The Lunar Observer

A Publication of the Lunar Section of ALPO

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

March 2022

Online readers, click on images for hyperlinks

In This Issue

Here is to that this finds you and your loved ones in good health. Thank you for reading this issue of *The Lunar Observer.* In this issue, you will find a link to a short video "Pour l'amour du ciel featuring art work by Michel Deconinck, a wonderful lunar sketcher whose work is featured in this issue. Darryl Wilson provides two articles on imaging the Moon in color, with interesting interpretations of the images. This series of articles should carry on for some time. Robert. H. Hays, Jr. provided a wonderful sketch and write up of the concentric crater Hesiodus A. Alberto Anunziato explored areas of the Moon with telescope sketch and lunar orbiters. The Focus-On article, a bimonthly series, features the Two Faces of Stevinus and Snellius by Alberto Anunziato. The drawings and images from across the world in support of this is remarkable! Tony Cook provided another insightful article in the Lunar Geologic Change Program. Thanks to all who contributed to this and every issue.

I had the chance to read the book Across the Airless Wilds, The Lunar Rover and the Triumph of the Final Moon Landings by Earl Swift (Custom House, 2021). This is a book that was needed in the study of the Apollo era. Most of the Apollo books cover Apollo 11 in great detail, but the Apollo 15-17 missions are not emphasized as much. This book explores the genesis, building and implementation of the Lunar Rover, and all the challenges that it took to get it to the Moon. An interesting read. When I peer through the telescope, oh how I wish I was there! But then again, with the telescope, we *are* there!

Lunar Topographic Studies

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Assistant Coordinator-Wayne Bailey– wayne.bailey@alpo-astronomy.org
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Observations Received

Name	Location and Organization	Image/Article
Alberto Anunziato	Paraná, Argentina	Article and drawing *From Posidonius P to Luther in the Terminator, Mare Nectaris from Mädler to Rosse, Focus-On article The Two Faces of Stevinus and Snellius*, images and drawings of Stevinus and Snellius (7).
Sergio Babino	Montevideo, Uruguay	Images of Stevinus and Snellius (2).
Juan Manuel Biagi	Paraná, Argentina	Image of Stevinus and Snellius.
Francisco Alsina Cardinalli	Oro Verde, Argentina	Image of Stevinus and Snellius.
Jairo Chavez	Popayán, Colombia	Images of Stevinus and Snellius (9).
Yanjun Chen	Hefei, Anhui, China	Images of Stevinus and Snellius (2).
González Cian, Abel David Emiliano	AEA, Paraná, Argentina	Image of the Waxing Gibbous Moon
Leonardo Alberto Colombo	Córdoba, Argentina	Images of Stevinus and Snellius (3).
Michel Deconinck	Aquarellia Observatory - Artignosc-sur-Verdon - Provence - France	Pastel of Stevinus-Snellius, six day view of Stevinus and Snellius.
Robert H. Hays, Jr.	Worth, Illinois, USA	Article and drawing *Hesiodus A*.
Richard Hill	Loudon Observatory, Tucson, Arizona, USA	Article and image *Archimedes Environs*, Images of Stevinus and Snellius (5),
Eduardo Horacek	Mar del Plata, Argentina	Images of Stevinus and Snellius (2).
Rafael Lara Muñoz	Guatemala, Guatemala, SLA	Images of Stevinus and Snellius (2).
Rafael Benavides Palencia	Cordoba, Spain	Images of Clavius, Theophilus, Deslandres, Sinus Iridum, Maginus, Stevinus and Vendelinus.
Olivier Planchon	OAB (Observatoire Astronomique de Bauduen) Bauduen Provence France	Image of Stevinus and Snellius.
Raúl Roberto Podestá	Formosa, Argentina	Images of Fracastorius, Langrenus, Mare Crisium, Stevinus and Snellius (2).
Pedro Romano	San Juan, Argentina	Image of Stevinus and Snellius.

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

Lunar Topographic Studies

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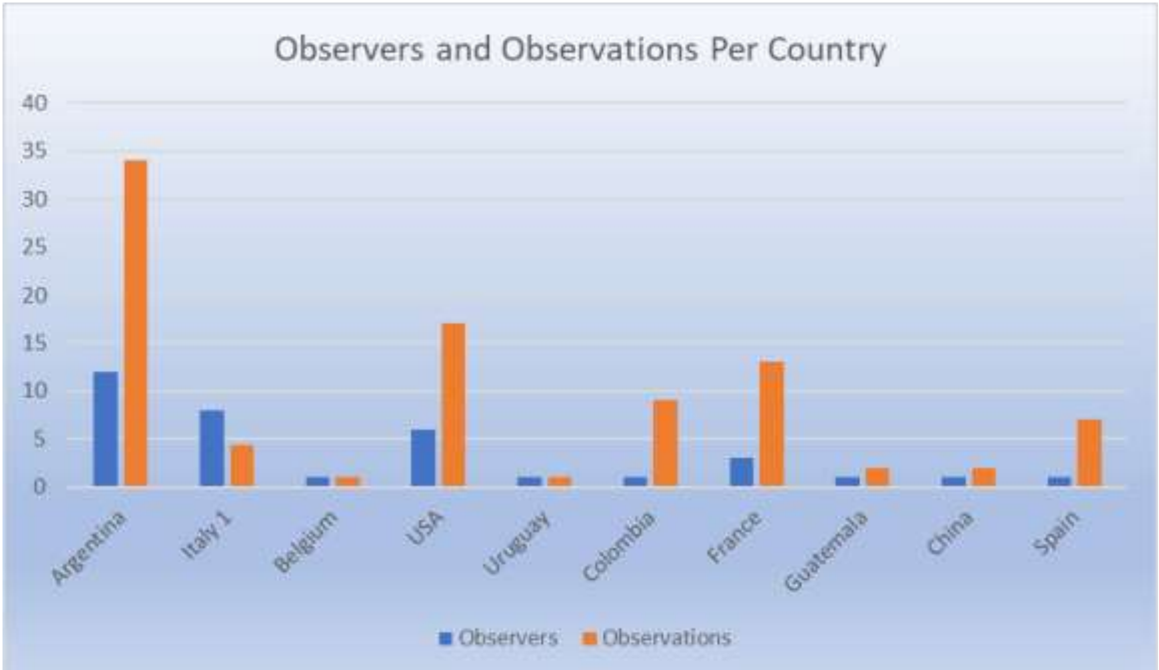
Observations Received

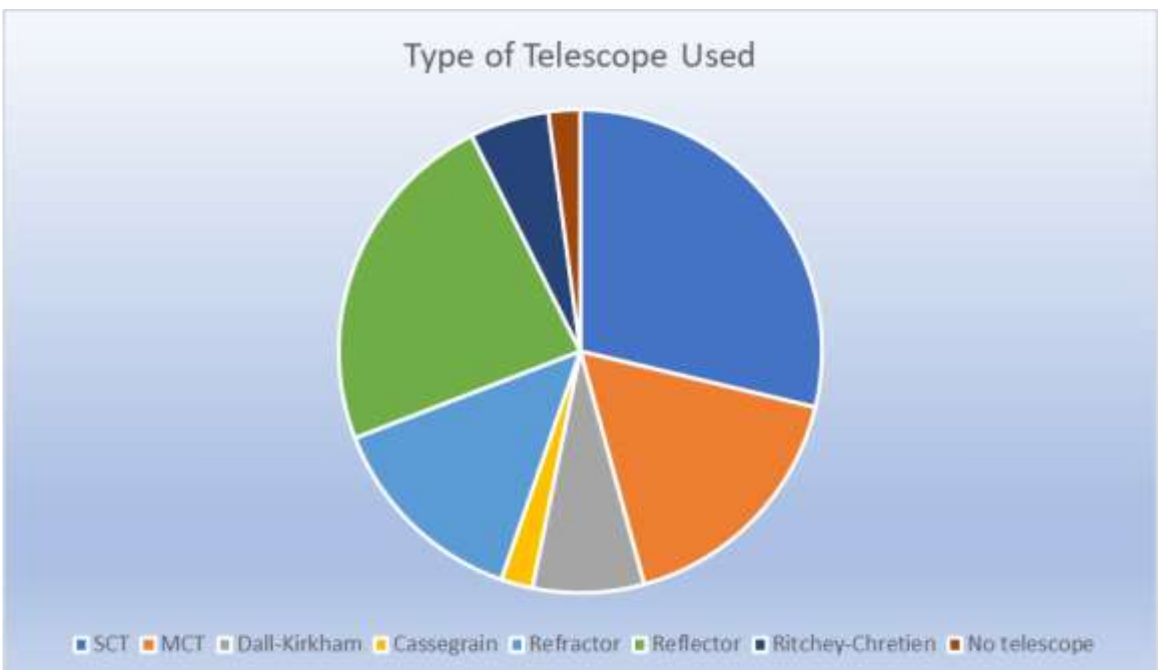
Name	Location and Organization	Image/Article
Camilo Satler	Oro Verde, Argentina	Image of Stevinus and Snellius.
Leandro Sid	AEA, Oro Verde, Argentina	Images of the Full Moon and Tycho (2).
Fernando Surá	San Nicolás de los Arroyos, Argentina	Images of Ptolemaeus, Plato and Montes Apenninus.
Michael E. Sweetman	Sky Crest Observatory, Tucson, Arizona, USA	Images of Janssen and Atlas.
David Teske	Louisville, Mississippi, USA	Images of Stevinus and Snellius (5)
Randy Trank	Winnebago, Illinois, USA	Image of Stevinus and Snellius.
Román García Verdier	Paraná, Argentina	Images of Stevinus and Snellius (3
Fabio Verza	SNdR, Milan, Italy	Images of Stevinus and Snellius (3), Archimedes, Birt, Langrenus, Mare Humboldtianum and Ptolemaeus.
Christian Viladrich	France	Images of Plinius, Mare Tranquillitatis, Menelaus, Rupes Recta and Posidonius.
Wilson, Darryl	Marshall, Virginia, USA	Article and images *Examination of HSV Colorspace Enhanced Imagery of Mare Imbrium, Aristarchus, Kepler, and selected Lunar Domes* and *Examination of HSV Colorspace Enhanced Imagery of Mare Imbrium, Mare Frigoris, Sinus Iridum, and Plato.*

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

March 2022 *The Lunar Observer*
By the Numbers

This month there were 94 observations by 28 contributors in 10 countries.





Astronomy generates dreams of travel. That is, in essence, astronautics. Traveling to the Moon has always been the dream of humanity, from the flying ship in the story of Lucian of Samosata to the heroes of the Apollo Program. In ALPO, the generations of those who lived the fantastic adventure of landing on the Moon and those of us who dream of repeating it live together, and we all dream of going to the Moon because we learn to love it through a telescope. That love for the Moon and the journey is wonderfully told in a little more than two-minute gem called “Pour l’amour du ciel”, made to participate in the Nikon Film Festival. And why do we invite you to see it? Because it is the story of Paulette, a little country girl, that is lulled by the stories of the Moon and stars told to her by her Grandpa and when she learns that he has "gone to heaven" she thinks he has gone to the moon and decide to join him… and the film is beautifully illustrated by lunar sketches made by a friend of us, Michel Deconinck, whose sketches we can also enjoy in the Focus On Section of this issue. Let's enjoy Michel's art also in

https://www.festivalnikon.fr/video/2021/1624

Examination of HSV Colorspace Enhanced Imagery of Mare Imbrium, Aristarchus, Copernicus, Kepler, and Selected Lunar Domes

Darryl Wilson

Articles in the December 2021 and January 2022 issues of "The Lunar Observer" described color enhancement techniques that can be applied to lunar imagery. This third article in the multiband image processing series shows how those techniques may be applied to examination of the areas near three well known lunar craters, Aristarchus, Copernicus, and Kepler. We also take a brief look at lunar domes near Hortensius and Milichius. All of the images presented here were processed according to the process flow diagram presented in the January, 2022 issue of "The Lunar Observer" (TLO).

As we have seen in recent articles, the maria are bluish due to relatively high Titanium (Ti) content. Brownish areas such as the interior of Sinus Iridum, the Aristarchus plateau, and Sinus Roris are Ti-poor by comparison. According to information published by the Clementine (ref 2) and SELENE (ref 3) science teams, the difference in Ti content between the enriched and depleted areas is roughly an order of magnitude. An examination of the SELENE science team's lunar maps that depict Ti and Fe concentrations shows a high correlation between Ti and Fe-rich areas. So, Ti-rich usually means Fe-rich. On earth, reddish brown soil is often indicative of high Fe content because Fe oxidizes and turns reddish-brown when exposed to air and water. There is no air or water on the moon. No air or water means no rusting, and no reddish-brown iron.

Figure 1 is a wide area image that includes eastern Oceanus Procellarum and Mare Imbrium. The patterns of Ti and Fe-rich areas are the same as those presented in the January 2022 TLO article (ref 4). Sinus Iridum is Ti and Fe-poor, as are the areas to the north and west of Copernicus, north of Kepler, and northwest of Aristarchus. This image provides a good view of Sinus Roris that was not in the frame of the January images. Western Sinus Roris is especially colorful, with reddish, yellowish, and tan streaks against a brown background. At the eastern edge of Sinus Roris, just before reaching Mare Frigoris, we find the crater Harpalus. Immediately to its northeast, the mare surface has a surprisingly strong reddish tone which this author cannot explain. The area deserves further investigation. It is interesting that Mons Rumker, at the boundary between Sinus Roris and Oceanus Procellarum, is barely visible at all. About 80 miles to the south of Mons Rumker is the 6-mile diameter crater Naumann, in northern Oceanus Procellarum. The general area around Mons Rumker and Naumann will have surprises for us in future articles.

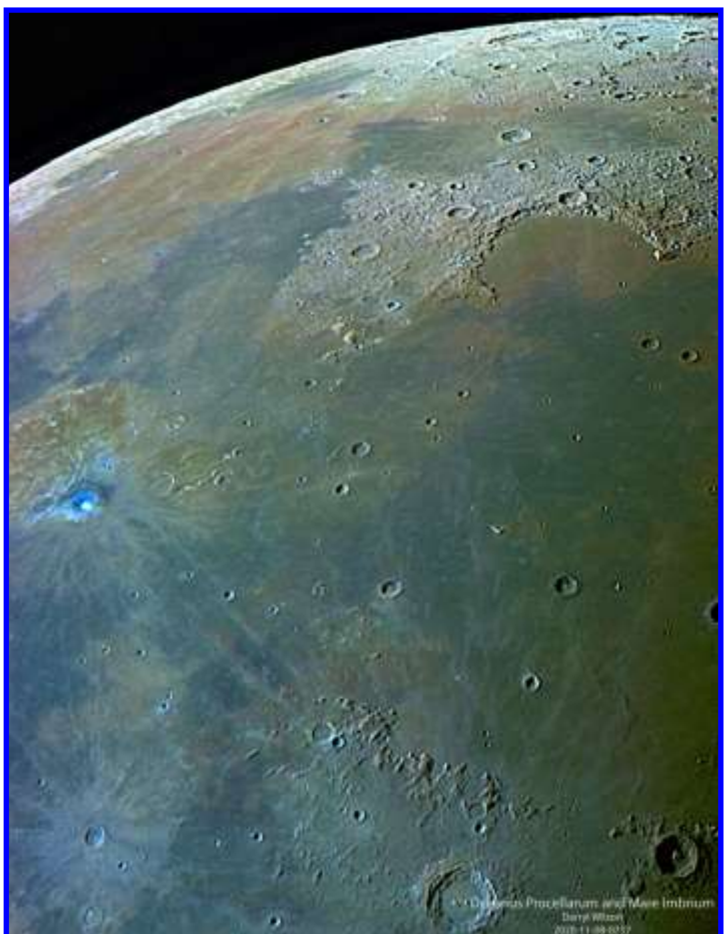


Figure 1, Oceanus Procellarum and Mare Imbrium, *Darryl Wilson, Marshall, Virginia, USA. 2020 November 08 07:37 UT. 18 inch Obsession Newtonian reflector telescope, Celestron Skyris 274C camera, saturation enhanced, Registax sharpened value band, 0.45" per pixel.*

The Aristarchus plateau is one of the most colorful areas on the moon. It even shows hints of color on unenhanced images - just barely. Figure 2 is a higher resolution image of the region. The interior walls of the crater seem to be bluish. The floor was so reflective that it saturated parts of the Registax sharpening image, but an examination of the Hue band of the HSV transformed image reveals that the brightest areas are also tinted blue. The strongest blue coloration appears on the exterior crater walls on the north side of the crater, but if the Registax image had been processed to a darker overall tone to avoid saturation, the entire crater would appear blueish. This is actually problematic. An examination of the Ti map produced by the SELENE science team (ref. 3, graphic not reproduced here) shows the plateau to be low in Ti content with the exception of an area that appears to be just north of the Aristarchus crater. Although this is consistent with the Figure 2 representation of maximal Ti content on the north side of the crater, the overall Ti content of the crater may be somewhat exaggerated by the color balance.

For comparison, two excellent color images of Aristarchus may be found in the January 2022 issue of TLO, on page 95. Figure 2 is qualitatively equivalent to them, but it has been stretched to a greater degree of saturation in order to clearly show some of the more subtle coloration that is present.

Figure 2, Aristarchus and Schröter's Valley, *Darryl Wilson, Marshall, Virginia, USA. 2020 November 08 07:17 UT. 18 inch Obsession Newtonian reflector telescope, Celestron Skyris 274C camera, saturation enhanced, Registax sharpened value band, 0.18" per pixel.*

Vallis Schroteri begins at an unnamed 3.5-mile diameter crater 15 miles NE of Herodotus, and about 15 miles NW of Aristarchus. The crater is visible in Figure 2 as a dark spot. The floor of the valley meanders across the plateau for about 100 miles. Although the plateau is mostly Ti- poor, the floor of the valley seems Ti-rich as far as it can be traced in the image. This suggests that below the Ti-poor surface of the plateau one will find Ti-rich material.

In the January 2022 issue of TLO we noted a slightly brownish pie shaped feature in the northern interior of Copernicus. This month, we examine a higher resolution image of the crater to see if the feature was real or just an image processing artifact. Figure 3 shows that a pie-piece shaped area in the upper interior of the crater (from about 10 O'clock to 1 O'clock) is indeed browner than its surroundings, as noted in January. Also as previously noted, the brownish tinge extends beyond the rim to the exterior of the northern wall. Although most of the floor of the crater seems moderately Ti-poor, there is an area of the floor adjacent to the southeast wall that is slightly Ti-rich

Figure 3, Copernicus, *Darryl Wilson, Marshall, Virginia, USA. 2020 November 08 07:09 UT. 18 inch Obsession Newtonian reflector telescope, Celestron Skyris 274C camera, saturation enhanced, Registax sharpened value band, 0.18" per pixel.*

Kepler grabs the center of attention in Figure 4. Encke, about 80 miles south of Kepler, appears to be almost completely covered by the same material that forms Kepler's rays. Within 100 miles to the north and to the east of Kepler we find surface material that is much lower in Ti content. The region surrounding the crater contains a complex interplay of Ti-rich and Ti-poor patches of surface. The color features inside Kepler are intriguing. Although most of the uneven floor is bluish, there are a few small brownish patches, suggesting a heterogonous surface that varies in mineral content on small spatial scales. The inner eastern wall of the crater seems reddish-brown, in contrast to the remainder of the inner wall, which is blue. If so, it would be selenologically interesting. Unfortunately, the inner eastern wall is partly saturated, which causes color distortion, so this is probably an imaging artifact.

Figure 4, Kepler, *Darryl Wilson, Marshall, Virginia, USA. 2020 November 08 07:11 UT. 18 inch Obsession Newtonian reflector telescope, Celestron Skyris 274C camera, saturation enhanced, Registax sharpened value band, 0.18" per pixel.*

About halfway between Copernicus and Kepler we find Hortensius and Milichius. They are notable for their proximity to many lunar domes. Figure 5 is a subset of an image that was printed in the January 2022 article. Although the same area of the lunar surface is covered by Figure 1, the January 2022 TLO image has superior color rendition due to its higher SNR, so the subset is reproduced here.

Milichius, 8 miles in diameter, is near the center of Figure 5. Hortensius is the large crater near the bottom. About 10 miles to the left of Milichius is Milichius Pi, a 5-mile diameter dome. Note that the dome is slightly reddish. Several other domes can be seen to the north of Milichius, and others are visible a few miles north of Hortensius. Most appear reddish, but at least a couple near Hortensius seem neutral in color, or slightly bluish.

Figure 5, Hortensius, Milichius and domes, *Darryl Wilson, Marshall, Virginia, USA. 2020 November 08 07:26 UT. 18 inch Obsession Newtonian reflector telescope, Celestron Skyris 274C camera, saturation enhanced, Registax sharpened value band, 0.45" per pixel.*

Figure 6 is an extreme enlargement of the central area of Figure 5. Milichius is in the lower right and Milichius Pi is in the upper left quadrant. Close examination of this 0.45" per pixel image reveals that the summit craterlet of Milichius Pi is reddish.

Figure 6, Milichius and Milichius Pi Enlargement, *Darryl Wilson, Marshall, Virginia, USA. 2020 November 08 07:26 UT. 18 inch Obsession Newtonian reflector telescope, Celestron Skyris 274C camera, saturation enhanced, Registax sharpened value band, 0.45" per pixel.*

In summary, in this third article on color enhancement, we have transitioned from examining the workings of a colorspace transformation algorithm to the application of that algorithm to examination of imagery of selected areas of the moon. We noted Ti-rich and Ti-poor areas in Mare Imbrium and Sinus Iridum. An intriguing reddish area was found in Sinus Roris. The area of highest Ti concentration in the Aristarchus region was found to be on the exterior of the northern crater wall. An examination of the floor of Schröter's Valley provided evidence that beneath a Ti-poor surface, the Aristarchus Plateau holds Ti-rich deposits. We confirmed that the northern floor and wall of Copernicus has slightly lower Ti content than the rest of the crater. The area surrounding Kepler was observed to have a varied pattern of surface mineral composition, as was the interior floor of the crater. Finally, we saw that most, but not all, of the lunar domes in the region near Hortensius and Milichius were somewhat reddish, and the summit craterlet of Milichius Pi was reddish.

The next few articles will primarily follow the pattern of this one. We will process images in the same manner as we examine other regions of the moon. Occasionally, we may encounter image processing artifacts and/or image quality issues that invite a discussion of some technical aspects of color image processing. We will eventually introduce the next color processing algorithm and explore the new kinds of information that it can provide.

References:

Lucey, Paul and Blewett, David, Jolliff, Bradley L., August 25, 2000, " Lunar iron and titanium abundance algorithms based on final processing of Clementine ultraviolet-visible images", Journal of Geophysical Research, Vol. 105, No. E8, p. 20,297-20,305.

Otake H., Ohtake M., Hirata N., "Lunar Iron and Titanium Abundance Algorithms Based on SELENE (KAGUYA) Multiband Imager Data", 2012, Lunar and Planetary Science Conference.

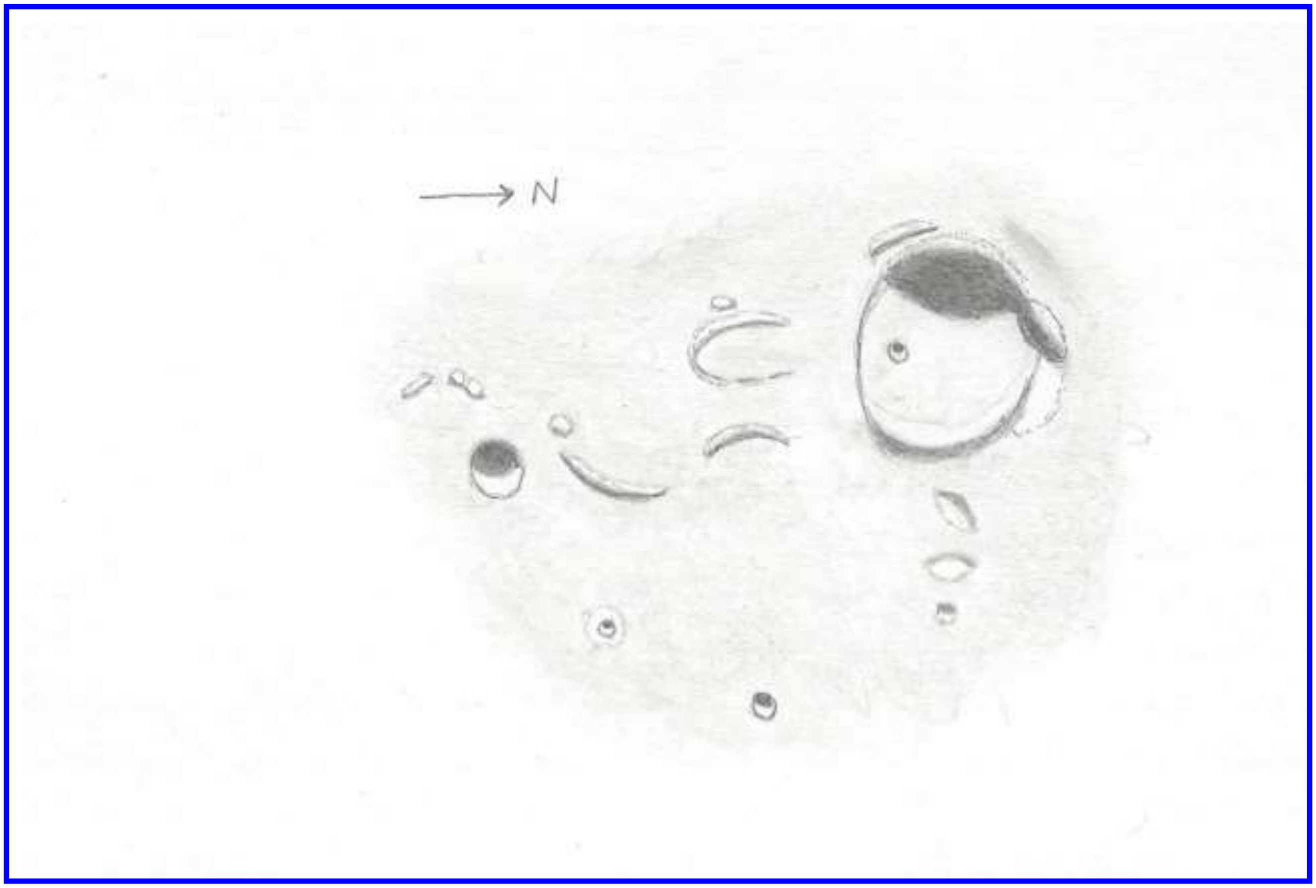
Collins, Maurice and Fontani, Valerio. January, 2022, "The Lunar Observer", Figure 4, p. 95.

Wilson, Darryl G., "A Sharpening Technique in HSV Colorspace for Lunar Surface Material Discrimination, RGB->HSV; enhance S; replace V; HSV->RGB", January, 2022, "The Lunar Observer", 7-10.

Wilson, Darryl G., "A Basic Color Enhancement Technique for Lunar Surface Material Discrimination, RGB->HSV; enhance S; HSV->RGB", December, 2021, "The Lunar Observer", 5-7.

Purbach Interior Detail

Robert H. Hays, Jr.



***Purbach Interior Detail**, Robert H. Hays, Worth, Illinois, USA. 2021 August 29 08:26-08:50 UT. 15 cm reflector telescope, 170 x. Seeing 7-8/10, transparency 6/6.*

I drew this area on the morning of August 29, 2021. Purbach is a large crater with a broken north rim east of Mare Nubium. Purbach G is the largest crater within or on the rim of Purbach. This crater has a flattish south rim and a blunt point to the southeast. I drew its interior shadowing as I saw it. An irregular depression abuts the north rim of Purbach G. The tiny pit on its floor is Purbach GA. Three irregular craters are east of Purbach G. The Lunar Quadrant map shows them along the north rim of Purbach which appears to be missing. A short ridge is southeast of Purbach G, and a dusky spot is to its north near the aforementioned depression. Purbach A is the conspicuous crater well south of Purbach G. The haloed craterlet northeast of Purbach A is Purbach X. The pit north of X is Purbach T; this crater has no halo. Several curved ridges are between Purbach G and A. These may be the remnants of old rings. The one just north of Purbach A is probably Purbach W. Other detail appears to form a horseshoe, but the result may be too elongated to be from the same ring. An isolated peak is near Purbach W, and three more are west of Purbach A. Purbach itself does not have a noticeable central peak.

