THE LUNAR OBSERVER

A PUBLICATION OF THE LUNAR SECTION OF THE A.L.P.O.
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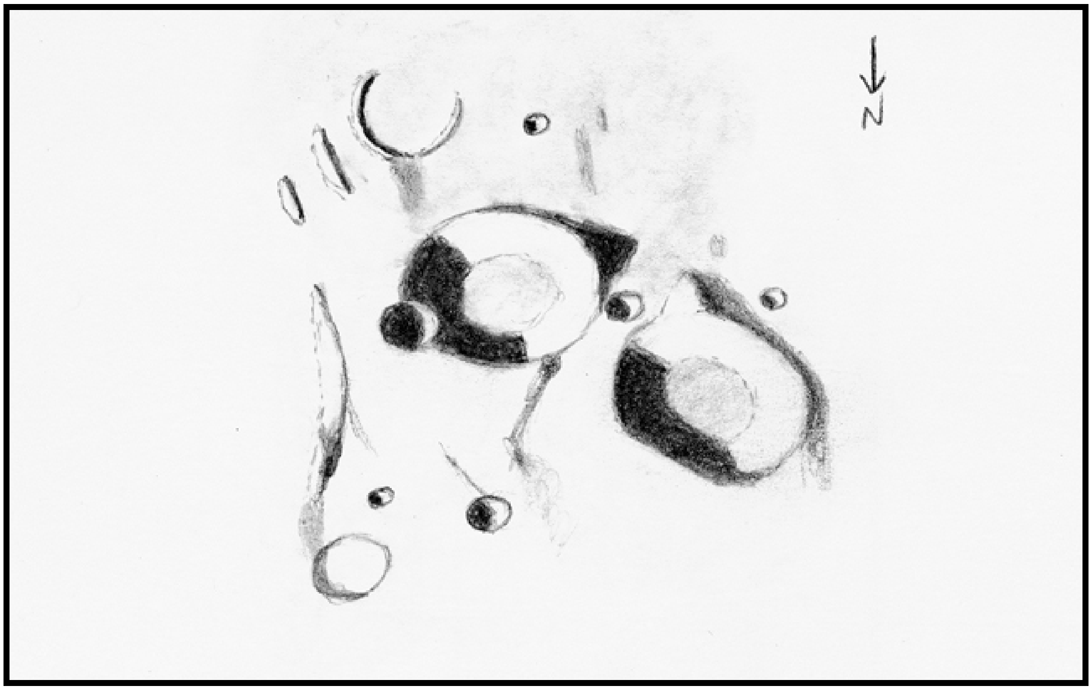
RECENT BACK ISSUES: http://moon.scopesandscapes.com/tlo_back.html

FEATURE OF THE MONTH – MARCH 2010

EPIMENIDES



Sketch and text by Robert H. Hays, Jr. - Worth, Illinois, USA
November 28, 2009 02:02-02:40 UT
15 cm refl, 170x, seeing 7-8

I sketched this crater and vicinity on the evening of Nov. 27/28, 2009. This crater is located south of Palus Epidemiarum. Epimenides is the more northwesterly of the two similar craters in this sketch. It has a featureless floor and a protruding spur on its south rim. It has nearly straight northeast and southwest sides and a relatively high west rim. The similar crater to the southeast is Epimenides S. These two craters both appear oval, but they are elongated differently. Their internal shadows, however, are oriented the same with respect to cardinal directions (compare with north arrow). The floor of Epimenides S also appears featureless, but this crater obviously has a very tall peak on its west rim. Epimenides B intrudes upon the east rim of Epimenides S. A variety of craters decorate this area. None are labelled on the Lunar Quadrant map, and some are not even shown there. A conspicuous pit is wedged between Epimenides and Epimenides S, and a smaller one is just west of the spur from Epimenides. Three varied craters lie to the northeast. The largest one is much shallower than the other two, and the smallest one has a particularly bright interior. A fairly conspicuous partial ring is southeast of Epimenides S, and a small pit is to its west. The area south of Epimenides S is quite dusky as though flooded with mare material. This may have destroyed the south rim of the partial ring. The east rim of the partial ring is more substantial than the west rim. There are several ridges and strips of shadow in this area aligned approximately north-south. The longest of these dangles southward from the shallow crater northeast of Epimenides.

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LUNAR CALENDAR

MARCH-APRIL 2010 (UT)

Mar. 02	04:00	Moon 7.4 Degrees SSW of Saturn
Mar. 07	15:43	Last Quarter
Mar. 07	21:24	Extreme South Declination
Mar. 12	10:08	Moon at Apogee (406,009 km - 252,282 miles)
Mar. 13	13:00	Moon 3.5 Degrees NNW of Neptune
Mar. 14	22:00	Moon 5.1 Degrees NNW of Jupiter
Mar. 15	21:02	New Moon (Start of Lunation 1079)
Mar. 15	23:00	Moon 5.4 Degrees NNW of Uranus
Mar. 15	24:00	Moon 6.0 Degrees NNW of Mercury
Mar. 17	05:00	Moon 6.1 Degrees NNW of Venus
Mar. 22	12:18	Extreme North Declination
Mar. 23	10:59	First Quarter
Mar. 25	11:00	Moon 4.3 Degrees SSW of Mars
Mar. 28	04:57	Moon at Perigee (361,876 km – 224,859 miles)
Mar. 29	12:00	Moon 7.4 Degrees SSW of Saturn
Mar. 30	02:25	Full Moon
Apr. 04	05:24	Extreme South Declination
Apr. 06	09:37	Last Quarter
Apr. 09	02:46	Moon at Apogee (404,997 km - 251,653 miles)
Apr. 09	13:00	Moon 0.80 Degrees SE of asteroid 6 Hebe
Apr. 09	22:00	Moon 3.8 Degrees NNW of Neptune
Apr. 11	18:00	Moon 5.5 Degrees NNW of Jupiter
Apr. 12	08:00	Moon 5.5 Degrees NNW of Uranus
Apr. 14	12:30	New Moon (Start of Lunation 1080)
Apr. 15	23:00	Moon 1.5 Degrees N of Mercury
Apr. 16	11:00	Moon 4.0 Degrees NNW of Venus
Apr. 18	17:18	Extreme North Declination

Apr. 21	18:19	First Quarter
Apr. 22	05:00	Moon 4.4 Degrees SSW of Mars
Apr. 24	21:00	Moon at Perigee (367,141 km - 228,131 miles)
Apr. 25	19:00	Moon 7.4 Degrees SSW of Saturn
Apr. 28	12:18	Full Moon

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

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

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

Our quarterly journal, **The 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 can be found on-line at: **http://www.alpo-astronomy.org/index.htm** 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.

Note: The published images now contain links to the original, full resolution images. Clicking on an image while connected to the internet, will download the original image, which in some cases is significantly higher resolution than the published version.

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 always be included:

- Name and location of observer
- Name of feature
- Date and time (UT) of observation
- Size and type of telescope used
- Orientation of image: (North/South - East/West)
- Seeing: 1 to 10 (1-Worst 10-Best)
- Transparency: 1 to 6
- Magnification (for sketches)
- Medium employed (for photos and electronic images)

CALL FOR OBSERVATIONS:
FOCUS ON: Ray Craters

Focus on is a bi-monthly series of articles which includes observations received for a specific feature or class of features. The subject for the **May 2010** edition will be Ray Craters. A list of some ray craters is available at: http://moon.scopesandscapes.com/alpo-rays-table.pdf. Although rays are most obvious near full phase, observations are requested at any phase to show the changing visibility and topographic features of the craters. Observations 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 complex region to your observing list and send your favorites to:

Wayne Bailey - wayne.bailey@alpo-astronomy.org

Deadline for inclusion in the Ray Crater article is April 20, 2010

FUTURE FOCUS ON ARTICLES:

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

Dark-Haloed Craters	**TLO Issue: July 2010**	**Deadline: June 20, 2010**
Mare Nectaris Basin	**TLO Issue: Sept. 2010**	**Deadline: Aug. 20, 2010**

A list of some dark haloed craters is in Appendix A of the Selected Areas Program Handbook, available at: http://moon.scopesandscapes.com/sap-hdbk-5.pdf.

FOCUS ON: Snellius-Furnerius

By Wayne Bailey
Acting Coordinator: Lunar Topographical Studies

The area around the large, old crater Furnerius in the Southeast quadrant is interesting, although often neglected. It's fairly close to the Eastern limb, on the terminator about 3 and 17 days after new moon. Several types of features in the vicinity make this region well worth closer study (Figure 1). Furnerius is a large, old, somewhat battered crater. Furnerius A (12 km) on the Northwest glacis is the source of two rays oriented north-south. To the northwest, Stevinus (75 km) has a prominent central peak. Stevinus A (8 km), west of Stevinus, is the source of a conspicuous ray system (Figure 2). North of Stevinus lies Snellius, similar but slightly larger (83 km), with an inconspicuous central hill. The Snellius Valley runs east-west, crossing the southern end of its namesake crater.

Figure 1: **FURNERIUS-SNELLIUS AREA-**Wayne Bailey-Sewell, NJ, USA. April 21, 2007 02:18-02:30 UT. Colongitude 314º, Seeing 3/10, Transparency 4/6. C-11 SCT f/10, Lumenera Skynyx 2-1m.

