

# THE LUNAR OBSERVER

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

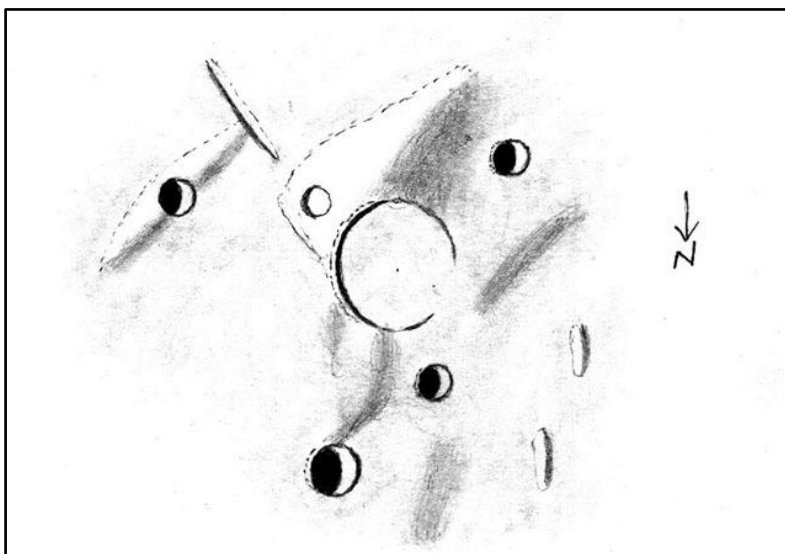
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RECENT BACK ISSUES: [http://moon.scopesandscapes.com/tlo\\_back.html](http://moon.scopesandscapes.com/tlo_back.html)

## FEATURE OF THE MONTH – SEPTEMBER 2016

### Jansen R



**Sketch and text by Robert H. Hays, Jr. - Worth, Illinois, USA**

**April 13, 2016 01:50-02:15 UT, 15 cm refl, 170x, seeing 8-9/10, transparency 6/6**

I drew this crater and vicinity on the evening of April 12/13, 2016 before the moon hid 26 Geminorum. This area is in northern Mare Tranquillitatis. Jansen R is the largest crater in this view, but it is a shallow, broken ring. It has a narrow, crisp east rim, a weak southwest rim, and a large gap to the northwest. Its floor appears very smooth. Jansen D is the crater near the northwest gap of Jansen R, and Jansen C is to the north and slightly larger than D. Jansen E is southwest of R and Jansen L is to the east. All four of these nearby lettered craters are neat, deep features, differing slightly in size. A shallow ring is just southeast of Jansen R. There is a straight, narrow rille southwest of Jansen L, pointing to the shallow ring. A wide ridge straddles Jansen L, but stops at the rille. A large, low swelling protrudes from the south and east rims of Jansen R, taking in the shallow ring. A fairly dark, angular strip of shadow connects Jansen R and C, and a vague shadow patch is west of C. Two short, low ridges are west of Jansen R and D, and another vague shadow strip is nearby.

# **LUNAR CALENDAR**

## **SEPTEMBER-OCTOBER 2016 (UT)**

2016		UT	EVENT
Sep	01	09:03	New Moon
	01	09:08	Annular Solar Eclipse
	01	15:27	Moon Ascending Node
	03	10:33	Moon-Venus: 1.2° S
	06	18:44	Moon Apogee: 405100 km
	08	21:23	Moon-Saturn: 4.2° S
	09	11:49	First Quarter
	10	22:05	Moon Extreme South Dec.: 18.5° S
	15	23:55	Moon Descending Node
	16	18:56	Pen. Lunar Eclipse
	16	19:05	Full Moon
	18	17:00	Moon Perigee: 361900 km
	21	22:13	Moon-Aldebaran: 0.2° S
	23	09:56	Last Quarter
	23	16:44	Moon Extreme North Dec.: 18.5° N
	27	22:32	Moon-Regulus: 1.8° N
	28	22:06	Moon Ascending Node
Oct	01	00:12	New Moon
	03	17:30	Moon-Venus: 5.6° S
	04	11:02	Moon Apogee: 406100 km
	06	08:04	Moon-Saturn: 4.2° S
	08	06:03	Moon Extreme South Dec.: 18.5° S
	09	04:33	First Quarter
	13	09:43	Moon Descending Node
	16	04:23	Full Moon
	16	23:36	Moon Perigee: 357900 km
	19	06:18	Moon-Aldebaran: 0.3° S
	20	23:38	Moon Extreme North Dec.: 18.6° N
	22	19:14	Last Quarter
	25	04:01	Moon-Regulus: 1.7° N
	26	01:45	Moon Ascending Node
	28	09:33	Moon-Jupiter: 1.6° S
	30	17:38	New Moon
	31	19:29	Moon Apogee: 406700 km

## **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](mailto:wayne.bailey@alpo-astronomy.org)

and Jerry Hubbell – [jerry.hubbell@alpo-astronomy.org](mailto:jerry.hubbell@alpo-astronomy.org)

### **CALL FOR OBSERVATIONS:**

#### **FOCUS ON: Schiller-Zuchius Basin**

***Focus on*** is a bi-monthly series of articles, which includes observations received for a specific feature or class of features. The subject for the **November 2016** edition will be **the Schiller-Zuchius Basin** located to the west of Schiller at selenographic coordinates 45.0 W, 56.0 S. 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 this to your observing list and send your favorites to (both):

**Jerry Hubbell** – [jerry.hubbell@alpo-astronomy.org](mailto:jerry.hubbell@alpo-astronomy.org)

**Wayne Bailey** - [wayne.bailey@alpo-astronomy.org](mailto:wayne.bailey@alpo-astronomy.org)

**Deadline for inclusion in the Schiller-Zuchius Basin article is October 20, 2016**

### **FUTURE FOCUS ON ARTICLES:**

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

<b><u>Subject</u></b>	<b><u>TLO Issue</u></b>	<b><u>Deadline</u></b>
<b>Montes Taurus &amp; Taurus-Littrow Valley</b>	<b>January 2017</b>	<b>December 20, 2016</b>

## PETER GREGO

I recently learned of the passing of Peter Grego, a long time contributor of lunar drawings. In addition to his drawings, which were created on a PDA and had an almost photographic appearance, he also contributed a short tutorial on lunar drawing to the April 2009 issue of The Lunar Observer. Peter was very active in British amateur astronomy. He edited the Lunar Section Circular of the BAA and served in various capacities several astronomical organizations. He was a prolific author, best known among lunar enthusiasts for **The Moon and How to Observe It**, although he also wrote books on a wide variety of topics. His sketches for the TLO were always accompanied by insightful commentary. He will be missed.

I never met Peter in person, only through his book and correspondence concerning submissions to the TLO, so with the kind permission of Bill Leatherbarrow, director of the BAA's Lunar Section, I am including the tribute he has written for the BAA's Lunar Section Circular. Tony Cook's Lunar Geological Change article in this issue also includes a tribute to Peter.

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### *Peter Grego, 1965-2016*



Occasionally something occurs to remind us of the disconnect between the apparent eternity of the celestial objects we study as amateur astronomers and the fragile transience of our own lives.

The sudden and untimely death of Peter Grego in early August deprives us not only of a long-standing friend and loyal servant of the BAA Lunar Section who for many years edited this Circular, but also of a figure who did as much as anyone to popularise our subject in the larger world.

Losses such as this are grievous, but they also remind us of the need to seize the day. Peter certainly seized the day. He was tireless in his contribution to amateur astronomy, taking on an apparently impossible workload, including much of a purely voluntary nature and done for the love of the subject. When I took over as Lunar Section Director in early 2009 Peter immediately volunteered his services, serving as a supportive Assistant Director. He assumed the editorship of the LSC in September 2009 and continued until pressure of work compelled him to step down in 2015. Under his editorship the publication grew from a relatively small pamphlet into a substantial monthly periodical with very high production standards. The amount of work involved was considerable, particularly as Peter was at that time also producing occasional issues of *The New Moon*, as well as acting as Section webmaster.

His work for our Section went alongside equally loyal service elsewhere: he was Lunar Section Director for the Society for Popular Astronomy and edited that society's journal; he wrote regularly for astronomy magazines, including monthly columns for *Astronomy Now*; and he also acted for many years as editor of the Bulletin of the Society for the History of Astronomy. In addition, he was an indefatigable author of his own books on popular and observational astronomy, having published over twenty volumes (including, more recently, work on local Cornish history).

As well as all this, Peter also kept up an impressively productive rate of observational activity, often using home-built telescopes, and he was renowned as an astronomical artist.

He will be sorely missed by his many friends and colleagues, but he packed a lot in to his years and that will stand as his legacy.

A more formal obituary of Peter will appear in due course, but in the meantime we extend our deepest sympathy to his wife Tina and daughter Jacy.

*Bill Leatherbarrow*

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# **FOCUS ON: MONTES APENNINES and** **PALUS PETREDINIS**

**By Jerry Hubbell**

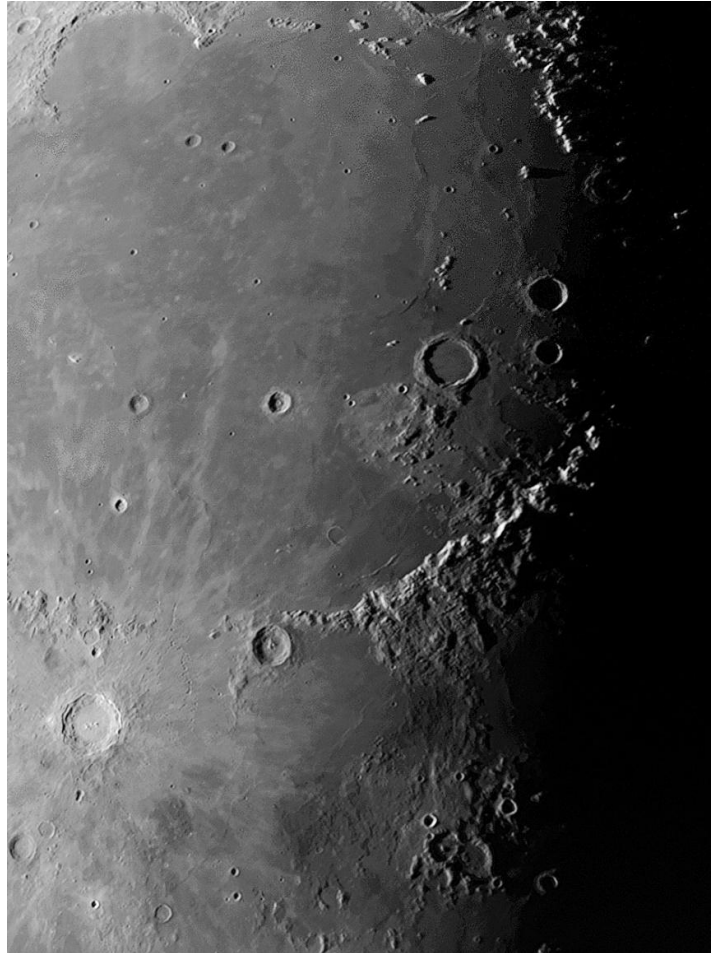
Assistant Coordinator, Lunar Topographical Studies

This Focus On article continues our look at some smaller features of the moon referred to as a Palus or “plain”. These so-called “Marshes” are small stretches of lava plains. These often overlooked areas are adjacent to other more prominent features. The area of the lunar surface known as the Montes Apennines and Palus Petredinis “Marsh of Decay” contain features that are of significance including Mons Hadley and the Hadley Rille visited by the

*Figure 1. Montes Apennines and Palus Petredinis – David Teske - Starkville, Mississippi, 14 November 2014 1137UT, Seeing 6/10, North/Up, East/Right, 3.5” Maksutov-Cassegrain, Skyris 445 video camera.*

Apollo 15 mission. The Montes Apennines (Fig. 1) are one of the most popular mountain ranges observed on the moon and also one of the easiest to study. There are several named peaks in this range including: Mons Wolf, Mons Ampère, Mons Huygens, Mons Bradley, and Mons Hadley. Mons Hadley is often considered the highest mountain on the moon.

