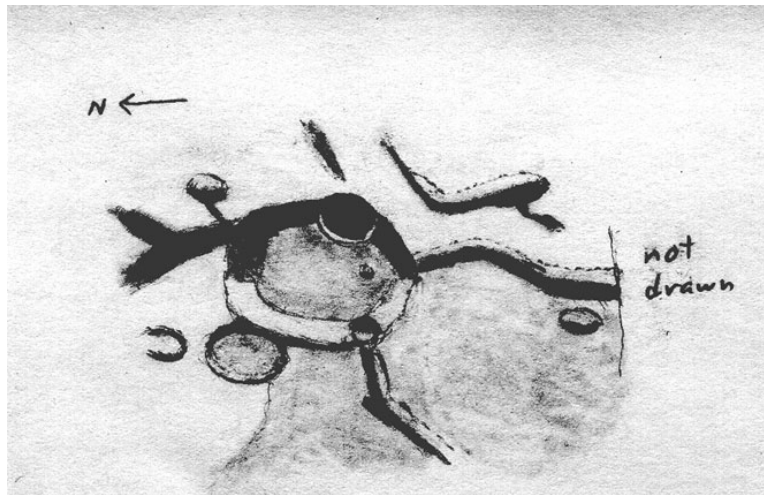




THE LUNAR OBSERVER

A PUBLICATION OF THE LUNAR SECTION OF THE A.L.P.O.
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219 Old Bedford Pike (Elton) - Windber, PA 15963

FEATURE OF THE MONTH - MAY 2005



PROCLUS

Sketch and text by Robert H. Hays, Jr. - Worth, Illinois, USA
December 18, 2004 - 00:30 to 00:54 UT
15cm Newtonian - 170x - Seeing 7-8/10

I sketched this crater and vicinity on the evening of Dec. 17/18, 2004 after the occultations of Psi-2 Aquarii and two other stars. Proclus is a modest-sized, but bright crater on the northeast corner of Palus Somnii (between Maria Tranquillitatis and Crisium). It has a polygonal shape that apparently is the result of at least three impacts. There are craters on the southeast and southwest corners that affect its shape. A tiny peak lies between these craters inside the south rim of Proclus. The brightest part of Proclus is the inside northwest rim. The shallow crater Proclus K adjoins this bright rim, and Proclus L is north of K. Proclus L has a gap in the north. A large peak is northeast of Proclus with wrinkle shadowing between it and Proclus L. A detached, right-angle ridge was seen southeast of Proclus; this may have been the broken ring Proclus S, according to the LQ Map. A wide, curving ridge extends south from Proclus; the LQ Map shows Proclus T in this location. Another large peak is near this feature. A low, bending ridge extends westward from Proclus. The grayish tint of Palus Somnii is evident between the remnant Proclus T and a fairly sharp boundary west from Proclus K. Proclus itself does not appear to have been flooded, but Proclus K is the same tint as Palus Somnii.

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. Several copies of recent journals can be found on-line at: <http://www.justfunfun.org/djalpo/> Look for the issues marked FREE, they are not password protected. Additional information about the A.L.P.O. can be found at our website: <http://www.lpl.arizona.edu/alpo/> 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.lpl.arizona.edu/~rhill/alpo/member.html> which now also provides links so that you can enroll and pay your membership dues online.

LUNAR TOPOGRAPHICAL STUDIES

Acting Coordinator - William M. Dembowski, FRAS

dembowski@zone-vx.com

OBSERVATIONS RECEIVED

GIORDANO ACHILLE - NAPLES, ITALY

Digital image of Schickard & Phocylides & Schiller

MICHAEL BOSCHAT - HALIFAX, NOVA SCOTIA, CANADA

Digital images of Copernicus, Clavius

DANIELE BOTALLO - PALERMO, ITALY

Digital image of Posidonius, Boussingault

ALBINO CARBOGNANI - PARMA, ITALY

Digital image of Sinus Iridum, Plato

ED CRANDALL - WINSTON-SALEM, NORTH CAROLINA, USA

Digital image of Aristoteles Region, Eratosthenes, Archimedes, Plato & environs

COLIN EBDON - COLCHESTER, ESSEX, ENGLAND

Sketch of Brenner to Fracastorius

HOWARD ESKILDSEN - OCALA, FLORIDA, USA

Digital image of Moon & Mercury

PAOLO LAZZAROTTI - OSTELLATO (FE), ITALY

Digital images of Theophilus, Posidonius, Stofler, Manilius, Walter, Triesnecker, Albategnius

GEORGIO MENGOLI - ITALY

Digital images of Stofler, Walter

YENAL OGMEN - LEFKONIKO, CYPRUS

RayMaps of Messier (3), Menelaus (2)

RAFAEL BENAVIDES PALENCIA - POSADAS, CORDOBA, SPAIN

Digital images of Janssen, Mare Crisium

GERARDO SBARUFATTI - CASSELE LANDI (LODI), ITALY

Digital images of Dorsum Oppel & Mare Crisium, Messier A, Burg & Lacus Mortis, Maginus

ALEXANDER VANDENBOHEDE - GHENT, BELGIUM

Digital images of Aristarchus (2), Copernicus, Kepler, Reiner Gamma, Mare Orientale, Tycho, Western Limb

CARMELO ZANNELLI - PALERMO, ITALY

Digital image of Schickard

STELLAR ECLIPSES / OCCULTATIONS

By Rob Robinson

I.O.T.A. Vice President for Lunar Occultation Services

**This article is a reprint of one which resides on the
American Lunar Society Website at: <http://otterdad.dynip.com/als/>**

Many people have observed lunar eclipses. Many people have also observed solar eclipses. Chances are there are a few who have observed stellar eclipses, or what is more commonly known as occultations. Occultations occur when any solar system body, passes between earth and a star. These bodies can be not only the moon, but also planets and asteroids.

For an observer on earth, just about any night the moon is visible, there is often an occultation of a star that can be seen in an amateur's telescope. Stars on the order of eighth magnitude and brighter are quite common. Most generally, the first time an observer watches the disappearance of a star behind the dark limb of the moon, they are quite shocked at how quick the event happens.

The International Occultation Timing Association (I.O.T.A.), is an organization of both amateur and professional astronomers, who on a regular basis, time the disappearance and reappearance of stars occulted by the moon. Timing occultations can be done with modest equipment, ranging from a 60mm refractor to a large Newtonian reflector; a shortwave radio to obtain WWV time signals; and a stopwatch. Many amateurs are now using video cameras to record occultations, which refine the accuracy of the observation from 1/10 of a second to 1/30 of a second, and allows a permanent record of the event. One can use a regular handheld camcorder for stars brighter than 3rd or 4th magnitude, or you can use a low light camera, such as the Supercircuits PC23A (\$79) attached directly to the focuser to record fainter stars to ninth magnitude.

I.O.T.A. also records timings of stars by asteroids, commonly known as appulses. By strategically setting up observers along an "observing fence", perpendicular to the asteroid's motion, size and shape of the asteroid can be determined. It was in the early 1980's that David Dunham made the bold statement that asteroids had moons of their own---by observing the results of asteroidal timings---which later proved to be true by Hubble in the 1990's.

I.O.T.A. is a non-profit (501c) corporation. The administrative site (www.occultations.org), is maintained by Rex Easton, which gives information on membership, where to send information and officers. Another web site (www.lunar-occultations.com/iota) is maintained by Rob Robinson, and gives information on upcoming events, occultation predictions, asteroidal predictions, informative articles on "how to", software and related links. For more information, contact David Dunham (dunham@erols.com) or Rob Robinson (webmaster@lunar-occultations.com).

Value of Occultations and Grazes

I have often heard the comment, "why observe occultations and grazes as they have no relevance in the age of the recent probes we have sent to the moon. We know all about the moon". So how true is this statement? A group of observers, on a graze expedition, travel sometimes fifty to hundred miles to a selected site, to see a four to five minute event, and then send the data in for reduction. Have they done this in vain? Have they already observed something that the lunar probes have shown us?