Furnerius is the southern most of the four large craters that have been variously referred to as the Meridional Chain (Elger 1895), Great Western Chain (prior to the IAU coordinates) or Great Eastern Chain (North 2000). These four craters (Langrenus, Vendelinus, Petavius, Furnerius) make an impressive sight when aligned along the terminator. In the past, this chance alignment (extended to include Mare Crisium and Endymion) has been used to argue that patterns in crater distribution indicate an internal origin for craters. Furnerius was named for Georges Furner (c. 1643), a French Jesuit professor of Mathematics. Rukl gives its diameter as 125 km. It's actually somewhat oval, elongated East-West, although our view is distorted by foreshortening. This is an old, somewhat battered crater (Figure 3). Furnerius B is the prominent crater on the floor near the West wall. The walls rise 3.5 km above the interior, but there are no terraces and several small craters are evident on the walls. Most of the floor is rough and cratered, except for a smooth section near the center. Only a few eroded hills mark what may be the remains of a central peak. A rille extends from the Northwest wall, curving East of B, continuing past the center, and careful examination will show several North-South grooves on

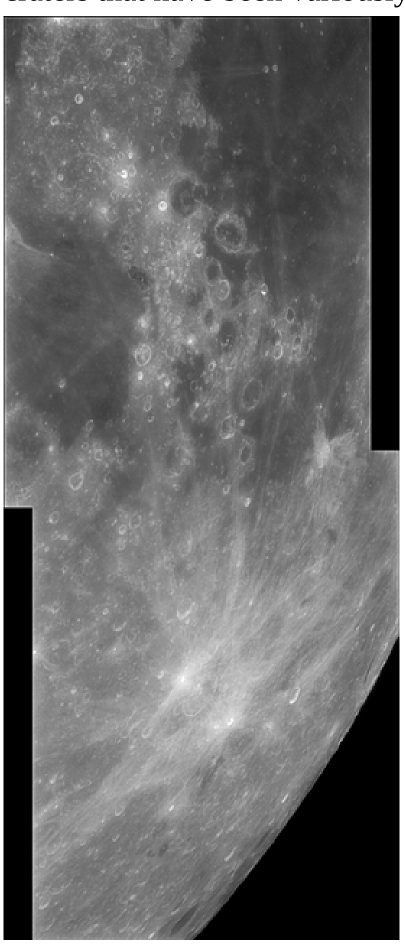
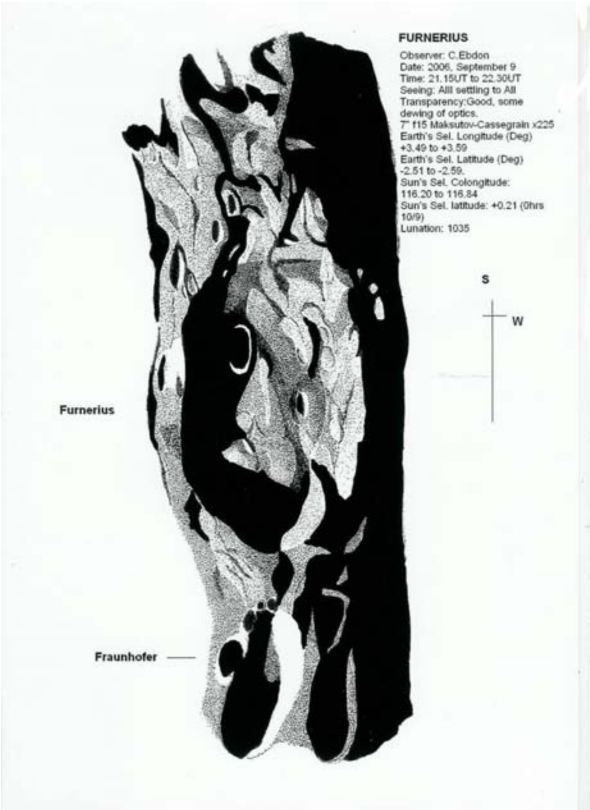


Figure 2: **FURNERIUS REGION UNDER HIGH SUN**-Howard Eskildsen, Ocala, FL, USA. November 30, 2009 02:08 UT. Seeing 8/10, Transparency 5/6. Meade 6" f/8 refractor, 2x barlow, DMK41AU02AS, no filters.



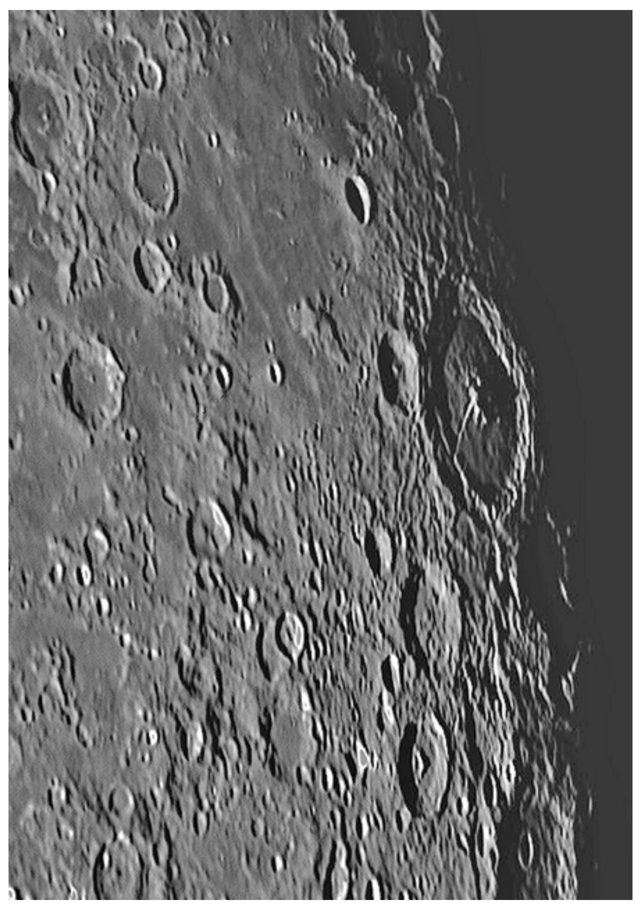
the western section of the floor, Apparently, lava flow in the interior was not sufficient to flood the entire crater, just the lowest parts in the center. According to Wood (2003) the lava appears similar to the magma in Mare Australe. Other patches of apparent mare lava have been found in highland regions on Clementine images also, which raises the question of why mare lava appears in the highlands. Furnerius is of pre-Nectarian age (>3.92 billion years old).

<u>**Figure 3:**</u> **FURNERIUS**-Colin Ebdon, Colchester (Essex), England. September 9, 2006 21:15-22:30 UT. Colongitude 116.2-116.8º, Seeing AIII-AII, Transparency Good, some dewing. 7" f/15 Maksutov-Cassegrain, 225x.

In contrast, Stevinus, has a sharp terraced rim, that is almost as high as Furnerius' (Figure 4). The central mountains form an almost complete ring around a small, dark, oval valley. The crater is almost perfectly circular, although foreshortened from our view point. Obviously, a younger crater.

Snellius, less than one crater diameter north of Stevinus, looks like an older, eroded, slightly larger, copy (Figure 4). It is named for Willibrord van Roijen Snell (1591-1626), a Dutch astronomer and geodesist, who is best known for Snell's Law in optics. Although battered, it's walls still rise 2.3 km above its heavily cratered floor. A rille runs through the center of the crater, and no prominent central peak exists, just a few small hills.

Snellius marks the approximate midpoint of the otherwise inconspicuous (compared to the nearby Rheita Valley, Figures 4 & 5), 500 km long, Snellius Valley. This valley is craterform (composed of overlapping craters), It extends from the crater Borda, eastward radially from Mare Nectaris, crossing over the south end of Snellius, then passing between Petavius and Funerius, and continuing almost to the eastern limb. East of Adams, just beyond Adams M, the valley is offset



<u>**Figure 4:**</u> **SNELLIUS VALLEY**. William Dembowski, Windber, PA, USA. October 6, 2009 02:06 UT. Colongitude 116.9º, Seeing 5/10. Celestron 9.25" f/10 SCT, DMK-41, UV/IR filter.

northward, then continues parallel to its original direction (en echelon). Figure 4 shows the western section best. The eastern end, including the offset portion is shown in the left part of figure 6, which also shows the Rheita Valley in the center of the image.

Under high sun illumination, two small craters, Stevinus A and Furnerius A, provide a fine, side-by-side, display of bright rays. This pair is unmistakable. They are the best ray craters in this quadrant and also serve as position markers when most other features are difficult to recognize (Figures 1 & 6).

Other prominent features in this area include the spectacular, large crater Petavius with it's terraced walls, and prominent Rimae Petavius stretching from the central peak to the Southwest wall (Figure 4). West of Furnerius, the Rheita Valley stretches Southeast from the crater Rheita, radially away from Mare Nectaris. Although it is actually fairly similar to the Snellius Valley, it is visually more prominent, probably because it is oriented so that the light emphasizes its linear form better (Figure 5).

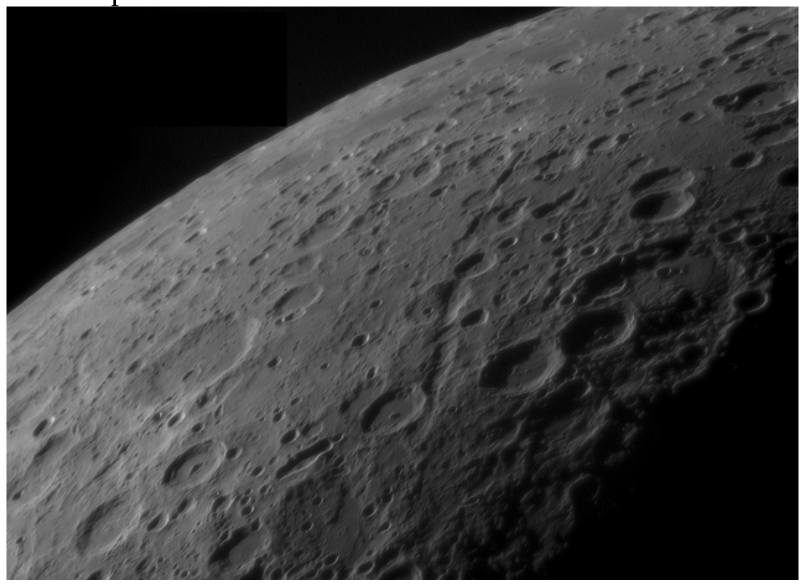


Figure 5: **SNELLIUS VALLEY & RHEITA VALLEY-** Mike White, Levin, New Zealand. December 21, 2009 06:29 UT. Seeing AII-AIII. Orion XT10i, NEQ6 Pro, 2x barlow, DMK41AF02.