Images of the the peaks around Montes Apennines provide the opportunity to practice using the program LTVT, the Lunar Terminator Visualization Tool. This program provides the tools to measure the heights of mountain peaks and crater rims on the lunar surface. (Fig. 2)



I would encourage observers to try using LTVT on your images, or other images available on the ALPO website. Comparing your measurements to other sources such as the Apollo era LAC charts available online would be a very interesting project. I will be talking more about this in future articles and encourage and appreciate suggestions.

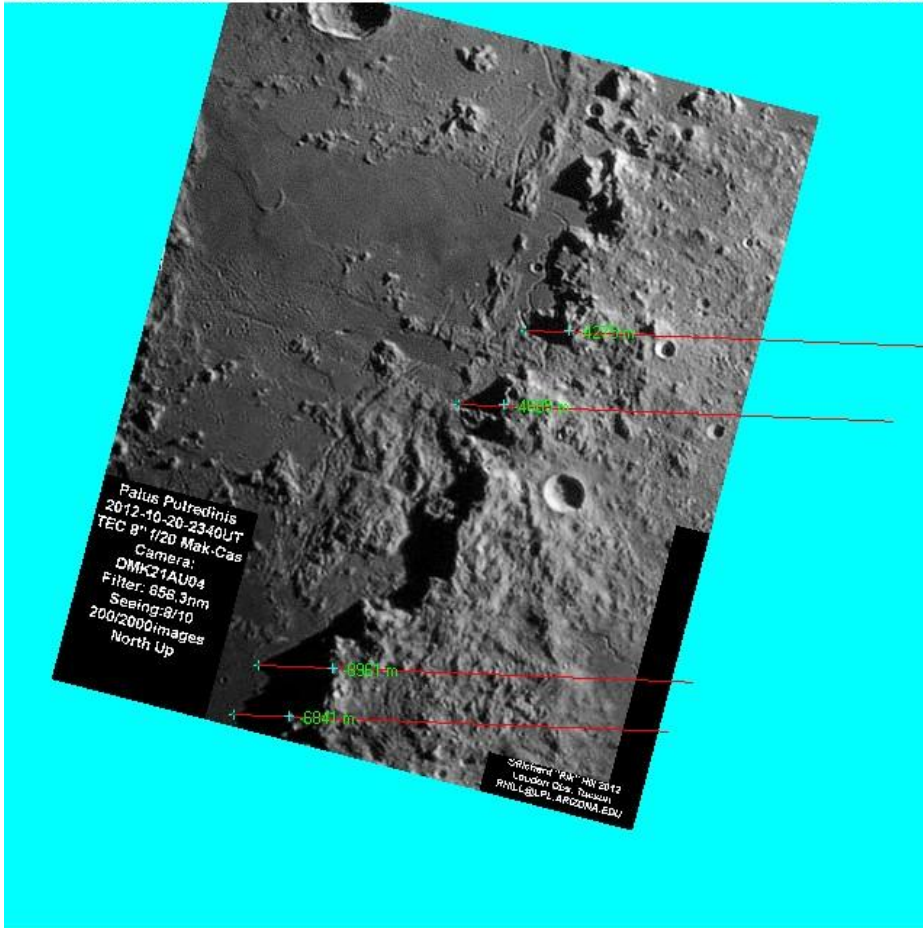
The adjacent lava-flooded plain known as Palus Petredinis (Fig. 3) is a level lava-flooded plain with the crater Autolycus to the north and the Montes Archimedes to the west. The selenographic coordinates of the Palus are 26.5° N, 0.4° E and is 100 miles (161 km) in diameter. Rimae Archimedes lies in the southern most area of Palus Petredinis. Rimae Hadley lies to the east of the Palus. The small submerged crater Spurr lies just northwest of the center of Palus Petredinis and is the site of crashed spacecraft Luna 2.

As mentioned previously, the Apollo 15 mission destination was Hadley Rille. This mission explored the region around the rille and Mons Hadley. The astronauts David Scott, James Irwin, and Alfred Worden explored the Hadley Delta and Hadley Rille area of the Palus Petredinis region over a 3-day period using the first lunar rover on the moon.



Sub-solar Pt = 110.325°E/0.747°S Sub-Earth Pt = 5.727°E/5.685°S Center = 3.237°E/23.955°N Zoom = 10.000  
Vertical axis : central meridian

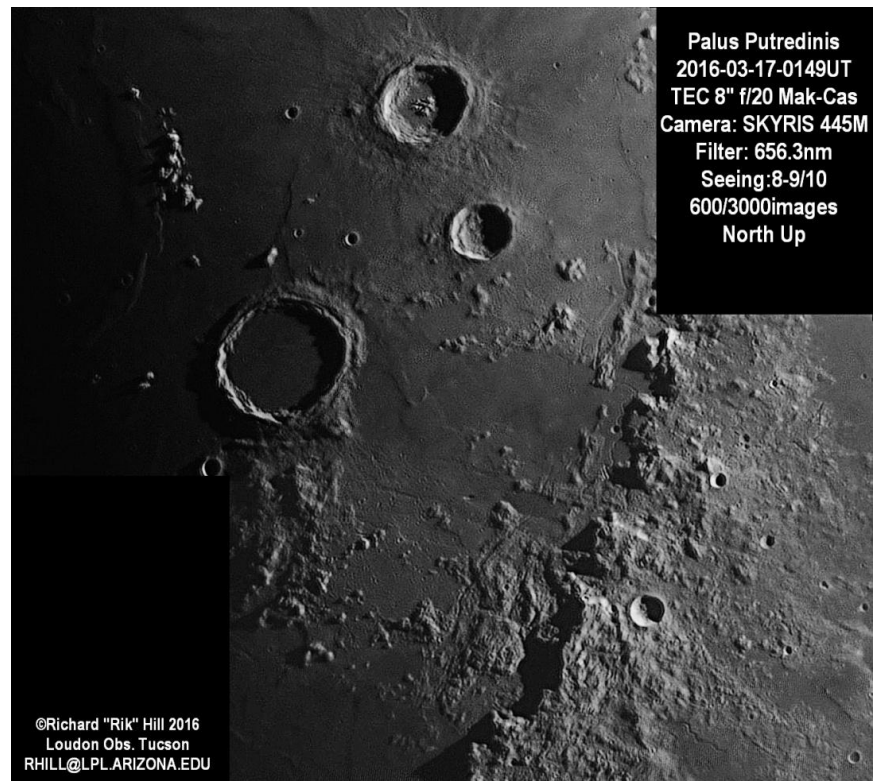
LTVT v0.21.4



Texture file: PalusPutredinis\_2012-05-29-0241\_fin8.jpg

**Figure 2. Montes Apennines – Palus Putredinis LTVT Measurements.** This image by Rik Hill – Tucson, AZ, shows several peaks, 2 of which are measured to be almost 9 km and 7 km in height in the lower portion of the image. 20 October 2012 2340UT, Seeing 8/10, North/Up, East/Right, 8” Maksutov-Cassegrain, DMK21AU04 video camera with IR filter. Processed by Jerry Hubbell in LTVT.

**Figure 3. Palus Petredinis – Rik Hill – Tucson, AZ, 17 March 2016 0149UT, Seeing 8-9/10, North/Up, East/Right, 8” Maksutov-Cassegrain, Skyris 445 video camera with IR filter.**





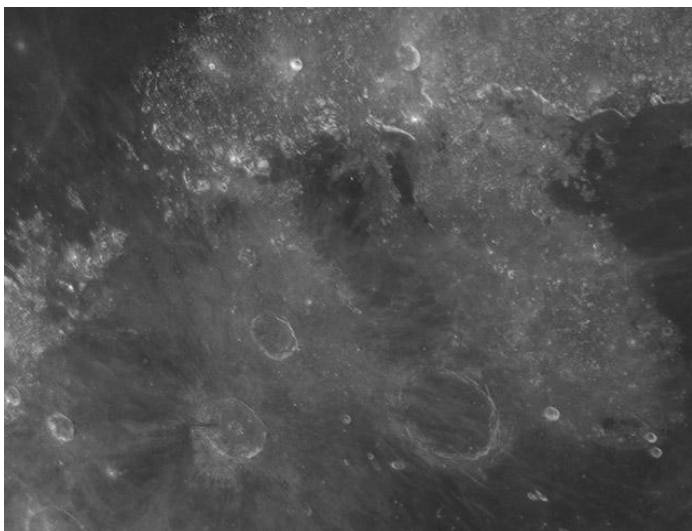
**Figure 4. *Palus Petredinis*** – Jay Albert – Lake Worth, FL, 14 June 2016 0246UT, Seeing 7/10, North/Right, East/Down, 11" SCT, video camera.



## ADDITIONAL READING:

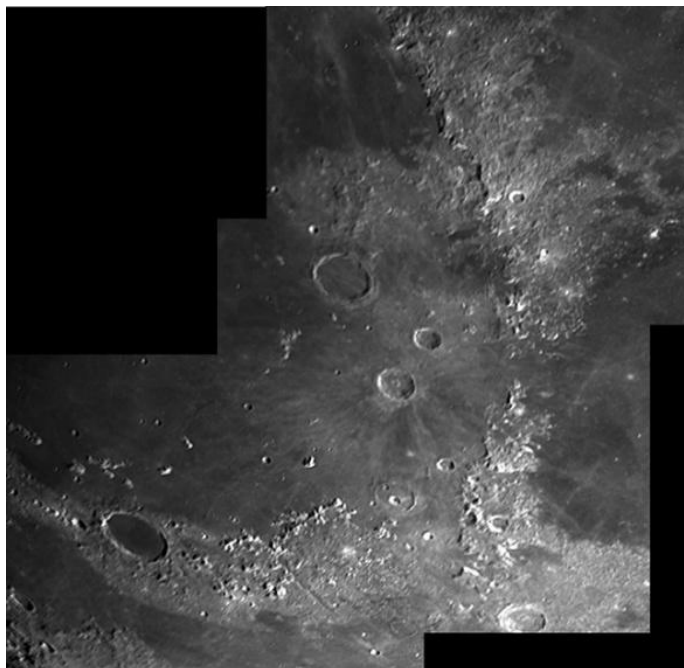
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## ADDITIONAL OBSERVATIONS



**PALUS PUTREDINIS**- Francisco Alsina Cardinali-Oro Verde, Argentina. June 19, 2016 05:15 UT. 250 mm LX200 SCT, QHY5-II, 742nm IR-pass filter.