Mitsuru Soma, of the National Astronomical Observatory in Japan, gathers information relating to graze data. He states, "The Clementine laser did not probe the lunar polar regions, so visual grazing occultation observations, inherently more accurate in any case due to the grazing geometry (their accuracy depends more on a good knowledge of the geographical position of the observer than on the event timings), will continue to be valuable in the foreseeable future". He goes on further to state, "I think occultations can be used to analyze the errors of the Hipparcos proper motion system". Dr. Soma's analyses of Aldebaran grazes observed in 1979-1980, compared with those observed a Saros cycle later in 1997-1998 in the same part of the lunar profile, have confirmed that the FK5 proper motion of this star is more accurate than the Hipparcos ICRS proper motion.

Grazes are the most dramatic of all observed events, other than a total eclipse of the sun. Anyone who has observed a star graze comes away with a feeling of awe towards the mechanics of the earth-moon system. Since the lunar profile is constantly changing, each grazing occultation is different, since the Moon's longitude and latitude librations only repeat themselves every 18.5 years; therefore, each observed graze is different. Observing total occultations sometimes can bring notoriety to the observer when he detects duplicity in a star occulted by the Moon that had not been previously known to be a binary star system. This conclusion is made when a star can be seen to disappear/reappear in two distinct "steps" over a time-period of approximately 0.5-seconds or less. Since the Moon has no atmosphere, it acts as a "knife edge", bisecting EACH star in a Binary System.

Timing Total Occultations

Modest equipment is all that is needed to time total occultation predictions. By submitting your observations, you too can contribute to the science of astrometry. There are some things you need to know about equipment in order to successfully time total occultations. Time signals are needed for timing occultations. Short-wave radio time signals, such as WWV and WWVH at 5, 10, and 15 megahertz are preferred. Radio Shack used to sell a convenient receiver, the "Weatheradio-Timecube", for these frequencies for about \$40, but it is no longer available. A more expensive alternative is a digital SW-Radio sold by Radio Shack, part#20-229 for \$100. It gives a much more reliable signal than similarly priced general-purpose short-wave receivers. If you buy a general-purpose short-wave radio, try to get one that at least covers 5 and 10 megahertz, the best nighttime frequencies.

Coordinates for your site are needed for predicting when an occultation/graze will occur in your area. Outside of buying USGS 7.5-minute survey maps, there are several on-line mapping sites which are good enough for total occultations. The "Maps On Us" mapping site (www.mapsonus.com) should be sufficient for total occultation predictions, but for grazing occultations, the 7.5 minute maps are preferred for accuracy.

You will need a stopwatch, which most observers find more convenient for making timings. Most stopwatches now are digital, although mechanical stopwatches can still be found. Methods that don't use a stopwatch include the Eye-and-Ear method and tape recording method. Personal preferences are to use stopwatch and the short-wave radio.

The choice of telescope for observing an occultation is predominantly limited to what the observer would normally use for observing. Whether you use a refractor, reflector or Schmidt-Cassegrain, you can observe occultations and grazes. Size does make a difference in the limiting magnitude of observations that you can make. Most generally, a six to ten inch primary will allow observations of stars to eight or ninth magnitude, which is usually the faintest that predictions will show. Smaller primaries will limit the observer to only the brighter stars.

If you have a camcorder, you can videotape the brighter star occultations (e.g. down to 3rd magnitude). With a video surveillance camera attached directly to the telescope, a 6" reflector will reach 9.5 magnitude. By using a video camera, with the time signal overlay, you have a permanent record of the event.

Predictions can be obtained by a variety of ways. If you are a member of I.O.T.A., you will automatically receive predictions from a regional coordinator. You can also generate your own predictions, by using David Herald's freeware program "Occult". If you are not a member, and do not wish to generate your own, this author will provide predictions for your site, free of charge (you must provide site coordinates and telescope size).

With the short-wave radio, stopwatch, predictions and telescope, you are now ready to start. The easiest way is to start the stopwatch on the event (when the star disappears). Then, stop the stopwatch on the next whole minute tone of the WWV receiver. Subtracting the stopwatch time from the whole minute time gives you the "raw" event time. Everyone has a "reaction time" which is normally around 3/10's of a second. Subtracting this from the "raw time" gives you the actual event time. This sounds complicated but it is actually very easy, and will become second nature after the first few timings. More information on timing total occultations and equipment can be found on the I.O.T.A. web site (www.lunar-occultations.com/iota/) under "Resources and Other Information". The website also provides current information about upcoming occultations and grazes.

A Method of Making Occultation Observations

Much information can be read on the IOTA homepage for lunar and grazing occultations. The beginning observer should read the documents pertaining to the basics. These pages can be found at: <http://lunar-occultations.com/iota>

For this article, I would like to explain my method of making observations. This is not the only method, but for me it is the easiest. Those who are members of IOTA will recall that this is referred to as the Taylor Method.

An observer, knowing his local coordinates in longitude and latitude to the nearest 50 feet, can use various computer programs to generate predictions for total occultations for his site. Two of the most common software packages are 1) Occult by David Herald; and 2) Lunar Occultation Workbench by the Dutch Astronomical Observers. To determine one's coordinates, the preferred method is by measuring your site location on a USGS 7.5-minute survey map. There is a software program, called MSDP on the IOTA homepage, where the freeware program can be downloaded. The program simplifies the procedure and eliminates having to do the tedious math, in order to triangulate your site coordinates. A GPS unit can also be used, but averaging over a period of time is necessary to get accurate coordinates. Methods for using a GPS unit for coordinate determination can be found on Scott Degenhardt's website, located at <http://www.home.com/~dega/>

There are various methods for timing occultations, but what has proven effective for me, using a stopwatch and WWW radio time signals, is described in the following steps:

1. Be sure to set the scope up at least a ½ hour before the event so that the it can acclimate to ambient temperature
2. I always try to locate the star at least 10-15 minutes before the event. This also helps eliminate the problem of looking for the star in the wrong hemisphere of the moon, when using higher magnifications.

3. Use an eyepiece that will give a magnification between 75-100x for stars brighter than eighth magnitude. For fainter stars, higher magnifications can be used, though I rarely go over 125x.
4. Whether you use a mechanical or electronic stopwatch, it should be checked periodically with WWV or CHU for accuracy. This can be done by starting the watch on a minute tone, letting it run 5-10 minutes and then stopping the watch on the minute tone. Do this 3-5 times, and then average the difference. Since there is a reaction time to starting and stopping a watch, you should subtract .3 sec when starting and .3 sec when stopping for a more accurate calibration.
5. I usually start watching the star 2 minutes before it is to disappear or reappear. Any sooner than this, and the eye becomes tired and fatigued. Any later than this, and there is the possibility of missing the occultation.
6. When the star disappears or reappears, I start the stopwatch. Then I go inside and turn on the WWV or shortwave radio. I watch the 1/10 sec marks, in relation to the clicks or tones from the radio. I then write down this 1/10-second number. The watch is then stopped on a whole minute tone. Write down the whole minute, and second shown on the stopwatch, and add the 1/10-second you recorded earlier.
7. The time you wrote down in step number 6, is then subtracted from the time given at the whole minute tone. This is the "raw time" of the disappearance.

Example:

Star disappeared and stopwatch started

Times clicks or tones, are heard when the stopwatch is at 7/10's of a second, each second.

Stopwatch is stopped on the whole minute tone, of

2:43:00 and stop watch shows 2m 21 sec and the tenths.

Ignore the tenths, since you already know that it is to be 7/10's

Add the 7/10th of a second to stop watch time = 2m 21.7s

To get raw disappearance time subtract:

$$2:42:60.0 - 2:21.7 = 2:40:38.3$$

After you have calculated "raw time", your reaction time or "Personal Equation" (PE) needs to be subtracted from the raw time. For most individuals, this is 3/10 of a sec. Therefore: $2:40:38.3 - .3 = 2:40:38.0$

The 2:40:38.0 is then the actual observed event time. This is the time that is reported to the International Lunar Occultation Centre in Tokyo, Japan. More can be found on reporting your timings on the IOTA homepage. There is a special format, which can be used for email, which will make the reports easily imported into their computer program for data reduction.