This is a highlands area that contains many interesting features. It will well repay the effort to examine it closely. Because it is near the eastern limb, topographic features are best observed when the phase is near new or full. The former has the moon inconveniently placed near the sun and thus low in the sky after sunset, the latter opportunity may be overlooked since most of the moon has high angle illumination. Under high sun conditions, when albedo features are best observed, navigation can be difficult in the highlands due to lack of contrast. The ray crater pair of Stevinus A and Furnerius A along with nearby Mare Nectaris can help to provide orientation and scale.

Figure 6: **STEVINUS A & FURNERIUS A RAYS-** Wayne Bailey, Sewell, NJ USA. May 24, 2007 02:47 UT.Colongitude 357.1º, Seeing 5/10, Transparency 3/6. C-11 f/10 SCT, Lumenera 2-1M, Schuler IR72 filter.

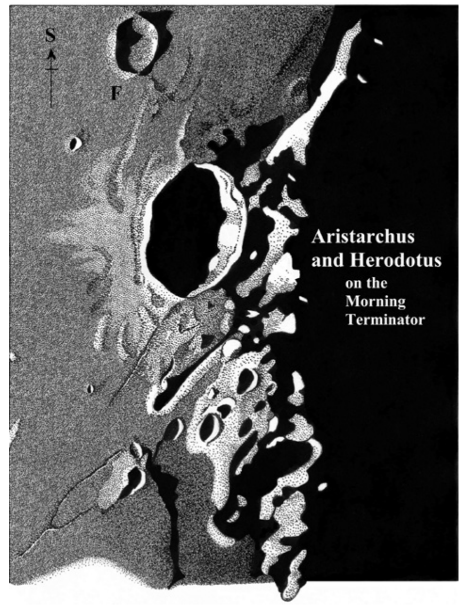
ADDITIONAL READING

Bussey, Ben & Paul Spudis. 2004. The Clementine Atlas of the Moon. Cambridge University Press, New York.
Byrne, Charles. 2005. Lunar Orbiter Photographic Atlas of the Near Side of the Moon. Springer-Verlag, London.
Elger, Thomas Gwyn. 1895. The Moon. Reprinted 2009, Book Jungle.
Grego, Peter. 2005. The Moon and How to Observe It. Springer-Verlag, London.
North, Gerald. 2000. Observing the Moon, Cambridge University Press, Cambridge.
Rukl, Antonin. 2004. Atlas of the Moon, revised updated edition, ed. Gary Seronik, Sky Publishing Corp., Cambridge.
Wlasuk, Peter. 2000. Observing the Moon. Springer-Verlag, London.
Wood, Charles. 2003. The Moon: A Personal View. Sky Publishing Corp. Cambridge.

Aristarchus and Herodotus

Phil Morgan

This observation of sunrise on Aristarchus and Herodotus was made on the evening of January 26th 2010. At this early stage of illumination one of the most notable features is the exceptional brightness of the outer southeast rampart of Herodotus, equalling the intense brightness of the inner western glacis of Aristarchus itself. This is due to the fact that the outer southeast rampart of Herodotus is in fact quite a steep scarp face and at this colongitude it catches the early morning solar rays almost' head on'. A brightness no doubt enhanced by that fact that this scarp face has a dusting of the bright Aristarchus ray material over much of its surface.



ARISTARCHUS – Phillip Morgan – Worcestershire, England. January 26, 2010 20:40-21:40 UT. Seeing 8/10, Transparency 4/6, Colongitude 49.2-49.7º. 305 mm, f/5 Newtonian, 400x.

It is at this stage of illumination that the famous dark radial banding that runs up the inner west glacis of Aristarchus is just becoming visible. These bands were once thought to be evidence for physical changes taking place on the lunar surface, since they were not recorded by the early lunar observers until they were described by Professor John Phillips in 1868. Although in fact they were shown clearly some five years earlier in a drawing made by Lord Rosse, using his great 72-inch reflector at Birr Castle.

Since then there has been much discussion as to the true nature of these dusky bands, with a modern day interpretation being that they are due to dark anorthositic ejecta emplaced at the time of the formation of Aristarchus, some 500 million years ago.

This may indeed be so, but it is a theory that doesn't account for the banding found on the outer slopes of some mountains, the most well known being Alhazen Alpha. It also fails to account for the fact, as shown on my drawing, that the bands are situated in shallow depressions, a fact noted in several other banded craters, unless somehow the ejected dark material was more abrasive. As the shadows recede down the inner rampart these band filled depressions become more evident, with the best views between colongitudes 51 to 55 degrees.

ARISTARCHUS – Lord Rosse, 1863.

Moving down northwards from Aristarchus several fine rilles were noted, these being the Rimae Aristarchus. Just to the west of these is a prominent fault known as the Rupes Tuscanelli. This appears to be a dip-slip fault of similar nature to the Straight Wall, and is about 70 km in length, and was seen casting a prominent shadow to the lower ground to the west.

Lunar Meteoritic Impact Search Section: 10 Years of Lunar Meteoroid Impact Monitoring

Brian Cudnick
Coordinator: Lunar Meteoritic Impact Search Progam

Introduction

The ALPO Lunar Meteoritic Impact search section has been in existence for 10 years now, since early 2000 and has coordinated the observations of lunar meteors worldwide for the duration of this period. The inspiration for this section stemmed from my own observation of a Leonid meteoroid impacting the moon, which was the first scientifically confirmed observation of this phenomenon. Many events resembling meteoroid impacts and other transient lunar phenomena have been recorded and reported over the centuries, but the Leonid impact was the first to have independent entities, under similar conditions, document one such event.

This event literally sparked my interest in the form of LTP that resembles meteoroid impacts and has led to my publishing a number of papers of various types as well as a book: *Lunar Meteoroid Impacts and How to Observe Them* (Springer publishing). In addition to coordinating the ALPO-LMIS, I participate in the observations whenever I am able to given my schedule, and I am active in other areas of astronomy, especially variable stars and asteroid occultations.

History

Over the course of the last millennia, many reports, dating back to a sighting by a group of monks in England of a probable impact event in the twelfth century A.D., of lunar transient phenomena have been recorded. These phenomena range from shading and obscurations to flashes and glow, and have been made by single (or small groups of) observers of varying experience. Until recently, however, none of these had been scientifically confirmed. The modern era of lunar meteoritic observation was initiated in 1938 with a paper by Lincoln La Paz published in Popular Astronomy magazine suggesting the possibility of observing impact flashes on the moon from ground-based observatories. After observing at least one unconfirmed event on March 10, 1941, Mr. Walter Haas, founder of ALPO, became interested in this phenomena and monitored the moon for such events from 1945 to 1965.

John Westfall, in 1999, wrote a monograph that described an earlier version of the Lunar Meteoritic Impact Search program called “Lunar Meteor Search” which ran from 1955 to 1965. It did not achieve the goal of simultaneous observations by two well-separated observers.[1] During this time, observers were limited to visual means which were subject to all the pitfalls of visual observing (observer fatigue, blinking, etc.). Mr. Westfall in this article goes into detail to describe the achievements of this earlier project the evidence only a few short years later (thanks to the Apollo seismometers) that lunar meteoroid impacts are actually fairly common and should be observable from the ground.

The article goes on to describe what a lunar meteor impact, as seen from the Earth, might look like. These assertions were put to the test on 19 November 1999 during the Leonid outburst at the moon when I visually observed an impact which was simultaneously video recorded by David Dunham, president of IOTA, making it the first confirmed lunar meteoroid impact observation ever made. Several more were recorded and confirmed that night, and each looked similar to another: a pinpoint of light that appeared and disappeared in mere milliseconds. Dr. Westfall’s argument that a lunar meteor monitoring program be resurrected was validated with the events of that night.

Two months later, the proposal to form a new section within the A.L.P.O. Lunar section, called the Lunar Meteoritic Impact Search section was put forth, and shortly thereafter the section was established with me as the acting coordinator. Some 21 months into its existence, the section was instrumental in achieving simultaneous observations of impact events, again from the Leonids.

The Physical Nature of the Impacts

Until recently the only meteor observations were of those entering the Earth's atmosphere. With the establishment of the Lunar Meteoritic Impact Search section and other such observing programs around the globe, lunar meteors have become the second most observed type of meteors observed after terrestrial meteors. Spacecraft observations of meteors on other planets, such as Venus, Mars, and Jupiter, show that the phenomenon of particles burning up in planetary atmospheres is not exclusively Earth's.

In addition to the eight true planets and the multitudes of lesser objects orbiting the Sun, there is a lot of dust and debris orbiting the sun, some of which occasionally collide with planets. Whenever one such object crosses paths with the Earth, the object first encounters the atmosphere of the planet, and in so doing, heats up to incandescence due to the friction between the object, traveling at cosmic speeds, and the molecules in the atmosphere. The heating is able to produce an object bright enough to easily be seen from the ground-a meteor (figure 1). Prior to the object's collision with the Earth's atmosphere, the object is referred to as a meteoroid; and if the object is large enough or dense enough to survive passage through the atmosphere, it makes it to the ground and is then called a meteorite.

Figure 1: A bright meteor recorded Sept. 9, 2007, by George Varros (image courtesy of Mr. Varros)

Objects that collide with the moon follow a similar sequence of nomenclature changes, but the big difference is the amount of time the object spends as a meteor. On Earth, the object takes several seconds to burn up in the atmosphere so it is visible for a relatively long time as a meteor. On the moon, where there is no substantial atmosphere, the object goes directly from being a meteoroid in the vacuum of space to being a meteorite (or being no more) on the moon's surface. With the moon lacking an atmosphere, the colliding object impacts the solid surface directly and immediately, producing a meteoric flash that lasts only 20 milliseconds or so…much shorter than a terrestrial meteor or "shooting star" (we can, along those lines, call a lunar meteor a "blinking star" or a "flashing star", one of which is shown in figure 2).