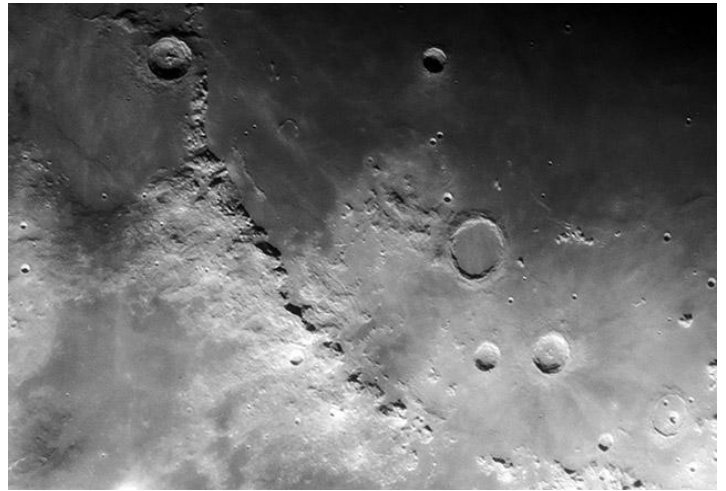
**PALUS PUTREDINIS** - Maurice Collins, Palmerston North, New Zealand. July 12, 2016 07:54 UT. Seeing A-I-II, FLT-110, f/21, ASI120MC (South up).



**MONTES APENNINUS-PALUS PUTREDINIS** – Guilherme Grassman, Americana, Brazil. August 13, 2016 21:22 UT. 10" f/10 SCT, Seeing 7/10, Transparency 4/6, Lumenera skynyx.

**MONTES APENNINUS-PALUS PUTREDINIS** –

Marcelo Gundlach, Cochabamba, Bolivia. April 19, 2013 22:51 UT. Seeing 10/10, transparency 6/6. Celestron 150mm f/8 refractor, Nikon D3100 B/W, V-block filter.



**MONTES APENNINUS.** Michael Sweetman, Tucson, Arizona, USA, April 8, 2014 05:56 UT. Seeing 6/10, transparency 3/6. 5" APO Refr. DMK21, Baader IR cut-off filter.

# RADIO OBSERVATION OF THE MOON

## Stephen Tzikas

The field of amateur radio astronomy offers a lot of rewarding and challenging projects. Unlike optical astronomy, radio astronomy does not have a plethora of resources in books and on the Internet to resolve questions and interpret observations. I had a simple goal of providing a radio image of the Moon for this article, and as often is the case, was faced with a data interpretation problem. It was, in all, probably a good example to provide for this article rather than a simple image, which would not have been so exciting.

I am both a member of A.L.P.O. and the Society of Amateur Radio Astronomers (SARA). One of the projects I have undertaken at SARA was the creation of SARA Sections, very similar to that found at A.L.P.O. The Solar System Section of the SARA website, found at: <http://radio-astronomy.org/node/196>, is where A.L.P.O. members can find projects related to the Solar System. If you are completely new to amateur radio astronomy, you may find helpful some of the information posted for beginners in the Introduction to the SARA Sections located at <http://radio-astronomy.org/node/202>.

In general, electromagnetic radiation is emitted by one of two means, either thermal or non-thermal mechanisms. Thermal emission, which depends only on the temperature of the emitting object, includes blackbody radiation, free-free emission (Bremsstrahlung) in an ionized gas, and spectral line emission. Non-thermal emission, which does not depend on the temperature of the emitting object, includes synchrotron radiation, gyrosynchrotron emission, and amplified emission from masers in space. Most light, from common objects like our sun and the majority of stars, is what is called thermal. In this article thermal radio radiation has been observed from the Moon. These observations are Moon phase/co-longitude independent, and can be made in daylight and cloudy conditions, as radio electromagnetic radiation is not affected by these situations. The thermal radio radiation from the Moon comes from beneath its surface, so will appear as a “full Moon” regardless of phase. My observation of the Moon was done in L-Band. Unlike optical astronomy, the frequencies of observation in radio astronomy are many, and different receivers are sensitive in different ranges.

For this observation I used the National Radio Astronomy Observatory (NRAO) Skynet 20-meter dish at Green Bank, WV, controlled remotely from my location. Skynet University, at <http://skynet.unc.edu/introastro/ourcourses/>, offers a low cost course providing access to this radio telescope. Specifics of this observation are noted in the caption.



**Figure 1.** Radio Skynet Observation: Skynet\_57618\_Moon\_23435\_23470

- Date: Thu Aug 18 03:20:42 2016(UT) NRAO Green Bank 20m Radio Telescope
- Sky Pattern Map Type: Map: Number of Channels: 1024
- Center Frequency: 1550.0; Secondary Frequency: 1421.88
- RA, DEC (stop): 21:27:55.95, -15:12:54.41
- Data Collection Mode: Low Resolution Spectral/ Continuum
- No filter – Full Band (L-Band, 1.3 to 1.8 GHz)
- Band Width: 500 MHz
- Estimated beam width is 0.676 degrees
- Map Size: 6 beam widths across in both directions
- Integration time: 0.3 seconds; Time to complete scan: 18 minutes
- Number of sweeps: 60

Figures 1 and 2 are the radio image of the Moon. Along with it, I was presented a challenge in explaining the band of radiation that appeared along with the Moon. At first, I thought it was probably the neutral hydrogen or the continuum associated with the Milky Way. However, this image of the Moon was taken in Capricornus, and is near, but not in the optical Milky Way.

Presented below are some additional details from the observation. The Moon is about  $\frac{1}{2}$  degree in apparent size. Since a complete circle contains 24 hours of right ascension or 360 degrees of arc, 1 hour of right ascension is 15 degrees. Converting the right ascension that is presented in degrees into hours, we find that 326



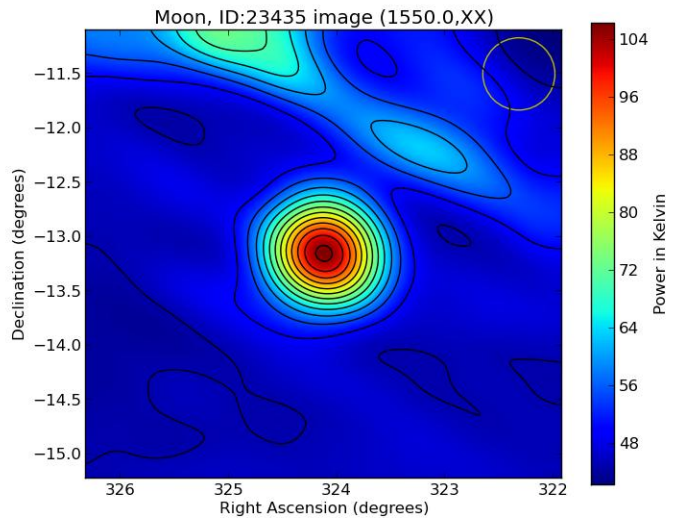
degrees/15 = 21.73 hours, and 322 degrees/15 = 21.47 hours. Hence the image scan of sky is approximately bounded by: -11, 326 degrees/ 21.73 hour; -11, 322 degrees/ 21.47 hour; -15, 326 degrees/ 21.73 hour, and -15, 322 degrees/ 21.47 hour, with the Moon at the center given

**Figure 2. Radio image of the moon.**

approximately by -13.2 declination and 324 degrees/ 21.6 hour.

This region of the sky is roughly bounded by a square with Delta, Gamma, and Iota Capricorni as one edge, with the rest of the square projected towards the star Beta Aquarii. There is no optical Milky Way in this part of the sky, nor are there any obvious radio sources such as galaxies or supernova remnants. Satellites move fairly quickly, and there are no geostationary satellites either that would appear as

Skyrnet\_57618\_Moon\_23435\_23470\_cal



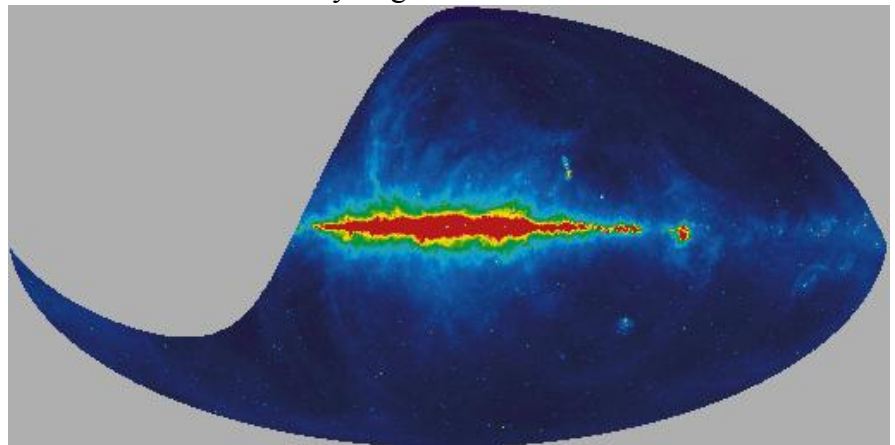
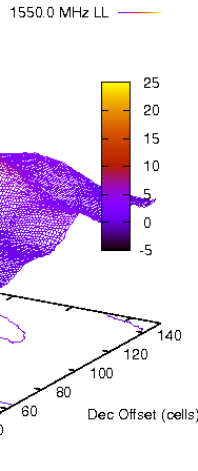
points, something like that of the Moon. Figure 3, also from the observation, shows a ridge like object next to the circular Moon.

**Figure 3. 3dimensional view of the contour plot.**

I decided to search for a radio image of the galaxy closest in the range of my observation, and the CHIPASS chart provides such a chart, displayed below. The CHIPASS 1.4 GHz continuum map (Fig. 4), covers the sky south of +25 degrees declination. Notice that the radio image of the Milky Way extends farther beyond the optical path.

Hence, the Capricornus constellation where the Moon was imaged, is close enough to the optical band of Milky Way light to capture radio emission. There are three important sources of radiation within the L-band window at 1.4 GHz that originate outside of our solar system: The cosmic microwave background (CMB), discrete line emission from (mostly) neutral hydrogen, and continuum emission such as is emitted by thermal sources. Neutral hydrogen radiation is concentrated around the plane of the galaxy, but clouds of hydrogen are widespread and no direction is observed without some such radiation.

There is also a continuum of radiation from extra-terrestrial sources. The source of the radiation is mostly galactic because these sources are closest, but there are also strong extra-galactic sources such as certain radio galaxies. My conclusion is that I imaged the Moon and captured some of the neutral hydrogen and/or continuum next to it.

