Bottom Left). For now, this has been assigned an ALPO/BAA weight of 1, but I think this is just a normal appearance of an inner circular ridge on the floor of the Crisium basin – possibly even an inner basin ring? We shall check this out on future repeat illumination predictions as it looks quite spectacular.

Routine reports received for February included: Alberto Anunziato (Argentina - SLA) observed: Eratosthenes, Moltke, Plato and Proclus. Maurice Collins (ALPO/BAA/RASNZ) imaged: Aristarchus, Theophilus and several features. Tony Cook (Newtown, Wales – BAA): videoed the Moon in the H band in the Shor Wave IR. Dave Finnigan (Halesowen, UK – BAA) imaged: De La Rue, Hercules, Janssen, Pitiscus, Rheita, Rosenberger, and Snellius. Rik Hill (Tucson, AZ, USA – ALPO/BAA) imaged: Archimedes. Ken Kennedy (Dundee, Scotland, UK – BAA) imaged Cassini. Bill Leatherbarrow (Sheffield, UK – BAA) imaged: Curtius, Hipparchus, Meton, Posidonius, Rima Hyginus, the south pole area, and Theophilus. Trevor Smith (Codnor, UK - BAA) observed: Aristarchus, Messier, Mons Piton and Proclus.

Analysis of Reports Received (February): Note that time constraints imposed on the author don't allow us to do any analysis in full this time, so please just take a look at the images and the reports and make your own judgement as to whether what happened in the past and was regarded as a LTP is recurring under these repeat illumination windows or was something unique that was seen.

Archimedes: On 2025 Feb 06 UT 01:53 Rik Hill (ALPO/BAA) imaged this crater under similar illumination to the following observer with the same surname:

Archimedes 1966 Mar 29 UT 21:00 Observed by E.G. Hill (England, 24" reflector, x250, S=E) "Brightening of E-W bands across floor. (Obscuration accord. to Moore)" NASA catalog ID #923. NASA catalog weight=3. ALPO/BAA weight=1.

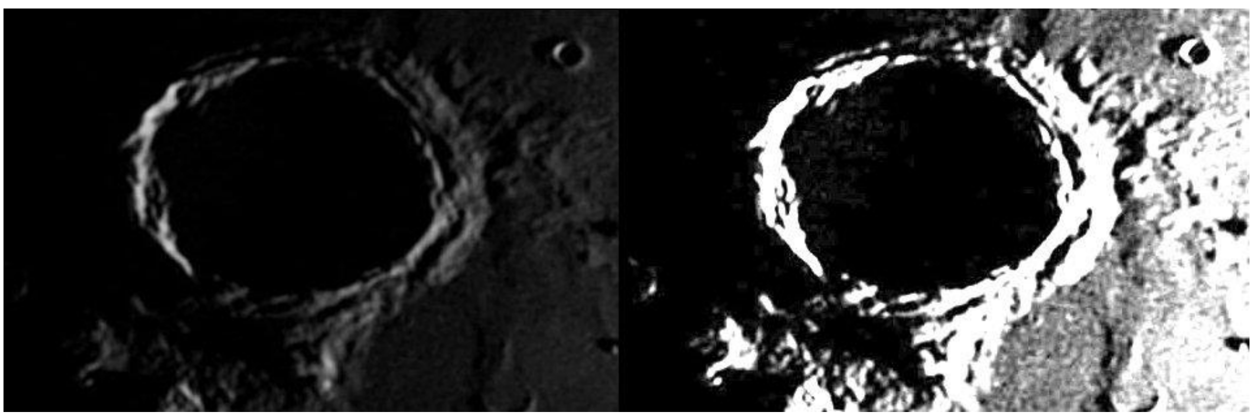


Figure 2. *Archimedes as imaged by Rik Hill (ALPO/BAA) on 2025 Feb 06 UT 01:53 and orientated with north towards the top.* ***(Left)*** *Original image.* ***(Right)*** *Contrast stretched image.*

By E-W bands I presume that E.G. Hill meant the gaps between the shadows? If so then the ±0.5° tolerance used to find similar illumination images may not be fine enough here. The brightening could simply be due to the widening of the gaps between shadow spires as they retreat across the floor at sunrise.

