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# Journal of the Association of Lunar & Planetary Observers

## The Strolling Astronomer

Volume 47, Number 1, Winter 2005

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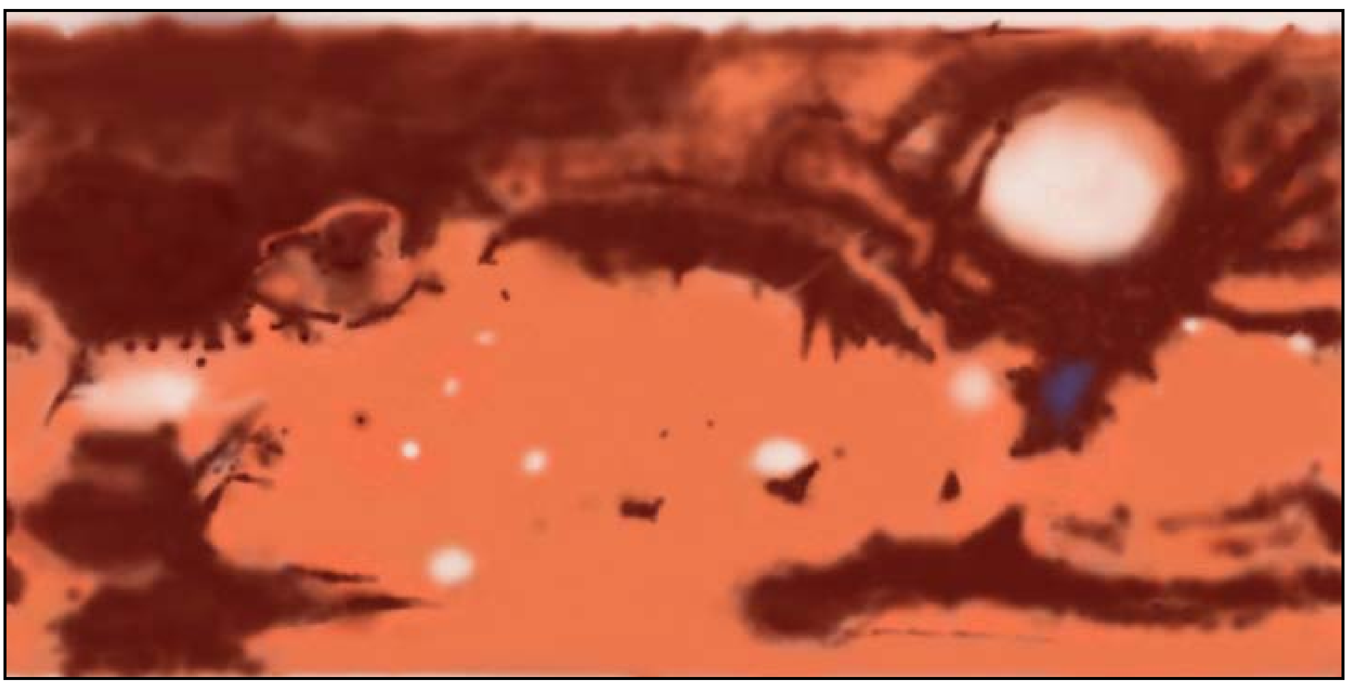
## Inside. . .

* A look back at last summer's ALPO conference (AstroCon 2004)
* Webcams — Are they for you?
* A Mercury apparition report
* Lots of stuff on the Moon -- the Stuart Flare and a Lunation Report
* A book review on the current exploration of Titan

. . . plus LOTS of reports about your ALPO section activities and much, much more.



Mars as seen from Earth in August 2003, as rendered by ALPO Mars Section Cordinator Dan Troiani. See page 13 for details.

# Journal of the Association of Lunar & Planetary Observers, The Strolling Astronomer

Volume 47, No. 1, Winter 2005
This issue published in December 2004 for distribution in both portable document format (pdf) and also hard-copy format.

This publication is the official journal of the Association of Lunar & Planetary Observers (ALPO).

The purpose of this journal is to share observation reports, opinions, and other news from ALPO members with other members and the professional astronomical community.



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http://www.lpl.arizona.edu/alpo

## *In This Issue:*

## Inside the ALPO



## Feature Stories



## ALPO Resources

## *Inside the ALPO*
# *Member, section and activity news*

## Association of Lunar and Planetary Observers (ALPO)

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(See full listing in *ALPO Resources* at end of issue)
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**Youth Section:** Timothy J. Robertson
**Historical Section:** Richard Baum
**Instruments Section**: R.B. Minton
**Eclipse Section**: Michael D. Reynolds
**Webmaster:** Richard Hill

## *Point of View*
# *Astro-Gifts & Me*

By Ken Poshedly, editor & publisher, *The Strolling Astronomer*

Happy New Year everybody! And to those of you not worried about political-correctness, I hope you had a Merry Christmas, too!

And with the gift-giving season now behind us, it's time to put any astronomical goodies we might have received to good use.

As for myself, Santa was pretty generous by furnishing me with a laptop computer to go with the Meade LPI webcam I purchased for myself at the Peach State Star Gaze this past October.

Now I feel almost intimidated in having to learn to produce images like those done routinely by folks like our ALPO's own Don Parker, Frank Melillo, Ed Grafton and many others. I've taken a few shots of the Moon and am satisfied that with a little more time and better polar alignment, things will be much better.

When I can do that, THEN I'll feel like a real contributor to our fine organization. Doing this journal is my hobby and I'm glad to do it. But I can honestly say that I also long to see my own images included in the gallery with others in Jupiter apparition reports.

So what say you? What did Santy bring you? Let me know what and how you're doing with it and we'll carry a feature in these pages.

Surely I'm not the only geek in town.

The Astronomical League is proud to announce the 2005 annual convention to be held in Kansas City, August 12-13, 2005.

The League's **Council meeting** will be held August 11 at the National Office, our first council meeting at the facility. There will also be an astronomical trade show and vendor exposition, a **Star-B-Q** at **Powell Observatory**, and a private exhibition at the **Linda Hall Library** where you can hold a Galileo first edition and read Herschel's journal. Our goal will be to increase participation by astronomers and companies and to make this the best trade show we've ever hosted. The meetings, annual awards banquet, trade show, and speakers will all be held at the Overland Park, Kansas, **Sheraton Hotel and Convention Center**. For information about the hotel, call 913-234-2100, or toll free 866-837-4214. Be sure to mention the Astronomical League for a discount rate. For additional information, contact Mr. Carroll Iorg, 7241 Jarboe Street, Kansas City, MO 64114. Phone 816-444-4878 or e-mail Carroll at: Carroll-Iorg@kc.rr.com.

## Inside the ALPO
# Member, section and activity news (continued)

## News of General Interest

### Astronomical League 2005 Annual Convention Set for Aug 12-13 in Kansas City

The Astronomical League is proud to announce a convention and trade show to be held in Kansas City, next year. The League's Council meeting will be held August 11 at the National Office. This will be our first-ever council meeting at our newly opened national office.

The meetings, annual awards banquet, trade show, and speakers will all be held at the Overland Park, Kansas Sheraton Hotel and Convention Center. For information about the hotel call, 913-234-2100. Be sure to mention the Astronomical League for a discount rate and call toll free at 866-837-4214.

For additional information, contact Mr. Carroll Iorg, 7241 Jarboe Street, Kansas City, MO 64114. Phone 816-444-4878, e-mail is CarrollIorg@kc.rr.com

### ALPO Membership Online

The ALPO now accepts membership payment by credit card via a special arrangement with the Astronomical League. However, in order to renew by this method you MUST have Internet access. See the inside back cover of this Journal for details.

### ALPO E-Mail List Updated

Be sure to consult the list of e-mail addresses in the ALPO Resources section of this Journal before contacting any of the staff or board members.

### Reminder: Address changes

Unlike regular mail, electronic mail is not forwarded when you change e-mail addresses unless you make special arrangements.

More and more, e-mail notifications to members are bounced back because we are not notified of address changes. Efforts to locate errant members via online search tools have not been successful.

So once again, if you move or change Internet Service Providers and are assigned a new e-mail address, please notify Matt Will at will008@attglobal.net as soon as possible.

### Our Advertisers: Good Friends of the ALPO

Just as they support us, we ask you to please support those who advertise in *The Strolling Astronomer.*

Sky Publishing has been with a fixture in the Journal for many years and is recognized as an authoritative source for information for the serious amateur astronomy community. And besides its most obvious product – *Sky & Telescope* magazine – Sky Publishing also produces a number of other itrems to satisfy your craving for astro-stuff.

Accurate Graphics, the company that produces the hard copy of each Journal, has gone out of its way many, many times to satisfy our needs as a nonprofit organization striving to publish a professional quality journal at an affordable rate. Please consider using Accurate Graphics for your printing needs, whether you are local to metro Atlanta or not.

## Inside the ALPO
# Member, section and activity news (continued)

## ALPO Interest Section Reports

### Computing Section
**By Kim Hay, coordinator**

*December 1* – With winter now here, that might mean some clear nights for observing. With the holiday season also here, I would like to wish everyone at ALPO a very Safe and Happy Holiday season, and all the best for 2005.

The ALPO Computing Section is dedicated to providing comprehensive computational support to the Association of Lunar & Planetary Observers.

The Computing Section has been lonely without your imput. Programmers, please send in your programs that pertain to any aspect of astronomy, and we would gladly put them online for all to share.

The ALPOCS listserv, which is located at http://groups.yahoo.com/group/alpocs/ is available to all ALPO members. It was established in 1999. Currently we have 146 members on the list, down slightly since our last report.

Our files are located on the group page as well.

If you wish to subscribe, please send a message to alpocs-subscribe@yahoogroups.com.

So on those cloudy nights when there might not be anything left to do, why not come on in and look around – you might be intrigued to put finger to keyboard and ideas to screen, and come up with a program to share with others.

If you have ideas on what you would like to see this section do or have included, please let us know. You can contact me at kimhay@kingston.net privately, or post to the ALPOCS list.

Visit the ALPO Computing Section on the World Wide Web at http://www.lpl.arizona.edu/~rhill/alpo/computer.html

### Instruments Section
**By R.B. Minton, coordinator**

*December 10* – This is a blanket announcement that I now have Yahoo email (r_b_minton@yahoo.com) and a web site: http://mypeoplepc.com/members/patminton/astrometric_observatory/ currently at 15 pages. I invite all to check it out and respond.

And I repeat my plea from the last issue of this Journal. ***Wanted***: Anyone who is using an observatory and would like to submit at least 2 pages of text and 4 photographs of their observatory for publication in the JALPO Instruments section report. Please send this material to me, R. B. Minton, and I will help with any editing and other details.

Visit the ALPO Instruments Section on the World Wide Web at http://www.lpl.arizona.edu/~rhill/alpo/inst.html

Digital photo of the Moon, Jupiter (directly below Moon) and Venus (just above tree at lower left) by ALPO Instruments Section Assistant Coordinator Dick Wessling the morning of November 9, 2004 approximately 6:15AM EST (11:15 UT) near his home in southwest Ohio. 5-second exposure made with a Nikon 995 Coolpix camera. Some enhancement using Adobe Photoshop software.

## Inside the ALPO
# Member, section and activity news (continued)

### Lunar & Planetary Training Program

**By Tim Robertson, coordinator**

*December 1* – The ALPO Training Program currently has 7 active students at various stages of training. The ALPO Training Program is a two-step program, and there is no time requirement for completing the steps. But I have seen that those students who are motivated usually complete the steps in less than 12 months. Their motivation comes from the desire to improve their observing skills and contribute to the pages of the Journal of the ALPO.

The Lunar & Planetary Training Program is open to all members of the ALPO, beginner as well as the expert observer. The goal is to help make members proficient observers. The ALPO revolves around the submission of astronomical observations of members for the purposes of scientific research. Therefore, it is the responsibility of our organization to guide prospective contributors toward a productive and meaningful scientific observation.

The course of instruction for the Training Program is two tiered. The first tier is known as the "Basic Level" and includes reading the ALPO's Novice Observers Handbook and mastering the fundamentals of observing. These fundamentals include performing simple calculations and understanding observing techniques. When the student has successfully demonstrated these skills, he or she can advance to the "Novice Level" for further training where one can specialize in one or more areas of study. This includes obtaining and reading handbooks for specific lunar and planetary subjects.

The novice then continues to learn and refine his or her own observing techniques specific to his or her area of study and is assigned to a tutor to monitor the novice's progress. When the novice has mastered this final phase of the program, he or she can then be certified to "Observer Status" for that particular field.

For information on the ALPO Lunar & Planetary Training Program on the World Wide Web, go to http://www.cometman.net/alpo/; regular mail to Tim Robertson at 2010 Hillgate Way #L, Simi Valley CA, 93065; e-mail to cometman@cometman.net

## ALPO Observing Section Reports

### Eclipse Section

**By Mike Reynolds, coordinator**

Please note that my e-mail address has changed; drmike@astrospace.net

Visit the ALPO Eclipse Section on the World Wide Web at http://www.lpl.arizona.edu/~rhill/alpo/eclipse.html

### Meteors Section

**By Robert Lunsford, coordinator**

*December 2* – Robin Gray, ALPO Meteors Section assistant coordinator, and I met in central California

Composite of three images of the total lunar eclipse, October 27-28, 2004, by Brad Timerson, ALPO Solar Section assistant coordinator. All images taken with an Olympus C-740 digital camera using the afocal method through an Orion 5" AstroView refractor; north is at top. Source: http://www.fingerlakessynthetics.com/astronomy.html

## Inside the ALPO
# Member, section and activity news (continued)

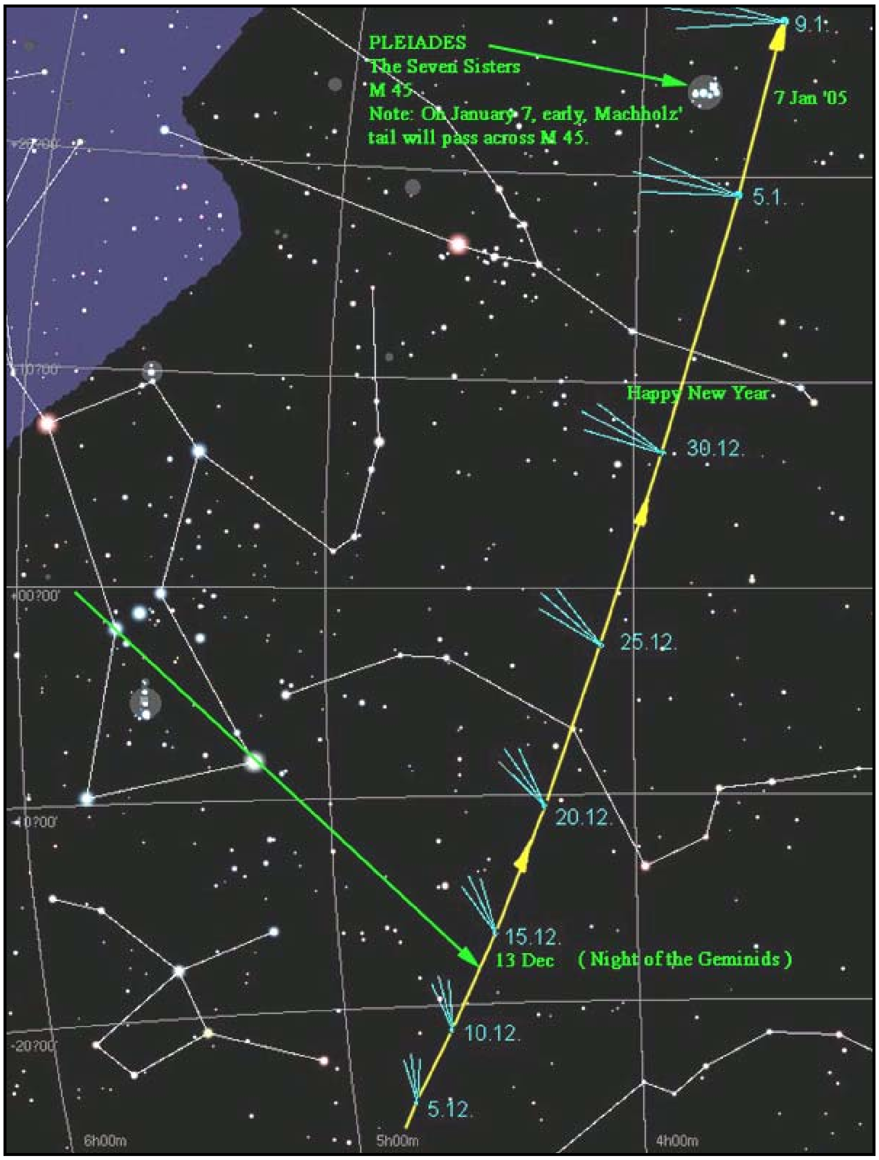
during mid-October and carried out a successful Orionid expedition. Despite cloudy weather during the days, the nights were clear, threby allowing us to observe the Orionids at maximum plus the lesser activity of several other showers.

During 16.28 hours of observing, I managed to record a total of 432 meteors, 251 of them belonging to the Orionid shower. My highest hourly Orionid count was 31, compared to the quoted zenith hourly rate of 23 by the International Meteor Organization.

This goes to show that exceptionally dark skies will enhance the capabilities of any meteor shower.

It was unfortunate that no other ALPO members were able to accompany us and share in this memorable experience. Robin and I plan to lead another expedition into the Mojave Desert in January 2006, to view the Quadrantid meteor shower. Hopefully, some other ALPO member will be able to join us then.

Visit the ALPO Meteors Section on the World Wide Web at http://www.lpl.arizona.edu/~rhill/alpo/meteor.html




Locating Comet Machholz 2004/Q2.
Source: http://www.stav.at/tipp_machholz.0.html (Courtesy Clevis Jones, Covington, Georgia)

## Comets Section

**By Ted Stryk, coordinator**

*December 13* – The ALPO Comets Section is currently undergoing a rebuilding phase. I look forward to hearing from anyone interested in participating in the section. I will begin to post images received on my website, http://pages.preferred.com/~tedstryk/ I will be posting comets of interest as they come so that observers know where the section is concentrating.

Currently (December 2004), the section is focused on Comet Machholz.

The aims of the section are twofold. One objective is to monitor selected bright comets to provide frequent coverage of activity throughout an apparition.

Secondly, we seek to provide observations of other, fainter comets in order to monitor them for unexpected activity and continue to build the archive. This will also provide a baseline should there be any unexpected activity.

## Inside the ALPO
# Member, section and activity news (continued)

I am very open to suggestions, and look forward to hearing from interested observers.  A big thank you to those I have heard from already.

Visit the ALPO Comets Section on the World Wide Web at http://www.lpl.arizona.edu/~rhill/alpo/meteor.html

### Solar Section

**By Rick Gossett, acting coordinator**

*November 16* – Observations are continuing to come in at a steady pace. Although the Sun is headed toward solar minimum, activity has been high recently. As of this writing (11/07/04), Active Region 0696 is visible without optical aid. Recently submitted observations may be viewed on the web at http://www.lpl.arizona.edu/~rhill/alpo/solstuff/recobs.html

The Solar Section handbook is progressing nicely. The ALPO's best observers are working together to create a new handbook for the section's observers. Jamey Jenkins is doing an extraordinary job of managing the project.

I would suggest that every member of the ALPO join the Solar Section's e-mail list. It's a great way of keeping abreast of what's happening on the Sun and what other solar observers are up to. Anyone may join the list by visiting the Solar group at
http://groups.yahoo.com/group/Solar-ALPO/

Submit all observations to rick2d2@sbcglobal.net

Visit the ALPO Solar Section on the World Wide Web at http://www.lpl.arizona.edu/~rhill/alpo/solar.html

### Mercury Section

**By Frank J. Melillo, coordinator**

*November 24* – We have some new members imaging Mercury with webcams with pretty favorable results. Now, more observers are using webcams instead of the CCD.  This provides a golden opportunity for beginners to try out imaging Mercury with ease for the first time. But the resolution still may be equivalent or close to the resolution of a CCD.

(Editor's Note: See R.B. Minton's fine article on webcam imaging later in this isue.)

Also, there is a fine article, "Mercury in the Morning", authored by myself and published in the September 2004 issue of *Sky & Telescope* magazine. This is to show that the ALPO members are observing this tiny planet more successfully than ever before. Hopefully, this will inspire more readers to observe Mercury.

With the article in S&T September 2004 issue, Mercury was very well observed during a favorable morning apparition. When Mercury was at the meridian during the daylight observation, I was surprised to see it even through a 6x30mm finderscope! Of course the sky was crystal blue and the planet's magnitude was –0.8. Mercury displayed a slightly gibbous phase with some dark features just south of the equator. Nearly all observations showed dark markings which were Solitudo Martis and Jovis (CM 90~110 degrees longitude) in the south. These two features are very well seen at this phase angle and were also observed quite often in 2003.

We look forward for the next morning apparition in late December and early January 2005 when Mercury will still be in a favorable position for most of us. But, with one exception, Mercury and Venus will be near each other most of the time.

Here is a great way to find Mercury during the daylight hours near the local meridian. Simply use your scope to first spot Venus and then swing to the position of Mercury. On December 28th, Mercury will lie 1 ¼ degrees north of Venus and 22 degrees west of the Sun. Mercury will stay just west of Venus for the next two weeks! Then, on January 13, Mercury will slide back to within 19 minutes of arc south of Venus! Both should be visible easily in a low-power field! They will be within a reasonable distance of 18 degrees west of the Sun. After that, Mercury will reach superior conjunction with the Sun on February 14, 2005.

Visit the ALPO Mercury Section on the World Wide Web at http://www.lpl.arizona.edu/~rhill/alpo/merc.html

### Venus Section

**By Julius Benton, coordinator**

*November 22* – Analysis of the observations and images from 2003-2004 Eastern (Evening) Apparition is well underway and will appear in this Journal at a later date. As of this writing, the 2004-2005 Western (Morning) apparition of Venus is quickly winding down and Venus appears lower and lower in the East before sunrise.

## *Inside the ALPO*
# *Member, section and activity news* *(continued)*

Venus passed greatest brilliancy on 2004 July 15 (visual magnitude -4.5) and reached Greatest Elongation West on 2004 August 17 (46°). Note that Venus is proceeding through waxing phases during any western apparition, yet diminishing in angular diameter (a progression from crescent through gibbous phases). We are seeing Venus' trailing hemisphere during western apparitions and observing the dawn side of the planet at the time of terrestrial dawn. Observations and images have continued to flow in from observers worldwide.

Venus will reach Superior Conjunction with the Sun on 2005 March 31, so there is ample opportunity for observers to follow the planet prior to that time. At times of western (morning) apparitions, it is possible to wait until the planet gains altitude and the background sky brightens considerably, and Venus can readily be followed into daylight. It is perfectly desirable to observe Venus during daylight hours when most of the prevailing glare associated with the planet is gone or reduced; but observing Venus too far into the daylight hours can become a problem, as solar heating produces turbulent air and resulting poor seeing.

While it may seem difficult to look for Venus in daylight, it should be recalled that the planet is comparatively bright, and in practice, the observer can usually find Venus if knowledge of exactly where to look is obtained before the observing session. It is worth mentioning that observers find that the presence of a slight haze or high cloud often stabilizes and reduces glare conditions while improving definition.

Observers are encouraged to submit regular CCD and webcam images, as well as carefully executed drawings, made at roughly the same time and on the same date (simultaneous observations). A greater level of confidence in our results increases as observers make an effort to do simultaneous observations, and the ALPO Venus Section is stressing combined visual observations and CCD imaging for comparative analysis of resultant data. There is also a definite need for continued ultraviolet imaging of Venus simultaneously with visual observations; for example, some observers apparently have a slight visual sensitivity in the near UV range, whereby they report radial dusky features that are so readily apparent on UV photographs and images.

ALPO studies of the Ashen Light, which peaked during the Pioneer Venus Orbiter Project, are still continuing every apparition. Constant monitoring of the planet for the presence of this phenomenon by a large number of observers (ideally participating in a simultaneous observing program) remains important as a means of improving our chances of capturing confirmed dark hemisphere events. Imaging with CCDs and webcams to attempt to capture the faint glow on the dark hemisphere at crescentic phases is an important endeavor that must continue.

It is the ultimate goal of the ALPO Venus Section to attempt to assemble a completely homogeneous mass of accurate, reliable observational data collected over many apparitions, permitting an exhaustive statistical analysis. It is hoped that we might derive enough from painstaking observations and analysis to help provide some answers to questions that continue to perplex us about Venus.

Observations of the atmosphere of Venus are organized into the following routine programs:

- Visual observation and categorization of atmospheric details in dark, twilight, and daylight skies.
- Drawings of atmospheric phenomena.
- Observation of cusps, cusp-caps, and cusp-bands, including defining the morphology and degree of extension of cusps.
- Observation of dark hemisphere phenomena, including monitoring visibility of the Ashen Light.
- Observation of terminator geometry (monitoring any irregularities).
- Studies of Schröter's phase phenomenon.
- Visual photometry and colorimetry of atmospheric features and phenomena.
- Routine photography (including UV photography), CCD imaging, photoelectric photometry, and videography of Venus.

The ALPO Venus Section invites interested readers worldwide to join us in our projects and challenges ahead.

Complete details can be found about all of our observing programs in the ALPO Venus Handbook. Individuals interested in participating in the programs of the ALPO Venus Section are cordially invited to visit the ALPO Venus Section on the World Wide Web at http://www.lpl.arizona.edu/~rhill/alpo/venus.html

## Inside the ALPO
# Member, section and activity news *(continued)*

### Lunar Section:
#### *Lunar Meteoritic Impact Search*
**By Brian Cudnik, coordinator**

*November 30* – The past year has seen several attempts at observing lunar meteoritic phenomena during annual meteor showers. These opportunities were communicated regularly to the e-group lunar-impact and through the Lunar Meteoritic Impact Search web page.

Annual showers for which the Moon was favorably placed and for which observations were attempted, include the Lyrids in April, the June Bootids, the South Delta Aquarids in July, the Perseids in August, the Orionids in October, and the Leonids in November. Two sets of multiple-event candidates (apparently not related to any of these showers) have been reported, but nothing conclusive as of this writing. However, a team in Japan reported multiple observations of a single, likely Perseid impact event, meeting the criteria of confirmation, and making this the first confirmed non-Leonid lunar meteoric impact event. Another individual reports at least two candidate Leonid impact events captured on videotape, but these are awaiting verification as of this writing.