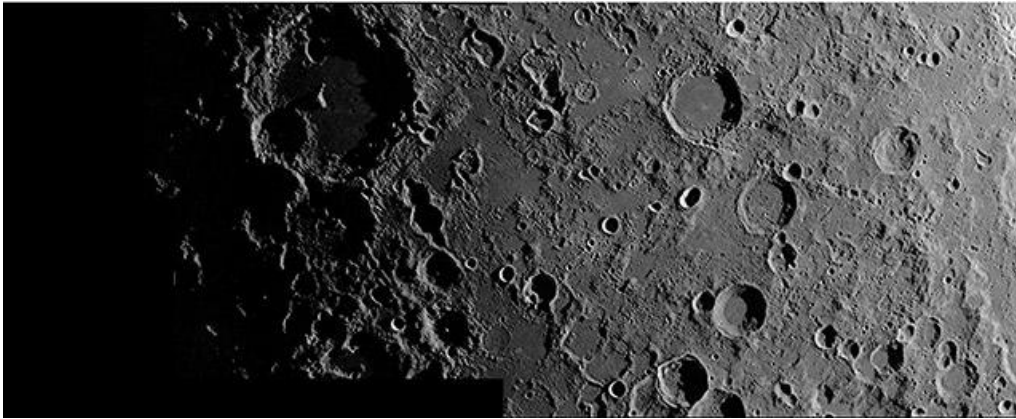


**Figure 4. Image: Continuum HIPASS found at**  
[http://lambda.gsfc.nasa.gov/product/foreground/f\\_images.cfm](http://lambda.gsfc.nasa.gov/product/foreground/f_images.cfm)

# AT THE CATENA

**Richard Hill**

Here we have another region that is often skipped over. To the right of center in this image (fig.1) we have a vertical arc of 4 large craters. From top to bottom they are Abulfeda (65km diameter), Almanon (51km), Geber (46km), Abenezra (43km) with Azophi (49km) just below that but cut off here. Starting at the bottom edge of Abulfeda and heading over 210km to the right, across part of Rupes Altai on the right side of this



image, is Catena Abulfeda. It consists of around 3 dozen craterlets strung out in a

**Figure 1. Catena Abulfeda-**  
*Richard Hill – Tucson, Arizona, USA July 12, 2016 02:52 UT. Seeing 8/10. TEC 8" f/20 Mak-Cass, SKYRIS 445M, 656.3 nm filter.*

curved line. There are 20 of these named on the moon but this one is my favorite

because of its clarity. Catena Davy is a close second. These are thought to be caused by asteroids (or comets?) that broke up shortly before impact. On Jupiter in 1994, the SL-9 comet did this but because of the rapid rotation of Jupiter (some 40-50 times faster than the moon) and the large extent of the comet pieces, it formed a belt of impacts on that planet. Davy is thought to be this kind of impact as it cannot be lined up radially with any larger impact feature that would make it likely secondary cratering. In this case it is possible that Catena Abulfeda may be associated with that very large crater just coming into the light on the left side of this image, the 139km diameter Albategnius. But this is only one thought as to its origin. Some selenologists felt that these quasi linear crater chains were examples of lunar diatremes, vents formed from volcanic explosions along a fault or rima, like Rima Hyginus. This had the potential of bringing up samples of the crust from well below the surface. In 1970 Apollo astronaut Stuart Roosa and Hal Masursky were pushing to get one of the last Apollo landing sites at this or Catena Davy believing that these deep samples of the lunar material could be found there. This idea was rejected by the rest of the landing site committee. Below Albategnius, we see large impact scars from the Imbrium impact one of which ripped across the two craters Vogel (27km) and Vogel B (22km). These were created by city sized and mountain sized blocks being ejected many kilometers per second! The more you look, the more you'll see these scars all converging at a point way above this image.

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## DOMES GAMBART AND MORE

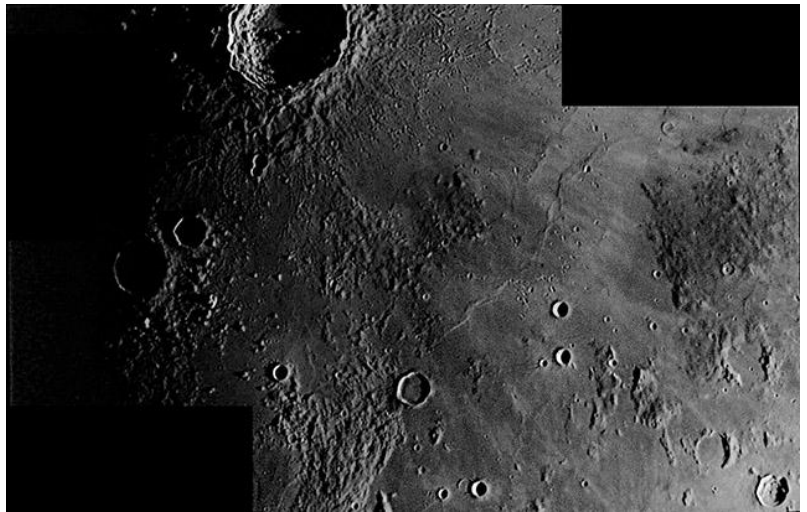
**Richard Hill**

This image (fig. 1) may look a little odd at first. It has been stretched so as to show the low contrast features on the floor of Sinus Aestuum, the mare-like region that dominates the central portion of this image. Of course, the monster crater seen in part at the top is Copernicus. Below it the twin craters Fauth and Fauth A still in deep shadow. A little further below is a hexagonal crater Reinhold B (24km) and below that Reinhold (49km) whose walls are just catching the first rays of sunlight. Near the center of this image, near bottom, is the ring that is the 26km crater Gambart. There are two nearly identical craters to the right of it, Gambart B (11.5km) below and Gambart C (12.2km) above. Between these last two craters and just a little left you can see a mild swelling. This is Gambart 2, one of the larger Gambart domes around 19.5km diameter and 150m high. Much smaller and just a little farther to the left is another dome, Gambart 3. some 9km in diameter and only 50m high. It's much harder to see being a lower swelling, best seen right on the terminator a few hours earlier



than this image. Note the tail small 6km crater just left of Gambart B. This is Gambart G and the tail, upon inspection with LROC QuickMap, is a rima that extends out the right side of the crater too. The rima is obscured near the crater indicating that the rima came first

**Figure 1. Gambart** - Richard Hill – Tucson, Arizona, USA July 14, 2016 02:59 UT. Seeing 8/10. TEC 8" f/20 Mak-Cass, SKYRIS 445M, 656.3 nm filter.



and the crater later. Due south, or below Gambart itself is an isolated mountain. It sits on the north edge of Gambart 1, a 30km diameter dome 140m high.

To the left of Fauth and Copernicus you can see 5 prominent swellings. I know of no nomenclature for these and must assume they are isolated mountain peaks. In the first days with my RV6 (6" f/8) Newtonian telescope I saw these and got quite excited thinking these were the Domes Gambart or "Gambart Domes" as they were known then.

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## LUNAR TOPOGRAPHICAL STUDIES

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Website: <http://moon.scopesandscapes.com/>

## OBSERVATIONS RECEIVED

FRANCISCO ALSINA CARDINALI - ORO VERDE, ARGENTINA. Digital image of Plato.

MAURICE COLLINS - PALMERSTON NORTH, NEW ZEALAND. Digital images of Alphonsus, Alpine Valley, Clavius, Copernicus, Deslandres, Eratosthenes(2), Fra Mauro(2), Heraclitus, Langrenus, Mare Frigoris, Meton, Palus Putredinis, Plato, Proclus, Ptolemaus, Tycho.

DESIRÉE GODOY - ORO VERDE, ARGENTINA. Digital image of Gassendi.

GUILHERME GRASSMAN - AMERICANA, BRAZIL. Digital images of Montes Apenninus-Palus Putredinis(2).

ROBERT HAYS - WORTH, ILLINOIS, USA. Drawings of Jansen R & Lassell C.

RICHARD HILL – TUCSON, ARIZONA, USA. Digital images of Archimedes, Aristillus, Catena Abulfeda, Gambart Domes, Montes Caucasus, Palus Putredinis(3) & South Polar Regions.

MICHAEL SWEETMAN – TUCSON, ARIZONA USA. Digital images of Montes Apenninus(2) & Petavius.

FRANCO TACCOGNA - GRAVINA IN PUGLIA (BA), ITALY. Digital images of Aristarchus(6) & Sinus Iridum(12).

DAVID TESKE - STARKVILLE, MISSISSIPPI, USA. Digital images of Montes Apenninus(2).

STEVE TZIKAS - RESTON, VIRGINIA, USA. Radio image of moon.

KEN WARREN – NICHOLSON, GEORGIA, USA. Digital image of Montes Spitzbergen-Kirch.

# RECENT TOPOGRAPHICAL OBSERVATIONS



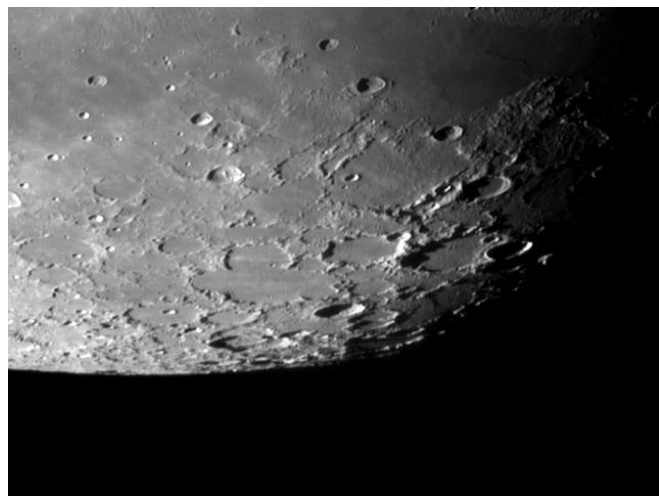
**PLATO**- Francisco Alsina Cardinali-Oro Verde, Argentina. August 14,, 2016 04:02 UT. 130 mm Celestron Newtonian, QHY5-II, 742nm IR pass filter.

**DESLANDRES** - Maurice Collins, Palmerston North, New Zealand. April 16, 2016 07:41 UT. FLT-110, f/21, ASI120MC (South up).



**FRA MAURO** - Maurice Collins, Palmerston North, New Zealand. April 16, 2016 07:29 UT. FLT-110, f/21, ASI120MC (South up).

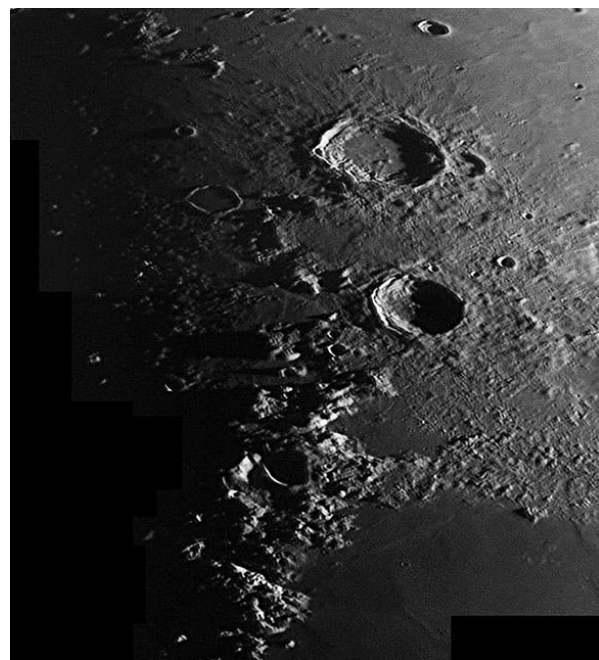
**METON** - Maurice Collins, Palmerston North, New Zealand. April 16, 2016 07:35 UT. FLT-110, f/21, ASI120MC (South up).



**GASSENDI**- Desireé Godoy-Oro Verde, Argentina. August 14,, 2016 03:53 UT. 130 mm Celestron Newtonian, QHY5-II, 742nm IR pass filter.

**MONTES CAUCASUS** – Richard Hill – Tucson, Arizona, USA August 10, 2016 02:16 UT. Seeing 7/10. TEC 8" Mak-Cass, f/20, SKYRIS 445M, 656.3 nm filter.

