ISSN-0039-2502

Journal of the Association of Lunar & Planetary Observers

The Strolling Astronomer

Founded in 1947

Volume 56, Number 3, Summer 2014

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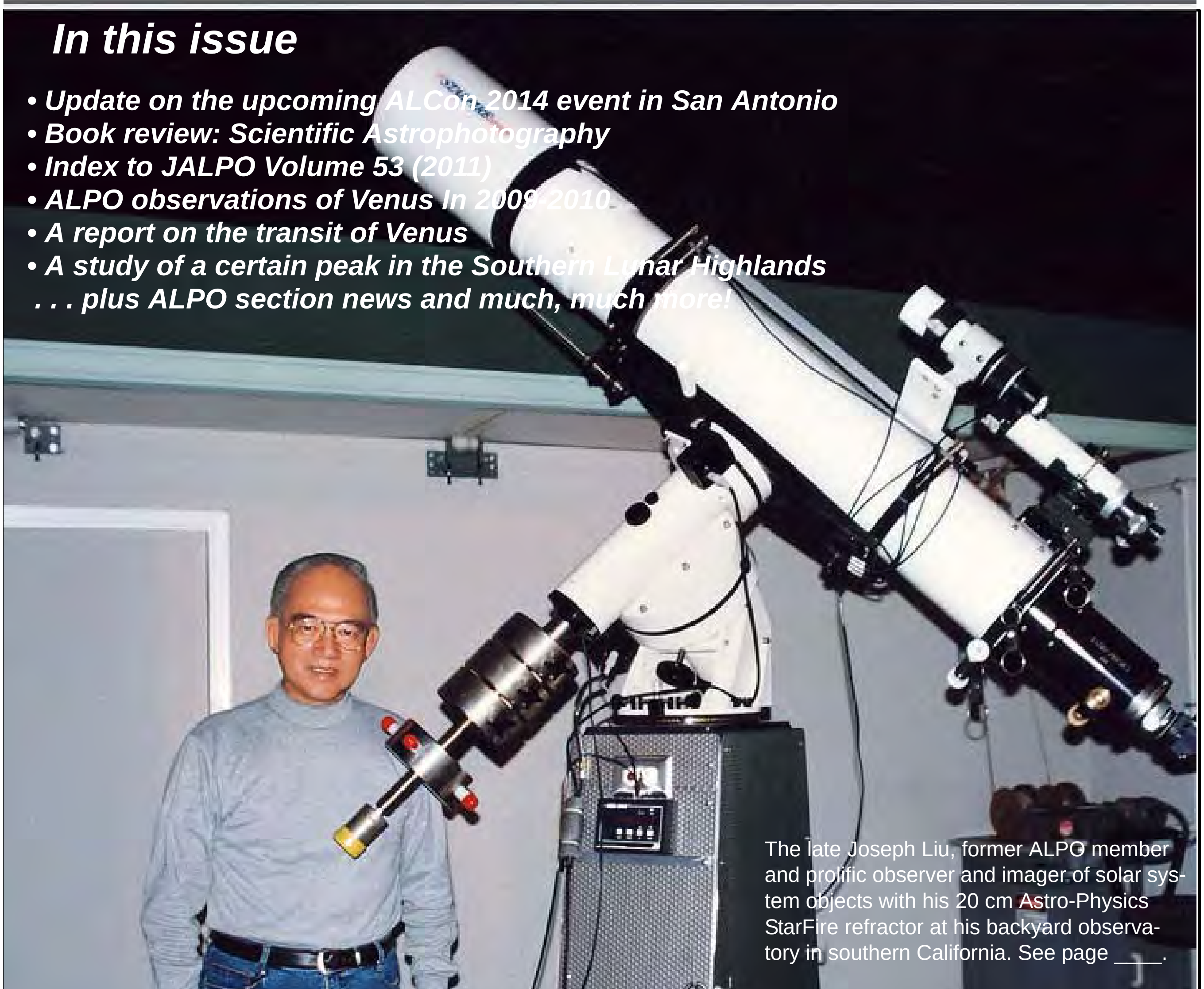
- *Book review: Scientific Astrophotography*
- *Index to JALPO Volume 53 (2011)*
- *ALPO observations of Venus In 2009-2010*
- *A report on the transit of Venus*
- *A study of a certain peak in the Southern Lunar Highlands*

. . . plus ALPO section news and much, much more!



The late Joseph Liu, former ALPO member and prolific observer and imager of solar system objects with his 20 cm Astro-Physics StarFire refractor at his backyard observatory in southern California. See page ____.

ALCon 2014 San Antonio

July 10 – 12, 2014

July 10–12, 2014 • San Antonio, Texas

The Stars are Big and Bright, Deep in the Heart of Texas

Location: Hilton San Antonio Airport

Host Organizations: San Antonio Astronomical Association, Astronomical League

• Plus – ALPO Annual Meeting!

Accommodations...

Hilton San Antonio Airport

- Be sure to ask for the Astronomical League rate
- http://www.sanantonioairport.hilton.com
- Telephone: 1.888.728.3031
- Thursday Night StarB-Q and Social — Meet amateurs from other clubs!
- Saturday Night Awards Banquet
- Plenty of restaurants and shopping nearby

San Antonio Attractions:

- The Alamo
- Paseo del Rio (Riverwalk)
- Sea World San Antonio
- Six Flags Fiesta Texas
- San Antonio Missions National Park
- San Antonio Zoo
- San Antonio Botanical Garden
- Japanese Tea Garden
- Tower of the Americas
- Witte Museum
- San Antonio Museum of Art
- McNay Art Museum
- Natural Bridge Cavern and Wildlife Ranch
- Institute of Texan Cultures
- Menger Hotel
- Spanish Governor's Palace

Excursions around San Antonio:

- Friday Night Paseo del Rio

Sign up for the bus — Avoid driving aggravations and parking fees

Speakers...including

Dr. Don Olson, Celestial Sleuth

Don Pettit, Astronaut

Forrest Mims, Atmospheric Science

Stephen Ramsden, Solar Outreach

and ★ more!

Register before June 1 and receive a free ALCon 2014 Lapel Pin!

Register at:

• **alcon2014.astroleague.org**

The Alamo

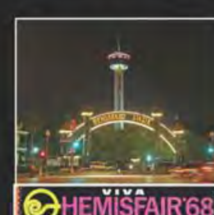
Sea World

McNay Art Museum

Paseo del Rio (Riverwalk)

San Antonio Skyline

Mission San Jose



Hemisfair Park

Journal of the Association of Lunar & Planetary Observers

The Strolling Astronomer

Volume 56, No.3, Summer 2014
This issue published in June 2014 for distribution in both portable document format (pdf) and also hardcopy 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.

For membership or general information about the ALPO, contact:

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Visit the ALPO online at:
http://www.alpo-astronomy.org

Founded in 1947

Inside the ALPO

Inside the ALPO
Member, section and activity news

Association of Lunar & Planetary Observers (ALPO)

Point of View
A Full Issue and a Sad Parting

By Ken Poshedly, executive director, editor & publisher
The Strolling Astronomer

This month, we offer another nice series of reading materials: in our review of *Scientific Astrophotography: How Amateurs Can Generate and Use Professional Imaging Data,* ALPO book review editor Robert Garfinkle reveals what is different between this 333-page explanation of all things involved with astro-imaging and all the other books on this subject; for those of you who keep track of the who's and what's of previous issues of this Journal, we include the index to volume 53 (2011) of the Quarterly Journal of the Assn of Lunar & Planetary Observers; as usual, we also include an apparition report, this time ALPO Observations of Venus During the 2009-2010 Western (Morning) Apparition (it's encouraging that there are still those of you out there who remain so dedicated to our goals of providing the finest reports by Earth-based observers of our solar system, this time 16 individuals from across the world submitting their results of 159 observations); William Sheehan documents his own adventures in observing the transits of Venus in 2004 and 2012; and our new acting assistant coordinator for the ALPO Lunar Topographical Studies Program Jerry Hubbell details his use of a certain software package to assist in his computation of the height of a certain lunar peak.

And we also urge all of you to try and attend this year’s conference of the Astronomical League, ALCON 2014 being held this July in San Antonio.

But we are also proud to present what can only be called a very abbreviated account of the astronomical pursuits of former ALPO member, the late Joseph Liu who passed away this past spring.

While it’s safe to say that a great many of our members — with a few exceptions — observe, image and even still sketch or draw solar system objects for their own enjoyment and pretty much leave it at that, there are others whose total fascination with the heavens keeps them going and going and going . . .

Mr. Liu’s passion for observing the skies drove him to excel both in his home country of China and here in the U.S. Over his many years as an astronomer — both as a professional in Hong Kong and later a very active amateur in California — he constructed two personal observatories, and obtained, modified and utilized various pieces of equipment to produce the most stunning images of lunar and other solar system objects.

We believe he will be truly missed.

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News of General Interest

ALPO 2014 Conference News

All ALPO members are urged to try and attend the Astronomical League convention (ALCon 2014) at the Hilton San Antonio Airport Hotel July 9 thru 12.

More at http://alcon2014.astroleague.org/

Please also see the full-page ad on the inside front cover of this Journal.

ALPO 2014 Call for Papers

As reported in the previous issue of this Journal, a number of ALPO presentations will be included as part of the main series at ALCon 2014, with the remainder of the ALPO papers presented at a separate room near the main presentation hall.

Those ALPO presentations scheduled for the main ALCon 2104 event are as shown below:

1 p.m., Thursday, July 10 — Mike Reynolds, the 2017 Total Solar Eclipse

4:30 p.m., Thursday, July 10 — Wayne Bailey, the ALPO Lunar Topographical Studies Program

1:30 p.m., Friday, July 11 — John Westfall, Crossing Jupiter's Equator: The Coming Season of Satellite Mutual Events

4 p.m., Friday, July 11 — Julius Benton, Saturn Observations

1 p.m., Saturday, July 12 — Richard Schmude, Recent Studies of Mars: 2013-2014

4:30 p.m., Saturday, July 12 — Matt Will, What the ALPO is All About

The final schedule of ALPO presentations besides those shown above will be announced via e-mail to the ALPO membership.

Participants are encouraged to submit research papers, presentations, and experience reports concerning various aspects of Earth-based observational astronomy. Suggested topics for papers and presentations include the following:

- New or ongoing observing programs and studies, specifically, how those programs were designed, implemented and continue to function.
- Results of personal or group studies of solar system or extra-solar system bodies.
- New or ongoing activities involving astronomical instrumentation, construction or improvement.
- Challenges faced by Earth-based observers such as changing interest levels, deteriorating observing conditions brought about by possible global warming, etc.

The preferred format is Microsoft PowerPoint, though 35mm slides are also acceptable. The final presentation should not exceed 20 minutes in length, to be followed by no more than five (5) minutes of questions from the audience. A hard-copy version of the paper should be made available for future web site publication.

Please submit by June 1, 2014, the following:

- Title of the paper being presented.
- A four- or five-sentence abstract of each paper.
- The format in which the presentation will be.
- A 100-word biography and a recent photograph of the presenter for posting on the ALCon 2013 website and inclusion in the printed program guide.

E-mail is the preferred method for contact:

ken.poshedly@alpo-astronomy.org

If regular mail must be used, address all materials to:
ALCon 2014
c/o Ken Poshedly
1741 Bruckner Court
Snellville, Georgia 30078 USA

All fees and other details are listed in the registration form.

ALPO Interest Section Reports

ALPO Online Section

Larry Owens, section coordinator
Larry.Owens@alpo-astronomy.org

Follow us on Twitter, become our friend on FaceBook or join us on MySpace.

To all section coordinators: If you need an ID for your section's blog, contact Larry Owens at larry.owens@alpo-astronomy.org

For details on all of the above, visit the ALPO home page online at www.alpo-astronomy.org

Computing Section

Larry Owens, section coordinator
Larry.Owens@alpo-astronomy.org

Important links:

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- To subscribe to the ALPOCS yahoo e-mail list, *http://groups.yahoo.com/group/alpocs/*
- To post messages (either on the site or via your e-mail program), *alpocs@yahoogroups.com*
- To unsubscribe to the ALPOCS yahoo e-mail list, *alpocs-unsubscribe@yahoogroups.com*
- Visit the ALPO Computing Section online at *www.alpo-astronomy.org/computing*

Lunar & Planetary Training Program

Tim Robertson, section coordinator
cometman@cometman.net

Those interested in this VERY worthwhile program (or even those who wish to brush up on their skills) should contact Tim Robertson at the following addresses:

Timothy J. Robertson
ALPO Training Program
195 Tierra Rejada #148
Simi Valley, California 93065

Send e-mail to:
cometman@cometman.net

Please be sure to include a self-addressed stamped envelope with all correspondence.

For information on the ALPO Lunar & Planetary Training Program, go to: *www.cometman.net/alpo/*

ALPO Observing Section Reports

Mercury / Venus Transit Section

John Westfall, section coordinator
johnwestfall@comcast.net

Visit the ALPO Mercury/Venus Transit Section online at *www.alpo-astronomy.org/transit*

Meteors Section

Robert Lundsford, section coordinator
lunro.imo.usa@cox.net

The string of celestial disappointments continued in May with the poor showing of the Camelopardalids. Just last November Comet ISON promised a grand display only to fade away at perihelion.

And now the Earth has passed through the orbit of comet 209P/Linear only to find out that this object is very dust-poor and has been for the last 200 years

It was not a complete dud as the few shower members that did appear were impressive. My own brightest meteor was a magnitude -3 beauty that lasted several seconds. It was a clear coppery-orange and fragmented at the end of its trail.

Unfortunately that was only one of two Camelopardalids seen during my 3 hour watch from the Sonora Desert in southern California. Many other observers obtained similar results.

Those who were able to view from pristine skies with deep limiting magnitudes were able to catch a few faint Camelopardalids but the highest total I found was still only 12.

As it turns out we have another opportunity to view a few more of these meteors in 2019. Due to the poor showing of the 2014 display, the predicted zenith hourly rates for the upcoming 2019 event have been revised downward to only 5. This is hardly a display to prompt one to circle a date on their calendar!

Finally, a reminder that the book *Uranus, Neptune and Pluto and How to Observe Them*, which was authored by this coordinator, is available from Springer at www.springer.com/astronomy/popular+astronomy/book/978-0-387-76601-0 or elsewhere (such as www.amazon.ca/Uranus-Neptune-Pluto-Observe-Them/dp/0387766014) to order a copy.

Visit the ALPO Meteors Section online at www.alpo-astronomy.org/meteorblog/ Be sure to click on the link to viewing meteors, meteor shower calendar and references.

Meteorites Section

Report by Dolores H. Hill, section coordinator
dhill@lpl.arizona.edu

Visit the ALPO Meteorite Section online at www.alpo-astronomy.org/meteorite/

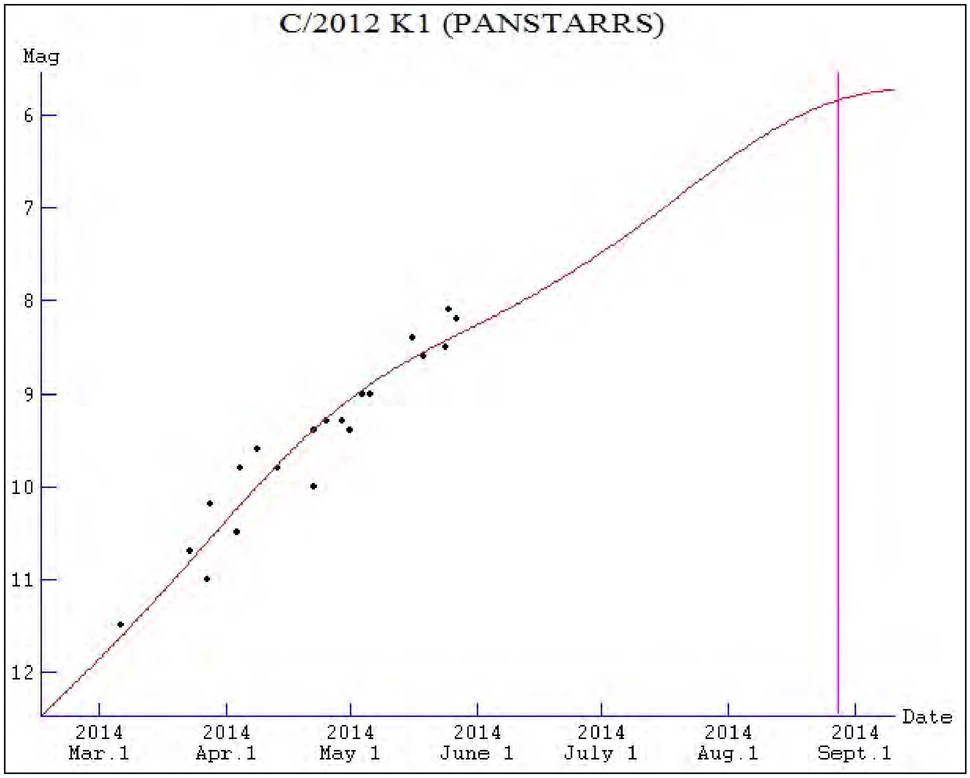
Comets Section

Report by Carl Hergenrother, acting section coordinator
chergen@lpl.arizona.edu

The first five months of 2014 have seen quite a bit of Section activity even though there have been few bright comets.