By using a consistent and proven method of timing occultations, one gains confidence in his observations. Over the years, I have timed stars that were off the predicted time more than 4-6 seconds, which is actually quite a large difference. If I knew the actual observation was accurate, and the calculations were not in error, I send these observation times in to ILOC anyway, since the reason of the large difference, could have been due to incorrect positional information of the star.

A DOME NEAR CRATER VENDELINUS

located at longitude +57.83 ° and latitude -15.74°

**By Raffaello Lena, Christian Wöhler, Jim Phillips,
Maria Teresa Bregante, and KC PAU - GLR Group**

Vendelinus is an ancient lunar impact crater located on the eastern edge of Mare Fecunditatis. To the north of Vendelinus lies the prominent Langrenus crater, while to the southeast lies Petavius crater. Due to its location, the crater appears oblong due to foreshortening. The floor of Vendelinus is flat and covered by a dark lava flow. It lacks a central peak, but includes multiple impact craters of various dimensions [1]. The smaller Lohse crater overlaps the rim to the northwest, and at the south end there is the Holden crater.

A number of domes are reported in this region but they are not easy to image as the crater is close to the lunar limb [2]. Observation of these domes requires low solar altitude for maximum detail. Recently this region was monitored by the GLR group. In addition, a low feature has been observed in this area, near the crater Vendelinus, and it is reported here. It lies at longitude +57.83 ° and latitude -15.74° ($\xi = 0.815$, $\eta = -0.271$). The dome was detected by J. Phillips (Fig. 1, with an image scale of 323 m per pixel). The image was taken on February, 26, 2005, at 09:30 UT, using a TMB 8" f/9. Another image, here proposed as Fig. 2, was taken by Pau on October 12, 2003, at 16:11 UT using a 25 cm Newtonian telescope.

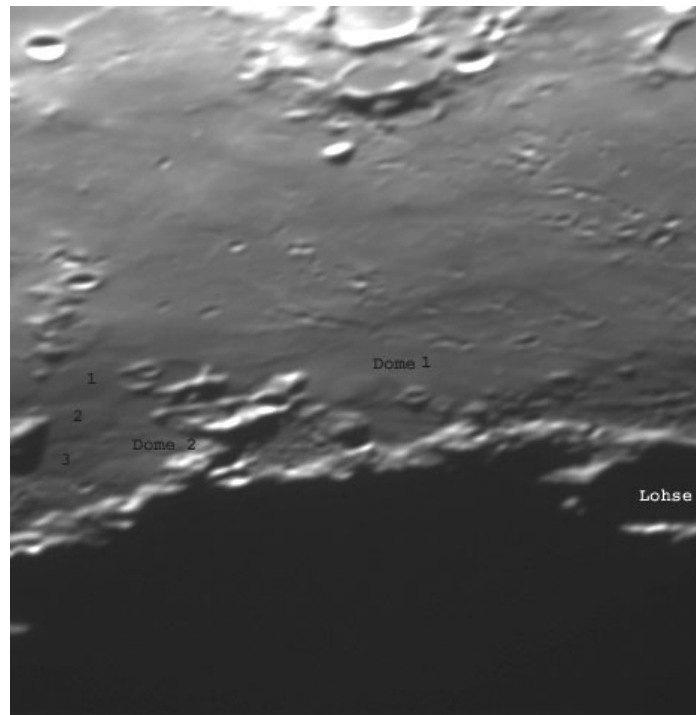


FIGURE 1 (See text for details)

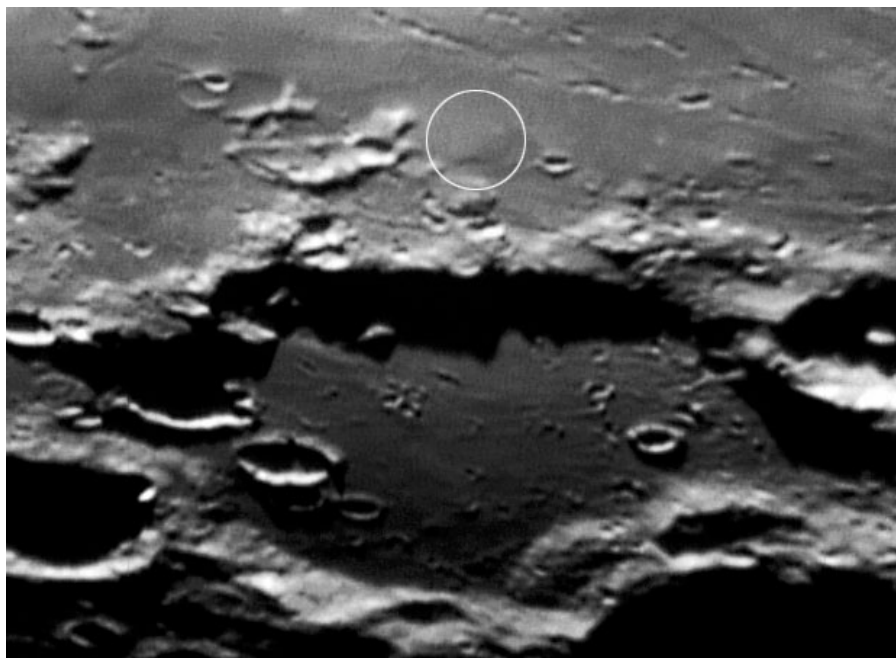


FIGURE 2 (See text for details)

For each of the observations, the local lunar altitude of the Sun (Alt) and the Sun's selenographic colongitude (Col) were calculated using the Lunar Observer's Tool kit by H. D. Jamieson (Table 1).

Preliminary estimations indicate a diameter (E-W direction) of 16.8 km and a rather low slope; moreover no black shadow is cast by the dome (see Fig. 1) which confirms its low relief character. It is, to our knowledge, previously unreported; neither is it on the ALPO list nor classified.

TABLE 1

**Local lunar altitude of the Sun (Alt) and the solar selenographic colongitude (Col)
calculated for the dome located at $+57.83^\circ$ longitude and -15.74° latitude**

| Figure | Col | Alt (dome 1) |
|--------|----------------|--------------|
| 1 | 120.17° | 2.24° |
| 2 | 115.02° | 6.64° |

Figures 1 and 2 are oriented North to the right and West (IAU) to the top.

Due to the higher solar altitude, this feature appears only faintly on Lunar Orbiter frame IV-052-H2 (North to the top and West to the left), displaying a craterlet on its summit. We believe that this is an impact crater, due to its large depth implied by the shadow cast by its rim (Fig. 3). As a note of interest, the images from the Consolidated Lunar Atlas (i. e. plate F2), taken under higher solar altitude, do not show the dome that we are dealing with.

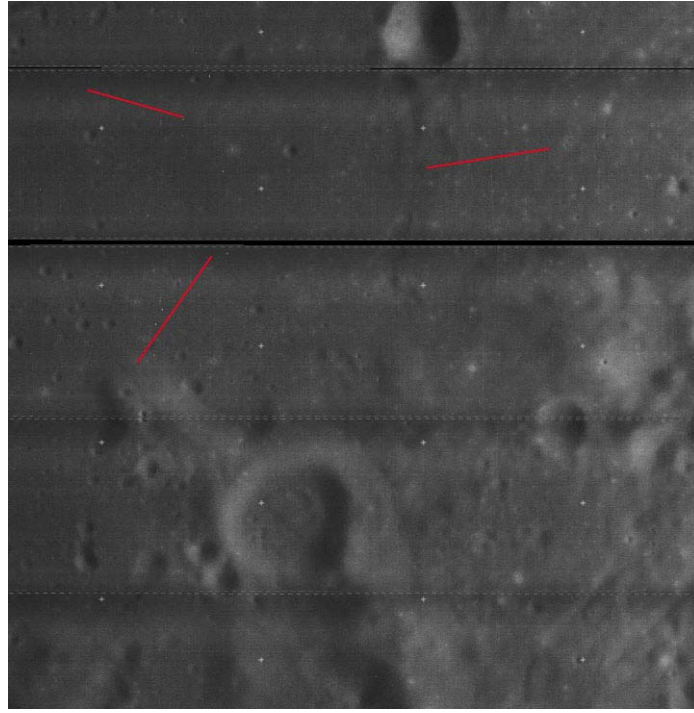


FIGURE 3 (See text for details)

The height values reported in Table 2 were obtained by determining elevation differences between the summit of the dome and its surrounding on the corresponding 3D profiles derived by photoclinometry and shape from shading analysis [5-7]. The height of dome 1 in the image shown in Fig. 1 was measured as (80 ± 10) m. Fig. 4 shows the 3D reconstruction results.