*I had a small window of reasonable seeing between our monsoon storms on the night of Aug. 09/10. When there is limited time it's always hard to decide what to image. Not this time. My favorite mountain range on the moon are Montes Caucasus and there they were right on the terminator as I had never seen them before. Of course the elephant-in-the-room were the two monster craters Aristoteles (90km dia.) and Eudoxus (70km) with nice ejecta splash about the former. To the left of Aristoteles can be seen the thin ring of the 37km, very shallow Egede. To the left and closer to Eudoxus is the 14km Lamech. But the most fascinating is the plain below Eudoxus a little farther away than Lamech. This is Alexander listed as 85km diameter though it is anything but round. It is an ancient feature and may be as old as 3.9-4.5 billion years old, called "Pre-Imbrium". The larger mare below is Mare Serenitatus. Notice the domes in this mare on the right edge of this image. I've never noticed them before.*



*The glorious sight for me was the glistening peaks of the Montes Caucasus just to the right of the title box. The big ink black circle on the north side of these mountains near Alexander is the 34km Calippus. Notice that spectacular cliff to the left of Calippus. Can you imagine the sight of this Caucasus sunrise from the top of that rampart!*



**SOUTH POLE** – Richard Hill – Tucson, Arizona, USA July 14, 2016 03:18 UT. Seeing 8/10. TEC 8" Mak-Cass, f/20, SKYRIS 445M, 656.3 nm filter.

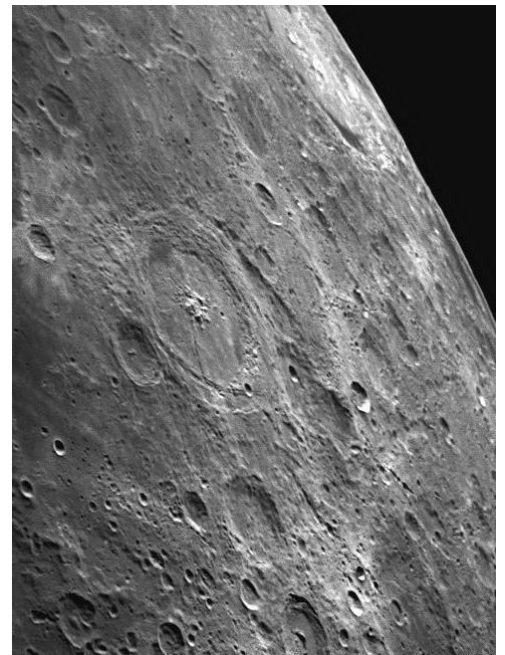
*I had yet another favorable libration the other night and some good seeing prompting me to go for the south pole once again. The big, well shown crater near the top is Moretus at 117km diameter. Above it is the 97km Gruemberger with a small crater on its floor and to the right of it the much smaller 51km Cysatus. Just a short distance below Moretus another 51km crater,*

*Short. To the left of Short is a large 3 lobed dark region. The upper lobe is the crater Newton (82km). Then at the very bottom of the Moon is a circular dark area that is Cabeus (100km) where the target crater for the LCROSS impactor in a search for water at the south pole of the Moon. I was on a team that used the 61-inch Kuiper Telescope of the Univ. of Arizona, with a large echelle spectrograph to try from Earth, to detect a water plume in the impact. We were unsuccessful but the LCROSS spacecraft did detect it and some other "volatiles" as well.*

*To the right of Cabeus is another dark pool with a pyramid shaped bit of light on its left edge. This pool is Malapert (71km). The pyramid is a mountain on one edge of Malapert with a tantalizing crater right in it's summit (not seen in my image but shown in images at <http://planetarynames.wr.usgs.gov/Page/Moon1to1MAtlas>). This same atlas shows that the libration and phase was not quite good enough on this night to see the pole itself.*

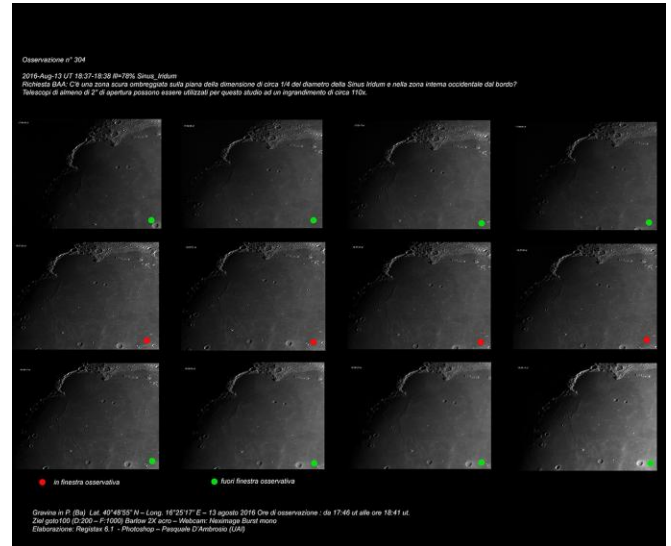
*Going further to the right is a very foreshortened crater, the 109km Amundsen, named after the explorer who led the first team to the Earth's south pole. Just above Amundsen, and just a little larger is the 111km Scott, who led the second team to the south pole but tragically did not return. Above these two is another large crater, Schomberger (88km) and yet above it is the 71km Simpelius. From these key landmarks (selenomarks?) you should be able to find your way around to other features.*

**PETAVIUS.** Michael Sweetman, Tucson, Arizona, USA, April 13, 2016 04:33 UT. Seeing 6-7/10, transparency 3/6. 11" f/10 SCT. DMK21, Astronomik Pro IR742 filter.





**SINUS IRIDUM**-Franco Taccogna, Gravina in Puglia (BA), Italy. August 13, 2016 17:47-18:40 UT. 8" f/5 Acro, 2x barlow. NexImage mono.



**MONTES SPITBERGEN-KIRCH** – Ken Warren, Nicholson, Georgia USA. July 27, 2016 10:23 UT. 8" Meade LX200 GPS, ASI120MC.

*What caught my eye: Realizing this is on the terminator (meaning I expected long shadows), I didn't remember a long, dark valley or trench, or depression in that area. So I imaged it before going in. After processing, 3 things stood out for me: 1) the west edge of the depression (the east is easier to identify), 2) several small craters towards that appears sunlit on their western side and still casts a long shadow and has a shadow to it's west (indicating to me that it rises above the western slope of the depression, and 3) at the southern end, what appears to me to be a long, more or less gradual, slope into the valley with what appears to be boulders that have left tracks in the lunar surface from rolling down the slope. Granted, the "boulders" could be, and most probably are, small craters where I can't see into the crater so they appear solid.*

**Editor's Note:** The discussion with Ken concerning this feature is summarized by Tony Cook below.

# **LUNAR GEOLOGICAL CHANGE** **DETECTION PROGRAM**

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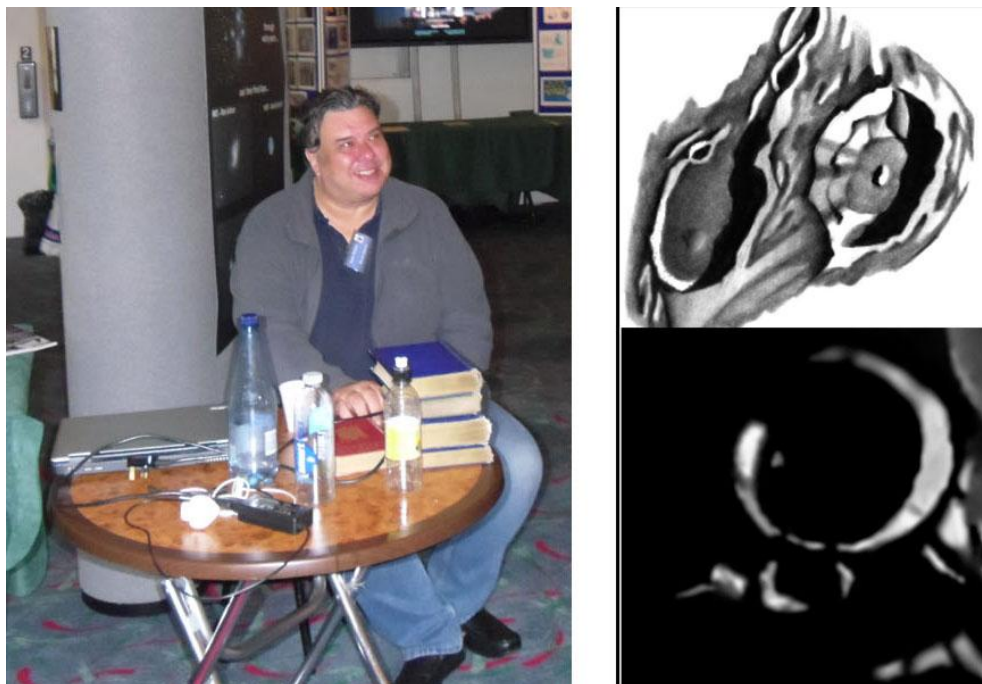
**Observations/Studies for July** were received from: Jay Albert (Lake Worth, FL, USA - ALPO) observed: Aristarchus, Mare Crisium, Proclus and Taruntius. Alberto Anunziato (Argentina – AEA) observed Alphonsus, Birt, Censorinus, Curtis, Herodotus, Hyginus N, Mons Piton, Plato, Proclus, and several other features. Anthony Cook (Newtown, UK – BAA) imaged several features. Marie Cook (Mundesley, UK – BAA) observed Aristarchus and Manilius. Valerio Fontani (Italy, UAI) imaged Montes Tenerife. Marcelo Grundlach (Bolivia – IACCB) imaged Aristarchus. Rik Hill (Tucson, AZ, USA – ALPO) imaged: Catena Abulfeda, Gambart, Moretus, and Petavius. Thierry Speth (France – BAA) imaged Aristarchus, Bailly, Daniell, and Darwin. Gary Varney (Pembroke Pines, FL, USA - ALPO) imaged Lambert and several other features. Ken Warren (Nicholson, GA, USA) imaged the eastern Mare Imbrium.

**News:** It was with great sadness to learn of the passing of Peter Grego (See Fig 1 - Left). Peter was the director of the Lunar Section of the Society of Popular Astronomy (SPA), an assistant director of the British Astronomical Association (BAA) Lunar Section and its circular editor, he also edited the SPA journal for many years, produced the monthly Moonwatch column in Astronomy Now magazine, and was as an author of at least 20 astronomy books including : [The Moon and How to Observe It](#). In another achievement, he pioneered the sketching of the lunar surface by means of PDAs, or tablets; see: [Astronomical Cybersketching: Observational Drawing with PDAs and Tablet PCs](#). His book publication track record was quite an achievement too, and like Patrick Moore's series of books, has undoubtedly inspired countless numbers of amateur astronomers. Peter even had an asteroid, [95934 Grego](#), named after him earlier this year, in honour of his lunar observing, and topographic coordinating work.

In Peter's coordinated topographic observing role, he would, from time to time forward onto me candidate LTP reports, by himself, or other SPA/BAA members. Not all of them turned out to be LTP, for example the appearance of a "pseudo peak" on the southern half (not central) of Herodotus (Fig 1 – Top Right) was eventually tracked down to an albedo marking with possibly the shading effect on its western side being due to a combination of seeing conditions and telescope resolution - following a study many years later by Raffaello Lena (GLR). Repeat illumination observations have at least shown that it is a regular occurring feature unlike the central "pseudo peak" effect in Herodotus. Other lunar surface oddities that Peter found included a white spot on the inner western shadowed rim of Menelaus crater (Fig 1 – Bottom Right), and this still remains a mystery despite repeat illumination observation attempts and [LTVT](#) style simulations. Although I mostly communicated with Peter by email, as is the way with amateur astronomy these days, I did meet him in person from time to time at BAA exhibition meetings, and he would always come across as a jolly individual, and proud of his Italian ancestry. But I suspect that behind the scenes he must have been an incredibly hard worker, putting in hours of work to keep us readers informed.