Jupiter emerging from behind the Moon as imaged by Becky Ramatowski of Tijeras, New Mexico. “It was 26 degrees when I took this, and the wind was blowing just enough to make hand holding the camera a chore," she said. "The visual experience was warming, though!" Source http://space.com. Photo by Becky Ramatowski.

The program was simplified in late May, as the following excerpt from the online *Impact Alert Newsnote* from 29 May outlines. This was due to a lack of reports during non-shower periods when the Moon is favorably placed to receive sporadic impacts as seen from Earth. The excerpt is written as follows:

A number of ideas came to mind this evening as I considered the direction of the Section after some 4.4 years as Coordinator. These ideas amount to streamlining the operation, making it more simple, straightforward and (hopefully) successful. Based on my experience as Coordinator and the many experiences of having collected observations of the Moon during a number of meteor events, and this coupled with four attempts (all unsuccessful) at procuring funding from NASA and the National Science Foundation (the experience here comes from helping to assemble and then refine the setup of a network of well-equipped observers), I have decided to make the following refinements.

(1) The 3-C approach to lunar meteoritic impact observing.

Confirm, Count, and Characterize. Nothing more. I have had ambitions to do much for the study of lunar meteoritic phenomena, but due to my busy personal schedule, it was like trying to do many things half as well. I have decided to be more focused and instead try to do one thing very well. The whole of the section will boil down to these three steps to catalog lunar meteoritic events.

With the extensive, dedicated efforts of Anthony Cook and others in the “Earthshine Watch”, it is determined at this time that the monthly watch will not be pursued any further in an organized sense. We just don't have the resources to do such an ambitious project at this point in the history of this Section, and as the very-much appreciated efforts of Dr. Cook have shown, the yield is extremely low. The equipping by NASA would have provided the resources, but at this point, we do not have the key numbers of personnel, coupled with the wide availability of detection software, to take on this task to the extent it should be taken. I will, however, continue to post prime dates for anyone who wishes to observe during the “Earthshine period”, and as always, any and all observations — video and visual — are very welcome.

# Inside the ALPO
# Member, section and activity news (continued)

(2) Annual only, and the 3-10's criteria for lunar meteor observing

I have decided to adopt the following (recommended) parameters for lunar meteoritic observing.

- We will do annual showers only, and only when the Earth-Moon geometry is favorable.
- We will observe when three parameters exceed 10: Local elevation of the Moon 10 degrees or greater, Earth-based ZHR 10 or more, and the percent of impacts on unlit near side 10 or greater. These parameters maximize the chances for success. Typically, this amounts to about a half-dozen or so chances per year which is the right amount, considering the time it takes to observe, record, and later review the recording. In this sense, we will become more like the ALPO Eclipse Section, but events will be a bit more frequent in most years.
- Also, when in doubt, report it anyway! Surely we will likely be building up a catalog of cosmic ray hits and retinal flashes, but there could very well be faint impact flashes in there as well. If your confidence is at least 10%, (another 10-parameter), report it anyway, but note the low confidence for the record. And for you visual observers, it is recommended that you follow a 10-3 rule (named after the first two approaches described above) — that is, for every 10 minutes staring thru the eyepiece, rest for 3 minutes, so that you are in optimal condition to monitor for impact flashes. Be sure to carefully record when you take your breaks (including sketching the position of an impact candidate). Remember also that the tape-recorder-shortwave radio is the best way to record your observing sessions (that I am aware of, anyway).

[End of Excerpt]

The rough draft of the observing manual, *An Observer's Guide to Lunar Meteoritic Phenomena*, has been completed and is currently under extensive revision. It is hoped that this revised version will be complete very, very soon, after which a final revision will be made to prepare it for submission to a publisher. I hope to have the manual publicly available by mid-2005 or sooner.

Visit the ALPO Lunar Meteoritic Impact Search site on the World Wide Web at http://www.lpl.arizona.edu/~rhill/alpo/lunarstuff/lunimpacts.html

## Lunar Topographical Studies

**William M. Dembowski, FRAS**
**acting section coordinator**

*November 16* – Since the last quarterly report, participants in the Lunar Topographical Studies Section battled their seasonal nemesis, that is, the low riding Moon. During the summer months, while the Sun rides high in the sky, the Moon takes the low road on the nights preceding Full. This makes for difficult viewing but those who persisted submitted some excellent observations. Of particular interest this quarter were the lunar rilles with some fine images and sketches being made. The range of targets ran

Digital image of Rima Hyginus by K.C. Pau, Hong Kong, China, taken September 4, 2004, 21:45 UT. Colongitude 156.1°, North at top, taken with 250mm f/6 Newtonian w/5x Barlow and Philips Toucam Pro (121 frames stacked).

## Inside the ALPO
# Member, section and activity news (continued)

from the classic Triesnecker and Ariadaeus systems to the elusive rille that traverses the floor of the Alpine Valley. (See K.C. Pau's remarkable image of Rima Hyginus below.)

The Bright Lunar Rays Program continues to generate interest and participation with 48 new observations and a dozen more, older images, gleaned from the personal files of team members. To see an online reprint of the most recent report on the Project go to: http://www.zone-vx.com/RaysReport_2004.pdf

As always, selected contributions to the section are featured in the Lunar Section's newsletter, *The Lunar Observer*, which has been averaging 12-16 pages per month and can be found at http://www.zone-vx.com/tlo.pdf  In addition, discussions of the Moon are always welcomed at the Lunar Section e-mail discussion group at http://groups.yahoo.com/group/Moon-ALPO/

For information on how you can participate in the study of the topography of Earth's only natural satellite, contact William Dembowski at Dembowski@adelphia.net

Visit the ALPO Lunar Topographical Studies Section on the World Wide Web at http://www.zone-vx.com/alpo_topo.htm

### *Lunar Dome Survey*
**Marvin Huddleston, FRAS**
**coordinator**

*December 8* – The ALPO Lunar Dome Survey has had a total of 10 participants who have officially registered observations and/or interest in the program or provided other valuable direct support. There are also a number of other active groups doing valuable observations who have not directly submitted their work to the program. Their work is likewise appreciated.

The major emphasis in 2004 has been on working to establish a baseline catalog; this effort has basically involved attempting to take the official catalog (found in Harry Jamieson's *Lunar Observer's Toolkit* program) and from it, establish an authoritative listing of confirmed vs. unconfirmed lunar domes.

One of the projects that is being considered is establishing a three-tier observing list somewhat like the Messier List, thereby allowing observers to earn certificates and pins for observing domes on the list. The three tiers will be Beginner, Intermediate and Advanced. The underlying motivation is not to

Featured lunar dome observer of the quarter Ed Crandall with his 10-inch f/7 (ca. 1958) Cave Newtonian Telescope.

present yet another certificate program, but rather a training platform for participants. By attaining the three levels, the observer will become proficient in dome observation and, therefore, their future observations will thus be of greater scientific value.

The other major area of interest is confirming the many unconfirmed domes in the toolbox catalog. The current catalog offers a wealth of data only when the domes listed in the current catalog are fully confirmed, classified and carefully observed over many lunations and under differing solar altitudes. Many of the objects in the current catalog may prove not to be volcanic lunar domes at all; some may be hills and other geologic features, and should be removed. Discovery of new lunar domes offers little scientific value presently until the current catalog and such new domes have met these tests. Thus new discoveries actually worsen the existing problem: a matter of quantity vs. quality.

Another project which a number of observers have participated in has been the imaging of objects in the catalog using digital imaging techniques. Ed Crandall, Mike Wirths and Marvin Huddleston have submitted such observations.

## Inside the ALPO
# Member, section and activity news (continued)

Daniel del Valle has submitted a number of excellent drawings, demonstrating the continued value of this age-old observing technique.

The ALPO Lunar Dome Survey active participants (who have either submitted observations and/or provided other valuable assistance) are listed below:

| Observer | Location | Telescope |
|---|---|---|
| Raffaello Braga | Corsico, Italy | 203mm Newtonian |
| Ed Crandall | Winston-Salem, NC USA | 10" f/7 Newtonian/110mm f/6.5 APO |
| Eric Douglass | N/A | N/A |
| Bob Garfinkle | California | N/A |
| Marvin W. Huddleston, F.R.A.S. | Mesquite, TX USA | 18" Starmaster Newtonian |
| Harry Jamieson | Cheyenne, WY | 10" Newtonian |
| Stephen M. Linscott | Baytown, TX USA | 14" Meade LX200 |
| Daniel del Valle | Puerto Rico | N/A |
| Mike Wirths | Perth, Ontario, Canada | N/A |
| Robert R. Young | N/A | 17" f/15 Cass./ 10" f/7 Newtonian |

The ALPO Lunar Dome Survey Yahoo discussion group is located at: http://groups.yahoo.com/group/lunar-dome/ While membership on the list is open to anyone interested in Lunar Domes, however, it is a closed membership list in order to protect the list participants from unwanted spam. To subscribe, send an email to: lunar-dome-subscribe@yahoogroups.com with the word "subscribe" in the subject line (without quotes).

This Yahoo group currently has 42 people subscribed and a total of 56 messages to date (only 5 during this quarter) during 2004. It is hoped that this group's activity will increase as the program begins to mature.

Observers can be featured as quarterly observers by contributing observations to the program coordinator and posting a photo of themselves with their telescope on the Yahoo group web site in the photo folder labeled "Members Equipment".

Visit the ALPO Lunar Dome Survey on the World Wide Web at http://www.geocities.com/kc5lei/lunar_dome.html

### Lunar Selected Areas
**Julius Benton, coordinator**

Visit the ALPO Lunar Selected Areas Program on the World Wide Web at http://www.lpl.arizona.edu/~rhill/alpo/lunarstuff/selarea.html

### Lunar Transient Phenomena
**Anthony Cook, coordinator**

*December 8* – The LTP sub-section has been very active during the fall/winter, as nights are long and the Moon is at a favorable altitude for most observers. Great progress is being made in re-observing LTP sites under identical illumination (+/-0.5 deg) to past LTP observations listed in the NASA catalog so that we may establish the true normal appearance of these features. When conditions permit, some features have been re-observed under both identical illumination and identical libration (to within +/-1 deg).

This work has shown that at least some past LTP events are not LTP but normal appearances of these features. Excellent work is being undertaken in color imaging with CCDs in order to check out cataloged color LTP reports. This has confirmed that some past color LTPs were just detections of natural surface colour.

Typically, around 10 observers are actively participating in the LTP program by submitting observations although approximately a hundred have signed up to participate during the SMART-1 mission.

Observing Alert — Aristarchus
*December 1* – Observer Clyde Brooks in Plymouth, UK reported at 02:00 UT 2 December 2004. He could see brightness variations in Aristarchus.

Please make every effort to view this crater and, if successful, to submit a report regardless if it is positive or negative.

Visit the ALPO Lunar Transient Phenomena program on the World Wide Web at http://www.lpl.arizona.edu/~rhill/alpo/lunarstuff/ltp.html

## Inside the ALPO
# Member, section and activity news (continued)

### Mars Section

**By Dan Troiani, coordinator**
**Daniel P. Joyce, assistant coordinator**

**About the Mars Map.** Mars as seen from Earth in August 2003, as rendered by Dan Troiani. South is at the top with the South Polar Cap and some white clouds seen over the South Polar Region during most of the observing season. North is at the bottom, showing the bright white, but small, North Polar Cap. Most white areas were clouds with the "Syrtis Blue Cloud" over Syrtis Major. Fog was in the Hellas region at times and Chryse had a mix of white clouds with a little dust. Orographic clouds were observed over great volcanoes in the Tharsis region (See the 2003 Apparition Report in this Journal). The map was produced using Adobe "Photoshop", and is based on drawings and CCD images made using a Meade 12-inch LX200 Schmidt-Cassegrain. The hues and colors match the CCD images perfectly and what Mars looked like visually. CCD images, drawings, and photos from the ALPO Mars Section made during the 2003 apparition were used to confirm all of the observations made with the LX200.

*November 16* – Though the Grand Apparition hype has vanished, among Mars Section observers things are just getting going again as the Red Planet rather reservedly re-emerges from its conjunction limbo.

The 2005 apparition starts slowly this time for Northern Hemisphere observers as the declination stays entrenched in heavily negative territory for a few months. We are reminded, though, that by the time of the opposition, Mars will be considerably higher for Boreans than last time. Its most recent counterpart was the 1990 apparition, which saw dust activity (mostly around Solis Lacus).

The 2003 Mars Map, courtesy of the usual suspect (Dan Troiani), will be accessible on the Section's ALPO website.

There is now more information from recent studies concerning the methane findings in the Martian atmosphere. Terrestrial observations from several years ago strongly suggested its presence, and now confirmation has been established. See it at http:www.skyandtelescope.com/news/. Very intriguing!

We also want to pass along congratulations to our mentor Jim Bell of Cornell University, whose camera arrays on the Spirit and Opportunity rovers have been dazzling us for nearly a year now. Keep up the good work.

Visit the ALPO Mars Section on the World Wide Web at http://www.lpl.arizona.edu/~rhill/alpo/mars.html

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### Minor Planets Section

**By Frederick Pilcher, coordinator**

*November 16* – The Minor Planets section is pleased to announce that the *Minor Planet Bulletin* becomes available on line starting with the first issue in 2005, Volume 32, No. 1, at http://www.minorplanetobserver.com/mpb/default.htm

Lightcurves of 35 minor planets are published in Volume 31, No. 4, 2004 October-December of the *Minor Planet Bulletin*. Planet 371 Bohemia, for which discordant values had been previously published due to an irregular lightcurve, has been observed at its most recent three apparitions, and observations of 2003-2004 are sufficiently numerous to determine an unambiguous period of 10.3791 hours and an equator near the ecliptic.

Minor planet 2841 Puijo, as observed by Brian Warner, shows some slight dips which might be due to a satellite with 24.6 hour revolution period, but additional observations at future apparitions are required to confirm this suggestion.

Other minor planets for which rotation periods, amplitudes, and lightcurves are published include 105, 206, 863, 903, 907, 928, 955, 970, 977, 978, 1027, 1103, 1127, 1196, 1341, 1386, 1501, 1508, 1528, 1656, 1816, 2112, 2417, 2577, 2612, 2653, 3455, 4266, 5036, 5599, 6743, 21652, and 75747.

Visit the ALPO Minor Planets Section on the World Wide Web at http://www.lpl.arizona.edu/~rhill/alpo/minplan.html

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### Jupiter Section

**By Richard W. Schmude, Jr., coordinator**

*November 28* – Jupiter is now visible in the early morning in the eastern sky. The Great Red Spot is visible along with Oval BA and several South South Temperate Belt ovals. The North Temperate Belt is still faint but both of the equatorial belts are distinct.

## Inside the ALPO
# Member, section and activity news (continued)

Ralf Vandebergh,Christopher Go, Paul Maxson, Robert Heffner, Daniele Botallo and Paolo Lazzarotti have all sent in images of Jupiter as of Nov. 27, 2004.

The Jupiter coordinator is currently working on the 1997 Jupiter report. The 1993-95 Jupiter reports are now completed and will be submitted to the editor shortly.

Visit the ALPO Jupiter Section on the World Wide Web at http://www.lpl.arizona.edu/~rhill/alpo/jup.html

## Saturn Section
**By Julius Benton, coordinator**

*November 22* – Saturn remains in the constellation of Gemini at visual magnitude -0.2 as 2004 draws to a close. All reports for the 2003-2004 apparition have been received, logged into the ALPO Saturn Section database, and are now undergoing detailed analysis, but because of the wealth of contributed data needing analysis, the 2003-2004 apparition report will probably not appear in this Journal until mid-2005.

The southern hemisphere and south ring face remain open to our telescopes during 2004-2005, with the rings inclined at about -23° to our line of sight. Saturn is now well up in the eastern sky before sunrise, almost on the celestial meridian, and the planet will reach opposition on 2005 January 13.

Observer response during 2004-2005 has been excellent so far, with a considerable number of superb CCD, videographic, and webcam images of Saturn already arriving along with some very impressive drawings. The rings are gradually “closing up” with Saturn diminishing gradually in brightness as the next edgewise orientation in 2009 approaches.

Saturn’s southern hemisphere has been showing considerable transient white spot activity this observing season, and it will be interesting to see if these phenomena continue to develop as the 2004-2005 apparition progresses.

All ALPO Saturn observers are again reminded that there is a great opportunity this apparition for participation in the Amateur-Professional Cassini Observing Patrol. Cassini's arrival at Saturn (orbit insertion) occurred on 2004 July 1 and as of this writing, the Titan Probe Entry and Orbiter flyby will occur on 2004 November 27. The professional community is seeking digital images of Saturn at wavelengths ranging from 400 nm - 1 micron in good seeing using webcams, CCDs, digital cameras, and videocams. This effort began in April 2004 in order to coincide with the time when Cassini starts observing Saturn at close range.

Use of classical broadband filters (e.g., Johnson system: B, V, R and I) have been recommended, and for telescopes with large apertures (e.g., 30.0 cm. and greater), imaging through a 890-nm narrow band methane filter will also be extremely worthwhile.

The Cassini Team continues to stress the importance of ALPO Saturn observers to carefully and systematically patrol the planet every clear night to search for individual features, their motions and morphology, to serve as input to Cassini's imaging system, thereby indicating to Cassini scientists where interesting (large-scale) targets exist.

Suspected changes in belt and zone reflectivity (i.e., intensity) and color will be also useful, so visual observers can also play a very useful role by making careful visual numerical relative intensity estimates. The Cassini team also would like to combine ALPO Saturn Section images with data from the Hubble Space Telescope and from other professional ground-based observatories (a number of proposals have been submitted).

The ALPO Saturn Section is always eager to enlist new observers, and anyone interested in our programs should contact the ALPO Saturn Section cordinator on how to get started.

Further information on ALPO Saturn programs, including observing forms and instructions, can be found on the Saturn page on the official ALPO Website at http://www.lpl.arizona.edu/~rhill/alpo/sat.html

All are invited to also subscribe to the Saturn e-mail discussion group at Saturn-ALPO@yahoogroups.com

## Remote Planets Section
**By Richard W. Schmude, Jr., coordinator**

*November 16* – The planets Uranus and Neptune will reach conjunction in February and will not be visible until about April in the morning sky. Pluto will be visible in the morning sky during the first 5 months of 2005. CCD photometry measurements of Pluto are of great value to the section. Newly--discovered Sedna will be visible in the evening sky. Be aware that Sedna is about magnitude 21, so use the appropriate equipment.

During the summer of 2005, Uranus’ moon Ariel will begin transiting the planet. Get your cameras ready so that you can image this rare event. Tom Cragg saw the Uranian moon Umbriel transit the planet back in the 1960s, shwoing that it is possible to witness or image these satellite transits.

Visit the ALPO Remote Planets Section on the World Wide Web at http://www.lpl.arizona.edu/~rhill/alpo/remplan.html

## Inside the ALPO
# Member, section and activity news (continued)

## Sponsoring Members ($100 or more per membership) and Sustaining Members ($50 per membership)

**by Matthew L. Will, ALPO Membership Secretary/Treasurer**

The ALPO wishes to thank the following Sponsoring Members listed below and our Sustaining Members on the next page for voluntarily paying higher dues to help make this organization succeed even more. The extra income helps in maintaining the quality of the *Journal* while also helping to keep the overall cost of the *Journal* in check. Thank you! As of November 28, 2004:

| SPONSORING MEMBER | CITY | STATE |
|---|---|---|
| DR JULIUS L BENTON, JR | SAVANNAH | GA |
| CHARLES L CALIA | RIDGEFIELD | CT |
| KURT CASBY | SAINT PAUL | MN |
| LELAND A DOLAN | HOUSTON | TX |
| ROBERT E DUNN | FLORAL PARK | NY |
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| DONALD C PARKER | CORAL GABLES | FL |
| BERTON & JANET STEVENS | LAS CRUCES | NM |
| ROGER J VENABLE | AUGUSTA | GA |
| GERALD WATSON | CARY | NC |
| MATTHEW WILL | SPRINGFIELD | IL |
| CHRISTOPHER C WILL | SPRINGFIELD | IL |
| THOMAS R WILLIAMS | HOUSTON | TX |

## Inside the ALPO
# Member, section and activity news (continued)

## Sustaining Memberships ($50 per membership)

| SUSTAINING MEMBER | CITY | STATE | COUNTRY |
|---|---|---|---|
| ROCKY ALVEY | FRANKLIN | TN | |
| PAUL H BOCK, JR | HAMILTON | VA | |
| RAFFAELLO BRAGA | CORSICO | MI | ITALY |
| KLAUS R BRASCH | HIGHLAND | CA | |
| ORVILLE H BRETTMAN | HUNTLEY | IL | |
| HANK BULGER | GRANTS | NM | |
| CRAIG COUNTERMAN | WAKEFIELD | MA | |
| THOMAS DEBOISBLANC | THOUSAND OAKS | CA | |
| WILLIAM DEMBOWSKI | WINDBER | PA | |
| MIKE DILLON | MINNEAPOLIS | MN | |
| T WESLEY ERICKSON | WARNER SPRINGS | CA | |
| RICHARD R FINK | BRICK | NJ | |
| RICHARD G FOSBURG | PALM DESERT | CA | |
| GORDON W GARCIA | HOFFMAN ESTATES | IL | |
| ROBERT A GARFINKLE, FRAS | UNION CITY | CA | |
| JOSEPH GELVEN, JR | FALLS CHURCH | VA | |
| CHRIS GILLIES | MAREEBA | Q | AUSTRALIA |
| JOHN A GRAVES | NASHVILLE | TN | |
| ROBIN GRAY | WINNEMUCCA | NV | |
| ROBERT H HAYS | WORTH | IL | |
| JOHN M HILL | TUCSON | AZ | |
| MIKE HOOD | KATHLEEN | GA | |
| DAVID A HURDIS | NARRAGANSETT | RI | |
| RICHARD KOWALSKI | ZEPHYRHILLS | FL | |
| JIM LAMM | CHARLOTTE | NC | |
| DAVID J LEHMAN | FRESNO | CA | |
| GREGORY MACIEVIC | CAMDEN | OH | |
| ROBERT MAXEY | SUMMIT | MS | |
| DR ARTHUR K PARIZEK | RIO VERDE | AZ | |
| R BRAD PERRY | YORKTOWN | VA | |
| CECIL C POST | LAS CRUCES | NM | |
| TIM ROBERTSON | SIMI VALLEY | CA | |
| TAKESHI SATO | HATSUKAICHI CITY | HI | JAPAN |
| MARK L SCHMIDT | RACINE | WI | |
| RONALD SIDELL | SAN CARLOS | CA | |
| LEE M SMOJVER | TUKWILA | WA | |
| ROGER J VENABLE | AUGUSTA | GA | |

# Inside the ALPO
# Member, section and activity news (continued)

## Newest Members

**By Matthew L. Will, ALPO Secretary/Treasurer**

The ALPO would like to wish a warm welcome to those who recently became members. Below are persons that have become new members from August 30, 2004, through November 28, 2004, their location and their interest in lunar and planetary astronomy. The legend for the interest codes are located at this page

| MEMBER | CITY | STATE | COUNTRY | INTERESTS |
|---|---|---|---|---|
| JOHN CHARLES BELL | VICKSBURG | MS | | |
| DIETMAR BUETTNER | CHEMNITZ | | GERMANY | |
| JAMIE CASTLE | OLNEY | MD | | |
| MARK S DEPREST | ANN ARBOR | MI | | |
| JAMES FORRESTER | ANN ARBOR | MI | | |
| STEVEN HILL | BOULDER | CO | | |
| GARY INGRAM | SANDUSKY | OH | | |
| JESSE JARVI | MESA | AZ | | |
| TIM KENYON | AUSTIN | TX | | 4CM |
| GEORGE LAMY | DENHAM SPRINGS | LA | | |
| RICHARD LANE | SAN ANTONIO | TX | | |
| GEORGE LILLEY | WARNER ROBINS | GA | | |
| EDWARD LOMELI | SACRAMENTO | CA | | |
| JOE MC GRAW | KINSTON | NC | | |
| DON MORTON | MEXIA | TX | | |
| THOMAS E OATES | POWDER SPRINGS | GA | | 0123DMPR |
| STEVEN ROBERTS | WYLIE | TX | | |
| BOB SCHMALL | MOKWONAGO | WI | | |
| HARRIS C SMITH | BAY MINETTE | AL | | |
| DAVID TRAPANI | WADLWICK | NJ | | |
| BRUCE WINGATE | LAS VEGAS | NV | | |
| DAVID YAGER | WARNER ROBINS | GA | | |

## ALPO Interest Codes

The following codes are used to indicate member interests in the table of newest members later in this section.

| | | | |
|---|---|---|---|
| 0 = Sun | 5 = Jupiter | A = Asteroids | M = Meteors |
| 1 = Mercury | 6 = Saturn | C = Comets | O = Meteorites |
| 2 = Venus | 7 = Uranus | D = CCD Imaging | P = Photography |
| 3 = Moon | 8 = Neptune | E = Eclipses | R = Radio Astronomy |
| 4 = Mars | 9 = Pluto | H = History | S = Astronomical Software |
| | | | T = Tutoring |

## Feature Story:
# Photo Highlights and Minutes of the July 23, 2004 Board Meeting, Berkeley, California

***Call to Order:*** Meeting called to order at 6:42 p.m. by Executive Director Richard Schmude.

Present were:

Richard Schmude, Matt Will, Mike Reynolds, Don Parker, John Westfall, Elizabeth Westfall, Julius Benton (via speaker phone)

***Participate in the Astrophysics Data System to put ALPO Journal on line:*** This project would give on-line access to all issues of ALPO journals at no cost to the ALPO. The Board felt this would expand the access and use of the Journal. In order to protect our current subscription/memberships, it was decided to submit all issues through 2002, and then release issues to the project every two years. John Westfall has offered to have his collection used for scanning, if the organization can confirm that the only "destruction" is the unstapling of issues. The Board approved moving forward to have the Journal entered into the Astrophysics Data System. In addition, the Board will work to bring indexing of the journal up-to-date.

Michael Reynolds, AstroCon 2004 Co-Chair, opens the conference of Wednesday morning, July 21.