We have received a number of magnitude estimates and images from Salvador Aguirre, Frank Melillo, John Sabia and your acting Comets Section coordinator for comets C/2012 K1 (PANSTARRS), C/2012 X1 (LINEAR), C/2013 R1 (Lovejoy), P/2013 TL117 (Lemmon), C/2013 V2 (Borisov), C/2013 V5 (Oukaimeden) and C/2014 E2 (Jacques).

Also please check out the ALPO Comets Section webpage, as a new "Comet Magnitude Repository" has been created. This page includes all recent ALPO Comets Section magnitude estimates and lightcurves derived from the data. As always, the



Visual magnitude lightcurve for comet C/2012 K1 (PANSTARRS) derived from magnitude estimates submitted to the ALPO Comets Section by Salvador Aguirre, Carl Hergenrother and John Sabia.

ALPO Comets Section would like to receive your comet observations.

The July through September quarter may see a bonanza of cometary activity. As many as 5 comets may be visible in small telescopes and some may even reach naked eye brightness.

- C/2012 K1 (PANSTARRS) - Rapidly brightening over the past few months, K1 was at about 8th magnitude at the end of May. It will brighten to 7th magnitude before getting too close to the Sun to observe in mid-July. When the comet re-emerges in early September, it may be as bright as 6th magnitude. See graph also on this page.
- C/2013 A1 (Siding Spring) - It may not be the brightest comet of the fall, but it may be the most newsworthy as Siding Spring will pass within 135,000 km (83,885 miles) of Mars on Oct. 19. On Earth, the comet will be a far southern object for most of the summer. By the end of September, it will start to become visible for Northern Hemisphere observers at ~8th magnitude.
- C/2013 UQ4 (Catalina) - For months after discovery, UQ4 was observed to be inactive. Finally in May, observers noticed that the comet had "woken up". In early July, it will approach within 0.32 AU (29,760,000 miles) of Earth.

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Though its predicted brightness is still uncertain, it may be a 7-8th magnitude object at the time. It will be interesting to see if this comet turns off as suddenly as it turned on.

- C/2013 V5 (Oukaimeden) - This comet is named after the observatory in Morocco where it was discovered. It should become brighter than 10th magnitude in August and may be as bright as 6th magnitude by the end of September as it closes to within at 0.6 AU (55,800,000 miles) of the Sun and Earth.
- C/2014 E2 (Jacques) - Jacques rounds the Sun on July 2 at a perihelion distance of 0.66 AU (61,380,000 miles). Unfortunately, it will be too close to the Sun to be seen from Earth. By mid-July it will be far enough from the Sun to be seen from Earth and may even be as bright as 5th magnitude. The comet will steadily fade to 10th magnitude by the end of September.

As always, the ALPO Comets Section thanks those who have sent observations during 2013 and we solicit new images, drawings and magnitude estimates during the rest of this year.

The ALPO Comet Section solicits all observations of comets, including drawings, magnitude estimates, images and spectra. Drawings and images of current and past comets are being archived in the ALPO Comet Section image gallery at *http://www.alpo-astronomy.org/gallery/main.php?g2_itemId=4491*

Please send all observations and images to Carl Hergenrother at the e-mail address shown at the beginning of this section report.

Visit the ALPO Comets Section online at *www.alpo-astronomy.org/comet*

Solar Section

Report by Kim Hay, section coordinator
kim.hay@alpo-astronomy.org

We are always looking for members to submit an article to the JALPO on solar imaging and solar phenomena. Please send to myself (*kim.hay@alpo-*

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astronomy.org) or to Ken Poshedly (ken.poshedly@alpo-astronomy.org)

For information on solar observing – including the various observing forms and information on completing them – go to www.alpo-astronomy.org/solar

Mercury Section

Report by Frank J. Melillo, section coordinator
frankj12@aol.com

Visit the ALPO Mercury Section online at www.alpo-astronomy.org/mercury

Venus Section

Report by Julius Benton, section coordinator
jlbaina@msn.com

Venus is now visible well before sunrise, having already passed through Greatest Brilliancy in mid-February, followed by Greatest Elongation West of 47° on March 22 and theoretical dichotomy (half phase) on March 23. Observers will notice that Venus is progressing through its waxing phases, shrinking in angular diameter as it changes from a crescent to a gibbous and ultimately a fully illuminated disk as it approaches Superior Conjunction in late October.

The table of geocentric phenomena in Universal Time (UT) that accompanies this report is presented for the convenience of observers for the 2014 Western (Morning) Apparition.

The ALPO Venus Section has been receiving an increasing number of drawings and images of Venus as the apparition has progressed.

But observers are alerted that images are still needed by the Venus Express (VEX) mission which started systematically monitoring Venus at UV, visible (IL) and IR wavelengths back in May 2006.

This Professional-Amateur (Pro-Am) effort is ongoing at least until the end of 2014, so observers should continue to send images to both the ALPO Venus Section and the VEX website at:

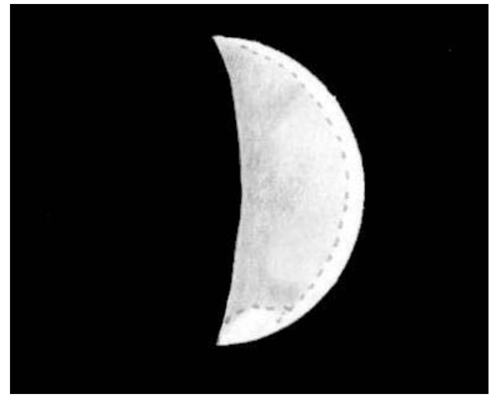
http://sci.esa.int/science-e/www/object/index.cfm?fobjectid=38833&fbodylongid=1856.

Regular Venus program activities (including drawings of Venus in integrated light and with color filters of known transmission) are also valuable throughout the period that VEX is observing the planet.

The observation programs carried out by the ALPO Venus Saturn Section are listed on the Venus page of the ALPO website at http://www.alpo-astronomy.org/venus as well as in considerable detail in the author's ALPO Venus Handbook, which is available from the ALPO Venus Section. Observers are urged to carry out digital imaging of Venus at the same time that others are imaging or making visual drawings of the planet (i.e., simultaneous observations).

Geocentric Phenomena of the 2014 Western (Morning) Apparition of Venus in Universal Time (UT)

Inferior Conjunction		Jan 11 (angular diameter = 63.1 arc-seconds)
Greatest Illuminated Extent		Feb 15 (m_V = –4.9)
Greatest Elongation West	2014	Mar 22 (Venus will be 47° west of the Sun)
Predicted Dichotomy		Mar 23.73 (exactly half-phase predicted)
Superior Conjunction		Oct 25[d] (angular diameter = 9.7 arc-seconds)



Michel Legrand of Le Baule-Escoublac, France, submitted this excellent drawing made in integrated light (IL) and blue (W80A and W38) filters of the crescent of Venus on March 10, 2014, between 09:15 UT and 09:31 UT using a 21.0 cm (8.3 in.) Newtonian at 251X. Seeing = 7.0 and Transparency = 5.0 (both based on the ALPO scales). Radial dusky markings are seen on the disk of Venus in this sketch, as well as the bright limb band running along the limb from cusp to cusp and the northern cusp cap. The apparent diameter of Venus is 28.7”, phase (k) 0.425 (42.5% illuminated), and visual magnitude -4.5. South is at top of image.

Although regular imaging of Venus in both UV, IR and other wavelengths is extremely important and highly encouraged, far too many experienced observers have neglected making visual numerical relative intensity estimates and reporting visual or color filter impressions of features seen or suspected in the atmosphere of the planet (for instance, categorization of dusky atmospheric markings, visibility of cusp caps and cusp bands, measurement of cusp extensions, monitoring for the Schröter phase effect near the date of predicted dichotomy, and looking for terminator irregularities).

Routine use of the standard ALPO Venus observing forms will help observers know what needs to be reported in addition to supporting information such as telescope aperture and type, UT date and time,

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Lunar Calendar for Third Quarter 2014 (All Times UT)

Jul	05	11:59	First Quarter
	06	01:21	Moon-Mars: 0.2° S
	06	06:32	Moon-Spica: 2.2° S
	06	09:50	Moon Ascending Node
	08	02:48	Moon-Saturn: 0.4° N
	10	17:29	Moon South Dec.: 19° S
	12	11:25	Full Moon
	13	08:27	Moon Perigee: 358300 km
	18	21:21	Moon Descending Node
	19	02:08	Last Quarter
	22	11:56	Moon-Aldebaran: 2° S
	23	15:36	Moon North Dec.: 18.9° N
	24	18:16	Moon-Venus: 4.9° N
	26	22:42	New Moon
	28	03:27	Moon Apogee: 406600 km
Aug	02	11:26	Moon Ascending Node
	02	13:27	Moon-Spica: 2.5° S
	03	10:02	Moon-Mars: 2.4° S
	04	00:50	First Quarter
	04	10:54	Moon-Saturn: 0.1° N
	07	04:26	Moon South Dec.: 18.8° S
	10	17:43	Moon Perigee: 356900 km
	10	18:09	Full Moon
	15	00:18	Moon Descending Node
	17	12:26	Last Quarter
	18	17:46	Moon-Aldebaran: 1.7° S
	19	22:12	Moon North Dec.: 18.8° N
	24	05:48	Moon-Venus: 6.3° N
	24	06:09	Moon Apogee: 406500 km
	25	14:13	New Moon
	29	13:14	Moon Ascending Node
	29	19:08	Moon-Spica: 2.7° S
	31	19:21	Moon-Saturn: 0.4° S
	31	23:43	Moon-Mars: 4.4° S
Sep	02	11:11	First Quarter
	03	13:10	Moon South Dec.: 18.6° S
	08	03:29	Moon Perigee: 358400 km
	09	01:38	Full Moon
	11	07:32	Moon Descending Node
	15	01:01	Moon-Aldebaran: 1.5° S
	16	02:05	Last Quarter
	16	05:15	Moon North Dec.: 18.6° N
	20	14:22	Moon Apogee: 405800 km
	24	06:14	New Moon
	25	17:41	Moon Ascending Node
	26	00:48	Moon-Spica: 2.8° S
	26	09:32	Moon-Mercury: 4.6° S
	28	04:46	Moon-Saturn: 0.8° S
	30	19:29	Moon South Dec.: 18.5° S

Table courtesy of William Dembowski and NASA's SkyCalc Sky Events Calendar

magnifications and filters used, seeing and transparency conditions, etc.

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

Individuals interested in participating in the programs of the ALPO Venus Section are encouraged to visit the ALPO Venus Section online http://www.alpo-astronomy.org/venusblog/

Lunar Section

Lunar Topographical Studies / Selected Areas Program

Report by Wayne Bailey, program coordinator

wayne.bailey@alpo-astronomy.org

The ALPO Lunar Topographical Studies Section (ALPO LTSS) received a total of 89 new observations from 12 observers during the January-March quarter. Five contributed articles were published in addition to numerous commentaries on images submitted.

The *Focus-On* series continued with articles on Aristarchus and Mare Frigoris. Upcoming *Focus-On* subjects include Mare Vaporum, Banded Craters, and the Altai Scarp.

The big news this quarter was that the Chinese lander Chang'e 3 and rover Yutu have survived several lunar nights, although Yutu has not recovered from a malfunction that prevents it from moving. NASA's LADEE has completed its mission and impacted as planned.

All electronic submissions should now be sent to Acting Assistant Coordinator Jerry Hubbell at jerry.hubbell@alpo-astronomy.org or myself at wayne.bailey@alpo-astronomy.org.

Hard copy submissions should continue to be mailed to me at the address

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provided in the ALPO Resources section of this Journal.

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Visit the following online web sites for more info:

- ALPO Lunar Topographical Studies Program *moon.scopesandscapes.com/alpo-topo*
- ALPO Lunar Selected Areas Program *moon.scopesandscapes.com/alpo-sap.html*
- The Lunar Observer (current issue) *moon.scopesandscapes.com/tlo.pdf*
- The Lunar Observer (back issues) *moon.scopesandscapes.com/tlo_back.html*
- Banded Craters Program: *moon.scopesandscapes.com/alpo-bcp.html*
- The Lunar Discussion Group: *tech.groups.yahoo.com/group/Moon-ALPO/*
- The Moon-Wiki: *the-moon.wikispaces.com/Introduction*
- Chandrayaan-1 M3: *pds-imaging.jpl.nasa.gov/portal/chandrayaan-1_mission.html*
- LADEE: *www.nasa.gov/mission_pages/ladee/main*
- LROC: *lroc.sese.asu.edu/EPO/LROC/lroc.php*
- GRAIL: *http://www.nasa.gov/mission_pages/grail/main/*

Lunar Meteoritic Impacts

Brian Cudnik, program coordinator
cudnik@sbcglobal.net

Please visit the ALPO Lunar Meteoritic Impact Search site online at *www.alpo-astronomy.org/lunar/lunimpacts.htm*.

Lunar Transient Phenomena

Report by Dr. Anthony Cook, program coordinator
tony.cook@alpo-astronomy.org

Lunar Transient Phenomena

By Dr Anthony Cook

Only one Lunar Transient Phenomena (LTP) observation has come to light (so to speak) since the last LTP summary article:

- Campanus: 2014 Jan 11 UT 22:00-22:30 Steve Bush (SPA observer, UK) noticed the central peak of this crater was difficult to resolve and the floors of Campanus and Mercator were devoid of detail. ALPO/BAA weight=1.

Four candidate observations from 2013: Dec 19 (Geminus), and 2014: Mar 10 (Copernicus), Mar 16 (Pythagoras), and Apr 11 (South), did not make it onto the LTP list, for reasons explained in the monthly ALPO Lunar Section newsletter *The Lunar Observer*. We are grateful for all candidate LTP observations submitted for study and hope that our feedback will make it easier for future observers to recognise false effects in optics, our atmosphere, and in CCD images, which might resemble LTPs.

We would like very much to encourage those with high resolution imaging expertise to take part in repeat illumination observations and to help eliminate past LTP by re-observing under similar lighting conditions. Images obtained in this way can then undergo computer simulations for chromatic aberration, atmospheric spectral dispersion, and atmospheric seeing blur which might perhaps account for many past LTP reports.

Since 2001 we have made great progress in eliminating, or at least lowering, the weights of a multitude of past LTP reports, as described in the monthly TLO. But there are nevertheless a minority of LTP which cannot be simply accounted for by these non-lunar explanations. I would like especially to thank astronomers: Jay Albert, Maurice Collins, Marie Cook, Rik Hill, Brendan Shaw, Franco Taccogna (UAI observer) and Claudio Vantaggiato (UAI observer) who regularly contribute images or highly detailed sketches to support this research.

Dates and UTs, on which to see features under similar illumination conditions to past LTPs, can be found at *http://users.aber.ac.uk/atc/tlp/tlp.htm*. If you think that you see a LTP, please follow through the rigorous checklist also on that web site before contacting me.

Twitter LTP alerts are available on: *http://twitter.com/lunarnaut*.

Finally, please visit the ALPO Lunar Transient Phenomena site online at *http://users.aber.ac.uk/atc/alpo/ltp.htm*

Mars Section

Report by Roger Venable, section coordinator
rjvmd@hughes.net

Mars was at opposition on April 9 and closest to Earth on April 14. As I write this in late May, its retrograde motion is ending. You can find it easily, as it is bright in the evening sky in Virgo, not far from Spica. If you give your telescope at least an hour to adjust to the ambient temperature after dark and then

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collimate it accurately, you will see much detail on the surface of Mars.

While Mars has passed through its cloudiest season, you can still see clouds and hazes. Don't be discouraged if you can't make out some surface details, but rather ascribe the difficulty to obscuration by haze. Using a red filter like W25 will enable you to see through much of the haze, while a violet filter like W47 will make the clouds and haze appear bright, showing you clearly where they are.

Sometimes the bright clouds of Hellas in the south can be confused with the North Polar Cap at the opposite edge of the planet, so take care to get your directions right.

Observers are very active in drawing and imaging Mars this apparition. Join the 1416 members of our Yahoo group at https://groups.yahoo.com/neo/groups/marsobservers/info . There you can upload your images and drawings, communicate your perceptions about the planet, and see what other observers are seeing.

Join us in the Mars observers group on Yahoo at groups.yahoo.com/neo/groups/marsobservers/info

Note that this is a new web address, as Yahoo has changed its group addresses. If you type into your browser the previous Mars observers group address, you will be automatically redirected to this new one.

