THE LUNAR OBSERVER

A PUBLICATION OF THE LUNAR SECTION OF THE A.L.P.O.

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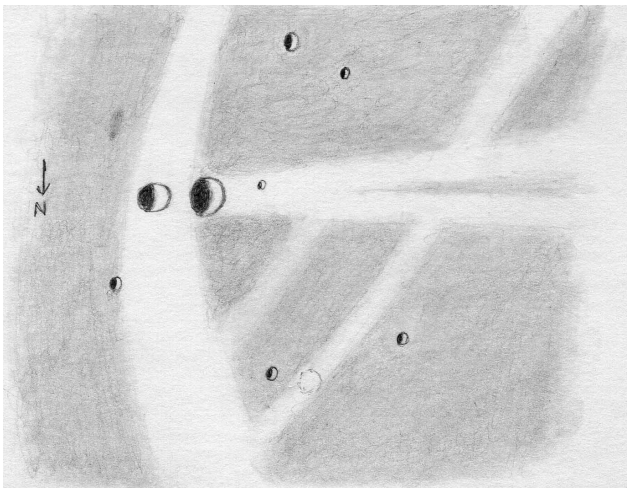
RECENT BACK ISSUES: http://moon.scopesandscapes.com/tlo_back.html

FEATURE OF THE MONTH – JULY 2017

MESSIER & MESSIER A



Sketch and text by Robert H. Hays, Jr. - Worth, Illinois, USA
May 3, 2006 01:57-02:13; 02:20-02:30 UT, 15 cm refl, 170x, seeing 7-8/10.

I drew these well-known craters and vicinity on the evening of May 2/3, 2006. Messier itself is the eastern crater of the large pair. It has a distinct east-west orientation despite its proximity to the eastern limb in Mare Fecunditatis. Messier A is the larger crater to the west of Messier. It is somewhat D-shaped, and is considerably deeper than Messier. A long, narrow ray extends westward from this pair. It splits in two lengthwise giving it a cometlike appearance. The craters Messier D and E lie south of this ray, and a tiny pit is within it just west of Messier A. The small crater northeast of Messier is Messier B. The craters Secchi K and X are farther to the northwest. A wide north-south ray encompasses Messier, and grazes the east rim of Messier A and the west rim of Messier B. This ray tapers somewhat to the south. Another ray extends from the wide ray to the cometlike feature on a diagonal. A small, bright dot is within this narrow ray west of Secchi K. The diagonal ray is faintly evident south of the cometlike ray, but it does not affect the latter ray's split. These rays have isolated a patch of Mare Fecunditatis with Secchi K near its northern end. A short, weak ray is within this patch, parallel to the diagonal feature. The LQ map shows a rille in this area, but I was not able to detect it.

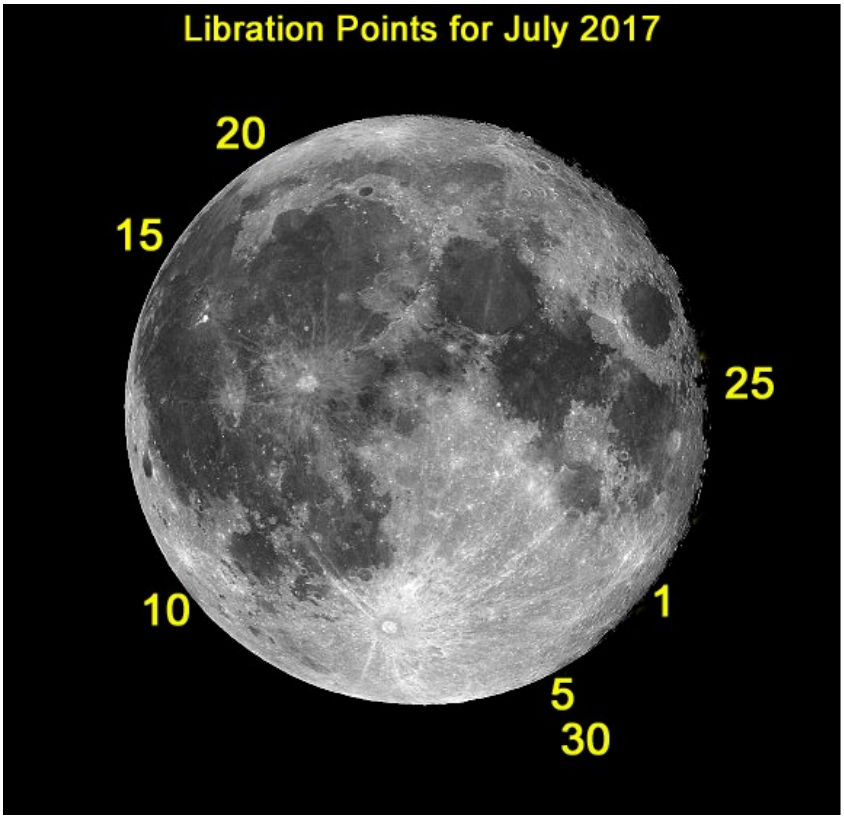
LUNAR CALENDAR

JULY-AUGUST 2017 (UT)

2017		UT	EVENT
Jul	01	00:51	First Quarter
	01	07:28	Moon-Jupiter: 2.9° S
	06	04:27	Moon Apogee: 405900 km
	07	03:34	Moon-Saturn: 3.6° S
	08	10:49	Moon Extreme South Dec.: 19.4° S
	09	04:07	Full Moon
	16	19:26	Last Quarter
	19	23:37	Moon-Aldebaran: 0.4° S
	20	11:13	Moon-Venus: 2.7° N
	21	17:09	Moon Perigee: 361200 km
	21	22:11	Moon Extreme North Dec.: 19.4° N
	23	09:46	New Moon
	25	08:49	Moon-Mercury: 0.9° S
	25	10:14	Moon-Regulus: 0°
	28	20:15	Moon-Jupiter: 3.4° S
	30	15:23	First Quarter
Aug	02	17:55	Moon Apogee: 405000 km
	03	07:31	Moon-Saturn: 3.8° S
	04	18:17	Moon Extreme South Dec.: 19.4° S
	07	18:11	Full Moon
	07	18:22	Partial Lunar Eclipse
	15	01:15	Last Quarter
	16	06:39	Moon-Aldebaran: 0.4° S
	18	06:50	Moon Extreme North Dec.: 19.4° N
	18	13:14	Moon Perigee: 366100 km
	19	04:45	Moon-Venus: 2.3° N
	21	18:30	New Moon
	25	13:00	Moon-Jupiter: 3.7° S
	29	08:13	First Quarter
	30	11:25	Moon Apogee: 404300 km
	30	14:23	Moon-Saturn: 3.9° S

LUNAR LIBRATION

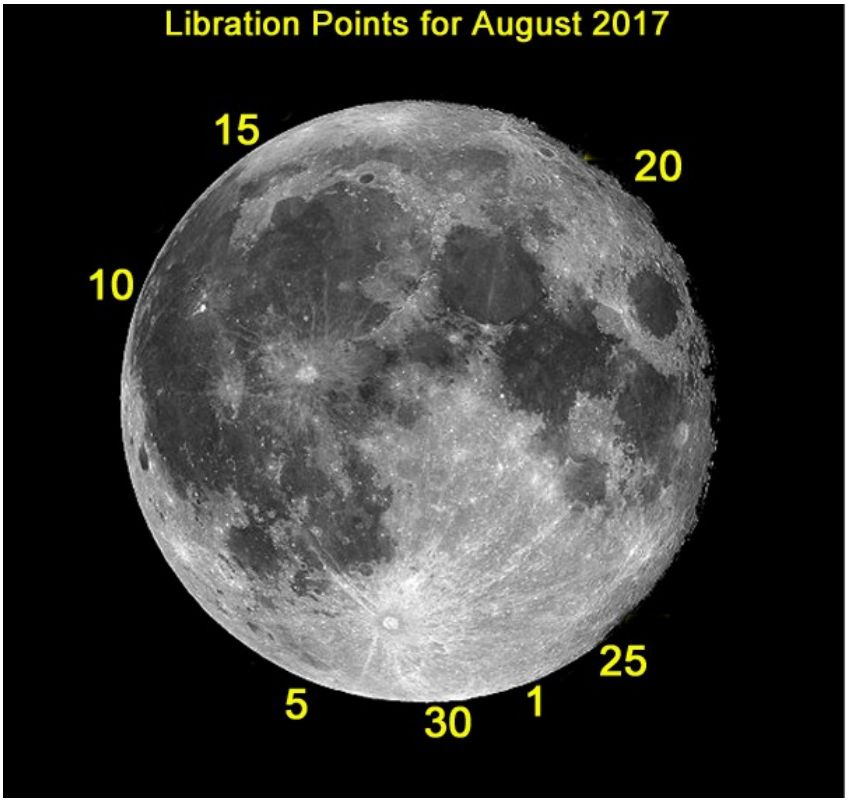
JULY-AUGUST 2017



Size of Libration

07/01	Lat -04°36'	Long +06°33'
07/05	Lat -06°41'	Long +02°25'
07/10	Lat -03°08'	Long -03°41'
07/15	Lat -03°54'	Long -06°49'
07/20	Lat +06°32'	Long -02°34'
07/25	Lat +00°06'	Long +05°15'
07/30	Lat -06°11'	Long +05°18'

NOTE:
Librations are based on a geocentric position and for 0 hr. Universal Time.



Size of Libration

08/01	Lat -06°48'	Long +03°13'
08/05	Lat -04°38'	Long -01°46'
08/10	Lat +02°18'	Long -05°29'
08/15	Lat +06°54'	Long -03°36'
08/20	Lat +02°24'	Long +02°34'
08/25	Lat -05°06'	Long +05°26'
08/30	Lat -06°25'	Long +01°09'

NOTE:
Librations are based on a geocentric position and for 0 hr. Universal Time.