TABLE 2
Morphometric properties of features marked in Fig. 1

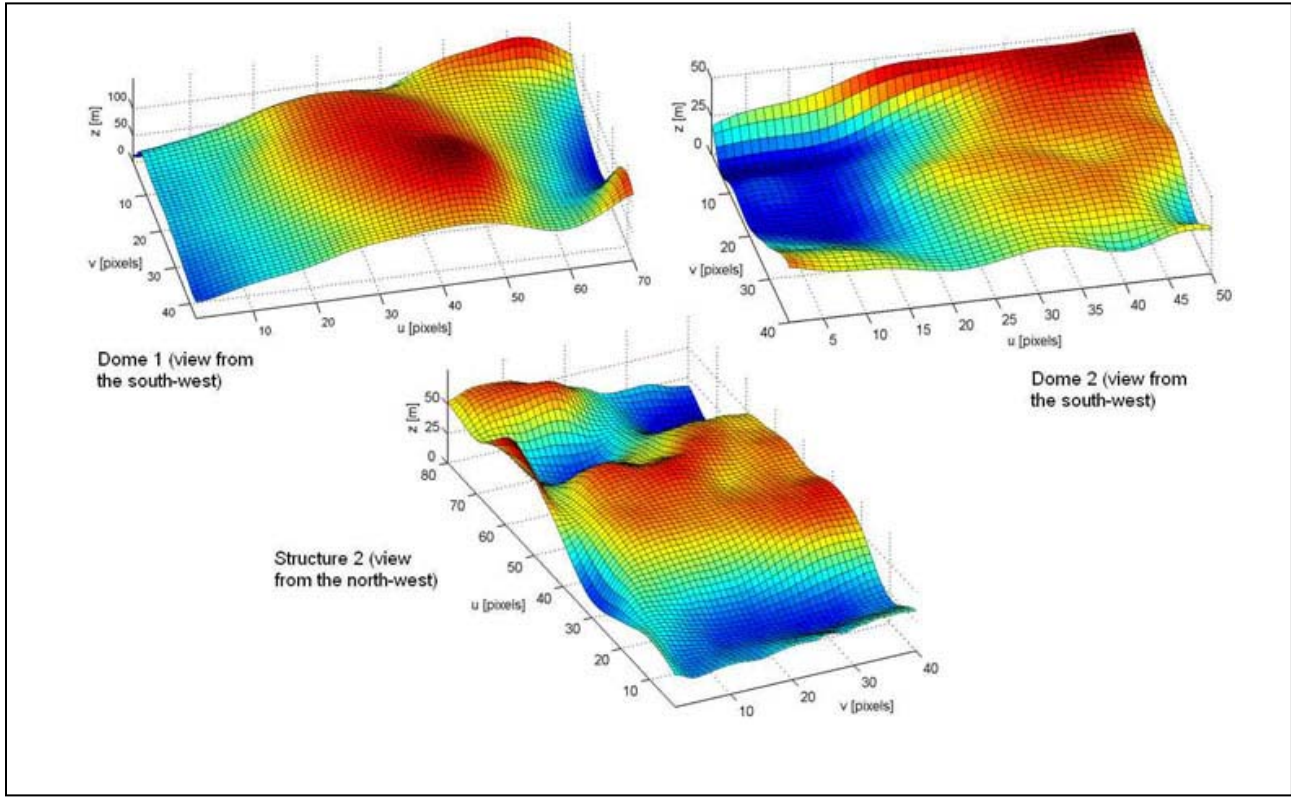
| Feature | Longitude | Latitude | Alt | Diameter (km) | Height (m) | Slope (°) | Westfall Classification |
|-------------|-----------|----------|-------|---------------|------------|-----------|-------------------------|
| Dome 1 | +57.83° | -15.74° | 2.24° | 16.8±0.60 | 80±10 | 0.55±0.07 | DW/2B/5G/0 |
| Dome 2 | +59.00° | -17.75° | 1.19° | 13.5±0.60 | 30±10 | 0.25±0.10 | DW/2B/5G/7J |
| Structure 2 | +57.50° | -17.65° | 2.62° | 20.0±0.60 | 40±10 | 0.25±0.06 | DW/2B/5G/0 |

From Table 2 it follows that the average slope angle is smaller than 2°, corresponding to a dome having a very gentle slope. This dome is presumably of class 2, according to the classification scheme for lunar mare domes introduced by Head and Gifford [4]. In Table 2 we categorize the present dome and other structures using the Westfall scheme [3].

Moreover, several other dome-like features are located to the SW of crater Vendelinus (see Fig. 1, structures labelled as 1-3). They could be very gentle intrusive swells, but a different origin cannot be excluded at this stage of our study. However, these structures are situated close to positions in the ALPO dome catalogue and likely represent the same domes or swells.

A possible further dome is indicated in Fig. 1 (dome 2 in Fig. 1 and Table 2). It lies at longitude +59.00° and latitude -17.75° ($X_i = 0.817$, $E_t = -0.305$). Our preliminary estimation indicates a height of (30 ± 10)

m and a thus a very gentle slope. A summit crater is visible, for which we estimated a diameter of (3.0 ± 0.6) km. For a similar, even more subtle feature (structure 2 in Fig. 1 and Table 2) we obtained a height of (40 ± 10) m.



Clearly these preliminary data can be improved by new specific observations. Any observations that readers can make about these unlisted domes will be gratefully received for our GLR survey (lana@glrgroup.org).

In the next issue of TLO we will describe another unlisted dome, recently detected during an our survey. It is located near crater Hortensius E at longitude -25.17° and latitude 6.07° . The activities of the GLR group are described at <http://www.glrgroup.org>

References

- [1] D. Wilhelms, The geologic history of the Moon, USGS Prof. Paper 1348, 1987
- [2] H. D. Jamieson, The Lunar Dome Survey – Fall, Strolling Astronomer, 1992 Progress Report, 37 (1), pp. 14-17, 1993.
- [3] J. Westfall, A Generic Classification of Lunar Domes, J.A.L.P.O., vol. 18, no. 1-2, pp. 15-20, 1964.
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- [5] B. K. P. Horn, Height and Gradient from Shading, MIT technical report, AI memo no. 1105A, 1989. <http://www.people.csail.mit.edu/people/bkph/AIM/AIM-1105A-TEX.pdf>
- [6] R. Lena, K.C. Pau, J. Phillips, C. Fattinanzi, C. Wöhler, Lunar domes: a generic classification of the dome near Valentine, located at 10.26° E and 31.89° N, JBAA, 2005, article in press.
- [7] A. S. McEwen, Photometric Functions for Photoclinometry and Other Applications, Icarus, vol. 92, pp. 298-311, 1991.