Visit the ALPO Mars Section online and explore the Mars Section's recent observations: www.alpo-astronomy.org/mars

Minor Planets Section

Frederick Pilcher, section coordinator
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Some highlights published in the *Minor Planet Bulletin*, Volume 41, No. 2, 2014 April - June are hereby presented. These represent the recent achievements of the ALPO Minor Planets Section.

Based on lightcurves from multiple oppositions, Mahfuz Krueng and Maurice Clark have prepared a model of the spin axis orientation and shape of 1825 Klare.

Melissa H. Hayes-Gehrke and students, and Lorenzo Franco, have found that 3905 Doppler is a binary asteroid with deep narrow minima resembling those of eclipsing binary stars.

Brian Warner has found that (69406) 1995 SX48 and (119744) 2001 YN42 also have satellite companions. Of these, (119744) is a very remarkable system with a very slowly rotating primary (period 625 hours) and a short period secondary (period 7.24 hours). The period of revolution is likely to be long, but could not be measured because no dimmings due to transits or eclipses were observed.

Tumbling behavior (or simultaneous rotation about two different axes) has been found for 6063 Jason, (24077) 1998 TD233, probably (163696) 2003 EB50, 2013 RM43, 2013 SU24, and 2013 YL2. For tumbling objects, the lightcurve has a complex and nonrepeating behavior.

Robert Stephens, Linda French, and colleagues have found the rotation periods of 24 additional Trojan asteroids. These are identified in the list below with the symbol "T".

Lightcurves with derived rotation periods are published for 128 other asteroids. These are of asteroids numbered 64, 67, 279, 540, 560, 567, 607, 641, 712, 734, 804, 870, 983, 989, 1003, 1125, 1420, 1425, 1468, 1486, 1870 T, 1871 T, 2112, 2241 T, 2254, 3169, 3182, 3250, 3263, 3451 T, 3618, 3632, 3737, 3753, 3823, 3896, 4031, 4440, 4450, 4707 T, 4727, 4867 T, 4943, 5040, 5110, 5120 T, 5175, 5431, 5489, 6041, 6249, 6602, 6634, 7087, 7173, 7352 T, 7505, 9068, 9873, 9950, 10115, 11089 T, 11833, 11887 T, 11941, 11976, 12369, 12920, 15502 T, 15977 T, 16141, 16197, 17171 T, 17365 T, 17492 T, 17511, 18109, 18137 T, 20210, 21321, 22180 T, 24445, 24448 T, 24451 T, 30705 T, 30856, 31173, 32496 T, 32615 T, 32856, 49667, 49675, 51958 T, 52760, 53435, 65733, 76867 T, 82060, 85118, 86192, 88710, 105158, 120578, 125742, 134549, 138095, 142781, 162566, 249595, 251346, 1997 WQ23, 2003 WX25, 2006 CT, 2010 CL19, 2010 SL13, 2010 XZ67, 2011 CQ4, 2013 RH74, 2013 SC25, 2013 SW24, 2013 TB80, 2013 TE6, 2013 UH5, 2013 UH9, 2013 UR3, 2013 VJ2, 2013 XA4, 2013 XY8.

Some of these provide secure period determinations, some only tentative ones. Some are of asteroids with no previous lightcurve photometry, others are of asteroids with previous period determinations which may be consistent or inconsistent with the earlier values.

The *Minor Planet Bulletin* is a refereed publication and that it is available online at http://www.minorplanet.info/mpbdownloads.html.

Annual voluntary contributions of $5 or more in support of the publication are welcome.

Please visit the ALPO Minor Planets Section online at http://www.alpo-astronomy.org/minor

Inside the ALPO
Member, section and activity news

Jupiter Section

Report by Ed Grafton, acting section coordinator
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Jupiter reached opposition on January 5, 2014. This apparition, the GRS continued its trend of shrinking in size while its orange coloration became more saturated in contrast to its more pale appearance in the past. B. Combs captured the GRS on February 17, 2014 as shown in Figure 1.

In mid-February, a NTB outbreak was observed. The outbreak had become more defused as of April and its evolution can be seen from February 15 to February 22 at this URL: http://www.egrafton.com/ntboutbreak.jpg

One of Jupiter's more interesting features is Oval BA. It acquired a reddish coloration as noted by C. Go in 2006 and this apparition, the center of BA is seen to have a whitish center. High resolution images show detail within oval BA and resolve a light-colored center encased by an orange outer perimeter and darker surrounding collar. Images of BA by D. Parker, C. Pellier, P. Maxson and D. Peach are seen at this URL: http://egrafton.com/ovalba.jpg

Visit the ALPO Jupiter Section online at http://www.alpo-astronomy.org/jupiter

Galilean Satellite Eclipse Timing Program

Report by John Westfall, program coordinator
johnwestfall@comcast.net

Contact John Westfall via e-mail at johnwestfall@comcast.net or via postal mail at 5061 Carbondale Way, Antioch, CA 94531 USA to obtain an observer's kit, also available on the Jupiter Section page of the ALPO website.

Saturn Section

Report by Julius Benton, section coordinator
jlbaina@msn.com

Saturn reached opposition on May 10 and is now well-placed for observing most of the night. During the 2013-14 observing season, with the rings tilted about +22° towards Earth, the northern hemisphere of the globe and north face of the rings are visible to greater advantage than in several prior apparitions.

Now that the 2013-14 apparition is well underway, observers have already submitted well over 120 images and drawings of Saturn. Although there have been no reports of significant atmospheric activity other than brightenings along the EZn, a few observers with larger apertures have suspected extremely small elusive dark spots near the periphery of the NPR. As the observing season progresses, it will be interesting to see if diffuse bright areas or dusky features among the zones and belts of the planet's northern hemisphere emerge now that Saturn is higher in the sky as opposition approached. Consequently, observers are encouraged to keep Saturn under careful surveillance in the forthcoming weeks.

The accompanying table of geocentric phenomena for the 2013-14 apparition is presented for the convenience of readers who wish to plan their Saturn observing activities.

The observation programs conducted by the ALPO Saturn Section are listed on the ALPO Saturn Section web page at www.alpo-astronomy.org/saturn as well as in considerable detail in the author's book, *Saturn and How to Observe It*, available from Springer, Amazon.com, etc., or by writing to the ALPO Saturn Section for further information.

Observers are urged to carry out digital imaging of Saturn at the same time that others are imaging or visually watching Saturn (i.e., simultaneous observations). Although regular imaging of Saturn is extremely important and highly encouraged, far too many experienced observers have neglected making visual numerical relative intensity estimates, which are badly needed for a continuing comparative analysis of belt, zone, and ring component brightness variations over time. So this type of visual work is

Geocentric Phenomena for the 2013-14 Apparition of Saturn in Universal Time (UT)	
Conjunction	2013 Nov 6^d
Opposition	2014 May 10^d
Conjunction	2014 Nov 18^d
Opposition Data:	
Equatorial Diameter Globe	18.6 arc-seconds
Polar Diameter Globe	16.6 arc-seconds
Major Axis of Rings	42.2 arc-seconds
Minor Axis of Rings	15.5 arc-seconds
Visual Magnitude (m_v)	+0.1 m_v (in Libra)
B =	+21.6°
Declination	-15.4°

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A nicely detailed image of Saturn captured on April 6, 2014 at 14:56 UT by Anthony Wesley observing from Murrumbateman, Australia, using a 36.8 cm (14.5 in.) Newtonian at RGB wavelengths. Numerous belts and zones are apparent on the globe of Saturn, including the hexagonal North polar hexagon, and the major ring components are easily seen. Cassini's division (A0 or B10) runs all the way around the circumference of the rings, and notice how the globe of Saturn can be seen through this gap. Apparent also are Encke's complex (A5), Keeler's (A8) gap, and other "intensity minima" at the ring ansae. The dark shadow of the globe on the rings is situated toward the East (left) in this image and will shift to the West (right) after opposition. Seeing was better than average in this image. Apparent diameter of Saturn's globe is 18.6" with a ring tilt of +21.8º. CMI = 337.4°, CMII = 193.0°, CMIII = 288.3°. S is at the top of the image.

strongly encouraged before or after imaging the planet.

The ALPO Saturn Section appreciates the dedicated work by so many observers who regularly submit their reports and images. *Cassini* mission scientists, as well as other professional specialists, are continuing to request drawings, digital images, and supporting data from amateur observers around the globe in an active Pro-Am cooperative effort.

Information on ALPO Saturn programs, including observing forms and instructions, can be found on the Saturn pages on the official ALPO Website at *www.alpo-astronomy.org/saturn*

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

Remote Planets Section

Report by Richard W. Schmude, Jr., section coordinator
schmude@gordonstate.edu

Both Uranus and Neptune will be visible in the early morning in June. Uranus will rise higher in the sky than it has in about 50 years for people in the United States, Canada and Europe.

ALPO Remote Planets Section members have successfully imaged albedo features on both Uranus and Neptune. For example, Damian Peach imaged two bright bands on Uranus on October 7, 2013 using a 14-inch telescope and a red filter. His images are on the ALPO Japan Latest website in the Uranus section (*http://alpo-j.asahikawa-med.ac.jp/Latest/Uranus.htm*).

Section members have also monitored the brightness of both Uranus and Neptune using an SSP-3 photometer since 1991. One observer who has been very successful is Jim Fox. Jim uses a 10-inch Schmidt-Cassegrain along with an SSP-3 photometer to carry out his work and his results are of high quality.

In the fall of this year, this section coordinator hopes to begin collecting J and H filter brightness measurements of Uranus and Neptune. Professional astronomers already record images of both planets using these two filters, both of which are sensitive to near infrared light with wavelengths of J (1.25 micrometers) and H (1.65 micrometers).

To all remote planet observers, please keep up the good work!

Finally, a reminder that the book *Uranus, Neptune and Pluto and How to Observe Them*, which was authored by this coordinator, is available from Springer at *www.springer.com/astronomy/popular+astronomy/book/978-0-387-76601-0* or elsewhere (such as *www.amazon.ca/Uranus-Neptune-Pluto-Observe-Them/dp/0387766014*) to order a copy.

Visit the ALPO Remote Planets Section online at *www.alpoastronomy.org/remote*.

Inside the ALPO
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Joseph Liu: 1931 - 2014

The Assn of Lunar & Planetary Observers is saddened to learn of the recent death of former ALPO member, Mr. Joseph Liu, an avid observer and imager of the Moon, planets and comets, and first chief curator of the Hong Kong Space Museum. Mr. Liu passed away on April 23, 2014. He was age 83.

We were notified of this by Takeshi (Ken) Sato of Hatsukaichi, Hiroshima, Japan, an ALPO member himself since the late 1950s. Says Mr. Sato, "It was a very sad news to hear that Mr. Joseph Liu passed away on Apr.23. In addition to the Most Excellent Order of British Empire which he received in 1982, (he also received) the Chiro Astronomical Prize. After the award ceremony in Tokyo, Mr. Liu visited Hiroshima and stayed one night at my home. An asteroid was named by the IAU, "(6743) Liu" following a suggestion by Mr. Akira Fujii and me."

Some beautiful photos of Mr. Liu and his work were provided by another ALPO member, Jingming Lin of China. Plus, we also were able to access "Amateur Astronomy in Hong Kong, A Brief History" by Alan Chu.

Born in Hong Kong 1931, Mr. Liu earned his Bachelor of Arts degree from the University of Hong Kong in 1961.

From the info from the Alan Chu source: "Mr. Liu taught Chinese literature and Chinese history at the Queen's College where he was subsequently promoted to Vice Principal. He remained with the Queen's College until 1971 when he became Principal of the Sha Tau Kok Government Secondary School located in rural Hong Kong. In 1974, the then Urban Council sought Mr. Liu's assistance in the establishment of a planetarium, which later became the Hong Kong Space Museum. The Hong Kong Space Museum opened in 1980 and was the first fully automated planetarium in the world. Mr. Liu was appointed as its first Chief Curator until 1985 when he retired and settled in California. From 1966 to 1977, Mr. Liu was a part-time lecturer at the University of Hong Kong Extra-Mural Studies, teaching observational astronomy."

His personal Hong Kong observatory and its various telescopes and imaging equipment allowed him to produce exquisite works. "With the 32cm reflector, Mr. Liu obtained highly detailed lunar and planetary images for which he was awarded the first and third prices in the astrophotographic competition organized by the Astronomical League in 1977."

He constructed another backyard observatory after relocating to California, where he placed his Astro-Physics 20cm Starfire refractor and the 30 cm Astromak astrograph.

From another online source: "In April 1998, the International Astronomical Union approved the naming of the minor planet 6743 as 'Liu', as proposed by the discoverers K Endate and K Watanabe."

For so much more about this fine gentleman, please go to www.alanchuhk.com/hk_astro.doc

(At left) Joseph Liu and wife Julia prepare to observe Comet Arend-Roland in 1957 while in Hong Kong.

Book Review

Scientific Astrophotography: How Amateurs Can Generate and Use Professional Imaging Data

Review by Wayne Bailey, PhD, FRAS
ALPO Lunar Topographical Studies & Selected Areas Program Coordinator
wayne.bailey@alpo-astronomy.org

Scientific Astrophotography: How Amateurs Can Generate and Use Professional Imaging Data by Gerald R. Hubbell, 2013, The Patrick Moore Practical Astronomy Series, published in New York by Springer (ISBN 978-1-4614-5172-3); 333 pages, softcover; list price $44.95. eBook (ISBN 978-1-4614-5173-0); list price $29.95.

First, a full-disclosure disclaimer: Jerry Hubbell is an assistant coordinator of the ALPO Lunar Topographical Studies & Selected Areas Program, of which I am the full coordinator.

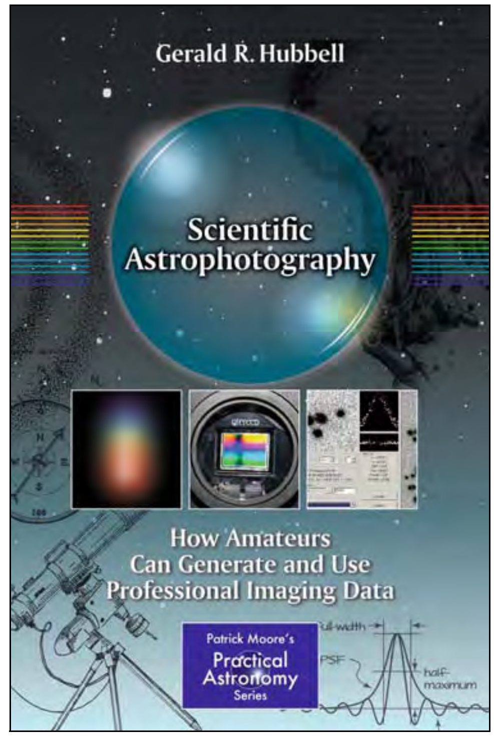
The first thought that comes into my mind when examining a new book on astrophotography is, what does this book offer that's new? The answer, in the case of Gerald Hubbell's *Scientific Astrophotography* is a systematic approach to choosing and using the entire imaging and processing system. The book covers everything from selecting a telescope, mounts and imagers, through planning, obtaining and processing images, to analyzing and using the data. As the title implies, this book concentrates on obtaining scientifically useful images and extracting scientifically useful data from them. Aesthetically pleasing images are not the primary goal here, although they are not precluded. Some techniques that are commonly used to enhance the appearance of images are mentioned along with comments on how those same techniques can actually degrade the scientific usefulness of the image.

To be scientifically useful, an image must be an accurate geometric and/or photometric representation of the object. Any storage format, such as jpeg, that uses a "lossy" compression technique, and most sharpening algorithms, destroy the photometric accuracy of the image. Similarly, geometric accuracy is compromised by stacking techniques that align multiple sections of the image independently. There are, of course, situations where "over-processing" is useful, for example to identify low-contrast features by extreme contrast enhancement. But it is important to understand what is lost and also to keep the original image.

This book is organized into an introductory chapter followed by three parts dealing with imaging system hardware characteristics (7 chapters), system design and operation (4 chapters), and data analysis and use (4 chapters).

There are also appendices that expand on some technical topics. Every chapter also includes references to more detailed treatments of the topics covered. Jerry's engineering background is evident in the approach used; application of basic principles to the choice and use of an imaging system, and explanation of how the components interact.

This book really will be useful to anyone interested in scientific imaging, from the complete novice to the experienced astrophotographer. Although the title refers to astrophotography, it includes all applications of photography, such as photometry, astrometry and spectroscopy, as well as deep sky, lunar, planetary or solar imaging. It will not be an easy read for the novice (depending on technical background), but Jerry's liberal use of examples and exercises provides considerable help. The reward will be that the systematic approach, applying basic principles, will help the novice avoid frustrating, and sometimes costly, mistakes. The expert may not find many new ideas, but the integrated approach may clarify why things work the way they do. For those interested in more technical depth, references are provided. Also, the discussion of specific



applications will help those entering a new field.

In summary, this is a book that I will recommend to anyone interested in any field that uses astroimages. It is not a step-by-step cookbook for producing astro-images. But it does provide a systematic overview of the requirements for producing useful scientific data, along with examples and exercises illustrating how to apply these principles.