I typed the date incorrectly last month on this fine drawing by Robert H. Hays, Jr. -David Teske-

Examination of HSV Colorspace Enhanced Imagery of Mare Imbrium, Mare Frigoris, Sinus Iridum, and Plato

Darryl Wilson

Articles from the December 2021 and January 2022 issues of "The Lunar Observer" (TLO) described an HSV color enhancement technique that can be applied to lunar imagery, and began to examine enhanced color features on the lunar surface in selected regions. A third article, appearing in this March 2022 edition of TLO, discusses selected features in western Mare Imbrium, northern Oceanus Procellarum, and western Mare Frigoris.

In this fourth article in the multiband image processing series, we take a look at Mare Frigoris, northern Mare Imbrium and zoom in on Plato. The images presented here were processed according to the process flow diagram presented in the January, 2022 issue of TLO.

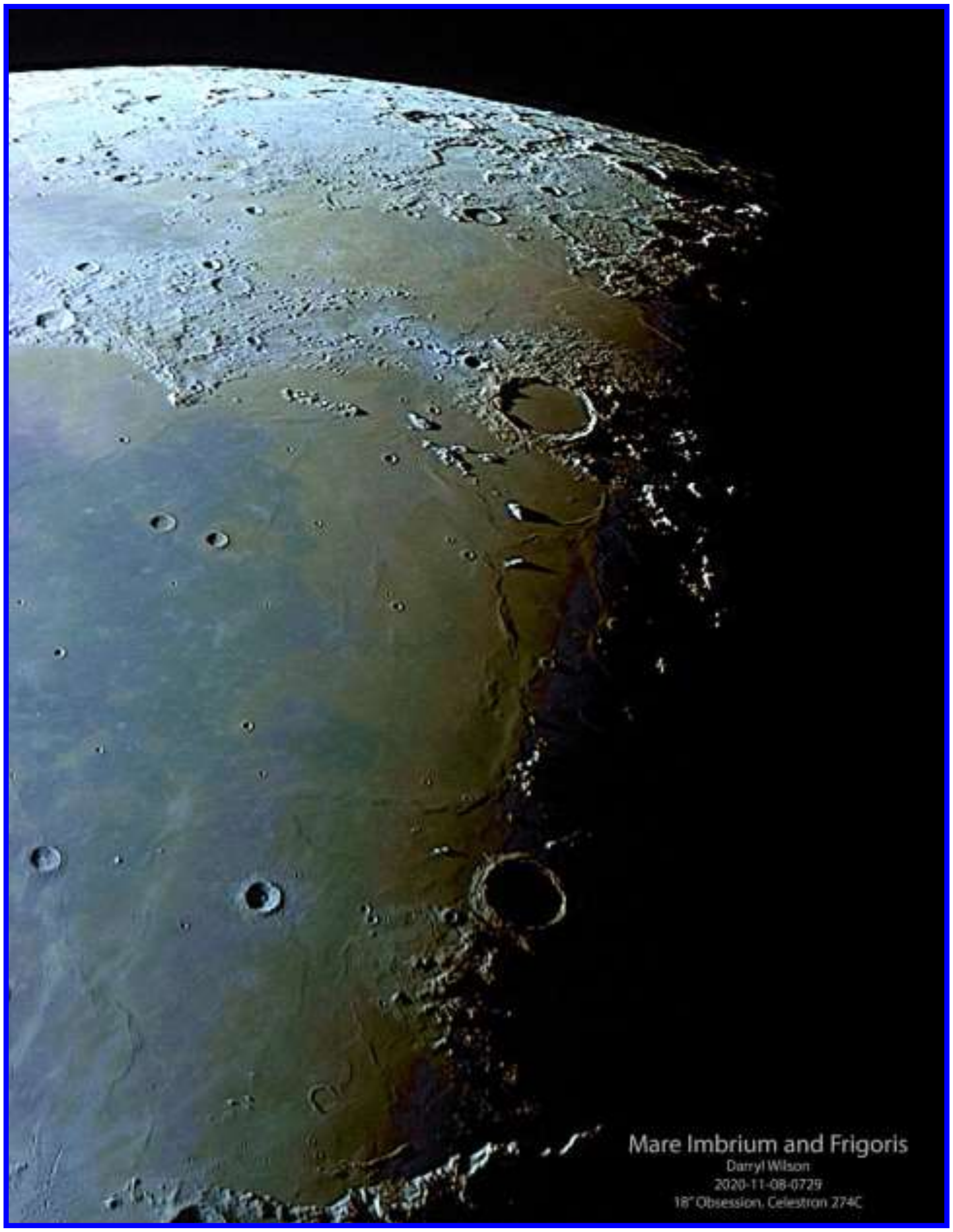


Figure 1, Mare Imbrium and Frigoris, *Darryl Wilson, Marshall, Virginia, USA. 2020 November 08 07:29 UT. 18 inch Obsession Newtonian reflector telescope, Celestron Skyris 274C camera, HSV saturation enhanced, Registax sharpened value band, 0.45" per pixel.*

Figure 1 is a wide area image taken November 8, 2020, 0729 UT that includes eastern Sinus Iridum, northeastern Mare Imbrium, and most of western Mare Frigoris. The patterns of blue and brown surface coloration in Mare Imbrium and Sinus Iridum, indicative of titanium dioxide (TiO_2) abundance in the surface regolith, can be compared to those presented in the January 2022 TLO article (ref 4) and the other article in this issue.

A line drawn from Maupertuis to the eastern wall of Herschel will cross Mare Frigoris. This line defines a boundary between blue surface coloration to the west and brown coloration to the east. It is tempting to label them as Ti-rich and Ti-poor respectively, but examination of an authoritative reference (SELENE) gives cause for a more nuanced interpretation.

A close examination of the SELENE science team's Ti abundance map shows low concentrations in western Mare Frigoris and even lower concentrations on the eastern side of the boundary line. Figure 1 correctly reflects relative differences in Ti concentrations in the mare, but perhaps exaggerates the absolute concentration in western Mare Frigoris.

One should keep in mind that although our color enhancement process does reveal previously invisible detail that is, in fact, real - it is not a scientifically valid, robust process for the detection of any particular mineral. It just happens to work fairly well - usually - for the detection of titanium when imaging the moon because TiO_2 on the lunar surface is relatively bluish. Still, we must be cautious about making definitive statements based solely on color enhanced imagery.

Wouldn't it be nice to have an algorithm that inputs an RGB image and outputs a mineral map that shows the relative concentration of Ti, or Fe? Well, references 1 and 2 provide detailed methods for accomplishing that using Clementine and SELENE imagery. Unfortunately, those methods will not work as well for ground based amateur astronomers because our RGB imagers do not have the same radiometric and spectral response functions as the spacecraft's imaging systems. We must also deal with wavelength dependent atmospheric absorption - a problem not experienced by the orbiters. For readers hoping for a multiband image processing technique that can produce a mineral map for Ti or Fe, there is hope. HSV based color enhancement alone can't do it, but in future articles we will cover an algorithm that will.

Figure 2, Plato, *Darryl Wilson, Marshall, Virginia, USA. 2020 November 08 07:00 UT. 18 inch Obsession Newtonian reflector telescope, Celestron Skyris 274C camera, HSV saturation enhanced, Registax sharpened value band, 0.18" per pixel.*

The hi-res image of Plato in Figure 2 is almost completely devoid of color detail. A uniform brownish hue covers almost the entire scene. Minor albedo variations are visible in places. The western 40% of Plato's floor is a slightly lighter shade of brown. Where are the blue areas? What happened to the color enhanced image information? A comparison with Figure 1 shows the primary reason. This particular image just happened to be centered in an area that has little variability in surface color. With close inspection, we can find a couple of areas with slight color variability.

About 50 miles to the west (upper left) of Plato's western wall is a brighter, relatively blue patch in a cratered area that can be seen in Figure 1 to extend further to the west, a little beyond the left edge of Figure 2. The extreme lower left corner of Figure 2 is slightly blue; it is the beginning of the blue center area of Mare Imbrium.

In summary, we examined a color enhanced image of northern Mare Imbrium that includes much of Mare Frigoris. The same patterns of coloration on the lunar surface that we saw in other recent articles was evident. We found a Ti concentration delineation in Mare Frigoris and noted that the color in the far west seemed to suggest a higher Ti concentration than that reported by the SELENE science team. Plato was seen to be Ti-poor, with Ti-poor surroundings, except for an area about 50 miles to the west. We reminded readers that inferring Ti concentration by the degree of blueness in these color images provides a fairly good estimate, but is not a valid, robust technique. Finally, we promised to present a surface material mineral mapping algorithm in a future article.

References:

Lucey, Paul and Blewett, David, Jolliff, Bradley L., August 25, 2000, " Lunar iron and titanium abundance algorithms based on final processing of Clementine ultraviolet-visible images", Journal of Geophysical Research, Vol. 105, No. E8, p. 20,297-20,305.

Otake H., Ohtake M., Hirata N., "Lunar Iron and Titanium Abundance Algorithms Based on SELENE (KAGUYA) Multiband Imager Data", 2012, Lunar and Planetary Science Conference.

Wilson, Darryl G., " A Basic Color Enhancement Technique for Lunar Surface Material Discrimination, RGB->HSV; enhance S; HSV->RGB", December, 2021, "The Lunar Observer", 5-7.

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Archimedes Environs

Rik Hill

Just below center of this image is Archimedes (85 km), one of those craters that newcomers to lunar observing learn quickly. It’s an area of few large craters so it stands out with its relatively smooth flat floor. It’s famous for several things. One is the tiny 1-2 km craterlets on the floor that amateurs have used for years to gauge the quality of the night. Also, there have been numerous reports of colorations on the floor that make it one of the better-known sites for suspected transient lunar phenomena. Because the Moon has only a quarter the radius of the Earth, if you stood in the center of Archimedes, you might just see the tops of the craters walls but it would be unlikely you would get the sense that you were in a crater!

On the right side of the image are two more good sized craters. The upper, larger one is Aristillus (56 km) with curious central peaks and nicely terraced walls. Below is Autolycus (41 km) with a small rima on its floor. Above Archimedes is the cluster of the Montes Spitzbergen. They look tall but are only around 1,400 m high. Nonetheless, they sparkle in the morning sunlight, a glorious sight. The small crater just left (west) of Archimedes is Bancroft (14 km) with the twin craters Beer (4 km) south, and Fueillée (10 km) north. I have to admit, they look more equal in size than that!

Below Bancroft are the Montes Archimedes. These get a bit taller than the Montes Spitzbergen, rising as much as 2 km high. Finally, the large crater, mostly in shadow, on the left edge of this image is Timocharis (36 km). It has a central peak but the Sun is not yet high enough there to show it here.

Archimedes Region, *Richard Hill, Loudon Observatory, Tucson, Arizona, USA. 2021 December 13 00:57 UT, colongitude 16.1°. 8 inch f/20 TEC Maksutov-Cassegrain telescope, 610 nm filter, SKYRIS 132M camera. Seeing 8/10.*

From Posidonius P to Luther in the Terminator

Alberto Anunziato

In the night of the observation the terminator passed exactly through the center of Luther dividing it into two parts, the western half in shadow and the eastern half barely visible, with the rim glowing in the first rays of the Sun. At the other end of the field, we find Posidonius P, 15 kilometers in diameter, showing the typical figure of a crater of its size illuminated very obliquely: very bright circular rim, completely dark interior, and extended triangular shadow, spreading in the manner of the illumination of an ancient expressionist film. What we see to the north is the southern end of Dorsa Smirnov (or Serpentine Ridge), at an ideal time to observe it: a beautiful spectacle of successive elevations like the wall of a sand castle on the beach. Beautiful for a photograph, but very complicated to draw. Dorsa Smirnov ends in the small Posidonius F. Between Posidonius P and Luther, a relief of lights and shadows unfolds, quite difficult to distinguish, which forces us to check later to know what we are registering. It is a small area, resembling a flower with four petals around the brightest center. Looking through the eyepiece, I thought that the two bright, irregularly circular spots casting shadows to the west might be the two domes I had seen earlier to the east of Luther.

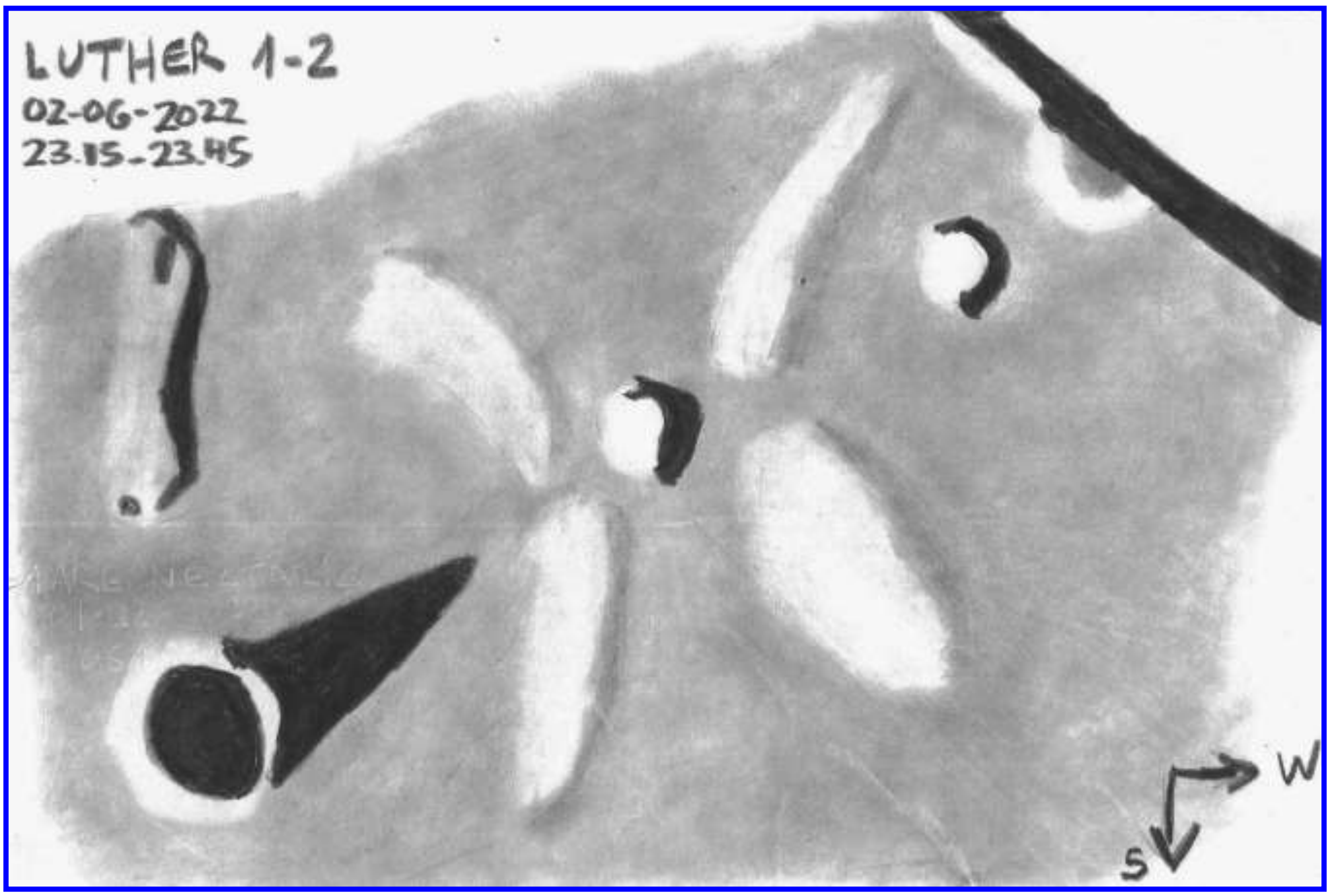


Image 1, Luther, *Alberto Anunziato, Paraná, Argentina. 2022 February 06 23:15-23:45 UT. Meade EX105 mm Maksutov-Cassegrain telescope, 154x.*

The Virtual Moon Atlas identifies them as Luther 1 -the closest to Luther- and Luther 2: "Volcanic shield, extrusive volcanism". I did not find any information about these quite conspicuous domes. If we see the LROC Quickmap (IMAGE 2) there seems to be no trace of our domes, which reminds us of the importance of telescopic observations from Earth to know the surface.

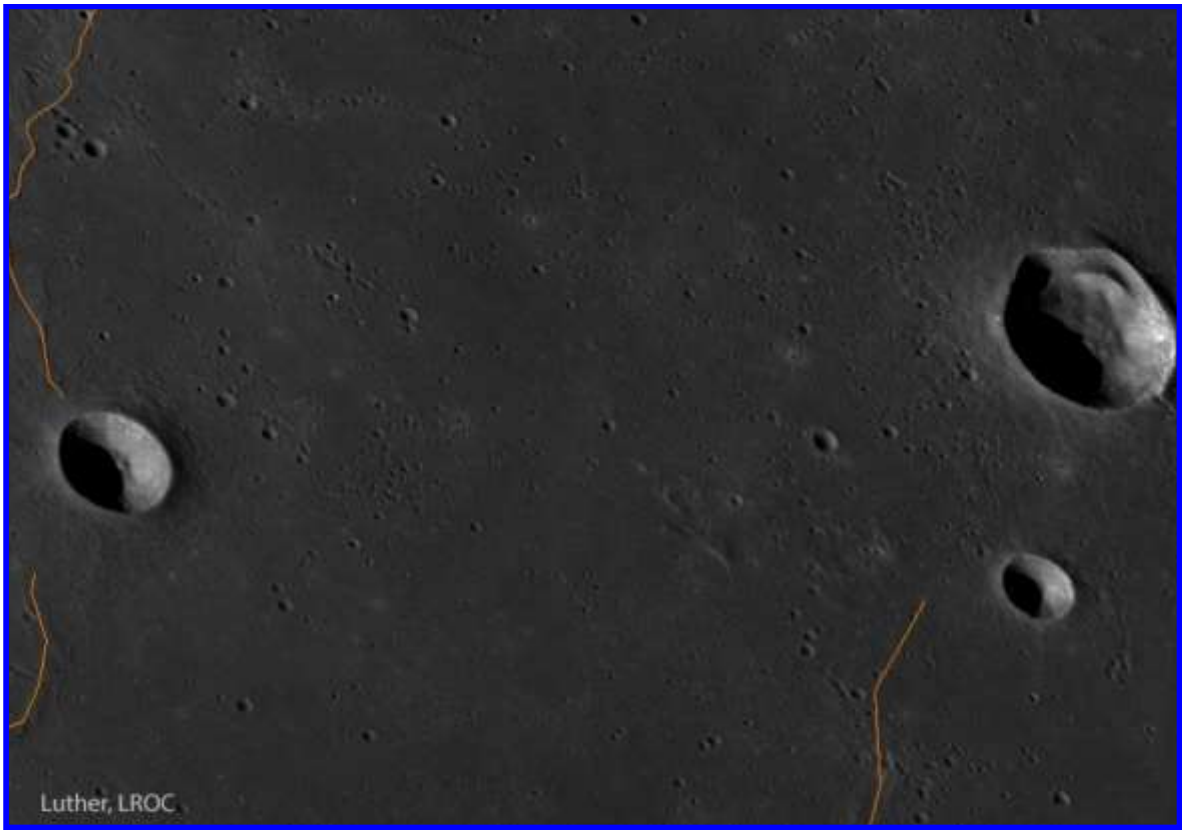


Image 2, Luther, *LROC*

They also do not appear in Antonin Rükl's Atlas of the Moon (2004, Sky Publishing, Cambridge), as we see in IMAGE 3 (from the Chart 14). In the Rükl Atlas we do see an elevation (which we know is not a wrinkle ridge, because it is not marked as such in the LROC Quickmap) and that could correspond to what we saw as four segments around Luther 2. It is exciting to see what does not appear on the maps, right?

Image 3, Luther, *Antonin Rükl's Atlas of the Moon (2004, Sky Publishing, Cambridge), Chart 14.*

What led me to observe the area was trying to find in the terminator the "ghost wrinkle ridge" that we refer to in "Bright ray or ghost wrinkle ridge?" (The Lunar Observer, December 2021), a putative wrinkle ridge not included in the "Map of lunar wrinkle ridges digitized from LROC Wide Angle Camera (WAC)". At the time of observation, this elevation was in the shadow zone, only a thin bright line was visible parallel to the terminator, the wrinkle ridge that crosses Luther. I resumed observation of the area a few minutes later (IMAGE 4) and that bright line (1) was accompanied by another one further north (2) and a third bright line that ended in the first (3).

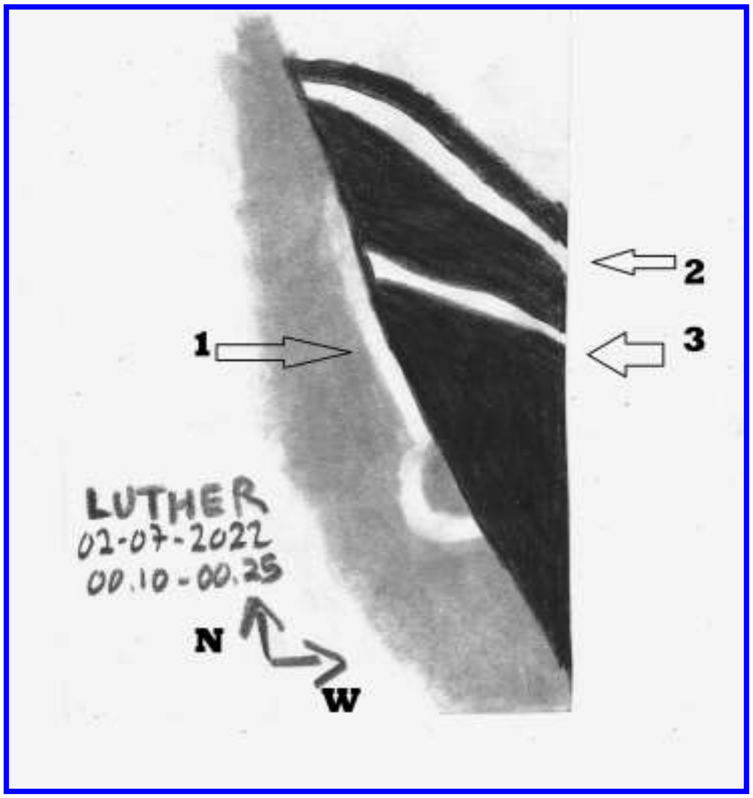
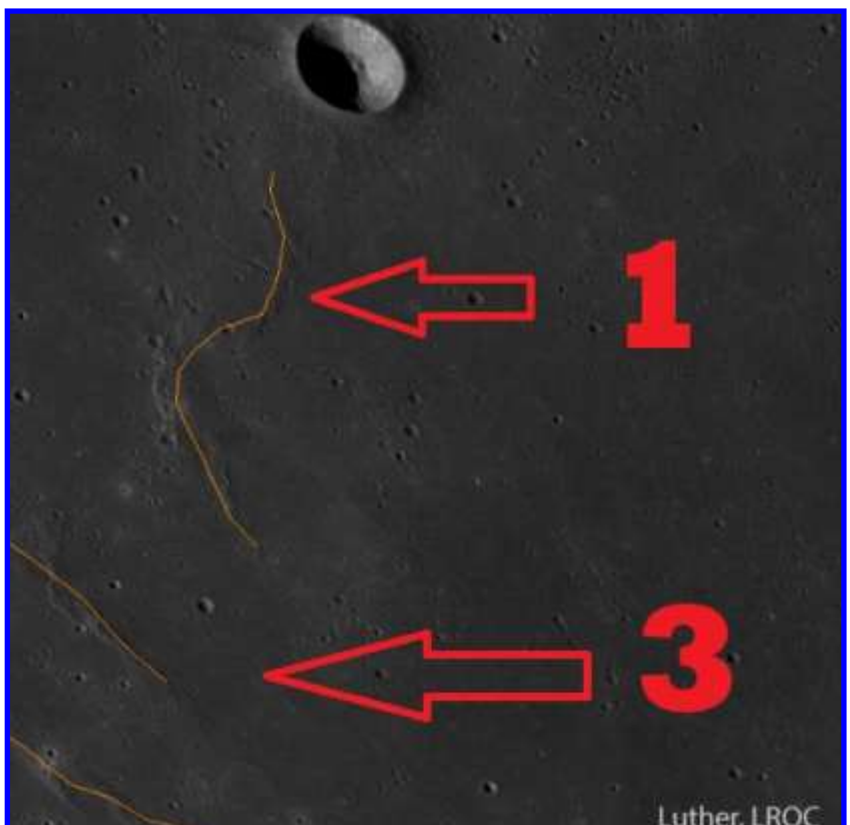


Image 4, Luther, *Alberto Anunziato, Paraná, Argentina. 2022 February 07 00:10-00:25 UT. Meade EX105 mm Maksutov-Cassegrain telescope, 154x.*

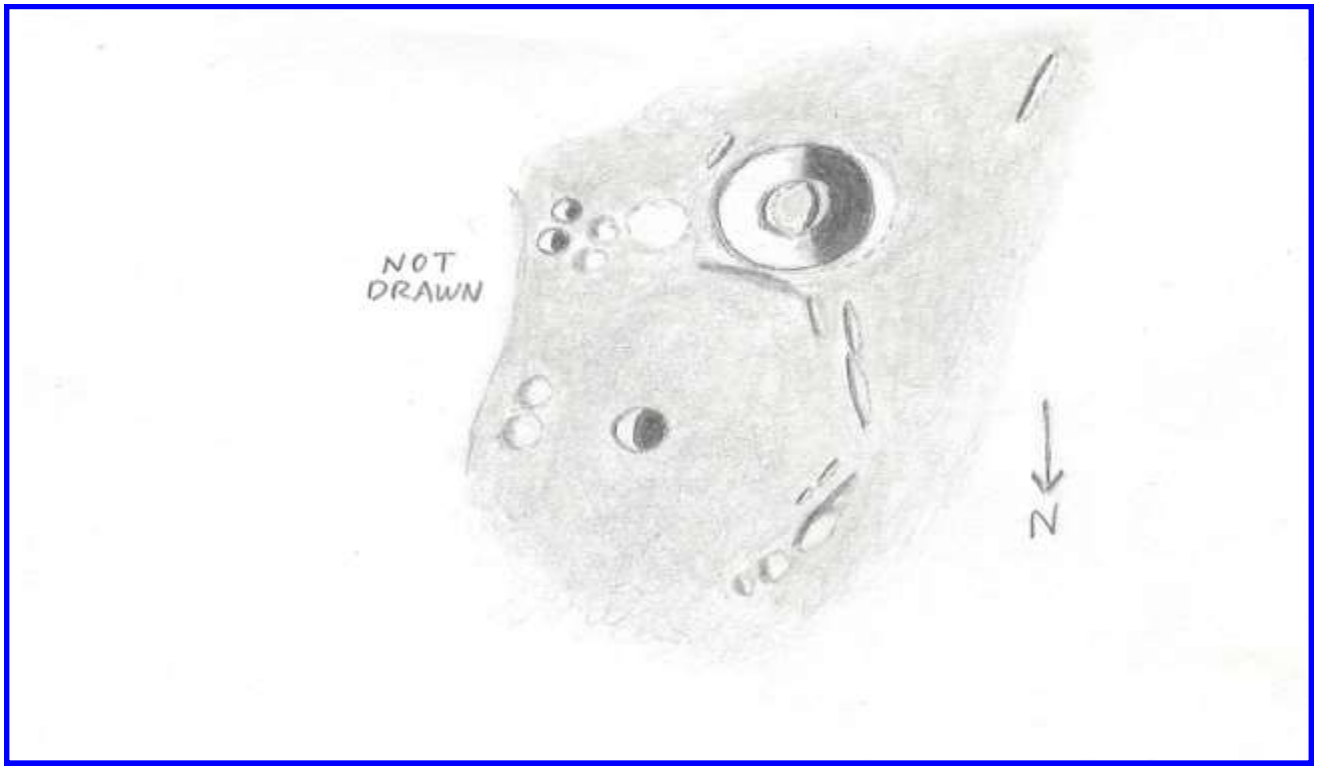
By the location of those subtly glowing lines in the dark, compared to the wrinkle ridge map of the LROC Quickmap, we could relate (1) and (3) but the line/wrinkle ridge (2) would be missing in the LROC Quickmap (IMAGE 5), as we said in the text cited above. If the segment is the uncharted wrinkle ridge (although it appears to be in the Rükl Atlas) it is logical that it receives the first rays of the Sun when the sun rises in the area, showing that it is an elevated area. It is an interesting fact to continue analyzing this area that does not seem to be completely represented in the lunar cartography.