Manilius and Mons Piton: On 2025 Feb 05 UT 18:57 Ken Kennedy (BAA) imaged the Moon under similar illumination to the following two events:

Dome W. of Manilius 1965 Dec 30 UT 10:35 Observed by Newport (England, 4" refractor x180) "White patch or haze, everything else was sharp" NASA catalog weight=3. ALPO/BAA weight=2.

On 1983 May 20 at UT00:00-03:00 K. Marshall (Medellin, Columbia) noted that Mons Piton was too bright near the terminator and was surrounded by shadow. A sketch was made. The mountain appeared segmented with one thin shadow line. The mountain looked like a Mexican Sombrero hat. This appearance is normal. What was abnormal was that Piton was brighter than Proclus, and only slightly fainter than Censorinus. The CED brightness measurements were normal Piton=3.6, Proclus=3.5 and Censorinus=3.7. Please check to see whether this is still the case. The Cameron 2006 catalog ID=221 and the weight=3. The ALPO/BAA weight=1.

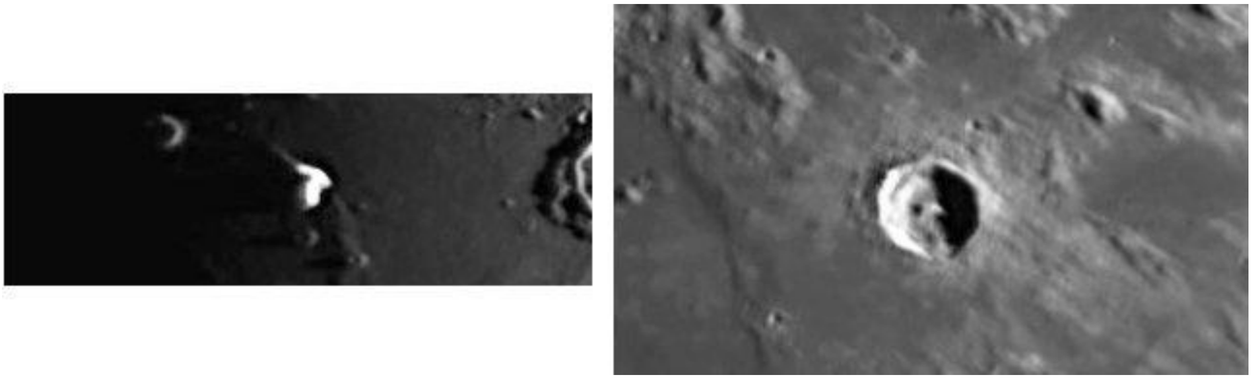


Figure 3. *From a larger image by Ken Kennedy taken on 2025 Feb 05 UT 18:57 and orientated with north towards the top.* ***(Left)*** *Mons Piton.* ***(Right)*** *Manilius.*

Readers may make up their own minds over whether Fig 3 (Left) and (Right) match the descriptions of the 1983 and 1965 LTP.

Copernicus: On 2025 Feb 08 UT 08:50-08:54 Maurice Collins (ALPO/BAA/RASNZ) imaged the lunar disk, which included Copernicus under similar illumination to the following report:

Copernicus observed by G.H. Johnstone of Albuquerque, NM, USA on 1954 Nov 05 UT 20:00 (according to Cameron), but 02:00-04:00 according to the original observation and at colongitudes 34.7 to 35.7 deg. 4" reflector, x150 used. The observer reported that the western part (about 1/3rd of the interior) was pitch black with shadow. However, there was a zone about as wide, or perhaps only a fourth of the total width that was distinctly a lighter bluish shade, almost like twilight. The shadows of the peaks on the western edge of the rim were clearly seen crossing this bluish shadowed area. Then this area ended sharply, and the far side was bathed in light from the rising sun. The shadows of the peak were sharply defined across the twilight zone, and the edge of the pitch black shadow was easily defined but not as sharp as the darker shadows crossing the blue twilight zone. The observer checked other craters but did not see this condition in any of them - they all had the abrupt division between black and white that we would normally expect to see. Cameron 1978 catalog ID=579 and weight=2. Reference 1962 edition of ALPO's Journal: The Strolling Astronomer. ALPO/BAA weight=3.