Within any subfield, you'll eventually want to look further for specific tips and techniques to optimize your observing. The references provide a good starting point. *Scientific Astrophotography* provides the basic principles which are often ignored, but which underlie the advanced techniques.

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Book reviews appropriate for the ALPO are welcome for publication in this journal. Please send your reviews to the ALPO Book Review Editor, Bob Garfinkle at *ragarf@earthlink.net*.

Feature Story:
Index to Volume 53 (2011) of The Strolling Astronomer

By Michael Mattei
E-mail: micmattei@comcast.net

PUBLICATION DATA

Issue Number:

AUTHOR INDEX

SUBJECT INDEX

Feature Story: Venus

ALPO Observations of Venus During the 2009-2010 Western (Morning) Apparition

By Julius L. Benton, Jr., coordinator
ALPO Venus Section
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An ALPO Venus Section Observing Report Form is located at the end of this report.

Abstract

Sixteen observers from the United States, Canada, Greece, France, Germany, Philippines, United Kingdom, Italy, New Zealand, and The Netherlands contributed digital images and visual observations (drawings and descriptive reports) to the ALPO Venus Section during the 2009-10 Western (Morning) Apparition. This report summarizes the results of the 159 total observations. Types of telescopes and accessories used in making the observations, as well as sources of data, are discussed. Comparative studies take into account observers, instruments, visual and photographic results. The report includes illustrations and a statistical analysis of the long-established categories of features in the atmosphere of Venus, including cusps, cusp-caps, and cusp-bands, seen or suspected at visual wavelengths in integrated light and with color filters, as well as digital images captured at visual, ultraviolet (UV), and infrared (IR) wavelengths. One of the highlights of 2009-10 discussed in this observational summary was the extremely brilliant white spot at ultraviolet wavelengths reported near the limb of Venus' southern hemisphere, exclusive of the cusp regions, during second half of July 2009. Terminator irregularities and the apparent phase phenomena, as well as results from continued monitoring of the dark hemisphere of Venus for the enigmatic Ashen Light are discussed.

Introduction

The ALPO Venus Section received 159 observations for the 2009-10 Western (Morning) Apparition, comprised of visual drawings, descriptive reports, and digital images from sixteen observers residing in the United States, Canada, Greece, France, Germany, Philippines, United Kingdom, Italy, New Zealand, and The Netherlands. Geocentric phenomena in Universal Time (UT) for this observing season are given in *Table 1*, while *Figure 1* shows the distribution of observations by month during the apparition. *Table 2* gives the location where observations were made, the number of observations submitted, and the telescopes utilized.

Observational coverage of Venus during this apparition was reasonably good, with several individuals beginning their monitoring of the planet early on, and one observer, Detlev Niechoy, sketched the crescent Venus only a couple of days after Inferior Conjunction on March 27, 2009 [refer to Illustration No. 001]. The observational reports upon which this report is based spanned the period starting March 29 through October 25, 2009, with 91.8% of the total contributions for April through September 2009. For the 2009-10 Western (Morning) Apparition of Venus observers witnessed the trailing hemisphere of Venus at the time of sunrise on Earth (a progression from crescent through gibbous phases) as the planet passed through greatest brilliancy

All Readers

Your comments, questions, etc., about this report are appreciated. Please send them to: *poshedly@ bellsouth.net* for publication in the next Journal.

Online Features

Left-click your mouse on:

The author's e-mail address in blue text to contact the author of this article.
The references in blue text to jump to source material or information about that source material (Internet connection must be ON).

Observing Scales

Standard ALPO Scale of Intensity:
0.0 = Completely black
10.0 = Very brightest features
Intermediate values are assigned along the scale to account for observed intensity of features

ALPO Scale of Seeing Conditions:
0 = Worst
10 = Perfect

Scale of Transparency Conditions:
Estimated magnitude of the faintest star observable near Venus, allowing for daylight or twilight

IAU directions are used in all instances.

Terminology: Western vs Eastern

"Western" apparitions are those when an "inferior" planet (Mercury or Venus, whose orbits lie inside the Earth's orbit around the Sun) is **west of the Sun**, as seen in our morning sky before sunrise.

"Eastern" apparitions are those when that planet is **east of the Sun,** as seen in our sky after sunset.

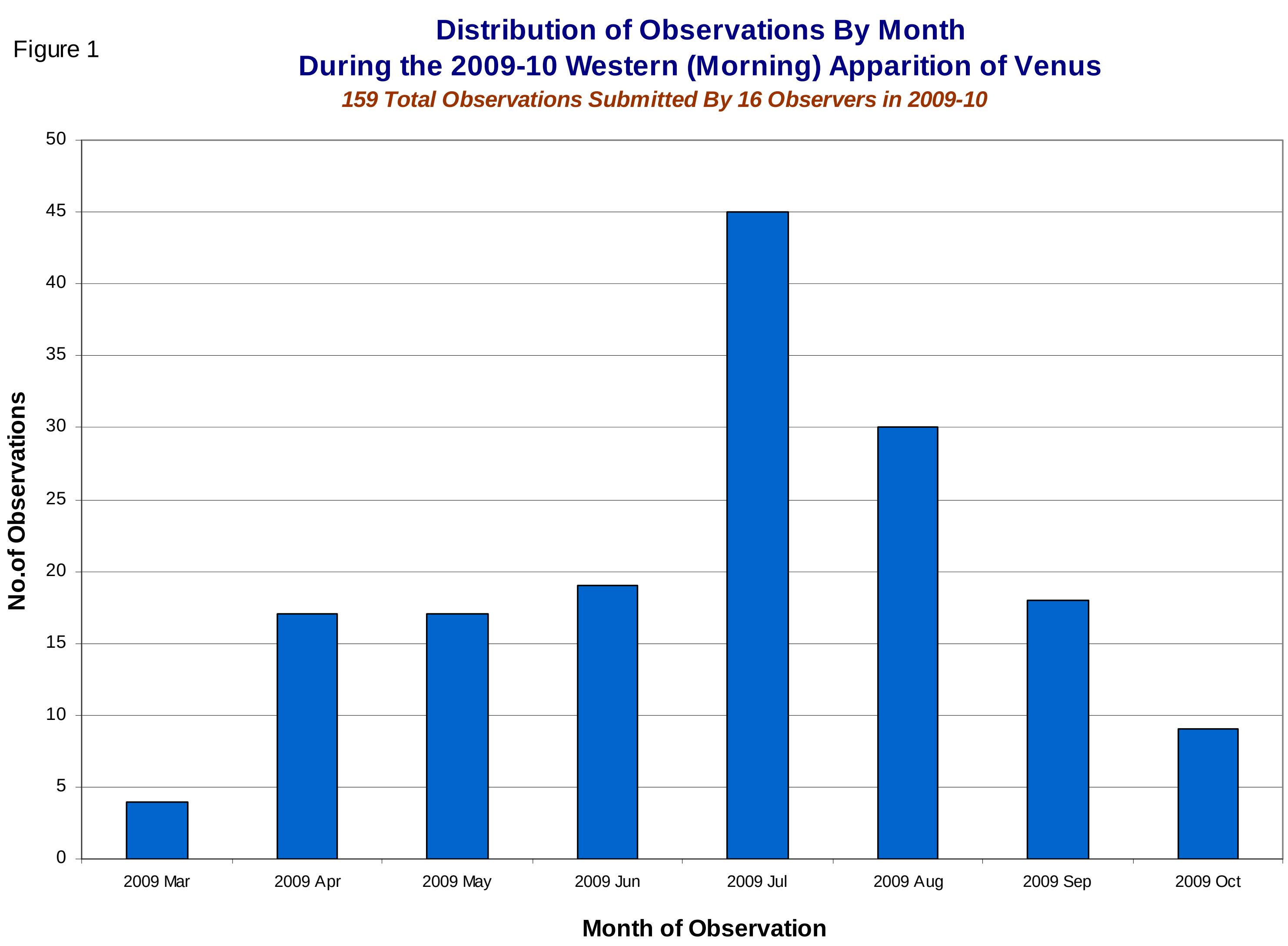
($-4.7m_v$), dichotomy, and maximum elongation from the Sun (46.0°). Observers are urged to try to carry out systematic observations of Venus when seeing conditions permit from conjunction to conjunction, and the ALPO Venus Section is quite fortunate to have a growing team of persistent, dedicated observers who have tried very hard to do that in recent observing seasons.

Figure 2 shows the distribution of observers and contributed observations by nation of origin for this apparition, where it can be seen that 37.5% of the participants in our programs were located in the United States, and they accounted for 20.8% of the total observations. Continued international cooperation took place during this observing season, whereby 62.5% of the observers resided outside the United States and contributed 79.2% of the overall observations. The ALPO Venus

Table Geocentric Phenomena in Universal Time (UT) for the 2007-08 Western (Morning) Apparition of Venus

Inferior Conjunction	2009 Mar 27^d 19^h UT
Initial Observation	Mar 29 10:30
Greatest Brilliancy	May 02 15 ($m_V = -4.7$)
Dichotomy (predicted)	Jun 06 14:38:24 (06.61^d)
Greatest Elongation West	Jun 05 21:00 (46.0°)
Final Observation	Oct 25 12:44
Superior Conjunction	2010 Jan 11 21:00
Apparent Diameter (observed range): 59.6” (2009 Mar 29) ↔ 10.6” (2009 Oct 25)	
Phase Coefficient, ***k*** (observed range): 0.010 (2009 Mar 29) ↔ 0.946 (2009 Oct 25)	

Figure 1



Section welcomes a widening global team of observers in the future.

The types of telescopes used to observe and image Venus are shown in *Figure 3*. All observations submitted were made with telescopes of at least 15.2 cm (6.0 in.) in aperture. During the 2009-10 Western (Morning) Apparition of Venus, the frequency of use of classical designs (refractor and Newtonian) was only 18.9%, while utilization of catadioptrics (Schmidt-Cassegrain and Dall-Kirkham) was 81.1%. All visual and digital observations were performed under twilight or daylight conditions, generally because more experienced Venus observers have found that viewing the planet during twilight or in full daylight substantially reduces the excessive glare associated with the planet. Also, viewing or imaging Venus when it is higher in the sky substantially cuts down on the detrimental effects of atmospheric dispersion and image distortion prevalent near the horizon.

The writer expresses his gratitude to all sixteen observers who made this report possible by regularly sending in their drawings, descriptive reports, and digital images of Venus in 2009-10. Readers who wish to follow Venus in coming apparitions are urged to join the ALPO and start participating in our observational studies. Then brightness of Venus makes it easy to find, and surrounding around the dates of greatest elongation from the Sun, it can be as much as 15 times brighter than Sirius and can even cast shadows when viewed from a dark, moonless observing site. Getting started in the Venus Section programs requires only minimal aperture, ranging from 7.5 cm (3.0 in) for refractors to 15.2 cm (6.0 in) reflectors.

Table 2: ALPO Observing Participants in the 2009-10 Western (Morning) Apparition of Venus

Observer and Observing Site	No. Obs.	Telescope Used*
Akutsu, Tomio Cebu City, Philippines	4	35.6 cm (14.0 in) SCT
Arditti, David Middlesex, UK	1	35.6 cm (14.0 in) SCT
Benton, Julius L. Wilmington Island, GA	10	15.2 cm (6.0 in) REF
Collins, Maurice Palmerston North, NZ	3	20.3 cm (8.0 in) SCT
Hansen, Torsten Reichau Boos, Germany	4	20.3 cm (8.0 in) NEW
Kivits, Willem Siebengewald, The Netherlands	6	35.6 cm (14.0 in) SCT
Lazzarotti, Paolo Massa, Italy	1	31.5 cm (12.4 in) NEW
Mattei, Michael Littleton, MA	1	35.6 cm (14.0 in) SCT
Maxson, Paul Phoenix, AZ	13	25.4 cm (10.0 in) DALL
Melillo, Frank J. Holtsville, NY	6	25.4 cm (10.0 in) SCT
Niechoy, Detlev Göttingen, Germany	93	20.3 cm (8.0 in) SCT
Parker, Donald C. Coral Gables, FL	1	25.4 cm (10.0 in) DALL
Prost, Jean-Pierre Marseille, France	1	25.4 cm (10.0 in) DALL
Roussell, Carl Hamilton, Ontario, Canada	13	15.2 cm (6.0 in) REF
Schrantz, Rick Nicholasville, KY	1	25.4 cm (10.0 in) NEW
Tarsoudis, George Alexandropoulis, Greece	1	25.4 cm (10.0 in) NEW
Total No. of Observers	16	
Total No. of Observations	159	
*REF = Refractor, SCT = Schmidt-Cassegrain, NEW = Newtonian, DALL = Dall-Kirkham		

Observations of Atmospheric Details on Venus

The methods and techniques for visual studies of the especially faint, elusive “markings” in the atmosphere of Venus are described in detail in ***The Venus Handbook***, available from the ALPO Venus Section in printed or pdf format. Readers who maintain archives of earlier issues of this Journal may also find it useful to consult previous apparition reports for a historical account of ALPO studies of Venus.

Most of the drawings and digital images used for this analytical report were made at visual wavelengths, but several observers routinely imaged Venus in infrared (IR) and ultraviolet (UV) wavelengths. Some examples of submitted observations in the form of drawings and images accompany this report to help readers interpret the level and types of atmospheric activity reported on Venus this apparition.

Figure 2

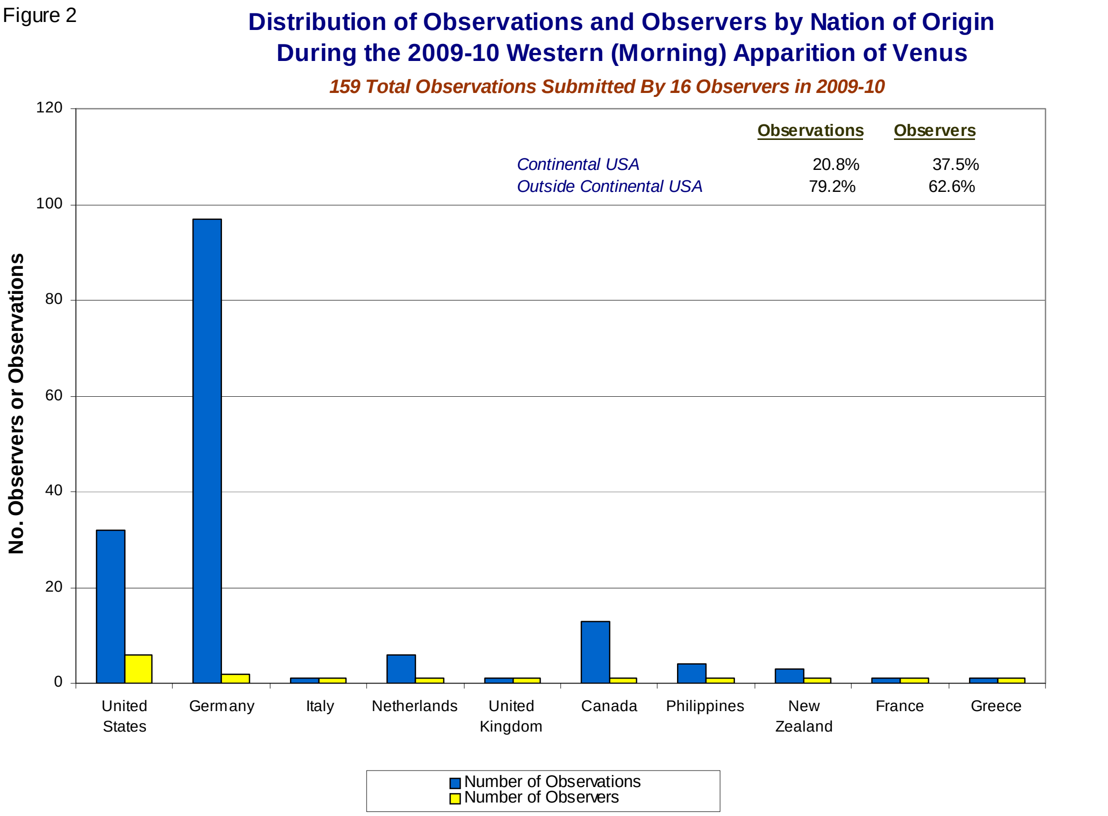
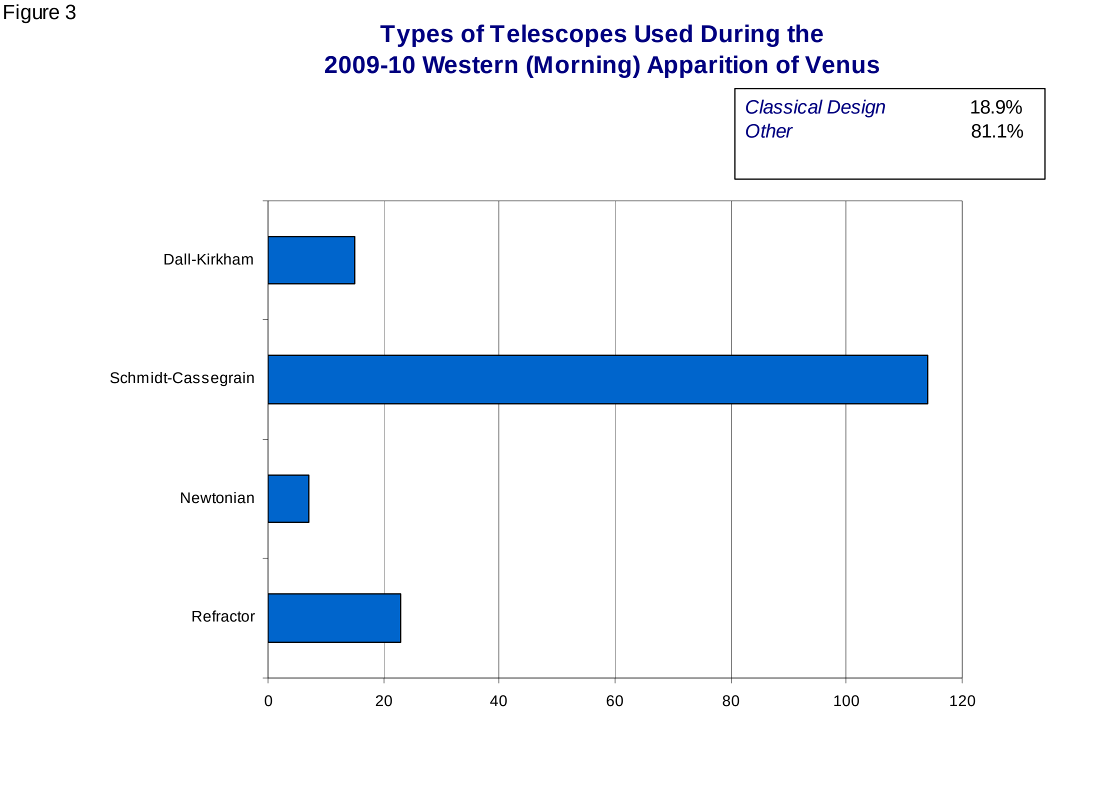