***Next Executive Director:*** Richard Schmude completes his term as Executive Director at the conclusion of the Board meeting in the summer of 2005. The scheduled next Executive Director was to have been Matt Will. He would prefer to continue his work on Membership and the Endowment Fund. Therefore, the Board agreed that Julius Benton will become the Executive Director for 2005-2007, with Matt Will continuing to be the Associate Executive Director, as well as Membership Chair/ Treasurer.

ALPO Executive Director Richard Schmude welcomes conference attendees on Wednesday morning.

***ALPO meeting in 2005:*** The Astronomical League will meet in Kansas City, July 14-16, 2005, and has invited the ALPO to join them. The Board voted to accept the invitation to meet with the AL. Thursday, July 14 is the AL Council meeting; paper sessions will be on Friday, July 15, and Saturday, July 16. Richard Schmude will work with the AL to coordinate ALPO paper sessions at the meeting.

***ALPO meeting in 2006:*** ALPO meeting plans for 2006 remain undecided. The Board felt that it is time for meeting on our own, rather than with the AL in Dallas in 2006. Ken Poshedly has invited ALPO to meet in Atlanta, which was favorably received by the Board. However, there were also discussions about

Donald Parker, ALPO Mars Section, during the "Exploration of the Solar System" panel, Wednesday morning session.

ALPO Associate Director Matthew Will with the ALPO informational display

possibly meeting in Las Cruces if local members could handle local arrangements. The Board agreed to explore the possibility of Las Cruces; if that does not work out, then we will meet in Atlanta.

***ALPO meeting in 2007:*** Richard reported that he received an invitation from the Royal Astronomical Society of Canada (RASC) to meet with them in 2007, probably in Calgary. The Board voted to approve meeting with the RASC, subject to their final decision on the meeting city.

***Journal Items:*** Ken Poshedly would like to attract more advertisers. Is there someone who could sell ads? Mike Reynolds and Don Parker offered to speak with some vendors. There was also discussion about finding someone to "train" as a back-up editor, possibly someone already on the Publications staff. Richard Schmude will speak with Ken about possible candidates.

***Board vacancy:*** Richard Schmude read a letter of resignation from the Board from Elizabeth Westfall. The Board thanked her for her years of service on the Board. Matt Will takes on the responsibilities of Corporate Secretary, since they mostly involve reporting financial and membership information to various state and federal agencies. It was agreed that Richard Schmude will contact several Board candidates who have expressed interest in the past year, asking them each to submit a letter of interest.

***Lunar Section:*** Because of the many sub-sections of the Lunar Section, Director Schmude will be selecting a person to act as General Coordinator, responsible for assembling reports from each of the sub-sections and preparing them for publication in the Journal. Bill Dembowski had expressed interest in this position.

***Staff with expired memberships:*** Two staff members have not renewed their memberships, a requirement for a staff position. Richard Schmude will review the circumstances in each case and take appropriate action.

***"Why Join the ALPO":*** These short forms were designed by Richard Schmude to pack with new telescopes. There have been a small number of memberships resulting from these, so it was decided to continue the program. Two suggestions were made: to prepare these as bookmarks, and second, to change the reverse side to less text and more graphics.

***Treasurer's Report:*** Matt Will had separately sent a detailed Treasurers Report to each Board member. Matt discussed one issue of concern in that report, that the first six months of 2004 showed a deficit. Matt explained that we are in the trough of cash flow having just paid for an issue of the journal, and still awaiting membership renewals and other incoming cash. He expects that the cycle will balance by year end. Matt also showed a brochure he has prepared to explain and gain support for the Endowment Fund, which has a balance as of June 30, 2004, of $18,803. The Board was very impressed with the brochure; he will add drawing and/or pictures to improve its appearance. Matt has also prepared a business plan for fund-raising for an ALPO

Daniel Troiani, ALPO Mars Section coordinator, speaking on the subject of Mars observing, Thursday morning, July 22.

headquarters to maintain our extensive, historical observational archives.

The 2004 ALPO Board of Directors meeting on the evening of July 23. From left to right are Donald Parker, Michael Reynolds, Matthew Will, Richard Schmude, Elizabeth Westfall (and John Westfall's jacket). Julius Benton, physically absent, participated via the speakerphone on the table.

***Student Membership Rates:*** The ALPO has been asked if we have student memberships. We have none at present, and after Board discussion it was decided that the digital subscription at $11 for 4 issues is affordable for students and should be advertised to that market.

***Jupiter Section:*** Richard Schmude updated the Board on the progress of the Jupiter Section reports, which had been 14 years behind. He has published 5 reports, 2 are ready to be published, and 4 reports remain to be done. Richard will continue to finish these and publish them in the Journal.

***Amateur/Professional Cooperation:*** Don Parker, Julius Benton, and Richard Schmude reported that the Mars, Jupiter and Venus sections continue to have projects in cooperation with professional scientists. Don also brought up another issue that will need to be dealt with at some time: North or South at the top in our illustrations? Scientific publications want North at the top; *Sky & Telescope* magazine now requires North at the top. The BAA and other organizations want to keep South at the top. This is an issue that won't go away and becomes more important as the ALPO works more and more with professional scientists. Don Parker will discuss the question with other international astronomy groups and report back to the Board.

Richard Schmude had sent a questionnaire to staff members regarding their activities, number of talks, outreach activities and so on. This information is essential for our reporting to the IRS, as well as crucial for grant applications. Staff are encouraged to keep track of such activities for reporting next year.

## Congratulations . . .

. . .to the winners of this year's ALPO awards:

Elizabeth Westfall, winner of the Peggy Haas Service Award

Damian Peach, winner of the Walter H. Haas Observer's Award

## Coordinator and Section Changes

### *Promoted from acting to permanent positions:*

#### *Publications Section:*

- Robert Garfinkle
- James Lamm
- Richard Ulrich
- Richard Wessling

#### *Comets Section:*

- Gary Kronk (Editor's Note: Since the board meeting, Gary has chosen to leave the coordinator position, but remain as assistant coordinator of the Comets Section.)

### *Mars Section changes:*

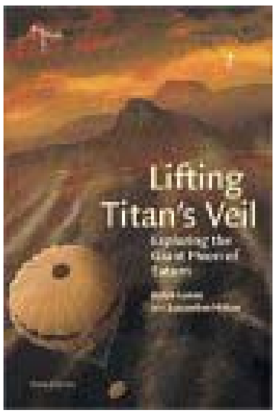
- Dan Troiani continues as Coordinator, and his outstanding outreach work is recognized by the Board.
- Deborah Hines is the contact person for everyone sending in observations.
- Dan Joyce will write the Mars status reports.
- The publication of the *Martian Chronicles* will be dropped, as information is now readily available on-line.
- A schedule plan for the next Mars apparition report was developed.

There being no further business before the Board, the meeting was adjourned at 9:47 p.m.

### Book Review:
## Lifting Titan's Veil: Exploring the Giant Moon of Saturn

By Ralph Lorenz and Jacqueline Mitton; published by Cambridge University Press, 40 West 20th Street, New York, New York, 10020. 2002. 268 pages, index. Price $30. Hardbound (ISBN 0 521 79348 3).

**Review by Richard W. Schmude, Jr. at schmude@gdn.edu**




This book is organized into seven chapters which are titled: "Discovering Titan", "Seeing Titan", "Titan's puzzling atmosphere", "Murky meteorology", "Titan's landscape", "The Cassini-Huygens mission" and "The shape of things to come". There are 4 tables, 69 illustrations, 19 color plates, 1 appendix and a 547-item index in the book. There is also a section that describes additional sources of information about Titan.

My feeling is that this book does a good job of describing three things: 1. The development of our understanding of Titan, 2. The human side of planning space exploration experiments, and 3. How it would be like on Titan if we could live there. Ralph and Jacqueline do a good job of weaving these three topics together in the book.

The book begins with a discussion on the discovery of Titan. The reader then learns about an early drawing of Titan made by Jose Comas Sola in August, 1907, which may be the first piece of evidence showing that Titan has an atmosphere. The reader then learns about how Kuiper discovered Titan's atmosphere in the 1940's; the original spectra are even shown.

Good discussions are given about both Earth-based and Hubble Space Telescope images of Titan. One strong point about this book is that the authors do a good job of describing several astronomical techniques such as adaptive optics, photometry, polarization and spectroscopy. The writers also do a good job of describing the Cassini/Huygens instruments and what they will measure.

As a former Ph. D. student myself, I appreciate the discussions about the human side of space exploration. The reader discovers that there is more to a space probe than just putting a bunch of instruments on a rocket. The writers describe several Ph. D. projects which include computer modeling of Titan's atmosphere along with the building of a penetrometer, which will be the first piece of equipment to come into contact with the surface of Titan.

Some discussion is also given on how the American and European scientists/engineers worked together to build the Cassini/Huygens spacecraft. Interestingly, one of the writers lives in America and the other one lives in the United Kingdom. The reader discovers that there are stringent weight restrictions and time restrictions when building a spacecraft like Cassini; furthermore, the reader even discovers that the trajectory of Cassini had to be planned so that all participating scientists got their fair share of data.

A third dimension of this book explains what it might be like on Titan. The reader's imagination is allowed to wonder a little bit here. There are several excellent illustrations of what the surface of Titan might look like. The reader also discovers that he/she could swim under a lake and then leap above the lake on Titan because of that moon's low gravity. The writers, of course, point out that humans would first have to find a way to stay warm on Titan's frigid surface before swimming on Titan.

I feel that this book is well-written and well-illustrated. The index is very useful. I would recommend this book to the casual reader or to someone who has some scientific background.

## *Feature Story:*
# *Lunar and Planetary Photography With Inexpensive Webcams*

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### For Online Readers

Items in blue text are links to e-mail addresses, tables, figures and websites for more information. Left-click your mouse on:

- •Items labeled "Table" to jump to that particular table.
- •Items labeled "Figure" to jump to that particular figure.
- •Bracketed numbers in blue text to jump to that particular item in the References section.
- •In the References section, items in blue text to jump to source material or information about that source material (Internet connection ON).

## Webcams

In early 2004, I purchased two webcams to introduce myself to the newest astronomical craze – webcam astroimaging. These color webcams don't use RGB (red-green-blue) filtration, but instead a matrix of plastic microlenses coated with yellow, magenta, cyan, and green filters. The RGB colors are restored by the camera's circuitboard and camera software installed on your computer. I found these two webcams to reproduce colors and flesh tones well. The two I used can be found at any big-box or office supply store. There are many webcams in the $20 price range, and I chose the Veo brand for no particular reason. It uses a small, inexpensive complementary metal oxide semiconductor (CMOS) sensor. All the cameras I surveyed at this price used the less expensive CMOS sensor.

I purchased the $100 Quickcam [1] because it has a Sony ICX098BQ charge-coupled device (CCD). This is the same chip used in the popular Philips ToUCam. This CCD has better sensitivity than a CMOS sensor, and the CCD can be modified by a savvy experimenter for long-exposures [2]. My camera is not modified, but a vendor-modified version using the very similar Sony ICX098AK CCD is in the SAC 7b color camera [3]. I bought the Veo at Wal-Mart, and the Quickcam at Office Max. Both use 6 foot length USB 1.1 cables and both run in Windows 98SE/Me/2000/XP. I bought a 10-foot USB extension cable to provide an adequate work distance from the telescope.

## Sensitivity and Color Response

Both webcams give nice sharp images, and each has an automatic and non-automatic exposure capability. The Quickcam screen display shows the shutter speeds when non-auto is selected – they range from 1/15 to 1/10,000 second. The Veo exposure times are not displayed, nor are they listed in the user guide. The Veo has enough sensitivity on my 8-inch reflector at f/40 to image Venus, but the first quarter Moon was a little underexposed. I estimate that the Veo is about 1/4 as sensitive as the Quickcam. Jupiter was very underexposed with the Veo. Both cameras have an automatic frame rate which means that as the subject becomes fainter, the frame rate decreases.

Both have frame rates of 15 frames per second for bright subjects. The Quickcam sensitivity was quite adequate for Jupiter, but the frame rate was reduced to 10. The Veo lets you time video snippet durations from 1 to 999 seconds, and the Quickcam 1 to 60 seconds (but an unlimited duration if stopped with a mouse click). The video filename suffixes are automatically incremented and time-stamped to the nearest minute at the end of each snippet. This frees the observer from tedious record keeping.

Both cameras have an IR rejection filter. The Veo has a coated lens, whereas the Quickcam has a small, 1/4-inch filter in the rear of the lens focus tube. It remains in place when the lens is unscrewed, but was removed because dust found its way between it and the CCD. Their removal did not appear to alter the color balance when using the Auto color balance feature. In the Auto mode, the infrared excess is most likely suppressed (to give more accurate colors) by decreasing the computed R color channel signal strength, and/or increasing the computed GB values. Not surprisingly, the images are redder using the Daylight color balance. I prefer the Daylight setting for the Moon and Venus, and the Auto setting for the other planets. The Moon appears to have better contrast, and Venus is much better because I photograph it near the meridian and the blue sky is darkened.

I tested the sensitivity of the Quickcam to see if it could be used for narrower wavelength photography such as R, IR, or UV; but when I used a Wratten 25

**Table 1: Two Webcams Tested**

| Camera Manufacturer / Model | Cost | Chip Manufacturer / Type | Size (mm) | # x/y pixels |
|---|---|---|---|---|
| Veo Stingray | $20 | CIF CMOS (352 x 288) | 1.79 x 1.34 | 320 x 240 |
| Logitech Quickcam Pro 4000 | $100 | Sony CCD ICX098BQ | 3.58 x 2.69 | 640 x 480 |

red filter on Venus on April 27, it gave an image far too dim. Since CCD's are quite sensitive in the R and IR passbands, this indicated that it would not work with any supplementary filters (except the Sun). The bandpass of black and white prints such as my figures is best described as being IR+RGB, panchromatic, or integrated-light. If truer RGB color images are required, reattach or add an IR rejection filter. Table 1 lists some specifications for the two web cameras I purchased.

The size is the number of pixels times the size of the pixel. These are the active chip sizes, and determine the actual field of view for the optical system. The physical size can be slightly larger, because some chips have a still photo capability, and this uses more pixels than that used for video imagery. This is why the Veo type number is slightly larger than the pixels number.

## Webcams versus Video Cameras

In this article, I'll briefly review the major differences between web cameras and video cameras, since both are in common use for video astrophotography and there may be some confusion between the two. Most webcams use 7-conductor USB cable, and the output signal is digital because the analog video is digitized inside the webcam. A video camera is simple to use because it does not require a computer or software to operate. It has a 2-conductor cable or a video jack to output an analog signal to a television or video tape recorder.

If one wants to make a composite, the user must convert the analog data (usually stored on a VCR tape) to a digital format using a computer equipped with a video frame-grabber. This is either an internal card or an external box. This extra step in image processing probably makes a webcamera more attractive for routine imaging and compositing; but David Moore has proven the Astrovid 2000 video camera to be capable of high resolution lunar and planetary imaging [4], and Ron Dantowitz has recorded amazing images of Earth satellites [5] and Mercury with a GBC 505E high-sensitivity video camera (similar to the Astrovid 2000 which uses the Sony ICX038DLA CCD).

It probably makes more sense to have both a good CCD webcam and a sensitive video camera (camcorders are yet a third type of electronic camera).

There will be times when all you want is simple video of something, or you don't want to set up a lot of equipment, or you don't have gigabytes of data storage capability. Here, then, are three situations where you might want a video camera:

1. A public star party where you just want a live TV image for fun

**Table 2: Video Cameras**

| Camera | Cost | Color/ B&W | Lux | Width of x/y pixels (mu) | Active Chip Size x/y (mm) | # x/y pixels |
|---|---|---|---|---|---|---|
| Astrovid 2000 | $595 | b/w | 0.01 | 8.4 x 9.8 | 7.95 x 6.45 | 946 x 658 |
| Astrovid Color PlanetCam | $495 | color | ?? | 4.6 x 4.6 | 3.53 x 2.27 | 768 x 494 |
| Supercircuits PC-23C | $90 | b/w | 0.04 | 16.4 x 16.4 | 8.36 x 8.07* | 510 x 492 |
| Supercircuits PC-164C | $130 | b/w | 0.0003 | 16.4 x 16.4 | 8.36 x 8.07* | 510 x 492 |
| Supercircuits PC-165C | $230 | color | 0.05 | 11.2 x 11.2 | 8.42 x 6.52* | 752 x 582 |

NOTE: Supercircuits [6] lists only the number of x/y pixels and the chip sizes - with the latter as approximately 1/3 inch; therefore, the widths of x/y pixels and active chip sizes shown here are my best estimates.) Note the large pixel sizes for the Supercircuits models which affords greater sensitivity. For example, the PC-23C camera is often used in lunar occultations, and I use one for meteor and satellite photography.

**Table 3: Nyquist Values for Some Excellent Solar and Planetary Photographs**

| Ref. | Object | Aperture (inches) | f/no. | Scale (arc-sec/ mm) | Pixel width (microns) | Pixel Field of View (arc-sec) | Dawes' Limit (arc-sec) | Nyquist value (Nv) |
|---|---|---|---|---|---|---|---|---|
| 7 | Sun | 03.70 | 28.8 | 76.21 | 11.2 | 0.848 | 1.28 | 1.51 |
| 8 | Mars | 16.00 | 59 | 08.60 | 20.0 | 0.171 | 0.30 | 1.73 |
| 9 | Sun | 05.12 | 32 | 49.56 | 08.4 | 0.414 | 0.92 | 2.23 |
| 10 | Saturn | 14.50 | 27 | 20.74 | 05.6 | 0.115 | 0.33 | 2.82 |
| 11 | Saturn | 09.25 | 27 | 32.52 | 05.6 | 0.181 | 0.51 | 2.82 |
| 12 | Sun | 06.10 | 43.7 | 30.46 | 08.4 | 0.254 | 0.77 | 3.04 |
| 13 | Jupiter | 08.00 | 30 | 33.84 | 05.6 | 0.188 | 0.57 | 3.14 |
| 14 | Saturn | 14.00 | 32 | 18.13 | 05.6 | 0.101 | 0.34 | 3.34 |
| 15 | Saturn | 14.00 | 66 | 08.79 | 11.5 | 0.100 | 0.34 | 3.36 |
| 16 | Jupiter | 10.00 | 34.5 | 23.54 | 05.6 | 0.131 | 0.47 | 3.61 |
| n/a | various | 08.00 | 40 | 25.40 | 05.6 | 0.142 | 0.57 | 4.02 |
| 17 | Mars | 10.00 | 67 | 12.12 | 05.6 | 0.067 | 0.47 | 7.00 |

2. A lunar occultation where time signals need to be recorded on tape with the video to 1/30 second accuracy

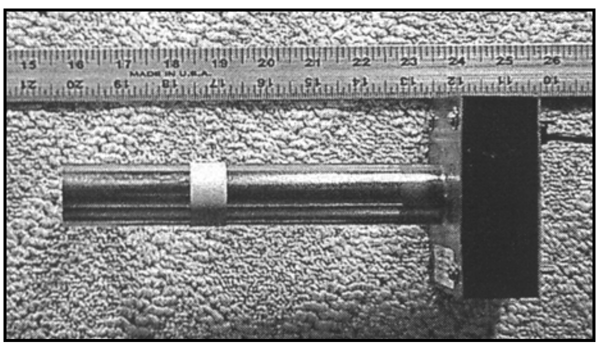

Figure 1 – Assembled modular camera. (All photos by author.)

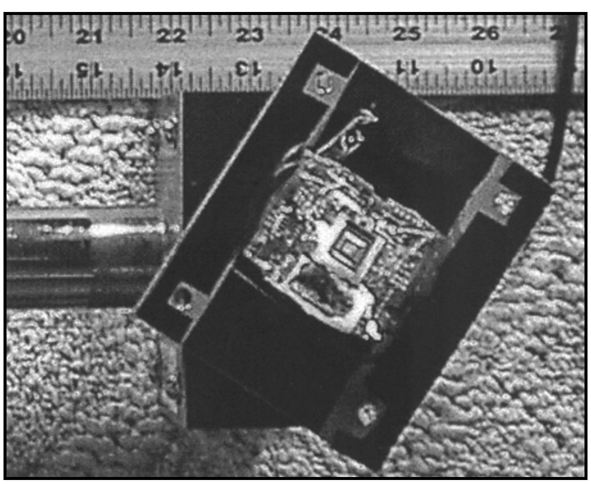

Figure 2 – Back plate of camera with CCD.

3. You need to record many hours of video and don't have a computer; or if you do, you don't have enough disk space.

If you require more sensitivity and want to consider a video camera, Table 2 lists a few found in popular literature that are easily available.

When the PC-23C is used with a 2-inch focal length, f/1.2 lens, the field of view is 4.6 x 3.2 degrees, and it reaches a limiting magnitude of 7 at 30 frames per second. When one composites 13 seconds of video (about 400 frames) using RegiStax, the limiting stellar magnitude is increased to 10. Knowing this, any lux and aperture can be scaled to determine your own particular limiting magnitudes.

Webcams typically have small chips and small pixels, and the two I bought have 5.6 micron square pixels. The more expensive astronomical CCD's are bigger and have much larger pixels - 10 and 20 micron sizes are common. Two drawbacks with webcams are that a smaller pixel collects less light than a larger pixel, and dust spots appear to be correspondingly larger in the smaller frame. An advantage is that the Nyquist criterion is met using a smaller focal length objective or telescope.

## Image Scale

The Nyquist sampling criterion states that the Airy disk of a star (or every disk in an extended object) should span two sensor elements (such as pixels of a CCD). For example, if your telescope has a resolution of 0.4 arc-seconds, then each pixel field of view should be at least 0.2 arc-seconds. It is also said that any scale larger than this is empty magnification

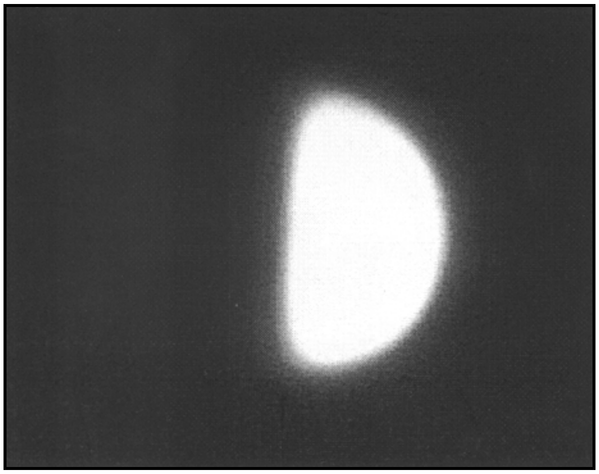

Figure 3 – Venus, 31 March 2004, 20:39 UT, 30 images.

because it wastes light. However, this appears not to be the case for the Sun and brighter planets. I surveyed many excellent photos found in publications and on the web which were taken in the last 2 to 3 years. Where there were sufficient data listed with the photo, I computed the Nyquist sampling value. The Nyquist value (Nv) in Table 3 is the diameter of the Airy disk (i.e., Dawes' limit) divided by the pixel field of view – both quantities expressed in arc-seconds. This list is ordered by increasing Nyquist values. This shows that 7 out of 11 of those included in the survey (References 7 through 17) use about 3 to 4 pixels to sample the Airy disk. My values are listed after Reference 16 for comparison.

The reader may compute the Nyquist value with the formula: Nv = (120 / d) / (205*(mu / fl)) , where **d** is the telescope aperture (mm), **mu** is the pixel size (microns), and **fl** is the telescope focal length (mm). If one is using 5.6 micron pixels (such as are in my 2 webcams and the Philips ToUCam), you can calculate the Nyquist sampling value using Nv = f/no / 9.565. For other pixel sizes you may use the formula Nv = f/no / (1.708*mu).

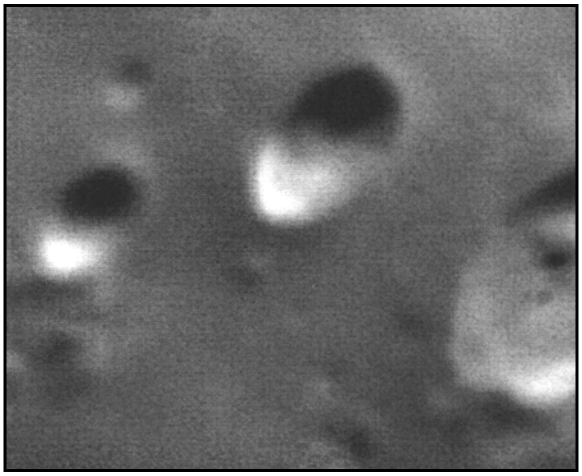

Figure 4 – Lunar crater Clavius, 1 April 2004, 01:29 UT, 6 images.

I suspect that Nyquist values exceed 2 because amateurs may wish to enlarge a planet, crater, or sunspot until it nearly fills the camera's field of view. I also suspect that these more enlarged images are better than smaller images because pixel variations and dust contributions are reduced. Therefore, I chose a Nyquist value near the high end of the range used by these amateurs and used a Barlow amplification of 5.13. I cut my camera nosepiece long enough to hold a Pentax camera Barlow 8 inches ahead of the prime focus. This increases the focal ratio of my 8 inch from 7.8 to 40. Thus, the Veo field of view is 46 by 34 arc-seconds, and the Quickcam field of view is 1.52 by 1.14 arc-minutes (double the Veo).

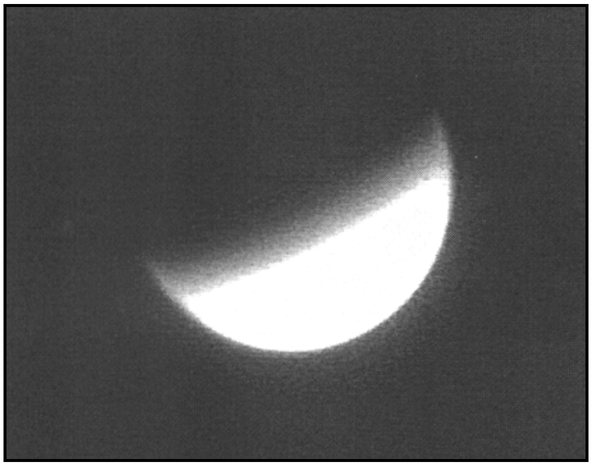

Figure 5 – Venus, 12 April 2004, 21:10 UT, 7 images.