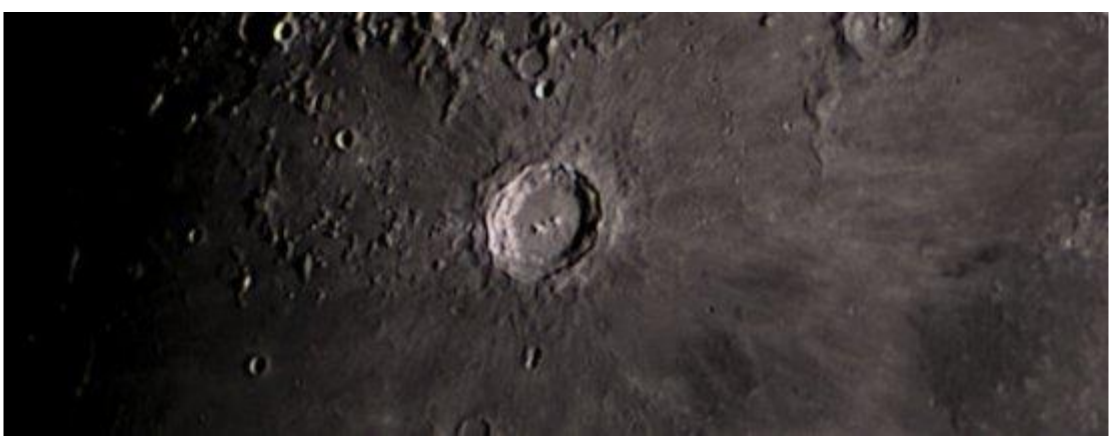


Figure 4. *Copernicus as imaged by Maurice Collins on 2025 Feb 08 UT 08:50-08:54 and orientated with north towards the top.*

Note that the date held in the LTP database is actually Nov 6th and not Nov 5th as in the description – this corresponds to the colongitudes given in the description.

Eratosthenes: On 2025 Feb 18 UT 05:40-05:50 Alberto Anunziato (SLA) observed the Moon under similar illumination to the following report:

Eratóstenes 1976 Sep 14 UT 04:24 Observed by Bartlett (Baltimore, MD, USA, 4.5" reflector, 45-300x, S=6, T=3 hazy) "Pseudo shadow F disappeared & wall here is same intensity as whole inner crater wall, =4deg. No change in X, X3 or X2 (4 deg much brighter than normal)." NASA catalog weight=4. Cameron 1978 catalog ID=1453 and weight=4. The ALPO/BAA weight=2.