Figure 3



***General Caption Note for Illustrations 1-28**. REF = Refractor, SCT = Schmidt-Cassegrain, NEW = Newtonian, DALL = Dall-Kirkham; UV = Ultra Violet light; Seeing on the Standard ALPO Scale (from 0 = worst to 10 = perfect); Transparency = the limiting naked-eye stellar magnitude.*

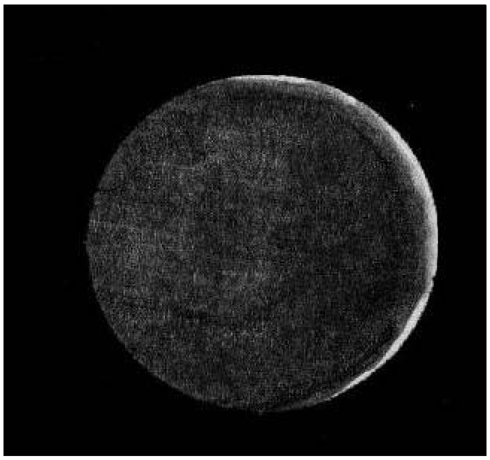


Illustration 001. 2009 Mar 31 12:51 UT, Detlev Niechoy, Göttingen, Germany, 20.3 cm (8.0 in.) SCT, Drawing @ 225X W25 (red) filter, Seeing 4.0 (interpolated), Transparency (not specified), Phase (k) = 0.014, Apparent Diameter = 59.2", Drawing shows very thin crescent of Venus just 4 days after Inferior Conjunction; S is at the top of the image.

Illustration 002. 2009 Apr 19 16:13 UT, Michael Mattei, Littleton, MA, 35.6 cm (14.0 in.) SCT, IR filter 807nm, Seeing 4.5, Transparency (not specified), Phase (k) = 0.147, Apparent Diameter = 47.6", IR image of bright crescent of Venus with terminator shading; S is at the top of the image.

Represented in the photo-visual data for this apparition were all of the long-established categories of dusky and bright markings in the atmosphere of Venus, including a small fraction of radial dusky features, described in the literature cited earlier in this report. *Figure 4* shows the frequency of identifiable forms of markings seen or suspected on Venus. Most observations referenced more than one category of marking or feature, so totals exceeding 100% are not unusual. At least some level of subjectivity is inevitable when visual observers attempt to describe, or accurately represent on drawings, the variety of highly elusive atmospheric features on Venus, and this natural bias had some effect on the data represented in *Figure 4*. It is assumed, however, that conclusions discussed in this report are, at the very least, quite reasonable interpretations.

The dusky markings of Venus' atmosphere are always troublesome to detect using normal visual observing methods, and this well-known characteristic of the planet is generally independent of the experience of the observer. When color filters and variable-density polarizers are utilized as a routine practice, however, views of cloud phenomena on Venus at visual wavelengths are often measurably improved. Without neglecting vital routine visual work, the ALPO Venus Section urges observers to try their hand at digital imaging of Venus at UV and IR wavelengths. The morphology of features captured at UV and IR wavelengths is frequently quite different from what is seen at visual regions of the spectrum, particularly atmospheric radial dusky patterns (in the UV) and the appearance of the dark hemisphere (in IR). Similarities do occasionally occur, though, between images taken at UV wavelengths and drawings made with blue and violet filters. The more of these that the ALPO Venus Section receives during an observing season, the more interesting are the comparisons of what can or cannot be detected visually versus what is captured by digital imagers at different wavelengths.

Figure 4 illustrates that in only 9.4% of the observations submitted this apparition the dazzlingly bright disc of Venus was considered as being completely devoid of atmospheric features [Refer to Illustrations No. 002 and 003]. When dusky features were

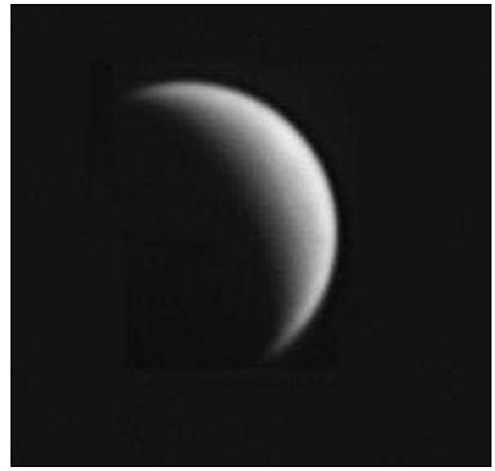


Illustration 003. 2009 May06 13:43-13:48 UT, Paul Maxson, Phoenix, AZ, 25.4 cm (10.0 in.) DALL, IR and UV wavelengths, Seeing (not specified), Transparency (not specified), Phase (k) = 0.295, Apparent Diameter = 36.2", View of the crescent Venus in UV; no obvious features other than terminator shading and bright limb band; S is at the top of the image.

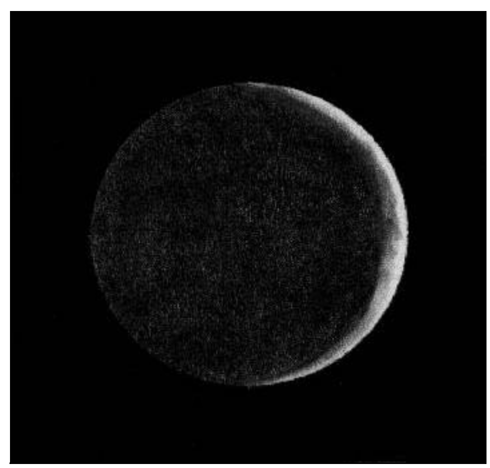


Illustration 004. 2009 Apr 12 10:18 UT, Detlev Niechoy, Göttingen, Germany, 20.3 cm (8.0 in.) SCT, Drawing @ 225X W47 (violet) filter, Seeing 3.0 (interpolated), Transparency (not specified), Phase (k) = 0.083, Apparent Diameter = 53.0", Drawing depicts thin crescent with amorphous dusky features and terminator shading; S is at the top of the image.

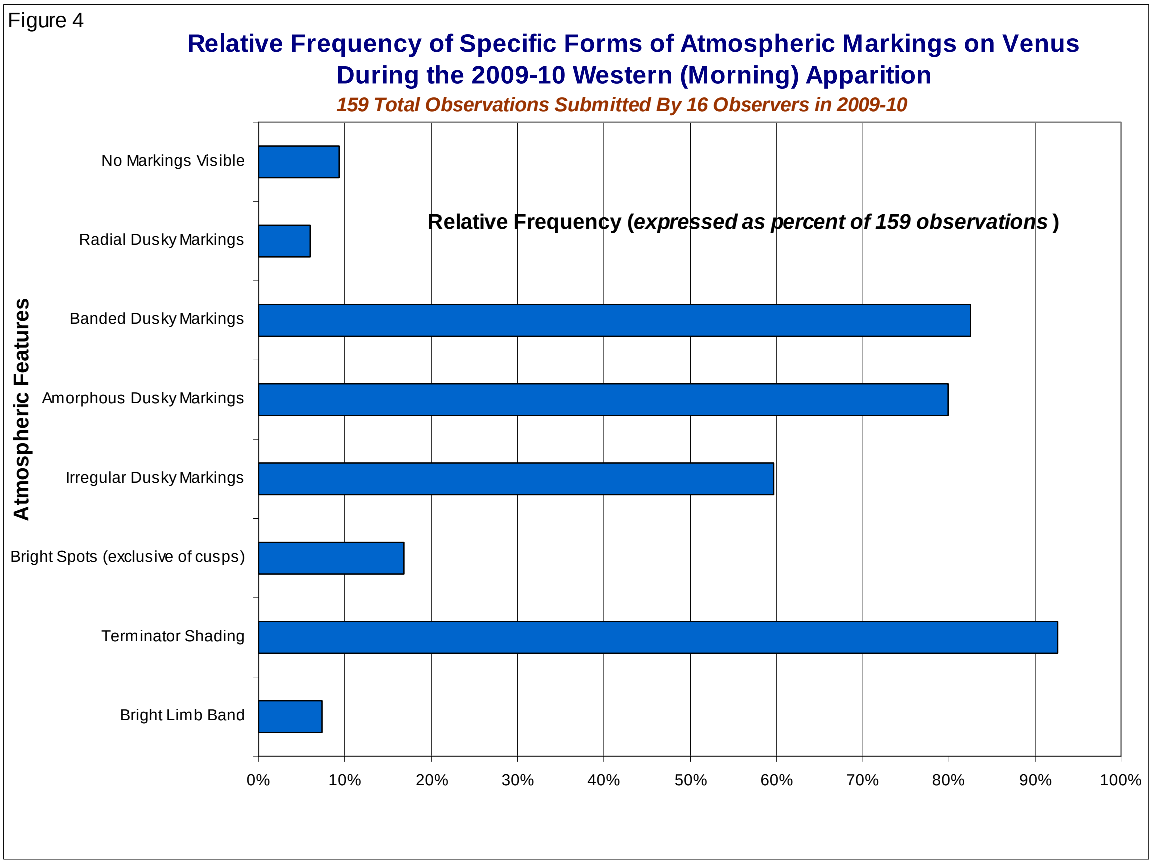


Figure 4
Relative Frequency of Specific Forms of Atmospheric Markings on Venus
During the 2009-10 Western (Morning) Apparition
159 Total Observations Submitted By 16 Observers in 2009-10
Relative Frequency (expressed as percent of 159 observations)
Atmospheric Features
No Markings Visible
Radial Dusky Markings
Banded Dusky Markings
Amorphous Dusky Markings
Irregular Dusky Markings
Bright Spots (exclusive of cusps)
Terminator Shading
Bright Limb Band
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%

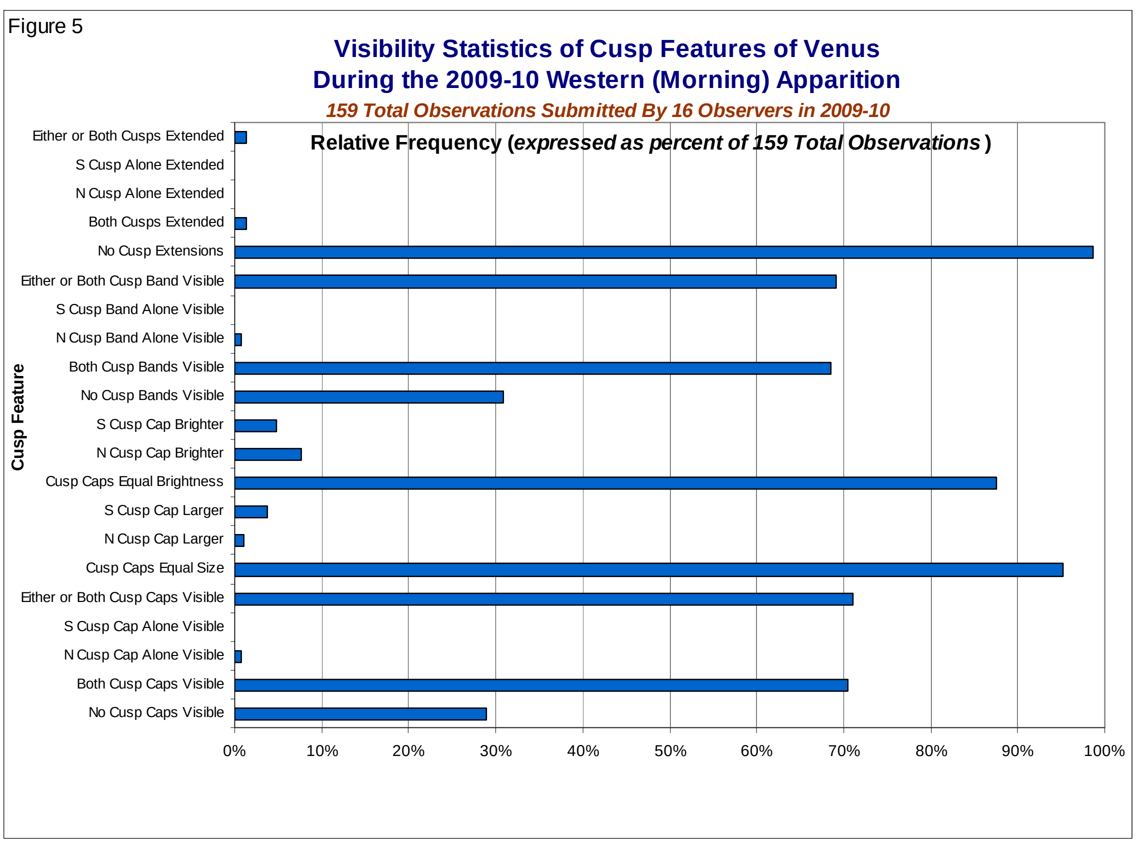


Figure 5
Visibility Statistics of Cusp Features of Venus
During the 2009-10 Western (Morning) Apparition
159 Total Observations Submitted By 16 Observers in 2009-10
Relative Frequency (expressed as percent of 159 Total Observations)
Cusp Feature
Either or Both Cusps Extended
S Cusp Alone Extended
N Cusp Alone Extended
Both Cusps Extended
No Cusp Extensions
Either or Both Cusp Band Visible
S Cusp Band Alone Visible
N Cusp Band Alone Visible
Both Cusp Bands Visible
No Cusp Bands Visible
S Cusp Cap Brighter
N Cusp Cap Brighter
Cusp Caps Equal Brightness
S Cusp Cap Larger
N Cusp Cap Larger
Cusp Caps Equal Size
Either or Both Cusp Caps Visible
S Cusp Cap Alone Visible
N Cusp Cap Alone Visible
Both Cusp Caps Visible
No Cusp Caps Visible
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%

seen or suspected, or imaged, on the brilliant disc of Venus, the highest percentage was Banded Dusky

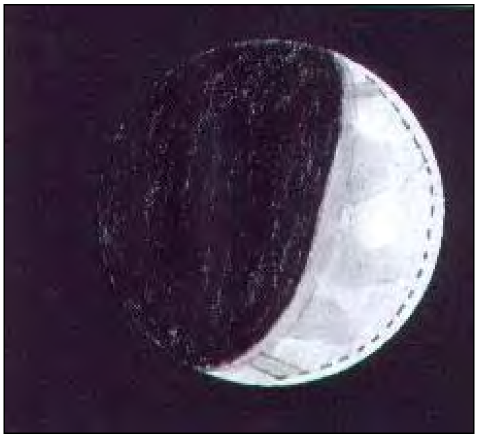


Illustration 005. 2009 May 12 16:07-16:25 UT, Carl Roussell, Hamilton, Ontario, Canada, 15.2 cm (6.0 in.) REF, Drawing @ 200-400X Integrated Light, W25, W58, W47 filters, Seeing 6.0, Transparency (not specified), Phase (k) = 0.342, Apparent Diameter = 33.0", Excellent drawing shows banded dusky markings, cusp caps, cusp bands, terminator shading, and the bright limb band complete from cusp-to-cusp; S is at the top of the image.