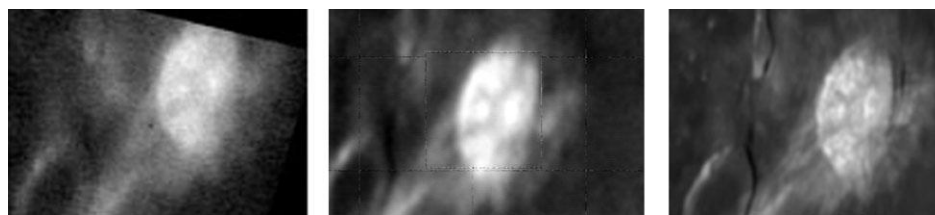
Peter was originally from Great Britain's second biggest city, Birmingham, and his main occupation had been in health care - this was at least until he decided to make a career out of writing astronomy books etc, and it was around this time that he and his family moved down to the more picturesque Cornwall in the south west of England. He even wrote a book about his new locality: [Cornwall's Strangest Tales: Extraordinary But True Stories](#). A more in depth tribute to Peter can be found on the Astronomy Now web site: <https://astronomynow.com/2016/08/20/peter-grego-1965-2016/>. We send our condolences to his wife Tina, and daughter Jacy, and will greatly miss his observations work in the Lunar Section.





**Figure 1** Peter Grego (1965-2016) and a couple of his observational sketches: **(Left)** Peter Grego at the BAA exhibition meeting, in Cardiff, UK, on 2015 Jun 27. **(Top Right)** A sketch of Herodotus 1985 May 31 UT 20:20-21:00 illustrating a southern “pseudo peak” effect. **(Bottom Right)** Menelaus 2012 Mar 28 UT 21:40-21:51 with a white spot just inside the shadow on the west - it was not visible in earlier PDA sketches that night.

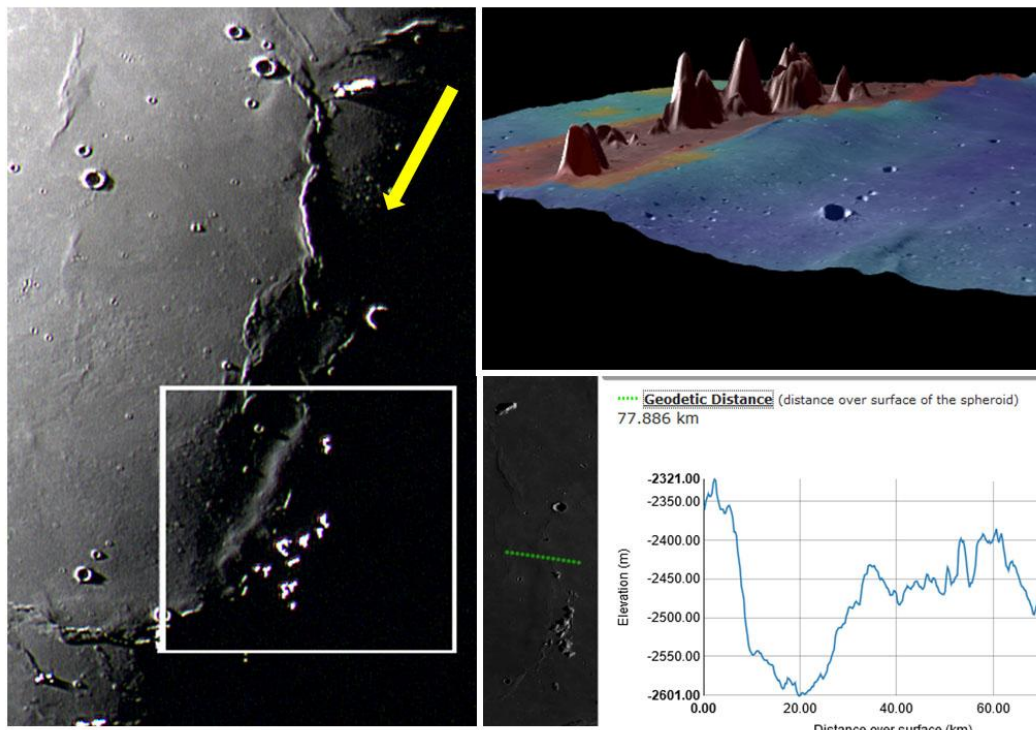
Thierry Speth took up my challenge to reprocess part of my VHS video recording of a 1989 Oct 13 LTP in Aristarchus, using [Registax](#) as you can see by comparing Fig 2 Centre Vs Left, and it clearly shows a less grainy, and more detailed, image. If readers remember last month’s article about this event, a bright blob was visible off the eastern rim of Aristarchus, which was at least as bright as the central peak, and parts of it gave the impression of a 2<sup>nd</sup> crater beyond the eastern rim. This was confirmed by two other visual observers. Video recordings unfortunately did not start successfully for a while after the visual sightings, and by this time the effect had lessened significantly. Indeed if you compare Thierry’s version of the image with the repeat illumination image by Alberto Anunziato, there is not a lot of difference, apart from image contrast and sharpness.



**Figure 2** Aristarchus orientated with north towards the top. **(Left)** A crude Registax attempt by myself from a 1989 Oct 13 VHS tape recording. **(Centre)** re-processed by Thierry Speth using Registax. **(Right)** A repeat illumination image by Alberto Anunziato (AEA) from 2016 Jun 19 UT 02:15 – note that this has been blurred artificially in order for the resolution to be slightly more comparable to the 1989 video.

I received an interesting possible discovery of a previously unknown, subdued valley? On 2016 Jul 27 UT 10:23 Ken Warren was imaging the Moon in its last quarter stage (See Fig 3 Left) and recorded a curious linear depressed area just to the north west of the Montes Spitzbergen – if you blur your eyes a bit it could even resemble a very subdued chain of craters which increase in size towards the north. Ken was surprised as he did not recall that there should be a valley here and he could not find this marked clearly on any maps and so he

contacted us for our opinion? It seems to be associated with a wrinkle ridge, or two which are visible on map 12 in Rukl's Hamlyn Atlas of the Moon. It is also just about visible if you use the 3D Live part of the NASA [LROC Quickmap](#) web page (Fig 3 Top right), but you need a vertical exaggeration factor of 10x to detect it. Only the eastern edge, in the vicinity of Montes Spitzbergen shows up on the GRAIL Bouguer gravity gradient map. A topographic cross section through the area (Fig 3 Bottom right) reveals the subdued nature of this shallow valley like depression to be about a hundred metres. Precisely what this feature is we do not know for sure – it might just be simply a region between two wrinkle ridges, or it could be something more exciting like a buried catena (crater chain), though it is difficult to see what the originating crater might have been as it would have had to have been older than the Mare Imbrium basaltic lava flows in the area. Or it could just be the impression of a crater chain is due to the two overlapping lobate-like edges of the wrinkle ridge lava flows? Whatever the cause, this area is definitely worth mapping in future and shows that amateurs can find interesting lunar surface features which might not be so apparent in the limited number of spacecraft imagery. However you will have to get up early in the morning, and observe at a narrow selenographic colongitude range of around, 186.0°, in order to capture it again.



**Figure 3.** (Left) Image taken by Ken Warren ((Nicholson, GA, USA) orientated with north towards the top left. Taken on 2016 Jul 27 UT 10:23. (Top Right) The boxed area in the left image has been displayed as a perspective view, using the NASA Quickview 3D Live tool, with a color overlay of the GRAIL Bouguer gravity gradient map, plus topography exaggerated 10x. The view direction is approximately along the yellow arrow in the original image on the left. (Bottom Right) A topographic cross section through the area of the centre of the image.

Onto the last bit of news: NASA's LRO mission has been extended till 2018, with several new goals, for example to get a better understanding on how lunar volcanism has changed over time, and also to detect new impact craters, of which some 220 have been found to date - ranging in size from 3-43m (see: <http://lroc.sese.asu.edu/posts/939> ). If you wish you can still instruct the NASA spacecraft to take images of the Moon for you on: [http://target.lroc.asu.edu/output/lroc/lroc\\_page.html](http://target.lroc.asu.edu/output/lroc/lroc_page.html) .

**LTP Reports:** No LTP reports were received during July,

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

**Taruntius:** On 2016 Jul 9 UT 01:20-01:35 Jay Albert (ALPO) observed this crater under the same illumination conditions (to within  $\pm 0.5^\circ$ ) to the following report:

*On 1980 May 18 at UT 22:27 P. Madej (Huddersfield, UK, 12" reflector, seeing very good) observed Taruntius crater (in earthshine) to change brightness from black to light grey in about 30 seconds. Cameron 2006 catalog extension ID=95 and weight=2. ALPO/BAA weight=2.*

Jay reported that, using his 6" Celestron Nexstar, (Transparency 2-1, seeing 6-4) at x214, it was clear that Taruntius was NOT in earthshine, indeed the terminator was already quite far away. He found the central peak was lit and cast a shadow to the west. There was black shadow on the floor along the interior eastern wall as well as the western exterior wall. The floor surrounding the central peak was darker than the lit floor closer to the walls. There appeared to be sunlit ridges running N-S to the E and W of the darker central part of the floor. He saw no changes in color or brightness, despite the slowly deteriorating seeing. Now the only reference I can find for the Peter Madej observation is a two line account in the July 1980 BAA Lunar Section circular, which essentially describes what is in the Cameron Extended catalog description above, with one exception, a 77mm refractor, and NOT a 12" reflector had been used. In light of this, and the fact that at the date and UT given in 1980 the Sun was  $7.2^\circ$  above the floor of Taruntius in altitude, I shall reduce the weight from 2 to 1, as there may have been a mix up with the day, or more likely the month of this observation?

**Montes Teneriffe:** On 2016 Jul 12 UT 19:42-20:17 Valerio Fontani (UAI) observed this area under the same illumination conditions (to within  $\pm 0.5^\circ$ ) to the following LTP report:

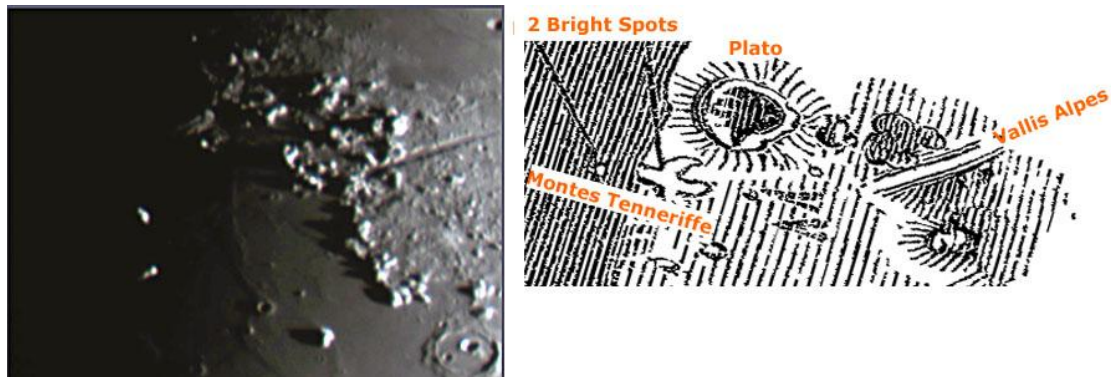
*nr. Plato in Teneriffe Mountains 1854 Dec 27 UT 18:00-23:00 Observed by Hart & others (Glasgow, Scotland, 10" reflector) "2 luminous fiery spots on bright side on either side of a ridge, contrasting color. Seemed to be 2 active volcanoes. Ridge was normal color. Spots were yellow or flame color. Never seen before in 40 yrs. of observing." NASA catalog weight=4. NASA catalog ID #129. ALPO/BAA weight=4.*

I decided to look up some additional information about this report and it is nicely summarized by Robert Hart in the [Monthly Notices of the Royal Astronomical Society, 15, 89 \(1855\)](#). This contains just a written account and did not even give the location of these spots; but to give a more accurate description than the NASA catalog, they are described as: "were two luminous spots, one on either side of a small ridge, which ridge was in the light and of the same color as the moon; but these spots were of a yellow flame color". He called in two neighbours, who confirmed the appearance. Other areas of the Moon were just a snowy white. He observed the effect for five hours! Prior to this discovery, the observer saw a star off the limb of the Moon, which the editor of the journal, in a foot note, reckoned was  $\mu$  Piscium, and this was "in conjunction with the Moon" at 18:54UT, before Robert Hart turned his attention to the dayside of the Moon.