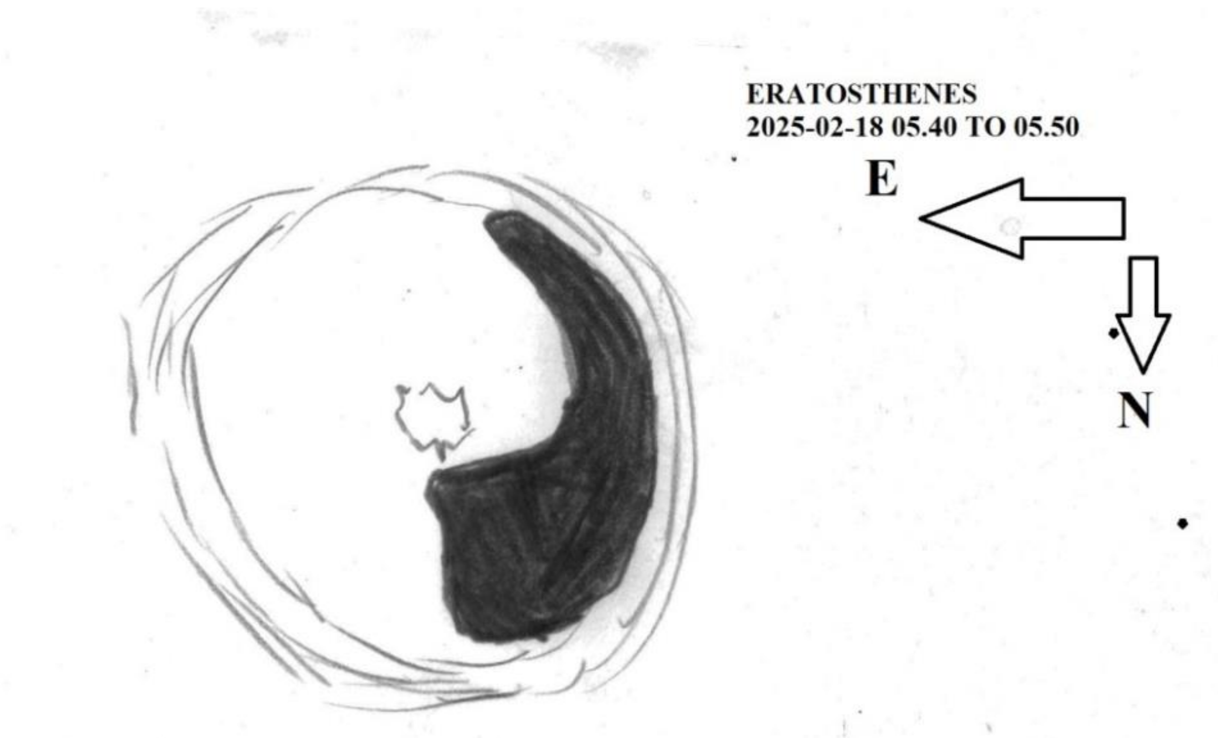


Figure 5. *Eratosthenes as sketched by Alberto Anunziato. Dates, UT and arrows as written and depicted in the sketch.*

Alberto commented that the shadow was not very dark!

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. 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 .

Dr Anthony Cook, Department of Physics, Aberystwyth University, Penglais, Aberystwyth, Ceredigion, SY23 3BZ, WALES, UNITED KINGDOM. Email: atc @ aber.ac.uk

Lunar Calendar April 2025

Date	Time	Event
1	0500	Saturn 1.1˚ south of Moon, occultation Asia
1	2000	Venus 2˚ north of Moon
1	2206	Moon at ascending node
1	2300	Neptune 1.4˚ south of Moon, occultation Alaska., Russia
2	0300	Moon at perigee 367457 km
5	0802	First Quarter Moon
6	0700	Moon 0.5˚ north of Pleiades
7	0400	Jupiter 5˚south of Moon
8		South limb most
8		Greatest northern declination +28.4˚
9	2000	Mars 0.8˚ south of Moon, occultation NE USA to China
10		East limb most exposed +5.1˚
12	1353	Full Moon
15	0653	Moon at descending node
17	1300	Spica 0.3˚ north of Moon, occultation Pacific Ocean
18	0100	Moon at apogee 404882 km
20	1732	Last Quarter Moon
21	0900	Antares 0.4˚ north of Moon, occultation Easter Island to
23		North limb most exposed +6.8˚
23		Greatest southern declination -28.7˚
24		West limb most exposed +6.8˚
25	1000	Pluto 1.0˚ north of Moon, occultation Antarctica
28	0045	New Moon lunation 1264

CONTRIBUTION GUIDELINES

While it is a great honor to put together The Lunar Observer, we are now overwhelmed by our success with some issues in excess of 200 pages.

The increased time it requires for me to perform this job (as a volunteer) pulls me away from my own family and other obligations. Thus, the following rules are being implemented to improve content flow on my end and provide you with the criteria needed to make the "TLO" even more professional in appearance and subject matter.

1. **Review your image(s) at your location before submitting it/them, then brighten or darken it/them as needed and if required, using whatever tools you have at hand. Images deemed unsuitable (including blurry, out-of-focus or "clouded-out" images) will either be returned for your attention or simply not used.**
2. **Images in jpeg format are preferred but others are also acceptable.**
3. **Crop your images to avoid jagged edges.**
4. **Orient the image so it makes the most sense. North at the top (with Mare Crisium at the upper right) is preferred but not required. To our many wonderful southern hemisphere contributors, please orient as you wish (probably south at top).**
5. **Be very limited on end-of-the-month submissions.**
6. **CHOOSE ONLY YOUR BEST IMAGES and limit the number to no more than eight (8) per each issue of the TLO. (obviously, if there is an article you are writing or contributing to this does not apply).**
7. **The image filename should be submitted with the object name spelled correctly, then the year-month-day-hour-minutes-Your Name or initials So, my image of Copernicus should have a file name of:**

Copernicus_2023-08-31-2134-DTe
means
Copernicus, 2023 August 31, 21:34 UT by David Teske

If we all do this going forward, it should make putting this all together faster and easier. Many of you already do this. Thank you for your contributions and your help. We have a premier lunar resource for the planet.