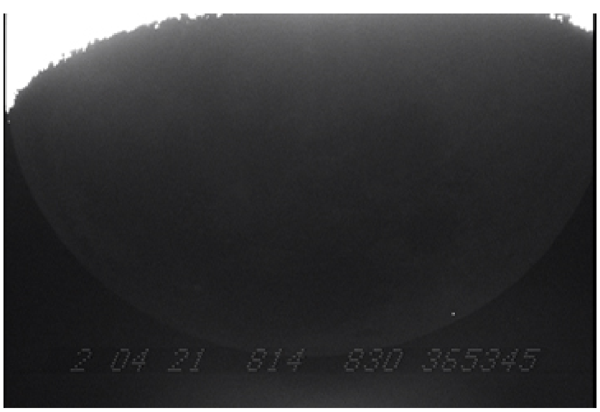


Figure 2: Confirmed lunar meteoroid impact recorded by George Varros on March 13, 2008 (image courtesy of Mr. Varros)

In the case of both the Earth (when the object makes it to the surface) and the Moon, objects produce craters whose size depends on the speed of the object and its density (as well as the surface gravity of the target planet and the presence / absence of an atmosphere). The craters produced by the Leonid impacts of 1999 and 2001 are on the order of tens of meters across, way too small to see through ground based telescopes. However, the lunar reconnaissance orbiter is able to resolve objects the size of the Apollo landers, so it would easily resolve such small craters. The trick that limits its ability to do so is the lack of high precision in pinpointing the location of the meteor strike in the Leonid cases (to no better than a kilometer or so-much larger than the crater sizes themselves-and there are many craters in the tens of meters range).

As is the case for terrestrial meteors, where there are certain times of the year where the numbers go up due to the Earth passing through trails of debris left over from passing periodic comets, lunar meteors are more frequent during certain times of the year. Since the moon and Earth are relatively close to each other in terms of interplanetary distance, whatever shower is affecting the Earth is also affecting the moon (although there is up to a 7 hour difference, depending on the position of the moon with respect to the Earth and Sun), so the moon experiences a larger flux of impacts. The next section describes the conditions needed to make observations of lunar meteors from the ground.

Ten Years of Observing Lunar Meteoritic Phenomena

Observation attempts of lunar meteors are always welcome, and the purpose of the ALPO Lunar Meteoritic Impact search section is to "coordinate the observation of lunar impact events. The vision is to develop the program and resources to make serious professional research of these 'lunar flashes' a reality in the near future. For the time being, we will use the resources given and coordinate the observations of willing participants to develop a catalogue of lunar impact events. Several questions to answer in the immediate future include: Just how common are these "impact flashes" that have been observed on the Moon as of late? Is it possible to observe these impacts during the occurrence of every major meteor shower when the Moon is favorably placed? What can these flashes tell us about the impactors themselves? What sorts of models (these are for the theorists in our audience, of which I am not) of size, composition, kinetic energy to light efficiency, etc. best match the observed flashes? How can systematic observations of lunar meteors best complement ground-based observations of meteors burning up in the Earth's atmosphere? What can both sets of observations (previous questions) tell us about the meteor stream itself? (This is more long-term, but) Is it feasible to position a lunar-orbiting satellite to constantly monitor for and observe lunar flashes (during meteor showers and at other times) in various bandpasses (perhaps taking spectra) on the dark side of the Moon?" [2]

This mission statement was "penned" ten years ago, and most of the questions are as relevant today as they were back then. We have information that shows the occurrence of lunar meteors is rather common; the challenge is looking at the right location at the right time. Lunar events happen so fast that a low light video camera attached to a telescope of modest aperture is needed to just capture the event, and even with this setup, there is no guarantee of success. Over the years, video cameras have become more light sensitive and techniques more refined to increase the odds of a successful observation. In fact, some 80 impact candidates have been reported to the Section over its decade of activity, and confidence increases each year that these candidates are genuine impact events and not merely electronic noise and flashes generated by cosmic rays hitting the camera's CCD chip.

A number of observers around the world have been involved in obtaining observations of the 80 some impacts, two of which are Mr. George Varros in Maryland, USA, and Mr. Robert Spellman in California, USA. Both are among the most active observers monitoring the moon for impact events. One of Mr. Spellman's events is shown in Figure 3 below.

Mr. Varros' impact observations are featured on his website: http://www.lunarimpacts.com/lunarimpacts.htm

Mr. Spellman's activities are highlighted at his website: http://www.angelfire.com/space2/robertspellman/

The main website for the ALPO Lunar Meteoritic Impact Search section is: http://www.alpo-astronomy.org/lunar/lunimpacts.htm where people can find links to a number of webpages, including the ones featured above.

Figure 3: Evolution of an impact event over three frames, the event (a Lunar Perseid) took place on August 9, 2008 at 4:06:22UT.

Calling All Interested Observers

We always welcome observations of all kinds of lunar meteoritic phenomena. The websites just noted have excellent resources for any would-be observer, with links to more helpful websites. Also, my book *Lunar Meteoroid Impacts and How to Observe Them* has a lot of resources, including descriptions of techniques for observing lunar craters and classifying their morphology.

Observations are typically carried out during times of elevated meteoroid activity, namely during the annual meteor showers when their occurrence coincides with a waxing crescent or a waning crescent Moon. Observations also are performed monthly, during the five day period that includes the waxing crescent and first quarter moon phases, and the five day period during the respective waning phases. It is desired that observers be paired with each partner separated from the other by at least 30km. It is also desirable for at least one observer to be equipped with video camera equipment, but having both so equipped will increase the chances of having a confirmed impact event recorded.

The following table contains a list of significant lunar meteor observation opportunities [3]. The dates of activity and the maximum are for Earth centered phenomena; the maximum as experienced at the Moon's location can occur as early as seven hours before, to as late as seven hours after. Only meteor showers with the ZHR of greater than 5 are included in the table. The shower, activity, and the max date are self-explanatory; the v_{inf} denotes the velocity of meteoroids within a given stream; the r is the population index (which indicates the proportion of fine material to coarse material, a higher r means the shower is almost entirely composed of fine particles), and the ZHR is the Zenithal Hourly Rate that would be experienced on Earth by an observer for whom the radiant is placed at the zenith in a sky with magnitude 6.5 stars visible to the unaided eye.

Shower	Activity	Max Date	v_{inf}	*r*	ZHR
Lyrids (LYR)	Apr 16 - Apr 25	Apr 22	49	2.1	18
η-Aquariids (ETA)	Apr 19 - May 28	May 06	66	2.4	85
α-Aurigids (AUR)	Aug 25 - Sep 08	Sep 01	66	2.5	6
Northern Taurids (NTA)	Sep 25 - Nov 25	Nov 12	29	2.3	5

In addition to the resources listed above, one can also join the yahoogroups lunar impacts list. This group provides, among other things, discussions about how to observe, what observing tools are new and available on the market, and reminders of upcoming events.

References

[1] "Worthy of Resurrection: Two Past A.L.P.O. Lunar Projects" by John E. Westfall, located at http://iota.jhuapl.edu/lunar_leonid/alpoproj.htm
[2] http://www.alpo-astronomy.org/mission.html
[3] http://www.alpo-astronomy.org/lunar/Observing%20Schedule%202010.pdf which has information courtesy of the International Meteor Organization (www.imo.net)

LUNAR TOPOGRAPHICAL STUDIES

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

Assistant Coordinator – William Dembowski - dembowski@zone-vx.com

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

OBSERVATIONS RECEIVED

ED CRANDALL – LEWISVILLE, NORTH CAROLINA, USA. Digital image of Theophilus.

HOWARD ESKILDSEN - OCALA, FLORIDA, USA. Digital images of Agatharchides A-Mare Nubium, Airy Swirl, Anaxagoras. Banded Crater reports for Damoiseau E, Anaxagoras.

PETER GREGO – ST. DENNIS, CORNWALL, UK. Drawings of Arago (2), Fracastorius, Mare Cognitum.

PAOLO LAZZAROTTI – MASSA, ITALY. Digital images of Carpatus-Copernicus, Fra Mauro, Maurolycus, Palus Epidemarium, Rima Draper, Rima Hesiodus, Schiller-Longomontanus-Wilhelm, Sinus Iridum, Sinus Iridum-Mare Frigoris-Pythagoras, Stoffler-Heraclitus-Licetus.

MIKE MATTEI – LITTLETON, MASSACHUSETTS, USA. Digital images of Eratosthenes-Stadius.

PHILLIP MORGAN –LOWER HARTHALL-TENBURY WELLS, WORCESTERSHIRE, ENGLAND. Drawing of Aristarchus-Herodotus.