Image 5, Luther, *LROC*



Hesiodus A

Robert H. Hays, Jr.



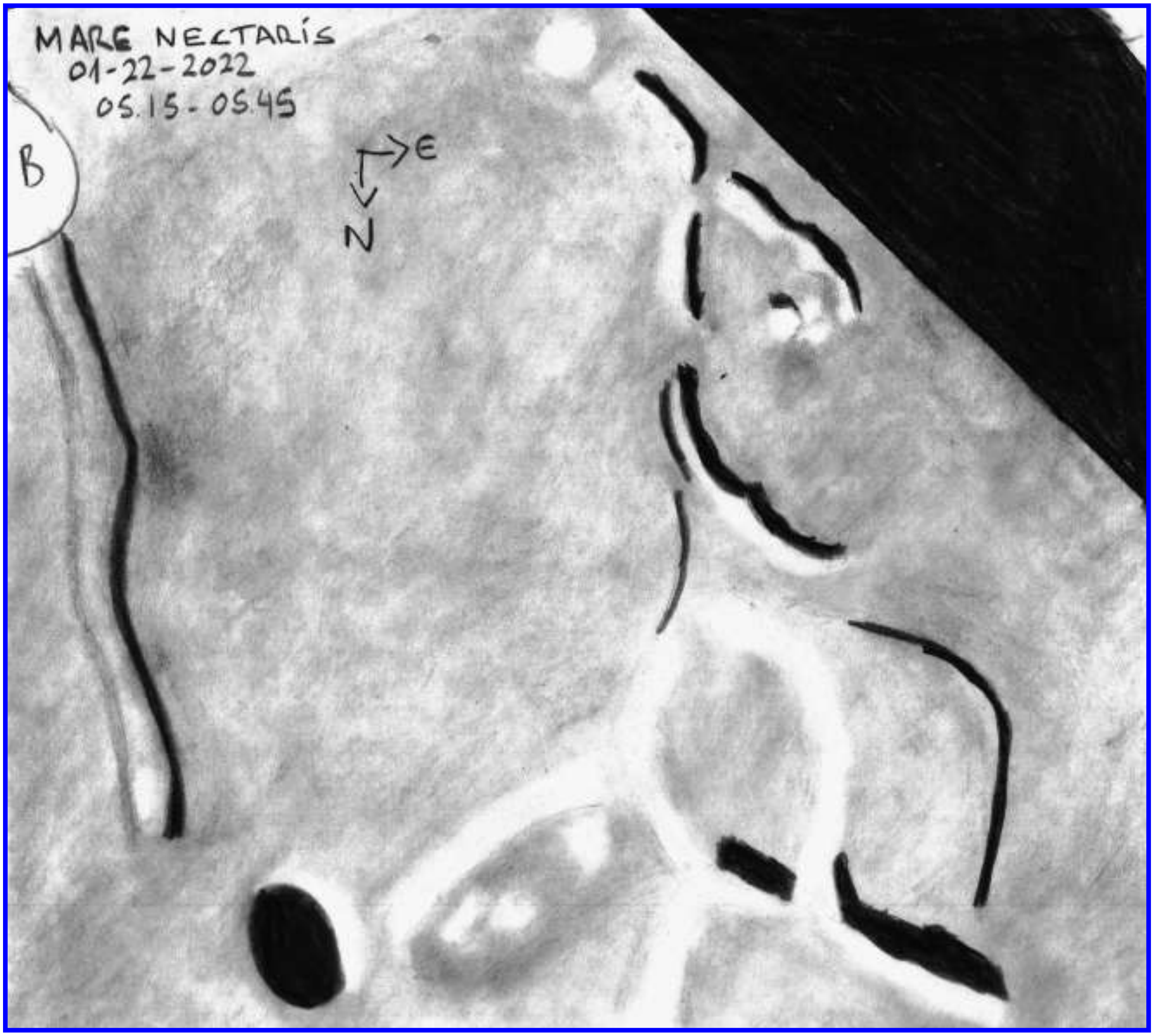
Hesiodus A, *Robert H. Hays, Jr., Worth, Illinois, USA. 2021 November 26 11:13-11:25; 12:12-12:22 UT. 15 cm reflector telescope, 170 x. Seeing 8/10, transparency 6/6.*

I drew this crater and vicinity on the morning of November 26, 2021. This crater at the southwest edge of Hesiodus and west of Pitatus. Hesiodus A is unusual in that it consists of two concentric rings. The inner ring is about 40% the diameter of the outer ring, and neither ring shows any irregularities. At this time, part of the inner ring was an arc of light surrounded by shadows from both rings. Hesiodus D is the conspicuous crater northeast of Hesiodus A and near the center of Hesiodus. Hesiodus itself is a broken crater flooded by Mare Nubium. Two dark low hills are east of Hesiodus D. Two small craters are east of Hesiodus A, and the sunlit rim of Hesiodus is nearby. Two hills are near this crater pair, and a relatively light area is between these and Hesiodus A. An elongated depression is southeast of Hesiodus A, and a strip of shadow is just north of this crater. Three ridges are north of Hesiodus A, and three peaks are to their north. Two tiny ridges are just east of the largest peak. The ridges and peaks north of Hesiodus A are probably part of the rim of Hesiodus. An isolated ridge is well to the southwest of Hesiodus A.

Mare Nectaris from Mädler to Rosse

Alberto Anunziato

The diameter of the Mare Nectaris basin is 350 km, what we see is approximately 2/3 of its surface, the terminator passes through the eastern zone. In the extreme southeast we have Rosse and in the extreme northwest Daguerre, in the center we have an area that appears very flat in slightly forward illumination, but in oblique illumination appears full of detail, much of which we fail to register (if the hand could be as accurate as the eye…). On the left we have a typical mid-height wrinkle ridge, which casts a homogeneous shadow and has a higher area at its northern end (marked by a bright spot). In the extreme south the bright spot is Rosse, a crater from the Eratosthenian era of 12 km in diameter, curiously there are no shadows on its bottom. Between Rosse and Daguerre (the bright-walled ghost crater) was a complex net of shadow-casting rises.

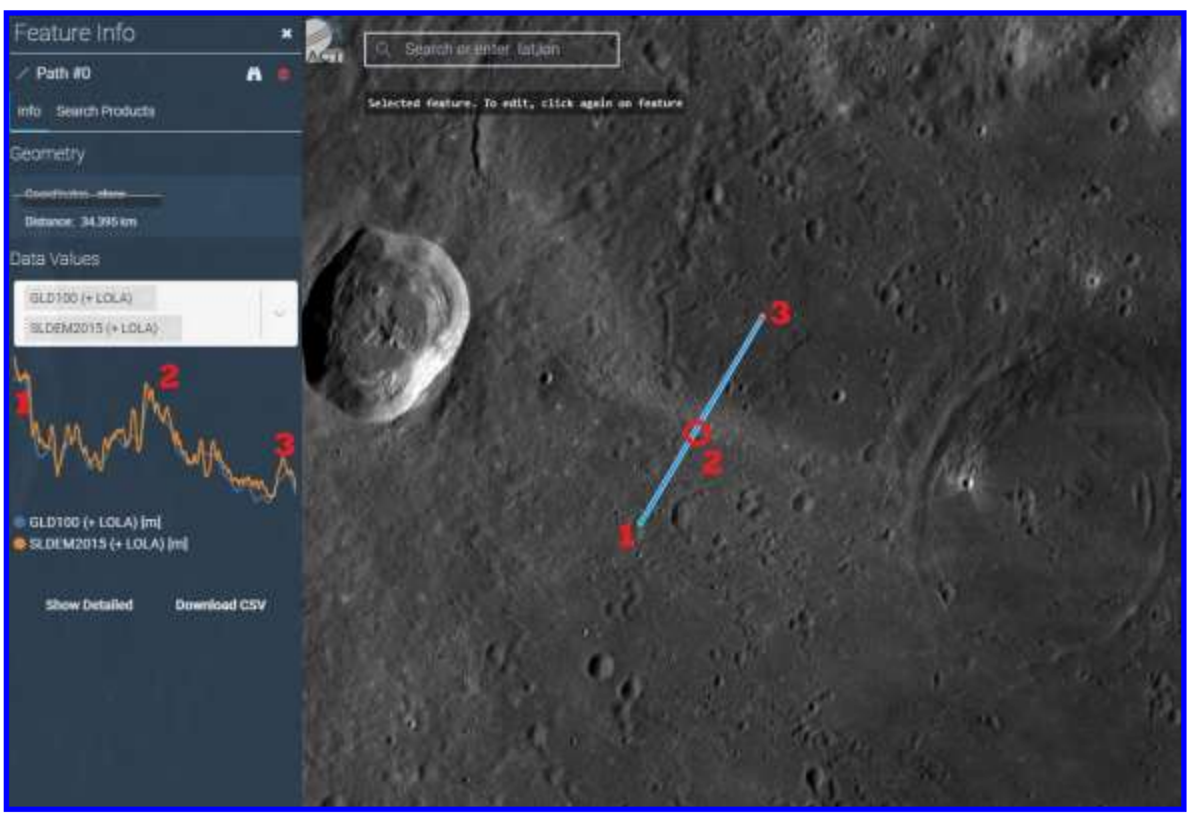


Mare Nectaris, *Alberto Anunziato, Paraná, Argentina. 2022 January 22 05:15-05:45 UT. Meade EX105 mm Maksutov-Cassegrain telescope, 154x.*

Image 2 ***Mare Nectaris*** *LROC.*

There are segments that seem to coincide with the dorsa included in "Map of lunar wrinkle ridges digitized from LROC Wide Angle Camera (WAC)" (IMAGE 2) and others that do not, the 3 bright spots, one casts a shadow, do not seem to be elevations but small craters (but we're not sure). In the far north is the 28 km-diameter Eratosthenian Mädler crater, whose best-known feature is its strange and lonely ray: "a bright, single ray that stretches for 130 km eastwards across northern Mare Nectaris, covering the southern floors of two ghost craters, an unnamed one (54 km) and Daguerre (46 km), both of whose southern rims have been completely submerged" (Peter Grego, "The Moon and How to Observe It", Springer, 2005, page 216). Is it really a bright ray? It's an interesting question, which we address in the May 2021 issue of "The Lunar Observer" ("Mädler's bright streak: ray or elevation?"). It would be a peculiar bright ray, since it is observed with very oblique illumination. This is obviously a very bright area, because it appears on the LROC Quickmap as bright (unlike other craters with bright rays). Observing that area, bright near the terminator, it was clearly perceived that the area to the north of the "bright ray" was lower than the bright area by the shadows, whose depth we can deduce from the slightly bright areas inside (craters too?) that start to light up as the terminator line progresses. If we consult the data from the LOLA altimeter of the Lunar Reconnaissance Orbiter (IMAGE 3), we notice that the bright area coincides with a narrow elevation, while to the north and south the terrain is lower (especially inside the Mare Nectaris).

Image 3 ***Mare Nectaris*** *LOLA.*



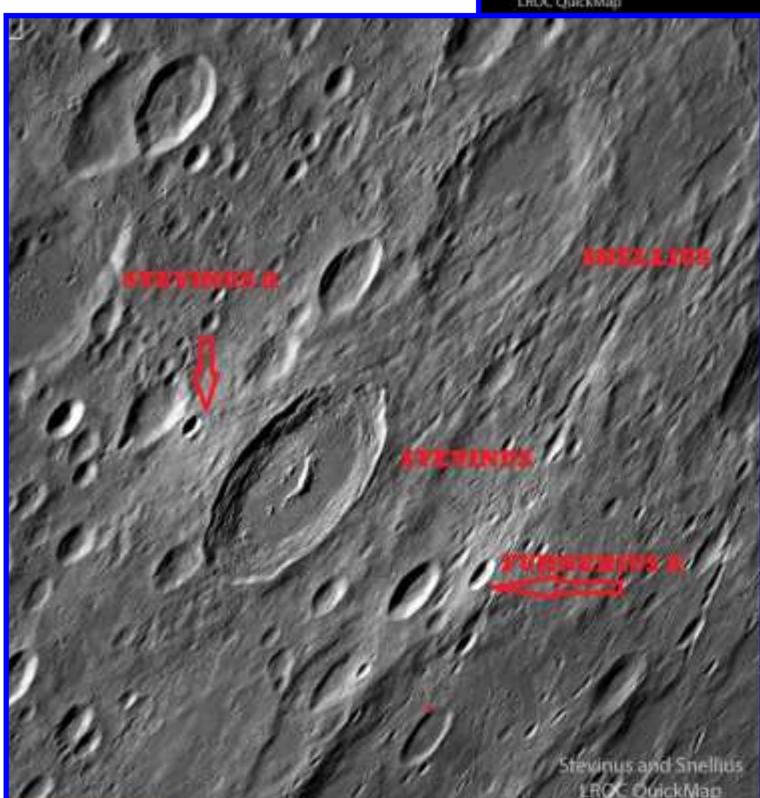
The Two Faces of Stevinus and Snellius

Alberto Anunziato

Stevinus and Snellius are two craters of almost identical size located in the south-east quadrant of the Moon, as we see in IMAGE 1, but very different in their morphology (IMAGE 2).

***Image 1,** LROC QuickMap.*

Stevinus is a "Copernican-age circular crater is about 71.54 km (44.45 miles) in diameter and 3820 m (12,530 feet) deep. Stevinus is surrounded by a bright rumpled ejecta blanket from which is rises steeply (…) The interior walls are covered with narrow steep terracing. The floor is smooth, except for a couple of isolated hills that form the crescent-shaped central peak complex" (Garfinkle, page 324).



Snellius, is "Pre-Nectarian-age crater is about 85.98 km (53.42 miles) in diameter and about 3830 m (12,565 feet) deep. Ejecta from Petavius covers the eastern half of Snellius' floor, while the western half is covered by bright ejecta and rays from Stevinus. There is some evidence of terracing, but the ancient walls have been heavily battered by impacts and displaced where Vallis Snellius crosses over the crater. The floor is very lumpy with hills and secondary impact craters and layers of materials from its neighbors' ejecta. The southwestern wall is low and missing in places" (Garfinkle, page 326).

***Image 2,** LROC QuickMap, Stevinus and Snellius.*

Both of these descriptions of Garfinkle are very inspiring to observe, but it's hard to get the conditions to look at Snellius and Stevinus in detail, due to a couple of very bright companions that we'll talk about later. In IMAGE 3 you can see, after Snellius and Stevinus, other wonders of the area, such as the oblique crater Rheita E and the gigantic Vallis Rheita, as in IMAGE 4 and IMAGE 5 we appreciate Petavius (future candidate "Focus On"). In IMAGE 4 in Snellius the "evidence of terracing" and the floor "very lumpy with hills and secondary impact craters". In IMAGE 6 we can see how "Stevinus is surrounded by a bright rumpled ejecta blanket from which is rises steeply".

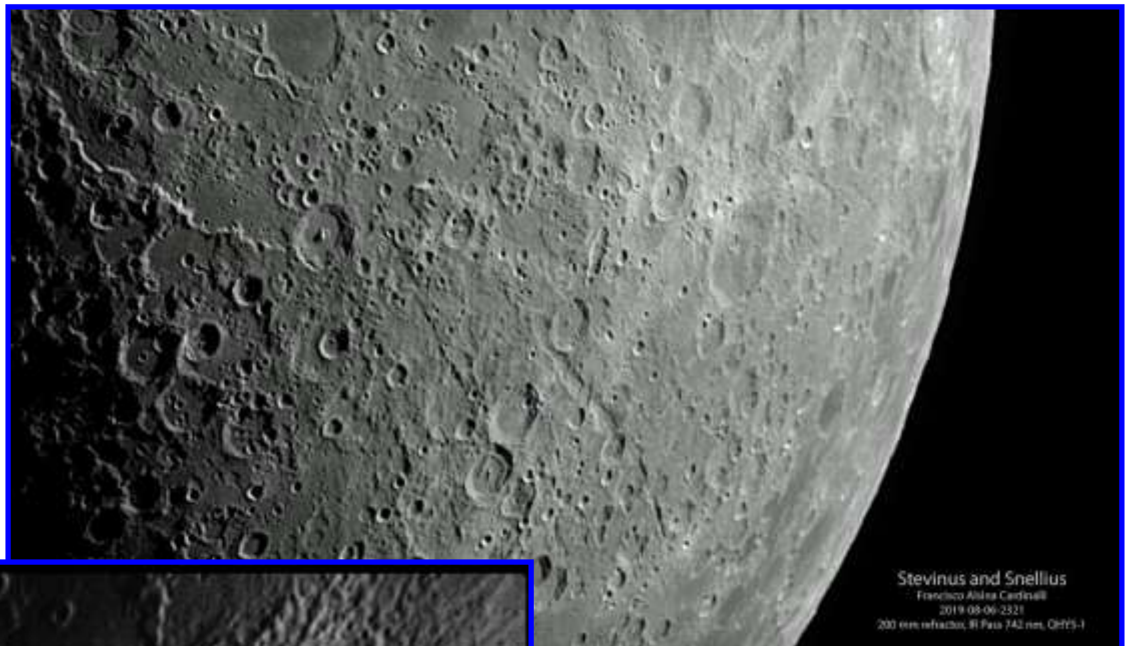


Image 3, Stevinus and Snellius, *Francisco Alsina Cardinalli, Oro Verde, Argentina. 2019 August 06 23:21 UT. 200 mm refractor telescope, IR Pass 742 nm filter, QHY5-I camera.*

Image 4, Rima Hase, *Richard Hill, Loudon Observatory, Tucson, Arizona, USA. 2008 May 08 22:02 UT. Celestron 14 inch Schmidt-Cassegrain telescope, 656.3 nm filter, SPC900NC camera. Seeing 6/10.*

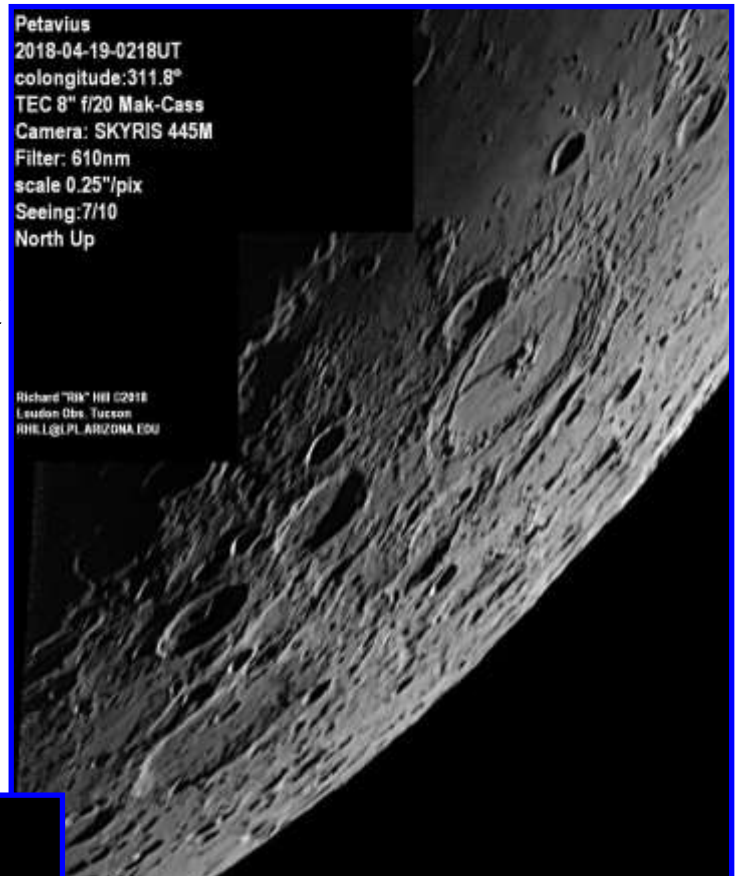


Image 5, Petavius, *Richard Hill, Loudon Observatory, Tucson, Arizona, USA. 2018 April 19 02:18 UT, colongitude 311.8º. 8 inch f/20 TEC Maksutov-Cassegrain telescope, 610 nm filter, SKYRIS 445M camera. Seeing 7/10.*

Image 6, Petavius to Rheita, *Richard Hill, Loudon Observatory, Tucson, Arizona, USA. 2007 June 19 03:50 UT. Celestron 14 inch Schmidt-Cassegrain telescope, 1.6 x barlow, UV/IR blocking filter, SPC900NC camera. Seeing 6/10.*

In other images (IMAGE 7, 8, 9, 10, 11 and 12) we can see the characteristics that Elger points out in Snellius "terraced walls, considerably broken on the S.W. by craters (…) dark floor, which contains a central mountain" and in Stevinus "a border rising on the S. to more than 11,000 feet above a dark interior, which includes a bright central mountain" (page 131). In IMAGE 10 we can compare the terraced walls in both craters, very similar, but much more deteriorated in Snellius and more preserved and steeper in Stevinus, as well as in Snellius there are almost no vestiges of a central peak, while the extended central peak of Stevinus projects shadow and shine on top.

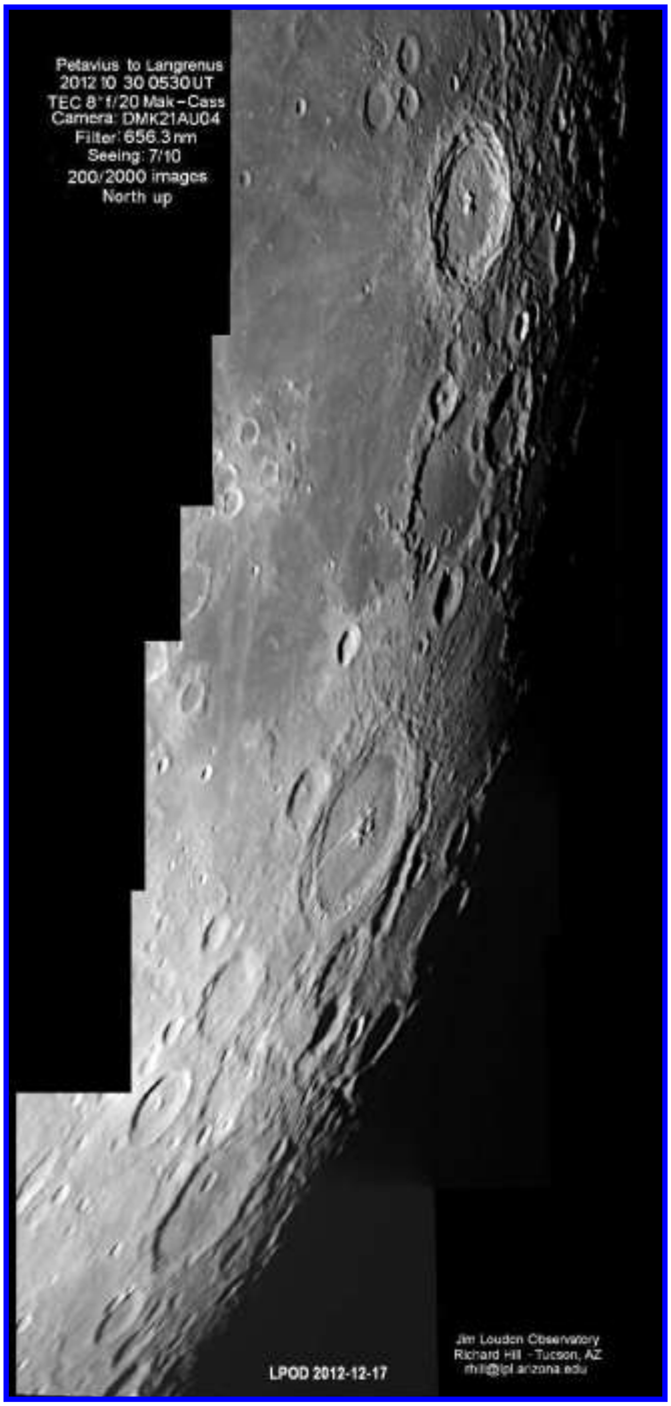


Image 7, Petavius to Langrenus, *Richard Hill, Loudon Observatory, Tucson, Arizona, USA. 2012 October 30 05:30 UT. 8 inch f/20 TEC Maksutov-Cassegrain telescope, 656.3 nm filter, DMK21AU04 camera. Seeing 7/10.*

Image 8, Petavius to Langrenus, *Richard Hill, Loudon Observatory, Tucson, Arizona, USA. 2008 April 10 02:14 UT. Celestron 14 inch Schmidt-Cassegrain telescope, UV/IR blocking filter, SPC900NC camera. Seeing 6/10.*

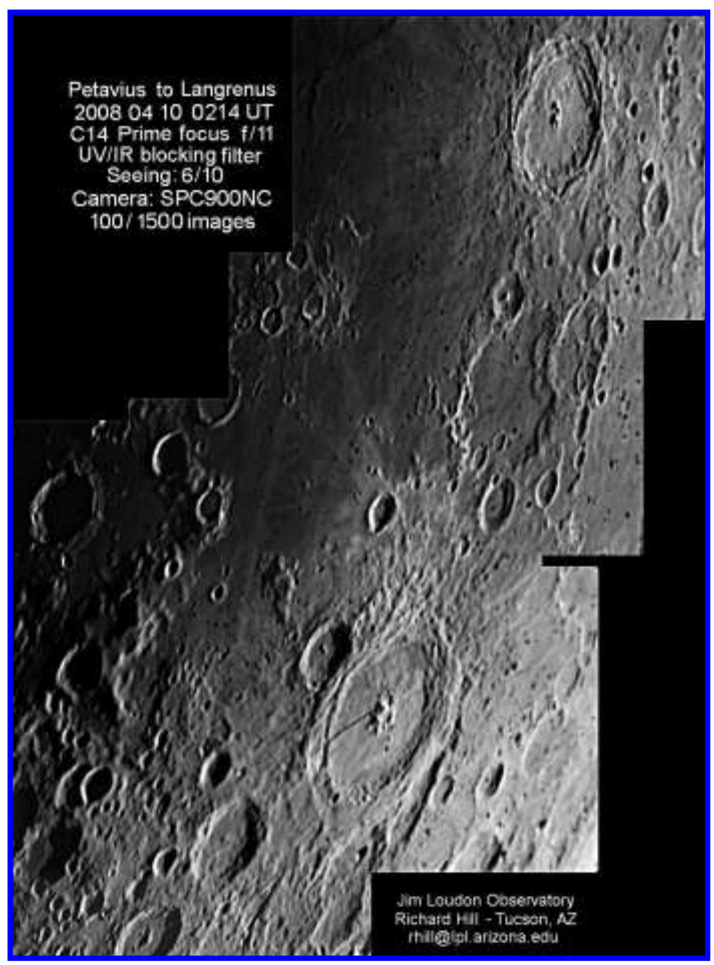


Image 9, Stevinus and Snellius, *Rafael Lara Muñoz, Guatemala, Guatemala, SLA. 2021 May 28 21:30 UT. 114 mm reflector telescope, Samsung Note 20 cell phone camera.*

Image 10, Stevinus and Snellius*, Randy Trank, Winnebago, Illinois, USA. 2022 February 08 00:58 UT. 14 inch Schmidt-Cassegrain telescope, f/11, ZWO ASI290MC camera.*

Image 11, Stevinus and Snellius, *Raúl Roberto Podestá, Formosa, Argentina. 2022 February 06 23:53 UT. 102 mm refractor telescope, ZWO ASI178 MC camera.*

Image 12, Stevinus and Snellius, *Alberto Anunziato, Paraná, Argentina. 2019 September 15 04:02 UT. 180 mm reflector telescope, QHY5-II camera.*

In the terminator, you can see that not only the Copernican Stevinus has high walls but also the old Snellius degraded by billions of years of successive meteoric impacts, both of which has its floor almost completely covered by shadows in IMAGE 13. Both craters show their depth even at a certain distance from the terminator, as we see in IMAGE 14, 15, 16, 17 and 18.