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

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

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

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

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

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, dd/mm/yyyy)
Size and type of telescope used Magnification (for sketches)
Filter (if used)
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

Full resolution images are preferred-it is not necessary to compress, or 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 both
Wayne Bailey – wayne.bailey@alpo-astronomy.org
and Jerry Hubbell –jerry.hubbell@alpo-astronomy.org

Hard copy submissions should be mailed to Wayne Bailey at the address on page one.

CALL FOR OBSERVATIONS:
FOCUS ON: Lunar Domes

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 **September 2017** edition will be **Lunar Domes.**
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 subtle features to your observing list and send your favorites to (both):

Jerry Hubbell –jerry.hubbell@alpo-astronomy.org
Wayne Bailey - wayne.bailey@alpo-astronomy.org

Deadline for inclusion in the Lunar Domes article is August 20, 2017

FUTURE FOCUS ON ARTICLES:

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

Subject	TLO Issue	Deadline

Focus On: Messier & Messier A – Oblique Impact Craters

Jerry Hubbell
Assistant Coordinator, Lunar Topographical Studies

Oblique impact craters are those that were formed by a high-speed, low-angle impacts, and results in an elliptical shaped crater with ejecta material spread out from the impact site. There are several craters on the moon that exhibit these characteristics, but there are also those that may appear, at first glance, to be formed through this process, but were not, in fact, formed that way.

There are crater chains, called Catenae, that are formed from a single body that disintegrates prior to impact and spreads out forming a long line of small craters. There may be a small number of instances where craters were formed by a single body that broke up into perhaps 2-3 separate bodies, and impacted very close to one another. This could form an elliptical shaped crater but would probably not display the long line of ejecta material that low-angle impacts would have.

There are also larger craters that are very elongated, most notably the crater Schiller 70x130 mi (110x210 km) is a good example of this type of crater. Located at selenographic coordinates 39.8° west and 51.7° south, this crater was originally thought to be formed by volcanic activity, Schiller was formed by a large impactor grazing and breaking up into several bodies. Chuck Wood explains on the Lunar Photo of the Day for November 12, 2004:

> "Schiller is bizarrely unique and has long been a topic of speculation and bewilderment. The problem with Schiller is obvious - craters are round, but Schiller definitely isn't. Because of its elongated shape, it was often claimed that Schiller could not be of impact origin and must be volcanic. But, volcanists were wrong again. And they were wrong for a good reason - who could have imaged that an impact event could produce something as non-circular as Schiller?
>
> The clue came from high speed-impact cratering experiments at NASA Ames Research Center in California in the 1970s. Vertical impact experiments by Don Gault and colleagues had recreated lunar crater shapes, central peaks and even ejecta deposits. But when the experimenters made oblique impacts they discovered dramatic changes in crater geometry. They were able to show that the crater pair Messier and Messier A were likely produced by a ricocheting impact at an angle of less than 5 degrees.
>
> Schiller appears to be another low angle impact of a much larger projectile, at a somewhat higher angle, that made a series of elliptical, overlapping and nearly simultaneous craters. In fact, the linear ridge seen at the northern end of Schiller also appears in the Ames experiments. This good photo also illustrates a later phase of Schiller's development. The lavas that rose up inside the crater created a floor that is not quite level. A previously unknown - at least to me - broad but low diagonal plateau exists on the floor of the broadest part of Schiller. Hmm."

A remarkable and probably the best-known example of an oblique crater is the pair Messier 7x5 mi (12x9 km), and Messier A 8x7 mi (13x11 km). Located near selenographic coordinates 47° east, 2° south, it is named after the 18th century French astronomer Charles Messier. Messier is famous for his deep sky object discoveries while searching for comets. The 110 objects in the

Messier catalog is a perennial favorite among deep sky observers. His namesake lunar objects are also very popular with lunar observers. This pair of craters lies in the flat plain of Mare Fecunditatis surrounded by several similarly size craters including craters Messier B, D, and E.

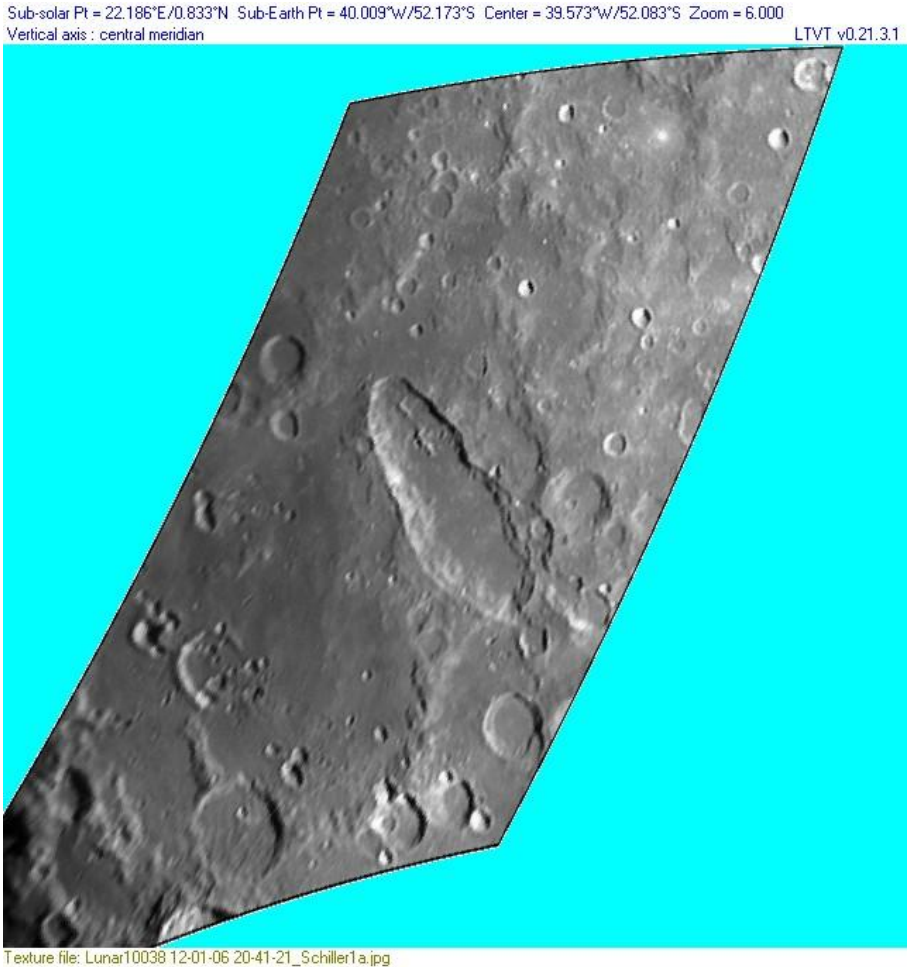


Figure 1. Oblique Impact Crater Schiller, Jerry Hubbell, January 6, 2012 0141 UT, 5-inch APO refractor, DMK 41AU02 CCD video camera. Processed in LTVT to show the aerial overhead viewpoint.

As a testament to this crater's popularity, several observing reports, images, and detailed studies were received about Messier and Messier A. Extensive reports were received from David Teske, and the members of the Madrid Amateur Astronomical Society (Alberto Martos, Antonio Noya, Nieves del Río, Fernando Bertrán, Luis Leyva and Jaime Izquierdo). Here are a few excerpts from their reports:

David Teske

"… Both craters have floors that are noticeably darker than the inside walls. The eastern side of Messier A is flattened, while the western rim has a much more pointed form. Both craters have highly reflective interiors with dark streaks extending westwards from the central regions up their western walls. Messier A is actually a double crater with the rounder eastern half that looks brighter than the overlapping western half. Both Messier and Messier A have depths of 2.2 km. Though both craters look distinctly different, selenographers Beer and Mädler who claimed to have inspected the formation no fewer than 300 times between 1829 and 1837 always found these two craters "as like two peas in

a pod—perfectly and singularly alike in shape, height of ring, depth of cavity, and even in the position of some peaks upon the ring." Messier A is the origin of two bright rays of ejecta, each of which is 100 km long, looking like the tail of a comet. …" (ed. It is interesting that David describes the long ejecta rays as looking like a comet!)

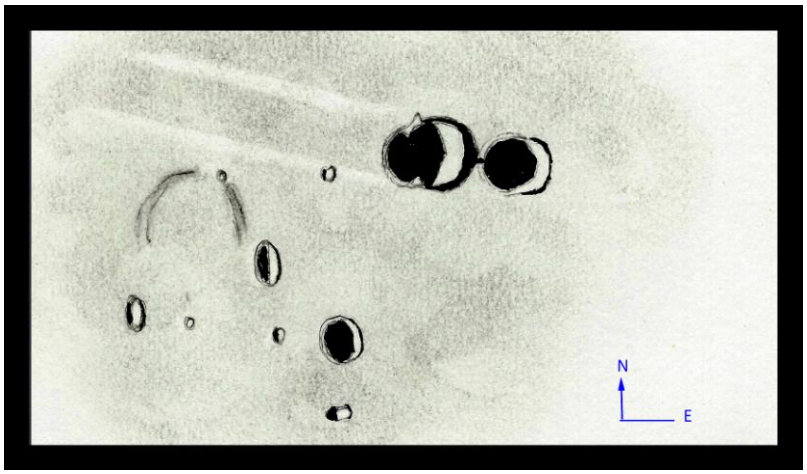


Figure 2. Drawing Messier & Messier A, David Teske, Louisville, MS, August 24, 2013 1009 UT, 5" f/15 refractor, Seeing: Good, Transparency: Good. Media: pastel, pencil, paint.