## Construction

One may purchase a webcam-to-telescope adapter, or build one. My camera is inexpensive, but it is certainly not the lightest or best that can be built. Unless you wish to test several webcams, it would be best to buy a well-known webcam such as the Philips or Logitech (which use CCD's and not CMOS sensors) and its adapter. I built mine because I did not want to buy an adapter for each webcam. I also decided to make a modular camera with a replaceable nosepiece, body, and back. This allows easier testing for different sensors, optics, and focusers.

Figure 1 shows the assembled modular camera, and Figure 2 is an exploded view of the two major parts – the nosepiece attached to the body and the back plate. I used a 1.25 inch brass plumbing tube since it fits snugly in my 1.25 inch focuser. My Barlow is held by friction at the front edge of the tube. This location and friction fit allows for easy removal, cleaning, and accurate replacement.

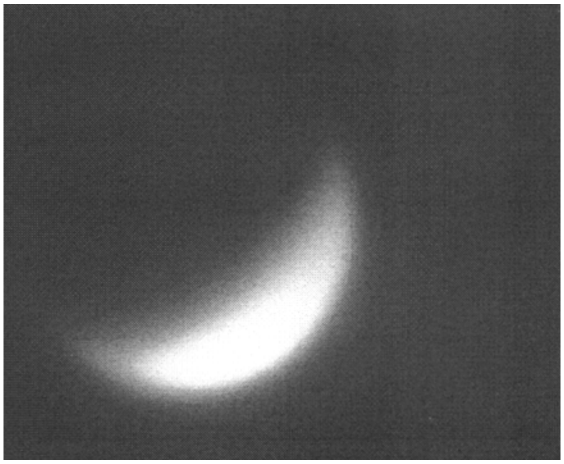

Figure 6 – Venus, 27 April 2004, 20:50 UT, 15 images.

It is important to return the Barlow to the same position after cleaning, or the image scale will not be constant.

This tube is soldered to a 1/16-inch-thick soft iron plate. The brass and iron are easily soldered with a propane torch, and the parts did not warp when they cooled

The body is a piece of 2-by-4 lumber about 5 inches long with a 2.5-inch hole in the center. This hole is large enough to accommodate either circuit board. It is important to remove the printed circuit board from its housing and remove the lens – this is not an afocal camera design! The Veo can be opened by removing the bottom label and then the screw. The lens on the Quickcam can be unscrewed until the case pops open. Protect the board from dust and static by keeping it in a plastic static protection bag until it is mounted. The back is another soft iron plate the size of the front. The three parts are taped together, clamped in a vise, and drilled in the corners and center.

Four countersunk nuts hold the body to the front, and the rear is held to this by wing nuts.

I have three sensor backs (one for each webcam and a spare), and a fourth back carries an eyepiece with a reticle. The circuit boards are taped to a small square of wood the size of each circuit board. This spacer provides electrical insulation between the circuit board and the iron back. The spacers can be adjusted in thickness to give a common focal position. The spacer is attached with a screw to the center of the back.

An oversize hole and washer allows rotating and centering the sensor chip to the tube axis. Another oversize hole below this lets the USB plug and cable drop through the back plate. This way, the cable does not have to be desoldered from the rather complex Quickcam circuit board.

This board appears to have many insulating and conductive layers, and I recommend no soldering be done to it.

I presently use the camera with the back plate held by gravity alone, since this greatly simplifies changing backs and saving time. The eyepiece back is "dropped in" to center the image, and then carefully removed and replaced with the sensor back. This arrangement works, but is tedious and prone to moving the fov. I plan to purchase (and highly recommend) using a flip mirror viewer and a firmly attached back.

## Video Imaging

Here is a bulleted list to review to help you get the best images, and also offer my own thoughts on preserving your data:

- I recommend a webcam with a CCD (not a CMOS) unless you are on a very tight budget, and are only interested in imaging the brightest celestial objects.
- Use a f/no. to meet the Nyquist sampling criterion (Nv = 2), but try 3 to 4 if there is enough light and enough fov.
- Use a refractor to reduce scattering, or a reflector with the fewest optical surfaces.
- Consider using a Barlow or an eyepiece designed for eyepiece projection. Don't use an old eyepiece which might have a few hard to reach dusty surfaces.

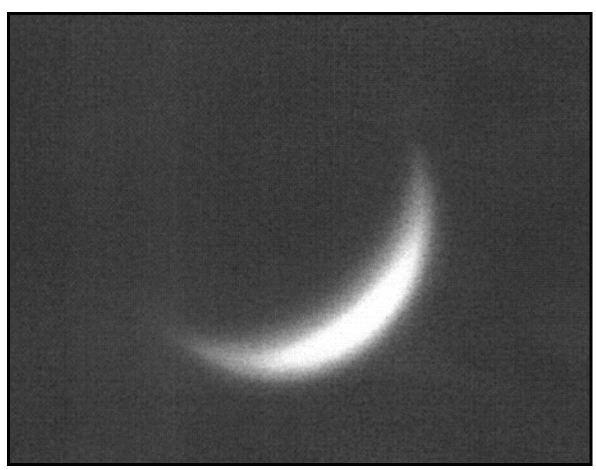

Figure 7 – Venus, 12 May, 2004, 20:50 UT, 9 images.

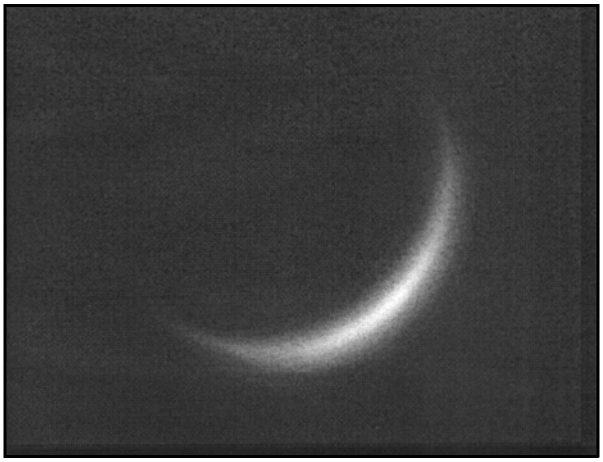

Figure 8 – Venus, 21 May, 2004, 19:16 UT, 7 images.

- Keep all optics clean by frequent washing and by using covers, plastic bags, and tarps.

- Align or collimate the optics to get the sharpest possible on-axis images.

- Use a telescope mount with good tracking and slow motions – the field of view will be extremely narrow.

- Align the mount to reduce any declination drift to a small value, then balance the tube and adjust the clutches to optimize both for easy centering and wind resistance.

- Minimize temperature gradients both in and around the telescope – good seeing is a must.

- It also goes without saying (but here it is anyway), observe as often as possible.

- If color is important, observe near the meridian or use a Risley prism (a weak prismatic wedge) to null atmospheric chromatic dispersion. If color is unimportant, and the object is sufficiently bright, consider using a filter to minimize dispersion; and make a black and white print.

- At a convenient interval, refocus the telescope for best focus. At best focus, you should see a few fleeting images that are sharper in a vast multitude of poorer ones. Use a bright star or planetary satellite if the planet is difficult to focus.

- Set the time limit and frame rate to suit your particular needs and the object being imaged. If adjacent images are duplicates, try reducing the frame rate – duplicate images waste file space and needlessly slow down RegiStax. If the time limit is too long, the file may be too large for you and your computer to manage. (Expose one video at the maximum frame rate and time limit to determine your limits.) A good starting point for the Quickcam is to use 10 frames per second (fps) for 20 seconds. This video file or snippet will have 200 frames, and will be about 2.5 Mb in size.

- Get a good signal to noise ratio (i.e., image density) without over or underexposure. This may require switching from Auto to User mode to manually adjust the exposure times. This may result in a higher or lower frame rate – one influences the other.

- A small image drift helps a lot in removing dark spots due to dust and blemishes (in the final composite).

- Expose flat frames to more fully remove the effects of spots and vignetting.

- Shoot perhaps 20 to 50 video files per object. For 50 files, this would be 10,000 frames! Err on taking too much data – bad files can be easily deleted.

- Understand the power of RegiStax. Start by compositing the best 5 or more frames from each video file. This also aids in determining a good video file size.

- Remember what the photos are to be used for; and adjust the color, density, contrast, and print size accordingly.

- Develop a simple but effective video archive storage system – perhaps back up your original videos to CD-R's. A 700 Mb CD-R will hold about 280 video files that are 2.5 Mb in size. I first make a CD backup of all video for that date, then I view it and make composites; and then I file it – never writing to it again.

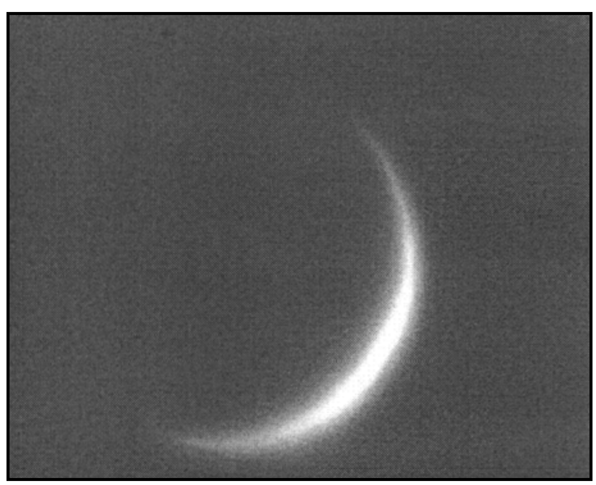

Figure 9 – Venus, 22 May, 2004, 19:51 UT, 8 images.

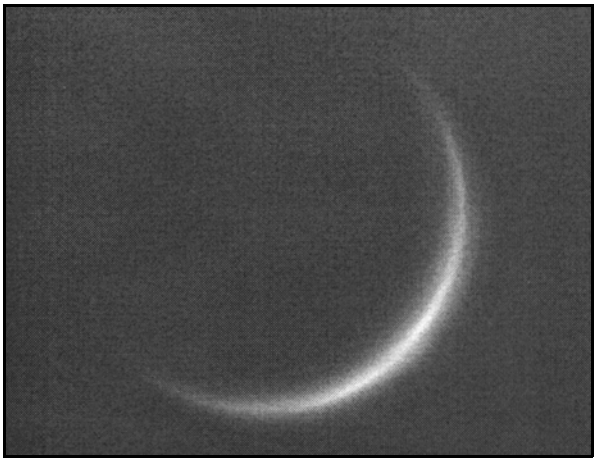

Figure 10 – Venus, 31 May 2004, 17:32 UT, 8 images.

With lots of video at hand, you can practice the art of making composites. This involves selecting the best frames, aligning those frames, stacking the frames; and finally enhancing the composite with a variety of image processing tools. If things turn out bad, you can reset the composite to its initial conditions and try again. There are perhaps a half-dozen video compositing programs available, and I chose RegiStax for no particular reasons other than it fits on a single 1.4 Mb floppy disk and it was easy to use.

## RegiStax

This powerful software tool is available at http://aberrator.astronomy.net/registax/ and has 4 main functions – input files, frame alignment, frame stacking, and image processing. Mine is Version 1.1 and is a few years old with newer versions now available; but it was free, and it fills all my needs. After downloading, create a DOS directory (such as "RS") and install it and your other input files into the same directory. RegiStax can use AVI, BMP, JPG, FITS, and TIF files. Invoke the program in DOS by typing "registax", or you can use a Windows run command "run C:\RS\registax.exe". References 4, 5, 12, 18, 19, and 20 are excellent guides to video and webcam imaging.

### RegiStax Input Files

The "Start: window allows you to choose an input file, input a dark frame, and input a flat frame. After the input movie file is identified, you may use it to create a single dark or flat frame. If your chip has dust, blemishes, or noticeable dark current, take a short video to create these frames; but using established CCD deep-sky imaging guidelines. These frames are applied automatically when the composite is made. If the input movie is in color, check the color box. Uncheck this box if you desire to work in black and white. I also prefer the full deinterlace option.

### RegiStax Frame Alignment

If the imaging chip is large enough, you should use the 256 (or larger) pixel size alignment box. This will produce better alignment over a larger field of view than a smaller box. Check the show frame list box to view the input file as individual frames. Review some frames and record the numbers of a few best ones. A good frame should be used as the initial reference image for all subsequent image alignment. Later, you can view the best frames box to see the best frames selected by RegiStax. After you have found the very best frame, you may wish to repeat the process using this one as the reference. Check the "Show FFT Spectrum" dialog to see the FFT evaluation.

Now place the alignment box over the entire planetary disk or a high contrast lunar feature. The aim is to create an FFT icon that is small and fairly round. If it is large, very elongated, or otherwise strange, the alignment may be poor, or it may fail altogether. If the alignment is poor, the composite will be fuzzy. If the alignment fails, the alignment box will jump around or disappear. To see a good FFT icon, try using a short home movie file with lots of fine image detail.

To modify the FFT, check the two boxes below graphs – "Show Graph" and "Show FFT". "Show Graph" displays the registration properties box. This box has a red line to show the reference image power spectrum. This appears as the right half of a fairly Gaussian distribution with a tail to the right. The blue and green lines are moved by changing the values for the FFT filter pixels, and the quality estimate pixels. The blue line should be placed in the tail just to the left of any hump, or where the tail begins to flatten. The green line should be placed just to the right of where the tail reaches a zero value. The area between the blue and green lines represents the highest resolution data in each image. As each image is evaluated, you

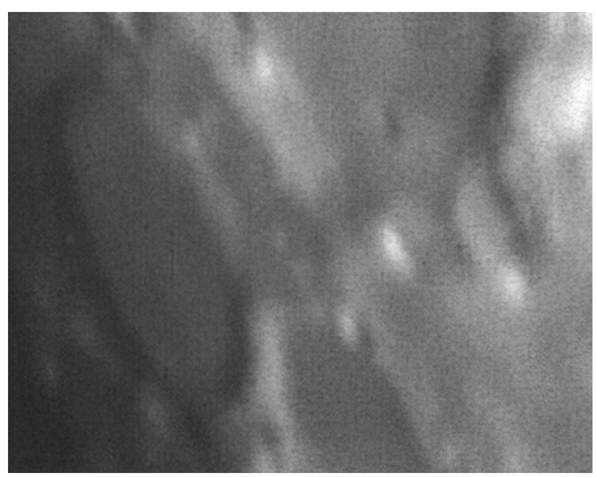

Figure 11 – Lunar crater Wargentin, 1 June 2004, 4:29 UT, 22 images.

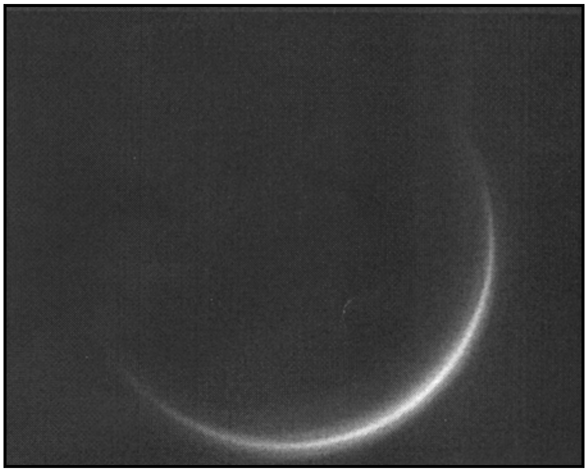

Figure 12 – Venus, 2 June 2004, 17:34 UT, 5 images.

will see this part of the red line rise and fall in response to its quality. You must recompute the FFT if you move the blue or green line – this modifies the FFT.

There are still two optimizing options to consider before starting the alignment. First is the "% Image Quality" (the FFT fit) to use in the alignment testing. I usually start at 95%, see how many images are this good (n), and then decrease the quality to a lower value to increase the number of images in the composite. A good approach is to make many composites from 95% to 70% quality. In the final step of RegiStax layer processing, you can decide which composite really works best to show the desired features.

Second, the user should decide on a final registration value (optimize until %) for terminating alignment. The default, and minimum value, is 1%. Registax will pass through the image file many times to reduce image excursions to 1%, but it might take many, many passes. My 1.6 GHz computer requires 15 minutes to loop 10 times through a 200 image file, and a slower computer may be prohibitively long. One could decrease this tolerance or change other alignment parameters to speed processing. You can also reduce pass times by examining each image visually and checking it as a frame to either align or ignore.

Initiate the alignment by clicking on "Align" or "Align and Stack". I prefer to proceed one step at a time to better evaluate the compositing. After any alignment, the user can override the "% Image Quality" factor and thus increase or decrease the number of images stacked. Display the image quality graph found in the stackgraph box. The frames are ordered with best at the left and worst at the right. Move the quality cutoff red line to the right to include lower quality images, or left to only include the best. You can also move the upper horizontal line down to exclude frames with spikes. These are often inferior, but you might examine them to see why they scored poorly.

### RegiStax Frame-Stacking

Click on "Stack and Monitor the Image" and "Stack List" to see if any blurred frames were included. If so, these frames can be removed in two ways – edit the frame input list in pre-alignment, or the stacking list in post-alignment. It is wise to view each image in the stack list to skip poor images near the top of the list, and include good images farther down. These images can be very good in some areas, but blurred elsewhere – I call them "Janus" frames. These require a judgment call for inclusion or exclusion. I would exclude them if they represent 10% or more of the composite; but try it both ways and see if it makes a difference.

### RegiStax Image Processing

After invoking image processing, a composite is displayed without any supplementary image processing. Save the composite and then see if further processing helps. If you make a mess of the image, press "Reset" to restore the initial composite. If you used only 10 or 20 images in the composite, further processing may have minimal value. Nevertheless, it is extremely educational to try all the adjustments to fully understand the power of RegiStax.

I first increase the contrast by clicking in the "% Gamma" box. The image usually improves with each click regardless of the number of input images; but stop before it becomes excessive. I never vary the histogram/ gamma curves, or the brightness/contrast sliders; but experiment – you can always reset the image. I increase the contrast first before adjusting any of the 7 wavelet layers, because the layer settings require readjustment if the contrast is increased last.

A wavelet layer is an unsharp mask. Using an unsharp mask lets the user increase the overall contrast in an image without another part of that image becoming lost. The old darkroom analog of this process is called "photographic dodging" – where the user might place his cupped hands in the beam of light from the photographic enlarger to prevent the limb of a planet from "burning-in" to the sky background. This action modifies the density of the largest scale features (the entire limb and terminator), and is akin to layer #7 in RegiStax.

Layer #1 is the unsharp mask for the smallest features – those at the limit of telescopic resolution. Mr. Cor Berrevoets is the author of RegiStax and states, "Layer 1 (the top slider) will always have the most details"[18]. All 7 layers can be adjusted from -5 to 50; and are set to a default value of 1.

A 10- or 20- image composite can only take a little unsharp masking before it begins to show a mottled pattern, but a 200-image composite can take much more masking. After a good composite is made, save all settings by clicking on "Save Project". The composite can be enlarged or cropped with a simple image editing program supplied with many webcams or CCD cameras. If you have a more sophisticated image editing program, you can cut and paste multiple composites made from Janus images into a better quality composite.

## Photographs

My astronomical illustrations are black and white composites of color video with my Veo (figures 3 and 4) and Quickcam (figures 5, 6, 7, 8, 9, 10, 11 and 12). All have some degree of contrast increase, but there is no unsharp masking. I observed on any date from March 31 to June 2, 2004 that had clear skies (regardless of the seeing). These dates do not include vacation and sick time, thus I only have photos on 8 out of 43 possible dates. I've included at least one photo for each date to illustrate my seeing quality, rather than publish only photos on the best dates. This gives a much better perspective on how well a webcam really performs in any routine observing program.

Two dates deserve special mention because I obtained sub-arcsecond resolution on 12 frames total. April 12 had average seeing, but excellent seeing on about 20 frames. About 2/3 of these frames were Janus images and were left out of the final 7 image composite. June 2 also had average seeing, but excellent seeing on about 15 frames. Again, about 2/3 of these were Janus images and were left out of the final 5 image composite. I estimate the resolution on these 12 frames at about 0.6 arc-seconds — Dawes limit for an 8-inch telescope.

## Observations

I had intended to include some Venus photographs nearer its 2004 inferior conjunction than June 2; but bright and hazy skies thwarted those plans. My finders had 18- and 24-inch long black cardboard tubes to exclude solar glare, and the 8-inch telescope had a 3-foot square cardboard sunscreen (with a 9-inch diameter hole) held with a lightweight spar 8-feet in front of the telescope. Even with internal optical solar glare reduced to nil, I was not able to observe Venus on either June 8 or 9. I finally did see Venus on June 10 at 16:30 UT – some 2.34 days after inferior conjunction and when it reached 3.74 degrees western elongation from the Sun.

The brightest portion of the crescent was about twice the brightness of the daytime sky (which was average for that day). The faint limb extended about 60 degrees on either side of the subsolar point. Venus was only visible in the 8-inch at 50X with great difficulty; and was invisible in the 8x35 mm finder and the 20x50 mm guidescope. No photography was attempted. I now realize that the sky background intensity was greater than the surface brightness of Venus on June 8 and 9 because the skies were brighter and Venus was closer to the Sun.

## Conclusions

My Venus and lunar photos on March 31 and April 1 were the best that I had ever taken up to that date, even though it was my first attempt with a webcam. Why? I believe that image visualization, comfort, and ease of use play a major role. You can easily tell when comfortably seated and looking at a TV screen if the image is centered, focused, and the current state of seeing. It is all too easy to click the mouse when everything looks good, tweak the focus and click it again and again – taking many dozens of video snippets.

The seeing for Venus was average to poor on all 8 dates, because I observed in the daytime with the Sun quite high. I took about 20,000 Venus images per day (160,000 total), and was surprised to find 12 near-perfect images taken on 2 dates with average seeing. I did not find any excellent images when the seeing was less than average. I very seriously doubt I would have found any great images if I had exposed only one roll of film each day. Video imagery vastly improves the odds for getting that great or near-perfect image. If one is lucky enough to have excellent seeing and a composite with many hundreds of images, unsharp masking can reveal very subtle albedo features at (and much beyond) the limit of telescopic viewing.

## Kudos

Amateur astronomers owe immeasurable thanks to those who have created free or inexpensive software programs for compositing video images. Compositing used to be quite labor-, time-, and cost-intensive, and was done only at observatories and by advanced amateurs. It required exposing a lot of expensive film or plates at the telescope, processing the raw imagery, compositing images, processing composites; and then making prints from the composites. Nowadays, one can make composites hundreds of times faster, cheaper, and better than anyone could have dreamed 40 years ago.

## References

### For Online Readers

Left-click your mouse on items in blue text to jump to source material or information about that source material.

[1] Logitech Inc. Web page: http://www.logitech.com; postal address: 6505 Kaiser Drive, Fremont, CA. 94555-3615, sales and information center telephone: (800) 231-7717.

[2] Logitech Quickcam Pro 3000 Long Exposure Modification. Web page: http://www.unm.edu/~keithw/quickcamPro 3000mod.html.

[3] SAC 7b Color CCD Camera-SAC7b from Digitec Optical, March 2004. Web page: http://www.digitecoptical.com/ccd-sac7b.htm;
telephone: (888) DARK SKY.

[4] Moore, David. August 1999. Video of the Stars, *Sky & Telescope*, Vol. 98, No. 2, p. 61-64.

[5] Dantowitz, Ron. August 1998. Sharper Images Through Video, *Sky & Telescope*, Vol. 96, No. 2, pp. 48-54.

[6] *Supercircuits 2004 Catalog*, One Supercircuits Plaza, Liberty Hill, TX. 78642, telephone 1-800-335-9777.

[7] Schiralli, Frank. Spring 2002. *Journal of the Assn. of Lunar & Planetary Observers*, Vol. 44, No. 2, p. 2 and cover.

[8] Parker, Donald C. December 2003. *Sky & Telescope*, Vol. 106, No. 6, p. 139.

[9] Garcia, Gordon. Winter 2001. A New Solar Filter Material – Baader Planetarium Astrosolar. *Journal of the Assn. of Lunar & Planetary Observers*, Vol. 43, No. 1, p. 29.

[10] Higgins, Wes. March 2004. *Sky & Telescope*, Vol. 107, No. 3, p. 140.

[11] Gu, Yu. July 2003. *Sky & Telescope*, Vol. 106, No. 1, p. 139.

[12] Garcia, Gordon. Summer 2003. High Resolution Solar Imaging, *Journal of the Assn. of Lunar & Planetary Observers*, Vol. 45, No. 3, pp. 16-20.

[13] Go, Christopher. July 2004, *Sky & Telescope*, Vol. 108, No. 1, p. 142.

[14] Yen, I.C. August 2003. *Sky & Telescope*, Vol. 106, No. 2, p. 139.

[15] Grafton, Ed. Winter 2004. *Journal of the Assn. of Lunar & Planetary Observers*, Vol. 46, No. 1, p. 30.

[16] Chan, T.P. June 2003. "Cloudy Nights Telescope Review-Philips ToUCam Pro", p. 4., e-mail: oldfield@sinaman.com.

[17] Leong, Tan Wei. October 2003. *Sky & Telescope*, Vol. 106, No. 4, p. 138.

[18] Berrevoets, Cor. April 2004. Processing Webcam Images with RegiStax, *Sky & Telescope*, Vol. 107, No. 4, pp.130-135.

[19] Buchanan, John. June 1998. QuickCam Astronomy, *Sky & Telescope*, Vol. 95, No. 6, pp. 120-122.

[20] Cidadao, Antonio Jose. December 2001. Thoughts on Super-Resolution Planetary Imaging, *Sky & Telescope*, Vol. 102, No. 6, pp. 127-134.

Since Mr. Minton's article was written, webcam imaging has become even more popular.

(From http://www.Meade.com) Meade's exciting new LPI (Lunar Planetary Imager) can be used on any telescope for making images! It's VGA resolution (640x480) color CMOS chip is capable of creating high-quality lunar and planetary images, as well as daytime terrestrial images. And with the capability to make long exposures, you can digitally capture bright deep sky objects with the LPI system that only costs a fraction of a typical astronomical CCD imager system.

With an effective magnification similar to a 6mm eyepiece, the Meade LPI produces images that are inherently high magnification with no additional adapters, making it the perfect tool for imaging the Moon, planets, and small, bright deep sky objects. Using a barlow lens with the LPI will increase the magnification even more, and installing the LPI is just as easy as sliding in an eyepiece.