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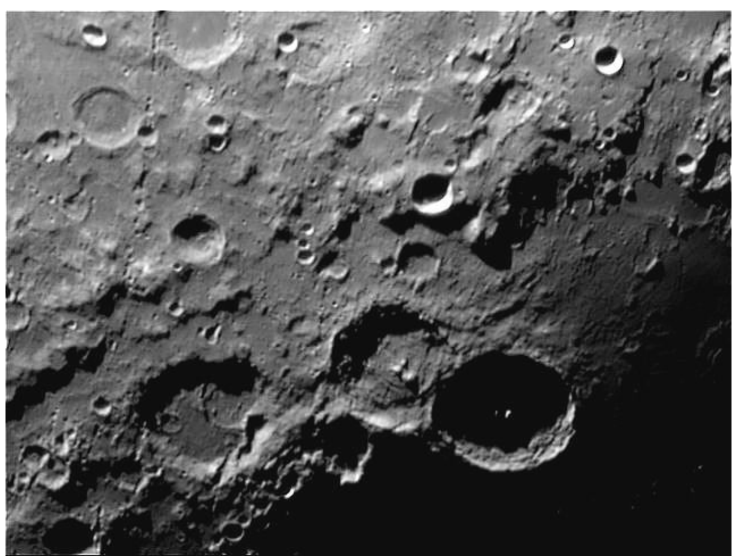
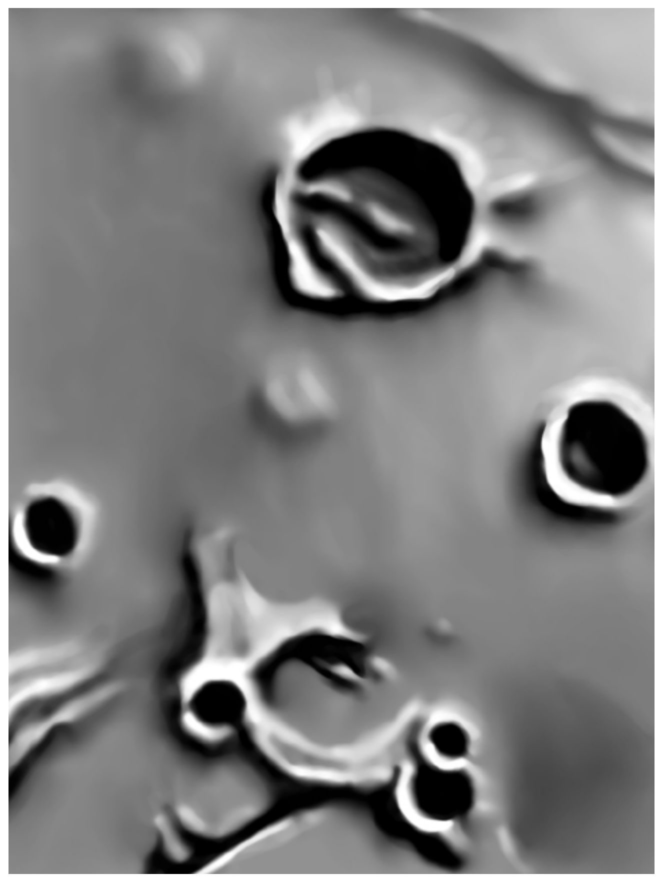
RECENT TOPOGRAPHICAL OBSERVATIONS

THEOPHILUS – Ed Crandall – Lewisville, NC, USA. November 7, 2009 10:25 UT. Colongitude 151º, Seeing AIII. 110 mm APO.



RECENT TOPOGRAPHICAL OBSERVATIONS

SINUS AESTUUM – Howard Eskildsen - Ocala, Florida, USA. January 28, 2010 01:06 UT. Seeing 8/10, Transparency 5/6. Meade, 6" f/8 Refractor, 2x barlow, DMK 41AU02AS, no filters.

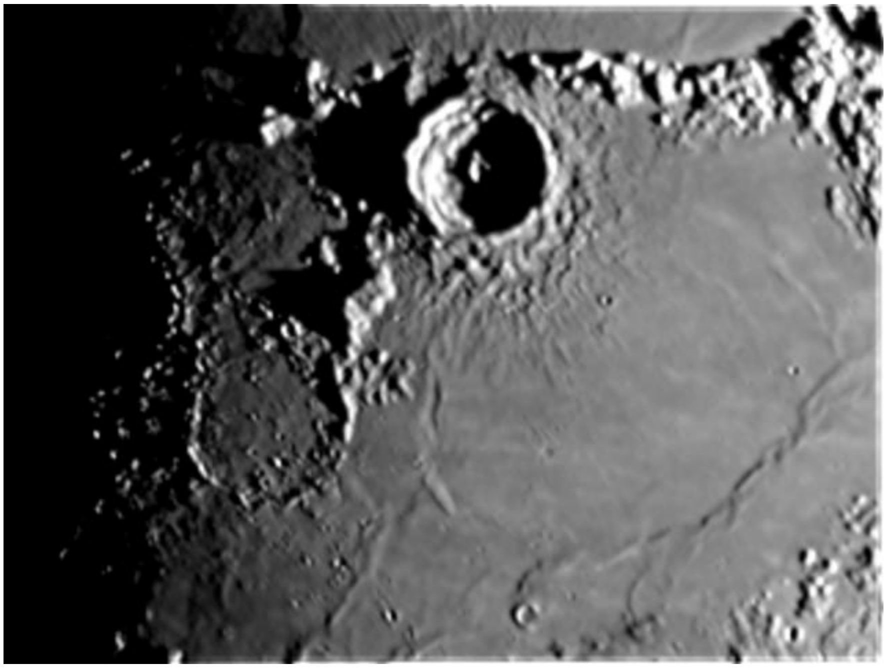


ARAGO – Peter Grego – St. Dennis, Cornwall, UK. February 20, 2010 18:45-19:25 UT. Seeing AII, cold, clear, still. Colongitude 352.1-352.5º. 300 mm Newtonian, 195x.

This observation depicts precisely the same scene that was covered in an observational sketch made some 24 hours previously, from the dome Arago Alpha to Ariadaeus and Rima Ariadaeus (although the latter two features were beyond the terminator in yesterday's sketch). The Sun had risen sufficiently highly for Arago's interior to be discerned; shadow cast by the eastern rim covered about one-third of the floor, but there were several low hills/ridges to be seen, one running down the crater's centre from north to south, another in the west adjoining the inner wall. Domes Arago Alpha and Arago Beta were barely visible; neither cast a shadow as such, but both were slightly darker on their western slopes and brighter on their eastern slopes, slight structure being discernable. The outer ridges of the Lamont formation were visible east of Arago, but they were not very prominent. Manners was largely filled with shadow, although a slight brightening of its inner western section suggested that the floor had now begun to catch the rising sunlight. Sosigenes A was full of shadow save for its inner western rim. The area around Ariadaeus, including Ariadaeus A and the ruined, flooded crater Ariadaeus E, was very interesting. Included in the observation is the very easternmost part of Rima Ariadaeus.

RECENT TOPOGRAPHICAL OBSERVATIONS

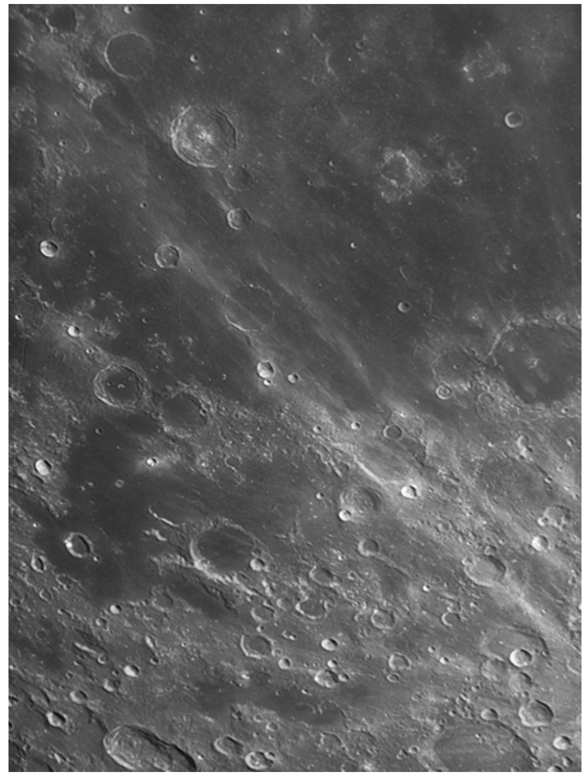
RIMA HESIODUS – Paolo Lazzarotti – Massa, Italy. August 14, 2009 04:12 UT. Seeing 6/10, Transparency 4/6. Gladius CF-315 Lazzarotti Opt. Scope, LVI-1392 PRO experimental camera, Edmund R filter, 0.18 arcsec/pixel. (http://www.lazzarotti-hires.com/2010/02/rima-hesiodus.html)

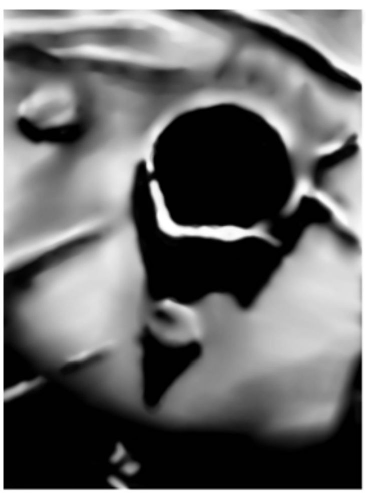


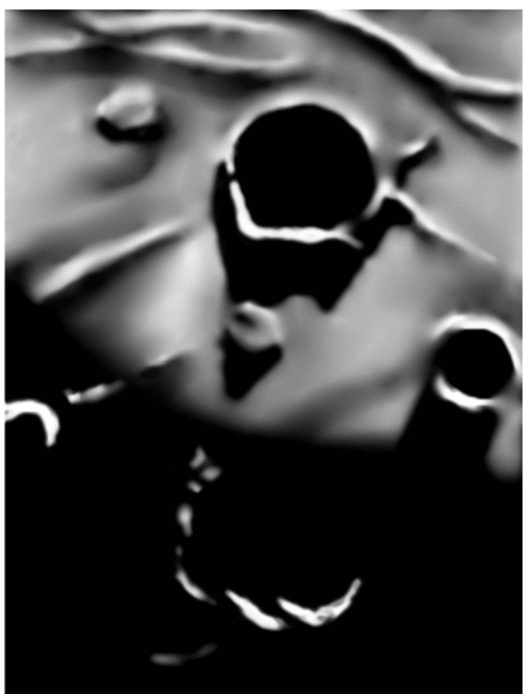
ERATOSTHENES-STADIUS-SINUS AESTUUM – Mike Mattei – Littleton, Massachusetts, USA. January 24, 2010 02:21 UT. Colongitude 13.12º. Meade 14" SCT, f/10, ToUcam.

ADDITIONAL TOPOGRAPHICAL OBSERVATIONS

AGATHARCHIDES A-MARE NUBIUM – Howard Eskildsen - Ocala, Florida, USA. January 28, 2010 01:32 UT. Seeing 8/10, Transparency 5/6. Meade, 6" f/8 Refractor, 2x barlow, DMK 41AU02AS, no filters.