RECENT TOPOGRAPHICAL OBSERVATIONS

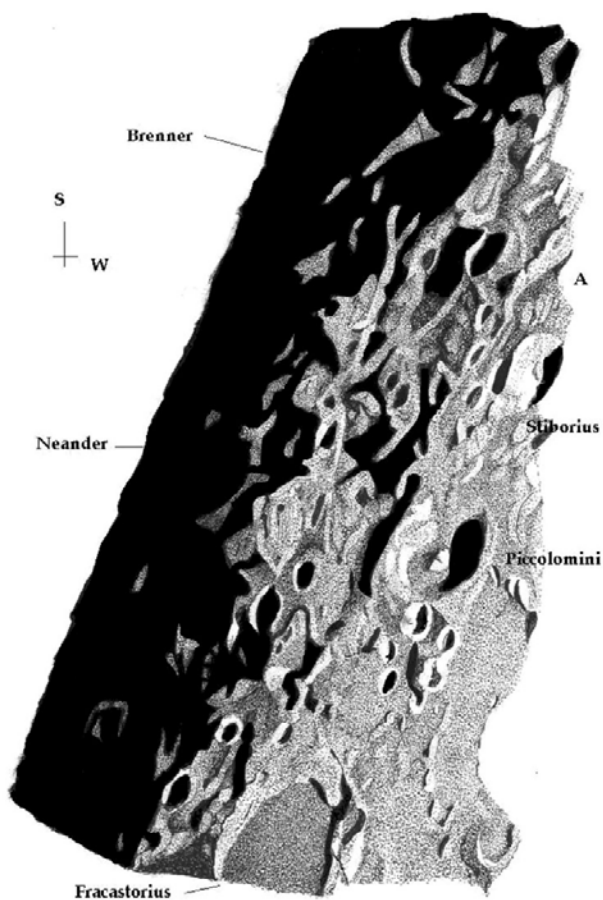


SCHICKARD, PHO CYLIDES, SCHILLER

Digital image by Giordano Achille - Naples, Italy

March 22, 2005 - 23:41 UT

125mm ETX w/2x Barlow



BRENNER TO FRACASTORIUS

Sketch by Colin Ebdon - Colchester, Essex, England

February 28, 2005 - 01:30 to 02:00 UT

7 inch f/15 Maksutov-Cassegrain - 225x

RECENT TOPOGRAPHICAL OBSERVATIONS

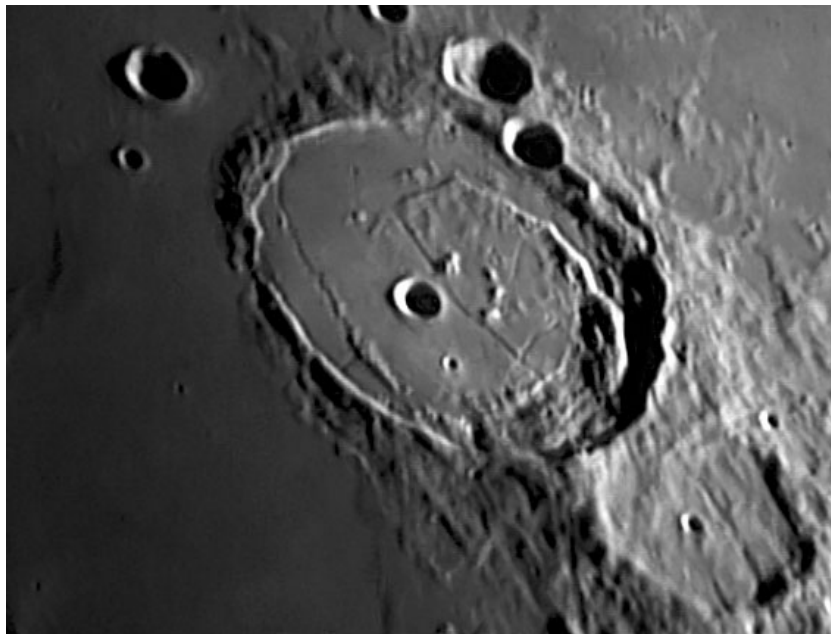


CLAVIUS

Digital image by Michael Boschat - Halifax, Nova Scotia, Canada

April 18, 2005 - 00:25 UT

120mm f/8.3 SkyWatcher Refractor - 3mp Centrios Camera



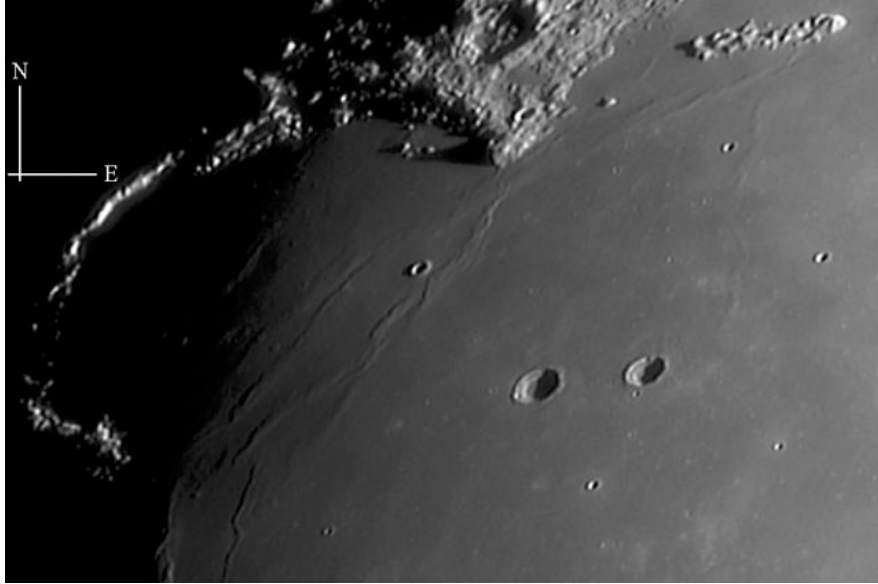
POSIDONIUS

Digital image by Daniele Botallo - Palermo, Italy

March 16, 2005 - 18:16 UT

250mm Maksutov-Gregory - Philips Toucam Pro

RECENT TOPOGRAPHICAL OBSERVATIONS



SINUS IRIDUM

Digital image by Albino Carbognani - Parma, Italy

March 20, 2005 - 19:36 UT

150mm f/8 OG - 2x Barlow - Philips Toucam



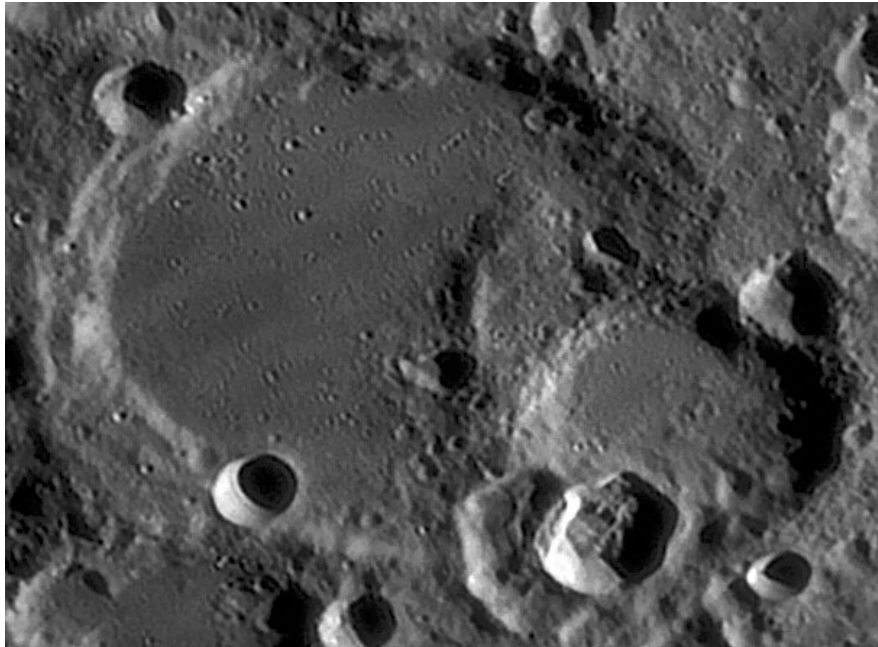
ARISTOTELES & ENVIRONS

Digital image by Ed Crandall - Winston-Salem, North Carolina, USA

April 17, 2005 - 01:51 UT

110mm f/6.5 APO Refractor - 3x Barlow - Philips Toucam

RECENT TOPOGRAPHICAL OBSERVATIONS

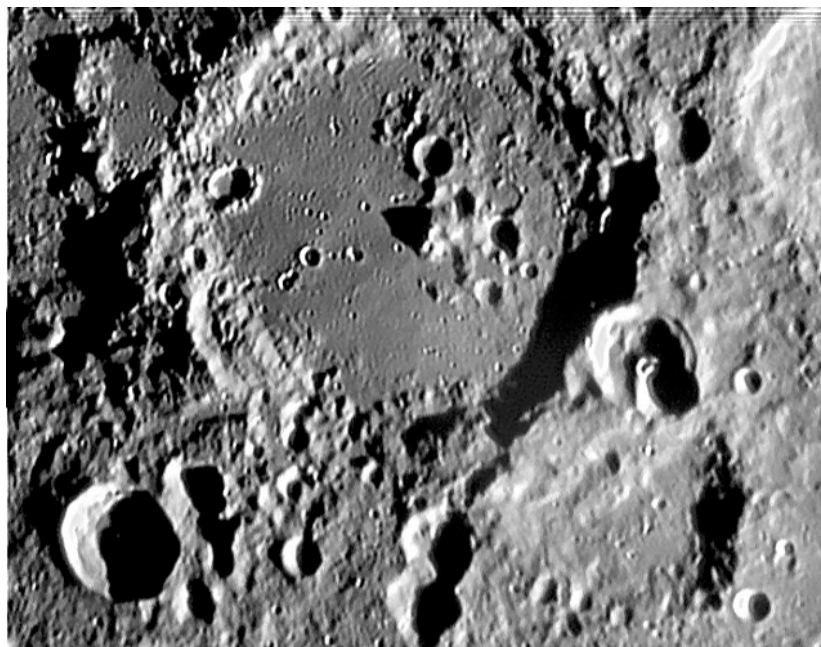


STOFER

Digital image by Paolo Lazzarotti - Ostellato, Italy

March 18, 2005 - 19:56 UT

250mm Planetary Newtonian - Lumenera LU075M Camera



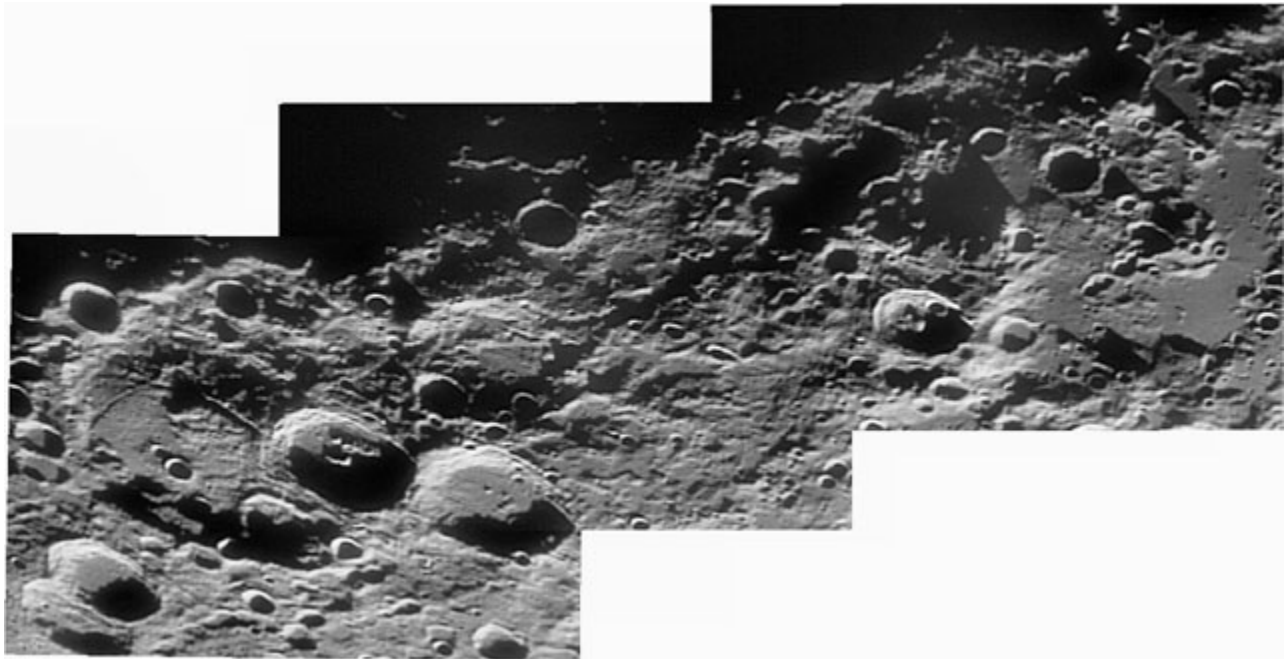
WALTER

Digital image by Georgio Mengoli - Italy

March 18, 2005 - 20:25 UT

Taakahashi M-210 - KC-381 Camera

RECENT TOPOGRAPHICAL OBSERVATIONS



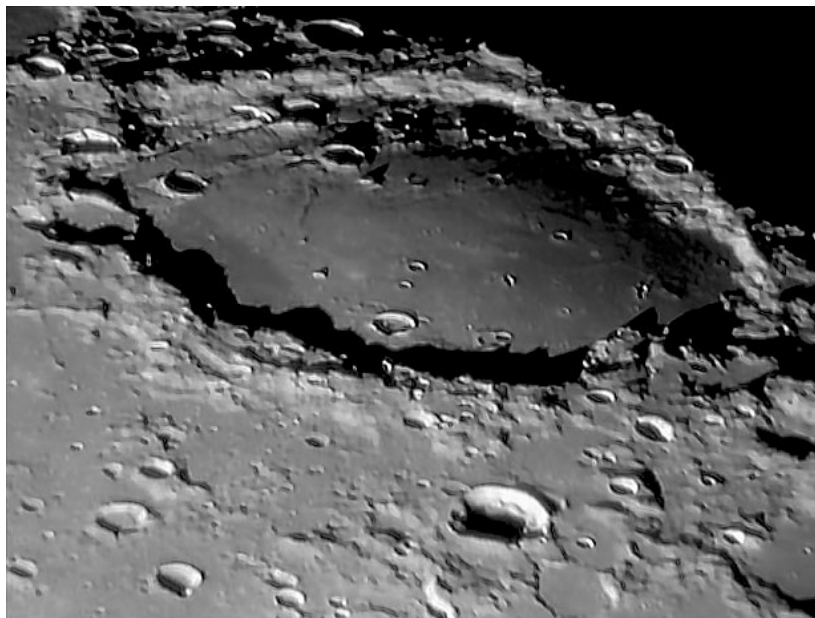
JANSSEN & ENVIRONS

Digital image (Mosaic) by Rafael Benavides Palencia

Posadas, Cordoba, Spain

April 13, 2005 - 19:53 UT

150mm f/8 Refractor - 3x Barlow - Philips Toucam Pro



SCHICKARD

Digital image by Carmelo Zannelli - Palermo, Italy

March 22, 2005 - 21:50 UT

235mm SCT - Webcam Vesta Pro

Observations submitted to the Topographical Studies Section should include the following:

Name and location of observer

Name of feature

Date and time (UT) of observation

Size and type of telescope used

Magnification (for sketches)