Another, somewhat improved description of the observation was made in a later Monthly Notices, and this time a sketch was provided showing the location of the two spots, (See Fig 4 - Right) and an inset enlargement made on another night (not shown here) illustrating more precisely where on Montes Teneriffe the spots occurred. He also states that he was using a 12 foot (3.7 metre) focal length speculum mirror that he had figured himself, though comments that it was a bit tarnished after 12 years of use. He ceased observing when the temperature got too cold – a reasonable excuse in the Victorian era without the benefits of modern central heating indoors! Despite looking on subsequent nights he had failed to see the effect ever again, so he communicated his observation to the Astronomer Royal (Sir George Biddell Airy), who forwarded it onto the Monthly Notices. It is interesting to compare Valerio's image with the sketch from 1854. For a start the "crows foot" shape of the eastern most part of Montes Teneriffe is not visible in Valerio's image, but is clearly seen in the 1854 sketch – but this may have something to do with the  $\pm 0.5^\circ$  tolerance that we use in our predictions, rather than errors on the part of Robert Hart, though I suspect that the sketch is more likely to be representative towards the end of the 1854 observing session than the start. Secondly the sketch is not of good quality as Plato looks a bit odd and I am not sure exactly which peak is Mons Pico? There are also some positional inaccuracies too – I even had to change the vertical scale to make Plato resemble an elliptical shape. However the description of color on these two spots (and nowhere else) sounds intriguing. Part of the sketch inaccuracies maybe down to



the reproduction in the engraving used in the publication perhaps? Reproduction of images, in those days, was a two step process, firstly one had to make a sketch, and secondly an engraver at the publishers had to make a depiction in metal/wood with lines as shadings – so there were plenty of opportunity for errors to creep in. I think though that although it was a confirmed observation (with the same scope), in view of the artistic inaccuracies present I will lower the weight to 3.



**Figure 4.** (Left) Color image by Valerio Fontani, (UAI) orientated with north towards the top, taken on 2016 Jul 12 UT 20:17. (Right) A sketch by Robert Hart made on 1854 Dec 27 UT18:00-23:00, ([Mon Not. RAS, 15, 162 \(1855\)](#)) with modern day annotation added. The sketch has been squashed a little and rotated so that it matches approximately Valerio's image.

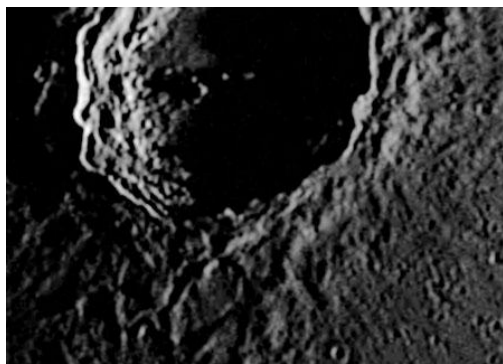
. **Copernicus:** On 2016 Jul 14 UT 02:59 Rik Hill, whilst capturing an image mosaic revealing some lunar domes near Gambart, just happened to clip Copernicus into the frame and this was under the same illumination (to within  $\pm 0.5^\circ$ ) to the following two LTP reports:

*Copernicus 1969 Nov 18 UT 21:10-21:11 Observed by Hedervari (Budapest, Hungary, 3.5" refractor) "Yellowish-red stripe on inner W. wall (chrom. aberr.?, Apollo 12 watch)." NASA catalog weight=2. NASA catalog ID No. 1217.*

*On 1995 Jul 07 at UT 04:22 R. Spellman (Los Angeles, CA, USA) noted that the floor of Copernicus was slightly darker in blue light. The ALPO/BAA weight=2. This report came from R. Spellman's web site.*

Although Rik's image is not in color, as it was taken in monochromatic Hydrogen Alpha light, it does at least show the normal appearance of the crater would have looked like in 1969 and 1995 if the crater had appeared normal. It also offers the opportunity to re-examine these two past reports. For the 1969 Hungarian report, I have experimented with adding artificial atmospheric spectral dispersion, and although I can get some nice red on the outer western rim, it is a bit more problematic to reproduce red on the more fragmented inner part of the rim. I have also tried out some tentative simulations with chromatic aberration, whereby the image scale, and potentially image centre offset changes with wavelength, however there are a huge range of permutations that could be investigated here. Certainly I can produce some yellow-red with this, but again this is strongest on the outer west rim, and not so well presented on the inner part of the rim. Maybe I need to explore a bit more? In view of the suggestion of chromatic aberration made in the Cameron catalog, and the fact that no filters appear to have been used to check the reported color, or any reports from a 2<sup>nd</sup> observer, I think I will lower the weight to 1.

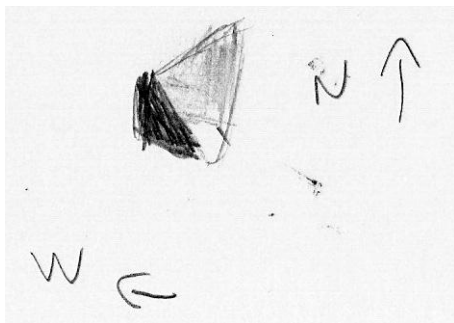
For the Robert Spellman report, I dug a little deeper into the archives and it transpires that he found the floor of not just Copernicus, but also Proclus and Godin darkened slightly in blue light. Earlier, 03:29-03:56UT, he found both Copernicus and Tycho to be normal. The weight of this report is 2, but I am highly suspicious of simultaneous multiple target LTP in terms of real lunar surface processes, so I will reduce the weight of this to 1 – after all it might just be natural surface color effects just on the limits of detection when atmospheric conditions were optimum?



**Figure 5.** Copernicus as imaged by Rik Hill (ALPO) on 2016 Jul 14 UT 02:59, orientated with north towards the top. Please note that this is a sub-section from a much larger mosaic covering the lunar dome region near to Gambart, and was not originally intended to be centered on Copernicus, hence why the northern part of the crater has been clipped by the edge of the mosaic. The telescope used was an 8" Mak-Cass and the camera was a SKYRIS 445M working in a waveband of 656.3nm.

**Mons Piton:** On 2016 Jul 15 UT 03:30-03:45 Alberto Anunziato (AEA) observed, using a Meade EX105, this mountain under the same illumination conditions (to within  $\pm 0.5^\circ$ ) to a 1969 report by Richard Baum:

*Piton 1969 Nov 19 UT 21:15-22:00 Observed by Baum (England, 4.5" refractor) "Traces of cloudiness on E. slope at 2115h. Increased at 2150h in extent & brightness. Spread onto plain. Summit & shadow in W. part sharp & clear. (Apollo 12 watch)." NASA catalog weight=3. NASA catalog ID #1221. ALPO/BAA weight=2.*



**Figure 6.** Mons Piton as sketched by Alberto Anunziato (AEA) on 2016 Jul 15 UT 03:30-03:45, orientated with north towards the top,

Alberto reported that Mons Piton looked normal, and made a very rough sketch (see Fig 6), though he does not state what his observing conditions were like at this time. I tried to look up more details about the original report, but cannot find a reference to it in the ALPO Strolling Astronomer or the BAA Lunar Section Circulars of that era. Cameron lists a reference to a LION network report during the "Apollo 12 Watch", which unfortunately I do not have, so I think that we had better keep this one at a weight of 2 for now.

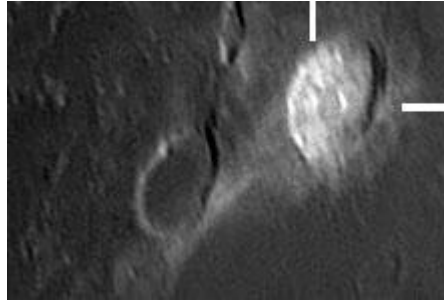
**Aristarchus:** On 2016 Jul 17 UT 22:24-23:11 Thierry Speth (BAA) observed this crater under the same illumination conditions (to within  $\pm 0.5^\circ$ ) to three past LTP reports:

*Aristarchus 1975 Sep 18 UT 21:00? Observed by Foley (Kent, England, 12" reflector) "Deep blue-viol. spot in NW (IAU?) interior corner." NASA catalog weight=3. NASA catalog ID #1414. ALPO/BAA weight=3.*

*Aristarchus 1957 Jul 11 UT 04:35-05:00 Observed by Bartlett (Baltimore, MD, USA, 6.5" reflector, x180, S=4, T=4) "Floor, uniform bluish radiance)." NASA catalog weight=4. NASA catalog ID #667. ALPO/BAA weight=1.*

*Aristarchus 1969 Nov 22 UT 18:20-21:13 Observed by D. Cutts (Chester, Eng., 8.5" reflector, x200), Moore*

(Sussex, Eng., 12" reflector x425), Miles (Coventry, Eng. 5" refractor), Delaye and Jourdran (Marseilles, Fr., 8" reflector) "Pulsating patch on W. wall between 2 radial bands. Faded by 2000h. Returned to normal.(Cutts). Miles saw strong pink in whole interior at 2112h. Strong blink. No blink there at 2210-2212h. Gass., Grim., & Plato were neg. Delaye & Joudan photog. it as very bright. Moore got neg. results at 2135. (confirm. of activity?, Apollo 12 watch)." NASA catalog weight=5. NASA catalog ID #1226. ALPO/BAA weight=3. – see 22:49-23:01, 23:11



**Figure 7.** Aristarchus as imaged by Thierry Speth on 2016 Jul 17UT 22:51-23:00, orientated with north towards the top. The tick marks point to the probable location of the bright spot referred to in the 1969 Cutts observation.

Although Thierry's images (one example is shown in Fig 7) were in monochrome, and so we cannot comment on the bluish colors seen in the first two reports, we can at least check up on the locations of spots mentioned in the 1969 and 1975 reports. There is a bright spot on the NW of the crater as mentioned in the 1975 report. The tick marks in Fig 7 point nicely to the described position of the spot from 1969, namely a patch on the west wall between two radial bands.

Thierry checked this spot between 22:05 and 23:01, and saw no pulsations here, however after 23:11 he found the whole of Aristarchus blurry, where as other craters like Bailly and Darwin were sharp. I have found this to be the case in the past, namely a slight change in seeing plays havoc with visibility of detail inside the bright crater Aristarchus, where as areas with plenty of fine detail and contrast are less affected.

I will keep the weights of all three LTP reports as they are for now. Just one other point to note.

**Aristarchus:** On 2016 Jul 17 UT 05:08 Marcelo Grundlach (IACCB) imaged this crater under similar conditions to four past reports. The first and fourth reports below were captured under similar illumination, to within  $\pm 0.5^\circ$ , and the second and third reports under both similar illumination and topocentric libration (viewing angle) to within  $\pm 1^\circ$ .