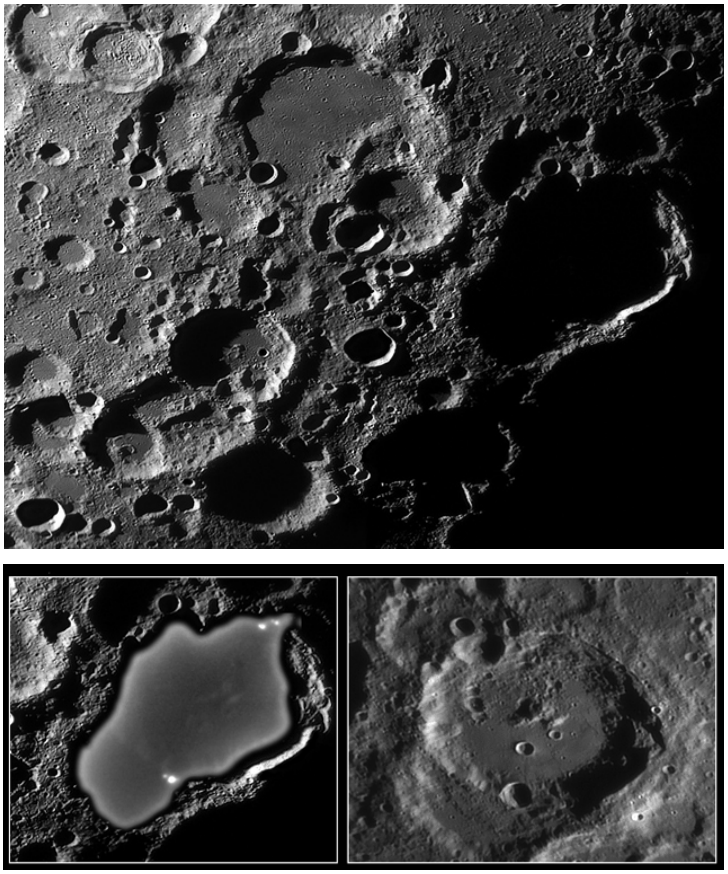




ARAGO, ARAGO ALPHA AND BETA - Peter Grego – St. Dennis, Cornwall, UK. February 19, 2010 18:20-19:15 UT. Seeing AII-III. Colongitude 339.8-340.3º. 300 mm Newtonian, 135x.

A two sketch study of sunrise over western Mare Tranquillitatis and the crater Arago, domes Arago Alpha and Arago Beta, and Manners. The first observational sketch was made between 18:20 and 18:45 UT and took in the area immediately around Arago to the terminator, but did not extend to Manners. It became clear as the session progressed that as features later began to emerge from beyond the morning terminator a second observational sketch (made between 18:55 and 19:15 UT) needed to be made to a smaller scale to include these, plus Manners to the south of Arago. Arago's interior was almost completely in shadow, apart from the upper slopes of its inner western wall. A number of wrinkle ridges could be seen around Arago – those to its east are part of the Lamont formation. Shadow from Arago stretched west to the eastern slopes of Arago Beta, and Arago Beta cast a triangular shadow towards the terminator. In the second part of the session a number of areas beyond the terminator were catching sunlight – these were around the area of Ariadaeus and Ariadaeus E, and further north Sosigenes A.

ADDITIONAL TOPOGRAPHICAL OBSERVATIONS



MAUROLYCUS – Paolo Lazzarotti – Massa, Italy. August 12, 2009 02:07 UT. Seeing 6/10, Transparency 4/6. Gladius CF-315 Lazzarotti Opt. Scope, LVI-1392 PRO experimental camera, Edmund R filter, 0.18 arcsec/pixel.

The upper image nicely portrays a very familiar crater formation: Stofler (middle-top on the image), Licetus (bottom-left corner) and Maurolycus (on the limb) completely filled with shadow. Playing with the histogram, I was courious enough to look more in depth into Maurolycus crater and I got a nice surprise indeed! The ghost of the crater floor suddenly took its classical form as the Sun light was coming from the right! In short, a waxing crater inside a waning Moon! Amazing! The image on the lower right (Jan. 17, 2005) shows the typical Maurolycus floor, the enhanced image on the lower left basically shows the same reliefs and the same depressions as the light is coming from the right! I didn't see something like this any time before, nor in any place on the web! I'd dare to call it as "self moonshining" because the Moon is illuminating itself through scattered light coming from a crater rim. Last, this image is my answer to those are still believing to a tubeless telescope as home of scattered light coming all around from a subject as wide as the Moon. (http://www.lazzarotti-hires.com/2010/02/un-classico-ritratto-lunare-con-ospite-a-sorpresa.html)

FRACASTORIUS - Peter Grego – St. Dennis, Cornwall, UK. February 28, 2010 18:00-18:40 UT. Seeing AII, patchy cloud, slight wind, complete cloud cover ended session. Colongitude 327.6-327.9º. 300 mm Newtonian, 135x.

Never having made an observational study of Fracastorius at such an early morning illumination, I was quite unprepared for the sight. I had previously considered Fracastorius' floor rather smooth and featureless, but here, under the first rays of morning sunshine, there was an enormous amount of intriguing detail. The crater's east wall cast a large curved shadow across the eastern part of its floor. A very prominent triangular shadow crossed the northeastern part of the floor to the centre, where it converged with a number of shadows produced by subtle floor topography. It may be possible that the shadow running from centre crater to the 2 o'clock position corresponds with one of the crater's floor rilles. Two linear shadows crossing the floor from north to south were particularly striking; one ran down the centre of the floor, the other was to its west and parallel to it. These were obviously very low ridges perhaps a few tens of metres high. The far western floor was in shadow, and beyond it was Fracastorius' bright inner western wall and the rim crater Fracastorius D. The to the east and northeast of Fracastorius is only roughly depicted. It would have been good to have had much more time to study Fracastorius and produce a sequential observation, but it was not to be this evening. Most certainly worth another attempt.

BRIGHT LUNAR RAYS PROJECT

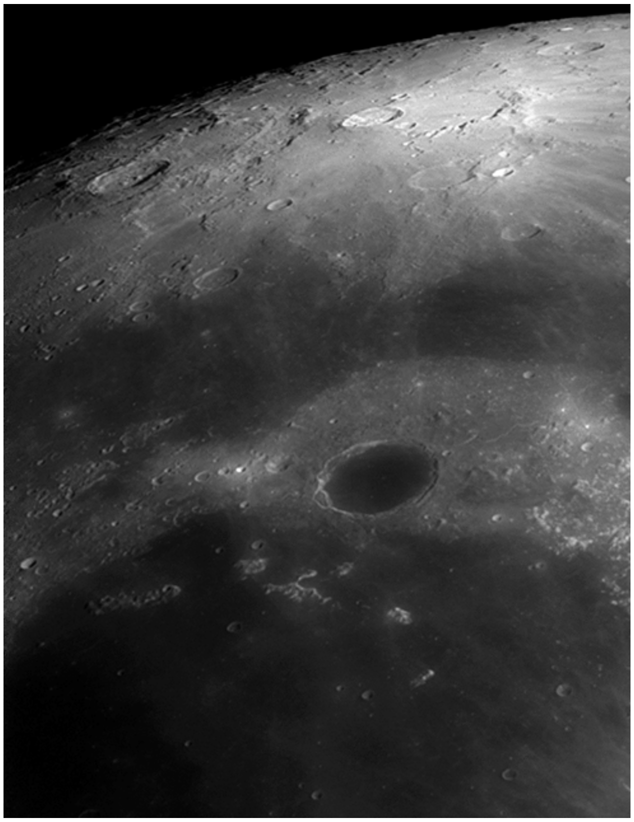
Coordinator – Wayne Bailey – wayne.bailey@alpo-astronomy.org

Assistant Coordinator – William Dembowski – dembowski@zone-vx.com

Bright Lunar Rays Website: http://moon.scopesandscapes.com/alpo-rays.html

RECENT RAY OBSERVATIONS

AIRY SWIRL-TYCHO RAYS – Howard Eskildsen - Ocala, Florida, USA. January 28, 2010 01:45 UT. Seeing 8/10, Transparency 5/6. Meade, 6" f/8 Refractor, 2x barlow, DMK 41AU02AS, no filter.



ANAXAGORAS – Howard Eskildsen - Ocala, Florida, USA. January 28, 2010 01:28 UT. Seeing 8/10, Transparency 5/6. Meade, 6" f/8 Refractor, 2x barlow, DMK 41AU02AS, no filter.

BANDED CRATERS PROGRAM

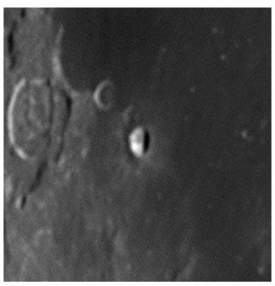
Coordinator – Wayne Bailey – wayne.bailey@alpo-astronomy.org

Assistant Coordinator – William Dembowski - dembowski@zone-vx.com

Banded Craters Program Website: http://moon.scopesandscapes.com/alpo-bcp.html

A.L.P.O. Lunar Section: Selected Areas Program Banded Craters Observing Form

Crater Observed: Damoiseau E
Observer: Howard Eskildsen   Observing Station: Ocala, Florida
Mailing Address: P.O. Box 830415, Ocala, Florida, 34483
Telescope: Meade Refractor   152 cm   f/8
Imaging: DMK AU02.AS, 2X Barlow, Filters: None
Seeing: 5/10   Transparency: 3/6
Date (UT): 2009/12/01   Time (UT): 01:28
Colongitude: 78°
Position of crater: Selen. Long.   Selen. Lat.
58.3° West   5.2° South
Lunar Atlas Used as Reference: VMA Expert Version 2.1
Image (North up):   Comments:

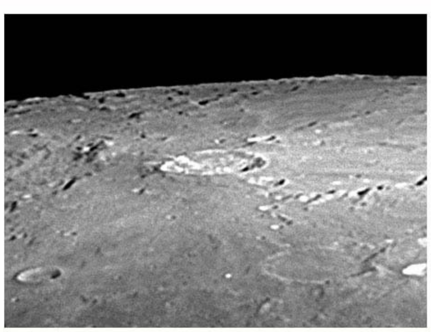


Two thin dark bands are visible on the western and the northwestern crater rims and connect with a dark area in the northern half of the interior of the crater.