(From David Haworth's Observational Astronomy website at http://www.stargazing.net/david/toucam/) The Philips PCVC740K ToUcam PRO PC video camera is a small 640x480 color camera designed to used with a computer with an USB interface. The PCVC740K ToUcam PRO has a 1 lux illumination sensitivity which makes it a good camera for bright planets, Moon and Sun. Check technical specifications in the user manual for more details. The PCVC740K ToUcam PRO is operated with Philips VRecord software that controls the camera and saves images in an AVI video file.

The PCVC740K ToUcam PRO has been replaced by PCVC840K ToUcam PRO II.

*Feature Story:*
# The 2004 Perseids

**By** ***Robert D. Lunsford*****, coordinator, ALPO Meteors Section**

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## Introduction

The Perseid showers of the new millennium have been unimpressive when compared to the strong displays that were seen during the last three decades of the 20th century.

All of this changed on the night of August 11/12, 2004, when observers all over the world counted Perseid rates well in excess of one per minute. Many observers, who were able to view in dark skies away from city lights, were able to record in excess of one-hundred Perseid meteors per hour.

This was a very bright shower with a large percentage of the Perseids producing negative magnitudes. The predicted outburst occurred, but produced a slight bump in the rate profile rather than a large spike. Peak ZHR's (Zenith Hourly Rates) for this outburst were estimated at 187. These high rates lasted approximately 15 minutes before dropping off to more normal levels.

## Discussion

The first Perseids were observed on July 11. At this early date, the rates were much less than one shower member per hour. The ZHR reached one near July 17 and slowly climbed as we approached the August 12 maximum. The Full Moon on July 31 made meteor observing difficult during late July and early August. By the time the Moon reached the Last Quarter phase on August 7, observers were reporting Perseid rates as high as nine per hour. This is outstanding, considering that the Moon was still casting a significant amount of light during the morning hours!

Perseid rates exceeded 10 per hour on the following night and reached 50 per hour early on August 11 (Universal Time). Rates reached 100 per hour near 20:30 UT on August 11 and peaked 25 minutes later. Visual observers were hampered by the many faint meteors that occurred near the time of outburst. Those observers viewing in less than pristine conditions missed many of these faint meteors. Video recordings of the Perseid activity helped immensely in determining the exact time of the peak rates. After a dip of the ZHR's down to 82 near 22:45 UT, rates again climbed and reached the annual peak near 2:25 UT with ZHR's near 150. ZHR's remained above 100 until approximately 18:30 UT. This means that all of Europe, the North Atlantic Region, North America and the Eastern Pacific Region were able to view the Perseids with ZHR's over 100. Actual rates would have varied, depending on the local conditions. Figure 1 represents a graph of the Perseid activity.

Personally, I myself was able to view the Perseids on the mornings of August 11 and 12 from the mountains of San Diego County away from city light. Unfortunately, our usual coastal stratus was absent on both mornings which created a large light dome in the western sky. The waning crescent moon was also a slight nuisance when it rose late in the morning. Table 1 lists my own Perseid magnitude estimates and Table 2 lists my own meteor counts for both mornings.

Other ALPO members are invited to send the Meteor Section coordinator their Perseid results. A table of the observations received will be published in the March issue of the ALPO Meteors Section Newsletter.

The outlook for the Perseids in 2005 is even better than this year. Although there is no forecast for an outburst next year, impressive rates should continue. More good news is that the Moon will be near its First Quarter phase and will set by 1 a.m. local daylight time for most locations, allowing the early morning hours to be free of moonlight.

## Reference

Arlt, Rainer (2004). 2004 Perseids, *Analysis 1-4, IMO Shower Circulars*.

**Table 1: Perseid Magnitudes by Lunsford for Aug 11 & 12, 2004**

| Shower | Magnitude (Qty Observed) | Average Magnitude |
|---|---|---|
| **August 11, 2004** | | |
| ANT: | -1 (1) 0 (1) +1 (2) +2 (2) +3 (1) +4 (4) +5 (1) | +2.42 |
| PER | -7 (1) -5 (2) -4 (2) -3 (1) -2 (4) -1 (9) 0 (16) +1 (17) +2 (27) +3 (24) +4 (17) +5 (8) +6 (1) | +1.67 |
| NPX | 0 (0) +1 (0) +2 (0) +3 (2) +4 (1) +5 (0) +6 (0) | +3.33 |
| SPX: | 0 (0) +1 (2) +2 (1) +3 (1) +4 (0) +5 (0) +6 (0) | +1.75 |
| SPO | -3 (1) 0 (1) +1 (1) +2 (6) +3 (3) +4 (10) +5 (9) +6 (2) | +3.52 |
| **August 12, 2004** | | |
| ANT: | -1 (0) 0 (1) +1 (0) +2 (3) +3 (1) +4 (1) +5 (0) | +2.17 |
| KCG | -1 (0) 0 (1) +1 (0) +2 (1) +3 (0) +4 (0) +5 (0) | +1.00 |
| PER | -5 (3) -4 (1) -3 (5) -2 (5) -1 (11) 0 (25) +1 (45) +2 (71) +3 (64)+4 (40) +5 (21) +6 (0) | +2.02 |
| SPX: | 0 (1) +1 (0) +2 (1) +3 (1) +4 (0) +5 (0) +6 (0) | +1.67 |
| SP: | -5 (1) 0 (1) +1 (3) +2 (12) +3 (12) +4 (10) +5 (9) +6 (0) | +2.98 |

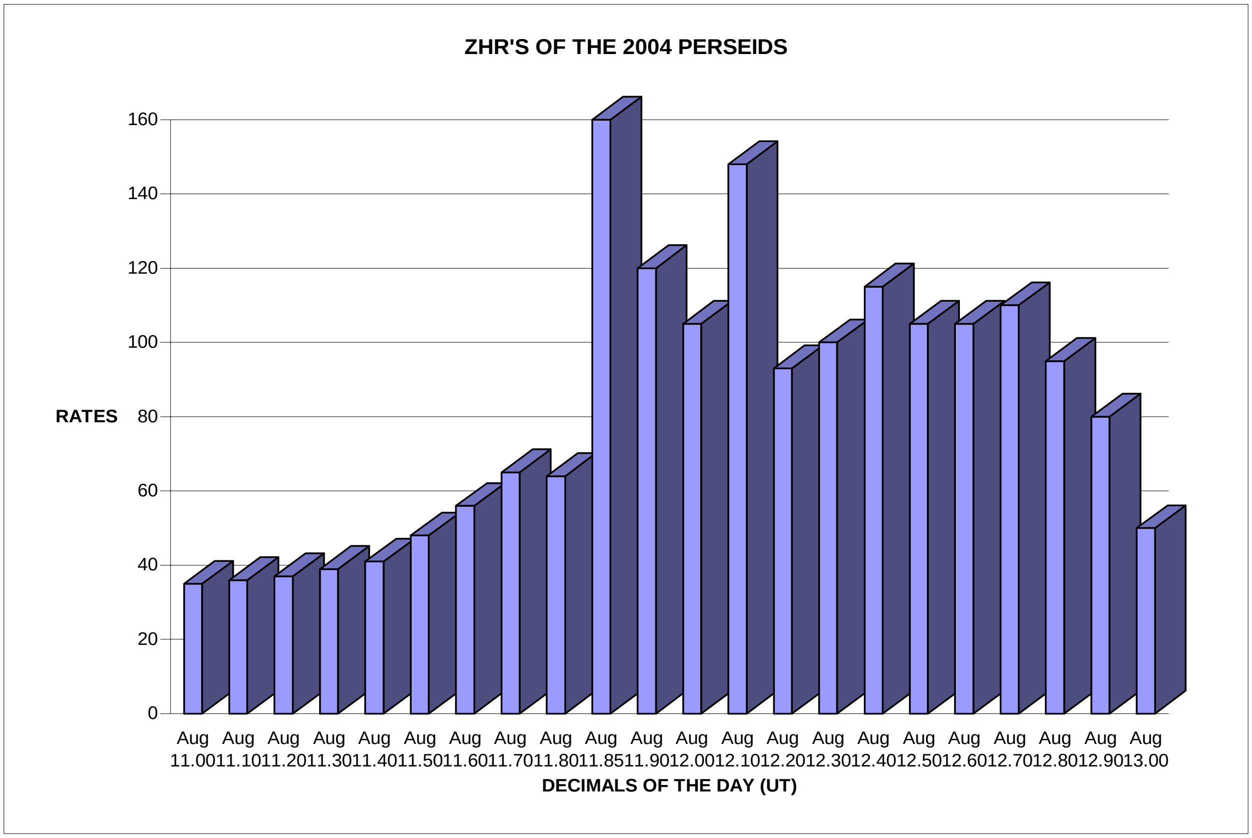


Figure 1: Graph of the 2004 Perseid Meteor Shower Activity by Lunsford.

**Table 2: Meteor Counts by Lunsford for Aug 11 & 12, 2004**

| August 11 | % Obs. | Lim. Mag | Qty and Shower | | | | | | Totals |
|---|---|---|---|---|---|---|---|---|---|
| 0758-0900 UT | 1.03 | 6.64 | 5 ANT | — | 25 PER | 1 NPX | 0 SPX | 11 SPO | 42 TOTAL |
| 0900-1000 UT | 1.00 | 6.59 | 3 ANT | — | 36 PER | 0 NPX | 2 SPX | 11 SPO | 52 TOTAL |
| 1000-1100 UT | 1.00 | 6.58 | 3 ANT | — | 30 PER | 0 NPX | 0 SPX | 4 SPO | 37 TOTAL |
| 1100-1200 UT | 1.00 | 6.46 | 1 ANT | — | 36 PER | 2 NPX | 2 SPX | 7 SPO | 48 TOTAL |
| TOTALS | 4.03 | 6.57 | 12 ANT | — | 127 PER | 3 NPX | 4 SPX | 33 SPO | 179 TOTAL |
| Augsut 12 | | | | | | | | | |
| 0545-0645 UT | 1.00 | 6.43 | 0 ANT | 1 KCG | 16 PER | 0 NPX | 0 SPX | 2 SPO | 19 TOTAL |
| 0645-0745 UT | 1.00 | 6.39 | 2 ANT | 0 KCG | 49 PER | 0 NPX | 0 SPX | 16 SPO | 57 TOTAL |
| 0745-0845 UT | 1.00 | 6.44 | 2 ANT | 0 KCG | 35 PER | 0 NPX | 0 SPX | 8 SPO | 45 TOTAL |
| 0845-0945 UT | 1.00 | 6.39 | 2 ANT | 0 KCG | 73 PER | 0 NPX | 2 SPX | 8 SPO | 85 TOTAL |
| 0945-1045 UT | 1.00 | 6.34 | 0 ANT | 0 KCG | 79 PER | 0 NPX | 1 SPX | 18 SPO | 98 TOTAL |
| 1045-1145 UT* | 1.00 | 6.31 | 0 ANT | 1 KCG | 39 PER | 0 NPX | 0 SPX | 6 SPO | 46 TOTAL |
| TOTALS: | 6.00 | 6.38 | 6 ANT | 2 KCG | 291 PER | 0 NPX | 3 SPX | 48 SPO | 350 TOTAL |

NOTE: Column 1 = The time period watched stated in Universal Time (UT), which is PDT + 7 hours; Column 2 = The percent of that particular hour actually spent observing the sky (1.00 = 100%); Column 3 = .The average limiting magnitude estimated during each period; Final columns = The activity seen during each period; Misc. = I was facing north northwest at an altitude of 50 degrees during the entire session. No breaks were taken. ANT = Antihelion radiant, KCG = Kappa Cygnids, PER = Perseids, NPX = Northern Apex, SPX = Southern Apex and SPO = Sporadics (random activity).

## ALPO Feature: Mercury
# Mercury Apparition Observations of 2002

By Frank J. Melillo, ALPO Mercury Section coordinator at FrankJ12@aol.com
Peer review by John Westfall at johnwestfall@comcast.net

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## Abstract

The most noteworthy feature of the seven apparitions of Mercury in 2002 is the significant increase in the number of excellent high-resolution drawings and images submitted, with a total of 53 sketches, 15 sets of CCD images and 8 webcam images contributed by 13 observers using apertures from 7.8 to 27 cm. The features reported show good correlation with the official IAU albedo chart prepared by A. Dollfus and J. Murray (1971).

## Introduction

There were seven apparitions of Mercury in 2002, with three morning and four evening elongations (*Table 1*). In addition, the 13 ALPO observers of these apparitions (*Table 2*) made a significant number of independent simultaneous observations. The quality of observations has greatly improved over the years, due largely to improved techniques and Internet communication. There has also been an explosion of webcam imagery, providing another way of capturing this planet at high resolution.

The year 2002 also marked the first Pro-Am collaboration in observing Mercury. This was organized by Dr. Ann Sprague and her student Josh Emery of the Lunar and Planetary Laboratory, Tucson, AZ, and by Dr. Johan Warell of Uppsala University in Sweden, who announced a Mercury Observing Campaign for May and June. Dr. Sprague did spectroscopic work at the Mauna Kea Infrared Telescope Facility, Hawaii, and Dr. Johan Warell conducted albedo studies with the Swedish Vacuum Solar Telescope in the Canary Islands.

In March 2002, Dr. John K. Harmon and Donald B. Campell of the Arecibo Radio Telescope, Puerto Rico, announced the discovery of a young crater in the unmapped region of the planet . The 85-kilometer crater, situated between 340° – 360° longitude and –25° and –40° latitude, has a large splash-like appearance. A "radar image" was taken in June 2001 when Mercury was near inferior conjunction and near aphelion, hence near its closest to Earth.

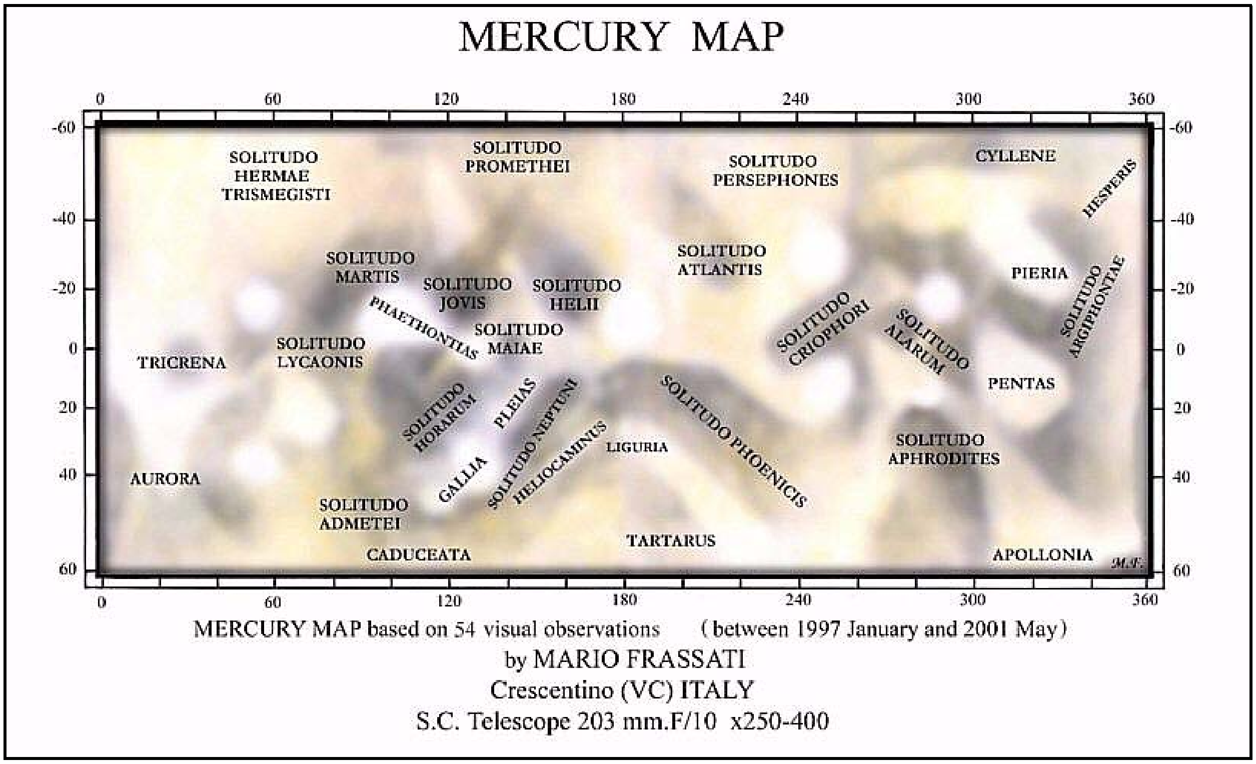
## Apparition 1, Evening, 2001 Dec 04 – 2002 Jan 27; CM = 260° - 175°

Mario Frassati made drawings on 2001 Dec 22 and 27 at CM (central meridian) longitudes of 345° and 007°, respectively, both showing what appeared to be a large bright spot [*Figure 1*]. This appears to be the

**Table 1: Characteristics of the Apparitions of Mercury in 2002 (all dates UT)**

| Number and Type | Beginning Conjunction* | Greatest Elongation | Final Conjunction | Aphelion | Perihelion |
|---|---|---|---|---|---|
| 1. Evening | 2001 Dec 04 (s) | 2002 Jan 11 19°E | 2002 Jan 27 (i) | 2001 Dec 06 | 2002 Jan 19 |
| 2. Morning | 2002 Jan 27 (i) | 2002 Feb 21 27°W | 2002 Apr 07 (s) | 2002 Mar 04 | ---------------- |
| 3. Evening | 2002 Apr 07 (s) | 2002 May 04 21°E | 2002 May 27 (i) | ---------------- | 2002 Apr 17 |
| 4. Morning | 2002 May 27 (i) | 2002 Jun 21 23°W | 2002 Jul 21 (s) | 2002 May 31 | 2002 Jul 14 |
| 5. Evening | 2002 Jul 21 (s) | 2002 Sep 01 27°E | 2002 Sep 27 (i) | 2002 Aug 27 | ---------------- |
| 6. Morning | 2002 Sep 27 (i) | 2002 Oct 13 18°W | 2002 Nov 14 (s) | ---------------- | 2002 Oct 10 |
| 7. Evening | 2002 Nov 14 (s) | 2002 Dec 26 20°E | 2003 Jan 11 (i) | 2002 Nov 23 | 2003 Jan 06 |

* (i) = inferior conjunction, (s) = superior conjunction




area of the crater registered by the Arecibo Radio Telescope. In fact, Frassati drew the area three months before the discovery of the crater was announced! The bright area is not the crater itself, but rather the ejecta ray system such as is seen about Copernicus and Tycho on the Moon. According to the 1971 Mercury chart by Dollfus and Murray, it appears to be a bright area in the Pieria region. We

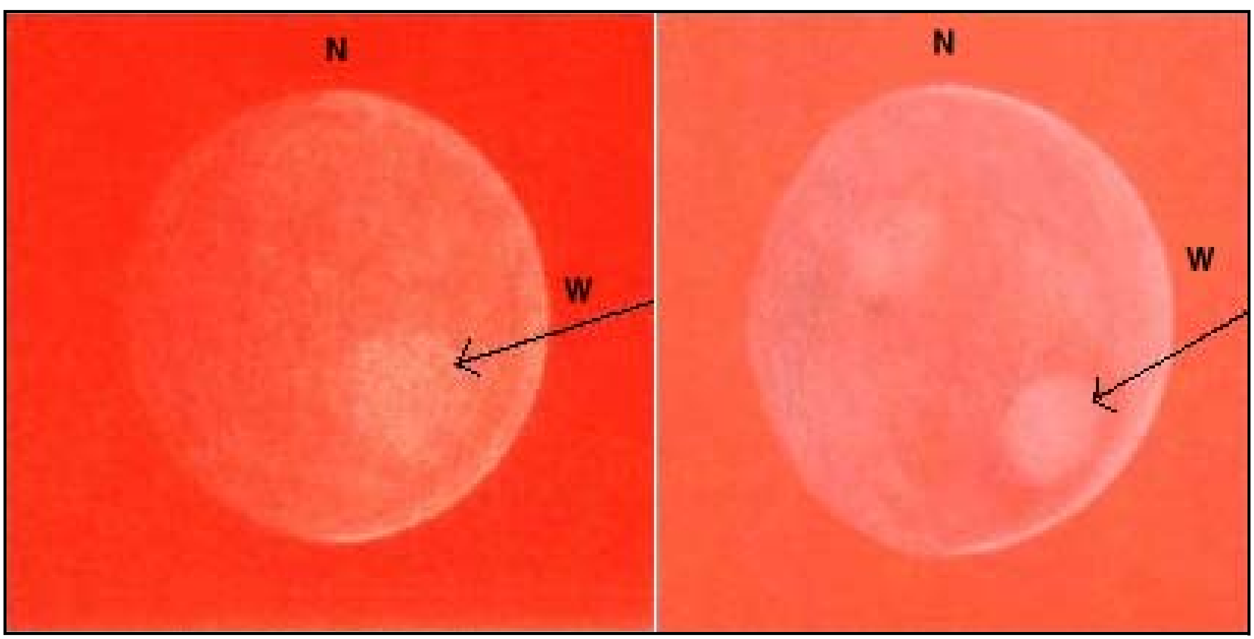



Figure 1. Two drawings of Mercury made during daytime by Mario Frassati with a 20.3-cm Schmidt-Cassegrain telescope and a W21 (orange) Filter. In each drawing the arrow indicates the location of the newly discovered crater in the Pieria region. (left) 2001 Dec 22, 11h40m UT, 160X, seeing Ant. IV (poor), 95.9% phase, 4".93 disk Dia., CM 345°. (right) 2001 Dec 27, 11h00m UT, 250X, seeing Ant. II-III (good-moderate), 92.2% phase, 5".16 disk Dia., CM 007°. (Mercury's north pole is at top in Figures 1-7.) Note: the Antoniadi Seeing Scale: I, Perfect; II, Slight quivering of the image with moments of calm lasting several seconds; III, Moderate seeing with larger air tremors that blur the image; IV, Poor seeing (constant troublesome undulations of the image); V, Very bad seeing, hardly stable enough to allow a rough sketch to be made.

may have to take another look when the viewing geometry is favorable to verify this supposition.

Frassati drew Mercury again on 2002 Jan 1, 12 and 21. All three sketches show a marking just south of the equator, identified as Solitudo Martis, along with a bright spot near the limb on the Jan 21 drawing. On 2002 Jan 12, Frassati drew Mercury one-half day after greatest elongation. Ricardo Nunes took webcam images on 2001 Dec 24, and Frank J. Melillo obtained CCD images on 2002 Jan 12. Both sets show a possible albedo marking, which needs to be verified.

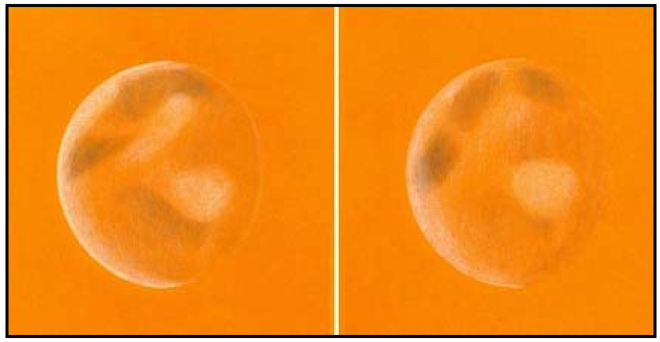


Figure 2. Drawings of Mercury made during daytime by Mario Frassati with a 20.3-cm Schmidt-Cassegrain telescope and a W21 (orange) Filter. (left) 2002 Mar 23, 09h45m UT, 222X, seeing Ant. III-IV (moderate-poor), 90.8% phase, 5".14 disk Dia., CM 115°. (right) 2001 Mar 24, 10h30m UT, 250X, seeing Ant. II-III (good-moderate), 91.6% phase, 5".12 disk Dia., CM 119°.

## Apparition 2, Morning, 2002 Jan 27 – Apr 07; CM = 175° - 176° (full rotation plus 1°)

This apparition was unfavorable for northern-hemisphere observers, and Mario Frassati was the only observer, making four drawings. Despite difficult observing condition, he made two excellent drawings on 2002 Mar 23 and 24, at CM longitudes 114° and 119° respectively (*Figure 2*). Solitudo Neptuni may be the darkest feature he drew along the southeast portion of the disk. Two bright areas, one circular, the other elongated, may be Pleias and Phaethontias. On his other two drawings, made on 2002 Mar 31 and Apr 1, at CM 149° and 154°, respectively, rotation had shifted the features identified earlier slightly westward.