"…This drawing (ed: Figure 2) was made through the D&G 5-inch f/15 refractor. The telescope had a focal length of 1905 mm. The telescope was mounted on a Losmandy GM8 mount and a tall tripod with a pier extension. The drawing was made using a 4 mm TBM Planetary eyepiece for a magnification of 476 and a 6 mm TBM Planetary eyepiece for a magnification of 318. The drawing was made under clear skies with good seeing. The drawing was made in Louisville, Mississippi. The drawing was made on August 24, 2013 at 5:09 AM CDT (1009 UT). Media is pastel, pencil, paint

This drawing was made with the 5-inch D&G refractor one month after the drawing with the Stellarvue 4-inch telescope. More small craters are seen. Northwest of E was the remnants of a flooded crater. On its northeast rim was a small crater. On the south ray was a small crater. I thought that I had seen this with the Stellarvue last month. The drawing compares favorably with chart 48 in Rükl and page 19 of the 21st century atlas of the moon. My drawing of the flooded crater was too large compared to photos of the area. …"

Madrid Amateur Astronomical Society

"… We observed the concerned pair in several occasions, last one on Friday, May 29, as a previous step to respond to TLO call for observations. As it is common in observations during the waxing Moon, first part of our task was carried out under twilight illumination, so some aids, as crossed polarizing filters, were needed to improve the contrast at the eyepiece. Even so, we were unable to see the ray patterns. Later on, as the sky was getting darker, we could see first the railroad tracks, and later, but very weak, the dragonfly wings. But because of the low Sun altitude (7.24 degrees) above the craters, we were unable to see their floors, being in shade. Two pictures [1] were taken to show the location of the crater pair in the Moon surface (Mare Fecunditatis). One widefield photo captured the whole Moon showing the phase, as we observed it that night, and the other one, at moderate resolution (inset), shows the twin pair of craters. …"

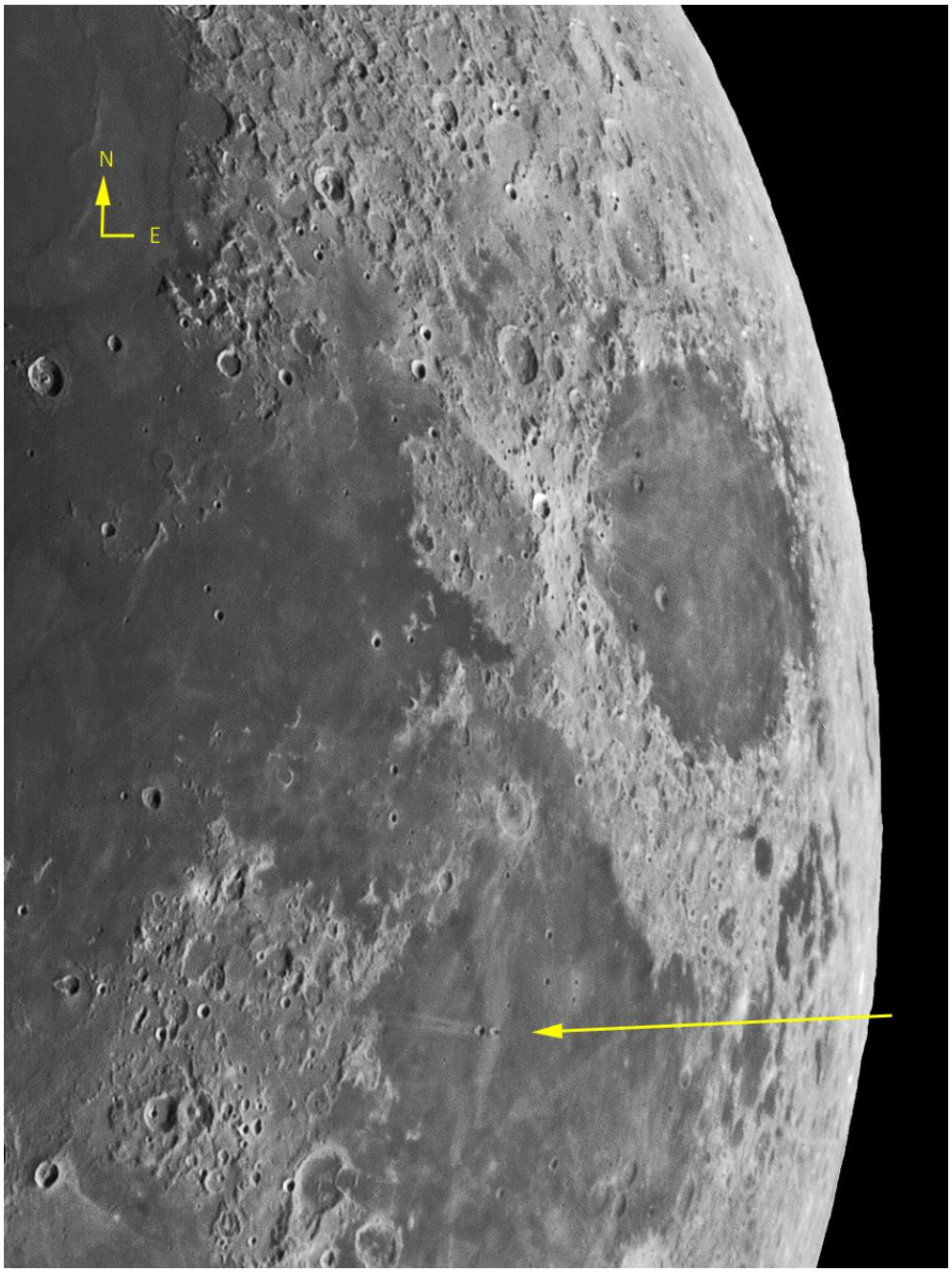


Figure 3. Mare Fecunditatis (Messier & Messier A), David Teske, Louisville, MS, October 30, 2014 0018 UT, 3.5-inch Questar, Skyris CCD, Seeing: 6/10, north/up, east/right. Best 150 of 300 image stack.

The extensive report continued…

> "… Since the ray patterns of all known lunar craters obey to the circumstances that ruled at their birth, out of meteoritic impacts, it is straightforward to deduct that whichever can be the way Messier and Messier-A were formed, both mechanisms must have been different one another. Thus we are able at this early stage of the observation, to reject one of the above mentioned proposals forwarded to explain the formation of the pair: the one that states that both craters were formed by independent impacts of two bodies of very same characteristics.

Similar crater sizes but different ray patterns onto same target material, certainly implies different trajectories. Thus, the whole point of this matter lays under the mechanism of ray pattern formation at different impact angles. That's the theory one must review to correctly interpret what the eyepiece brings in front of his eyes.

The subject has been worked out by several scientists working in geophysical laboratories around the world, by shooting high speed balls against special targets, in an attempt to reproduce the sought mechanism of crater and ray pattern formation. Here, in Madrid, we have visited the impact simulator at Laboratorio de Cráteres de Impacto Experimentales (Experimental Impact Crater Laboratory), located in the CAB (Center of Astrobiology), where a riffle-like machine fires metal balls of 20,5 mm at velocities of 500 m/s by compressed gas, on different targets and at different impact angles, in a test bench 7 meters wide and 3 meters deep. This widget can be seen at:

http://www.cab.inta.es/en/noticias/92/la-forma-de-los-crateres-proporciona-pistas-acerca-de-la-direccion-de-los-impactos-de-asteroides

We were told that the outcome of impact angles over 30 degrees is round craters, no matter which kind of material is the target composed of. Below 30 degrees, the crater outline becomes elongated along the direction of the projectile flight. As the impact angle grows shallower, the rim collapses in the uprange side. Below 20 degrees, a "forbidden zone" for ejecta appears in the uprange side, while long rays form in the downrange direction. At about 5 degrees, the dragonfly wings appear. And finally, at the grazing angle the projectile bounces back, as a flat stone thrown purposely onto a pond surface to bounce away over and over. …"

Figure 4. Messier & Messier A, Alberto Martos, et al., Madrid, Spain, July 25, 2013 0152 UT, 20-cm Newtonian reflector, TouCam CCD webcam, Seeing: 8/10, Transparency 4/5, north/up, east/right, stack of 500 images.

"… Photo [3] (ed: Figure 4) shows pretty well that there are no rays in the land space between both craters, as it is expected from the lessons learned. However, and although our pictures don't catch such a fine detail, close to the resolution limit of our 20-cm telescope, some of us were able to perceive some brightening in this space, as "a hyphen between two zeroes". …"

Figure 5. Mare Fecunditatis, Francisco Alsina Cardinalli, Oro Verde, Argentina, December 20, 2015 0135 UT, 25-cm SCT, Canon EOS Digital Rebel XS.

Figure 6. Messier & Messier A, John Duchek, Carrizozo, NM, May 2, 2017 0211 UT, 8" f/8 Criterion Dynascope, ZWO IS178MC CCD video. Seeing 7/10, Transparency 3/5. north/upper left, east/upper right.

Although Messier and Messier A is the best-known example, there are many more oblique impact craters for you to discover on the lunar surface. The moon Wikispaces has a listing of known and possible oblique impact craters including craters Thale, Hahn, Larmor. Many others are listed and worthy of study.

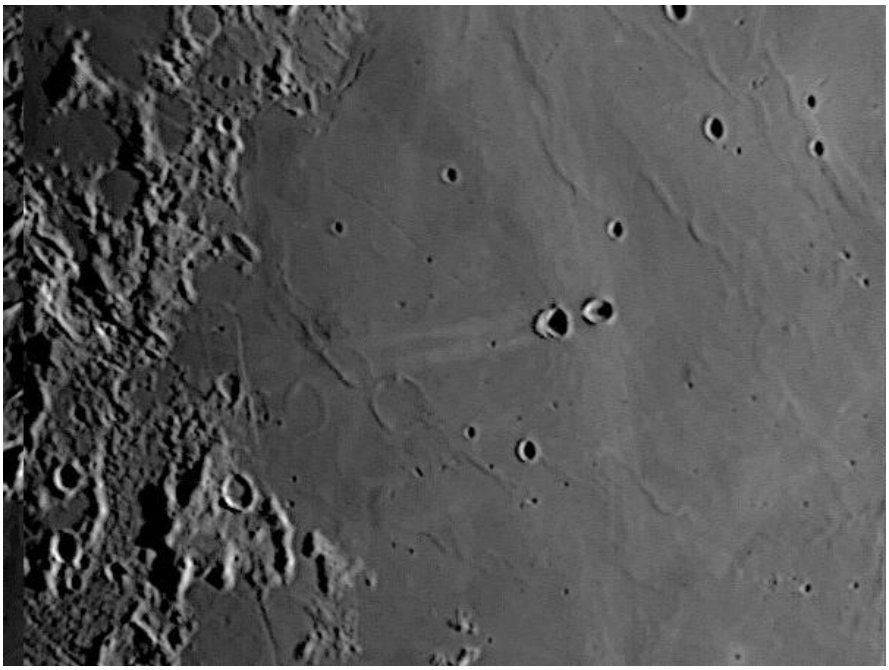


Figure 7, Messier & Messier A, Rik Hill, Tucson, AZ, April 22, 2007 0241 UT, 35-cm C14 SCT, Wratten 21 filter, SPC900NC CCD camera, best 150 of 1500 images, north/up, east/right.