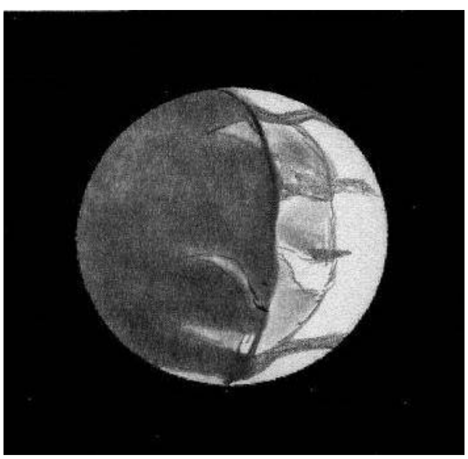


Illustration 006. 2009 May 23 02:53 UT, Detlev Niechoy, Göttingen, Germany, 20.3 cm (8.0 in.) SCT, Drawing @ 82X to 225X Integrated Light, Seeing 4.0 (interpolated), Transparency (not specified), Phase (k) = 0.415, Apparent Diameter = 28.5", Banded and irregular dusky markings are represented in this drawing along with cusp caps, cusp bands, and terminator shading; Ashen Light was claimed to be definitely seen on at least a portion of the otherwise dark hemisphere; S is at the top of the image.

Markings" (82.6%), followed by "Amorphous Dusky Markings" (79.9%),"Irregular Dusky Markings" (59.7%) [Refer to Illustrations No. 004 thru 011, 022, 023, and 027], and "Radial Dusky Markings" (6.0%) [Refer to Illustration No. 024], whereby the latter are normally only revealed in UV images.

Terminator shading was reported in 92.6% of the observations, as shown in *Figure 4*. Terminator shading normally extended from one cusp of Venus to the other, and the dusky shading was progressively lighter in tone (higher intensity) from the region of the terminator toward the bright planetary limb. Many observers described this upward gradation in brightness as ending in the Bright Limb Band. A considerable number of images at visual wavelengths showed terminator shading, but it was most obvious on many UV images [Refer to Illustration No. 025].

The mean numerical relative intensity for all of the dusky features on Venus this apparition averaged about 8.8. The ALPO Scale of Conspicuousness (a numerical sequence from 0.0 for "definitely not seen" up to 10.0 for "definitely seen") was used regularly, and the dusky markings in *Figure 4* had a mean conspicuousness of ~3.6 throughout the apparition, suggesting that the atmospheric features on Venus were within the range from very indistinct impressions to fairly strong indications of their actual presence.

Figure 4 also shows that "Bright Spots or Regions," exclusive of the cusps, were seen or suspected in 16.8% of the submitted observations and images. One of the highlights this apparition was an unusually intense white spot at ultraviolet wavelengths reported near the limb of Venus' southern hemisphere, exclusive of the cusp regions, during July 2009. Frank Melillo was the first observer to submit a UV image of the feature to the ALPO Venus Section at 13:10UT on July 19th [Refer to Illustration No. 012]. It was later discovered that several other observers had also imaged the dazzling white cloud with UV filters on the same date, including one taken at 02:52UT by George Tarsoudis [Refer to Illustration No. 013] and another by Willem Kivits at 10:57UT [Refer to Illustration No. 014]. The European Space Agency's (ESA) Venus Express (VEX) cameras confirmed

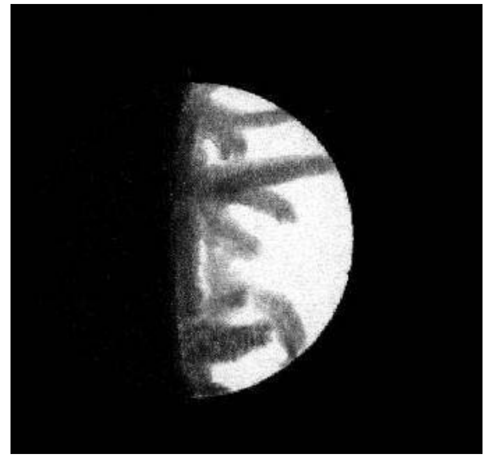


Illustration 007. 2009 Jun 13 08:28 UT, Detlev Niechoy, Göttingen, Germany, 20.3 cm (8.0 in.) SCT, Drawing @ 225X W25 (red) filter, Seeing 3.0 (interpolated), Transparency (not specified), Phase (k) = 0.535, Apparent Diameter = 22.1", Banded and irregular dusky markings appear on this drawing including obvious terminator shading; Venus reached point of theoretical dichotomy (half-phase) on June 6th; S is at the top of the image.

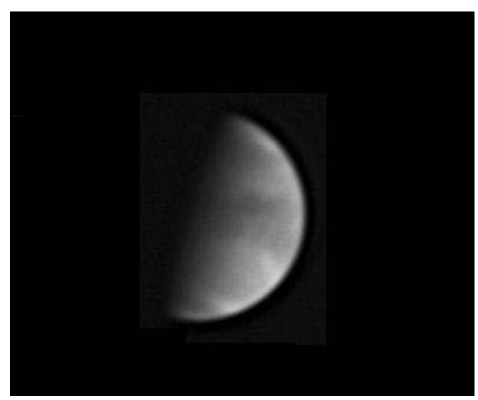


Illustration 008. 2009 Jun 23 10:50 UT, Rick Schrantz, Nicholasville, KY, 25.4 cm (10.0 in.) NEW, Schuler UV filter, Seeing (not specified), Transparency (not specified), Phase (k) = 0.584, Apparent Diameter = 20.0", Detailed UV image with obvious banded dusky markings blending into terminator shading, and bright areas exclusive of the cusp regions; S is at the top of the image.

the bright cloud on July 19th [Refer to Illustration No. 015]. Planetary scientist and ALPO Board member Sanjay Limaye noted, however, that the VEX spacecraft had actually imaged the bright feature four days prior to the reports by Melillo, Tarsoudis, and Kivits [Refer to Illustration No. 016]. On July 20th at 12:51-13:00UT Paul Maxson imaged the bright spot with a UV filter (his image at IR wavelengths did not show the bright spot) [Refer to Illustration No. 017], and his observation was followed four days later by a UV image by Don Parker at 13:57UT on July 24th and roughly five days after those taken by the first three aforementioned observers, all at about the same location on the planet's southern limb [Refer to Illustration No. 020]. Between Maxson's and Parker's observations on July 20th and 24th, respectively, UV images submitted on July 22nd did not clearly depict the feature [Refer to Illustration No. 018 and 019]. Readers who are familiar with the physical properties of Venus' atmosphere will be aware that high-level clouds rotate east to west in about four days, so one would anticipate that the bright cloud would move across the disk of Venus in about that same time span. This translates into an astounding wind velocity of 0.1 km/sec in this region, which is some 50 km or more above the solid surface of the planet. Further studies of the VEX images revealed that the bright area had gradually spread out longitudinally in response to the strong high-level wind shear occurring at that level in the thick atmosphere of Venus. Looking at images contributed by the end of July into early August, the bright feature had apparently faded almost as quickly as it appeared a few weeks before.

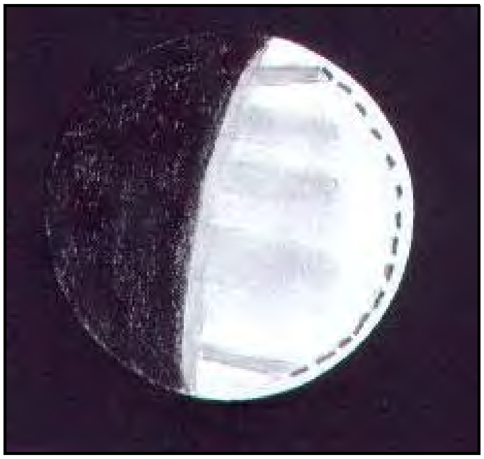


Illustration 009. 2009 Jun 23 14:25-14:50 UT, Carl Roussell, Hamilton, Ontario, Canada, 15.2 cm (6.0 in.) REF, Drawing @ 200-400X Integrated Light, W25, W58, W47 filters, Seeing 7.0, Transparency (not specified), Phase (k) = 0.585, Apparent Diameter = 20.0", Drawing depicts banded dusky markings, cusp caps, and cusp bands; S is at the top of the image.

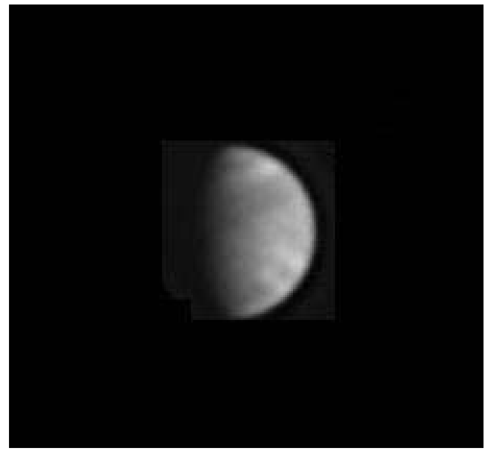


Illustration 011. 2009 Jul 06 13:31-13:32 UT, Paul Maxson, Phoenix, AZ, 25.4 cm (10.0 in.) DALL, UV (335nm) filter, Seeing (not specified), Transparency (not specified), Phase (k) = 0.641, Apparent Diameter = 17.8", Banded and radial dusky features, as well as several bright regions exclusive of the cusps, are quite prominent in UV; S is at the top of the image.

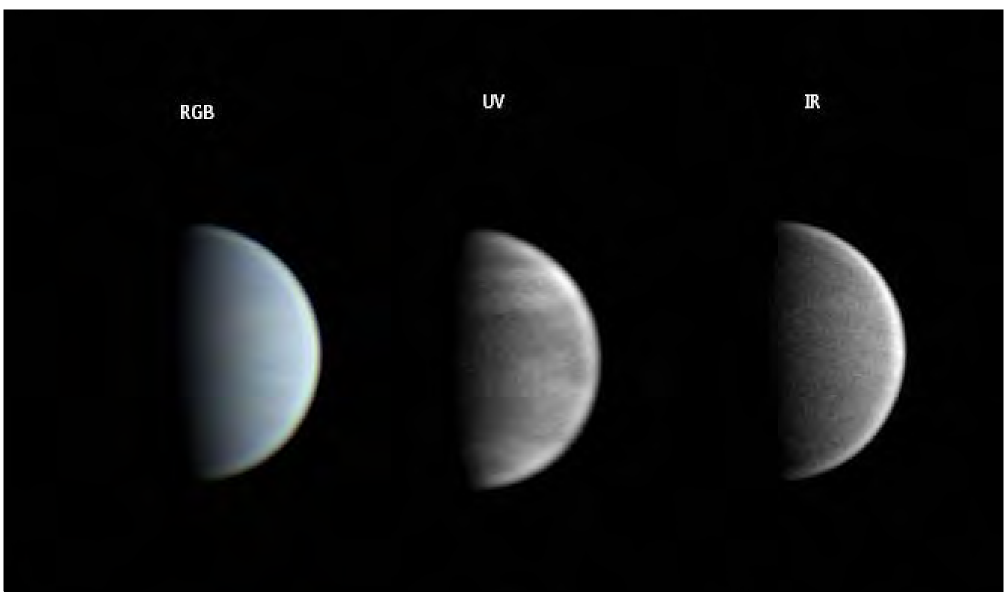


Illustration 010. 2009 Jun 25 21:05-21:11 UT, Tomio Akutsu, Cebu City, Philippines, 35.6 cm (14.0 in.) SCT, RGB, UV, IR filters, Seeing 5.0, Transparency 3.0, Phase (k) = 0.595, Apparent Diameter = 19.5", Compare appearance of banded and amorphous dusky markings, terminator shading and the bright limb band in these detailed images in RGB, UV, and IR wavelengths; S is at the top of the image.

Illustration 012. 2009 Jul 19 13:10-13:15 UT, Frank Melillo, Holtsville, NY, 25.4 cm (10.0 in.) SCT, UV filter, Seeing 6.5, Transparency (not specified), Phase (k) = 0.692, Apparent Diameter = 16.1", Notice amorphous dusky features; first report of an unusual bright spot toward the S (adjacent the bright limb of Venus); S is at the top of the image.

Although analogous bright clouds have been seen in previous apparitions at high latitudes on Venus, the brilliant feature this observing season was somewhat more prominent. Coming up with an explanation to account for the abrupt appearance of such an extraordinarily bright spot during July 2009 has presented quite a challenge given the limited number observations that were available. So far, speculation has included possible volcanism, an upwelling of convective cells within Venus' atmosphere, and solar wind interactions suddenly changing reflective properties of high-level clouds, but unraveling this puzzling phenomenon will take time. In the meantime, observers should remain alert for future events and continue imaging Venus in the UV and various other wavelengths to determine the limits of visibility and help shed light on root causes.

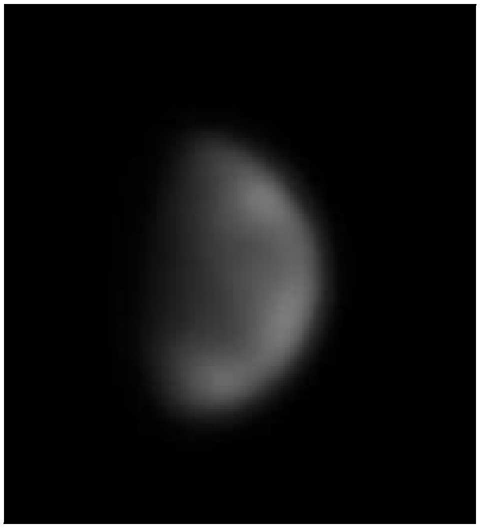


Illustration 013. 2009 Jul 19 02:52 UT, George Tarsoudis, Alexandropoulis, Greece, 25.4 cm (10.0 in.) NEW, UV filter, Seeing (not specified), Transparency (not specified), Phase (k) = 0.690, Apparent Diameter = 16.2", Notice amorphous dusky features; bright spot along the S limb; S is at the top of the image.

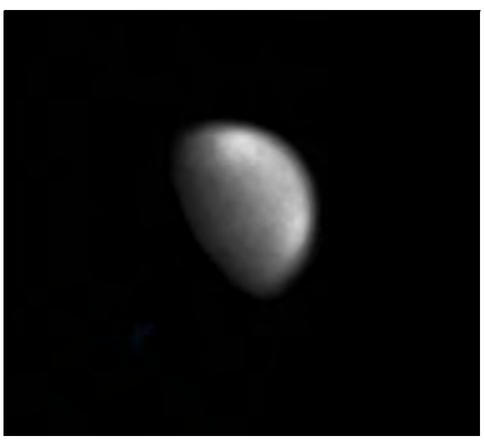


Illustration 014. 2009Jul19 10:57 UT, Willem Kivits, Siebengewald, The Netherlands, 35.6 cm (14.0 in.) SCT, RGB and UV filters, Seeing (not specified), Transparency (not specified), Phase (k) = 0.691, Apparent Diameter = 16.2", UV image clearly depicts the brilliant southern hemisphere white spot on the limb of Venus; amorphous dusky markings are apparent as well; S is at the top of the image.

No visual observers reported the presence of the unusual bright spot on Venus during July 2009, probably because the feature was obvious only at UV wavelengths. As a normal practice, when visual observers detect such bright areas, it is standard practice for to denote them on drawings by using dotted lines to surround them.

This apparition, observers regularly used color filter techniques when viewing Venus, and when results were compared with studies in Integrated Light, it was evident that color filters and variable-density polarizers improved the visibility of otherwise indefinite atmospheric markings on Venus.

The Bright Limb Band

Figure 4 illustrates that a little over two-thirds of the submitted observations (69.8%) this apparition referred to a very conspicuous "Bright Limb Band" on the illuminated hemisphere of Venus. When the Bright Limb Band was visible or imaged, it appeared as a continuous, brilliant arc running from cusp to cusp 68.3% of the time, and interrupted or only marginally visible along the limb of Venus in 31.7% of the positive reports. The bright limb band was more likely to be incomplete in UV images than those captured in the visible spectrum as well as submitted drawings. The mean numerical intensity of the Bright Limb Band was 9.8, seemingly a bit more obvious when color filters or variable-density polarizers were used. This very bright feature, usually reported by visual observers this apparition [Refer to Illustration No. 005], was also seen on a fairly large number of digital images of Venus received [Refer to Illustration No. 021].

Terminator Irregularities

The terminator is the geometric curve that separates the brilliant sunlit and dark hemispheres of Venus. A deformed or asymmetric terminator was reported in 58.4% of the observations. Amorphous, banded, and irregular dusky atmospheric markings often seemed to merge with the terminator shading, possibly contributing to some of the reported incidences of irregularities. Filter techniques usually improved the visibility of terminator asymmetries and associated dusky atmospheric features. Bright features adjacent to the terminator can occasionally take the form of bulges, while darker markings may appear as wispy hollows [Refer to Illustration No. 007].