## Apparition 3, Evening, 2002 Apr 07 – May 27; CM = 176° - 74°

Seven observers took advantage of this favorable apparition, obtaining 19 drawings, 5 sets of CCD images and 3 webcam images — an unusually large contribution. In addition, Dr. Johan Warell of Uppsula University, Sweden, and Dr. Ann Sprague of Lunar and Planetary Laboratory, Tucson, announced a Mercury Observing Campaign in which six ALPO Mercury section members took part. Twenty-six observations were received, some made simultaneously. For example, on 2002 May 05 Sostero and Frassati observed Mercury at 16:55 UT and 18:15 UT, respectively, their observations being made near

**Table 2: ALPO Observers of Mercury in 2002**

| Observer | Location | Instrument* | Number and Type of Observations** | Apparitions Observed |
|---|---|---|---|---|
| Michael Amato | West Haven, CT USA | 10.4-cm RR | 1 D | 6 |
| Dan Boyer | Baynton, FL USA | 10.5-cm RR | 1 D | 1 |
| Albino Carbognani | Parma, Italy | 11.0-cm RR | 1 CCD | 4 |
| Brian Cudnik | Houston, TX USA | 31.8-cm NT | 1 D | 7 |
| Robert De Manzano | Milano, Italy | 27-cm NT | 1 D | 4 |
| Mario Frassati | Crescentino, Italy | 20.3-cm SCT | 33 D | 1-7 |
| Darren Hennig | Edmund, AL Canada | 7.8-cm RR | 1 D | 3 |
| Frank J. Melillo | Holtsville, NY USA | 20.3-cm SCT | 14 CCD | 1, 3, 4, 6 |
| Ricardo Nunes | Lisbon, Portugal | 20.3-cm SCT | 4 W, 1 V | 1, 3, 4 |
| Christophe Pellier | Bruz City, France | 8.0-cm RL | 1 W | 6 |
| Giovanni Sostero | Udine, Italy | 15-cm RR | 3 D | 3 |
| Erwin van der Velden | Brisbane, Australia | 20.3-cm SCT | 3 W | 5, 6, 7 |
| Tim Wilson | Jefferson City, MO USA | 9.0-cm RR | 12 D | 3, 4, 6, 7 |

* NT = Newtonian, RL = reflector, RR = refractor, SCT = Schmidt-Cassegrain
** CCD = CCD image, D = drawing, V = video, W = webcam

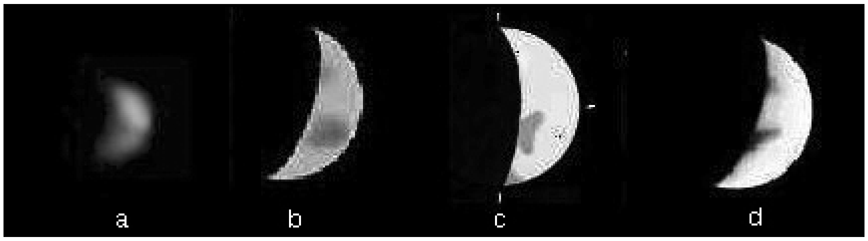



Figure 3. Mercury during its third (evening) apparition in 2002. (a) Image by Frank J. Melillo, 2002 May 3, 23h30m UT, 37.8% phase, 7".91 disk Dia., CM 294°. (b) Drawing by Tim Wilson, 2002 May 5, 01h20m UT, 34.8% phase, 8".14 disk Dia., CM 300°. (c) Drawing by Giovanni Sostro, 2002 May 5, 16h55m UT, 33.1% phase, 8".28 disk Dia., CM 303°. (d) Drawing by Mario Frassati, 2002 May 5, 18h15m UT, 32.9% phase, 8".29 disk Dia., CM 304°.

local sunset. Fifty-five minutes after Frassati, Melillo imaged Mercury in full daylight near his local meridian, at 19:10 UT in the early afternoon New York City local time.

Surprisingly, all recorded the same feature, Solitudo Criophori. Tim Wilson observed Mercury the night before and also recorded the same feature. (Figure 3)

The CM longitudes during prime-time viewing ranged from 269° to 309°. Solitudo Criopheri was the most visible albedo feature, just south of equator near the terminator. Mercury appeared at gibbous phase in mid-April 2002, was predicted to be at dichotomy (half-phase) in late April and as a crescent May 1. Wilson observed apparent dichotomy on April 30, the date of geometric half-phase at 0 hrs. UT.

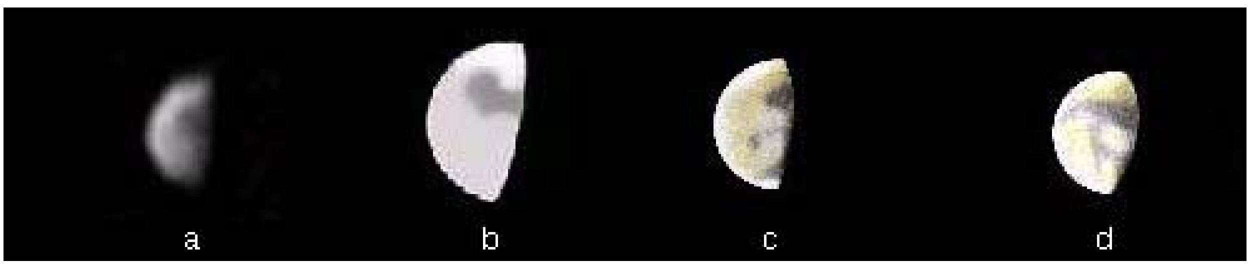



Figure 4. Mercury during its fourth (morning) apparition in 2002. (a) Image by Frank J. Melillo, 2002 Jun 29, 14h00m UT, 56.8% phase, 6".76 disk Dia., CM 269°. (b) Drawing by Tim Wilson, 2002 Jun 30, 10h45m UT, 58.5% phase, 6".63 disk Dia., CM 273°. (c) Drawing by Mario Frassati, 2002 Jul 1, 04h05m UT, 60.5% phase, 6".53 disk Dia., CM 277°. (d) Drawing by Mario Frassati, 2002 Jul 4, 04h30m UT, 69.0% phase, 6".14 disk Dia., CM 290°.

**Table 3: Orientation and Illumination of Mercury at Conjunction in 2002**

| Conjunction UT* | Conjunction Type* | CM (subearth) Longitude † | Subearth Latitude† | Subsolar Longitude †(SSL) | Subsolar Latitude† | Terminator Longitude #1(SSL - 90°) | Terminator Longitude #2(SSL + 90°) |
|---|---|---|---|---|---|---|---|
| 2001 Dec 04 22h | Superior | 264.58 | -1.96 | 264.34 | +0.01 | 174.34 | 354.34 |
| 2002 Jan 27 19h | Inferior | 180.60 | -10.29 | 000.33 | 0.00 | 270.33 | 090.33 |
| 2002 Apr 07 09h | Superior | 177.75 | -2.70 | 178.02 | -0.01 | 088.02 | 268.02 |
| 2002 May 27 07h | Inferior | 076.15 | +3.87 | 255.72 | +0.01 | 165.72 | 345.72 |
| 2002 Jul 21 02h | Superior | 359.87 | +5.00 | 359.62 | 0.00 | 269.62 | 089.62 |
| 2002 Sep 27 19h | Inferior | 354.86 | +7.45 | 175.40 | -0.01 | 085.40 | 265.40 |
| 2002 Nov 14 05h | Superior | 239.16 | -0.26 | 239.11 | +0.01 | 149.11 | 329.11 |
| 2003 Jan 11 20h | Inferior | 179.86 | -9.17 | 359.35 | 0.00 | 269.35 | 089.35 |

*From 2001-2003 Astronomical Almanac. †From JPL SSD Horizons program.

Unfortunately cloud prevented the spectroscopic work planned by Dr. Ann Sprague and Josh Emery with the Infrared Telescope Facility in Hawaii from May 2 -5.

## Apparition 4, Morning, 2002 May 27 – Jul 21; CM = 74° - 360°

The Mercury Observing Campaign continued during this morning apparition. Six observers contributed 12 observations, consisting of drawings and CCD and video imaging. There is good coverage for the two weeks 2002 Jun 29 - Jul 13, with albedo features well shown. Dr Ann Sprague and Josh Emery successfully observed Mercury, doing spectroscopic work from Hawaii on Jun 22 - 25. We await the results of their analysis.

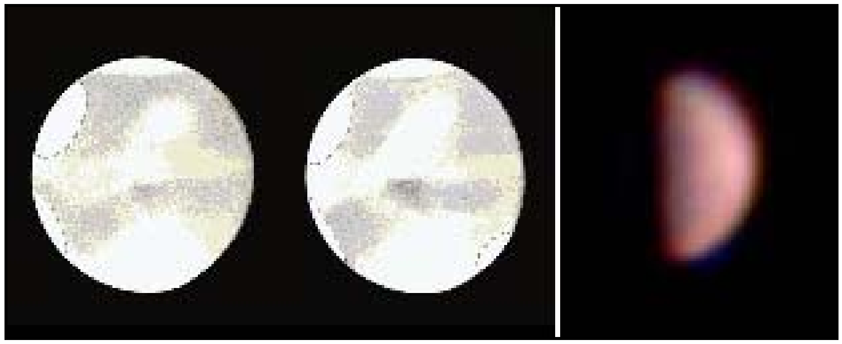


Figure 5. Three views of Mercury's fifth (evening) 2002 apparition. (left) Drawing by Mario Frassati, 2002 Jul 28, 10h35m UT, 20.3-cm Schmidt-Cassegrain, 250X, W21 (orange) Filter, seeing Ant. II-III (good-moderate), 95.6% phase, 5".06 disk Dia., CM 030°. (center) Drawing by Mario Frassati, 2002 Jul 30, 15h00m UT, 20.3-cm Schmidt-Cassegrain, 250X, W21 (orange) Filter, seeing Ant. III (moderate), 93.4% phase, 5".10 disk Dia., CM 039°. (right) Webcam image by Erwin van der Velden, 2002 Sep 5, 08h00m UT, 20.3-cm Schmidt-Cassegrain, 47.7% phase, 7".65 disk Dia., CM 212°.

On 2002 Jun 29, Melillo imaged Mercury at CM 268°. The most prominent dusky feature in the northern hemisphere was Solitudo Aphrodites; this marking is well- shown on drawings by Wilson and Frassati made during the succeeding two days. On 2002 Jul 4, Frassati and Melillo observed almost simultaneously, at CM 290° and 293°, respectively, and were in agreement over the position and aspect of the feature.(*Figure 4*) On Jul 5 at 4:30 UT, Ricardo Nunes obtained a video image which shows a slightly gibbous disk at CM 296°.

Nine hours later, at 15:30 UT (CM 297 °), Melillo imaged Solitudo Aphrodites and perhaps an additional feature to the south of it.

More simultaneous observations took place on 2002 Jul 7. Albino Carbognani and Melillo observed Mercury 7 minutes apart at 9:53 and 10:00 UT, respectively. At CM 304°, both recorded a dark feature just north of the equator, again identified as Solitudo Aphrodites. Carbognani's image agrees with Melillo's visual rendition. Robert De Manzano drew Mercury the next day and saw a dark band-like feature in the north of the planet. More observations were made by Melillo and Frassati on 2002 Jul 11 and 13, respectively, both recording the same details.

Greatest elongation occurred on 2002 Jun 21, but no observations were made until June 29. On that date, Mercury displayed slightly more than a half-disc, two days after geometric half-phase on June 27.

## Apparition 5, Evening, 2002 Jul 21 – Sep 27; CM = 0° - 349°

This was an unfavorable apparition for observers in the northern hemisphere. However, in the southern hemisphere, newcomer Erwin van der Velden of Brisbane, Australia, imaged Mercury 27° from the Sun.

Frassati observed Mercury on 2002 Jul 26, shortly after superior conjunction. From Jul 26 - Aug 1 (CM 022° - 048°), he obtained excellent observations on five days. His drawings all show a possible dark band, identified as Solitudo Tricrena, and a bright area to the north, which was Aurora. All five drawings confirm each other. Frassati observed in daylight, dangerously close to the Sun. He made additional observations on Aug 12 and 14. Both

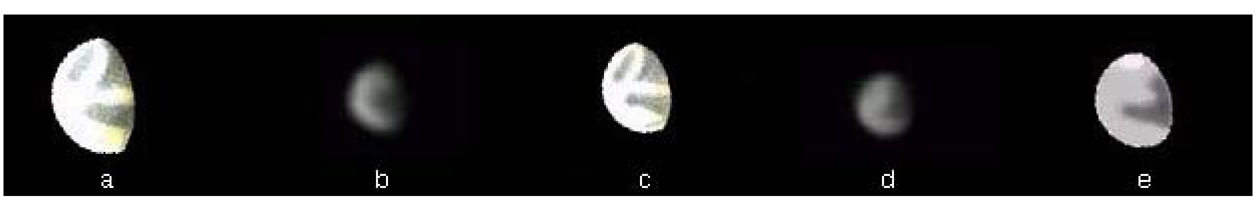



Figure 6. Five views of Mercury's sixth (morning) apparition in 2002. (a) Drawing by Mario Frassati, 2002 Oct 18, 10h02m UT, 73.4% phase, 6".08 disk Dia., CM 118°. (b) CCD image by Frank J. Melillo, 2002 Oct 18, 15h10m UT, 74.1% phase, 6".05 disk Dia., CM 119°. (c) Drawing by Mario Frassati, 2002 Oct 19, 08h45m UT, 76.5% phase, 5".95 disk Dia., CM 123°. (d) CCD image by Frank J. Melillo, 2002 Oct 20, 14h45m UT, 79.9% phase, 5".80 disk Dia., CM 128°. (e) Drawing by Tim Wilson, 2002 Oct 20, 10h23m UT, 79.4% phase, 5",82 disk Dia., CM 128°.

Figure 7. Mercury in its final (evening) apparition of 2002. (left) Drawing by Tim Wilson, 2002 Dec 27, 23h20m UT, 54.1% phase, 7".06 disk Dia., CM 084°. (right) Webcam image by Erwin van der Velden, 2002 Dec 30, 07h41m, 44.2% phase, 7".54 disk Dia., CM 097°.

drawings show a gibbous phase, Solitudos Martis in the south, and Lycaonis in the north, as dark bands, with Phaethontias as a bright area between them.

On Sep 5, at CM 212°,van der Velden made an excellent webcam image of Mercury, using a Vestro Pro Modified CCD webcam. Mercury then displayed a half phase and only slight terminator shading was detected. (*Figure 5*)

## Apparition 6, Morning, 2002 Sep 27 – Nov 14; CM = 349° - 238°

Mercury put on a fine show during this apparition, which was quite favorable for observers in the northern hemisphere. Despite a brief viewing opportunity, with a maximum elongation only 18° from the Sun, the ecliptic was steeply inclined to the horizon, with Mercury's orbit almost vertical in relation. Four observers contributed 11 observations, including several simultaneous observations.

Frassati drew the planet on 2002 Oct 7, at CM 061°, but not much detail could be seen at the then-crescent phase. However, on Oct 12 at CM 088°, he produced a fine drawing showing Solitudos Martis, Jovis, Lycaonis and Horarum. At about the same time, Christophe Pellier obtained an excellent webcam image showing Mercury as a thick crescent with possible albedo markings near the terminator, which corresponded with Frassati's drawing.

**Table 4: Mercury Data for Figures in 2002 Repo**

| Figure | UT | Phase (%)* | Disk Diam. (arc-sec)* | CM (subearth) Long. (°)* | Terminator Long. (°)† |
|---|---|---|---|---|---|
| 1 (left) | 2001 Dec 22 11:40 | 95.9 | 4.93 | 344.70 | 051.43 |
| 1 (right) | 2001 Dec 27 11:00 | 92.2 | 5.16 | 007.33 | 065.08 |
| 2 (left) | 2002 Mar 23 09:45 | 90.8 | 5.14 | 114.59 | 059.76 |
| 2 (right) | 2002 Mar 24 10:30 | 91.6 | 5.12 | 119.10 | 062.55 |
| 3 (a) | 2002 May 03 23:30 | 37.8 | 7.91 | 294.19 | 280.10 |
| 3 (b) | 2002 May 05 01:20 | 34.8 | 8.14 | 299.80 | 282.12 |
| 3 (c) | 2002 May 05 16:55 | 33.1 | 8.28 | 303.22 | 283.41 |
| 3 (d) | 2002 May 05 18:15 | 32.9 | 8.29 | 303.52 | 283.52 |
| 4 (a) | 2002 Jun 29 14:00 | 56.2 | 6.76 | 269.38 | 262.25 |
| 4 (b) | 2002 Jun 30 10:45 | 58.5 | 6.63 | 273.41 | 263.56 |
| 4 (c) | 2002 Jul 01 04:05 | 60.5 | 6.53 | 276.75 | 264.56 |
| 4 (d) | 2002 Jul 04 04:30 | 69.0 | 6.14 | 290.36 | 267.88 |
| 5 (left) | 2002 Jul 28 10:35 | 95.6 | 5.06 | 029.82 | 096.02 |
| 5 (center) | 2002 Jul 30 15:00 | 93.4 | 5.10 | 038.95 | 099.52 |
| 5 (right) | 2002 Sep 05 08:00 | 47.7 | 7.65 | 212.11 | 209.50 |
| 6 (a) | 2002 Oct 18 10:02 | 73.4 | 6.08 | 118.18 | 090.18 |
| 6 (b) | 2002 Oct 18 15:10 | 74.1 | 6.05 | 119.19 | 090.29 |
| 6 (c) | 2002 Oct 19 08:45 | 76.4 | 5.95 | 122.62 | 090.73 |
| 6 (d) | 2002 Oct 20 14:45 | 79.9 | 5.80 | 128.40 | 091.66 |
| 6 (e) | 2002 Oct 20 10:23 | 79.4 | 5.82 | 127.57 | 091.52 |
| 7 (Left) | 2002 Dec 27 23:20 | 54.1 | 7.06 | 083.84 | 088.56 |
| 7 (right) | 2002 Dec 30 07:41 | 44.2 | 7.54 | 096.57 | 089.84 |

* From JPL SSD Horizons program.
† Subsolar longitude from JPL SSD Horizons program, ±90° as appropriate to give longitude of earthward terminator.

Melillo secured a CCD image on Oct 14 (CM 100°), which appears to show Solitudos Jovis and Matae in the southern hemisphere. Also, van der Velden produced an image of Mercury with dark markings in the same place just south of the equator. In addition, Michael Amato was able to see a dark marking in the southern hemisphere.

On Oct 18, Frassati and Melillo observed almost simultaneously (CM 117° and 119°, respectively). Both registered similar detail. The following day Frassati obtained a repeat view.

Another simultaneous observation was made on 2002 Oct 20. At CM 129°, Wilson and Melillo observed simultaneous in daylight to capture the same detail in the southern hemisphere. Solitudos Jovis and Helii were seen and were very prominent at this phase.(*Figure 6*)

On the next day van der Velden videotaped Mercury at CM 134°, revealing a gibbous phase with slight darkening in the southern hemisphere. Again on Oct 27, Melillo imaged Mercury at CM 159° and recorded the features seen a week before. Frassati continued to observe and on Nov 5, at nearly full phase, CM 199°, drew two albedo features along the terminator, Solitudo Helii in the south and Solitudo Neptuni in the north.

Mercury reached perihelion on 2002 Oct 10. Greatest elongation occurred three days later. Theoretically, Mercury should have showed half phase. It was reported slightly crescentic on Oct 12, the date of theoretical half-phase, and slightly gibbous.

## Apparition 7, Evening, 2002 Nov 14 – 2003 Jan 11; CM = 238° - 174°

Only 6 observations were distributed for this final apparition of the year, which was quite favorable for both hemispheres with a solar elongation of 20° on 2002 Dec 25.

Frassati sketched the planet on 2002 Dec 13 (CM 014°), recording Solitudos Lycaonis/Tricrena (central) and the tip of Martis in the south. Wilson made three excellent drawings on Dec 19, 22, and 27 (CM 045°, 059° and 085°, respectively) and all prominently show Solitudos Martis and Hermae/Trismist as they rotated into view. Van der Velden made a fine webcam observation on Dec 27. At CM 096°, it showed a neat crescent with possible shadings along the terminator. In addition, Brian Cudnik made a fine drawing showing the terminator shading.

Most of this apparition's observations showed Mercury at gibbous phase. Greatest elongation occurred on Dec 25, about midway between perihelion and aphelion. On Dec 27, the phase was still slightly gibbous. On Dec 30, Mercury showed a crescent phase. Theoretical half-phase fell on either Dec 29. (*Figure 7*)

## References

### For Online Readers

Left-click your mouse on items in blue text to jump to source material or information about that source material.


Arnal, O.C. (1996), "The Challenge of Observing Mercury: Frustrations and Awards", *Journal of the Assn. of Lunar & Planetary Observers*, Vol. 39, No. 2, pp. 49-55.

Capen C., Dobbins, T. and Parker, D., (1988), *Introduction to Observing and Photographing the Solar System*, Richmond, VA: Willmann-Bell, p. 31.

Davies, M., Dwornik, S., Gault, D. and Strom, R. (1978), *Atlas of Mercury*, NASA.

Dobbins, T. and Sheehan, W. (2000), "Mesmerized by Mercury," *Sky & Telescope* magazine, Vol. 99, No. 6 (June), pp. 109-114.

Price, F.W. (1994), *The Planet Observer's Handbook*, Cambridge: Cambridge University Press, pp. 73-98.

Schaaf, F. (1991), *Seeing the Solar System*, New York: John Wiley & Sons, Inc., p. 49.

Schmude, R.W. (1990), "Observations of Mercury in 1988-1989," *Journal of the Assn. of Lunar & Planetary Observers*, Vol. 34, No. 3, pp. 101-103.


### *Where is Mercury Now?*

In early January, Mercury is a morning star and is up about an hour before the sunrise. On January 1, Mercury and Venus together are up at about 11:30 UT (6:30 a.m. Eastern Time in the U.S.).

By early February, Mercury rises shortly before the Sun.

**ALPO MERCURY SECTION**

NAME______________________________

ADDRESS____________________________

___________________________________

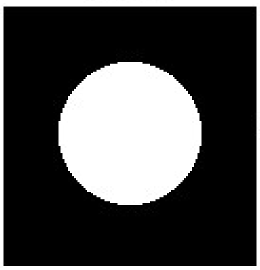
APPARITION:
Morning_____
Eveining_____

ARC SECONDS____"
ELONGATION:
_____° from the sun

For Coordinator Only:

**Sketch**

NORTH



WEST

DATE__________________
TIME (UT)______________
Telescope__________________________
Magnification______________________
Filter(s)__________________________
Seeing (10-best/1-worst)_____________
Visual Description:

Central Meridian Longitude______°

**Photo or CCD**

DATE:____________
TIME (UT):_________

Image 1

Central Meridian Longitude______°

Telescope:____________________
Camera Type:__________________
Exposure:_____________________
f/ratio:_______________________
Filter:________________________

Comments:

Date:________________
TIME (UT):____________

Image 2

Central Meridian Longitude______°

Telescope_____________________
Camera Type__________________
Exposure_____________________
f/ratio_______________________
Filter________________________

Comments:

Send all observations to: Frank J Melillo
ALPO Mercury Coordinator
14 Glen-Hollow Dr., E-#16
Holtsville, NY 11742

## Feature Story: ALPO Lunar Topographical Section

# A Report on Lunations #996 through #1001

*By William Dembowski, FRAS, acting assistant coordinator*

### For Online Readers

•Left-click your mouse on the author's name in *blue text* to open your own e-mail program with the To: field completed and ready for you to compose your own message. (Internet connection must be ON).

•Left-click your mouse on "Figure" or "Table" to jump to that particular item.

## Introduction

Lunations #996 through #1001 span the time period from June 29, 2003 through December 23, 2003. The lunar highlight of this period was the total lunar eclipse of November 8/9. However, since eclipses and occultations are not a part of topographical studies, observations that were received of these events will not be included in this report.

## Observers and Instrumentation

Eighteen observers contributed a total of 217 observations to the Section during the period. Their names, locations, instrumentation, and type of observation are shown in *Table 1*.

The instrumentation is summarized as follows:

- Reflector – 8
- Refractor – 6
- Schmidt-Cassegrain – 3
- Mak-Cassegrain – 21

The telescopes used ranged in size from 4 inches (10 cm) to 14 inches (36 cm) with the average aperture being approximately 7.6 inches (19 cm).

## Observations

A total of 217 observations were received that were made during the last six lunations of the year 2003 and are summarized as follows:

- Digital – 153 by 12 observers
- Sketches – 23 by 6 observers
- Maps – 41 by 2 observers

For purposes of this report, the "Digital" category is comprised of both CCD still images and those obtained with video equipment. The original thought was to separate the two methods since they appeared to be quite different, particularly when frame stacking was employed. However, a significant number of video images was obtained by the "frame-grabber" or "still" setting method which made them virtually identical to traditional CCD methods. On the other hand, still CCD images are routinely stacked, often in rather sizeable quantities.

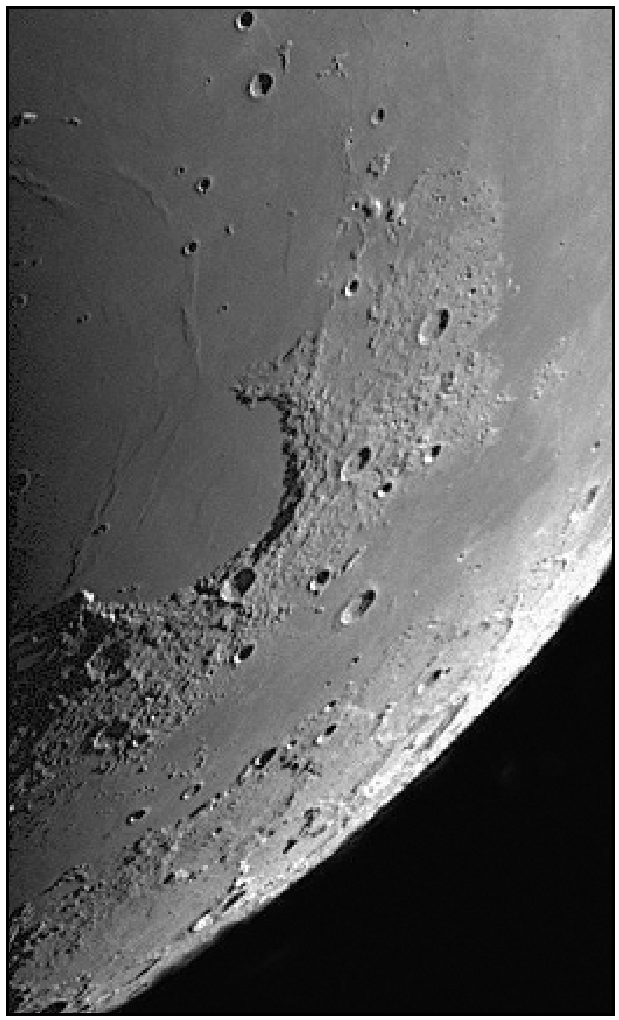
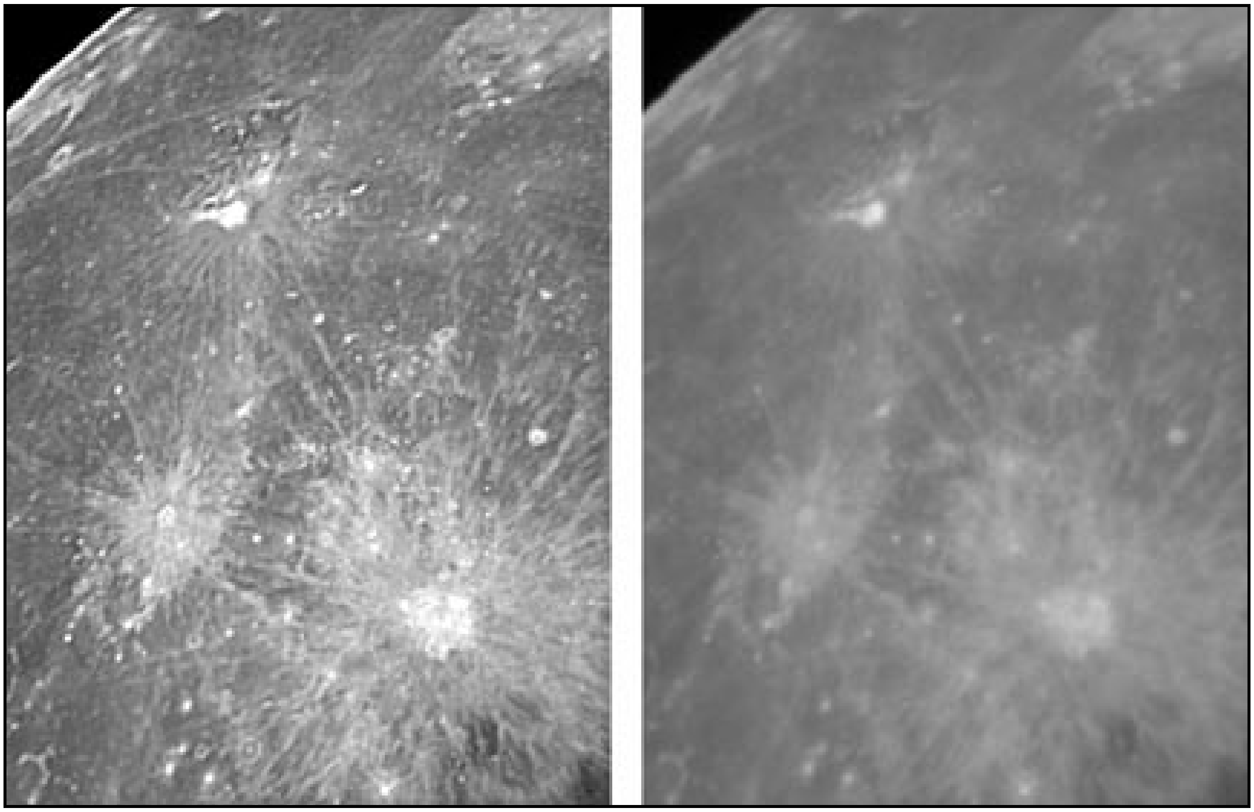


Figure 1: Digital image by Ed Crandall showing Sinus Iridum and Sinus Roris, and wrinkle ridges of western Mare Imbrium. Location: Winston-Salem, North Carolina, USA,. Date September 20, 2003 - 10:20 UT. Selenographic colongitude: 203.7. Equipment: 10 inch f/7 Newtonian Reflector, Starlight Xpress HX-516 CCD Camera.