Medium employed (for photos and electronic images)

BRIGHT LUNAR RAYS PROJECT

Coordinator - William M. Dembowski, FRAS

Each month TLO features a book or magazine excerpt dealing with Bright Lunar Rays.

Some are from current sources, others from vintage astronomical literature.

This month's offering is from:

A FUNDAMENTAL SURVEY OF THE MOON **(McGraw-Hill Series in Undergraduate Astronomy)**

By Ralph B. Baldwin

McGraw-Hill Inc. – 1965 - (Various pages)

In 1964, Kopal made photographs of the Aristarchus region of the moon. Aristarchus is one of the most recent of the major craters; and the entire area, and particularly the rays from the crater, shows distinct effect of luminescence. This suggests that the excitation of light is most prominent when relatively fresh materials are exposed on the moon and that the effect dies out with increasing exposure age of the lunar rock.

* * * * *

In an earlier chapter, it was pointed out that many of the postmare craters show a halo of rays. Other craters which look to be quite similar do not show rays. The ratio between the number of ray craters and the remaining craters formed after the development of the lava flows is about 1 to 4. Only about 20 percent of the postmare craters show rays. This could mean that only about one impact in five is of such character to produce rays, but there are two observations which militate against this. No rays are found around any of the multitude of premare craters. This suggests that there is some process which makes the rays fade out with age and ultimately disappear. This reminds us of Syntinskaya's observation that the range of brightness and the range of colors on the moon are very small and also that an average of less than 10 percent of the sunlight striking the moon is reflected. The average brightness of the moon is approximately that of a lump of coal. It seems likely that there is a process that darkens not only the rays but all parts of the lunar surface. Astronomers today are inclined to suspect that the darkening mechanism is a sputtering process which occurs when streams of protons from the sun strike the moon.