*On 1955 Sep 29 UT 02:40-03:15 Bartlett (Baltimore, MD, USA, 5" reflector x180) observed the following about Aristarchus: "Floor blue clay color. (MBMW has date as 9/9/55 which is a typo error)". The Cameron 1978 catalog ID=613 and the weight=4. The ALPO/BAA weight=1.*

*Cobra Head 1967 Mar 23 UT 18:40-20:47 Observed by Sartory, Moore, Moseley (Farnham, England, 15" reflector (Sartory) seeing very poor & 10" refractor in Armagh, N. Ireland (Moore & Moseley) x360 - seeing Fair to Poor) "Red patch seen intermittently; moon-blink from 1916-2047h. Position agreed with Sartory who alerted them to Aris. area; checks on others were neg." NASA catalog weight=5. NASA catalog ID 1020. Then Aristarchus 1967 Mar 23 UT 18:40-20:30, 21:30 by Marsh and Farrant (Cambridge, England, 8" reflector, x330). "Suspected color on SW (ast.) wall. Farrant saw color in crater, completely independently, (inform. suggests same phenom. as seen by Moore & Moseley tho they said Cobra head). NASA Catalog weight=5. NASA catalog ID #1021. ALPO/BAA weight=3.*

*On 1978 May 19 UT 21:45-03:30 P. Foley of Kent, UK, using a 12" reflector, seeing=III-II, noticed that initially that the crater was pretty dull and that the floor was a slate blue-gray in color at 22:45UT. A noticeable green spot inside the crater on the south east appeared at 22:25UT and vanished at 00:50UT. Cameron notes that one doesn't get green with spurious color. Crater Extinction brightness measurements were made at 22:00 UT (reading=2.8) and at 23:45UT (reading=3.7). The crater dropped in brightness from*



3.7 to 2.8 at 23:50UT and remained lower until 3.0 at 23:50-03:15 UT. A graph was produced and showed Proclus and Censorinus at similar brightnesses, but Aristarchus variable. The Earthshine was 0.3. Cameron 2006 Extension catalog ID=31 and weight=5. ALPO/BAA weight=3.

On 1990 Nov 30 UT 00:54-01:45 D. Darling of (Sun Prairie, WI, USA, using a 12.5" reflector at x150, noticed a hint of red? color on the south west rim of Aristarchus. Brightness measurements were normal for Aristarchus and Herodotus. No color seen elsewhere e.g. Prom. Laplace. The color on Aristarchus had gone by 01:15UT. Cameron 2006 catalog extension ID=414 and weight=3. ALPO/BAA weight=3.



**Figure 8.** Aristarchus as imaged by Marcelo Grundlach (IACCB) on 2016 Jul 17 UT 05:08, orientated with north towards the top.

For the 1955 report, because Marcelo's image (Fig 8) was monochrome, I cannot really comment on whether the floor had a blue clay color, though of course Aristarchus has a natural blue cast and I have always suspected that Bartlett had better blue/near-UV sensitivity than most observers. So I will keep this report at a weight of 1. Alas we do not know how many times Bartlett examined Aristarchus, and did not see color? This would be quite a useful piece of information because he was the most prolific observer for reporting color in Aristarchus, hence why most of his reports tend to have a low ALPO/BAA weight.

For the 1967 report, again although Marcelo's image is not in color, at least we have a view of what Aristarchus should have looked like. Reading through the BAA Lunar Section Circular reports of this event, it looks like there were multiple detections of color, seen from three different locations in the UK, but not necessarily in the same location and at the same time, so I will keep the weight of this report at 3.

For the 1978 report, thanks to Marcelo we now have a clear view of what Aristarchus should have looked like in terms of illumination, shadow etc, but that's about as far as we can go for now. Because Peter Foley was the only observer examining the crater at the time, although the description of what was seen and CED brightness variations are very intriguing, we have to keep the weight at 3 as it was an unconfirmed report.

Finally, for the 1990 report, it is not difficult to get atmospheric spectral dispersion, or chromatic aberration, producing red on the south west rim (assuming it was the outer part?), however we do have to take note that David Darling did check for color elsewhere but did not find any. Having had a look at David's description of the observation in the archives (no sketch is provided), it is not clear whether he checked the area with red and blue filters – a sure way to eliminate the effects of color produced in our atmosphere, or optics. Therefore I will lower the weight to 2.

**Aristarchus:** On 2016 Jul 18 UT 00:10-00:20 Marie Cook (BAA) observed this crater under the same illumination and viewing angle (to within  $\pm 1^\circ$ ) to a report from 1955:

*Aristarchus area 1955 Sep 30 UT 20:45 Observed by Firsoff (Somerset, England, 6.5" reflector, x200) "Area showed a westward yellow smear, looked darkish in red, indicating presence of green." NASA catalog weight=4 (high). NASA catalog ID #614. ALPO/BAA weight=3.*

Using a 90mm Questar scope, under Antoniadi seeing III-IV conditions, and poor transparency, she noted that although the bands inside Aristarchus were clearly seen, no localized lunar surface color was detected either visually, or with the aid of red and blue filters, The weight of this 1955 report shall therefore remain at 3.

**Plato:** On 2016 Jul 25 UT 10:28 Gary Varney (ALPO) imaged the whole of the Moon in color and on part of this was Plato under identical illumination conditions (to within  $\pm 0.5^\circ$ ) to a report from 1975:

*Plato 1975 Jun 29/30 UT 23:05-00:30. Foley (Wilmington, UK, 12" reflector, seeing, III, good clarity transparency). At 23:05, blue was seen on the inner wall:floor southern boundary, and red on the corresponding northern floor:wall boundary. However by 00:30, blue was now on the W floor:wall boundary, and red on the E floor:wall boundary. Atmospheric spectral dispersion existed in many regions, but did not change like the colors in Plato. Similar appearance craters such as Grimaldi, Schickard, and Riccioli, were checked for a similar change in color, but no change was noticed in these. ALPO/BAA weight=1.*

Gary's image (Fig 9) shows no natural color effect in the regions described by Peter Foley. So I did an artificial spectral dispersion test on the image (not shown here) and although I can reproduce the exact colors in the required locations, I concur with Peter Foley that if atmospheric spectral dispersion had been the cause then it should have been present on the other checked areas e.g. Grimaldi as these show up in my simulation. The fact that the color was not seen in the three analogue craters, back in 1975, and the color seems to have rotated by  $90^\circ$  in only one and a half hours, suggest it was not atmospheric spectral dispersion. Two other observers on that date had also been observing, but none overlapped Peter Foley's session: Patrick Moore had observed several features, including Plato, between 22:01 and 23:00 UT and recorded everything as normal. John Pedler had observed Plato 01:30-01:35 and also reported that everything was normal. What is not good about the Foley LTP report, and which would have really put the atmospheric dispersion theory to the test, was to check out the appearance in red and blue filters. I shall therefore leave this LTP at a weight of 1.



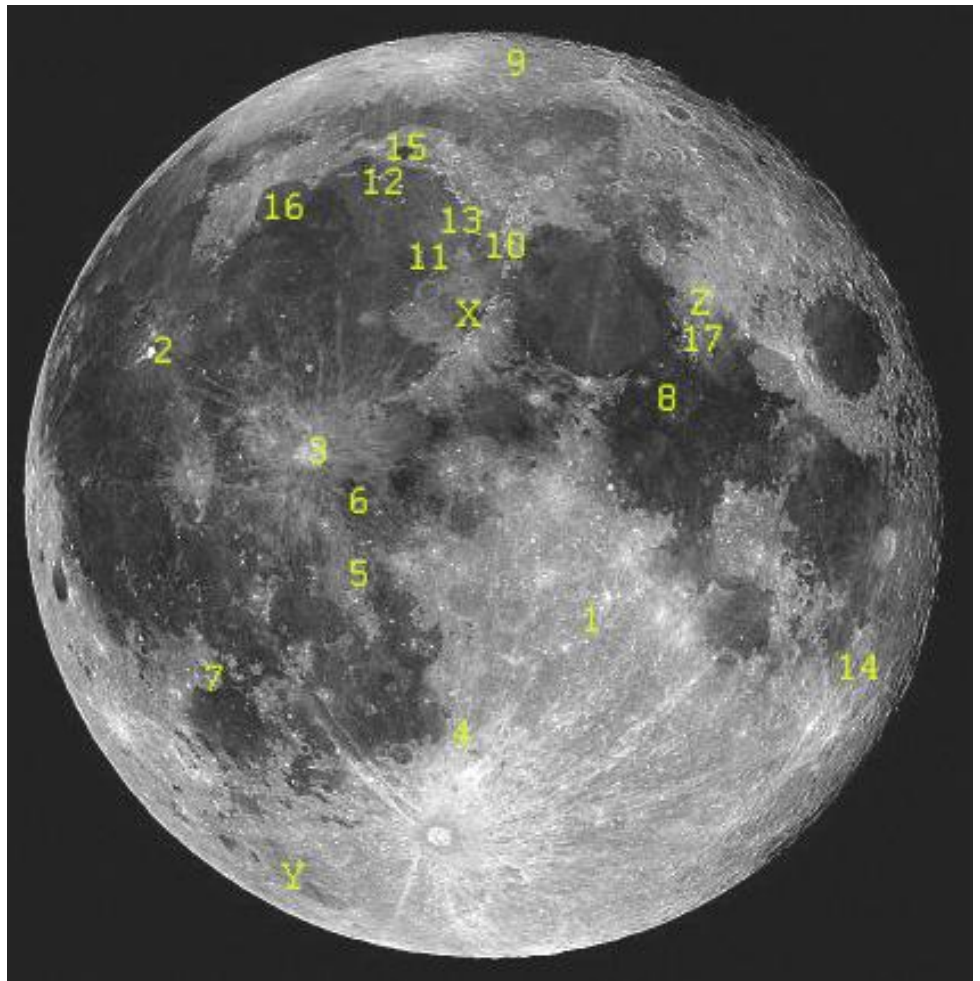
**Figure 9** A color image of Plato, taken by Gary Varney (ALPO) on 2016 Jul 25 UT 10:28 with north orientated towards the top. This is a subsection of a much larger one-shot image that has had its color normalized and then the color saturation increased to 50%. This single frame image was taken using an iPhone 5S through a 20mm Plossl eyepiece on an 8" Dobsonian telescope.

**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](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](http://users.aber.ac.uk/atc/tlp/spot_the_difference.htm) . If in the unlikely event you do ever see a LTP, firstly read the LTP checklist on <http://users.aber.ac.uk/atc/alpo/ltp.htm> , and if this does not explain what you are seeing, please give me a call on my cell phone: +44 (0)798 505 5681 and I will alert other observers. Note when telephoning from outside the UK you must not use the (0). When phoning from within the UK please do not use the +44! Twitter LTP alerts can be accessed on <https://twitter.com/lunarnaut> .

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## **KEY TO IMAGES IN THIS ISSUE**

1. Abulfeda
2. Aristarchus
3. Copernicus
4. Deslandres
5. Fra Mauro
6. Gambart
7. Gassendi
8. Jansen
9. Meton
10. Montes Caucasus
11. Montes Spitzbergen
12. Montes Teneriffe
13. Mons Piton
14. Petavius
15. Plato
16. Sinus Iridum
17. Taruntius



### **FOCUS ON targets**

**X = Montes Apennines-Palus Putredinus**

**Y = Schiller-Zuchius Basin**

**Z = Montes Taurus & Taurus-Littrow Valley**