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PETAVIUS

Richard Hill

When I took my very first crescent lunar photo (on Tri-X) in the twilight of Jan. 19, 1972, I noticed that one crater had a crack in the bottom. This was also my first photo of the 182 km crater Petavius. I have enjoyed this crater many times over the 45 years since, including a visual look at it with the 61-inch Kuiper telescope (formerly the "Catalina reflector") on Mt. Bigelow in the Catalina Mountains north of Tucson, Arizona. This is the same telescope used by Ewen Whitaker and D.W.G. Arthur and others as they worked to select the first Apollo landing sites.

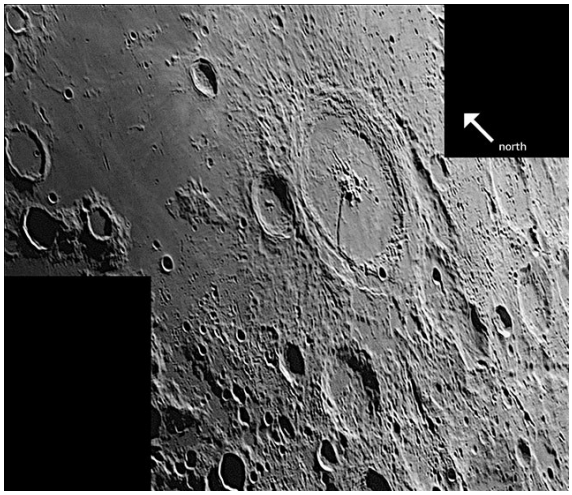

Figure 1*. *SINUS IRIDUM. *Tucson, AZ USA. June 28, 2017 03:02 UT.* Seeing 8/10. Tec 8" Mak-Cass, f/20, 656.3nm filter, Skyris 445.

Of course the most noticeable features of this 3.8 billion year old crater (fig. 1) are the Rimae Petavius, including the great rille itself and the smaller orthogonal ones. The great blanket of ejecta surrounding this crater has a wonderful radial pattern to it broken by the Wrottesley (60km) on the left wall in this image. (Note the direction of north in the legend.) Below Petavius is Snellius (85km) with it's Vallis crossing the lower wall. To the lower right of Petavius is a broad elongated ditch about 85km wide that is Hase and further out Hase D. Then out from Hase D is the thin Rima Hase trailing off to the lower right corner of the image. You can trace this rima into the two craters that are filled with ejecta probably from the Petavius impact. Directly to the right of Hase D is Adams (68km), one of the oldest craters (3.9 b.y.) in this image, older than Hase believe it or not!

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POSIDONIUS

Richard Hill

Dominating the center of this image (fig. 1) is the great 99km diameter crater Posidonius. Between 3.2 and 3.8 billion years old it was flooded almost to the top of the crater walls. The remnants of the central peaks can be seen as a broken ring of small mountaintops in the center. On the right side can be seen the remnant wall from a smaller enclosed crater that was completely flooded. The floor of Posidonius is covered with system of rilles called Rimae Posidonius that have several different origins with some being obvious faults and the one on the left side of the crater looking as if it were channel formed by a running fluid.

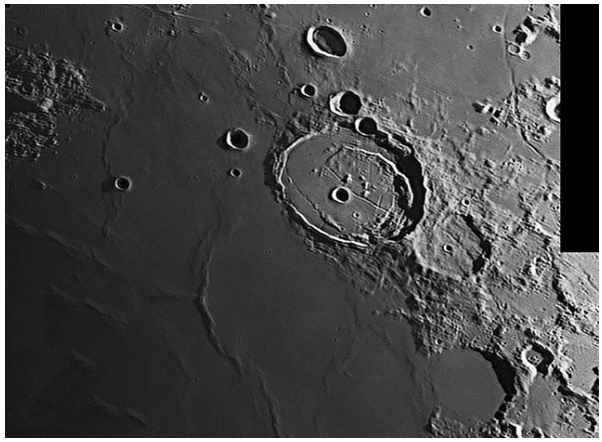

Figure 1*. *POSIDONIUS. *Tucson, AZ USA. May 2, 2017 02:04 UT.* Seeing 8/10. Tec 8" Mak-Cass, f/20, 656.3nm filter, Skyris 445.

To the lower right of Posidonius is the ancient crater Chacornac (53km), about a billion years older than Posidonius. On its floor is the vertical

system of Rimae Chacornac that you can trace all the way to the lower right corner of this image. Below Chacornac is the flooded cirque Le Monnier (63km) opening onto Mare Serenitatis. In the upper right corner of the image you can see most of Rima G.Bond. Above Posidonius is non-round crater Daniell (31km) which also has a system of rimae on its floor but hidden in shadow here.

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BAY OF RAINBOWS

Richard Hill

.Another night of horrible seeing but I'm still eager to exercise the new camera with the 3.5" Questar. The seeing was such that the 8" Mak-Cass would have been useless. I figured out how to run it in monochrome mode rather than go monochrome in the software. It performs well this way. They sky was like looking through a fish tank which is not surprising with the heat (106F today). Our best seeing is usually during a warming period not when we are peaking out at such high temps. We still might go another 10 degrees before monsoons come.

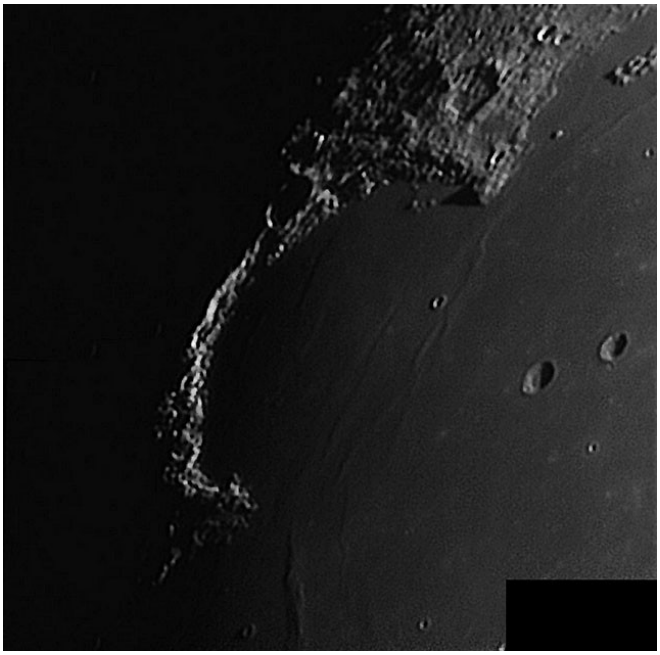

Figure 1*. *SINUS IRIDUM. *Tucson, AZ USA. June 5, 2017 03:11 UT.* Seeing 6/10. Questar 3.5", f/14.4, UV/IR block filter, NexImage 10.

Here (fig. 1) we have Sinus Iridum (Bay of Rainbows), just a giant 411km diameter flooded crater, with the west wall separately called Montes Jura, sparkling with the first rays of sunlight. The lower point of this crater is Promontorium Heraclides 1700m high, and the upper one, a little better defined, is Promontorium Laplace almost 1000m higher. Note the nice triangular shadow this mountain casts into the bay. The two craters on the right side of this image are Helicon (26km) and LeVerrier (20km). Forming a equilateral triangle to the south is a 6km crater Helicon B. On the southern edge of LeVerrier is a 4km crater, LeVerrier T. Between them is a barely discernible crater LeVerrier S, a 3km crater and the limit for this image which is pretty good given the seeing!

In the upper right corner is a portion of the Montes Recti. Below these is a small crater on the very edge of this image. This is Laplace F (6km). About 40km south of this is where the Chinese Chang-e 3 lander touched down on Dec. 14, 2013 and disembarked the Yutu rover.

LUNAR TOPOGRAPHICAL STUDIES

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OBSERVATIONS RECEIVED

FRANCISCO ALSINA CARDINALI - ORO VERDE, ARGENTINA. Digital images of Messier(2).

MAURICE COLLINS - PALMERSTON NORTH, NEW ZEALAND. Digital images of 5(2), 7, 8, 9 & 12(2) day moon, & Mons Rumker.

JOHN DUCHEK – St. LOUIS, MISSOURI, USA. Digital image of Messier.

ROBERT HAYS - WORTH, ILLINOIS, USA. Drawings of Messier & Posidonius P-Luther.

RICHARD HILL – TUCSON, ARIZONA, USA. Digital images of Copernicus, Messier(5), Petavius, Posidonius & Sinus Iridum

JERRY HUBBELL – LOCUST GROVE, VIRGINIA, USA. Digital image of 1st Qtr. Temninator.

DAVID JACKSON - REYNOLDSBURG, OHIO, USA. Digital image of eastern moon maria.

ALBERTO MARTOS, NIEVES del RÍO, JOSÉ CASTILLO, & ANTONIO NOYA – MADRID, SPAIN. Digital images of Messier(3) & waxing crescent.

DAVID TESKE - STARKVILLE, MISSISSIPPI, USA. Digital images(4) & drawings(3) of Messier.

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RECENT TOPOGRAPHICAL OBSERVATIONS

5 day MOON - Maurice Collins,- Palmerston North, New Zealand. May 31, 2017 05:20-05:30 UT. C-8 SCT, ASI120MC. N-down.