A.L.P.O. Lunar Section: Selected Areas Program Banded Craters Observing Form

Crater Observed: Anaxagoras
Observer: Howard Eskildsen   Observing Station: Ocala, Florida
Mailing Address: P.O. Box 830415, Ocala, Florida, 34483
Telescope: Meade Refractor   15.2 cm   f/8
Imaging: DMK AU02.AS, 2X Barlow, Filters: None
Seeing: 8/10   Transparency: 4/6
Date (UT): 2009/12/30   Time (UT): 01:49
Colongitude: 71°
Position of crater: Selen. Long.   Selen. Lat.
10.1° West   73.4° North
Lunar Atlas Used as Reference: Virtual Moon Atlas Expert Version 2.1 2004-11-07

Images (north up):   Comments:



A bright feature about 31 km long crosses the WNW floor at an azimuth of 335° and a short ray from it extends10 km beyond the rim of the crater. Just to the south, another short, bright ray extends 12 km from the rim at an azimuth of 285°.The floor of the crater has varying bright and dark albedo features while the northern rim appears bright at the crest, but the walls appear darker.

Measurements with LTVT and error estimated at ± 15%, but multiple measurements at different librations are needed to verify these preliminary estimates.

Painting the Moon Blue using NASA's Lunar Reconnaissance Orbiter

By Tony Cook

At the time of writing, NASA's Lunar Reconnaissance Orbiter (LRO) has been orbiting the Moon for just over 250 days, busy taking approximately 50cm (20 inch) resolution images of the surface using its LROC camera. You can see the image coverage at: http://lroc.sese.asu.edu by clicking on the Targeting tool. All the red rectangles show the last update of areas that LROC has taken images of. If you use the zoom tool on the left hand side of the screen and change the map scale then you will see that there are significantly large gaps between the image footprints that have yet to be covered.

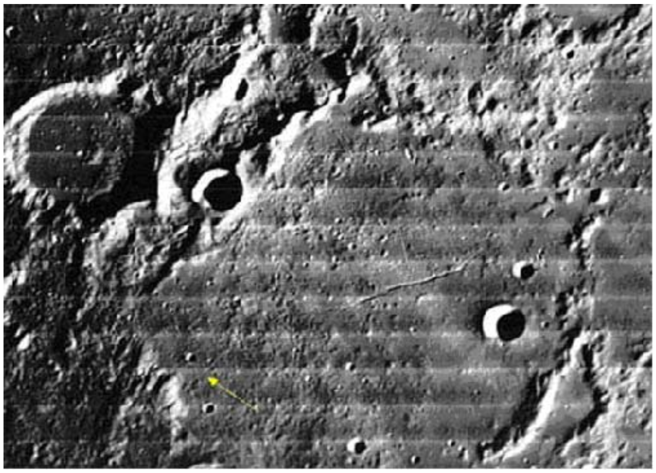


Figure 1. Modified reproduction of Lunar Orbiter IV-116-H2 frame used by Antonio Marino and Raffaello Braga (UAI), from TLO 2006 July article "CCD Images of W Bond Crater and Rima". The yellow arrow points to a 10km long rille section on the south west floor.

Although NASA and other investigators involved in LRO have designated targets of specific scientific interest and potential future manned and robotic exploration landing sites (these are illustrated as blue polygons, blue lines, or green/yellow dots) they anticipate that after the primary mapping phase of mission additional imaging targets will be required. The LRO team have therefore set up the above web site to encourage members of the public, school children, and even amateur astronomers to request the spacecraft to take high resolution images of the Moon of interesting features. It may not be too often that you are given a chance to instruct a spacecraft to take an image for you, but here is how you can go about this right now:

(1) Firstly decide what area you want to look at, and possible feature types to search for - see suggestions following these step by step instructions. As an example I have picked a figure from a past TLO (2006 July) from an article by Marino and Braga (U.A.I) concerning Rima Bond. In the article they show the obvious Rima Bond, but also highlight a rille section further to the south west. You can see this in a copy of the Lunar Orbiter IV-116-H2 frame that they use in Figure 1.

(2) Now visit the LROC web site on http://lroc.sese.asu.edu/

(3) Click on the "Targeting Tool" on the left side of the screen – and you should soon see a map of the Moon portrayed in "Simple Cylindrical" map projection. This will quickly have a multitude of red rectangles drawn over it. These red areas are regions of the surface where LROC images have already been taken, and so you should avoid these. The blue areas drawn are selected areas to target in the future.

(4) Now pick a map projection. Normally the default "Simple Cylindrical" projection will show you most areas of the Moon that you might be interested in, however it suffers from distortion at high latitudes. Alternative "Polar" projection views can be selected at the top of the web page.

(5) Now zoom in and move the cursor around to find your area of interest. This can be done by clicking on somewhere, centralizing it, and using the zoom tool on the left.

(6) Carefully pick the area of interest that you want to study. In the example in Figure 2, I have selected a region on the floor of W Bond crater with a rille section. Please compare it to the Lunar Orbiter image in Figure 1. If you are having difficulty finding the target that you are looking for, then try switching between Clementine, Lunar Orbiter, and Color-ratio base layers.

(7) To finalize the target image foot print area, click on Place Target and position the orange LROC foot print over the region concerned. Note that the size of the LROC image is only 5km wide on the Moon's surface, and so is unsuitable for large areas unless you intend a mosaic.

(8) Enter your email, followed by a nickname for the feature, sun angle, and select feature type.

(9) Once you are happy press the "Submit Target Request" button and if successful you should receive an email to say that your request has gone into the LROC Master Database. A few minutes (the length of time can vary) later your target area will appear as a blue rectangle on the map.

(10) Press the Navigate button for a new area, or quit from the web site if you are finished.

Here is what you may receive back by email if you have selected a target site successfully:

```
===================================
LRO/LROC Target Selection Interface
===================================
Request received at 2010-02-27T16:55:47.132
The target request has been entered into the LROC master database.
Thanks for your interest.
Originator ID:      email@email.co.uk
Feature nickname:   Marino and Braga rille N of Timaeus from 2006 Jul The New Moon ALPO
newsletter
Sun:                Low
Feature type:       Rille
Vertices: (lon, lat)
p1: (  -1.14560,  64.73797)
p2: (  -1.14560,  63.91381)
p3: (  -1.31043,  63.91381)
p4: (  -1.31043,  64.73797)
p5: (  -1.14560,  64.73797)
--
Applied Coherent Technology Corp.
```

Limitations: although a well designed web site and tool for citizen scientists, there are some things that have to be allowed for when using this:

(1) The choice of illumination angles: High (no shadow) or Low (with shadow) is somewhat restrictive for amateur astronomers who are used to using colongitude. So if you want to see low lying topography then pick the "Low" option. For everything else, including high latitude areas (there is always some shadow here), or where you are worried that nearby topographic relief could cast a shadow on whatever you wish to look at, then you might want to consider the "High" illumination option.

(2) The Feature Type choice is also limited to just: Crater, Central Peak, Impact Melt, Ray, Ejecta, Massif, Volcanic Flow, Pyroclastic, Vent, Volcano, Dark Halo Crater, Rille, Regolith, Boulders, Wrinkle Ridge, Graben TLP, Lobate Scarp, Lava Tube, Spectral Anomaly, Mountain, Light Plains, and Geological Comtact. So this presents a challenge for example would Schroter's Valley come under: Rille, Lava Tube, or Vent? The best advice I can offer is to pick the nearest choice that you can and then just elaborate in the "Nick Name" description.

(3) The base maps are good, but not ideal. The Clementine base map is essentially a Full Moon illumination image with little shadow except at high latitudes. The Lunar Orbiter base map varies in quality in terms of contrast and illumination – some areas on the farside are almost unusable. Also do not be confused by photographic processing marks on the Lunar Orbiter images. One can lose ones way on the color ratio map, so it is important to click between maps.

(4) No more than 5 targets per day should be selected by any one user of the LROC targeting tool.

(5) Avoid overlapping areas where images have already been taken or footprint requests already made.

(6) The plot of existing LROC imagery that has been taken does not appear to be updated frequently and could be several weeks old?

(7) There is no guarantee, if or when requested target areas will actually be imaged, although the LROC team say that they will contact you when the images are released.

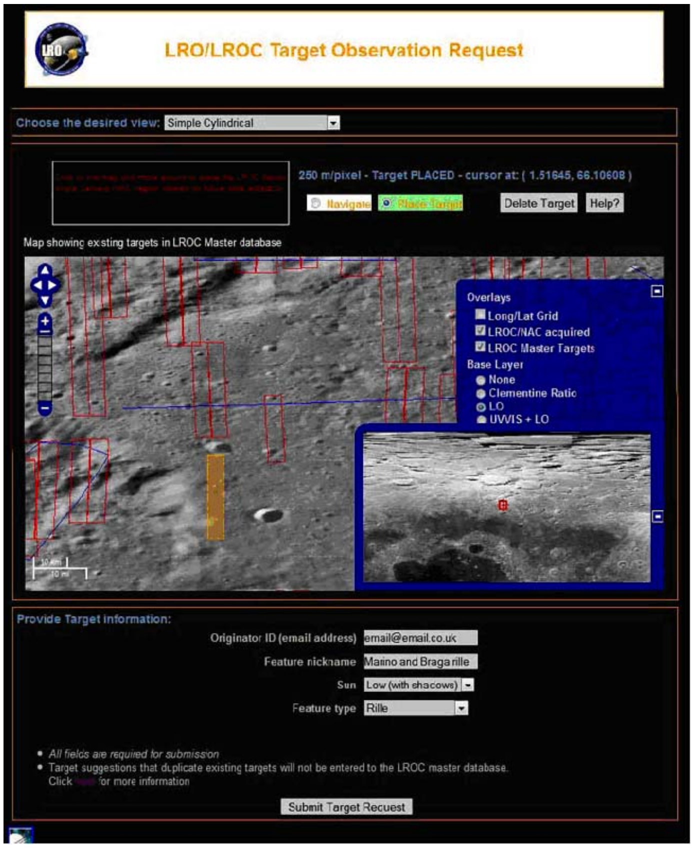


Figure 2. The selection of a proposed LROC target image footprint area of the south west rille in Rima Bond.