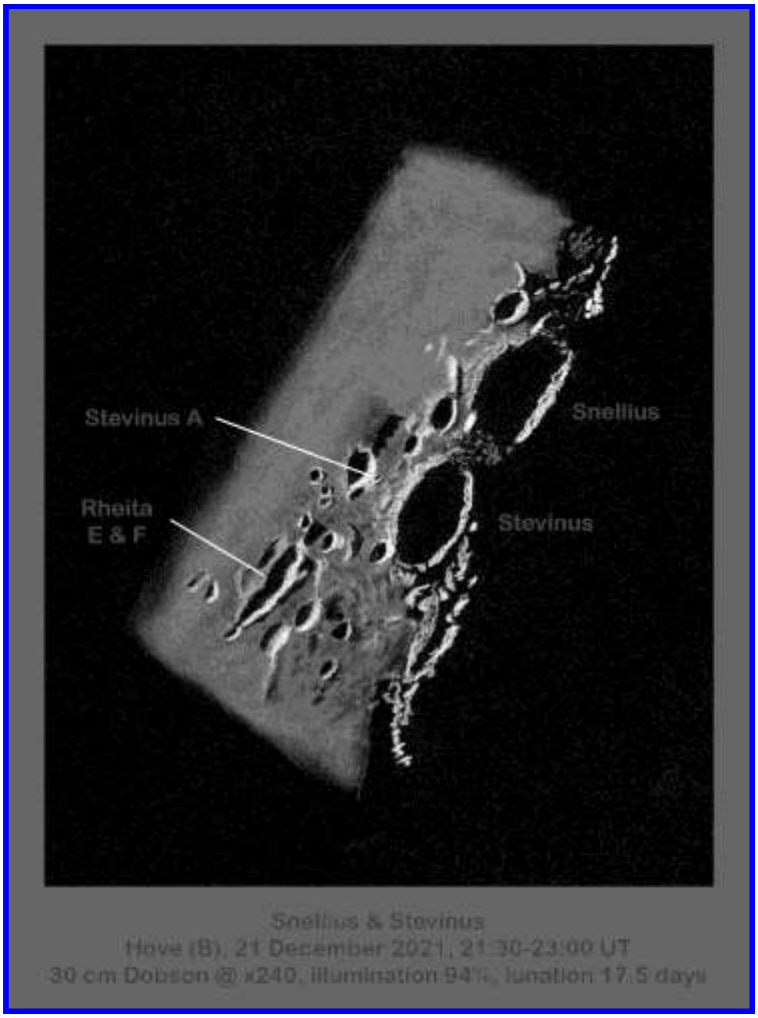


Image 13, Stevinus and Snellius, *Jef De Wit, Hove, Belgium, 2021 December 21 21:30-23:00 UT. 30 cm reflector telescope, 240 x.*

Image 14, Stevinus and Snellius*, Camilo Satler, Oro Verde, Argentina. 2018 March 21 23:19 UT. 100 mm reflector telescope, Samsung Galaxy J7 cell phone camera.*

Image 15, Stevinus and Snellius, *Juan Manuel Biagi, Paraná, Argentina. 2019 March 23 03:26 UT. Meade EX 105 mm Maksutov-Cassegrain telescope, Canon EOS 400 Rebel camera.*

Image 16, Stevinus and Snellius, *Juan Manuel Biagi, Paraná, Argentina. 2019 March 23 03:26 UT. Meade EX 105 mm Maksutov-Cassegrain telescope, Canon EOS 400 Rebel camera.*

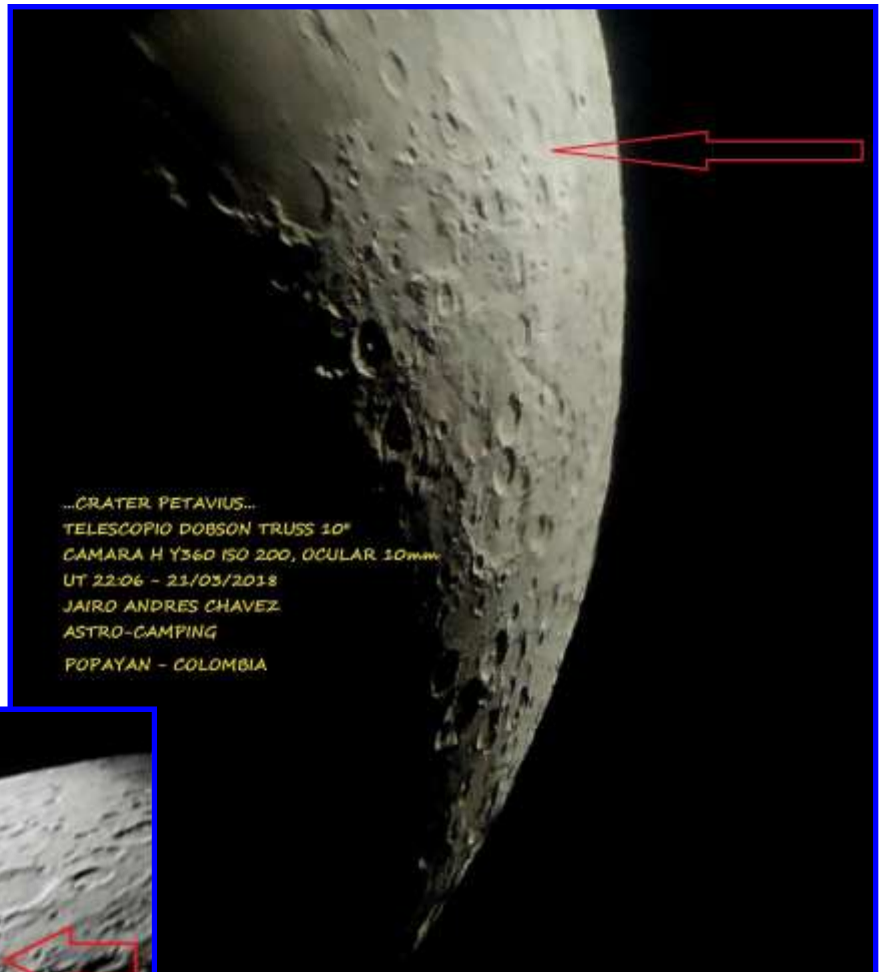


***Image 17, Stevinus and Snellius**, Jairo Chavez, Popayán, Colombia. 2018 March 21 22:06 UT. 10 inch truss Dobsonian reflector telescope, Huawei Y360 ISO200 camera.*

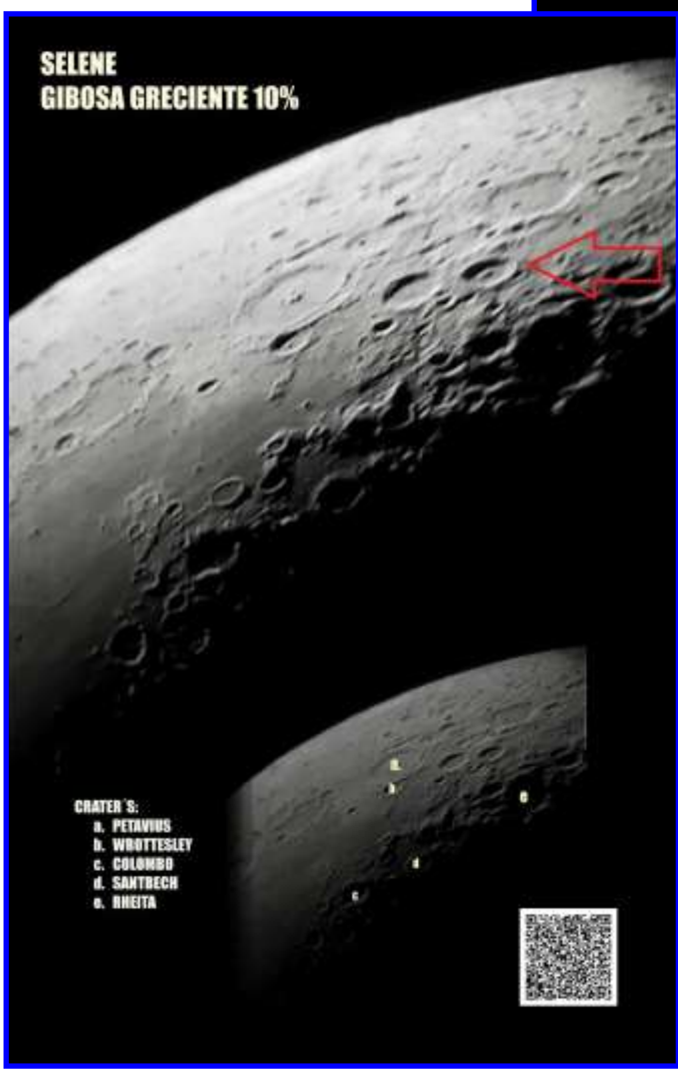


***Image 18, Stevinus and Snellius**, Jairo Chavez, Popayán, Colombia. 2021 August 12 00:23 UT. 12 inch reflector telescope, MOTO E5 PLAY camera.*

But as Stevinus and Snellius begin to be illuminated by the sun's rays more frontally, we see another face entirely. In first place, Snellius starts to get a lot harder to find. It is a fairly old and degraded crater, but its high walls should be a point of reference, for example in IMAGE 19. It is that as we get closer to the full moon, the prominence of two much smaller craters begins. We turn to Garfinkle once more: "West of Stevinus is the small very bright-rayed satellite crater Stevinus A (lat 31.86°S, long 51.65°E). Stevinus A is about 7.87 km (4.89 miles) in diameter (page 324...), "Furnerius A (lat 33.54°S, long 59.03°E), is the focus of a major ray system. Take some time and come back often to study this very complex crater and its 20 additional named satellite craters" (page 258). Stevinus A "is obviously younger than Stevinus, but otherwise seems a typical little crater. But under high illumination Stevinus A is very bright and has a longer ray system than would be expected for a crater only 8 km in diameter; perhaps the lengthy rays are related to it being an oblique impact" (Wood, 2007).

Image 19, Stevinus and Snellius, *Olivier Planchon, OAB (Observatoire Astronomique de Bauduen) Bauduen Provence France. 2022 February 08 19:00 UT. 152 mm f/8 refractor telescope.*

In IMAGE 20 we have a hard time visualizing Snellius, but Stevinus is clearly visible, even his dark interior mentioned by Elger. Notice the bright streaks across the east wall? Do they come from the small Stevinus A to the west or the larger Furnerius A to the east, which appears with its bright east wall and shadowed interior? What seems certain, at least in this image, is that little Stevinus A has a much denser ejecta blanket (as seen in IMAGE 21). These two bright ray craters, among the brightest on the near side, make this region known as the "headlights of the Moon." It's amazing how two small craters can shine so brightly. In IMAGE 22 we see that both systems of ejecta and bright rays are confused and make it difficult to know where each ray comes from separately. There are few images in which we can enjoy the two faces of Stevinus and Snellius, their topographies and the bright rays that flank Stevinus and almost hide Snellius, as clearly seen in IMAGE 23. In IMAGE 24 we see that the bright ejecta occupy the northern third of Snellius and that rays from Stevinus A seem to reach all the way to the central peak of Stevinus and its southern wall is very bright (unlike any other crater), presumably from material ejected by one or both headlights. In turn, we can do some stratigraphy by seeing how the rays of Stevinus A do not cover the probably more recent Stevinus R (26 km in diameter, to the west). In IMAGE 25 and IMAGE 26 we also see a double show, details of the walls and central peak, bright in the summit and shadows, from Stevinus along with the ray systems. Looking at these images we wonder, does Furnerius C, the crater 22 kilometers west of Furnerius A, also project bright rays? In IMAGE 27 we can see the two faces of Stevinus and Snellius: details of their topography of high stepped walls and central peak (conspicuous in Stevinus, hinted at Snellius) and the complicated bright ray systems of Stevinus A and Furnerius A which, with more frontal light, they end up hiding them. In this IMAGE 27 we see that the bright rays of Stevinus A seem to converge on the central peak of Stevinus and that the western side has a brightness that may derive from Furnerius A, on the left, while the bright material that covers the southern third of Snellius would come, whose rays to stop at a rise near Stevinus.

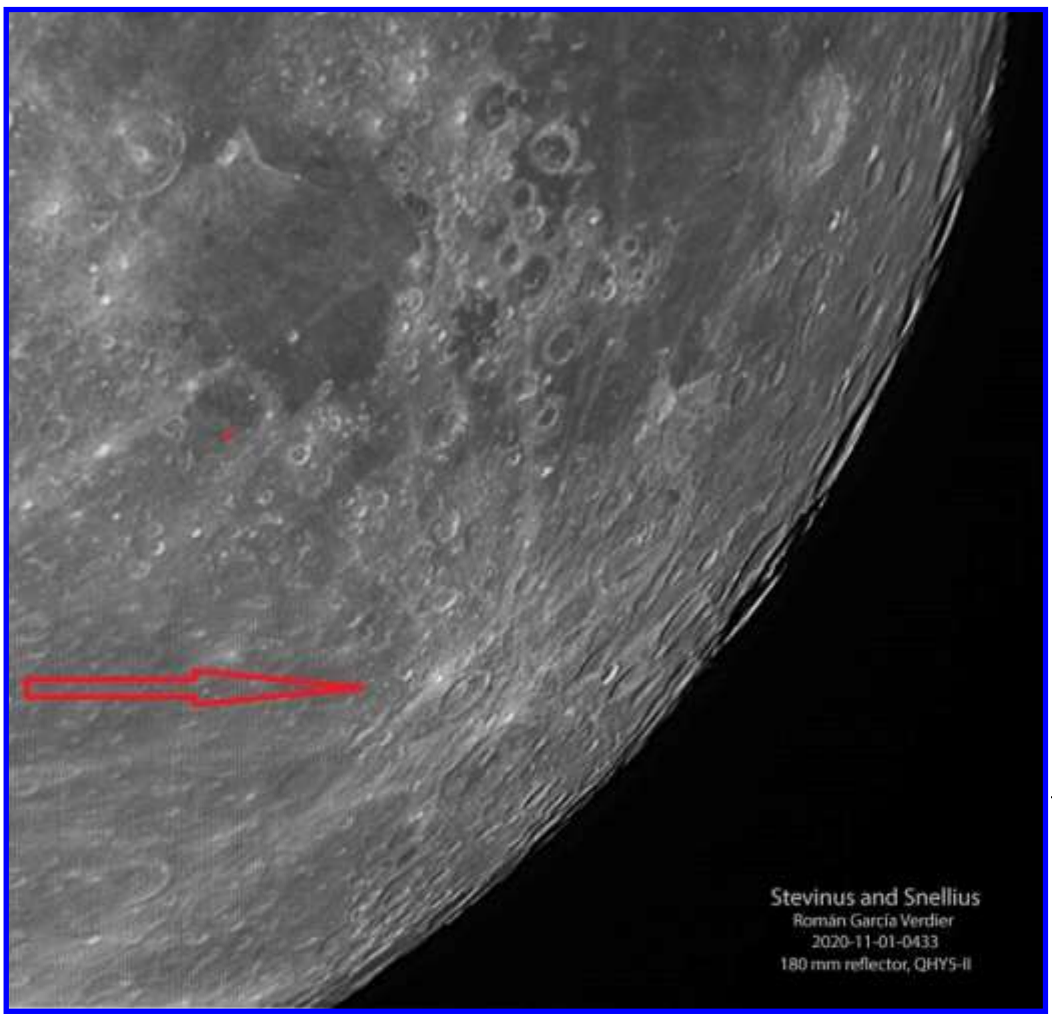


Image 20, Stevinus and Snellius, *Román García Verdier, Paraná, Argentina. 2020 November 01 04:33 UT. 180 mm Newtonian reflector telescope, QHY5-II camera.*

Image 21, Stevinus and Snellius, *Alberto Anunziato, Paraná, Argentina. 2022 February 07 00:00-00:20 UT. Meade EX105 mm Maksutov-Cassegrain telescope, 154x.*

Image 22, Stevinus and Snellius, *Alberto Anunziato, Paraná, Argentina. 2021 July 19 01:43 UT. 180 mm reflector telescope, QHY5-II camera.*

Image 23, Stevinus and Snellius, *David Teske, Louisville, Mississippi, USA. 2022 January 12 00:58 UT, colongitude 18.3º. 4 inch f/15 refractor telescope, IR block filter, ZWO ASI120mm.s camera.*

Image 24, Stevinus and Snellius, *Eduardo Horacek, Mar del Plata, Argentina. 2021 November 11 23:36 UT. 150 mm Maksutov-Cassegrain telescope, Canon EOS Rebel T5i camera. North is down, west is right.*

Image 25, Stevinus and Snellius, *David Teske, Louisville, Mississippi, USA. 2022 January 11 00:36 UT, colongitude 5.9°. 4 inch f/15 refractor telescope, IR block filter, ZWO ASI120mm.s camera.*

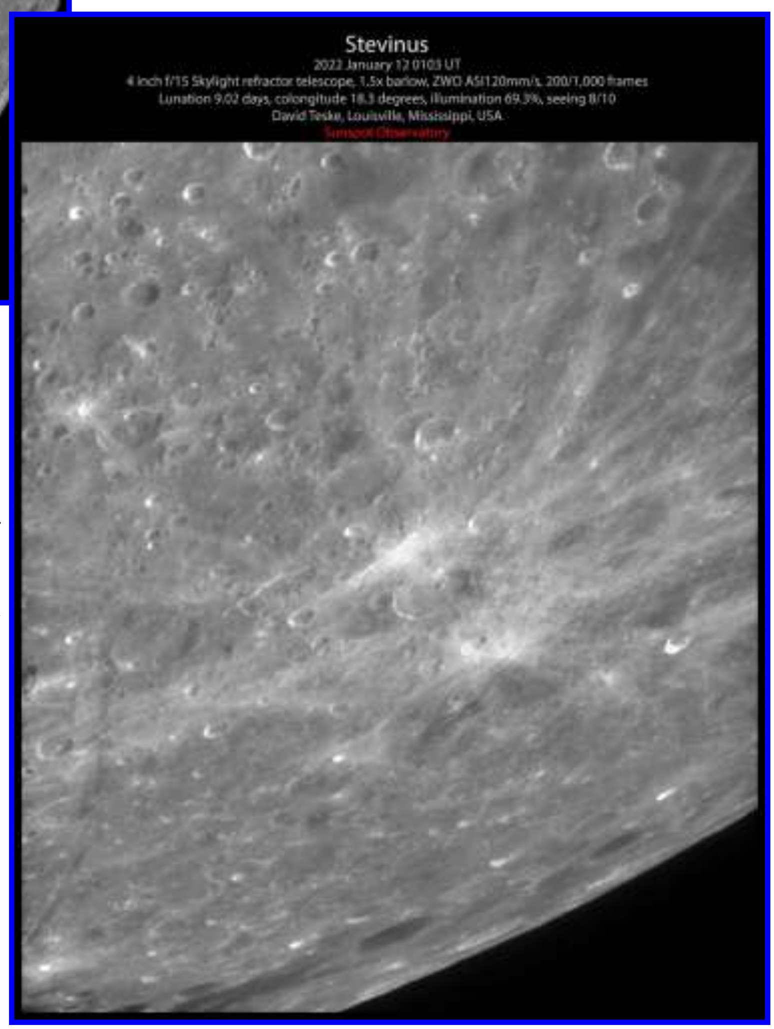


Image 26, Stevinus and Snellius, *David Teske, Louisville, Mississippi, USA. 2022 January 12 01:03 UT, colongitude 18.3°. 4 inch f/15 refractor telescope, 1.5x barlow, IR block filter, ZWO ASI120mm.s camera.*

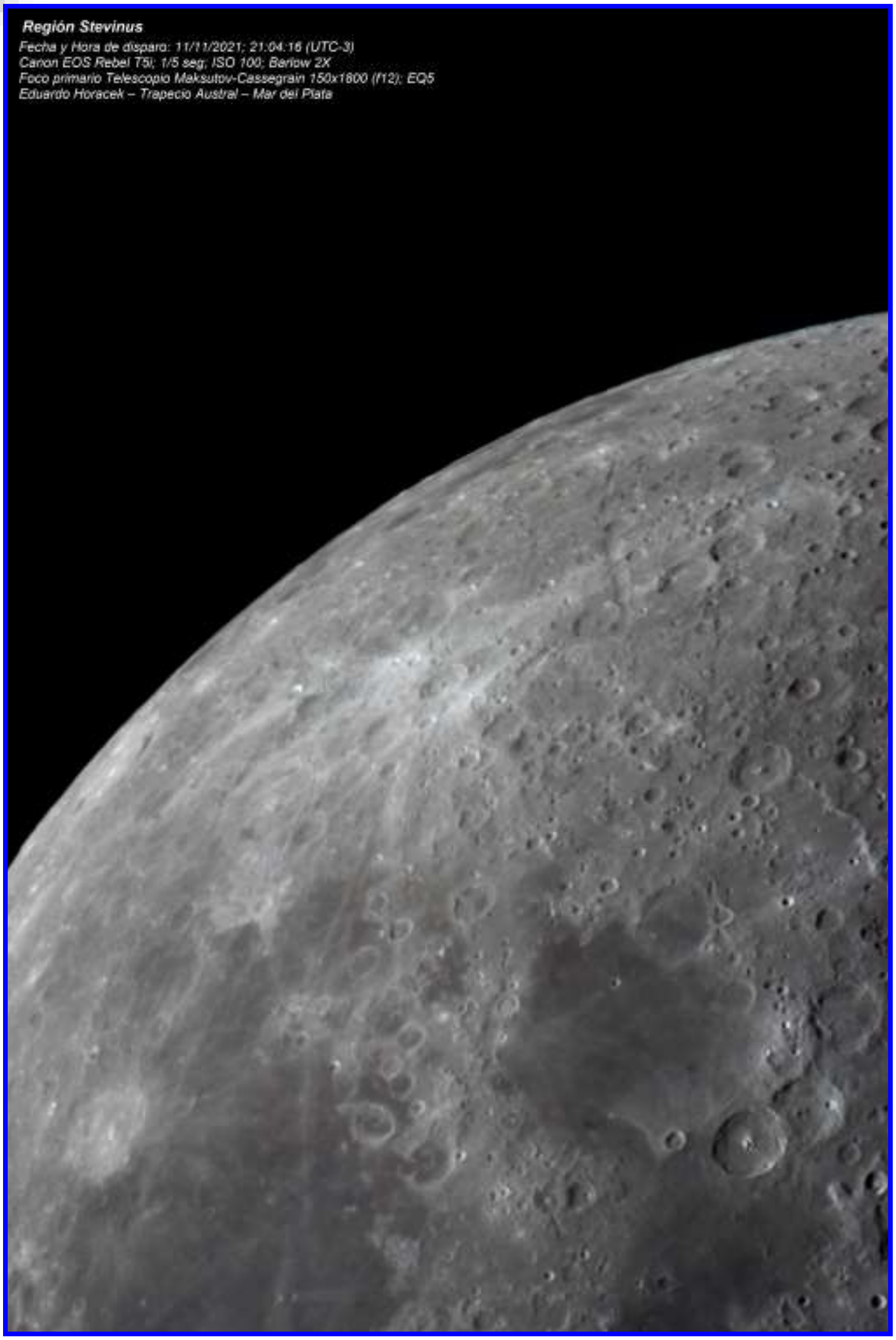


Image 27, Stevinus and Snellius, *Eduardo Horacek, Mar del Plata, Argentina. 2021 November 12 00:04 UT. 150 mm Maksutov -Cassegrain telescope, Canon EOS Rebel T5i camera. North down, west right.*

In IMAGE 28 and IMAGE 29 the bright rays are more developed and in the interior of Stevinus, we can see darker areas in the northern part.

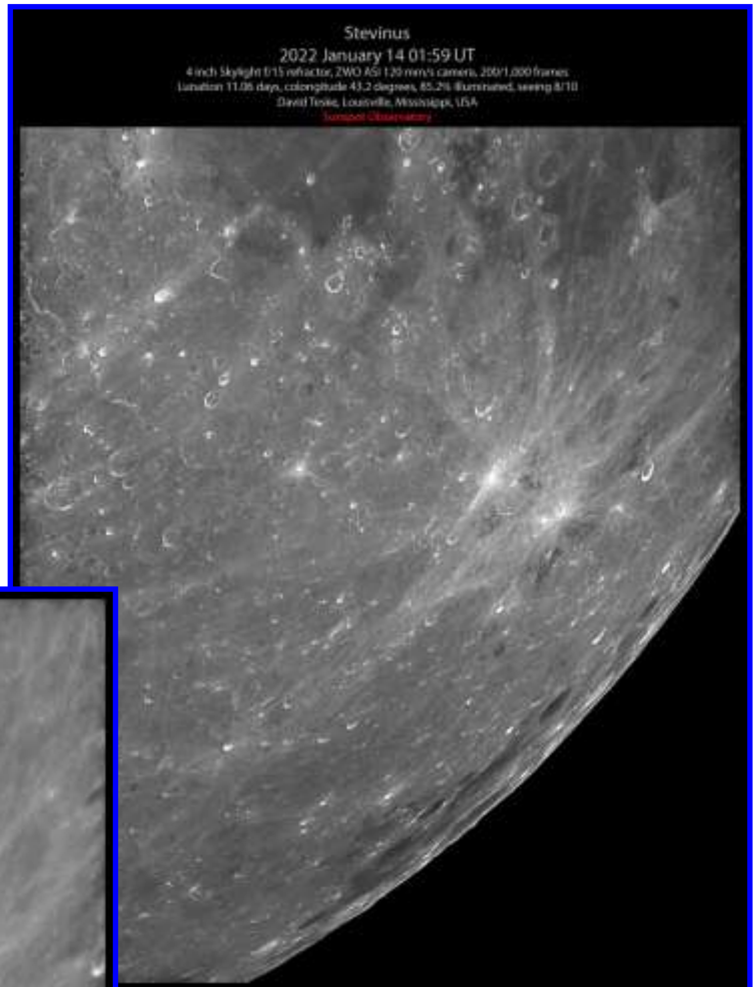


Image 28, Stevinus and Snellius, *David Teske, Louisville, Mississippi, USA. 2022 January 14 01:59 UT, colongitude 43.2°. 4 inch f/15 refractor telescope, IR block filter, ZWO ASI120mm.s camera.*

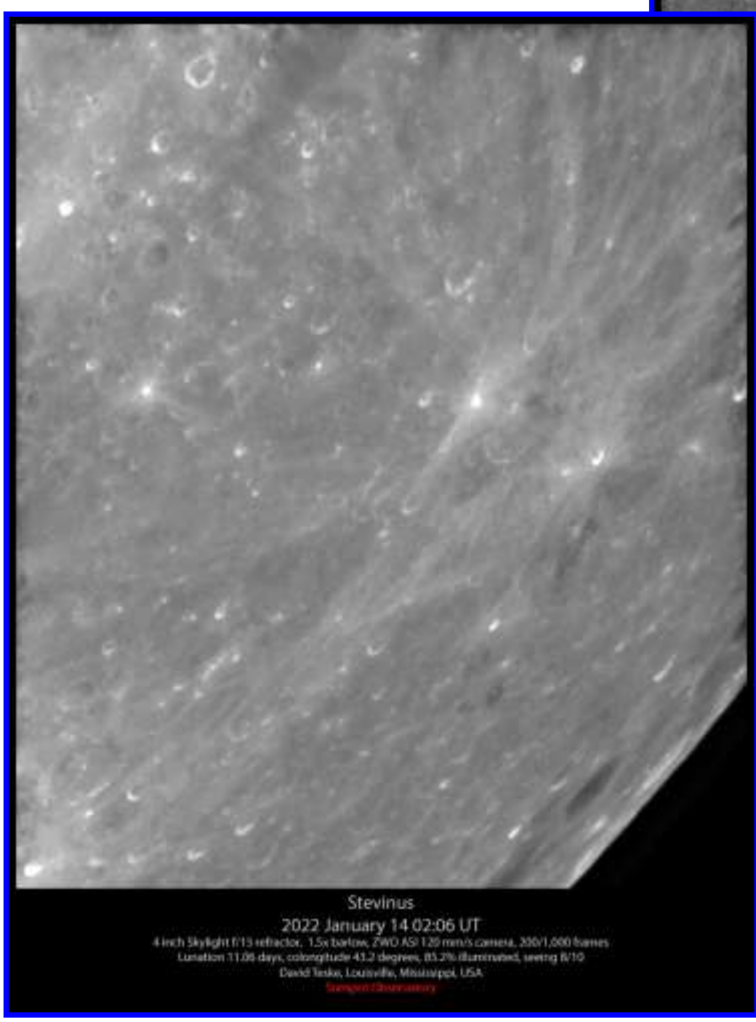
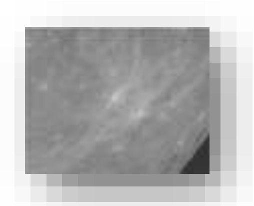


Image 29, Stevinus and Snellius, *David Teske, Louisville, Mississippi, USA. 2022 January 14 02:06 UT, colongitude 43.2°. 4 inch f/15 refractor telescope, 1.5x barlow, IR block filter, ZWO ASI120mm.s camera.*



Let's take a look at the bright rays from Stevinus A and Furnerius A. When do they start to see each other? Personally, I believe that the exact moment is found with an illumination greater than 35%, on the fifth day of the lunation. I was able to observe Stevinus in the early hours of February 7 (IMAGE 21) and they were not observable (at least with my small telescope). Only ejecta around Furnerius A and especially Stevinus A were observed: "the two craters are surrounded by large bright nimbuses that make them difficult to see" (Wood, 2006). And the next day, February 8 (00:25 UT, 44% illumination) the characteristic features of the rays were already visible, and I could say that they were already fully illuminated, although not as bright as the next days. Michel Deconinck accurately (and masterfully) recorded the illumination of our two craters between February 4 and 9 (IMAGE 30), and in the February 6 image (17 hours after IMAGE 21) he probably captured a moment very close to the beginning of the illumination of the system of bright rays that flanks Stevinus.