Please send images/drawings/text to drteske@yahoo.com or lunar@alpo-astronomy.org

Below are two sample captions. Both at least attempt to follow the above-stated guidelines

Meton Region as imaged by Massimo Dionisi of Sassari, Italy (10°43'26" N, 8° 33'9" E), on 2024 January 30, at 00:03 UT. Equipment details: Sky Watcher 250 mm, f/4.8 reflector telescope, Tecnosky ADC, Celestron X-cel LX 3x Barlow lens, effective focal length = 4,750 mm, 685 nm IR pass filter, Neptune-M camera, Skywatcher EQ6-R Pro mount. Seeing conditions = III-to-IV (Antoniadi scale). Software details: SharpCap 4.0 acquisition (mono), AutoStakkert! 3.1.4 ELAB, Registax Wavelets.

Lunar craters Hausen and Bailly D as imaged by István Zoltán Földvári of Budapest, Hungary on 2020 April 07, at 21:03-21:17 UT. Colongitude 86.5°. Equipment details: 70 mm refractor telescope, f/l = 500 mm, Vixen Lanthanum LV 4mm eyepiece, 125x, Baader Contrast Booster Filter. Sky seeing = 7 out of 10, sky transparency = 6 out of 6.

drteske@yahoo.com

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
Alberto Anunziato–albertoanunziato@yahoo.com.ar
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: Volcanic Features

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 May 2025, will be Volcanic Features. 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):

Alberto Anunziato – albertoanziato@yahoo.com-ar
David Teske – david.teske@alpo-astronomy.org

Deadline for inclusion in the Volcanic Features Focus-On article is April 20, 2025

FUTURE FOCUS ON ARTICLES:

In order to provide more lead time for contributors the following future targets have been selected:

Subject	TLO Issue	Deadline
Volcanic Features	**May 2025**	**April 20, 2025**
Rupes Recta	**July 2025**	**June 20, 2025**
Mare Humorum	**September 2025**	**August 20, 2025**