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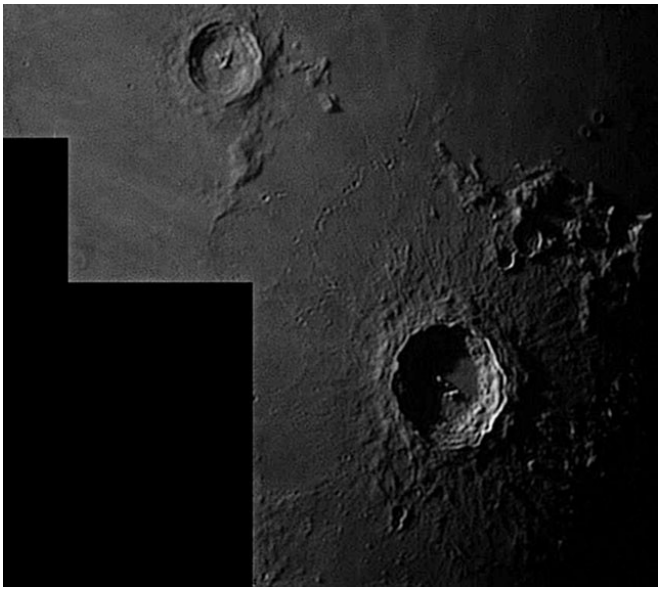
RECENT TOPOGRAPHICAL OBSERVATIONS

8 day MOON - Maurice Collins,- Palmerston North, New Zealand. June 3, 2017 10:17-10:44 UT. ETX-90, ASI120MC. North down.

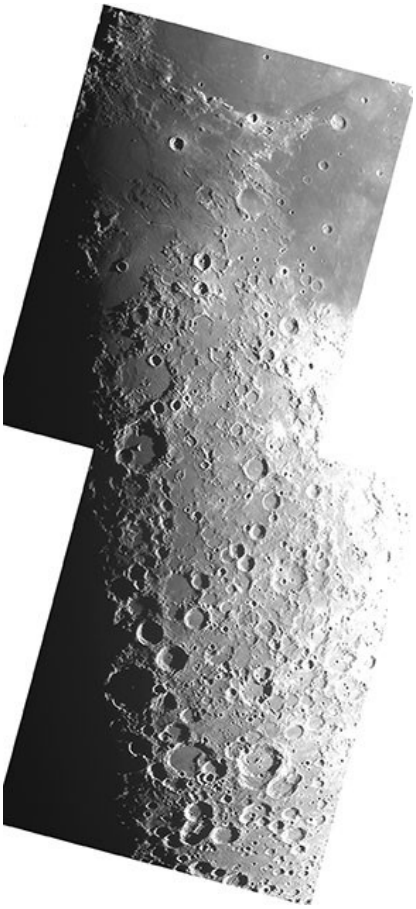
12 day MOON- Maurice Collins,- Palmerston North, New Zealand. June 7, 2017 08:19-08:49 UT. FLT-110, f/14, ASI120MC. North down,

MONS RUMKER-Maurice Collins,- Palmerston North, New Zealand. June 7, 2017 08:28 UT. FLT-110, f/14, ASI120MC. North down,

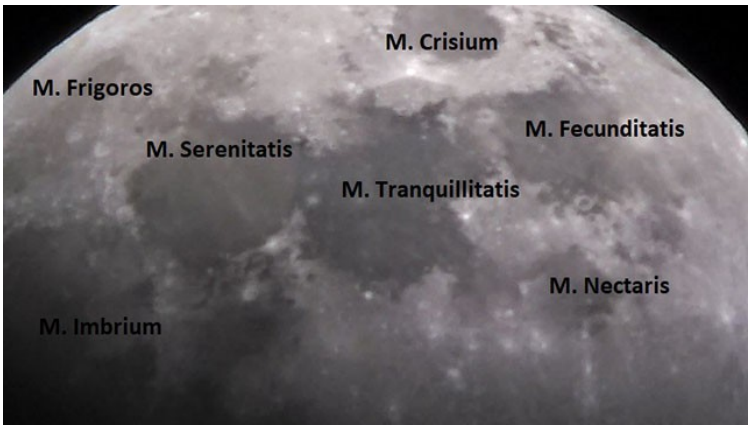
RECENT TOPOGRAPHICAL OBSERVATIONS



COPERNICUS. Tucson, AZ USA. June 4, 2017 02:57 UT. Seeing 5/10. Questar 3.5", f/14.4, UV/IR block filter, NexImage 10.



1st QUARTER TERMINATOR - Jerry Hubbell · Wilderness, Virginia USA.. June 2, 2017 01:30 UT. 0.15m refractor, f/5.6. Seeing 6/10, transparency 5/6. Colongitude 359.6º. Point Grey Flea 3.



Eastern Maria– David Jackson – Reynoldsburg, Ohio USA June 7, 2017 04:20 UT. Orion XT-10, 30mm eyepiece, Droid Razr camera (2x zoom). North left, East up.

LUNAR GEOLOGICAL CHANGE DETECTION PROGRAM

Coordinator – Dr. Anthony Cook – atc@aber.ac.uk

Assistant Coordinator – David O. Darling - DOD121252@aol.com

Observations for May were received from the following observers: Jay Albert (Lake Worth, FL, USA - ALPO) observed: Aristarchus, Censorinus, Daniell, Gassendi, Mons Pico, Plato, Promontorium Agarum, and Vallis Schroteri. Alberto Anunziato (Paraná, Argentina – AEA) observed: Alphonsus, Censorinus, Gassendi, Petavius, and Promontorium Agarum. Maurice Collins (Palmerston North, New Zealand – RAS NZ) imaged: Alphonsus, Deslandres, Maginus, Mare Imbrium, Mare Vaporum, Montes Caucasus, Moretus, Plato, Tycho, W. Bond, and several other features. Anthony Cook (Aberystwyth University and Newtown, ALPO/BAA) imaged several features. Marie Cook (Mundesley, UK – BAA) observed Manilius. John Duchek (Carrizozo, NM, USA – ALPO) imaged the earthshine, Mare Crisium, and Torricelli B. Les Fry (Elan Valley, UK – NAS) imaged several features. Marcelo Gundlach (Bolivia IACCB) imaged Copernicus. Rik Hill (Tucson, AZ – ALPO/BAA) imaged Posidonius. Nigel Longshaw (Oldham, UK, BAA) observed: Bullialdus, Eratosthenes, and Messier. Franco Taccogna (Italy – UAI) imaged Endymion, Eratosthenes, Lacus Mortis, Posidonius, and several features. Aldo Tonon (Italy – UAI) imaged Eratosthenes. Derrick Ward (Swindon, UK, BAA) imaged: Eudoxus, Lichenberg, and Manilius

News: I am an author, or co-author, on three lunar impact flash related abstracts to this year's European Planetary Science Congress (EPSC) conference, to be held in Riga, Latvia on Sep 17-22. More about this next month, though one of them covers the observation made from the UK that confirmed Stefan Spossetti's lunar impact flash observed on 2017 Jan 01.

LTP Reports: One visual report received from 2017 May 04, concerning Eratosthenes, was covered last month. I had an email query from Marcelo Gundlach (ICAROS) concerning a "horseshoe" shaped formation that he had imaged on the inner slopes of Copernicus on 2017 May 06 UT 03:02 – however this turns out to be a crater on the inner slopes of Copernicus, that we do not normally see until the illumination is just about right.

Routine Reports: Below is a selection of reports received for May that can help us to re-assess unusual past lunar observations.

The Moon: On 2017 May 01 UT 18:42 Franco Taccogna (UAI) imaged the Moon under similar the illumination conditions, to within ±0.5˚ to the following unusual report from Victorian Australia:

> *In 1879 Oct 20 UT 23:00 (Local time Oct 21 9AM) Hirst (Blue Mountains, NSW, Australia) saw a large part of the Moon covered with a dark shadow that was as dark as the Earth's shadow would have been if there had been an eclipse. Cameron says that this is a confirmed observation. Note that the Moon was just before first quarter. The Cameron 1978 catalog ID=215 and the weight=4. The ALPO/BAA weight=3.*

I am always very suspicious of reports of any extremely large area of darkening over the Moon. Nevertheless the observation is made by a professional astronomer, confirmed by a 2nd observer on site, and published in the Royal Astronomical Society's "The Observatory" – click on the web link to the left and turn to page 6 for further information. I cannot offer a practical explanation for this effect, which the observers reported to be circular, ¾ of the Moon's diameter, and lasted for three hours – unless of course the observers were unfamiliar with the lunar mare, which seems unlikely? It cannot be a lunar ejecta cloud as this would not last so long, it cannot be a swarm of comets between the Moon and the Sun as that would not absorb enough light and would have been seen from Earth. It cannot be a comet somewhere between us and the Moon, for similar reasons. It cannot be a cloud in our atmosphere as that would have moved after three hours. It seems unlikely to be a speck of dirt inside the scope optics as this would not remain stationary over the Moon if the scope was moved. So not knowing the answer, I will lower the weight to 1, as LTP simply do not come in such sizes on the sunlit side of the Moon! Nevertheless the observation remains a Victorian mystery?