Tips for target selection: We do not know how many images from individuals will be eventually imaged, therefore it is important to select targets carefully, with a valid reason that will give a good science return. I often put this reason in a very concise form at the end of the nick name description. Anyway here are a few ideas.

(1) Try to pick areas where there are not many existing LROC images nearby, and away from other people's target requests. As the spacecraft has to fly along a given longitude line, in polar orbit, once per month, if there are relatively few requests on that longitude line, then you may stand more chance of being selected.

(2) Attempt to look through the base maps for evidence of faint rilles, domes, etc that have not been selected yet.

(8) Examine old editions of TLO, looking for features of interest, or historical observational puzzles that have been discussed. As illustrated in the rille example in Figure 1, amateur astronomers have studied the Moon under a much wider range of illumination angles than are available to spacecraft, therefore you may see surface structures that the LROC team are just not aware of.

(9) The color ratio map, although resembling the worst kind of modern abstract art, does at least tell us about mineral distributions, and again this may help find you features in areas where the LROC targeting base map image contrast is too low.

(10) Scour the archives of old Lunar Orbiter http://www.lpi.usra.edu/resources/lunarorbiter/ and Apollo Metric http://www.lpi.usra.edu/resources/apollo/catalog/metric/ photographs looking for domes, rilles, volcanic vents, or anything else that you think might be scientifically important to image at high resolution. Use the image centre longitudes and latitudes given to help find their approximate

locations on the LROC target base maps. The longitude and latitude of the cursor will appear after a few seconds on the top of the LROC target map page.

MoonZoo: Lastly, I have been requested to ask if any of you might be interested in testing out a prototype crater counting and measuring tool that will help lunar scientists in the US and Europe to analyse the mountains of LROC images. If you have heard of GalaxyZoo, then this is similar, but will be working with craters instead of galaxies, see http://www.lpi.usra.edu/meetings/lro2009/pdf/6035.pdf for further details. There will be a Beta Test version initially, so as to enable us to shake out any bugs before this becomes available to the public. If you are interested, in trying out the Beta Test version, then please email me and I will put your name forward.

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LUNAR TRANSIENT PHENOMENA

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

LTP NEWSLETTER – MARCH 2010

Dr. Anthony Cook - Coordinator

Observations for January 2010 were received from the following observers: Jay Albert (Lakeworth, FL, USA), Maurice Collins (New Zealand), myself (Aberystwyth University, UK), Marie Cook (Mundesley, UK), Kerry Koppert (New Zealand), and Steve Lang (New Zealand).

LTP reports: No LTP reports were received for January 2010.

Request for more observers: I would like to ask if you would consider making the odd observation or two per month for the LTP sub-section? Whatever you think about the study of LTPs, please be assured that any observations received, are eventually forwarded on to other researchers in the Lunar Section. You may also find that making some of the types of observations discussed below will help you learn lunar geographical areas that you are unfamiliar with, and also give you a better understanding about some historical observations made by famous and lesser known lunar observers from the past.

For visual observations: although CCD images are very useful for confirming transient changes (especially time sequences), it is usually visual observers who are the first to spot LTPs! The sooner we hear about a suspected LTP sighting, the sooner an alert can be made by phone, text, email and Twitter, in order to get other observers into action for confirmation. One thing I should add though is that before contacting me concerning a LTP, please check similar looking craters to see if they exhibit similar effects e.g. colors, fuzziness or brightness variability. Swapping eyepieces and rotating eyepieces is also good practice to ensure that any effect seen is not optical. If you have red and blue filters then these can be used to check if perceived colors are due to atmospheric spurious color (spectral dispersion due to refraction) by switching between filters. A true red or blue color on the surface will make the image “blink”. A spurious color will appear the same brightness in both filters and will not cause a blink, though you might get a slight displacement of the image between filters.

Most of the time though we like our visual observers just to check out features on the Moon at dates and times listed on the web site at the bottom of this article. These provide calibration data on what the normal appearances of features should have been like under the same lighting conditions as past LTP. Observations can be quite simple, just a few descriptive sentences in an email to say how a feature compares with what the original LTP report describes, along with the date, start and end UT of the observation and details about the equipment and observing conditions. If you wish to do a sketch then these are always welcome, but not a necessity. These kinds of routine observations are incredibly valuable in eliminating past LTPs!

For CCD observers: again the observation of a specific lunar feature, at a time and day given on the web site at the bottom of this page will be incredibly useful to us in establishing the normal appearance of a feature. Alternatively images that are closely spaced in time of a feature, and/or through different color filters, is a very accurate way to detect subtle LTP colors, or indeed natural surface colors at the few percent level. In fact at Aberystwyth University we take time lapse images regularly of the Moon through narrow band filters, centered on emission lines of ionized gases suspected to be involved in LTPs (according to some refereed publications). These time lapse movies are quite instructive on how waves of atmospheric seeing, or changes in transparency can affect the appearance of lunar features, and how this may have fooled observes in the past.

Lunar and Planetary Science Conference: Two page abstracts for this year's 41st Lunar and Planetary Science Conference at The Woodlands, Texas (2010 Mar 1-5) are available on line to read on http://www.lpi.usra.edu/meetings/lpsc2010/ . These abstracts are very educational to browse through in order to see what the latest news is in the planetary sciences. This year they cast some light on some recent results from the LCROSS impact, LRO results and other missions, and the latest theories on lunar dust, and volatiles in the lunar regolith. I will summarize the latest theories on lunar dust and volatiles in the lunar regolith and detail here some of the findings from the LRO:

Firstly Crotts and Hummels from Columbia University, NY, has calculated that a seepage flow of 2 grams per second of gas at a regolith depth of 15 meters is enough (1 tonne of pressure of gas molecules with a mass equivalent to 20 times the weight of a hydrogen atom) to explosively erupt through the regolith. Although the heavier particles churned up would fall back into the pit, the lighter ones could expand for several minutes over several kilometers area, which by chance is the size and duration of a typical event that is needed for a LTP to be seen from Earth. They further speculate that charge separation within part of the cloud of dust could cause coronal discharge effects. The authors also discuss how their model of gas seepage had predicted correctly the distribution of hydrated lunar regolith, within about 20 degrees of each lunar pole, discovered in 2009. They do not comment though on why the Apollo instruments did not detect such large amounts of gas being added to the lunar atmosphere.

Concerning the electrostatic levitation of dust particles on the Moon, Poppe and Horanyi of the University of Colorado have been carrying out computational simulations on the process in a one dimensional model, The theory goes that ultraviolet light from the Sun causes photoemission from the lunar surface and solar wind plasma should give the lunar surface a negative charge. However the electrical current from the photoemission is roughly ten times greater than the solar wind electrical current and so the lunar surface is charged positively. Something called a photoelectron sheath develops and can form up to several meters thick above the surface. They find that downward directional electric fields in the photoelectron sheath limit the height to which dust particles can levitate and it becomes significantly more difficult to levitate particles larger than 0.15 microns in size. For future work they will model the process in two dimensional simulations and will also vary UV flux and solar wind conditions, but for now their models dispute some of the evidence for electrostatic dust particles attaining much altitude at all.

Conversely Glenar *et al.* (New Mexico State University) discuss whether the 1994 Clementine mission observed horizon glow from dust particles suspended a hundred km above the lunar surface from the spacecraft's star tracker cameras! Their conclusions, after removing the effects of zodiacal light, and the corona etc, hint that it does exist and they are now studying the spatial distribution of the horizon glow along the limb. Jackson *et al.* (Goddard Space Flight Center) submitted an abstract to the conference, expressing concern about tribo-electric discharge hazard faced by astronauts, especially at the polar regions near to permanently shadowed craters. Hartzell and Scheeres of the University of Colorado have been studying what happens if lunar water is present on dust particles at the parts per million level. There conclusion is that this reduces the cohesive force between dust particles and the surface and this can increase the chances of levitation should a particle become charged, furthermore the effect would be more prevalent at sunrise than at sunset and this is what is observed. They do however not discuss the precise mechanism for charging; I guess a lot of theoretical work still needs to be achieved in this research area to match the observational evidence!

Finally, you may be interested to know that LRO's Lyman Alpha Mapping Project (LAMP), a far ultraviolet imaging spectrograph that detected molecular hydrogen, mercury, calcium and magnesium volatiles in the ejecta plume of the LCROSS impact, will be used to monitor horizon glow at dawn, according to Gladstone and the LAMP team from the Southwest Research Institute. They hope to detect gaseous emissions from the surface, sodium emissions, dust particles during meteor showers, and other effects during crossings of the Earth's magnetotail.

LTP Alerts and Predictions: If you would like to join the LTP telephone alert team, please let me know your phone No. and how late you wish to be contacted. If in the unlikely event you see a LTP, 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 now be accessed on http://twitter.com/lunarnaut. For repeat illumination (only) LTP predictions for the coming month, these can be found on the following web site: http://users.aber.ac.uk/atc/tlp/tlp.htm .For members who do not have access to the internet, please drop me a line and I will post predictions to you.

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KEY TO IMAGES IN THIS ISSUE

1. **Agatharchides A**
2. **Airy**
3. **Anaxagoras**
4. **Arago**
5. **Aristarchus**
6. **Damoiseau E**
7. **Epimenides**
8. **Eratosthenes**
9. **Fracastorius**
10. **Maurolycus**
11. **Rima Hesiodus**
12. **Sinus Aestuum**
13. **Theophilus**

FOCUS ON targets

X = Snellius-Furnerius (March)
Ray Craters (May)
Dark-Haloed Craters (July)
Y = Mare Nectaris (September)