Focus On Announcement:
Volcanic Features: An Inventory of Past Chaos

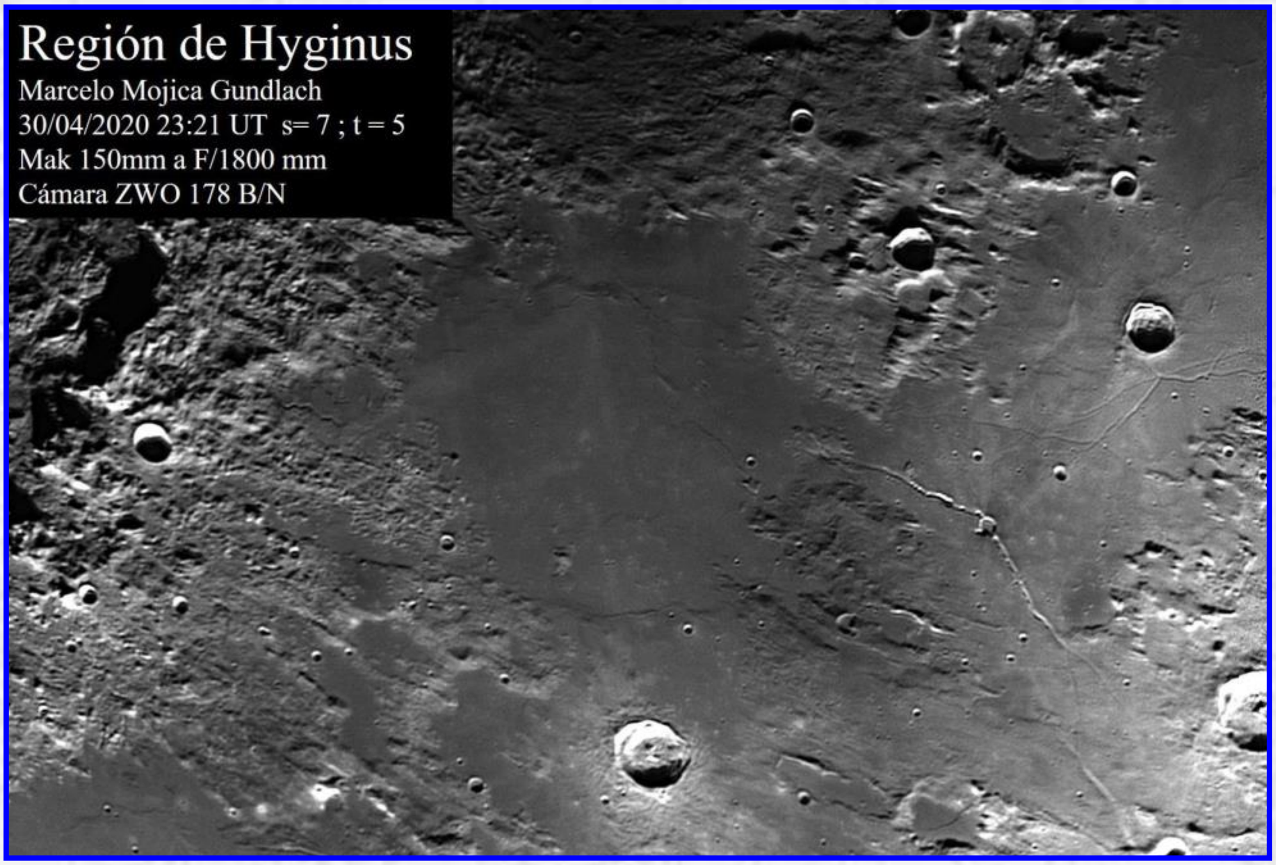
There was a (geological) time when the Moon was a real chaos, a new chaos, after the chaos of the great meteorite impacts that formed the basins. A volcanic chaos. We invite our observer friends to send their favorite images of the entire selenographic spectrum of volcanic features, from maria (including cryptomaria) to the smallest and most elusive, such as domes, passing through rilles, faults, volcanic craters, dark mantle deposits, fractured floor craters, including those of possible volcanic origin, such as wrinkle ridges and irregular mare patches. **We also invite you to share the reasons why you have sent images of your favorite volcanic features, to give a more personal touch to our Focus On.**

MARCH 2025 ISSUE-Due February 20 2025: CLAVIUS

MAY 2025 ISSUE-Due April 20 2025: VOLCANIC FEATURES

JULY 2025 ISSUE-Due June 20, 2025: RUPES RECTA

SEPTEMBER 2025 ISSUE-Due August 20, 2025: MARE HUMORUM



Marcelo Mojica Gundlach

Focus On Announcement:
Rupes Recta: The Biggest Pareidolia On the Moon

Rupes Recta, The Straight Wall, The Railroad, The Sword, so many names for one site that has been dreamed of (yes, why not? dreamed of) by so many observers over the decades. The most notorious of the lunar pareidolias is the most notorious example of a lunar fault (a crack with one edge higher than the other). Rupes Recta varies greatly according to illumination and we will analyze the images sent to us in search of details of this great wall, along with the other interesting formations in this region of eastern Mare Nubium.

MAY 2025 ISSUE-Due April 20 2025: VOLCANIC FEATURES

JULY 2025 ISSUE-Due June 20, 2025: RUPES RECTA

SEPTEMBER 2025 ISSUE-Due August 20, 2025: MARE HUMORUM

Luis Francisco Alsina Cardinalli

Key to Lunar Images In This Issue

1. Alphonsus
2. Aristarchus
3. Atlas
4. Australe, Mare
5. Bullialdus
6. Bürg
7. Capuanus
8. Carrel
9. Clavius
10. Cognitum, Mare
11. Copernicus
12. Crisium, Mare
13. Deslandres
14. Gassendi
15. Heraclitus
16. Hesiodus
17. Imbrium, Mare
18. Janssen
19. Langrenus
20. Medii, Sinus
21. Mercator
22. Mersenius
23. Moretus
24. Mouton, Mons
25. Plato
26. Posidonius
27. Scheiner
28. Schickard
29. Schiller
30. Tranquillitatis, Mare
31. Tycho