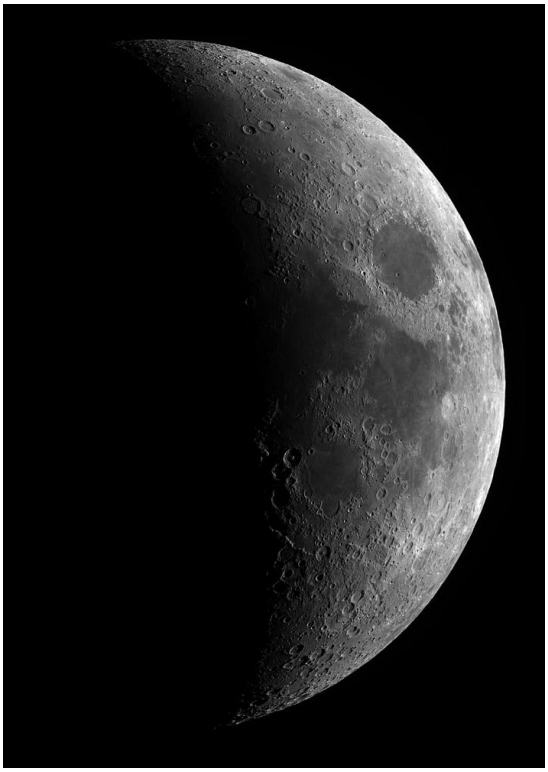


Figure 1 The Moon as imaged by Franco Taccogna (UAI) on 2017 May 01 UT 18:42, orientated with north towards the top.

Fracastorius and Petavius: On 2017 May 01 UT 22:06-22:09 Les Fry (NAS) imaged the Moon and covered the repeat illumination conditions, to within ±0.5˚, of two past intriguing reports:

> *On 1980 Apr 20 at UT21:12-22:45 J-H Robinson (Teighmouth, UK, 10.5" reflector, x180) found, using a Moon Blink device, evidence of color on the floor patches of Fracastorius crater, brighter in blue than in red. Also the floor to center varied in brightness in blue and in red. Peters observed in white light and found the south east-south wall had a slight orange cast and when a Moon blink was used it was less bright in blue than in red light. M. Cook found spurious color on the south rim and also on Mons Pico. There was a color blink reaction on the southeast floor of Fracastorius - this was both faint and blurred and not seen in white light. A.C Cook detected the permanent blink in the south east floor of the crater at 21:47 and a fainter one in the north west (marginally brighter in red than in blue). J.D. Cook found no color with the Moon blink device. 21:22-22:10 P.W. Foley got a strong color reaction with the Moon Blink device - brighter in red than in blue and detected a pink color visually on the south east wall 22:10-22:45 (this did not give a blink effect though). Cameron 2006 catalog ID=88 and weight=4. ALPO/BAA weight=2.*
>
> *On 1980 Apr 20 at UT21:38-21:50, Blair of Renfrewshire, Scotland (used an 8" reflector and seeing=III) saw three patches in Petavius and they could still be seen 7 minutes later. At 21:50UT he used a filter and found the "northern one was brighter in blue, the southern one was brighter in red and the central one was the same shade in both filters." Cameron comments that the central patch was a permanent one. She then goes onto say that the crater is described as having dark patches that are opposite to what one would expect from Fitton's theory applied to dark features. Cameron 2006 extension catalog ID=88 and weight=4. ALPO/BAA weight=3.*

I have cut out the Fracastorius and Petavius areas of the image that Les took and put them side by side in Fig 2, with some amount of color enhancement. The Fracastorius image, does in fact show some redness on the inside of the S to SE wall shadow, and partly onto the floor. This is at odds to the Cameron catalog description, however upon checking the original report I find that Hedley Robinson describes the SE quadrant of the floor as being brighter in red than in the blue filter, in fact agreeing partly with what is in the image that Les took. Back in 1980 the same redness was seen in this area by 6 observers in total, though not by all observers who participated. The reason for this may depend upon people's color sensitivity. But anyway the effect maybe natural surface color, though in the image that Les took, I also see similar red tinges in the SE interior rims of some other craters, and this is due to atmospheric spectral dispersion. I will lower the ALPO/BAA weight to 1 as we have two viable, albeit conflicting, explanations..

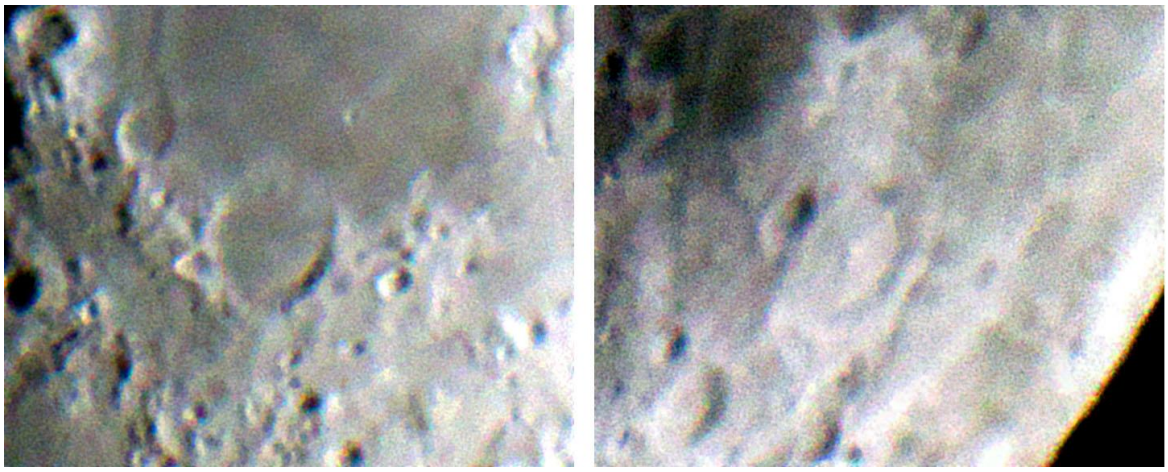


Figure 2 two section of the Moon as imaged by Les Fry (NAS) on 2017 May 01 UT 22:06-22:09, and orientated with north towards the top. Both images have undergone image grain removal sharpening, and a color saturation increase of 50%. **(Left)** Fracastorius. **(Right)** Petavius.

The definition in the Petavius section of the image by Les is less good, and we can only really confirm the northern dark spot, so the other two must be smaller. There is a hint of blueness on the northern spot, but it is by no means certain. I will therefore leave the weight at 3.

Messier: On 2017 May 02 UT 21:50-22:05 Nigel Longshaw (BAA) observed this crater under the same illumination conditions, to within ±0.5˚, to an 1878 report:

Messier 1878 Nov 01 UT 20:00? Observed by Kleis (Cologne, Germany, 6" refractor?) "Shaped like a half moon with E. edge missing. Appeared diffuse. Messier A was sharp & completely defined. Was sure there was fog there. Next day same appear. Shadow was diffused before noon, Mess. A is more yellow after noon, greener near Mess. At noon, both are same color." NASA catalog weight=4. NASA catalog ID #206. ALPO/BAA weight=3.

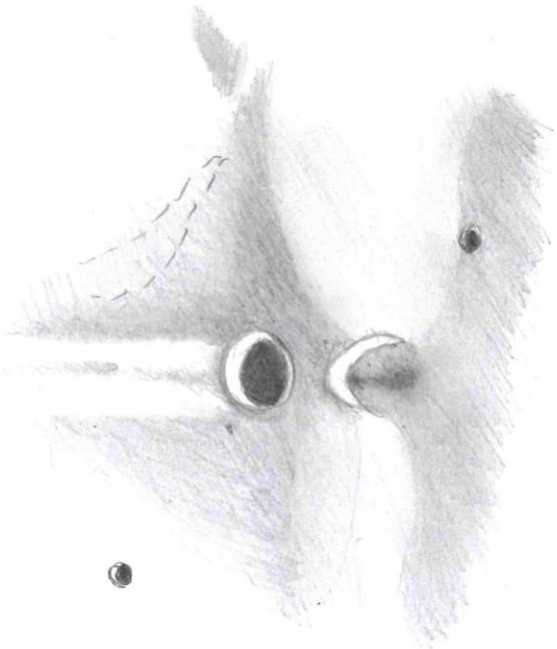


Figure 3 A sketch by Nigel Longshaw (BAA) of Messier A (Left) and Messier (Right) from 2017 May 02 UT 21:50-22:05, orientated, with north towards the top. Observation made with a 10 cm achromatic refractor at x106, under III seeing, and good transparency in between a little cloud. Note that the sketch has been mirror reflected to remove an E-W reversal, and has had annotation edited out to give a raw telescopic view.

Nigel comments that the lack of visibility of the eastern wall (See Fig 3), at this stage in illumination, is probably normal, and indeed a very similar appearance can been seen on p212 of Harold Hill's Lunar Portfolio,

under a selenographic colongitude of 356˚. The western edge of Messier was very sharply defined, whereas the eastern side seemed merged into the Mare. The tail on Messier A, out to the west was sharply defined with a central darker spine. This neatly takes care of the visual description, but we are still left with the color noted by Kleis, so I shall lower the weight to 2 for now, as we still need to explain the colors seen by Kleis.

Alphonsus: On 2017 May 04 UT 05:49 Maurice Collins imaged this crater under similar illumination, to within ±0.5˚, to the following report:

Alphonsus 1967 Feb 17 UT 17:47-18:12 Observed by Moore and Moseley (Armagh, Northern Ireland, 10" refractor, x300) "Eng. moon blink suspected just inside SW floor on the elevation NW of famous dark patch. Feb 18 was cloudy, then on Feb 19, after some neg. results with blink, suddenly a bright glow in same place." NASA catalog weight=4. NASA catalog ID #1014. ALPO/BAA weight=4.

Figure 4. Alphonsus as imaged by Maurice Collins on 2017 May 04 UT 05:49, and orientated with north towards the top. The image has had its color saturation increased to 60%.

Although some atmospheric spectral dispersion is present no color, on the floor of Alphonsus, can be seen in Maurice's image (Fig 4) at the location mentioned in the 1967 report. We shall therefore leave the weight at 4.

Gassendi: On 2017 May 06 UT 23:30-00:00 Alberto Anunziato (AEA) observed this crater under similar illumination, to within ±0.5˚, to the following two reports:

Gassendi 1977 May 28/29 UT 20:45-21:15 Observed by D. Sims (Dawlish, Devon, UK) saw a hazy area on the south east floor that was normal in red and white light but darker in blue. This was partly confirmed by J-H Robinson (Devon, England, 10" reflector) 21:24-23:12 who saw the south east floor of Gassendi to have a loss of detail - but no color seen, although at 21:57-21:58 it was slightly brighter in red than in blue briefly. P. Doherty (22:45-23:15) did not see anything unusual. D. Jewitt (22:22-22:55) did not reveal anything unusual, apart from spurious color. The Cameron 1978 catalog ID=3 and ID=1463. The ALPO/BAA weight=3.