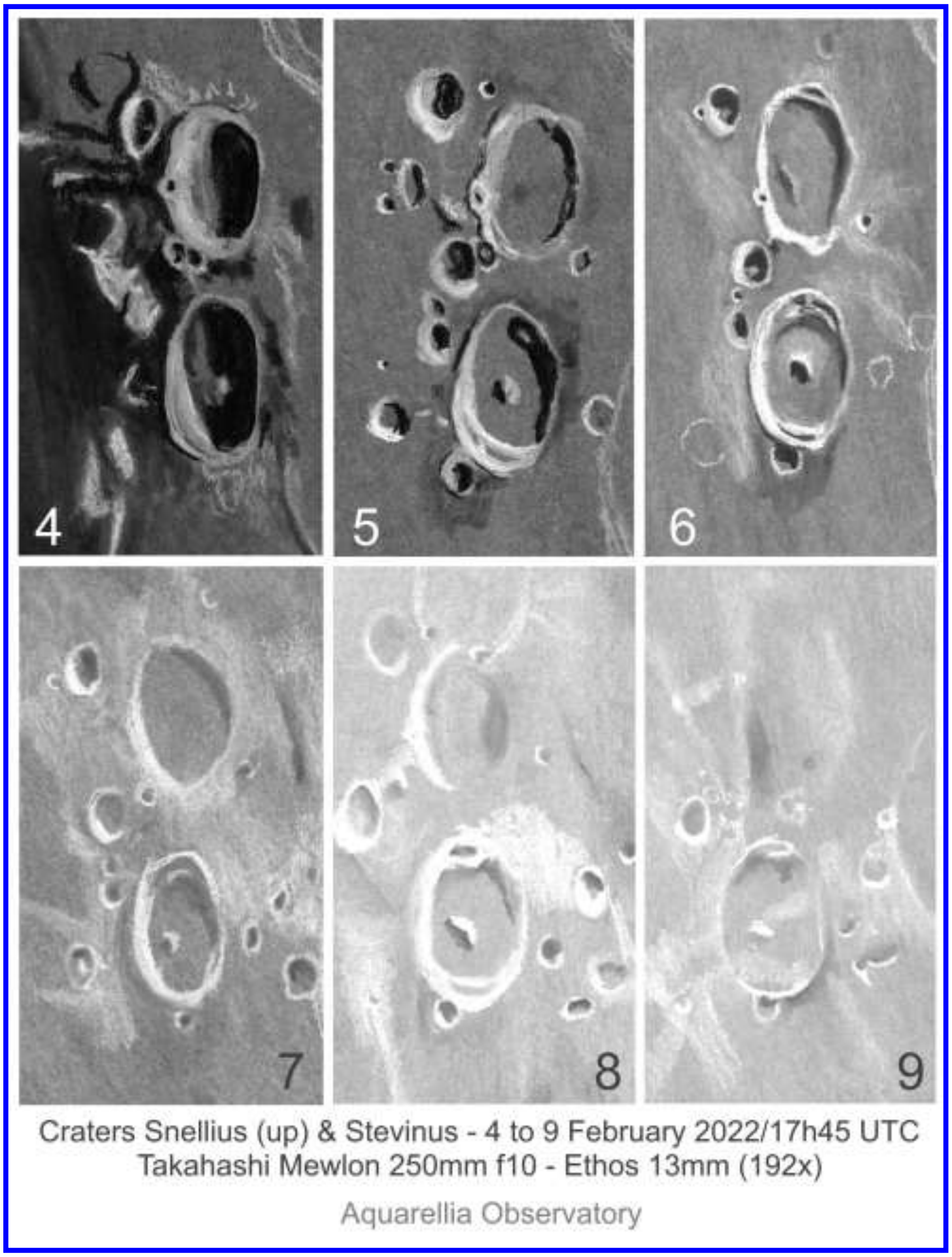


Image 30, Stevinus and Snellius, *Michel Deconinck, Aquarellia Observatory - Artignosc-sur-Verdon - Provence - France. 2022 February 04-09 17:45 UT. 250 mm Takahashi Mewlon telescope, f/10, Ethos 13 mm eyepiece, 192 x.*

Michel's composition, pastel on black paper, deserves a study in itself. Michel tells us that “I made the six sketches with the same material, all at the same time (pastel ended at 17:45 UTC) on the row. In fact, this is a very difficult exercise. I don't take into account the sketch of the days before, so they are all made directly from scratch and through the eyepiece. Don't cheat here. Sometime you will see that position or size of some peripheral craters are not exactly correct. That's the way I'm playing the game in sketching”. You can see how Snellius "disappears" with the most frontal lighting and in the image of February 9 we have a record of the bright rays inside Stevinus. IMAGE 31 is also very interesting because of the contrast between our two craters with their interiors in shadow and soon after we witness the initial stages of the ray’s illumination.

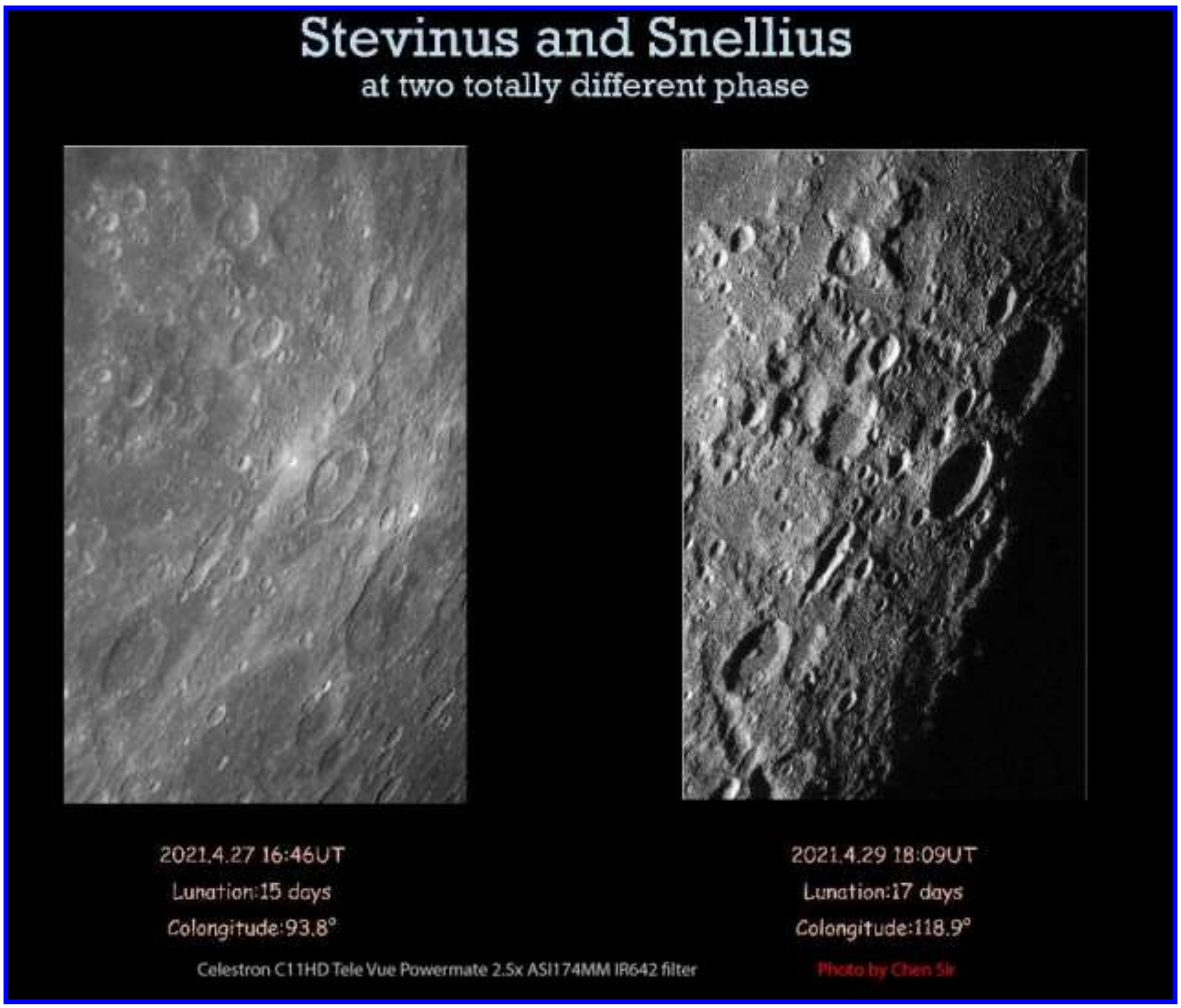


Image 31, Stevinus and Snellius, *Yanjun Chen, Hefei, Anhui, China. 2021 April 27 16:46 UT colongitude 93.8^o and 2021 April 29 18:09 UT colongitude 118.9^o. Celestron 11 inch HD Schmidt-Cassegrain telescope, Tele Vue Powermate 2.5 x, IR 642 nm filter, ZWO ASI174 mm camera.*

The image of the bright ray systems at 44% illumination (in which the rays are already bright) is very similar to IMAGE 32, 33, 34 and 35 where the illumination is 50%, in IMAGE 36 the illumination is 55% and both combined ray systems already cover much of the southeast quadrant of the near side. In IMAGE 37 the illumination is at 61%, in IMAGE 38 the illumination is at 73%, it is difficult to determine if as the illumination is more frontal, they gain in brightness, in IMAGE 39 it is at 82%, in the IMAGE 40 is 92%, IMAGE 41 is 99% and IMAGE 42 and IMAGE 43 is Full Moon. They are very bright rays, in IMAGE 44 they seem to compete in brightness with Proclus, but at Full Moon they do not seem to be so important, overshadowed by Tycho and Copernicus. If we see this sequence (from 32 to 44), it seems that the bright rays of Stevinus and Furnerius start to shine very quickly and as the lunation progresses, they appear less bright, probably a subjective impression due to competition from Tycho, Proclus, Censorinus and other bright lunar features.

Image 32, Stevinus and Snellius*, Jairo Chavez, Popayán, Colombia. 2019 June 11 01:23 UT. 10 inch truss Dobsonian reflector telescope, Sony DSC-WX 50 camera.*

Image 33, Stevinus and Snellius, *Rafael Lara Muñoz, Guatemala, Guatemala, SLA. 2020 May 29 19:34 UT. 114 mm reflector telescope, Samsung Note 9 cell phone camera.*

Image 34, Stevinus and Snellius*, Jairo Chavez, Popayán, Colombia. 2022 January 10 03:17 UT. 12 inch reflector telescope, MOTO E5 PLAY camera.*

Image 35, Stevinus and Snellius, *Raúl Roberto Podestá, Formosa, Argentina. 2022 January 11 01:19 UT. 102 mm refractor telescope, Hokenn CCD camera.*

Image 36, Stevinus and Snellius, *Leonardo Alberto Colombo, Córdoba, Argentina. 2021 March 21 23:11 UT. 67/350 mm telephoto lens, green and yellow filter, QHY5LII-M camera. North is down, west is right.*

Image 37, Stevinus and Snellius*, Jairo Chavez, Popayán, Colombia. 2019 July 11 03:03 UT. 10 inch truss Dobsonian reflector telescope, Sony DSC-WX 50 camera.*

Image 38, Stevinus and Snellius, *Leonardo Alberto Colombo, Córdoba, Argentina. 2021 March 23 23:29 UT. 67/350 mm telephoto lens, green and yellow filter, QHY5LII-M camera. North is down, west is right.*

***Image 39, Stevinus and Snellius**, Jairo Chavez, Popayán, Colombia. 2019 April 16 02:52 UT. 10 inch truss Dobsonian reflector telescope, Sony DSC-WX 50 camera.*

***Image 40, Stevinus and Snellius**, Jairo Chavez, Popayán, Colombia. 2019 August 24 02:23 UT. 10 inch truss Dobsonian reflector telescope, Sony DSC-WX 50 camera.*

Image 41, Stevinus and Snellius*, Jairo Chavez, Popayán, Colombia. 2019 April 19 04:04 UT. 10 inch truss Dobsonian reflector telescope, Sony DSC-WX 50 camera.*

Image 42, Stevinus and Snellius*, Jairo Chavez, Popayán, Colombia. 2020 October 02 02:26 UT. 114 mm Konus reflector telescope, MOTO E5 PLAY camera.*

Image 43, Stevinus and Snellius, *Leonardo Alberto Colombo, Córdoba, Argentina. 2021 August 22 07:59 UT. 70 mm refractor telescope, IR pass 650 nm filter, QHY5LII-M camera. North is down, west is right.*

Image 44, Stevinus and Snellius, *Pedro Romano, San Juan, Argentina. 2021 February 15 22:24 UT. 102 mm Maksutov-Cassegrain telescope, ZWO ASI120 camera.*

Regarding the origin and direction of the bright rays, for Wood (2006): “Stevinus A has some ray material to the south, but that nearly all the rest of its rays define a narrow fan pointing towards the northeast. Similarly, for Furnerius A there is diffuse brightness south of the crater but its rays fan out toward the north. It appears that both of these craters resulted from oblique impacts that focused their rays down range”.

Regarding its extension, Wood (2006) tells us that “There has been uncertainty about the length of these rays, with some suggestion that the ray passing through the west side of Mare Nectaris is from Stevinus A”.

Image 45, Stevinus and Snellius, *Román García Verdier, Paraná, Argentina. 2020 November 01 04:33 UT. 180 mm Newtonian reflector telescope, QHY5-II camera.*

In IMAGE 45 and especially in IMAGE 46 the rays are already in their splendor, projecting towards the north, a ray that seems to emanate from Stevinus A, as suggested by Wood, crosses the western part of Mare Nectaris and, passing through the west of Theophilus, it appears to be lost in the bright highlands to the west of Sinus Asperitatis, while a ray that appears to emanate from Furnerius A plunges into Mare Fecunditatis. For a future study of the extent of rays, such as the one proposed by Wood (2006), images such as IMAGE 47 and IMAGE 48 will be valuable: “It would be a good project to try to photographically document the extent of these rays with high resolution, high Sun imaging”.

Image 46, Stevinus and Snellius, *Román García Verdier, Paraná, Argentina. 2020 September 27 00:02 UT. 180 mm Newtonian reflector telescope, QHY5-II camera.*

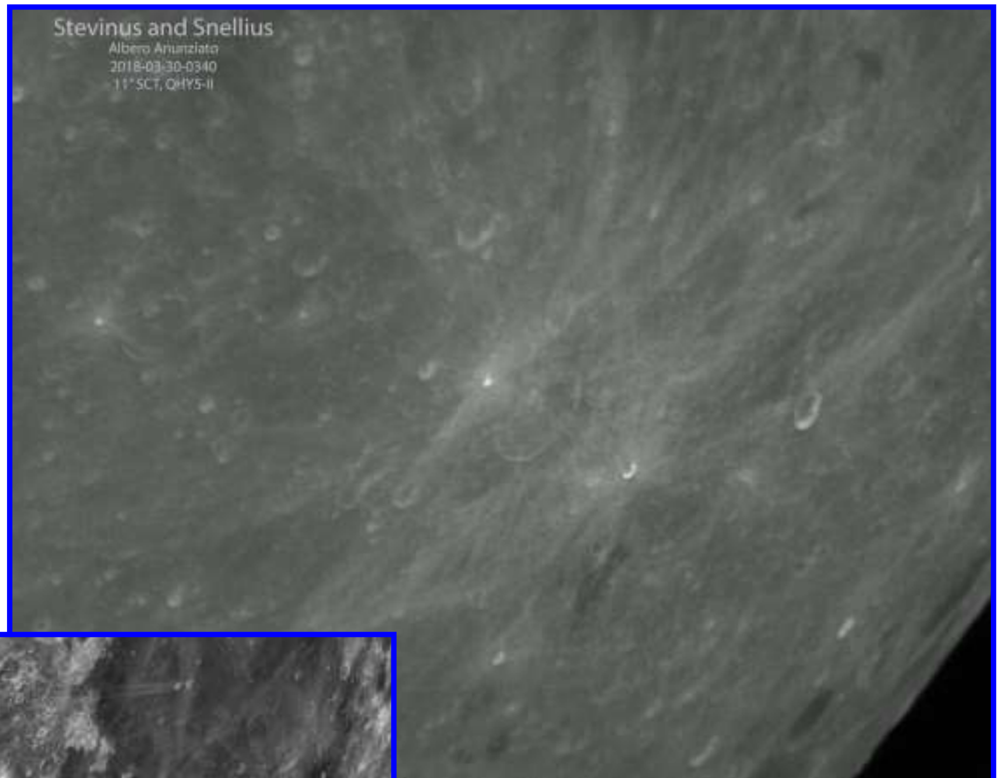


Image 47, Stevinus and Snellius, *Alberto Anunziato, Paraná, Argentina. 2018 March 30 03:40 UT. Celestron 11 inch Edge HD Schmidt-Cassegrain telescope, QHY5-II camera.*

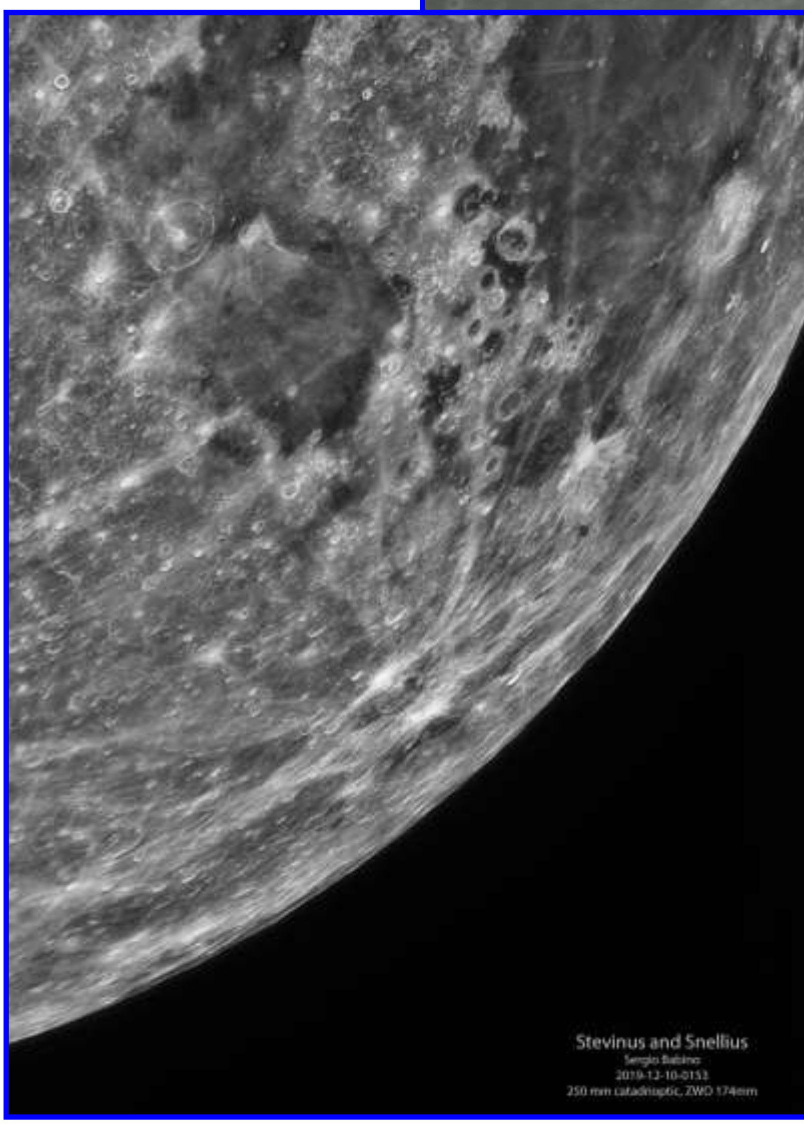


Figure 48, Stevinus and Snellius*, Sergio Babino, Montevideo, Uruguay. 2012 December 10 01:53 UT. 250 mm catadrioptic telescope, ZWO ASI174mm camera.*

IMAGE 49 is very interesting, because it shows this detail, which Wood (2006) pointed out: "Radiating from Stevinus A, just north of Stevinus, is a series of dark ribbons that don't look like rays - I wonder what they are". As it is a very good resolution image, we can zoom in on it and trace the path of the bright rays, observing that they lose brightness as they move away from their original crater and that they even disappear in places like the ray that crosses the west part of Mare Nectaris.

Figure 49, Stevinus and Snellius*, Sergio Babino, Montevideo, Uruguay. 2012 December 10 01:53 UT. 250 mm catadrioptic telescope, ZWO ASI174mm camera.*

We found it interesting to analyze these two conspicuous craters with bright rays according to the objectives of the ALPO's Bright Lunar Rays Project. Do rayed craters form any noticeable groups or clusters? Evidently, our two bright ray craters form a grouping of rays, many of them very difficult to determine which crater they come from. We found it interesting to analyze these two conspicuous craters with bright rays according to the objectives of the ALPO's Bright Lunar Rays Project. Do rayed craters form any noticeable groups or clusters? Evidently, our two bright ray craters form a grouping of rays, many of them very difficult to determine which crater they come from.

Regarding the structure: Are the rays evenly distributed around the crater of origin? In both craters the distribution is not homogeneous, as Wood points out, most of the ejecta goes towards the north, which would be related to a probable oblique impact of origin, probably from the south, as seen in IMAGE 50 and 51.

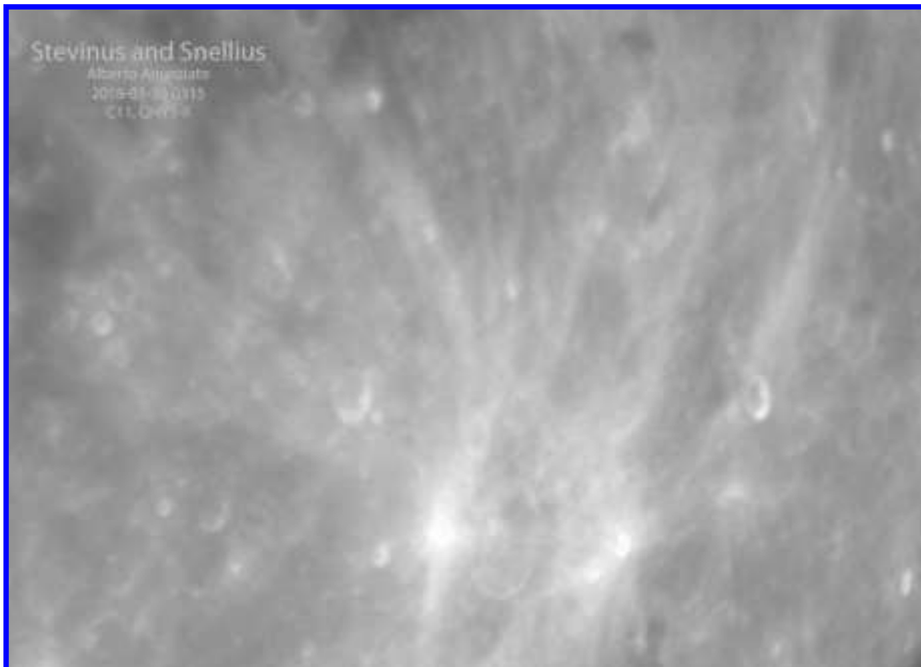


Image 50, Stevinus and Snellius, *Alberto Anunziato, Paraná, Argentina. 2018 March 30 03:15 UT. Celestron 11 inch Edge HD Schmidt-Cassegrain telescope, QHY5-II camera.*

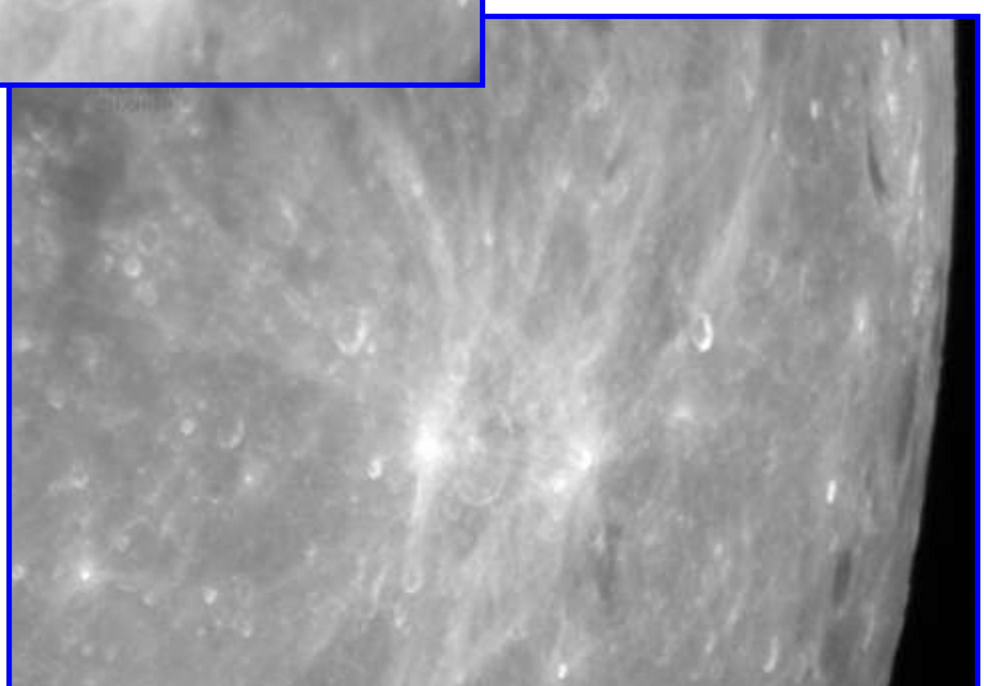


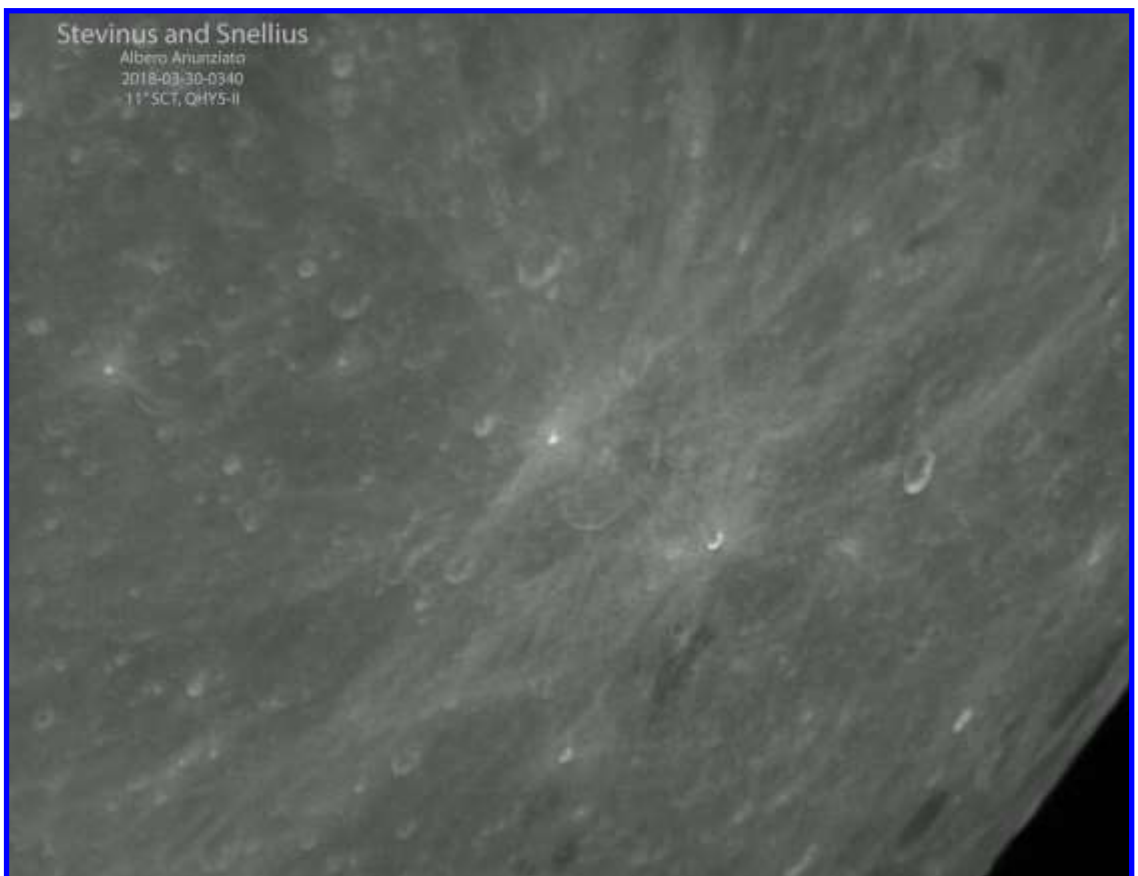
Image 51, Stevinus and Snellius, *Alberto Anunziato, Paraná, Argentina. 2018 March 30 03:17 UT. Celestron 11 inch Edge HD Schmidt-Cassegrain telescope, QHY5-II camera.*

If the rays emanate from a crater, do they start from its center, edge or some way from the rim? It's very hard to tell for craters so small and so bright that we can't see inside. In IMAGE 52 we can see that the rays continue the bright ejecta around both craters, there is no separation, but we do not have images of their interior.