RECENT RAY OBSERVATIONS

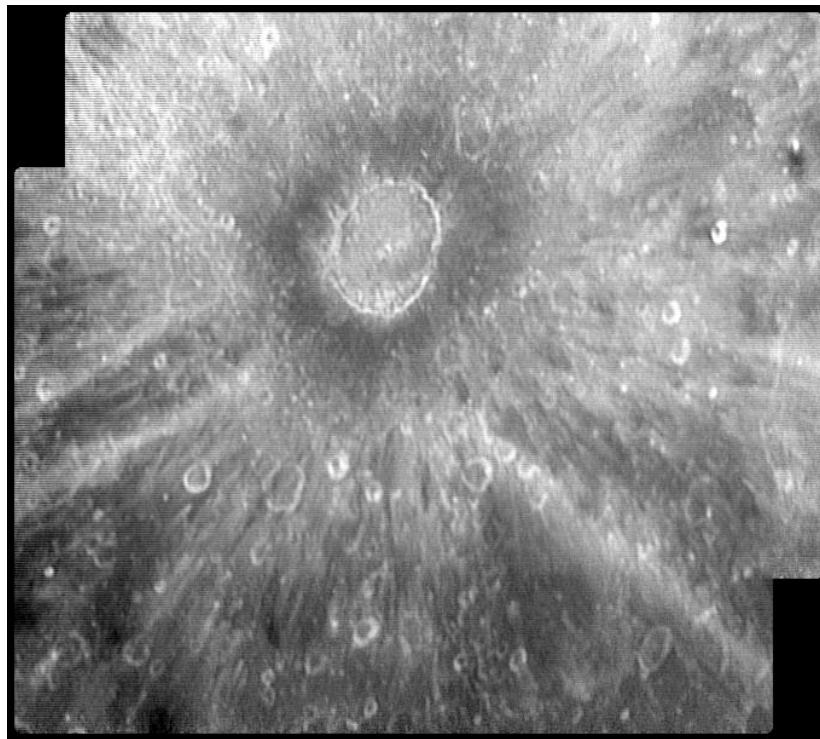


RAY NEAR BESSEL AND MENELAUS

Ray map by Yenal Ogmen - Lefkoniko, Cyprus

23 March, 2005 - 18:08 UT

Meade ETX-125 - 146x



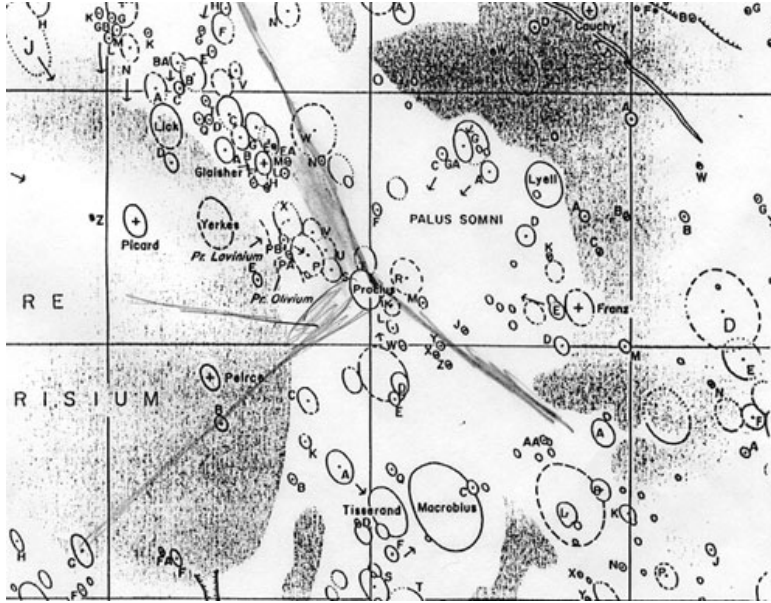
TYCHO

Digital image by Alexander Vandenbohede - Ghent, Belgium

25 March, 2005 - 22:30 UT

20cm f/15 Refractor with webcam at prime focus

RECENT RAY OBSERVATIONS

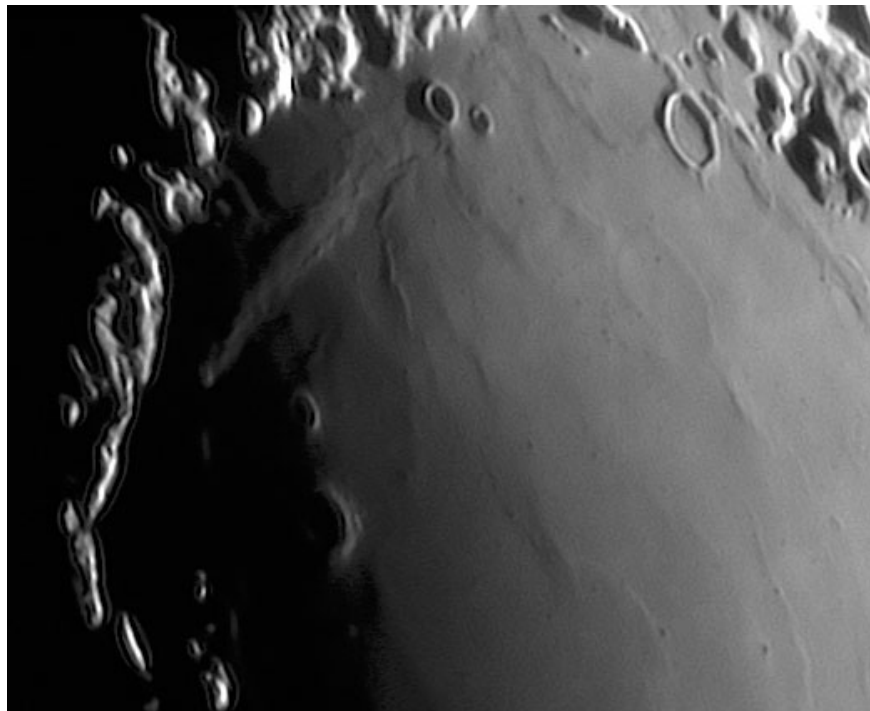


PRINCIPLE RAYS OF PROCLUS

Ray map by Michael Amato - West Haven, Connecticut, USA

February 24, 2005 - 00:40 UT

127mm Maksutov-Cassegrain - 123x



LOW RELIEF FEATURE MIMICING A RAY

Digital image by Gerardo Sbarufatti - Cassele Landi, Italy

13 March , 2005 - 18:20 UT

8 inch SCT w/2x Barlow - Red Filter

LUNAR TRANSIENT PHENOMENA

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LTP NEWSLETTER - MAY 2005

David O. Darling - Assistant Coordinator

Observations for the month of March have been received from Jay Albert, (USA), Michael Amato (USA), David O. Darling (USA), Gerald North (UK), Don Spain (USA),

Observers from two countries were represented by the observing network, they were the USA and United Kingdom. For this month nine days were covered giving us a 31% coverage for this lunation, these dates are 11, 13, 14, 15, 16, 17, 18, 21, 26.

During the observing period 52 lunar features were monitored this month. Those observed more than once are followed by the number of separate observations presented. Aristarchus = 2, Aristoteles, Aristillus, Atlas = 2, Albategnius, Alphonsus = 2, Alpine Valley, Arzachel = 2, Ariadacus Rill, Autolycus, Cape Agarum = 2, Catharina, Censorinus, Cobra Head, Copernicus, Cyrillus = 2, Catharina, Berosus, Earthshine = 3, Eudoxus, Eratosthenes, Endymion = 2, Fracastorius, Gassendi, Gauss, Grimaldi, Gutenberg, Hahn, Hercules, Hipparchus, Hyginus Rill, Langrenus, Mare Crisium, Mare Imbrium, Messier Twins, Maurolycus, Mons Piton, Petavius, Piccolomini, Plato = 2, Posidonius, Proclus = 4, Ptolemaeus = 2, Rheita, Rheita Vallis = 2, Rupes Altai, Sacrobosco, Schroteri, Vallis, Theophilus = 2, Torricelli B, Triesnecker, Tycho.