Cusps, Cusp-Caps, and Cusp-Bands

When the *phase coefficient*, **k**, is between 0.1 and 0.8 (the phase coefficient is the fraction of the disc that is illuminated), atmospheric features on Venus with the greatest contrast and overall prominence are consistently sighted at or near the planet's cusps, bordered sometimes by dusky cusp-bands. *Figure 5* shows the visibility statistics for Venusian cusp features for this apparition.

When the northern and southern cusp-caps of Venus were reported this observing season, *Figure 5* graphically shows that these features were equal in size the majority (95.2%) of the time and in brightness in 87.6% of the observations. Also, there were several instances when the southern and northern cusp-caps were larger and brighter than each other. Both cusp-caps were visible in 70.5% of the observational reports, and their mean relative intensity averaged 9.8 during the observing season. Dusky cusp-bands were detected flanking the bright cusp-caps in 68.5% of the observations when cusp-caps were visible. When seen, the cusp-bands displayed a mean relative intensity of about 7.5 (see *Figure 5*) [Refer to Illustrations No. 006, 026 and 028].

Table 3: Ashen Light Observations During the 2009-10 Western (Morning) Apparition of Venus

UT Date and Time		X	k	Observational Notes
2009 Mar 29	10:30	225	0.010	Ashen Light suspected in UG3 (blue) filter
2009 Mar 31	12:28	225	0.014	Ashen Light suspected in UG3 (blue) filter
2009 May 23	02:53	225	0.415	Ashen Light is definite in Integrated Light

Cusp Extensions

In 98.7% of the visual observations submitted during the apparition, no cusp extensions were reported in integrated light or with color filters beyond the 180° expected from simple geometry (see Figure 5). While Venus was passing through its crescent phases following inferior conjunction on March 27, 2009, rare instances of cusp extensions were detected from time to time, ranging from 3° to 10°, but not particularly noticeable on any contributed drawings and rather vague in images submitted. Experience has shown that cusp extensions are notoriously troublesome to image because the sunlit

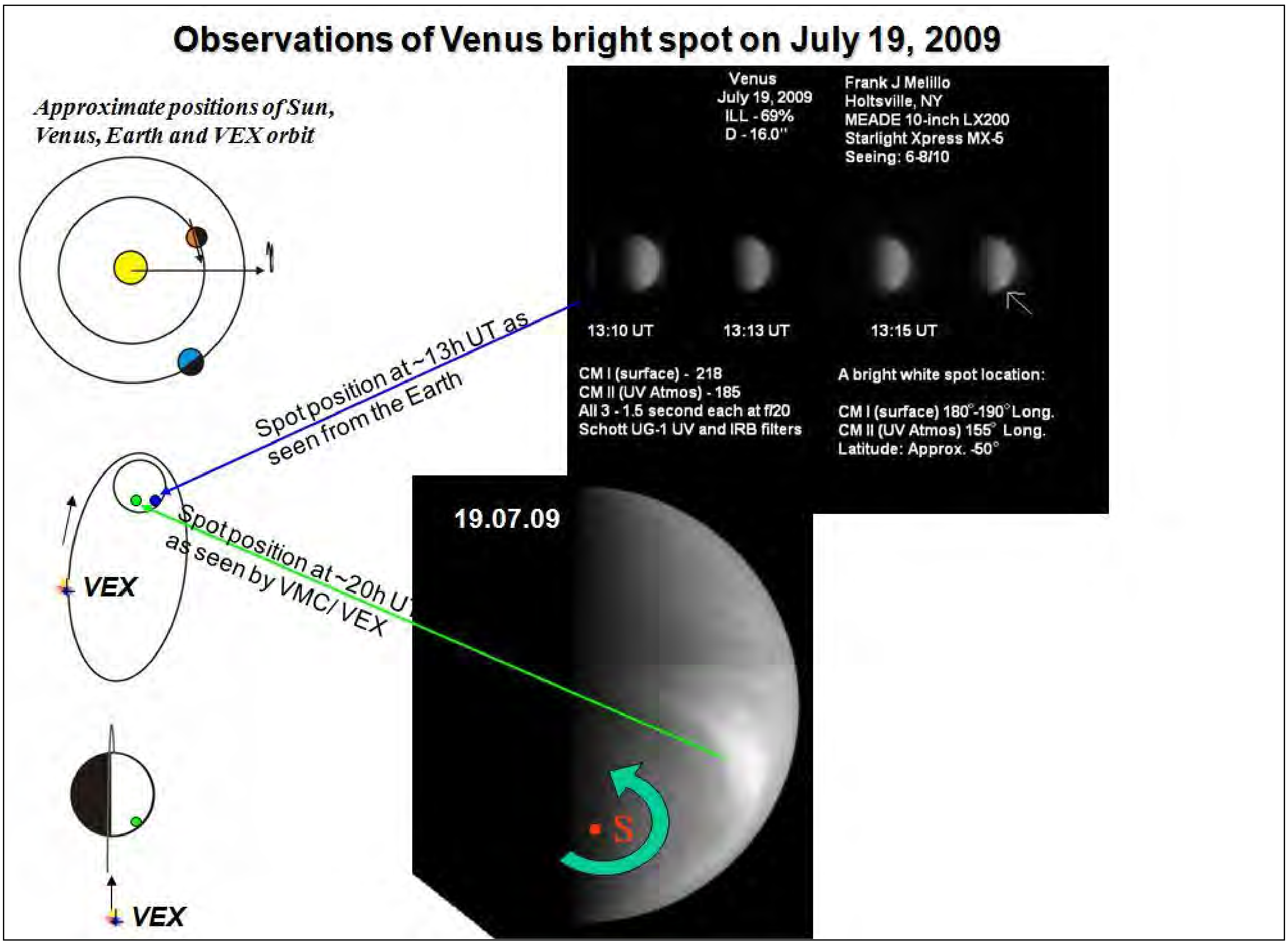


Illustration 015 (comparison of Illustration 012 by fjm with VEX 20:00UT image). 2009 Jul19 ~20:00UT VMC/VEX image of Venus compared with image by Frank Melillo on same date between 13:10 and 13:15 UT, N is up in all images in this illustration for comparison purpose. *Images provided courtesy Sanjay Limaye and European Space Agency's (ESA) Venus Express (VEX) Mission* regions of Venus are overwhelmingly brighter than faint cusp extensions, but observers are still encouraged to try to record these features using digital imagers in upcoming apparitions.

Estimates of Dichotomy

A discrepancy between predicted and observed dates of dichotomy (half-phase) is often referred to as the "Schröter Effect" on Venus. The predicted half-phase occurs when k = 0.500, and the phase angle, i, between the Sun and the Earth as seen from Venus equals 90°. Although theoretical dichotomy occurred on June 6, 2009 at 06.61^{d}, visual dichotomy estimates were not submitted during this apparition.

Dark Hemisphere Phenomena and Ashen Light Observations

The Ashen Light, reported the first time by G. Riccioli in 1643, is an extremely elusive, faint illumination of Venus' dark hemisphere. Some observers describe the Ashen Light as resembling Earthshine on the dark portion of the Moon, but the origin of the latter is clearly not the same. It is natural to presuppose that Venus should ideally be viewed against a totally dark sky for the Ashen Light to be detectable, but such circumstances occur only when the planet is very low in the sky where poor seeing adversely affects viewing. The substantial glare from Venus in contrast with the surrounding dark sky is a further complication. Nevertheless, the ALPO Venus Section continues to receive reports from experienced observers, viewing the planet in twilight, who are convinced they have seen the Ashen Light, and so the controversy continues. There were no digital images that were submitted suggesting the presence of the Ashen Light during 2009-10 Western (Morning) Apparition, but as shown in *Table 3*, three visual observations by Detlev Niechoy called attention to its occurrence in Integrated Light (no filter) during March and May with a 20.3 cm (8.0 in.) SCT [Refer to Illustration No. 006].

Venus observers are encouraged to monitor the dark side of Venus using digital imagers to try to capture any illumination that may be present on the planet, ideally as part of a cooperative simultaneous observing

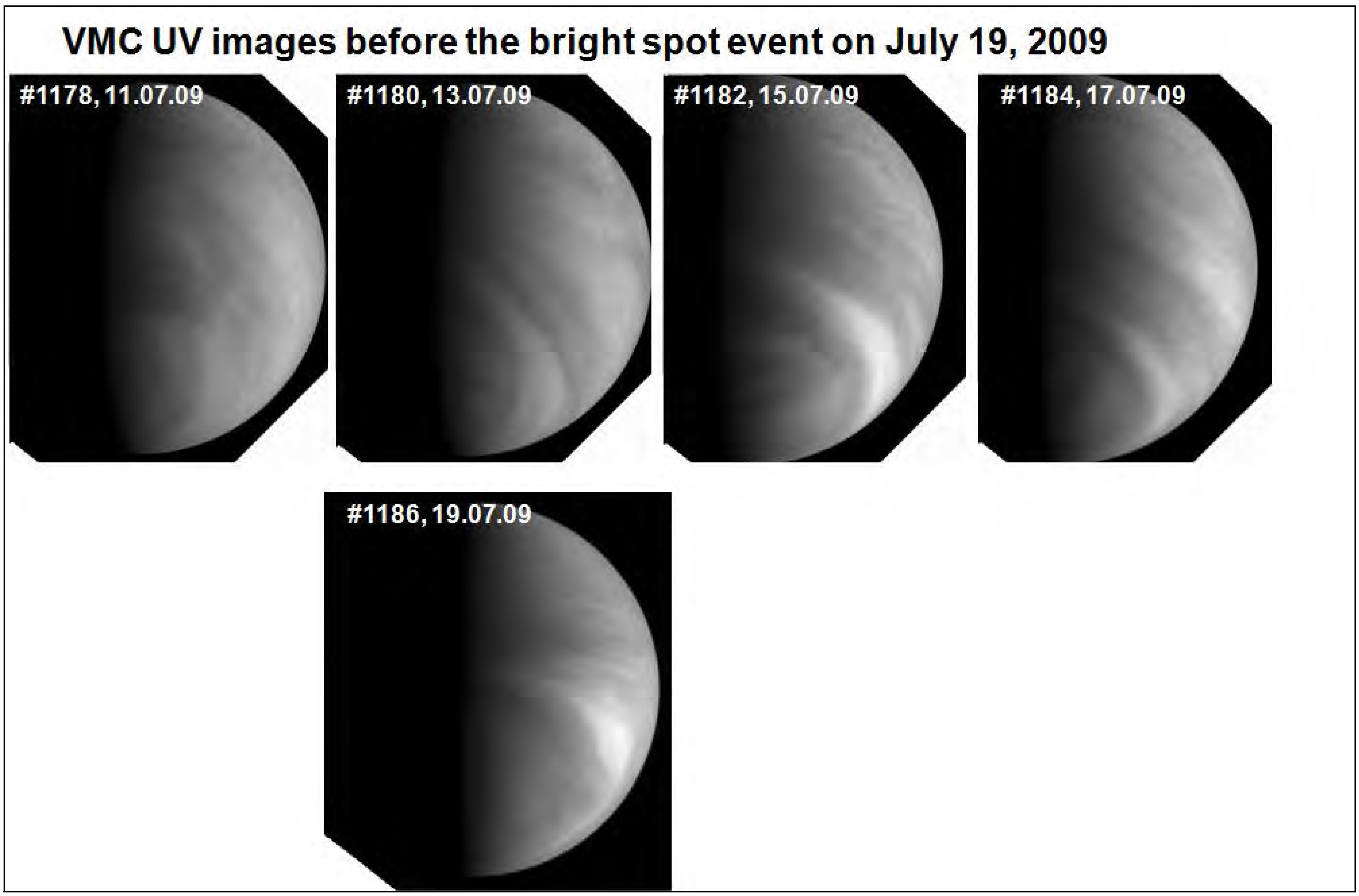


Illustration 016. 2009 Jul 19, VEX images of Venus from 2009 Jul 11 thru 2009 Jul 19, where the spot emerged on 2009 Jul 15, four days prior to reports of the feature by ALPO observers; N is at the top of these images. *Images provided courtesy Sanjay Limaye and European Space Agency's (ESA) Venus Express (VEX) Mission.*

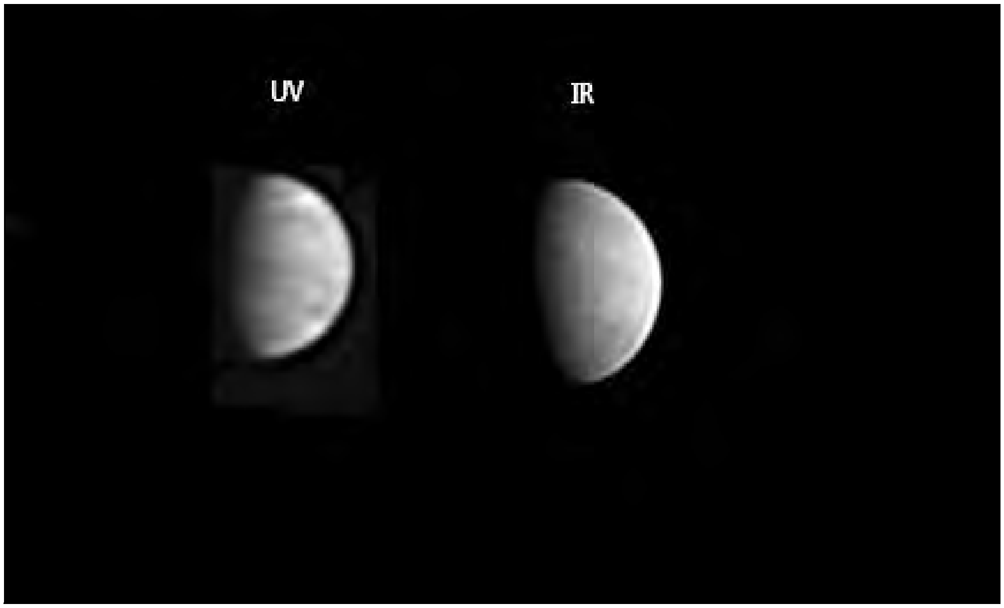


Illustration 017. 2009 Jul 20 12:51-13:00 UT, Paul Maxson, Phoenix, AZ, 25.4 cm (10.0 in.) DALL, UV (335nm) and IR (742nm) filters, Seeing (not specified), Transparency (not specified), Phase (k) = 0.695, Apparent Diameter = 16.0", UV image shows banded, amorphous and irregular dusky markings, as well as continued evolution of the bright spot near the limb; note that the bright spot is not obvious in IR (and dusky features are not as apparent in IR); S is at the top of the image.

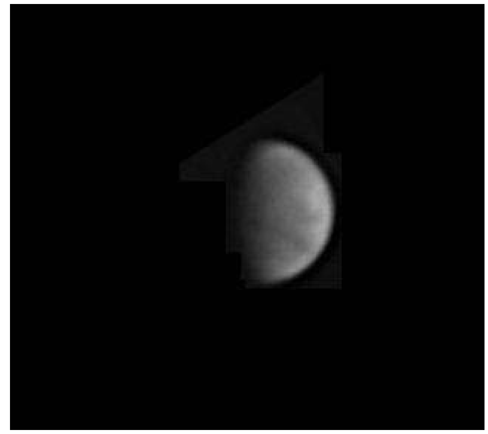


Illustration 019. 2009 Jul 22 12:50-12:54 UT, Paul Maxson, Phoenix, AZ, 25.4 cm (10.0 in.) DALL, UV (335nm) filter, Seeing (not specified), Transparency (not specified), Phase (k) = 0.703, Apparent Diameter = 15.8", UV image shows banded and amorphous dusky markings, cusp caps, cusp bands; S is at the top of the image.

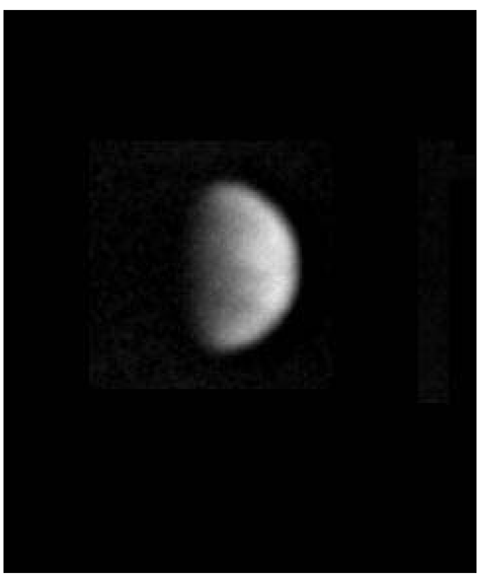


Illustration 018. 2009 Jul 22 06:52-17:00 UT, David Arditti, Middlesex, UK, 35.6 cm (14.0 in.) SCT, UV (320-390nm) filter, Seeing (not specified), Transparency (not specified), Phase (k) = 0.702, Apparent Diameter = 15.8", UV image shows banded and amorphous dusky markings, cusp caps, cusp bands; S is at the top of the image.

endeavor with visual observers.