What is the start and end point of individual rays and ray systems? The starting point of the complex system of bright rays Stevinus A/Furnerius A is clearly the edge (perhaps the interior) of those craters and the ending point of the individual rays is always very difficult to pin down, in this case the rays, according to Wood, extend mainly in a north-northeast direction, and in that direction, there are rays that reach as far as Taruntius and the vicinity of Mare Crisium. To the south the lack of contrast with the bright highlands they pass through and the bright rays from Tycho make it difficult to identify the end point. Will any ray reach the far side?

Appearance of rays: How does the brightness and/or color of a ray change during the lunation? Are there differences in brightness and/or color between one ray system and another? Does the brightness and/or color of a ray change along its length? These are very interesting questions to ask, which would require a study similar to the one by Michel Deconinck documented by IMAGE 29, since the images we have come from different instruments and processing.

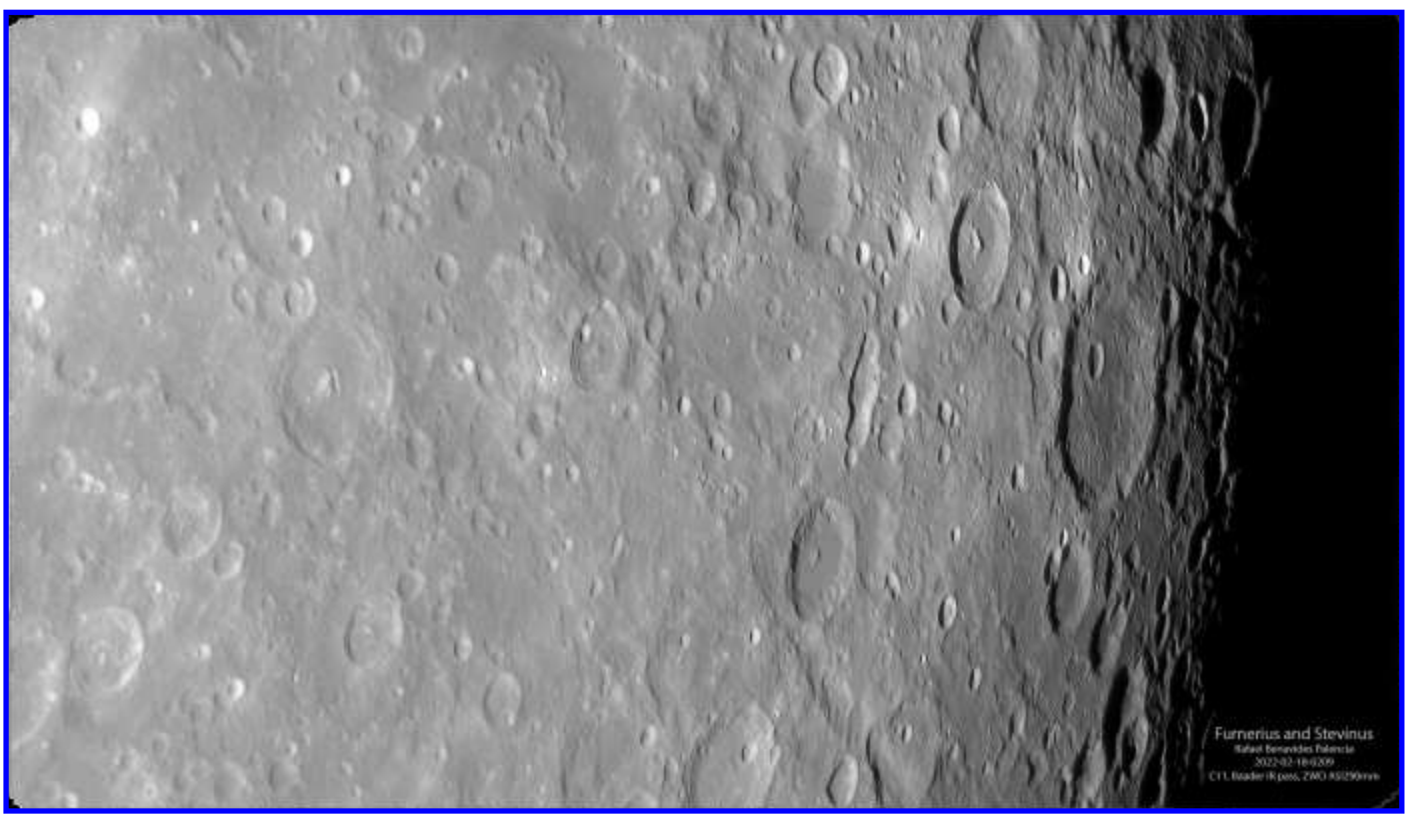
Image 52, Stevinus and Snellius, *Alberto Anunziato, Paraná, Argentina. 2018 March 30 03:40 UT. Celestron 11 inch Edge HD Schmidt-Cassegrain telescope, QHY5-II camera.*



Are craters always brighter than their rays or do any of the rays exceed the brightness of the main crater? In IMAGE 45, for example, we see that in the case of Stevinus A and Furnerius A both are brighter than the rays that emanate from them, although with that frontal illumination it becomes difficult to distinguish between the crater and adjacent ejecta.

Stevinus and Snellius, *Fabio Verza, SNdR, Milan, Italy. 2022 February 08 20:52 UT. Meade 12 inch LX200-ACF Schmidt-Cassegrain telescope, Baader Neodymium IR Block filter, ZWO ASI290MM camera.*

Furnerius and Stevinus, *Rafael Benavides Palencia, Cordoba, Spain. 2022 February 18 02:09 UT. Celestron 11 inch Schmidt-Cassegrain telescope, Baader IR pass filter, ZWO ASI290mm camera, seeing 3/10, transparency 5/6.*



Are the rays consistently brightest at the Full Moon, when the sun is overhead at their location, or at any other time during a lunation? As we said, it seems that the brightness of these rays rises very quickly and then declines towards the full Moon, but I'm afraid that is a subjective conjecture that would require more continuous recording.

The Japanese Hiten probe (the first lunar probe to break the USA-USSR monopoly) was deliberately crashed on April 10, 1993 at 34.3ºS-55.6ºE, between Stevinus and Furnerius, so the area we chose has historical importance for the exploration of our beloved orbiting companion.

Stevinus and Snellius, Fabio Verza, SNdR, Milan, Italy. 2022 February 05 18:50 UT. Meade 12 inch LX200-ACF Schmidt-Cassegrain telescope, Baader Neodymium IR Block filter, ZWO ASI290MM camera.

BIBLIOGRAPHY:

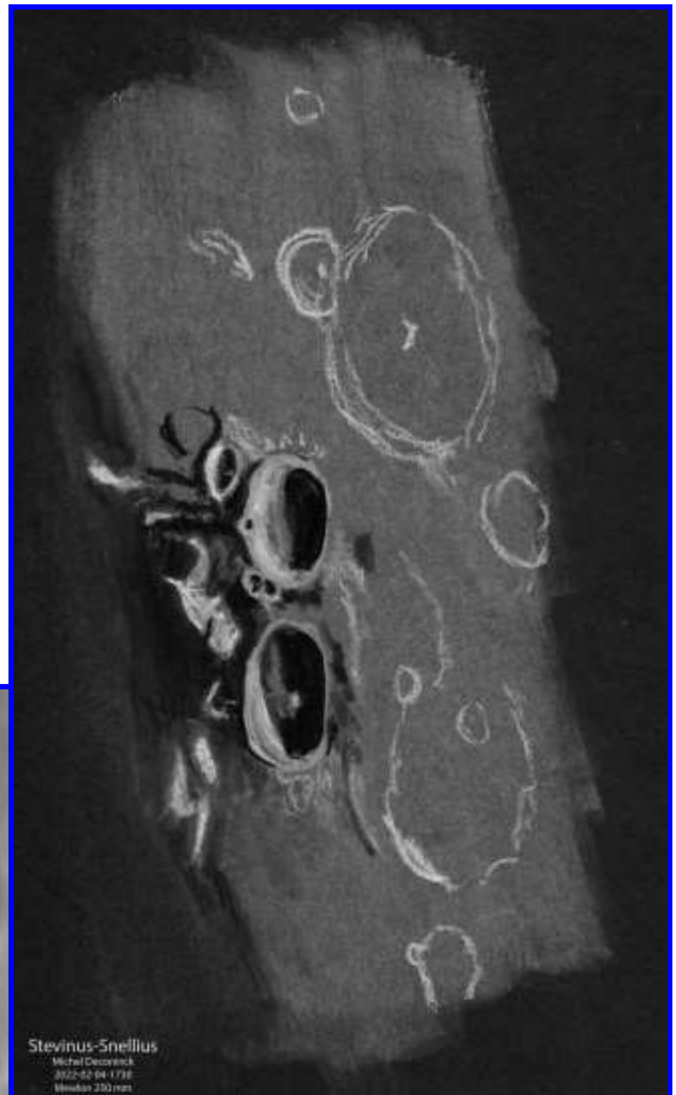
ALPO, Bright Rays Craters Project, : http://alpo-astronomy.org/

Elger, Thomas G. (1895), The Moon, George Philip & son, London.

Garfinkle, Robert (2020), Luna Cognita, Springer, New York.

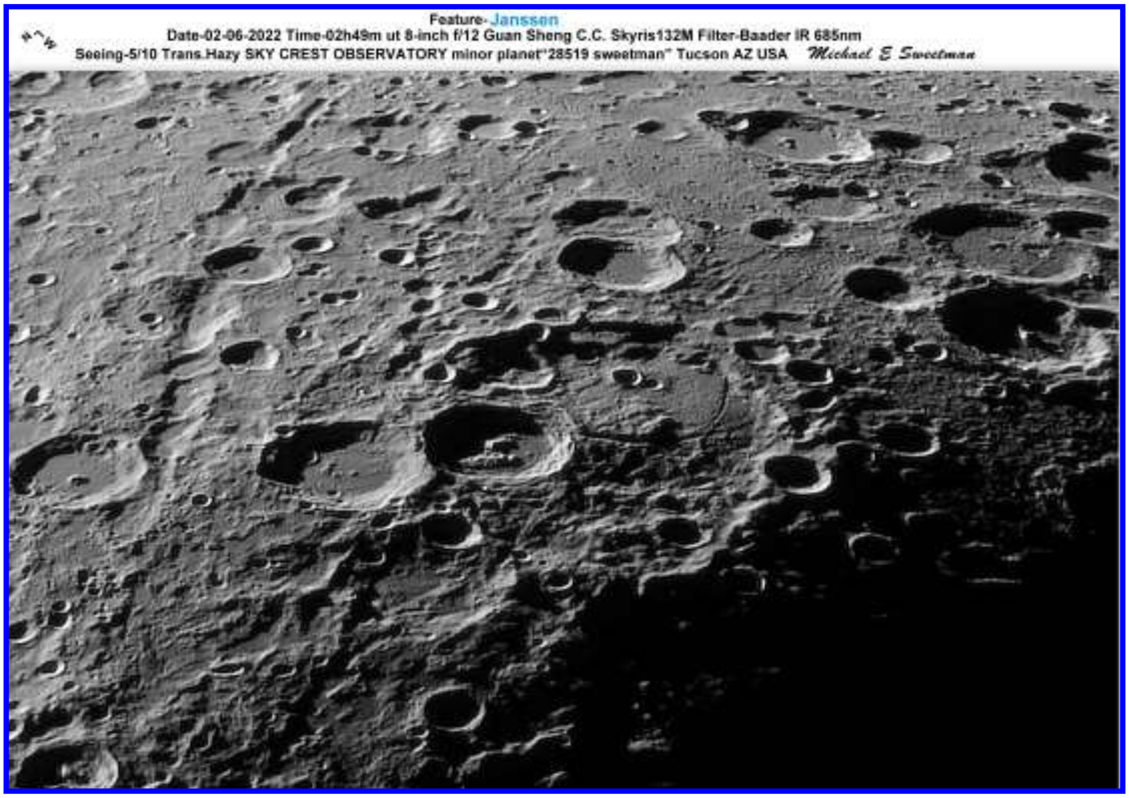
Wood, Charles: "An unfamiliar fresh crater", Lunar Picture of the Day-September 20, 2007. En: http://www2.lpod.org/wiki/September_20,_2007

Wood, Charles: "Headlights of Stevinus", Lunar Picture of the Day-October 8, 2006. En: http://www2.lpod.org/wiki/October_8,_2006



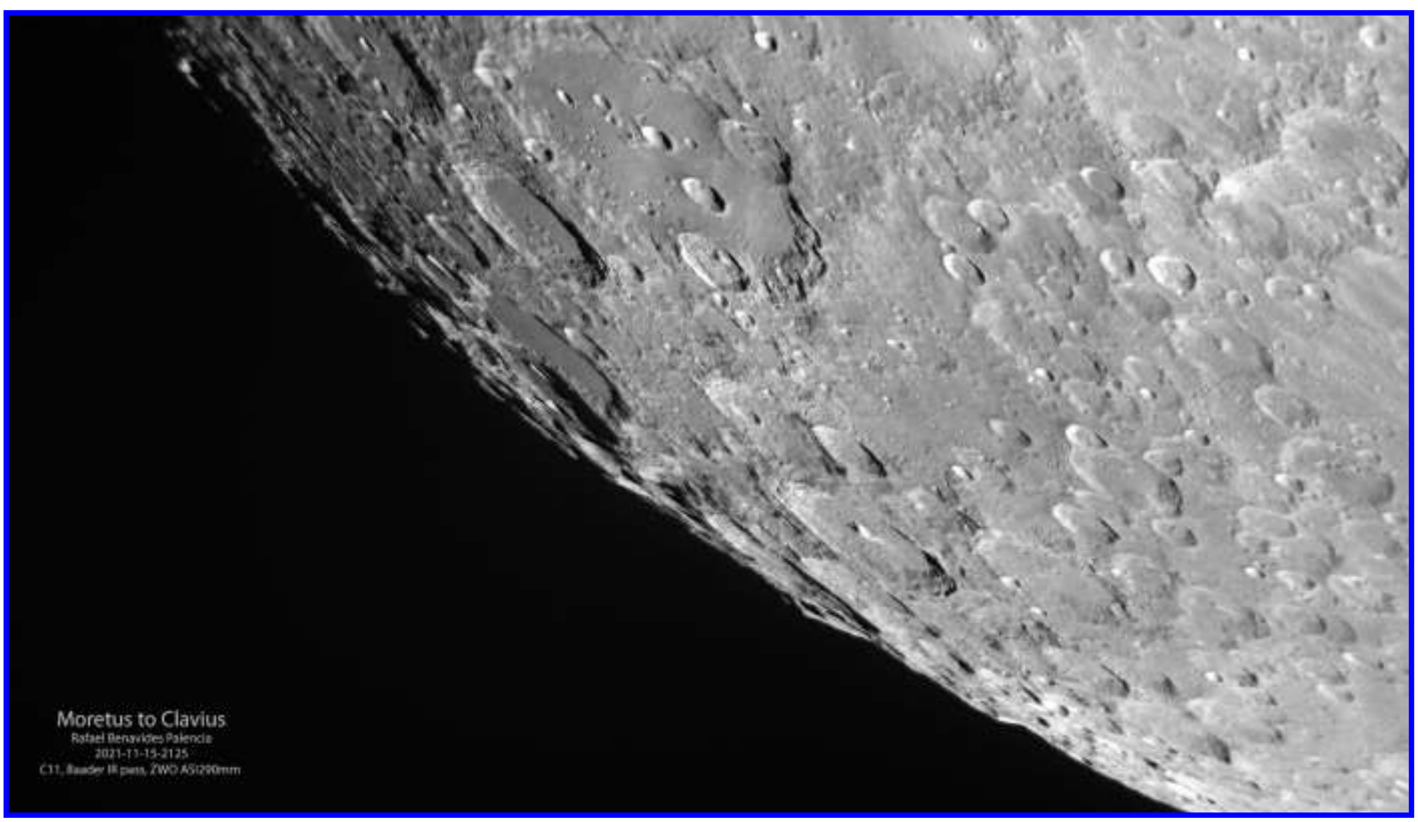
Stevinus and Snellius, *Michel Deconinck, Aquarellia Observatory - Artignosc-sur-Verdon - Provence - France. 2022 February 04 17:30 UT. 250 mm Takahashi Mewlon telescope, f/10, Ethos 13 mm eyepiece.*

Stevinus and Snellius, *Fabio Verza, SNdR, Milan, Italy. 2022 February 08 20:50 UT. Meade 12 inch LX200-ACF Schmidt-Cassegrain telescope, Baader Neodymium IR Block filter, ZWO ASI290MM camera.*

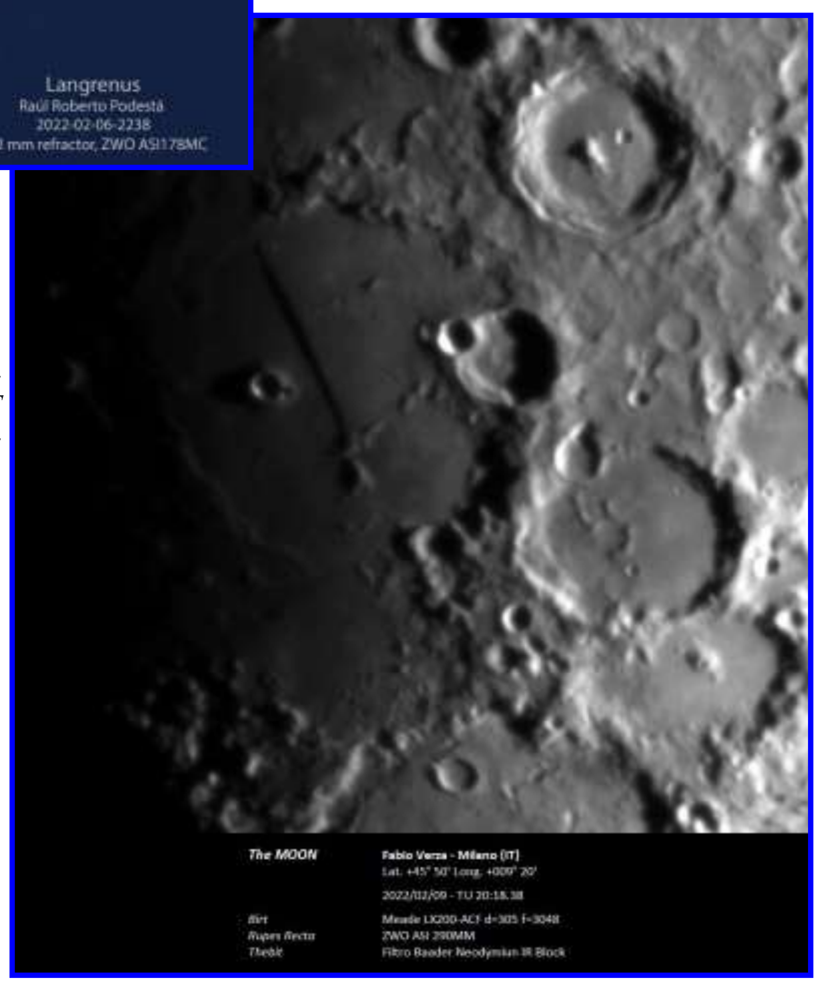


Janssen, *Michael E. Sweetman, Sky Crest Observatory, Tucson, Arizona, USA. 2022 February 06 02:49 UT. 8 inch f/12 Classical Cassegrain telescope, Baader 685 mm IR filter, Skyris 132 m camera. Seeing 5/10, transparency 3.5/6.*

Moretus to Clavius, *Rafael Benavides Palencia, Cordoba, Spain. 2021 November 15 21:25 UT. Celestron 11 inch Schmidt-Cassegrain telescope, Baader IR pass filter, ZWO ASI290mm camera, seeing 7/10, transparency 5/6.*



Langrenus, *Raúl Roberto Podestá, Formosa, Argentina. 2022 February 06 23:38 UT. 102 mm refractor telescope, ZWO ASI178 MC camera.*



Birt, *Fabio Verza, SNdR, Milan, Italy. 2022 February 09 20:18 UT. Meade 12 inch LX200-ACF Schmidt-Cassegrain telescope, Baader Neodymium IR Block filter, ZWO ASI290MM camera.*

Atlas, *Michael E. Sweetman, Sky Crest Observatory, Tucson, Arizona, USA. 2022 February 06 02:58 UT. 8 inch f/12 Classical Cassegrain telescope, Baader 685 mm IR filter, Skyris 132 m camera. Seeing 5/10, transparency 3.5/6.*

Mare Tranquillitatis, *Christian Viladrich, 2021 October 25 03:50 UT. 500 mm Ritchey Chretien telescope, red filter, ZWO ASI290 camera.*

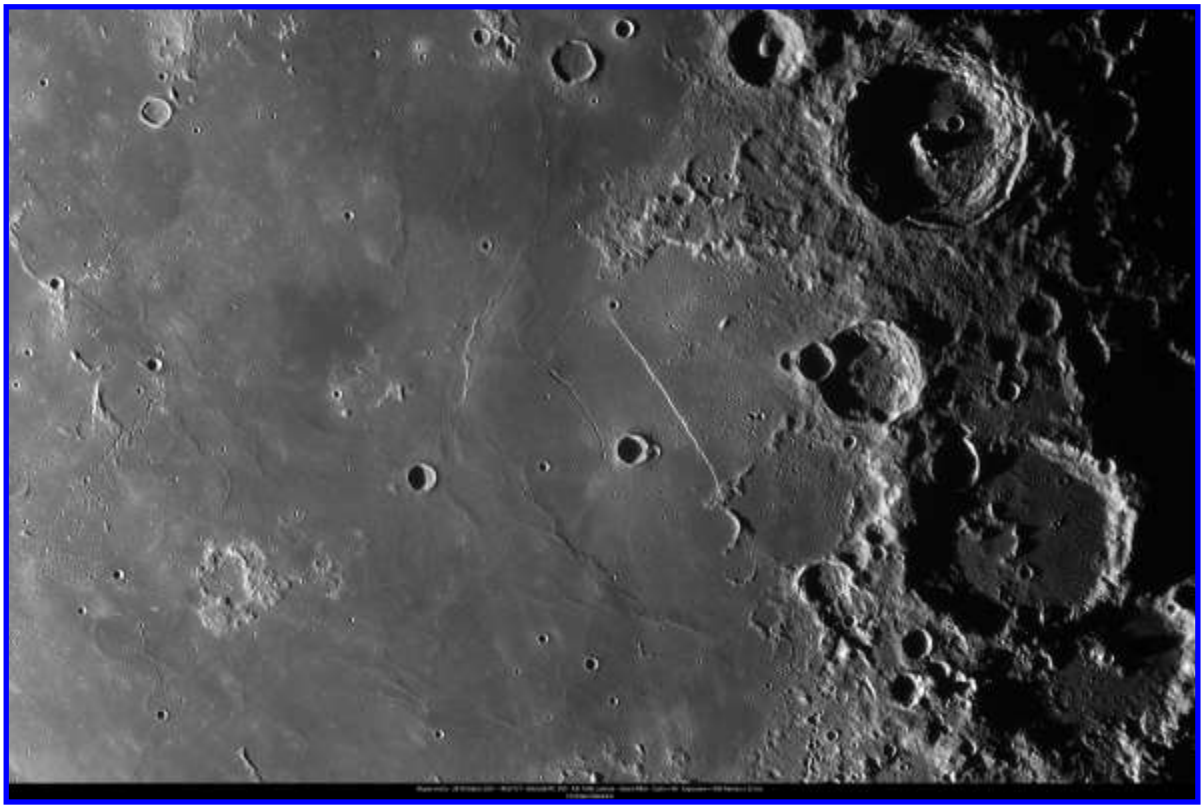
Plinius, *Christian Viladrich, 2021 October 25 03:40 UT. 500 mm Ritchey Chretien telescope, red filter, ZWO ASI290 camera.*

Waxing Gibbous Moon, *González Cian, Abel David Emiliano, AEA, Paraná, Argentina. 2022 February 14 21:17 UT. Meade DS2114 114 mm reflector telescope, Celestron 2 x barlow, Nikon D3100 camera.*