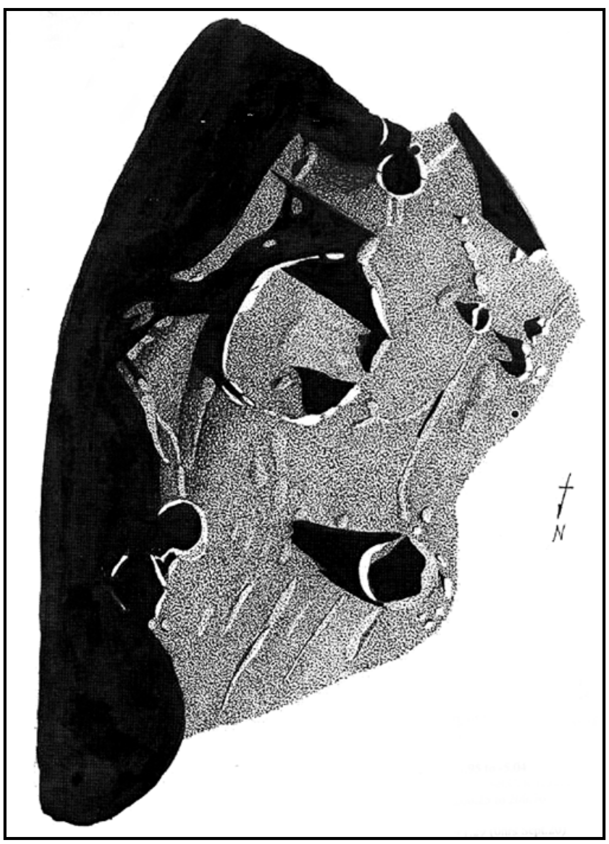



Figure 2. (Above) Digital images by Howard Eskildsen showing ray systems of Copernicus, Kepler, and Aristarchus. Location: Ocala, Florida, USA. Date: September 13, 2003 - 02:19 UT. Seenographic colongitude: 114.3. Equipment: 5 inch ETX - Nikon Coolpix 880 Camera.

Figure 3 (Left): Drawing by Colin EbdonS showing the low profile features in and near the crater Kies. Notice use of "stippling". Location: Colchester, Essex, England; Date: September 20, 2003 - 03:40 to 04:40 UT. Selenographic colongitude: 200.3 to 200.8. Equipment: 10 inch Newtonian Reflector - 236x

Digital imaging has certainly brought about a resurgence, and a revolution, in lunar observing. Not only is this technique readily available and user-friendly, some amateurs are now capable of imagery that rivals even that of lunar orbiter missions. The popularity of electronic imaging is evident in the fact that 70 percent of the observations received by the Topographical Section during the subject lunations was digital in nature. There were, by contrast, no film-based photographs submitted.

Ed Crandall's image (*Figure 1*) is a fine example of a medium-distance shot. It covers both Sinus Iridum and Sinus Roris, and clearly shows the wrinkle ridges of western Mare Imbrium. It was these ridges, giving the appearance of waves breaking on distant lunar shores, that helped convince some early lunar observers that the darker regions of the Moon were indeed seas. They, of course, never appeared to notice that the waves didn't move. Modern spacecraft

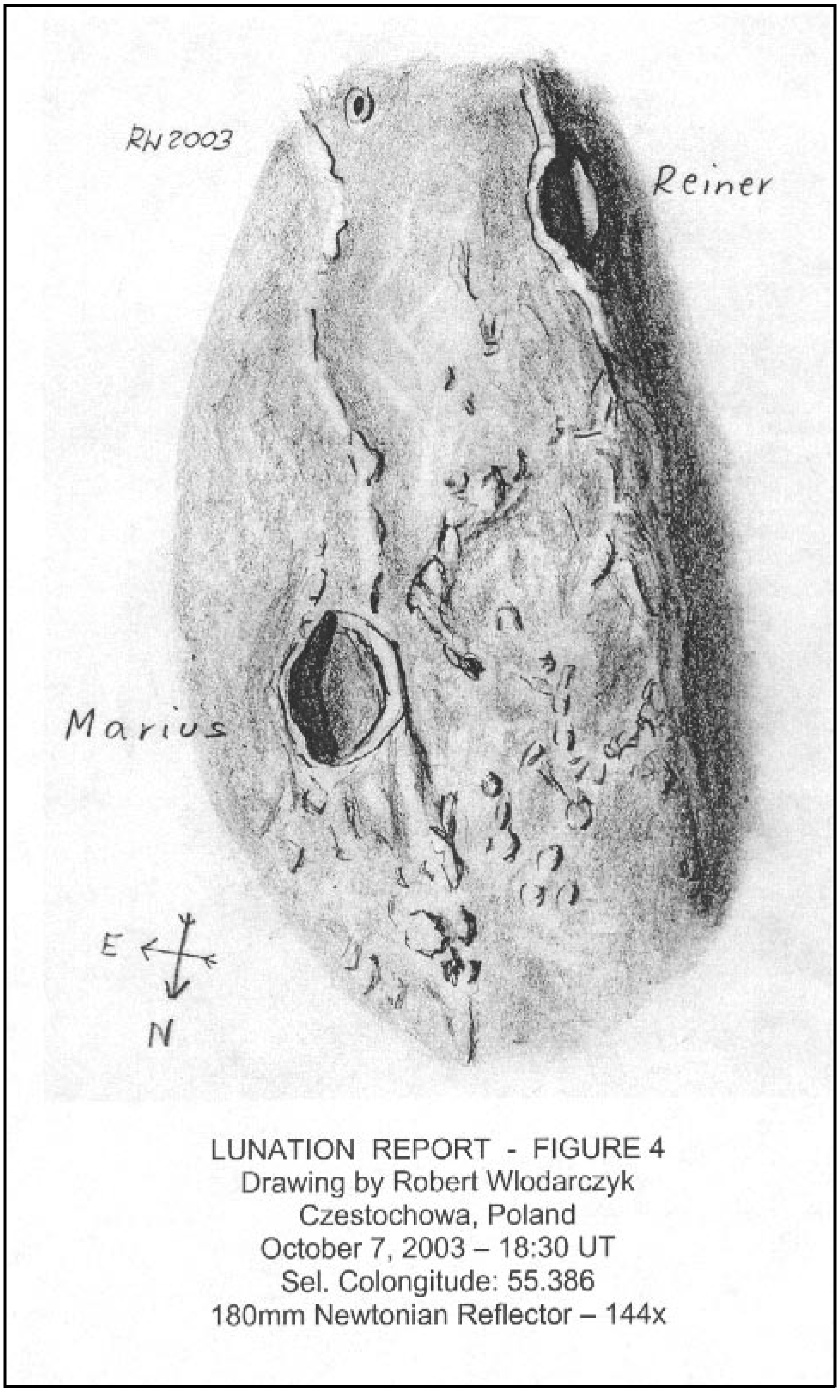



Figure 4: Sketch of crater Marius by Robert Wlodarczyk.

images, usually taken at rather high sun angles, do not favorably show low profile features such as wrinkle ridges and domes, making them favorite targets of many amateur observers. Domes, in fact, continue to be such popular features that the ALPO recently revived its Lunar Dome Program now coordinated by Marvin Huddleston.

Although domes tend to be rather compact (nearly circular in many cases), wrinkle ridges can stretch for hundreds of kilometers. Unlike mountain ranges, however, few ever exceed 300 meters in height. Some wrinkle ridges, such as those in *Figure 1*, follow the curve of the mare borders independent of other features. Others, however, neatly outline the walls of buried craters. All should be observed under a relatively low sun.

One of the major programs of the Lunar Topographical Section is the International Bright Lunar Rays Project, a joint venture of the ALPO, the American Lunar Society, the British Astronomical Association, and the Society for Popular Astronomy. This project was begun to study the splash patterns surrounding impact craters. These rays are not to be confused with sunrise/sunset rays which are tricks of lighting and, although interesting, not physical features. As part of this project, Howard Eskildsen imaged the ray systems of Copernicus, Kepler, and Aristarchus (*Figure 2*). These images clearly show the advantages of digital image enhancement. Howard used *Adobe Photoshop Elements* to perform unsharp masking and to improve brightness and contrast for the final image. The increase in information realized from these procedures is immediately apparent. These images also illustrate one of the inviting aspects of the project; that high magnification is not a requirement for engaging in the study of these intriguing features.

The time-honored tradition of lunar sketching is alive and well, with 6 observers submitting 23 drawings during the period. Colin Ebdon used his drawing skills to record the low profile features in and near the crater Kies (*Figure 3*). His use of the “stippling” method is particularly suited to portraying these subtle features. The shadows in his sketch clearly indicate the grazing angle of the sunlight and show that, had the observation been made under a higher Sun, these delicate features would have been lost.

Robert Wlodarczyk continued the study of low profile features with his sketch of the area around the crater

Marius (*Figure 4*). This region is a complex jumble of domes, hills, and ridges that almost defies manual recording. The only reasonable way to attack such a region is to concentrate on one small area at a time, as was done in this sketch. One must, again, keep in mind to do so while the low profile features are near the terminator.

As part of the Lunar Rays Project, two observers used the Mapping method to record their observations. Mapping is the sketching of rays onto a copy of a lunar map, usually the Lunar Quadrant Maps. The difficulty often encountered when sketching rays is their placement in relation to other surface features; especially since many features are extremely difficult to observe under a high Sun, when rays are most visible. Mapping makes the task somewhat easier by allowing the observer to concentrate on the rays themselves. *Figure 5* is a ray map of the Proclus system by the author. One of the more intriguing characteristics of this ray system is the gap to the west which indicates a shallow trajectory by the impactor from that direction. The shape of a crater does not depart much from the circular unless this angle is rather extreme, but the ray system will usually tell the tale.

**Table 1: Contributors to This Lunation Report**

| Observer | Location | Telescope Aper. (in.) | Obs. Method |
|---|---|---|---|
| Amato, Michael | West Haven, CT, USA | 6" (15cm) N | S,M |
| Ayiomamitis, Anthony | Athens, Greece | 14"(35cm) S | D |
| Crandall, Ed | Winston-Salem, NC, USA | 10"(25cm) N | D |
| del Valle, Daniel | Aguadilla, Puerto Rico | 8" (20cm) S | D |
| Dembowski, William | Elton, Pennsylvania, USA | 5" (12.7cm) R | D,M |
| Devriese, Wildried | Brugge, Belgium | 8" (20cm) N | D |
| Ebdon, Colin | Colchester, Essex, England | 10"(25cm) N | S |
| Elsbury, William | Mason City, Iowa, USA | 8" (20cm) S | D |
| Eskildsen, Howard | Ocala, Florida, USA | 5" (12.5cm) M | D |
| Rednal, Peter | Rednal, Birmingham, England | 10"(25cm) N | S |
| Hayes, Jr., Robert H. | Worth, Illinois, USA | 6" (15cm) N | S |
| Kramer, Jack | Libertyville, Illinois, USA | 4" (10cm) R | D |
| Liu, Joseph H.C. | Salinas, California, USA | 8" (20cm) R | D |
| Pau, K. C. | Hong Kong, China | 10"(25cm) N | D |
| Santacana, Guido | San Juan, Puerto Rico | 4.7" (12cm) R | S |
| Shaw, Brendan | Basingstoke, Hampshire, Eng. | 5" (12.5cm) R | D |
| Vandenbohede, Alexander | Gent, Belgium | 8" (20cm) R | D |
| Wlodarczyk, Robert | Czestochowa, Poland | 7" (18cm) N | S |
| Telescope type: M=Maksutov-Cassegrain, N=Newtonian Reflector, R=Refractor, S=Schmidt-Cassegrain | | | |
| Observation Method: D=Digital, M=Map, S=Sketch | | | |

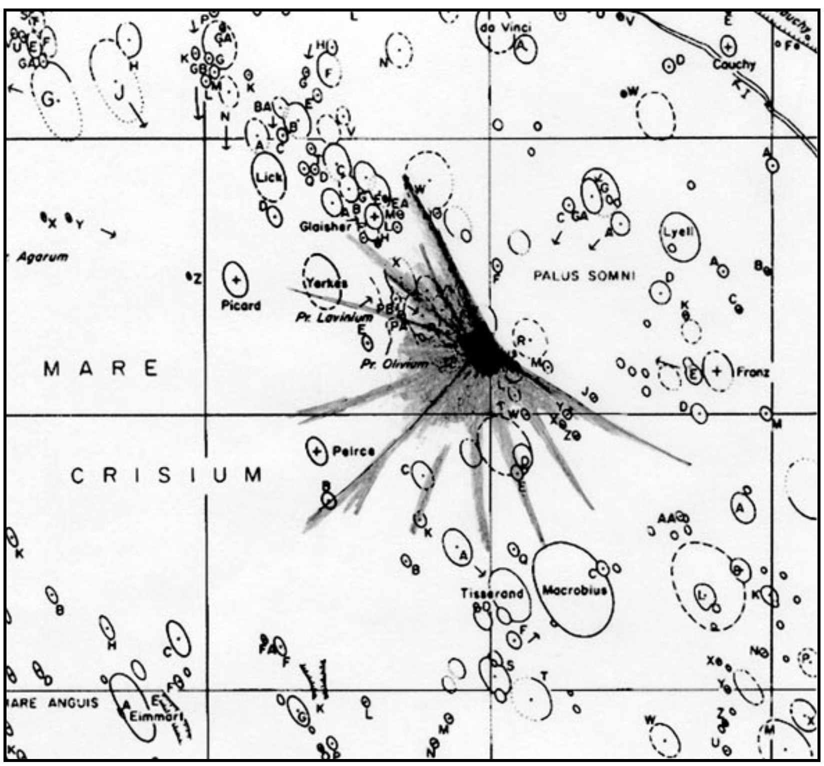



Figure 5: Ray map by Bill Dembowski showing Proclus system. (Based on Lunar Quadrant Map, University of Arizona, south at top.) Location: Elton, Pennsylvania, USA. Date: April 15, 2003 - 02:34 to 02:49 UT. Selenographic colongitude: 70.2 to 70.3. Equipment: 5 inch Refractor - 114x.

## Concluding Remarks

The author wishes to thank all of the dedicated lunar observers who contributed their observations and urge them to continue their study of the Earth's only natural satellite. He would also like to encourage other ALPO members to share their lunar observations by submitting them to: William Dembowski, 219 Old Bedford Pike, Windber, PA 15963 or via email to *Dembowski@adelphia.net*.

***Feature Story:***

# *That Stuart Brilliant Flare and The Search for a New Lunar Craterlet*

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## Abstract

On November 15, 1953, at 2 hrs., 0 mins, Universal Time (UT), Dr. Leon H. Stuart, a physician and amateur astronomer at Tulsa, OK, both saw and photographed a very bright spot near the middle of the terminator of the Moon, then 18 hours past First Quarter (Figure 1). The spot was hence neither a photographic blemish nor a visual illusion; and since it was found to move with the image of the Moon on the glass plate, it was not a foreground object like a terrestrial meteor. The only plausible explanation is that it was the fireball produced by the impact of a very large meteoroid upon the lunar surface. The diameter of the spot or flare was later measured to be 21 kms. Dr. Stuart witnessed neither its appearance nor disappearance, but estimated that it was under observation for about 8 seconds.

Dr. Stuart published an account of this remarkable observation in "The Strolling Astronomer" in 1956 and in "The Journal of the International Lunar Society" in 1957. He corresponded on the subject with a number of amateur and professional astronomers. A few of them expressed great interest, but most were skeptical or indifferent. Interest died down with the passing years. Then, Dr. Bonnie Buratti of the Jet Propulsion Lab (JPL) examined some high-resolution Clementine 1994 images of the immediate vicinity of the Stuart flare and proposed that a new-looking craterlet located there is a result of the 1953 impact.

Dr. John Westfall, however, finds from careful measures of photographs that the suggested Buratti craterlet is too far away from the 1953 flare and is also present on two pre-1953 photographs.

The original of the 1953 photograph is missing; but Jerry Stuart, P. E., the son of Leon Stuart, has preserved copies of the original plate and will make these available for research by qualified persons.

## Historical Perspective

The Moon was a very popular object of observation for amateur astronomers near the middle of the 20th century. At least one society tried to schedule its monthly meetings close to the First Quarter of the Moon. Probably the Moon and Saturn were the most frequent bodies shown at public nights at observatories. A few amateurs made drawings of selected lunar features, some of them of great artistic merit. Others took frequent photographs. However, the total quantitative scientific content of all these efforts was small.

Figure 1: Photograph of Moon by Dr. Leon H. Stuart with 8-inch, f/8 Newtonian reflector on November l5, 1953 at 2h 0m, U.T. Colongitude 14.6 degrees. Note the brilliant spot near middle of terminator. See text.

Figure 2: Dr. Leon Stuart with the 8-inch, f/8 reflector. (Photo by Jerry Stuart).

Some observers were very active in reporting changes in lunar features, variations in appearance not explained by changing solar lighting or differing librations. Among them were James C. Bartlett, Jr., V. A. Firsoff, H. Percy Wilkins, and Robert Barker. A few professional astronomers, such as Joe Ashbrook and Dinsmore Alter, were sympathetic toward such efforts. Most professional astronomers, however, were very skeptical and considered the Moon changeless.

There was some interest in possible meteors existing in a greatly rarefied lunar atmosphere, based on the observed absence of impact flares of meteorites striking a totally atmosphereless Moon (*11*). Searches for possible lunar meteors were carried out; and many faint moving specks looking like the conjectured lunar meteors were recorded; but the very necessary duplicate observation, at the same time and at the same place on the Moon, was never secured. Of course, these searches were also looking for the stationary flashes of meteoritic impacts on the lunar surface. Such flashes were also reported but were also never confirmed.

Eventually confirmed impact-flashes with the 1999 lunar Leonids showed that the durations of some milliseconds were at the very limit of the capabilities of visual observers (*14*).

## Leon H. Stuart, Physician and Amateur Astronomer

Born in Pennsylvania, Leon H. Stuart received his Bachelor's and Master's degrees from Washington and Jefferson College in Washington, PA. His medical training was at the Western Reserve School of Medicine at Cleveland, OH. During World War I, he served with the Army Medical Corps. He became the Director of the Radiology Department of St. Johns Hospital in Tulsa, OK, over the interval 1928-47. There he was responsible for directing a small support staff and establishing the treatment protocol for all patients. The Radiology Department had the ability to perform both radiology (the taking of images) and "roentgenology", or radiation treatment. The facility was considered a "state of the art" diagnostic and high-energy treatment laboratory. Dr. Stuart also maintained a private office in downtown Tulsa for the practice of radiology. He was a member of the Scottish Tulsa Club, the Tulsa Astronomical Society, the Royal Astronomical Society of Canada, and other astronomy groups.

He became interested in the sky while living in the Country Club heights near Tulsa with a clear, unobstructed view of the heavens. He ordered a 3-inch reflector, ground and figured a couple of 6-inch mirrors, and eventually purchased a custom-made 8-inch, f/8 Newtonian, all metal with removable optics, from Haines in Inglewood, NJ (Figure 2). He designed and built a camera that rode piggyback on the telescope and took 4x5-inch glass plates. Thus, he worked with lenses and plates and exposures in his profession during the day and with lenses and plates and exposures with his love for astronomy at night. There is reason to think that he gladly shared his hobby with neighbors and children.

## The November 15, 1953 Brilliant Flare (*1*, *2*)

Using the camera which fitted over the eyepiece of his 8-inch, f/8 reflector, Leon Stuart one night exposed four plates on the Moon in order to determine focus for pictures of small star fields. When he removed the fourth and last plate after an exposure of approximately one-half second, he saw on the ground glass a bright spot near the middle of the terminator. (He did not look at the Moon itself.). Nothing of the sort had been present on the first three plates. He immediately determined that the spot moved with the Moon image, not only in the same direction but fixed in relation to nearby lunar features. The time was 2 hours, 0 minutes, UT on November 15, 1953 (or 8 p.m. Central Standard Time on November 14). The Moon was 18 hours past its First Quarter. When the observer returned to the telescope 10 minutes later after developing the plate, the spot was gone.

Dr. Stuart wrote (*1*): "The total photographic-visual time was at first thought to be, roughly, less than 30 seconds, but later re-enactment of the whole process of loading, exposing and unloading the camera and making tests averaged about eight seconds. Neither the beginning nor the end of the flare was seen." No spot had been seen in the process of focusing for the plate that later showed it.

It is of interest, but also very difficult, to try to determine the brightness of the spot. Measures of its diameter mentioned below enable us to compute its area. Knowing its area and the area and stellar magnitude of the illuminated part of the Moon, we can compute that the average stellar magnitude of a spot of this size was about zero. The Stuart spot was so much brighter than this average that a stellar magnitude of -3 or -4 (similar to Jupiter or even Venus) appears plausible. However, a spot of this size would be dimmer than the average near the terminator of the illuminated Moon. Buratti and Johnson estimate stellar magnitude at -1 (*3*). A casual observer might have reported a star in front of the Moon!

When the doctor photographed the Moon on the next night, there was nothing unusual at the site of the flare.

## What Was the Flare?

Any highly unusual observation can expect to be challenged as an illusion or an artifact. Leon Stuart exhibited the true scientific attitude in that he considered many possible interpretations of the brilliant temporary spot. We can do no better than to quote his own words (*2*).

"Various explanations of the cause of the spot on the negative have been given such as ghost image; condensation of light; black spot commonly seen on plates and films; bright reflecting surface in the telescope tube; bright body in near-by star field, such as Venus; or street light, etc. The fact is that not one of these hypotheses holds. The Erfle eyepiece, with all glass-air surfaces coated, has been in use for a long time and has been thoroughly and repeatedly tested for spurious or ghost shadows, condensations or other defects but none has ever been produced. The glass edges of the prism are properly covered to obviate any edge effect. The black spot is easily discarded as a cause. This condition is due to a fungous growth in the developer which, when a group of mycelia clings to the emulsion during development, acts as a catalyser that hastens the reduction of the silver halide, exposed or unexposed, to the black metallic silver of the negative. This is seen as a black spot which, under the microscope is very irregular in outline. The spot in question is smoothly round. Past experience and careful search show there is nothing in the telescope tube that could possibly be the source of a bright reflection since the entire inner surface is painted a dull black. Venus was in the morning sky at the time and all bright stars in the surrounding southern sky were subdued by moonlight and skylight."

Now accepting the spot as real, all persons familiar with the long and controversial history of reported lunar changes immediately find it of great importance that the brilliant spot was BOTH seen and photographed. If it was photographed, it was not a visual illusion. If it was seen, it was not some photographic artifact. Some have proposed that it was a very bright meteor in the Earth's atmosphere coming exactly toward the observer. This explanation is nonsense quite apart from its great statistical improbability because the spot moved right along with the Moon image (see above). In eight seconds, the Moon travels about two minutes of arc in the Earth's sky, requiring a very well-educated meteor to imitate this motion! Any other object between the observer and the Moon is similarly ruled out.

The only likely explanation then becomes the fireball created by the impact of a very large meteoroid — or even a minor planet (asteroid) — on the lunar surface. Such events are surely very rare.

## The Flare, Published Papers and Astronomy Conventions

It has been said that an observation which is not reported to the proper places is no observation. Dr. Stuart appears to have been very modest about making his remarkable observation known and did not seek publicity or personal fame. Perhaps the flare soon became known to his personal friends and amateur astronomy colleagues in Tulsa, OK.

Leon Stuart went as an amateur astronomer attendee to the National Convention of the Astronomical League at Miami, FL, on July 1-4, 1955. There he showed prints of his photograph to different persons, among them Leonard Abbey of Atlanta, GA. Dr. Stuart appears to have had no part in the official program (*Figure 3*).