FLARES ON THE MOON

By

David O. Darling

Of the many different kinds of lunar transient phenomena events reported on the Moon, such as color events, glows, obscurations, and contrast effects, the most dramatic is the brilliant flashes seen on the Moon.

The most notable event took place on 15 November 1953, when Dr. Leon H. Stuart, using a 8" reflector, photographed a brilliant flash located near the Pallas region of the Moon. It was believed that he may have recorded an impact of a large meteor or small asteroid. When interest in this observation was renewed and a detailed examination of the evidence done, it was found that no impact crater could be located in the location where the flare took place. Some individuals, such as Winifred S. Cameron, believe that what was photographed was volcanic in origin and not an impact at all. This was the case for me as well with my encounters with this kind of phenomena only happening after observing many dozens of hours. The following is a listing of observations witnessed by other observers and myself.

21 April 1988 at 02:00 UT: Don Spain observed two tiny flashes in the earthshine region of the Moon. They lasted only a fraction of a second and were about magnitude 7. Both flashes were reddish in color and both occurred in the vicinity of the crater Aristarchus.

9 February 1989 at 00:15 UT: I observed three star like flashes near the Mare Humorum basin which was deep into the earthshine region of the Moon. The three flashes were twice as bright as the crater Aristarchus.

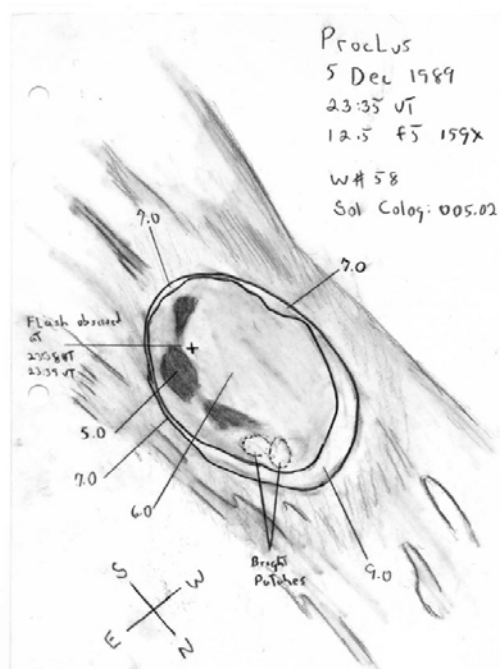


FIGURE 1 - Sketch by David O. Darling (See text)

5 December 1989 at 23:35 UT: I witnessed a brilliant flash inside the crater Proclus. It was extremely bright and lasted only for a moment. (See Figure 1.) My observing journal is filled with numerous accounts of individual flashes being seen. I have generally assumed that these events were caused by fluctuations in seeing and the flash consisting of a small crater too small to be seen until the seeing steadies for a moment. Or they were the cause of a small meteor impacting into the lunar surface. Generally these reports would only consist of sporadic events with there being only a single flash event.

1 March 1990 at 02:15 UT: Flash observed by Dr. Denny Fryback in the earthshine region located by the crater Pytheas.

3 May 1990 at 02:03 UT: I observed a flash inside the crater Alphonsus in region that was illuminated by direct sunlight.

28 May 1990 at 02:51- 02:56 - 03:04 UT: I saw three flashes in earthshine region that were very bright and lasted only for a moment.

The list presented is a short representation of what I found in several of my journals.

The following two reports describe flare activity that is beyond single reported events. The first was on December 30, 1982 total eclipse of the Moon. The totality was so dark that the Moon disappeared completely during its passage into the umbra. There were two of us observing; Mark Harris using a 6" f6 Newtonian and myself with a 12.5 f5 Newtonian. I saw the first 2 flashes. The flashes appeared about as bright as the stars around the Moon and lasted only a fraction of a second. My fellow observer, Mark Harris observed a total of 6 flashes and I saw the same amount. Never have I seen such a phenomena during a lunar eclipse before or since.

On October 14, 1989 my wife received a call at 12:45 A.M. my time from Peter Foley of the BAA TLP section. He reported that Aristarchus was reported to have bright points and the interior of the crater was exceptionally clear. I was at the hospital staying over night with my son at that time so I did not get to observe the Moon until that evening at 7:45 P.M. on 14 Oct or 00:45 to 01:59 on 15 October 1989 UT. When I began the observing session I noticed a bright glitter or points inside the crater. I saw the first flash when I was talking to Dave Weier on my cordless telephone. Upon hearing this he decided to come over to observe with me. He only lived 6 miles away so it would not take him very long to arrive. While I was waiting for Dave Weier to arrive I saw two flashes as bright as the central peak of Aristarchus, one was located between Herodotus and Aristarchus and the second one on the northeast of the crater rim.

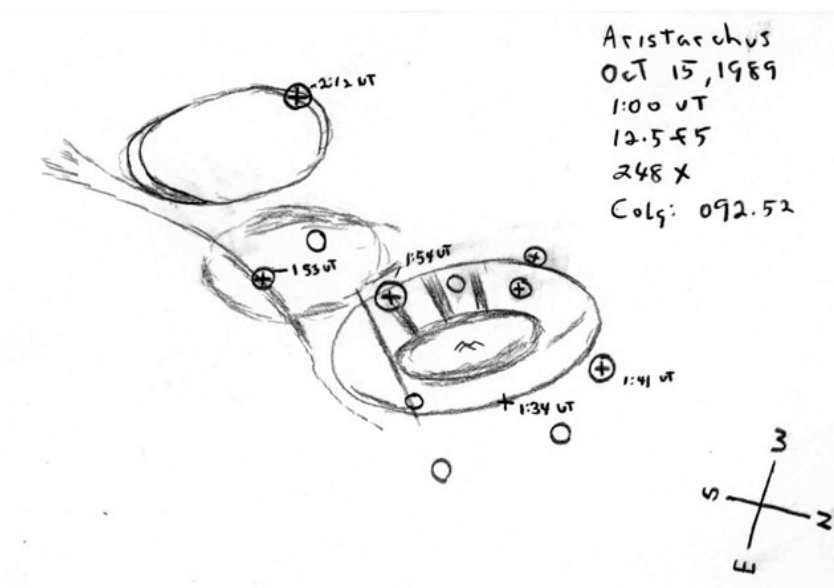


FIGURE 2 - Sketch by David O. Darling (See text)

I decided to do a drawing of the crater and region (See Figure 2.) so as to mark down the locations of the flares. While I was doing the drawing I saw another flash due south of Herodotus located on the cometary plume. While looking through the telescope again I saw two more flares. When Dave Weier had arrived and began observing he saw 3 flares during the next 40 minutes of observing

Between the two of us we saw 18 flares on and around the crater Aristarchus. I have documented the location of these events on the drawing enclosed with this story. The seeing that night was the best I have seen with the detail inside the crater. Both Dave Weier and myself agreed that the seeing was exceptional and the clarity of the interior of Aristarchus was the best we had ever witnessed. The Moon was at it closest approach or at perigee for the year.

It is unclear what this phenomena could be. It has been confirmed that some of the flares are only reflection off of solar panel of satellites. Some may be caused by tiny craters popping into view during moments of perfect seeing. Other flashes have been the results of possible meteor impacts. To date, with these reported impacts, no impact craters have been found.

Whatever the cause may have been though, the mystery deepens since no one can seem to find the smoking gun from these brilliant explosions. So whatever these flashes are, they continue to amaze the lucky observer whose view of the Moon is interrupted by one of these intruders.

MOON MISSIONS - PAST & PRESENT

SMART-1

SMART-1 Homepage: <http://smart.esa.int/science-e/www/area/index.cfm?fareaid=10>

SMART-1 Peaks of eternal light (again):
http://www.esa.int/SPECIALS/SMART-1/SEMLWGW797E_0.html

GENERAL

Search for the perfect location for Moon Base:
http://www.space.com/scienceastronomy/050413_moon_perfect.html

PAST MISSION

Album of classic photographs from the Apollo 11 Mission from liftoff to landing:
http://nssdc.gsfc.nasa.gov/planetary/lunar/apollo_11_30th.html

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