On 1990 Sep 30 at D. Darling (Sun Prairie, WI, USA, 12.5" reflector, x150) observed a red spot on the west wall (bright in red filter and faint in the blue filter. No filter reactions were found elsewhere. Gassendi had much detail visible. A sketch was made. BAA observers in the UK were alerted but they could not observe due to cloud. Cameron 2006 extension catalog ID=411 and weight=5. ALPO/BAA weight=3.

Alberto, using a Meade EX 105, x154, produced a sketch of the crater and labeled the brightest areas from 1 to 3 (See Fig 5 (Right)). It has some similarities with the David Darling sketch from 1990 (Fig 5 (Left)), although both sketches are more designed to be indicative of brightness's and locations, rather than geometrically correct. Although not able to confirm the colors seen in 1977, it does at least show where some of the bright areas were, as reported in the 1990 event. I will leave the weights of both reports at 3 for now.

Figure 5. Two sketches of Gassendi, orientated with north towards the bottom. (Left) A sketch by David Darling from 1990 Sep 30 UT 03:55. (Right) A sketch by Alberto Anunziato (AEA) from 2017 May 06 UT 23:30-00:00, - some annotation has been removed, and others have been re-orientated.

Toricelli B: On 2017 May 08 UT 05:21 John Duchek (ALPO) obtained a color image of this region, under similar illumination, to within ±0.5˚ to the following report from 1983:

On 1983 Feb 18 at 19:00?UT P.W. Foley (Kent, UK) noted that Toricelli B was steel blue in color and this spread 10-15 miles outside the crater. This was odd because Torricelli B was only 6 miles in size. Cameron 2006 catalog extension ID=205 and weight=3. ALPO/BAA weight=2.

John's image (Fig 6), although showing a slightly darker (shaded?) area in the mare outside the 6.5 km diameter crater, does not reveal a "steel blue" color, and another observation by Jeremy Cook, at the same time as the Foley observation in 1983, only mentioned the area around the outside to be "slightly blue". A check on the LROC Quickmap web site, using the "WAC Color Test" option, does actually reveal some blueness here out to about 6 mile in radius, so it is not far-fetched to suggest that this could partly explain what was seen in 1983. However it is odd that John's image does not show this? I will leave the weight at 2 for now.

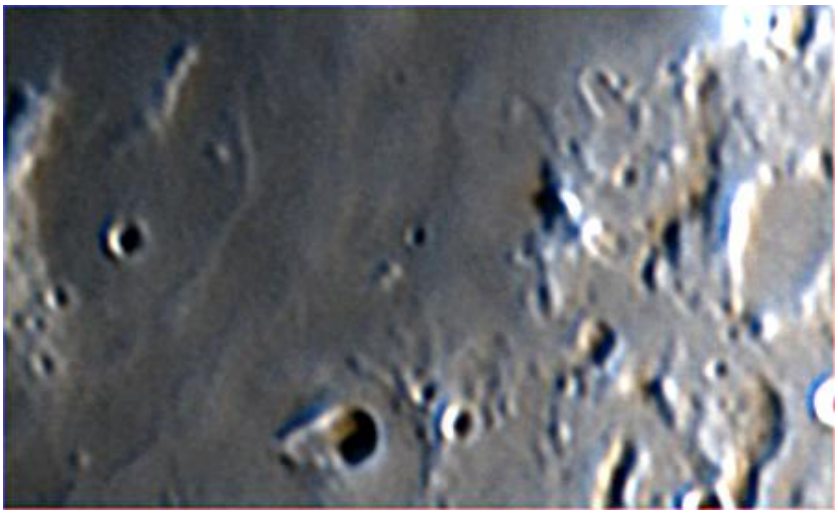


Figure 6. Toricelli B (Center) as imaged by John Duchek (ALPO) on 2017 May 08 UT 05:21, and orientated with north towards the top. The image has undergone an atmospheric spectral dispersion removal, though this appears to have not been 100% effective as some color on contrasty edges is still present.

Mons Pico and Plato: On 2017 May 09 UT 01:30-01:45& 01:45-02:08 respectively, Jay Albert (ALPO) observed this mountain under the same illumination conditions (±0.5˚) to the following LTP reports by Sir Patrick Moore from 1984:

On 1984 Feb 14 P. Moore (Selsey, UK) observed that Plato was darker than the nearby mare and no detail could be seen on the floor or the eastern wall - the later was obscured. At 23:40UT some dimming was still present on the north east wall and still no detail on the floor of Plato. Cook noticed that the eastern floor close to the wall was misty and also noted no detail on the floor. Amery though noted that all parts of the floor were sharp although some darkening was visible in the north west and a hint of obscuration. The east wall though was quite sharp. Moseley could see the central craterlet but from 8-6 o'clock tricky to define (Foley says that this effect has been seen at this colongitude before). Streak ray across the floor of Plato seen (North) - filter measurements made. Cameron 2006 catalog extension ID=241 and weight=5. ALPO/BAA weight=2.

On 1984 Feb 14 P. Moore (Selsey, UK) thought that there was something odd about Mons Pico in that it looked very bright and gave a good impression of a crater. Cameron 2006 catalog extension ID=241 and weight=5. ALPO/BAA weight=2.

Looking though the BAA Lunar Section archives, I see that other observers were studying the Moon at the time, as a LTP alert had been issued, and this is why Cameron gives these reports such high weights? Here is a run-down of what other saw in chronological order, in UT:

19:36 Gerald North (Bexhill-on-Sea, UK, 46 cm reflector, x46, seeing IV, transparency: hazy) could see the central craterlet in Plato faintly.

19:40 Gerald North (x144) comments that the central white spot in Plato can now be seen intermittently, and is quite faint. Other craterlets faintly and intermittently seen.

20:30 Martin Mobberley (Cockfield, UK, 14" Cassegrain, seeing II, transparency excellent) sketch made, showing three craterlets on the floor and a white spot, along with some shaded bands across the floor, and a mottled appearance on the floor near the N-NE rim. Sketch made.

20:58 Anthony Cook (Frimley, UK, BAA, 30 cm reflector, 64 pixel photodiode line scan camera, seeing III-IV, transparency moderate-poor). Images of low resolution, and in white light, but brightness measurements taken e.g. Plato floor: 20, Mare Imbrium, 22.5, Plato NE rim: 29.0, Plato NE rim: 29, Plato NW rim: 31, Plato W rim: 30, Mons Pico: 30.5.

21:05 Martin Mobberley – Plato same as before. In a later letter to Peter Foley he comments that he did not see the ray/streak mentioned by Foley, across the floor of Plato.

21:35-21:55 Patrick Moore (Selsey, UK, 32 cm reflector, x300, seeing III (at best). Patrick comments that the floor was a little darker than the Mare Imbrium., but he found it odd that the E. wall was badly defined, and whilst Mons Pico as very bright, there was something very odd about its appearance, namely it looked like a crater. He considered that the E Plato wall's haziness and obscure appearance was worth contacting Peter Foley about.

21:54-21:58 Peter Foley (Nettlestead, UK, 29cm reflector, seeing II, transparency II until completely fogged out). Indistinctiveness seen on E wall of Plato at 10-7 o'clock position, with intensity at the 8 o'clock position. The floor of Plato showed no detail whatsoever, which he considered unusual, apart from a ray/streak running from Mons Pico, running S, and across onto the floor of Plato, N-S across the floor, and slightly to the W of the center of the crater (this streak was also seen by Moore). Turning to Mon Pico (only 1 minutes observing before being fogged out), Peter found "unusual brightness" over the center, and a dark shadow line to the E.

22:10 Marie Cook (Frimley, UK, BAA, 30 cm reflector, seeing IV, transparency poor) found that there was a shadow seen on Mare Imbrium, close to Mons Pico, from the E to then. A "✓" or tick-like formation was seen on the top of Mons Pico, running from the W to the NE, then rearing away to the NW. In general nothing unusual was detected.

22:12 Marie Cook (Frimley, UK, BAA, 30 cm reflector, seeing IV, transparency poor) turned her attention towards Plato and found the crater quite elongated (libration). The rim SW-W was brightly lit by Sun and so too in the N. The E floor, close to the rim looked slightly misty – but she was not surprised considering the atmospheric conditions. A very distinct "V" shaped dip was seen to the ENE of the wall/rim, with a bright spot beyond it, also in the ENE. No craterlets seen on the floor of Plato.

22:10-22:45 Rob Moseley (Coventry, UK, BAA, 15 cm reflector, x120, seeing II-III, transparency good to poor) clearly saw the central craterlet on the floor, and Plato G on the E rim was very bright (usual), and a filament-like strip of terracing, was clear cut W of the interior residual shadow. From a bright point at 8 o'clock to a large bright

area at 6 o'clock, the wall seemed difficult to define, however Rob states that this has been noted previously at this colongitude. Rob checked the crater on and off until 00:00 but saw no changes apart from what was expected from deteriorating observing conditions.

22:18 Gerald North (x144, seeing IV) commented that Mons Pico looked odd, big and bright, with the interior shadows of the peak, not black, but a light hazy grey. He found that the rim of Plato was perfectly sharp all the way around, and the floor craterlets looked the same as before.

22:20-22:45 Geoff Amery (Reading, UK, BAA, 25 cm reflector, x200, seeing II or I, transparency 3/5 to 1/5, lunar altitude 62˚). All parts of the rim of Plato checked and everything looked sharp, though he suspected a slight darkening/obscuration on the NW. The E wall was quite distinct. The floor of Plato was dark with a suspicion of "patchiness". Mons Pico was checked out at x300 and appeared bright with an indistinct outline. A dark cleft/craterlet was seen running from the north slopes into the mountain. A sketch was made of Mons Pico.