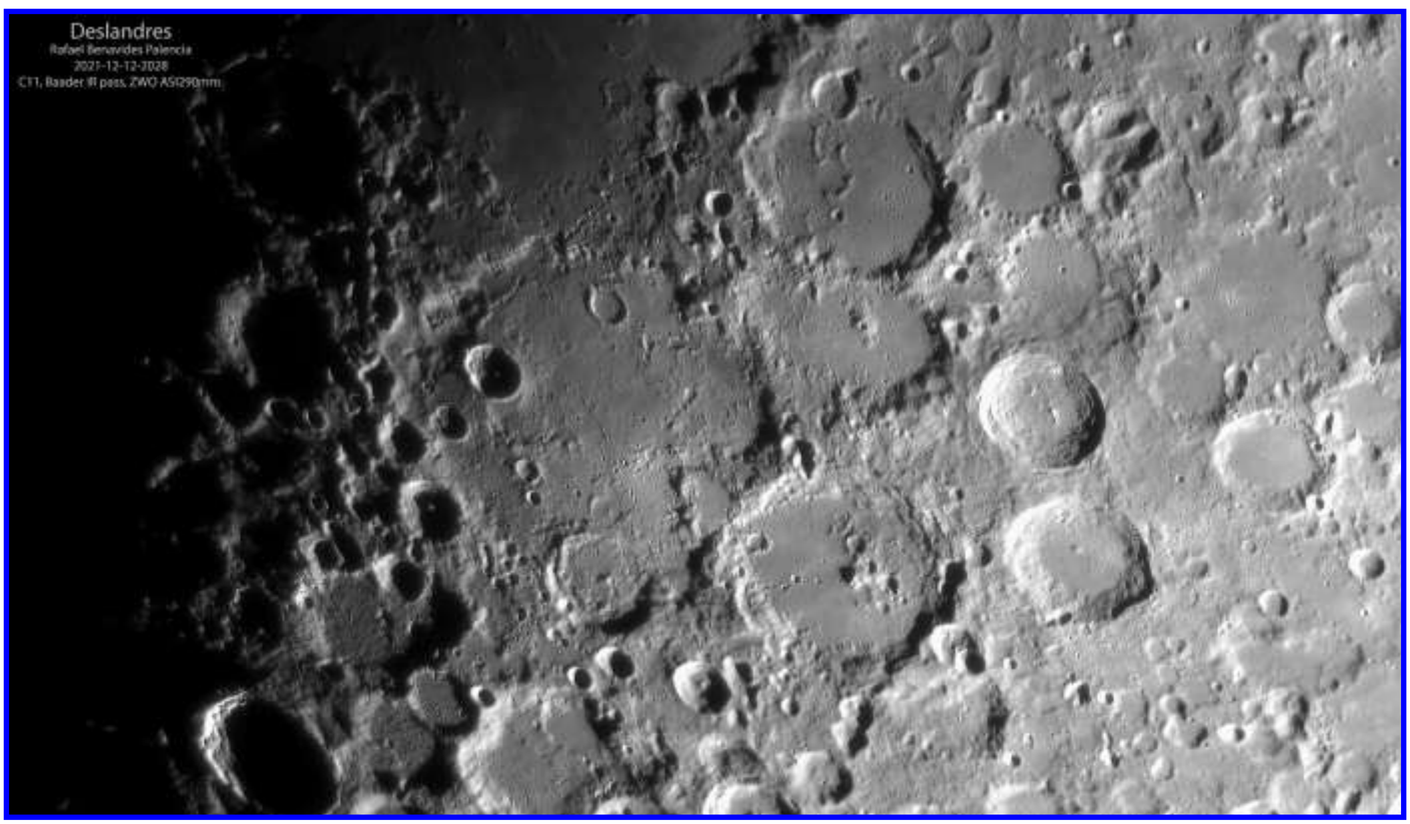
***Menelaus,** Christian Viladrich, 2021 October 26 04:22 UT. 500 mm Ritchey Chretien telescope, red filter, ZWO ASI1600 camera.*

***Catharina, Cyrillus, Theophilus, Mare Nectaris,** Rafael Benavides Palencia, Cordoba, Spain. 2022 January 22 02:40 UT. Celestron 11 inch Schmidt-Cassegrain telescope, Baader IR pass filter, ZWO ASI290mm camera, seeing 5/10, transparency 5/6.*

Rupes Recta, *Christian Viladrich, 2021 October 28 04:37 UT. 500 mm Ritchey Chretien telescope, green filter, ZWO ASI1600 camera.*



Deslandres, *Rafael Benavides Palencia, Cordoba, Spain. 2021 December 12 20:28 UT. Celestron 11 inch Schmidt-Cassegrain telescope, Baader IR pass filter, ZWO ASI290mm camera, seeing 6/10, transparency 5/6.*



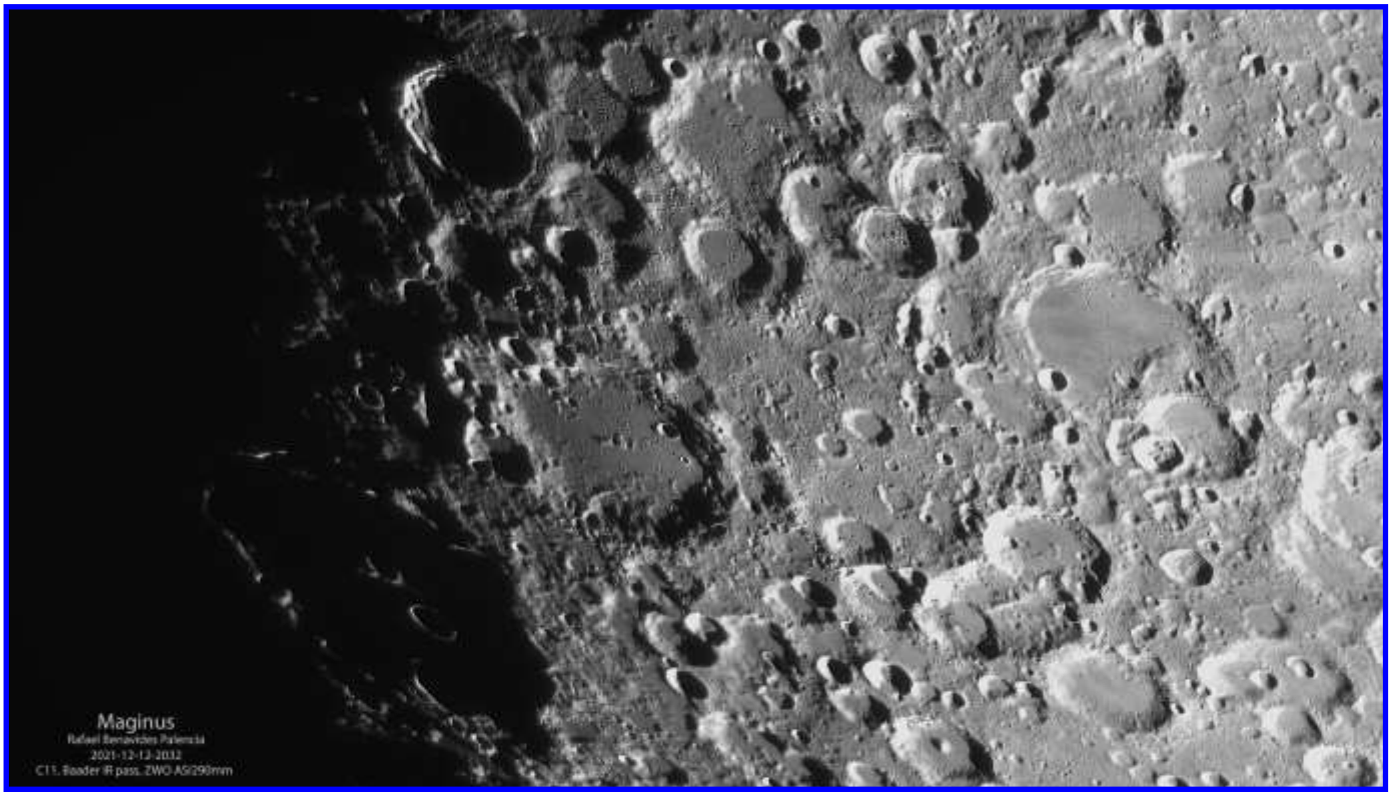
Posidonius, *Christian Viladrich, 2021 October 25 03:35 UT. 500 mm Ritchey Chretien telescope, red filter, ZWO ASI290 camera.*

Plato, Aristoteles and Eudoxus, *Fernando Surá, San Nicolás de los Arroyos, Argentina. 2022 January 12 01:50 UT. 127 mm Maksutov-Cassegrain telescope, CPL Sbony filter, Canon Revel T7i Reflex camera.*

Tycho and Luna Incognita, *Leandro Sid, AEA, Oro Verde, Argentina. 2022 February 16 02:49 UT. Meade StarNavigator NC 90 mm Maksutov-Cassegrain telescope, Motorola One Fusion camera.*

Leandro adds: In the center of the image, the Tycho crater, further down, towards the SW, show the area called: "Luna Incognita". Taking advantage of the special moment of libration in latitude -06°56´ and libration in longitude -05°10, Hausen, Doerfel, Boltzmann and Drygalski craters appear. Note: Poor seeing.

Fracastorius, *Raúl Roberto Podestá, Formosa, Argentina. 2022 February 06 23:43 UT. 102 mm refractor telescope, ZWO ASI178 MC camera.*



***Maginus,** Rafael Benavides Palencia, Cordoba, Spain. 2021 December 12 20:32 UT. Celestron 11 inch Schmidt-Cassegrain telescope, Baader IR pass filter, ZWO ASI290mm camera, seeing 6/10, transparency 5/6.*

***Archimedes,** Fabio Verza, SNdR, Milan, Italy. 2022 February 09 20:36 UT. Meade 12 inch LX200-ACF Schmidt-Cassegrain telescope, Baader Neodymium IR Block filter, ZWO ASI290MM camera.*

Mare Crisium, *Raúl Roberto Podestá, Formosa, Argentina. 2022 February 06 22:44 UT. 102 mm refractor telescope, ZWO ASI178 MC camera.*

Langrenus, *Fabio Verza, SNdR, Milan, Italy. 2022 February 05 18:44 UT. Meade 12 inch LX200-ACF Schmidt-Cassegrain telescope, Baader Neodymium IR Block filter, ZWO ASI290MM camera.*

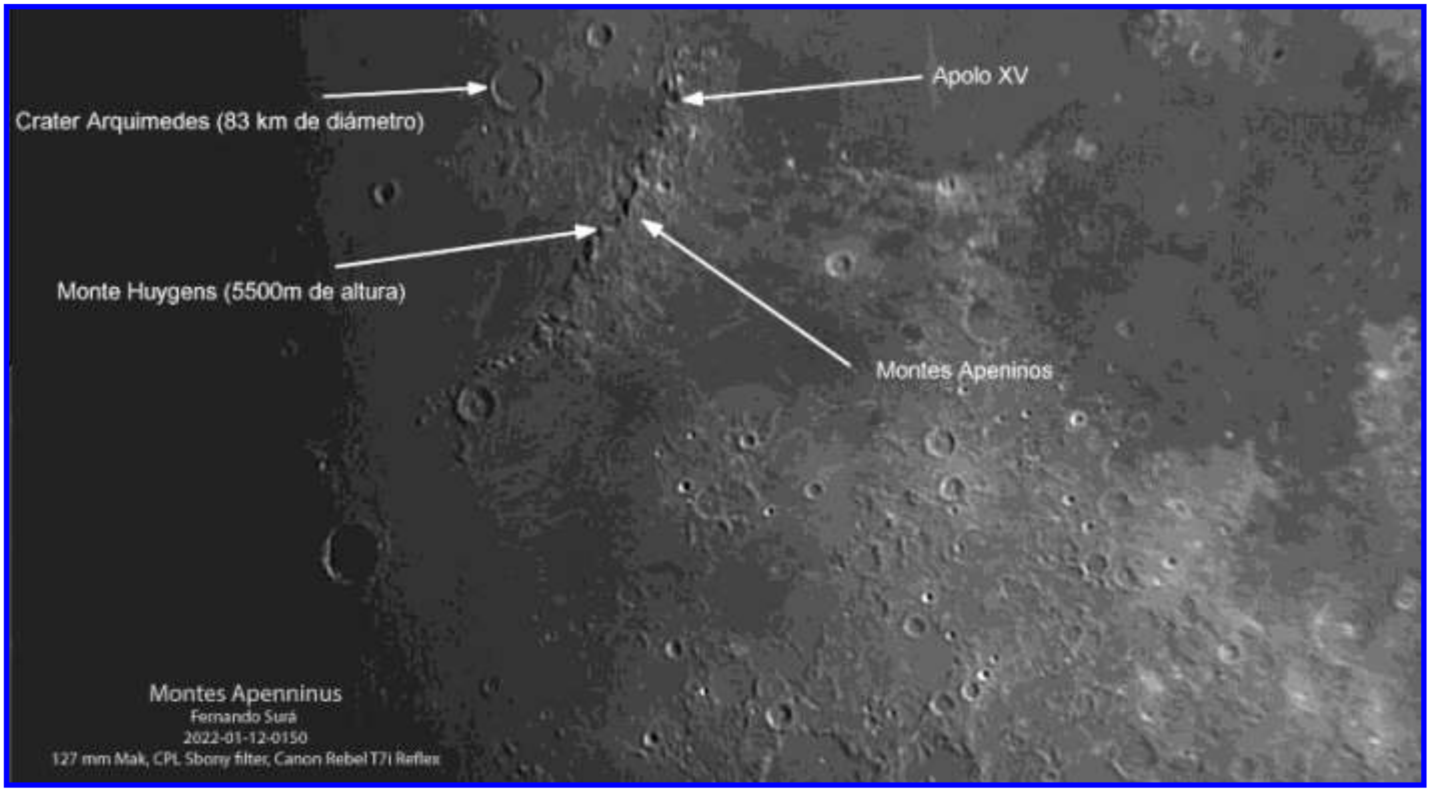
Ptolemaeus, Alphonsus and Arzachel, *Fernando Surá, San Nicolás de los Arroyos, Argentina. 2022 January 12 01:50 UT. 127 mm Maksutov-Cassegrain telescope, CPL Sbony filter, Canon Revel T7i Reflex camera.*

Mare Humboldtianum, *Fabio Verza, SNdR, Milan, Italy. 2022 February 05 18:42 UT. Meade 12 inch LX200-ACF Schmidt-Cassegrain telescope, Baader Neodymium IR Block filter, ZWO ASI290MM camera.*

Ptolemaeus, *Fabio Verza, SNdR, Milan, Italy. 2022 February 09 19:05 UT. Meade 12 inch LX200-ACF Schmidt-Cassegrain telescope, Baader Neodymium IR Block filter, ZWO ASI290MM camera.*

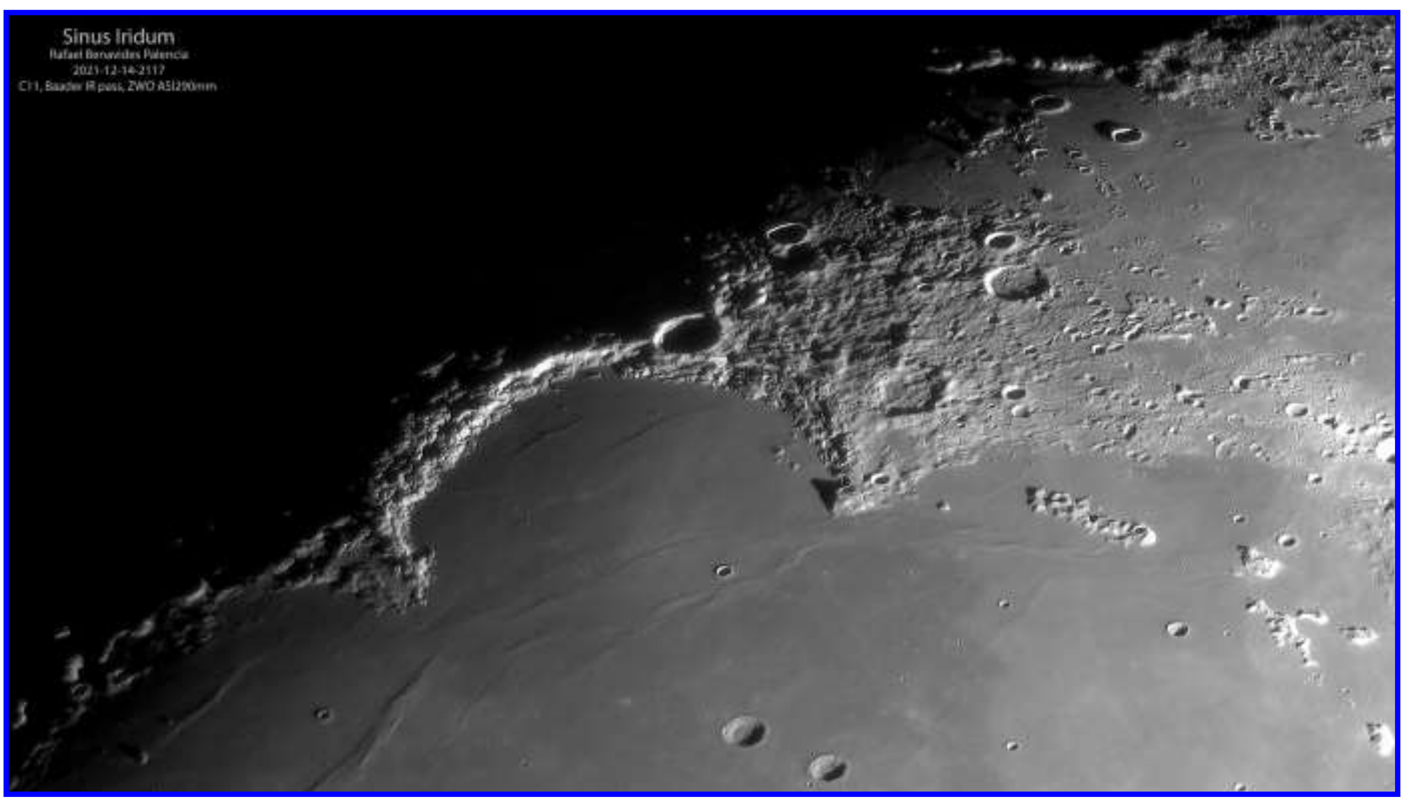
Vendelinus, *Rafael Benavides Palencia, Cordoba, Spain. 2022 February 18 01:39 UT. Celestron 11 inch Schmidt-Cassegrain telescope, Baader IR pass filter, ZWO ASI290mm camera, seeing 3/10, transparency 5/6.*

Full Moon, *Leandro Sid, AEA, Oro Verde, Argentina. 2022 February 16 02:37 UT. Meade StarNavigator NC 90 mm Maksutov-Cassegrain telescope, Motorola One Fusion camera.*



Montes Apenninus, *Fernando Surá, San Nicolás de los Arroyos, Argentina. 2022 January 12 01:50 UT. 127 mm Maksutov-Cassegrain telescope, CPL Sbony filter, Canon Revel T7i Reflex camera.*

Sinus Iridum, *Rafael Benavides Palencia, Cordoba, Spain. 2021 December 14 21:17 UT. Celestron 11 inch Schmidt-Cassegrain telescope, Baader IR pass filter, ZWO ASI290mm camera, seeing 7/10, transparency 5/6.*



Lunar Geologic Change Detection Program

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2022 March

LTP reports: No LTP reports have been received for January.

Routine Reports received for January included: Jay Albert (Lake Worth, FL, USA - ALPO) observed: Aristarchus, Daniel, Kepler, Piccolomini, Plato, Proclus and Theophilus. Alberto Anunziato (Argentina – SLA) observed: Gassendi, Messier A, Plato, Puiseux. Tycho and several features. Maurice Collins (New Zealand – ALPO/BAA/RASNZ) imaged: Lacus Mortis, Theophilus and several features. Anthony Cook (Newtown – ALPO/BAA) videoed earthshine and imaged several features. Walter Elias (Argentina – AEA) imaged: Albategnius, Alphonsus, Chacornac, Fracastorius, Halley, Hyginus N, Maskelyne, Menelaus, Montes Teneriffe, the lunar disk, Protagoras, Petavius, Plato, Theaetetus, and Tycho. Valerio Fontani (Italy – UAI) imaged: Censorinus, Copernicus, Herodotus and Vallis Schroteri. Les Fry (West Wales – NAS) imaged: Arzachel, Bullialdus, Clavius, Copernicus, Dorsum Bucher, earthshine, Eratosthenes, Fra Mauro, Gassendi, Hainzel, Kepler, Mare Crisium, Mare Humboldtianum, Mare Smythii, Miller, Montes Alpes, Montes Apenninus, Montes Recti, Pitatus, Rupes Recta, the southern limb of the Moon, the lunar south pole, Scheiner, Schiller, Sinus Iridum, Thales, Tycho and W Bond. Massimo Giuntoli (Italy) observed Cavendish E. Mark Radice (Near Salisbury, UK – BAA) imaged: Aristarchus, Gassendi, Jansen, Kepler, Mare Orientale, Marius, Messier, Neander, the southern lunar limb, the lunar south pole, Schiller and Taruntius. Trevor Smith (Codnor, UK – BAA) observed: Aristarchus, Atlas, Curtis, Daniell, earthshine, Moltke, Plato, Proclus, Torricelli B and several features. Bob Stuart (Rhayader, UK – BAA) imaged: Aristarchus, Aristotles, Atlas, Bohnenberger, Boussingault, Brenner, Capella, Clavius, Democritus, Fracastorius, Gassendi, Gutenberg, Hainzel, Herschel, Hommel, Isidorus, Jansen, Kepler, Macrobius, Magelhaens, Manzinus, Mare Frigoris, Mare Imbrium, Mutus, Neander, Nearch, Piccolomini, Possidonius, Prinz, Romer, Santbech, Schickard, Schiller, Sinus Iridum, Taruntius, and Vlacq. Franco Taccogna (Italy – UAI) imaged: Herodotus and Vallis Schroteri. Aldo Tonon (UAI) imaged: Bailly, Censorinus, Herodotus, Kies, and Vallis Schroteri. Gary Varney (Pembroke Pines, FL, USA – ALPO) imaged Aristarchus.

Routine Reports Received:

Note that both time and page space are limited this month for a full analysis, so it will be left up to the reader to compare the original and modern-day observations:

Theophilus: On 2022 Jan 08 UT 01:55-02:30 Jay Albert observed this and Proclus and Piccolomini craters under similar illumination to the following report:

On 1990 Aug 26 at UT 02:30-03:30 W. Cameron (Sedona, AZ, USA, 8" reflector, x110 and x220, seeing=good) observed that the west wall of Theophilus crater was red (on terminator). However, Posidonius was also on the terminator and no color was seen elsewhere along the terminator, however Proclus and Piccolomini had pink interiors. At a higher power of x220 a prismatic effect was seen on the terminator in Theophilus and other craters - "even on W rim of a crater due W of Theoph.". CED measurements of Theophilus... 3.5, 3.9, 3.5. The Cameron 2006 catalog ID=407 and the weight=3. The ALPO/BAA weight=1 because the Moon was below the horizon at this time.

Jay, was using a Celestron NexStar Evolution 8" SCT, magnification initially 185x then 226x. Transparency was initially 4th magnitude dropping to 3rd by the close of the session due to increasing haze. Seeing dropped from 6/10 to 3/10. The interior of this crater was in full shadow. The exterior E wall was highly detailed, but only fragments of the other rims of the crater were sunlit. He did not see the reported red color on the interior W wall at first using 185x. However, upon closer inspection at 226x he saw color on the central, brightest fragment of the interior W rim. The lower part of this rim fragment was a razor thin red line. Above the red was a thicker strip of white and on top was a razor thin blue line. This color pattern is typical of the kind of atmospheric spectral dispersion that can be observed on bright objects during periods of bad seeing.

Censorinus: On 2022 Jan 08 UT 17:48 Valerio Fontani captured an image that corresponded to the colongitude range in the following Lunar Schedule request:

ALPO Request: The aim here is simply to see at what earliest colongitude can you record with a color camera, natural blue color on the crater during sunrise. The effect can be quite impressive. Try to get the exposure right else the crater will be saturated white and you will not capture any color. Please send your images to: a t c @ a b e r . a c . u k

Figure 1. *Censorinus at 17:49 UT as imaged by Valerio Fontani (UAI) with north towards the top. Image has been color normalized and had its color saturation increased to 60%.*

Fig 1 Shows a hint of blueness in the ejecta blanket around the crater. Therefore, the blue color appears as early as a colongitude of 341.0°.

Proclus: On 2021 Jan 11 UT 18:55 Les Fry (NAS) imaged Mare Crisium under similar illumination to the following ng report:

Proclus 1976 Jul 06 UT 01:35 Observed by Bartlett (Baltimore, MD, USA, 3" refractor, 40-450x, S=6, T=3) "Nothing vis. on floor (albedo=2 deg?)(usually features are vis.)" NASA catalog weight=4.NASA catalog ID #1437. ALPO/BAA weight=2.

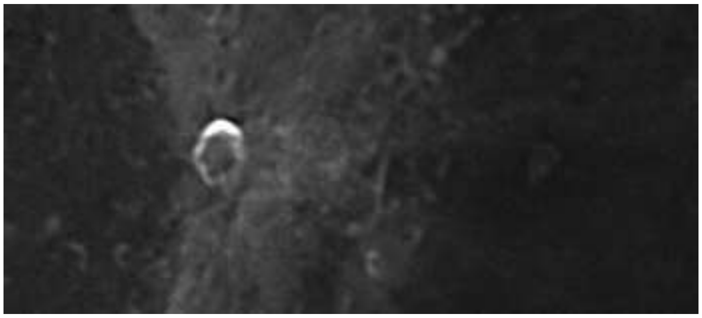


Figure 2. *Proclus enlarged up from a bigger image of Mare Crisium captured by Les Fry (NAS) on 2021 Jan 11 at 18:55 UT. North is towards the top.*

Well according to the image that Les took (Fig 2) there is some detail on the floor of Proclus, so a lack of detail (as seen by Bartlett) would be unusual. We shall therefore leave the weight as it is, but continue to collect similar resolution images captured with a view to seeing if the atmospheric conditions could have contributed to Bartlett's observation

Herodotus

On 2022 Jan 14 UT 16:16 to 17:14 Franco Taccogna (UAI) imaged this crater for the following Lunar Schedule request:

BAA Request: Some astronomers have occasionally reported seeing a pseudo peak on the floor of this crater. However, there is no central peak! Please therefore image or sketch the floor, looking for anything near the centre of the crater resembling a light spot, or some highland emerging from the shadow. All reports should be emailed to: a t c @ a b e r . a c . u k

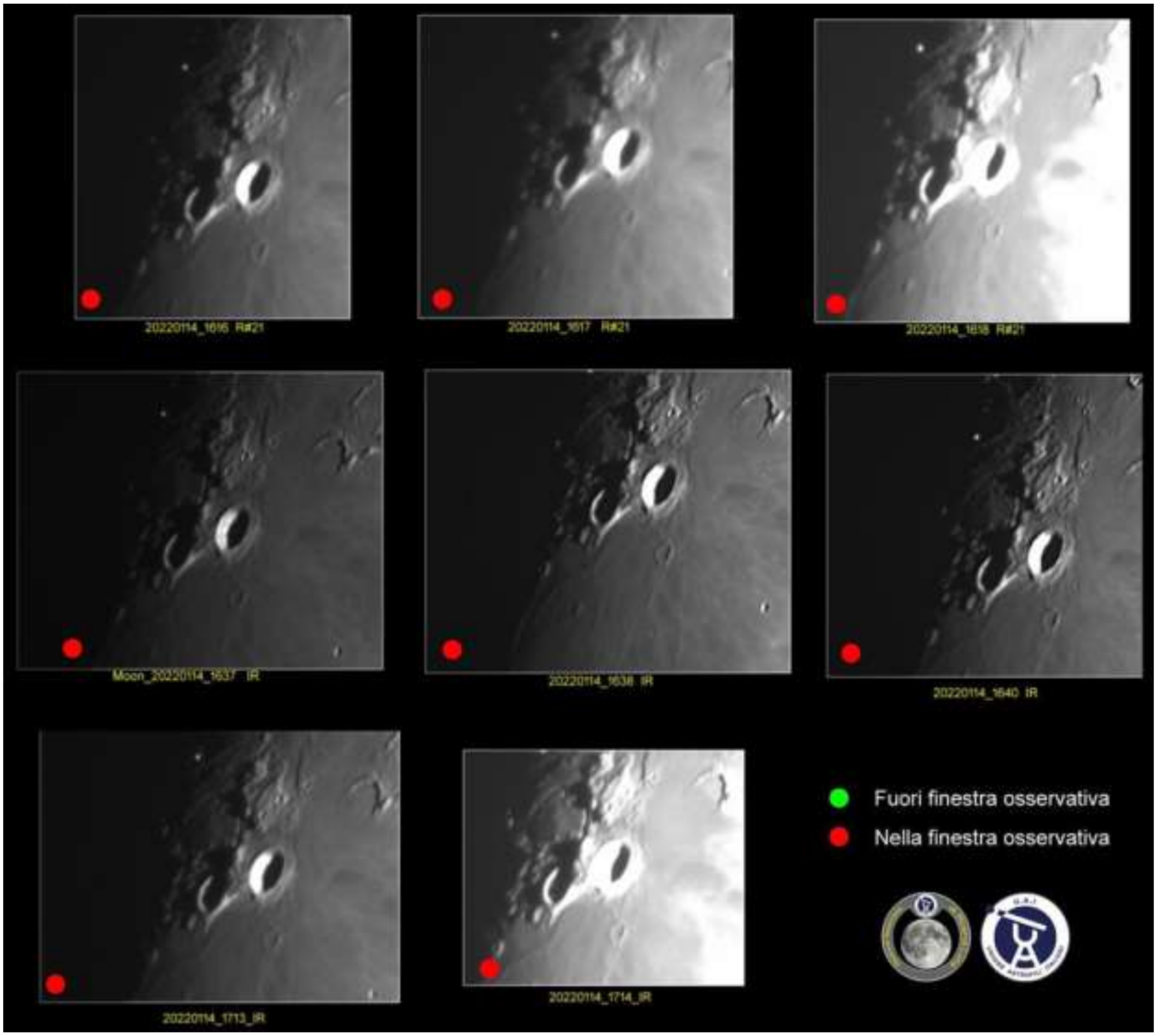


Figure 3. *Herodotus as imaged by Franco Taccogna on 2022 Jan 14 at the UTs given in the image. North is towards the top.*

Nothing unusual seems to have been seen this time around, bur we will continue looking as it seems to be around this range of colongitudes, that very occasionally these effects have been seen. We also have a good time sequence in Franco's images in Fig 3.