The first published account of the observation was in August, 1956 in "Prime Focus", the newsletter of the Columbus (OH) Astronomical Society (*13*). And the report was by Steadman Thompson and not Dr. Stuart. Perhaps Steadman had learned of the observation at the 1955 Miami Convention. (I am indebted to Messrs. Steve Wolfe and Jay Elkes of the Columbus Astronomical Society for researching this archival information.)

On August 6, 1956 Dr. Stuart submitted a paper describing the observation and including a copy of the photo to "The Strolling Astronomer" (now known also as "The Journal of the Association of Lunar and Planetary Observers"). It is interesting that it was on this very same date that he hand-stamped as "received" his copy of "Prime Focus". His paper was published in "The Strolling Astronomer" (*1*). A similar and longer paper appeared in "The Journal of the International Lunar Society" in 1957 (*2*). It was expected that there would be an account in "Meteoritics", published by the Institute of Meteoritics at Albuquerque, NM (*4*). Searches by Richard Baum

Figure 3: Group photo of the ALPO members attending the 1955 Miami, FL, Astronomical League convention. Left to right: David Meisel, (unknown), Steadman Thompson, Raymond Graham, Dan Albritton, Lenny Abbey, Bill Shawcross, Bob Wright, Downey Funck, Dr. Leon Stuart, "Doc" Gant. (Photo courtesy of Lenny Abbey.)

and Dolores Hill of the ALPO have found nothing in that journal. In June 1957, Dr. Stuart was apparently planning to attend the Astronomical League Convention in Kansas City, MO, later that year on August 31-September 2 and to discuss his observation there. He did not attend, and his name is missing from the Proceedings of the meeting.

Why he did not go is not known. Similarly, he had some plans to attend the first Nationwide Amateur Astronomy Convention in Denver in 1959 but did not go.

## Correspondence and Plate Measurements

A number of letters from Dr. Stuart to me in the years 1956-58 have been preserved in the Rio Grande Historical Collections in the archives of the New Mexico State University Library. Persons interested in seeing them should contact Mr. Stephen Hussman, the Director of the Department of Archives and Special Collections, either by e-mail at *shussman@lib.nmsu.edu* or by telephone at 505-646-4756.Other letters from Leon Stuart to me have almost certainly been lost. Nothing is known to exist of my correspondence to him or his correspondence about the flare with other persons.

The doctor found a few persons who were very interested in his observation. Among these were Dr. Lincoln La Paz at the Institute of Meteoritics of the University of New Mexico at Albuquerque; Steadman Thompson, then a leader in the Astronomical League; H. Percy Wilkins, the Lunar Director of the British Astronomical Association; Dr. Harold Urey; and a few amateur lunar observers like Robert Barker in England and James Q. Gant in the USA.. Most persons showed no interest.

Steadman Thompson made measures of a NEGATIVE COPY of the photograph with the Gaertner Measuring machine #261 at the Perkins Observatory near Delaware, OH (*8*, *9*). The lunar image was 61.72 mm in diameter, leading to a scale factor of 31.28"/mm. The known lunar diameter then gives 56.3 km/mm, surely accurate enough close to the center of the Moon where the spot appeared. Steadman made 24 measures taken in 8 directions at approximate 45-degree angles to each other. The result was an average diameter of 21.4 km (13.3 miles) for the spot and 35.5 km (22.0 miles) for the surrounding halo. The halo may be a photographic artifact rather than a physical feature on the Moon.

It is not known that any other measures of any kind were made in the 1950's, though one or two persons expressed intentions of doing so.

However, the image on the ORIGINAL plate was examined at the Lunar and Planetary Laboratory in 1967 by Barbara Middlehurst, who wrote to Leon Stuart as follows (*9*, *10*): "When we examined your negative, we were interested to find more evidence that the bright spot was at a considerable distance from the telescope and could not have been due to reflection from the walls of the tube. The plate was actually very slightly out of focus; the image of a point of light should then be a cross section of the optical beam, and though the image of a diffuse reflection would be a uniform bright spot, the point source image should show evidence of the central obstruction, and this does. The center of the bright spot on the negative was very slightly less dense than the surrounding regions, and we attributed this to the presence of the Newtonian flat or Cassegrain secondary. It is clear from your description that your telescope actually has a Newtonian flat". It is interesting that the famous photo is very slightly out of focus since Leon Stuart was making the Moon shots in order to determine exact focus for star photographs.

As far as is known, no one else ever analyzed the image on the ORIGINAL plate or made any measures of it there.

## The Lonely, Persistent Crusader

It was inevitable that interest in the unique observation should dwindle with the passing years. However, Mr. Leonard B. Abbey has spent half a century in untiring efforts to make the Stuart photo known and appreciated. He reports the results as follows(*12*):

"The recent publicity given to Dr. Leon Stuart's 1953 photograph of a lunar flare has brought to mind the early days of my involvement with astronomy, and the efforts I made to gain recognition for this unique image.

"When I attended the 1955 Convention of the Astronomical League in Miami, Florida, I was seventeen years old, and this was my first 'solo' trip away from home. I had been observing and drawing the Moon and planets for several years, so I considered myself to be quite an expert on the subject!

"At the convention I met Dr. Leon Stuart, a medical doctor from Tulsa, Oklahoma. He was passing around a photograph of the half Moon. The photograph was of excellent quality for that time, but what stood out was a brilliant bright spot of light directly on the terminator! I thought to myself, 'This is dynamite!' Amateur astronomers had been searching for changes on the lunar surface for hundreds of years, and now we had an excellent photograph of one. I asked Dr. Stuart for a print, and he gave me one.

"I took the picture home and showed it to members of our astronomy club, and to the few professional astronomers in my region. Nobody was interested. Over the intervening years I have shown copies of the print to professionals and amateurs around the country. Nobody was interested. I sent copies to astronomers who were conducting studies of lunar transient phenomena for NASA and JPL. Nobody was interested. About 1987 I posted a GIF of the image on Compuserve. It was downloaded many times, but nobody seemed to be excited about it.

"Now a candidate for the impact crater caused by the object which produced the flare has been located. An image of this crater can be found on the Internet at: *http://www.space.com/missionlaunches/lunar_impact_021214.html*, and the Stuart photo has become famous overnight.

"In recent years, I have turned my attention from observing to the history of observational astronomy in the 19th and 20th centuries. During this period the question of whether there have been changes on the Moon in the modern era has been discussed, and argued, at great length. A number of projects have been conducted systematically to search for changes. A sizeable portion of the literature has been devoted to this subject. Knowing that this issue is fundamental to selenography, I have devoted a great deal of energy to keeping the knowledge of this photograph alive.

"What puzzles me is, why has Dr. Stuart's amazing observation been almost completely ignored? Why did it take the discovery of a possible impact crater on a Clementine image to refocus our attention to it?

"I think that the answer lies in the psychological motivation of modern amateur observers. We want there to be changes on the Moon, but we want OUR observations to be the ones to reveal it. We are not particularly interested in finding that an observer who has been dead for forty years is the hero. To me this is sad. It is the antithesis of scientific investigation. It is the Achilles heel of the amateur scientist. A great discovery was handed to us. But we filed it away and forgot it.

"A copy of the print Dr. Stuart gave me in 1955, along with an enlargement, can be found on the Internet at: *http://labbey.com/Famous/Stuart.html*."

The observation did receive occasional attention over the interval 1958-2002. Thus I mentioned it as part of a longer paper about apparent lunar changes in talks given in 2000 at the Peach State Star Gaze near Atlanta, at the ALPO Convention in Ventura, CA, and at a monthly meeting of the Astronomical Society of Las Cruces. The paper has now been published (*20*).

## A Proposed New Lunar Craterlet and Some Objections

The achievement of higher resolution imaging of lunar surface details subsequent to 1953 improves the chances of finding the crater produced by the impact that Stuart witnessed. Indeed, Dr. Bonnie Buratti of JPL and Mr. Lane Johnson, a student at Pomona College, proposed that they had actually identified this crater (*3*). They estimated the position of the Stuart spot to be at lunar latitude 4.8 +/- 1.2 degrees north and longitude 2.9 +/- 1.2 degrees west (the hemisphere of Mare Imbrium) (*Figure 4*). They estimated the size of the meteoroid and the resulting impact feature by calculating the energy of the impact, beginning with -1 as the stellar magnitude of the spot. The process involves such parameters as how much of the energy is radiative and how much mechanical, the impact velocity, the density of the meteoroid, and the exact duration of the flash, some of them very poorly known. The computation made the meteoroid 20 meters in diameter, with an extreme range of 5 to 50 meters or greater, and the new crater it produced would be 200 meters in diameter, with a possible range of about 50 to 700 meters.

**Table 1: Measures of Buratti-Johnson Feature by John E. Westfall**

| Source and Date | Longitude (degrees) | Latitude (degrees) | RMS (kms) |
|---|---|---|---|
| Clementine Digital Image Model, CD-ROM,Vol. 13,BI03N357.jpg(1994, L) | -2.28 | +3.91 | 1.2 |
| Mt. Wilson Obs. 100-inch refl., Pease Photo. 97 (1919 SEP 13, L) | -2.32 | +3.90 | 0.9 |
| Lick Obs. 36-inch refr., Moore-Chappell Photo. 59 (1937 OCT. 22, L) | -2.31 | +3.90 | 1.2 |
| Catalina Obs. 61-inch refl. Photo 1900 (1966 MAY 28, Q) | -2.29 | +3.98 | 0.3 |
| Catalina Obs. 61-inch refl. Photo. 2139 (1966 JUN 03, Q) | -2.33 | +3.89 | 0.5 |
| MEAN | -2.31 | +3.92 | 0.6 |

Buratti and Johnson examined a Clementine 1994 multispectral map of the impact region, searching for fresh-looking craters. They proposed that a very bright crater at 3.88 N latitude and 2.29 W longitude is the result of the Stuart event (*Figure 5*). This object is 1.5 +/- 0.5 kms. in diameter, including an ejecta blanket and short bright rays, both of which further suggest a recent origin. It is also definitely brightened in blue light, and "space weathering" causes features on the airless Moon to become darker and redder with the passing of time, though probably EXTREMELY slowly. No other craters on the Clementine image showed the proper location, size, albedo, color, and morphology.

It would be wonderful to end this discussion with the discovery of the new lunar craterlet whose creation Dr. Stuart observed. However, John Westfall reports contradictory evidence (*15*). He identified the Buratti-Johnson feature on five photographs and made the measurements shown in *Table 1*. Note that two of the photographs were taken BEFORE the Stuart 1953 observation! Here lunar longitudes are positive to the east, the hemisphere of Mare Crisium; and lunar latitudes are positive to the north, the hemisphere of Mare Imbrium. The symbol **L** denotes a linear fit with 3 coefficients and **Q** a quadratic fit with 6 coefficients.

Dr. Westfall further reports (*15*): "The center of the bright spot photographed by Leon Stuart in 1953 was measured from a scanned image of the vicinity of the flash kindly provided by J. Stuart and L. Abbey, with a quadratic fit to 8 nearby features giving a longitude of -3.31 degrees and a latitude of +4.30 degrees, placing it about 32 km WNW of the Buratti-Johnson Feature. As there is only one photograph of the flash, the accuracy of its position is assessed from the RMS errors of the 8 control points used, giving +/- 2.2 km."

It is statistically impossible that the Buratti-Johnson Feature should be at the center of the impact-flare when the separating distance is approximately 14 standard deviations (*15*). Geometric perspective can indeed cause a difference if an impact-fireball is high above the lunar surface. However, this effect is negligible close to the center of the Moon, where the event occurred; moreover, in the near vacuum on the Moon, the fireball should form an approximate hemisphere centered on the point of impact. One may also wonder about possible bad seeing effects; but features are sharp on the photograph, and the RMS error of the 8 control points is small, as noted above.

Dr. Anthony Cook has suggested that a new, bright craterlet with attendant ejecta might be detected under high solar lighting, thus near Full Moon, even when its dimensions are below the resolution of the optics employed. Using the Westfall measures, searches might concentrate on a circle about 8 km in radius with its center at latitude 4.3 degrees N, longitude 3.3 degrees W.

## Copies of Lunar Flare Photograph for Research

It is known that the original November 15, 1953 plate was at the Lunar and Planetary Laboratory of the University of Arizona in Tucson in 1967. Time-consuming efforts to locate it by Mr. Ewen Whitaker and others have been unsuccessful. However, Jerry Stuart, son of Leon H. Stuart, has retained a number of both positive and negative copies of the original plate. He will supply a list of these copied plates to interested persons and will lend them for research and measurement subject to the following rules:

Jerry Stuart will lend two (2) plates at a time for an approved request. They may be two negatives or one


Figure 4: Map 33 from "Alas of the Moon" by Antonin Rukl, showing the general area of the subject of this paper. (Image used with permission of the author.)

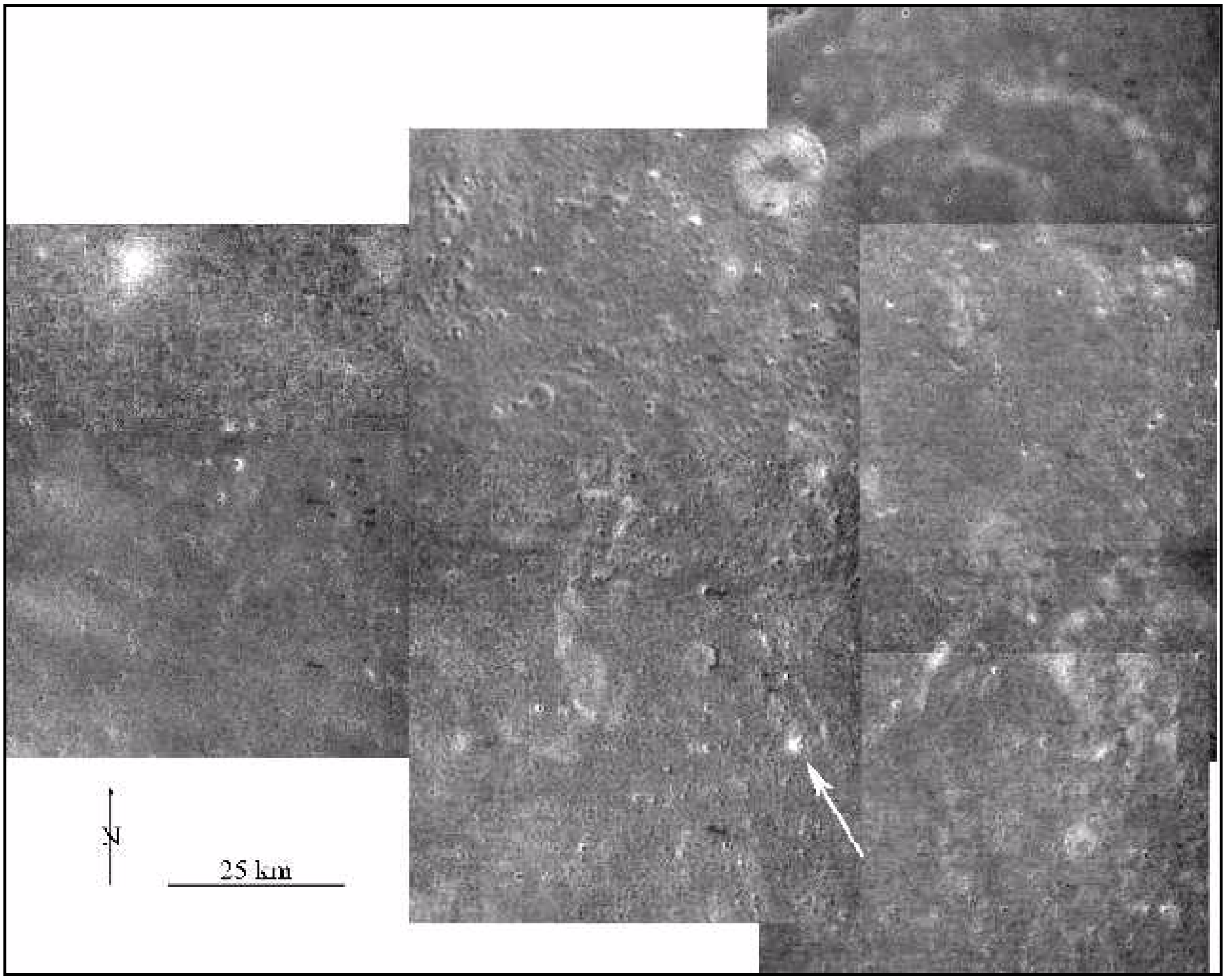


Figure 5: Mosaic of Clementine spacecraft images from 1994 showing likely candidate for site of fresh crater resulting from flare in photo by Dr. Leon Stuart. Arrow points to a 0.93 mile (1.5 km) wide crater with bluish tinged material surrounding the impact site. The crater's size matches what Buratti and Johnson estimate to be the energy produced by Stuart's flare, which they calculated to be about 0.5 megatons, or 35 times more powerful than the bomb dropped on Hiroshima. Source: (text) http://groups.msn.com/WeirdSpace; (photo) courtesy of JPL, Dr. Bonnie Buratti, Lane Johnson.

positive and one negative plate. Upon return of undamaged plates, within two weeks, a different combination may be requested (N + N or P + N). This process may be continued until your examination is completed. The same plate may be requested more than one time, to aid in performing comparison tests. In that case, return only the plate to be exchanged. The purpose of limiting plate access is to minimize loss should they be lost or otherwise damaged in transit. Jerry wants to keep the probability of current inventory loss or damage to a minimum. The borrower is granted the right to make electronic or physical copies of this material for research use; however, any publication of this material shall identify "Image courtesy of Jerry Stuart". The preliminary inquiry will cover some additional requirements such as shipping and insurance costs.

Inquiries may be addressed to:

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Santa Barbara, CA 93111-2547

or e-mail stuartjl@ieee.org.

## Miscellaneous Recent Discussion

Probably the only absolutely conclusive proof that the Stuart event created a new crater on the Moon would consist of finding a new crater very close to the impact-point meeting the Buratti criteria (3) and then further demonstrating its absence prior to 1953. Now many observers repeatedly saw the four largest craterlets on the floor of Plato prior to 1953, and they are even present on the best photographs for those years. These features are 1.7 to 2.2 km in diameter (16). Certainly still smaller objects could have been recorded and were. However, it would be very risky to infer the absence of such small features from the Moon prior to 1953 on the basis of their absence from pre-1953 drawings or photographs. I think that such caution would surely apply to objects up to 3 or 4 km across.

Dr. Stuart's carefully estimated duration of 8 seconds has been questioned on theoretical grounds. Buratti (3) and Alan W. Harris of the Space Science Institute arbitrarily change the duration to about 1 second (7). It is true that Dr. Stuart did not know that an event on the presumed scale should last no longer than a second, but he did know the difference between 8 seconds and 1 second. If we regard him as an honest observer, then 8 seconds is the best value we have for the minimum duration of the transient spot. Indeed, I think that Stuart was very nimble to do all that he described in only 8 seconds (1, 2). Jerry Stuart writes (22): "I don't see how Dad could have shuttered the scope tube end to take the picture, then slid the cover sheet over the glass plate in the cassette holder, removed the film cassette from the camera and recovered [covered again] the end of the scope in less than 8 seconds".

The duration question might suggest that we should not wholly overlook other possible interpretations of the transient bright spot. A few lunar observers have studied so-called Lunar Transient Phenomena and have reported temporary bright spots lasting from a few seconds up to several hours (10, 21, 23). They have offered a variety of explanations, even lunar volcanism. However, the brilliance of Stuart's spot may easily be unique.

Using the known gravitational constant of 1.60 meters/sec^2 at the surface of the Moon, Jerry Stuart computes that an object raised from the lunar surface by an impact to a height of 51 meters would fall back in 8 seconds. In 10 seconds it would fall back from 80 meters (17). Alternately, if a surface particle was blasted up to a height of 51 meters, its ascent and subsequent fall would require 16 seconds, etc. He remarks that it would not take much energy to reach such heights. He has watched from a distance as two different terrestrial volcanoes threw out luminous ejecta. Of course, there are large differences between cooling radiative effects at the Earth's surface and in free space without an atmosphere.

It is intriguing that the November 15 date of the photograph falls in the epoch of the Leonid meteors. John Westfall has computed that the Leonid radiant, at RA 10 hrs 18 min and Dec.+22 degrees, at the time of the Stuart photo was in the zenith for an observer on the Moon at latitude 9.7 degrees north and longitude 1.3 degrees west, thus about 7 degrees away from the center of the flare (18). Terrestrial Leonids have almost the maximum possible geocentric velocity of 71 kms/sec and lunar Leonids would have similar speeds. Buratti and Johnson in their analysis ASSUMED 20 kms/sec for the unknowable impact velocity(3). Since kinetic energy varies as the square of the velocity, it follows that the kinetic energy released at impact would become about 12 times greater if the meteoroid belonged to the Leonid stream. The craterlet produced would be larger — all assuredly pure speculation. As Jerry Stuart has pointed out, an alternative interpretation would be that, for a fixed amount of energy, the impacting Leonid would need to have only 8% as much mass.

We are all familiar with the diffraction spikes around bright stars on photographs made with reflecting telescopes having secondary mirrors and supporting arms. It has been suggested that the very bright Stuart flare should show similar diffraction spikes. There IS a question of observability; stars on a dark sky are not the same as brighter lunar features on the sunlit Moon. To my knowledge, no one has ever remarked about the required spikes on lunar photographs secured with reflecting telescopes around such brilliant features as Aristarchus, Censorinus, and Proclus. In the same way, stars not at the zenith MUST possess red and blue fringes caused by chromatic aberration, but they are noticed only near the horizon.

Jerry Stuart has investigated this problem and reports as follows (19): "The secondary was supported by three arms at 120-degree spacing. I have reviewed the best contact positive that I have for evidence of the three supports. For this I used my image scanner, an HP ScanJet 5370C. By very carefully manipulating the contrast and other controls, I have determined that there is an area of lower optical density at the center of the spot image and that there may be two very small barely visible points that would correspond to two of the three support arms as the spacing is about 1/3 of the circumference. I tried printing the image and had dubious success." There is also the fact that the famous photograph is very slightly out of focus(10).

Finally, Ms. Marylove Thralls is planning a book about "The Stuart Event", which will surely make more enjoyable reading than this wordy discussion. Curiously, she has lived in Tulsa and thus had the opportunity for historical research on Dr. Leon Stuart, and has moved to Santa Barbara, CA, where son Jerry Stuart can assist with memories and material.

It is a pleasure to thank for their help the many people who have contributed to this account, as acknowledged both in the text above and in the references below. Finally, I must especially thank Mr. J. O. Hughes of Las Cruces, NM, for his assistance in making the story into an acceptable document.

## References

1. Leon H. Stuart. "A Photo-Visual Observation of an Impact of a Large Meteorite on the Moon" *The Strolling Astronomer* (now *Journal of the Assn. of Lunar & Planetary Observers*, Vol. 10, Nos. 3-4, pp. 42-43. March-April, 1956 (but really autumn of 1956).

2. Leon H. Stuart, "A Photo-Visual Observation of an Impact of a Large Meteorite on the Moon", *The Journal of the International Lunar Society*, Vol. 1, No. 1, pp. 6-8 and rear outside cover. March, 1957.

3. Bonnie J. Buratti and Lane L. Johnson. "Identification of the Lunar Flash of 1953 with a Fresh Crater on the Moon's Surface," *Icarus*, Vol. 161, No. 1,pp. 192-197. Jan. 2003.

4. George Kane. "Tulsan's Astronomical 'First' Is Recognized," the *Tulsa World* newspaper. June 13, 1957.

5. J. Kelly Beatty and Monica Bobra. "The Moon's Youngest Crater?," *Sky & Telescope*, Vol. 105, No. 5, pg. 24. May 2003.

6. J. Kelly Beatty. "A Detective Story," *Sky & Telescope*, Vol. 105, No. 5, pg. 10. May, 2003.

7. J. Kelly Beatty. "Lunar Flash Doesn't Pan Out," *Sky & Telescope*, Vol. 105, No. 6, pg. 24. June 2003.

8. Steadman Thompson. Letter to Walter H. Haas on June 25, 1957.

9. Jerry Stuart. E-Mail to various persons with subject "Measurements on flare negative plate." April 5, 2003.

10. Barbara Middlehurst. Letter to Leon H. Stuart on July 13, 1967.

11. Lincoln La Paz, "The Atmosphere of the Moon and Lunar Meteoritic Erosion," *Popular Astronomy*, Vol. 46, No. 5, pp. 277-282, May 1938.

12. Leonard B. Abbey. E-Mail to Walter H. Haas on May 2, 2003.

13. Steadman Thompson, "Lunar Meteor News," *Prime Focus* (newsletter of the *Columbus, Ohio, Astronomical Society*), Vol. IV, No. VIII, pg.3, August 1956.

14. J. Kelly Beatty, "The Surprising 'Lunar Leonids'," *Sky & Telescope*, Vol. 99, No. 6, pg. 36, June 2000.

15. John E. Westfall, E-Mail in [ALPO-Member-Discussion listserv], Digest Number 224, March 5, 2003.

16. Antonin Rukl, "Atlas of the Moon", Kalmbach Publishing Co., page 32. 1996.

17. Jerry Stuart, E-Mail to Walter H. Haas. "RE: Caltech Examination of Lunar Flare? Response J. Stuart." May 6, 2003.

18. John E. Westfall, E-Mail to Walter H. Haas . "Sub-Leonid Point". June 30, 2003.

19. Jerry Stuart, E-Mail to Walter H. Haas. "RE:Did the Stuart Lunar Flare Show Diffraction Spikes?". July 7, 2003.

20. Walter H. Haas, "Those Unnumbered Reports of Lunar Changes - Were They All Blunders?", *Journal of the Assn. of Lunar & Planetary Observers*, Vol. 45, No. 2, pp.25-33, Spring 2003.

21. Winifred Sawtell Cameron, "Comparative Analyses of Observations of Lunar Transient Phenomena", *Smithsonian Institution Center for Short-Lived Phenomena*, October 1971.

22. Jerry Stuart,E-Mail to Walter H. Haas. "Re: Comments on book 'Stuart's Event' - J. Stuart Reply". December 16,2003.

23. Winifred Sawtell Cameron, "Lunar Transient Phenomena (LTP): Manifestation, Site Distribution, Correlations and Possible Causes", *Physics of the Earth and Planetary Interiors*, Vol. 14, pp. 194-216, 1977.

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