22:20-23:10 Bill Peters (Hever, UK, BAA, 21 cm reflector, x128, Seeing III, transparency hazy) noted that Mons Pico was bright with a dark area extending down the mountain on the S side. A bright spot was seen on the top of the mountain, on the NW. The floor of Plato was uniformly dark, and the crater rim was distinct, apart possibly for a section of the NE wall, which at times appeared slightly out of focus.

22:27 Gerald North observed the central floor craterlet of Plato to suddenly flash into prominence for a brief moment, but thinks that this was a result of atmospheric turbulence.

22:29-22:32 Gerald North found that the appearance of Plato was normal.

22:34 Gerald North (x144) comments that the environs of Plato look perfectly sharp and well defined.

22:35-22:46 Gerald North (x144) experimented with filters and found that with deep red that the central craterlet was invisible and that the floor was much darker than Mare Imbrium, whereas without the filter it was only slight darker than the mare. With the yellow filter the appearances were similar to using no filter. With a green filter, again everything appeared mostly similar to the views when not using a filter, though the floor of Plato was darker than mare Imbrium, in green light.

22:45 Rob Moseley, observing Mons Pico, found that the center of the formation to be very bright – marginally brighter than the E tip of the β mountain to the south. There were one (maybe two) light areas off to the W, and there may have been a rosy coloration at the N tip of the mountain but he was unsure whether this was due to atmospheric spectral dispersion, as little was seen elsewhere. A sketch was made.

23:40 Patrick Moore – seeing now worse, but the NE wall of Plato was unusually dim (albeit with some whiteness), the E wall was not as hazy as earlier, and no interior detail was seen on the floor, apart from a white streak running N-S and just W of the crater center.

23:50 Rob Moseley, observing Mon Pico (x240) now found that the brightest points lay to the N and S extremities of the main mass, and were brighter than the E tip of β. He could definitely see atmospheric spectral dispersion now – blue to the S and red to the N. This suggested that the earlier rosy color seen was atmospheric in origin. A sketch was made.

00:40 Rob Moseley, observing Mon Pico found that the mountain was now obviously brighter than the nearby β mountain.

Under repeat illumination conditions, Jay comments that for Mons Pico: "Mt. Pico and Pico B were brightly lit with their E slopes extremely bright. Because of its curved, roughly horseshoe shape, Mt. Pico did look a little like a crater as stated in the LTP description (if you didn't look too closely), but this appearance is normal." And for Plato: "I did not see as much detail as I saw on May 7th. I saw the central craterlet, but the N pair was seen only sporadically with difficulty and the S craterlet was not seen at all. The N part of the floor was a bit darker than the S floor and a partial light streak was suspected on the N floor. The E wall was clearly seen, but sometimes not as sharply as the N, S and W walls. No "mists" or obscurations were seen at or near the E wall."

So looking at what was described back in 1984, some observers saw the NE/E rim of Plato to be obscure, but this appears normal, especially if observing conditions are not so good. Concerning floor detail, again there is

not too much to see at this stage in the illumination, and this is limited by observing conditions. It is normal for the floor of Plato to be slightly darker than the Mare Imbrium – confirmed by my Photodiode array image. Mons Pico and Pico B can certainly look "crater-like" i.e. "horseshoe shaped" at this stage in illumination too. So the only oddities (probably normal) are the dimness of the NE/E rim, of Plato, why some observers saw the white NS streak across the floor and others did not (?), and a possible brightening of Mons Pico over time – though this might be expected as the Sun rises. I shall therefore reduce the weights of both LTPs to 1.

Manilius: On 2017 May 09 UT 21:42 Derrick Ward (BAA) imaged, and at 22:40-22:50 Marie Cook visually observed, this crater under similar the illumination conditions, and topocentric libration viewing angles, to within ±0.1˚ to the following Walter Haas LTP report:

Manilius 1939 Jul 30 UT 06:00 Observed by Haas? (NM?, USA, 12?" reflector) "Dark area in S. part was I=3.7 comp. with #449. Cond. were similar. (phase same. real difference?). (normal here?)". NASA catalog weight=4. ALPO/BAA weight=3.

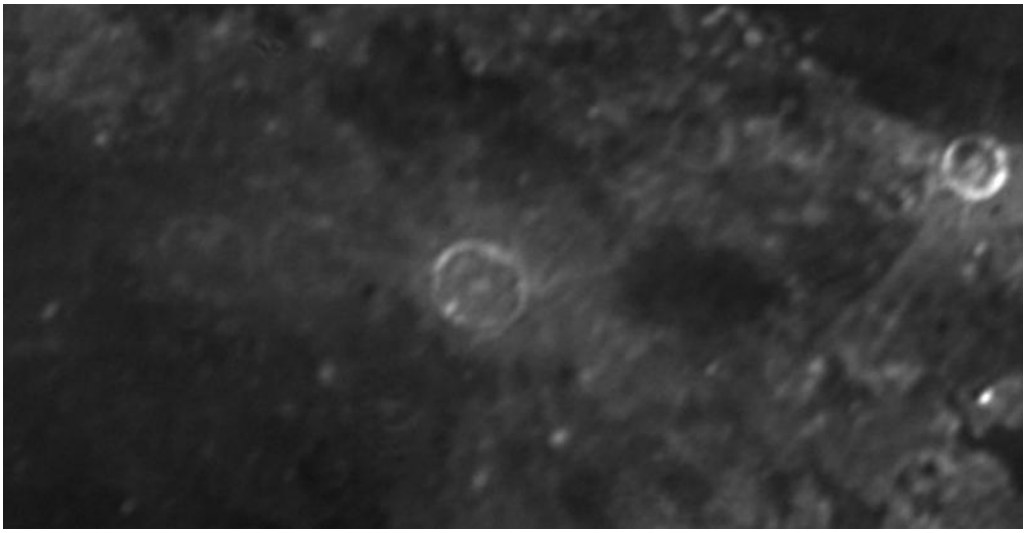


Figure 7 Manilius (Center) as imaged by Derrick Ward (BAA) on 2017 May 09 UT 21:42 and orientated with north towards the top.

Marie Cook, using a 90 mm Questar telescope under III-IV seeing and medium to good transparency, commented at 22:40-22:50 UT that there was no dark area seen in the south part of the crater – at least not darker that other parts of the crater floor, and everything looked normal. This is confirmed in Derrick Ward's image (Fig 7). I will therefore leave the weight of Walter's 1939 observation at 3.

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: +44 798 505 5681 and I will alert other observers. Twitter LTP alerts can be accessed on https://twitter.com/lunarnaut .

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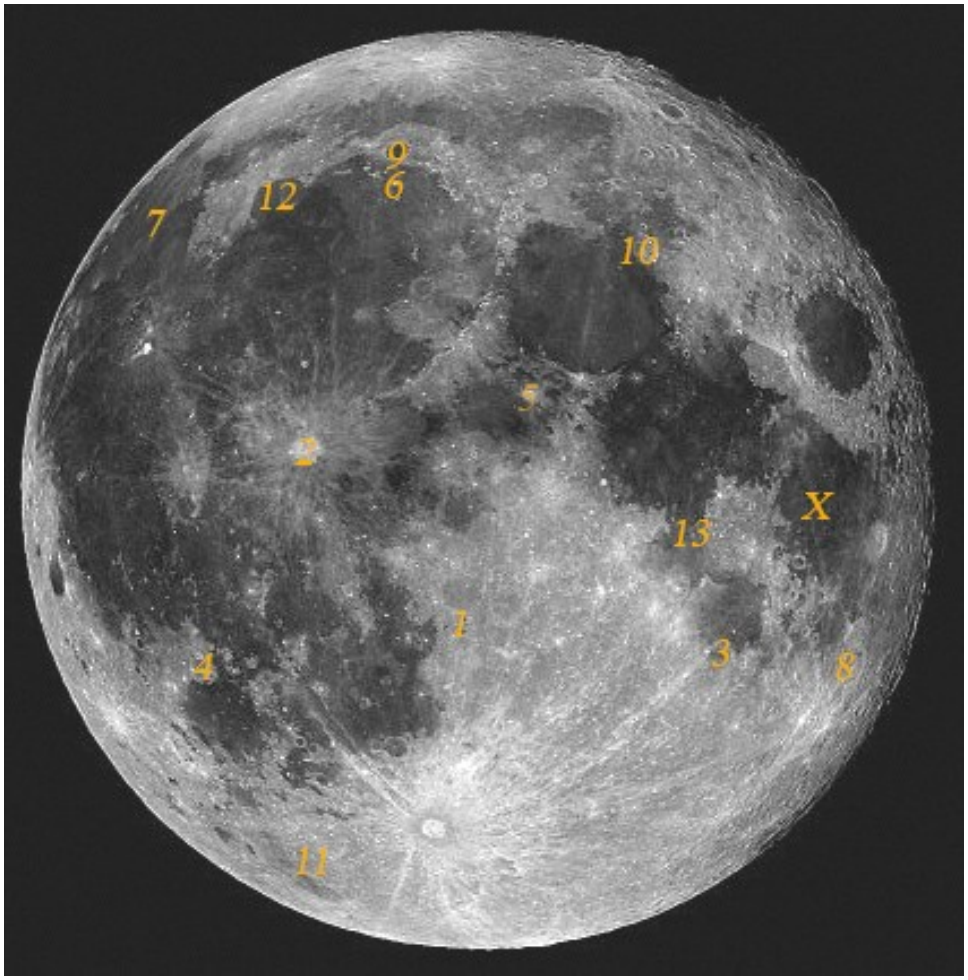
KEY TO IMAGES IN THIS ISSUE

1. **Alphonsus**
2. **Copernicus**
3. **Fracastorius**
4. **Gassendi**
5. **Manilius**
6. **Mons Pico**
7. **Mons Rumker**
8. **Petavius**
9. **Plato**
10. **Posidonius**
11. **Schiller**
12. **Sinus Iridum**
13. **Toricelli**



FOCUS ON targets

X = Messier-Messier A