Gassendi:

On 2022 Jan 14 Bob Stuart (BAA) at 22:07 UT and Mark Radice (BAA) at 22:18 UT imaged this crater under similar illumination to the following report:

Gassendi 1939 Aug 27 UT 02:00 Observed by Haas? (NM? USA, 12" reflector?) "NE part of c.p. was I=6.4, compared with I=9.4 on 9/28/39 (see #462) under similar cond.@ NASA catalog weight=4. NASA catalog ID# 458.ALPO/BAA weight=2.

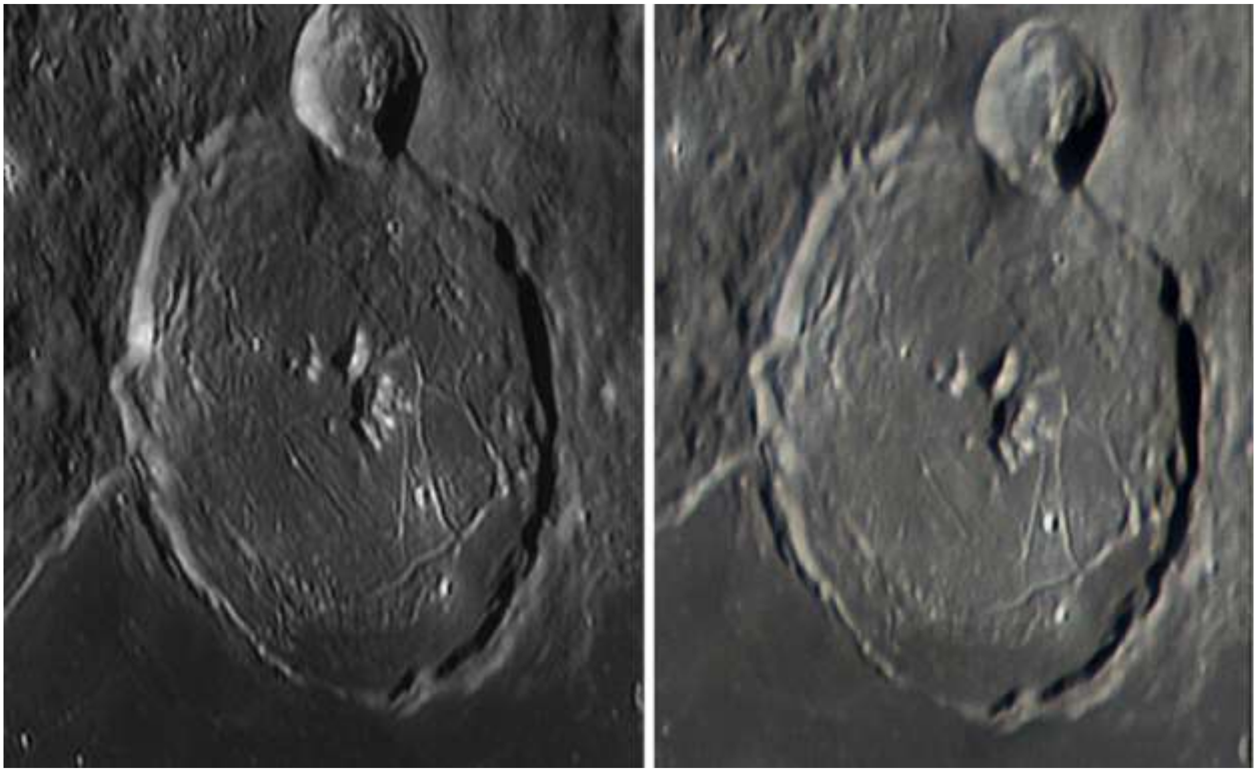


Figure 4. *Gassendi as imaged on 2022 Jan 14 and orientated with north towards the top.* ***(Left)*** *Imaged by Bob Stuart at UT 22:07 UT.* ***(Right)*** *imaged by Mark Radice at 22:18 UT.*

At least we now have the normal appearance of what the crater would have looked like (Fig 4) to Walter Hass if he had seen it under ideal observing conditions for that illumination.

Aristarchus: On 2022 Jan 15 UT 23:29 Gary Varney (ALPO) imaged this region under similar illumination to the first report below and under similar illumination and topocentric libration to the 2nd report below:

Vallis Schroteri – 1893 Jan 30 W.H. Pickering observed Variations in vapor column rising from the Cobra Head feature (seen on several nights in succession) and also in the visibility of craterlets A, C, F. Sunrise +2d. (time est. fr. gives colongitude). Cameron 1978 catalog ID=279 and weight=3. Pickering was observing from the southern station of Harvard University in Arequipa, Peru.

Aristarchus – 1985 Dec 25 Louderback observed that the south west wall was a creamy deep yellow. There was also strong fluorescent blue on the west wall of the Cobra Head - Schröter's Valley area and this was similar to the violet glare seen on Aristarchus at times. Violet was seen between Aristarchus and the Cobra Head. Seeing conditions were poor. Brightening of a point near C occurred roughly every 10-15 seconds and lasted 0.5 sec - (Cameron concludes that this was not due to the Earth's atmosphere). A 0.2 step drop in brightness was seen on point A (twin spots). point C had reduced by 0.6 steps. Elsewhere was stable in brightness. Cameron 2006 catalog ID=281 and weight=4. ALPO/BAA weight=3.

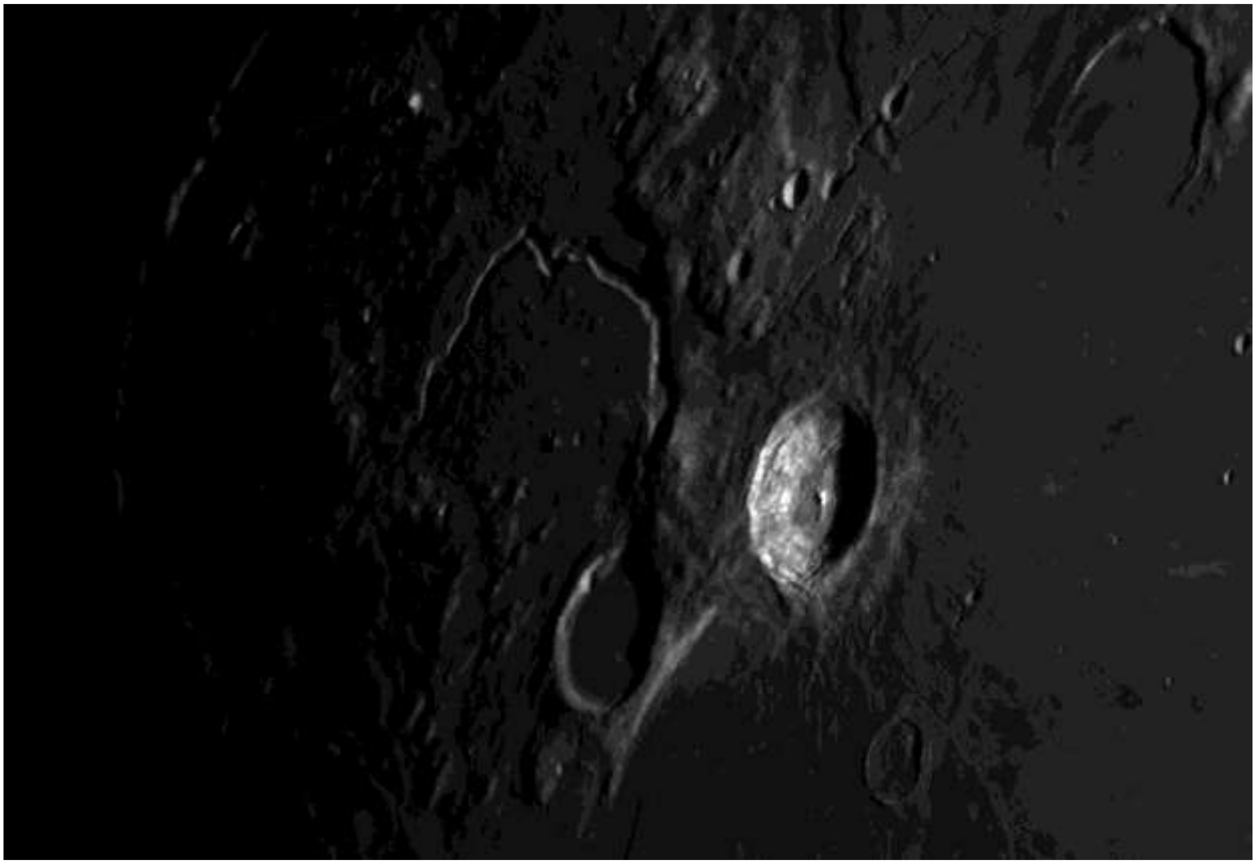


Figure 5. *Aristarchus as imaged by Gary Varney (ALPO) on 2022 Jan 15 UT 23:39 and orientated with north towards the top.*

I have no idea where craterlets, or points, A, B, C are, but at least we have a view (Fig 4) of what the crater would have looked like under normal circumstances for these two LTP reports.

Bailly: On 2022 Jan 16 UT 23:02 Aldo Tonon (UAI) obtained a color image of this crater following this Lunar Schedule request:

BAA Request. Please observe visually or image this crater in color to see if you can detect any color on part of the floor. Please email any observations to: a t c @ a b e r . a c. u k .

Figure 6. *Bailly as imaged by Aldo Tonon (UAI)i on 2022 Jan 16 UT 23:02, orientated with north towards the top. The image has been color normalised and then had its color saturation increased to 80%.*

This actually corresponds to a 1974 Oct 29 UT 22:00-23:00 report where Fylde Astronomical Society observer, Chris Lord, noted the south western floor to be darker in the blue than the red light. Wratten 25 & 44a and then Wratten 29 and 47b filters were used back then. Chris Lord suspected that the crater may have had a greenish color to the floor and that this was an effect that could always be seen around the range of colongitudes. In Fig 6 we can see perhaps a hint of green on the SW floor, though it may just be a darker shade of grey? It is doubtful if visual observers using a color filter Moon Blink device would have detected this.

Cavendish E: On 2022 Jan 16 UT 21:45 Massimo Giuntoli observed this crater visually in part of a program to monitor its brightness. He has on occasions noted this crater to be very bright before. However, on this night he noted that the southern floor of the crater was bright but not brilliant i.e., just anormal appearance. He was observing under Antoniadi III/IV seeing with a 15cm diameter refractor, x240, with a W8 filter. The selenographic colongitude was 81.2° and sub solar latitude -1.3° The libration was lat. -4°26' long. -2°33'.

Eimmart: On 2022 Jan 17 UT 22;05-23:10 Trevor Smith observed this crater visually under similar illumination, and topocentric libration, to the following LTP report:

Einmart 1983 Mar 19 UT 04:56-05:54 Louderback, of South Bend, WA, USA observed a bright area over Mons Anguis and Eimmart - it resembled a comet and had a bluish color and varied in brightness. The color was confirmed as it was not seen in a red filter but could be seen in blue and white light. Other features were checked but did not show anything similar although a violet glare was suspected in the blue filter. A sketch was made. Observer made Eimmart 8 in brightness at 07:30UT. Noted that the area around Eimmart appeared opaque at times and less so at other times. At 08:52UT the phenomenon was seen again. On May 2nd a bright spot was still seen in the region but it was not changing dimensions. During the observation on Apr 30th the atmospheric transparency was excellent. A 2.5" refractor was used. Reference: Personal communication from Louderback to Cameron on 1980 Jul 16th. The Cameron 2006 catalog extension ID of this LTP was 93 and the weight was 4. ALPO/BAA weight=3.

Trevor commented that he could see no resemblance to a comet shape, nor any bluish color. All looked perfectly normal. We shall leave the weight at 3.

Fracastorius: On 2022 Jan 19 UT 02:16 Walter Elias (SLA) imaged this crater under similar illumination to the following report:

Fracastorius 1975 Jul 24 UT 22:52 Observed by Robinson (Teignmouth, England, 10" ? reflector or 4" refractor?) "Fracastorius had a blink (red or blue?)" NASA catalog weight=3. NASA catalog ID #1409. ALPO/BAA weight=2.

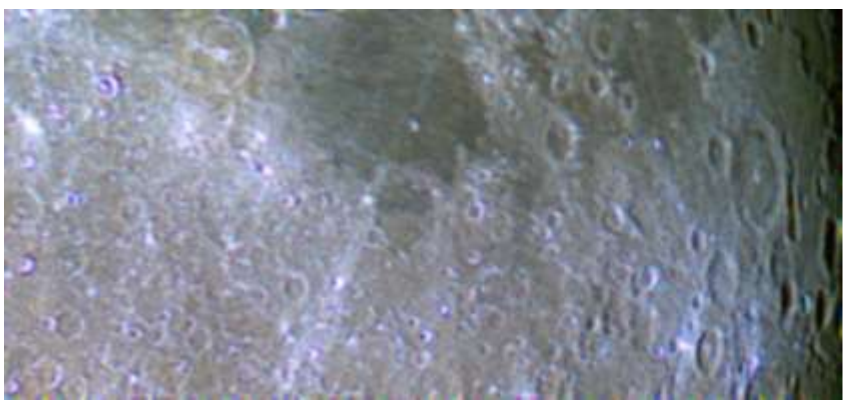


***Figure** 7. Fracastorius as imaged by Walter Elias (AEA) on 2022 Jan 19 UT 02:16. The image has north at the top, has been color normalised, and had its color saturation increased.*

It can be seen from Fig 7, that there is no natural color here that would have been detected in a Moon Blink device. Therefore, the weight shall remain at 2 for now. Sometime people have said that Fracastorius was a permanent blink site, meaning when one used colored red/blue filters, it always appeared brighter in one filter rather than the other. From Walter's image this would appear not to be the case either.

Puiseux: On 2022 Jan 22 UT 05:05-05:15 Alberto Anunziato (SLA) observed the crater under similar illumination to the following report:

On 1979 Jul 14 at UT 00:24-01:10 P. Madej (Huddersfield, UK, 15cm reflector, x35, x52, x73 and x110, seeing IV-V, transparency very good). Note that the observing date was also written as Jul 18th in the original report? Puiseux was very clear in white light, but could not see the central peak. The central peak though was visible through a Wratten 15 (yellow) filter. The ALPO/BAA weight=1.

Alberto comments that the bright point on the centre of the crater was hardly visible, and thought that this could be the central peak? Alberto was using a 10.5cm Meade EX 105 scope.

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

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

Lunar Calendar March 2022

Date	UT	Event
1	0000	Saturn 4° north of Moon
2	1735	New Moon lunation 1227
2		North limb most exposed +6.5°
5		East limb most exposed +5.5°
7	0600	Uranus 0.8° north of Moon, occultation Antarctica, Australia
9	0700	Ceres 0.3° north of Moon, occultation NW Australia, Polynesia
10	1045	First Quarter Moon
10	2300	Moon at apogee 404,268 km
12		Greatest northern declination +26.7°
16		South limb most exposed -6.6°
17		West limb most exposed -5.2°
18	0718	Full Moon
24	0000	Moon at perigee 369,760 km
25	0537	Last Quarter Moon
25		Greatest southern declination -26.6°
28	0300	Mars 4° north of Moon
28	1000	Venus 7° north of Moon
28	1200	Saturn 4° north of Moon
29		North limb most exposed +6.6°
30	1500	Jupiter 4° north of Moon

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

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

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

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

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

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

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

SUBMISSION THROUGH THE ALPO IMAGE ARCHIVE

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

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

It is helpful if the filenames follow the naming convention :

FEATURE-NAME_YYYY-MM-DD-HHMM.ext

YYYY {0..9} Year

MM {0..9} Month

DD {0..9} Day

HH {0..9} Hour (UT)

MM {0..9} Minute (UT)

.ext (file type extension)

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

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

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

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

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

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

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

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

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

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

Digitally submitted images should be sent to:
David Teske – david.teske@alpo-astronomy.org
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: Mare Frigoris

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 2022 Focus-On will be the craters Mare Frigoris. 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 Frigoris Focus-On article is April 20, 2022

FUTURE FOCUS ON ARTICLES:

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

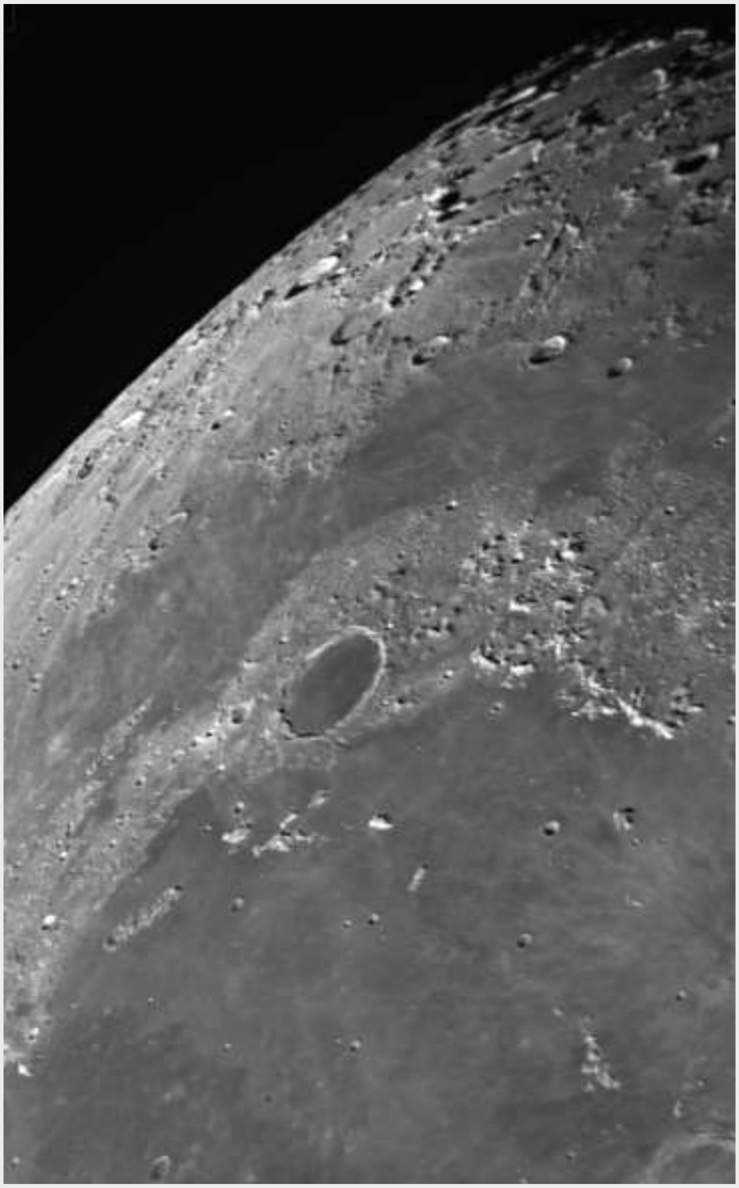
Subject	TLO Issue	Deadline
Mare Frigoris	**May 2022**	**April 20, 2022**
Bright Rays North	**July 2022**	**June 20, 2022**
Bright Rays South	**September 2022**	**August 20, 2022**

Focus-On Announcement

TRAVELING FROM EAST TO WEST ON THE MARE FRIGORIS

Mare Frigoris is the only mare that does not occupy a circular basin, it is an elongated strip of approximately 1500 kilometers that extends from the Lacus Mortis at its eastern end, passing through Aristoteles, Galle, Protagoras, Archytas, Timaeus, Birmingham, Fontenelle, La Condamine, Harpalus all the way to Sinus Roris in the west, with wonders like Plato and Sinus Iridum nearby. Mare Frigoris would be part of the Imbrium impact basin, and its north coast is covered by the material ejected by this impact. Let's share images of this area of the lunar north, sometimes forgotten due to its proximity to much more photogenic areas.

Please send articles, drawings, images, etc. to Alberto Anunziato and David Teske by **April 20, 2022** for the May 2022 issue of The Lunar Observer.



Sergio Babino

Focus-On Announcement

WONDERS OF THE FULL MOON

The full moon is loved by almost everyone, except for the majority of astronomers. But when the near side is illuminated almost completely by frontal light, it is the opportunity to enjoy a unique spectacle: the bright ray craters. It is a field of study favorable to amateur observation with scientific value: how far does each bright ray reach? Are some rays brighter than others coming from the same crater? Are they altered by the relief over which they pass? And many other questions that ALPO's Bright Lunar Rays Project has as its objectives.

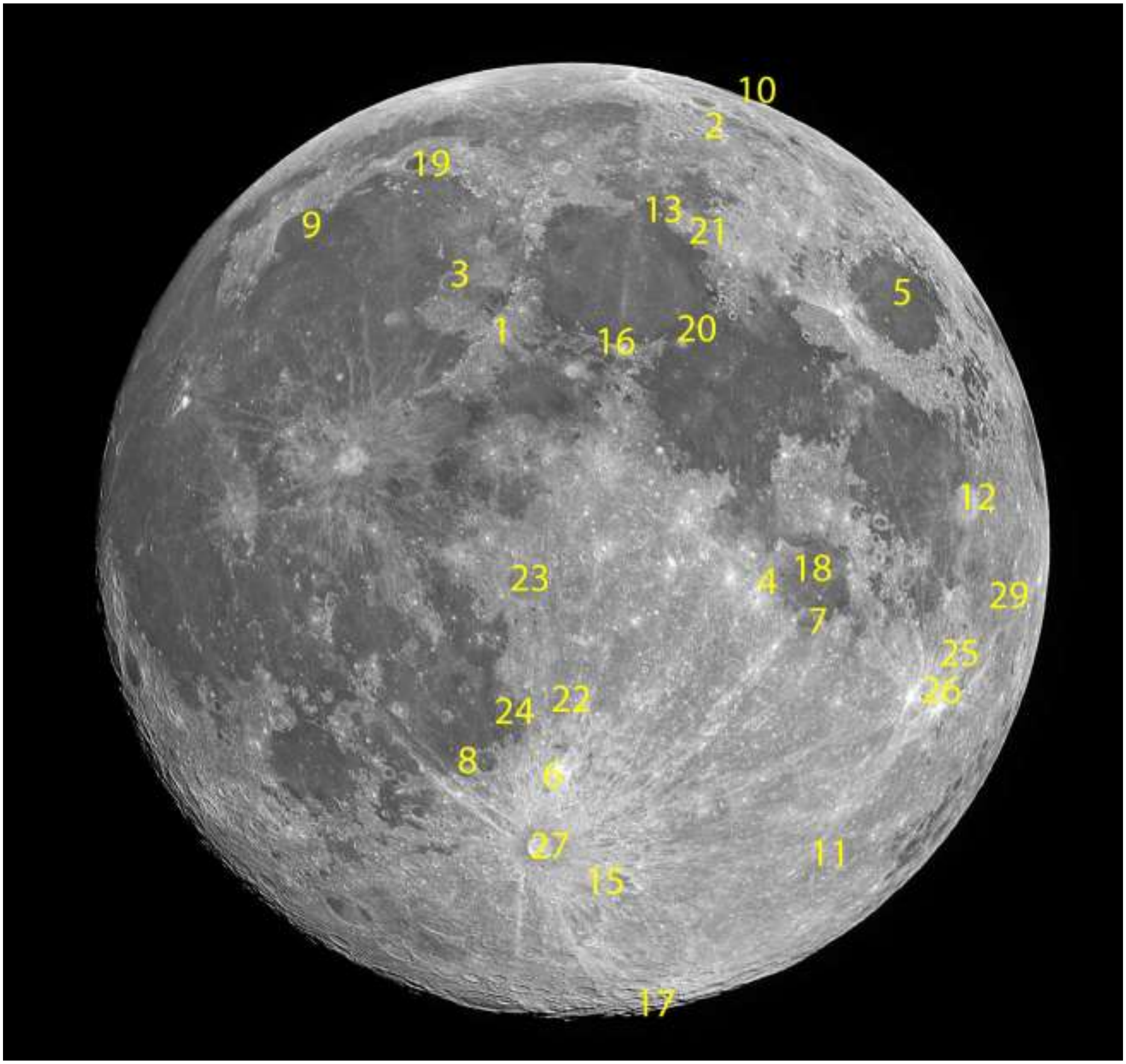
Bright Lunar Rays Project Objectives:
https://moon.scopesandscapes.com/ALPO%20Rays%20Project.htm

List of rayed craters and other non-crater features:
https://moon.scopesandscapes.com/alpo-rays-table.pdf

JULY 2022 ISSUE-Due **June 20th, 2022**: **NORTHERN BRIGHT RAY CRATERS**
SEPTEMBER 2022 ISSUE-Due **August 20th, 2022: SOUTHERN BRIGHT RAY CRATERS**

Leandro Sid

Key to Images In This Issue



1. Apenninus, Montes
2. Archimedes
3. Atlas
4. Birt
5. Catharina
6. Crisium, Mare
7. Deslandres
8. Fracastorius
9. Hesiodus A
10. Humboldtianum, Mare
11. Iridium, Sinus
12. Janssen
13. Langrenus
14. Luther
15. Maginus
16. Menelaus
17. Moretus
18. Nectaris, Mare
19. Plato
20. Plinius
21. Posidonius
22. Purbach
23. Ptolemaeus
24. Recta, Rupes
25. Snellius
26. Stevinus
27. Tranquillitatis, Mare
28. Tycho
29. Vendelinus