Since the instrumentation and methodology are not really complicated, the ALPO Venus Section also encourages observers to pursue systematic imaging of the planet in the near-IR. At these wavelengths the hot surface of the planet becomes quite apparent and occasionally mottling shows up in such images, which are attributed to the presence of cooler dark higher-elevation terrain and warmer bright lower surface areas in the IR. No observers submitted near-IR images of the dark hemisphere this observing season.

There were no instances when the dark hemisphere of Venus allegedly appeared *darker* than the background sky during the 2009-10 Western (Morning) Apparition, a phenomenon that is probably nothing more than a spurious contrast effect.

Simultaneous Observations

The atmospheric features and phenomena of Venus are elusive, and it not unusual for two observers looking at Venus at the same time to derive somewhat different

Illustration 020. 2009 Jul 24 13:57 UT, Donald C. Parker, Miami, FL, 25.4 cm (10.0 in.) DALL, UV (355nm) filter, Seeing 6.0, Transparency (not specified), Phase (k) = 0.710, Apparent Diameter = 15.6", UV image shows amorphous and irregular dusky markings; bright spot is apparent along the southern limb (4 days after initial reports on July 19th by other observers), S is at the top of the image

impressions of what is seen. Our challenge is to establish which features are real on any given date of observation, and the only way to build confidence in any database is to increase observational coverage on the same date and at the same time. Therefore, the ideal scenario would be to have simultaneous observational coverage throughout any apparition. Simultaneous observations are defined as independent, systematic, and standardized studies of Venus carried out by a large group of observers using the same techniques, similar equipment, and identical observing forms to record what is seen. While this standardized approach emphasizes a thorough visual coverage of Venus, it is also intended to stimulate routine digital imaging of the planet at visual and various other wavelengths, such as infrared and ultraviolet. By these exhaustive efforts, we would hope to be able to at least partially answer some of the questions that persist about the existence and patterns of atmospheric phenomena on Venus.

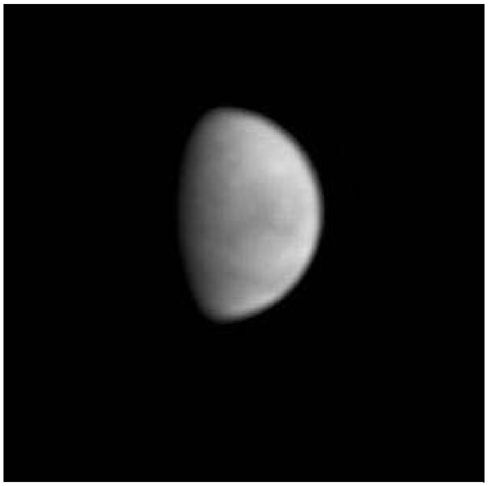


Illustration 021. 2009 Jul 27 03:32-04:00 UT, Jean-Pierre Prost, Marseille, France, 25.4 cm (10.0 in.) DALL, IR 642nm, IR 1000nm, UV, Seeing (not specified), Transparency (not specified), Phase (k) = 0.719, Apparent Diameter = 15.3", Amorphous dusky markings and mottling is apparent in UV wavelengths, terminator shading, cusp caps and cusp bands, and somewhat incomplete bright limb band; S is at the top of the image.

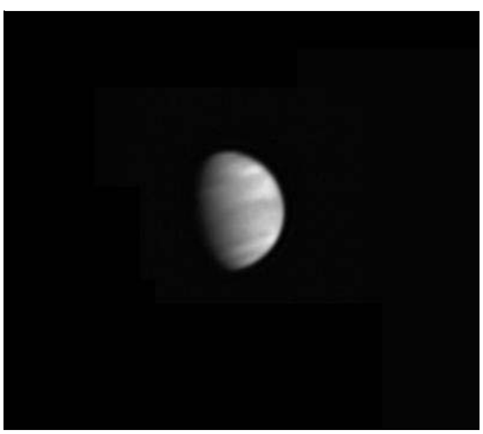


Illustration 022. 2009 Aug 08 04:24 UT, Torsten Hansen, Reichau Boos, Germany, 20.3 cm (8.0 in.) NEW, UV filter, Seeing (not specified), Transparency (not specified), Phase (k) = 0.760, Apparent Diameter = 14.3", Superb image showing banded dusky markings in UV; S is at the top of the image.

Amateur-Professional Cooperative Programs

The Venus Express (VEX) spacecraft began systematically monitoring Venus at near-UV, visible and near-IR wavelengths in May 2006 and has been extended through the end of 2014. Despite the fact that spacecraft images of Venus will be extremely high-resolution, far better than is achievable from Earth, monitoring by the VEX cameras will not be continuous. So, this opens up a great opportunity for amateur astronomers to attempt high-quality digital imaging of Venus in the wavelength range of 350nm to 1000nm (near-UV to near-IR). The Venus Amateur Observing Project (VAOP) has been organized in cooperation with the European Space Agency (ESA) where images are being contributed by amateur astronomers to complement the Venus Express (VEX) spacecraft results. More information about this effort, as well as prerequisites for participations and instructions for uploading images, can be obtained by contacting the ALPO Venus Section or by visiting the VAOP website at:

http://sci.esa.int/science-e/www/object/index.cfm?fobjectid=38833&fbodylongid=1856.

In addition to dispatching images to the VAOP project, they should also be regularly sent to the ALPO Venus Section. The submitted images will be archived for analysis and comparison with results on the planet's atmospheric circulation gleaned from the Venus Express (VEX) mission. The ALPO Venus Section looks forward to continued successful Pro-Am cooperation during the mission, and observers throughout the world are welcome to participate.

Conclusions

Analysis of ALPO observations of Venus during the 2009-10 Western (Morning) Apparition showed that vague shadings on the disc of the planet were periodically apparent to visual observers who utilized standardized filter techniques to help reveal the notoriously elusive atmospheric features. Indeed, it is often very difficult to be sure visually what is real and what is merely illusory at visual wavelengths in the atmosphere of Venus. Increased confidence in visual results is improving as more and more program participants are attempting

Illustration 023. 2009 Aug 11 12:28-12:31 UT, Paul Maxson, Phoenix, AZ, 25.4 cm (10.0 in.) DALL, Integrated Light (no filter), Seeing (not specified), Transparency (not specified), Phase (k) = 0.771, Apparent Diameter = 14.0", Superb images showing banded dusky markings in UV; S is at the top of the image.

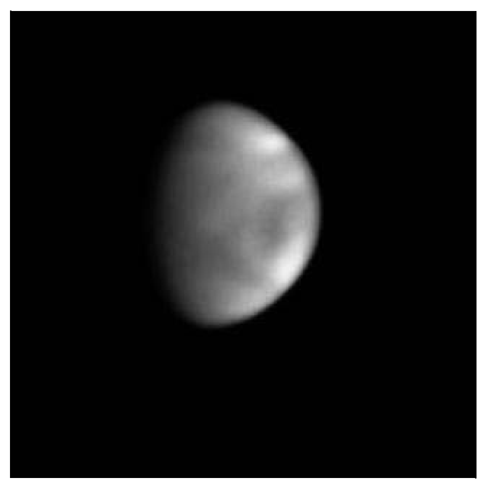


Illustration 024. 2009 Aug 14 04:43 UT, Paolo Lazzarotti, Massa, Italy, 31.5 cm (12.4 in.) NEW, 350nm UV filter, Seeing 3.0, Transparency 5.0, Phase (k) = 0.779, Apparent Diameter = 13.8", Bright areas along limb in UV with radial, banded and amorphous dusky markings in this detailed image; S is at the top of the image.

simultaneous observations. Readers and potential observers should realize that well-executed drawings of Venus are still a vital part of our overall program as we strive to improve the opportunity for confirmation of highly elusive atmospheric phenomena, to introduce more objectivity, and to standardize observational techniques and methodology. It is especially good to see that to a greater extent Venus observers are contributing digital images of the planet at visual, near-UV, and near-IR wavelengths. It is also meaningful when several observers working independently, with some using visual methods at the same time others are employing digital imaging, to produce comparable results. For example, atmospheric banded features and radial ("spoke") patterns depicted on drawings often look strikingly similar to those captured with digital imagers at the same date and time.

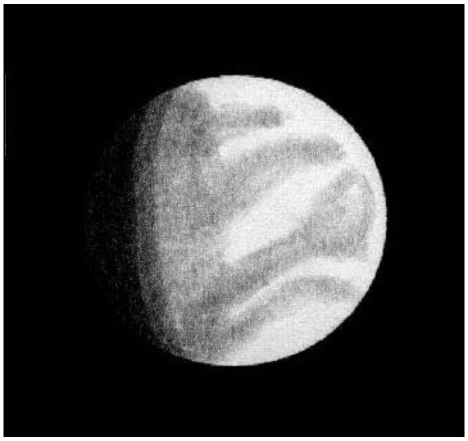


Illustration 025. 2009 Aug 27 04:21 UT, Detlev Niechoy, Göttingen, Germany, 20.3 cm (8.0 in.) SCT, Drawing @ 225X W15 (yellow) filter, Seeing 4.0 (interpolated), Transparency (not specified), Phase (k) = 0.818, Apparent Diameter = 12.9", Drawing shows terminator shading with associated dusky banded features on gibbous disk of Venus; S is at the top of the image.

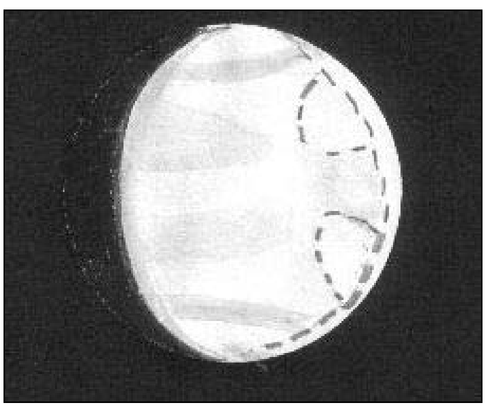


Illustration 026. 2009 Sep 01 19:20-19:45 UT, Carl Roussell, Hamilton, Ontario, Canada, 15.2 cm (6.0 in.) REF, Drawing @ 200-400X Integrated Light, + alternating W25, W58, W47 filters, Seeing 5.0, Transparency (not specified), Phase (k) = 0.833, Apparent Diameter = 12.6", Drawing shows suspected diffuse bright spots in conjunction with the bright limb band, as well as banded dusky markings, cusp caps and cusp bands; S is at the top of the image.

Many of our best UV images have been sought after by the professional community, and cooperative involvement of amateurs and professionals on common projects took another step forward with the establishment of the Venus Amateur Observing Project (VAOP) in 2006 coincident with the Venus Express (VEX) mission, which continues at least until the end of 2014.

Active international cooperation by individuals making regular systematic, simultaneous observations of Venus remain our main objective, and the ALPO Venus Section encourages interested readers to join us in our many projects and challenges in the coming years.

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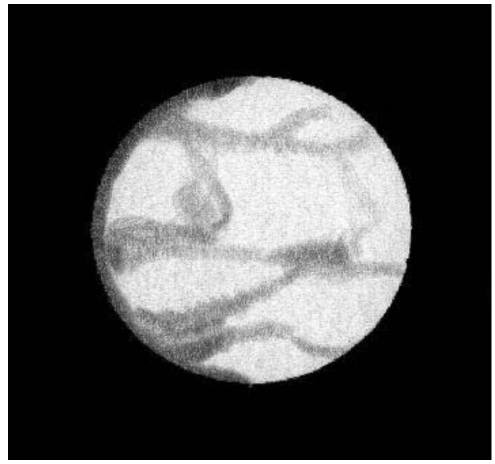

Illustration 027. 2009 Sep 27 10:23 UT, Detlev Niechoy, Göttingen, Germany, 20.3 cm (8.0 in.) SCT, Drawing @ 225X Integrated Light (no filter), Seeing 3.0 (interpolated), Transparency (not specified), Phase (k) = 0.895, Apparent Diameter = 11.5", Terminator shading with banded and irregular dusky markings depicted in this drawing; S is at the top of the image.

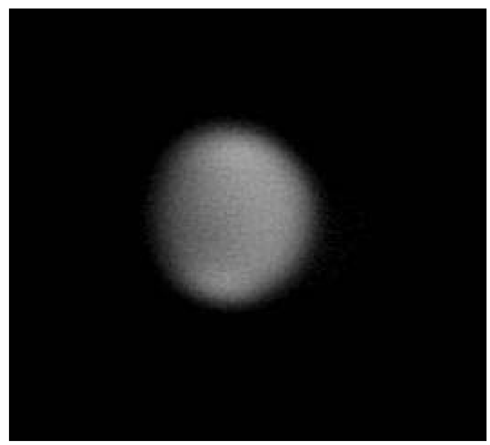

Illustration 028. 2009 Oct 15 21:06-21:08 UT, Tomio Akutsu, Cebu City, Philippines, 35.6 cm (14.0 in.) SCT, UV and IR filters, Seeing 4.0, Transparency 4.0, Phase (k) = 0.930, Apparent Diameter = 10.9", Aside from vague amorphous dusky markings, both cusp caps are quite noticeable in this UV image of the nearly full disk of Venus. S is at the top of the image.

Association of Lunar and Planetary Observers (A.L.P.O.): Venus Section

A.L.P.O. Visual Observation of Venus

Drawing Blank *Intensity Estimates Blank*

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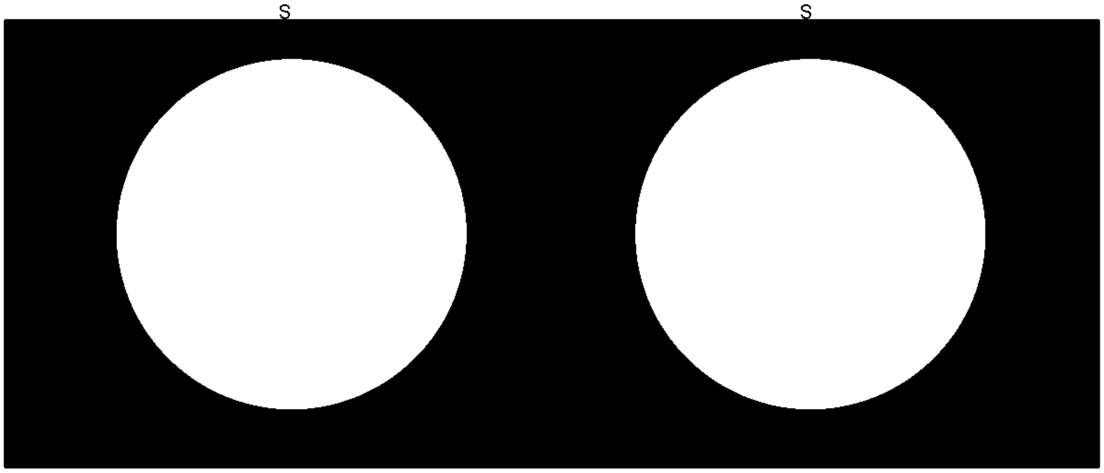
p  f

N (*all coordinates are IAU*) N

Observer________________________________Location____

UT Date _____________ UT Start _______________ UT End _______________ D = __________″ k_m = __________ k_c = ___________

m_v = ___________ Instrument ____ Magnification(s) _____________ x_{min} _____________ x_{max}

Filter(s) IL(none) ___________ f_1 ___________ f_2 ___________ f_3 ____________ Seeing _______________ Transparency _______________

Sky Illumination (*check one*): [ ] Daylight [ ] Twilight [ ] Moonlight [ ] Dark Sky

Dark Hemisphere (*check one*): [ ] No dark hemisphere illumination [ ] Dark hemisphere illumination suspected
[ ] Dark hemisphere illumination [ ] Dark hemisphere darker than sky

Bright Limb Band (*check one*): [ ] Limb Band not visible
[ ] Limb Band visible (complete cusp to cusp)
[ ] Limb Band visible (incomplete cusp to cusp)

Terminator (*check one*): [ ] Terminator geometrically regular (no deformations visible)
[ ] Terminator geometrically irregular (deformations visible)

Terminator Shading (*check one*): [ ] Terminator shading not visible
[ ] Terminator shading visible

Atmospheric Features (*check, as applicable*): [ ] No markings seen or suspected [ ] Radial dusky markings visible
[ ] Amorphous dusky markings visible [ ] Banded dusky markings visible
[ ] Irregular dusky markings visible [ ] Bright spots or regions visible (exclusive of cusp regions)

Cusp-Caps and Cusp-Bands (*check, as applicable*): [ ] Neither N or S Cusp-Cap visible [ ] N and S Cusp-Caps both visible
[ ] N Cusp-Cap alone visible [ ] S Cusp-Cap alone visible
[ ] N and S Cusp-Caps equally bright [ ] N and S Cusp-Caps equal size
[ ] N Cusp-Cap brighter [ ] N Cusp-Cap larger
[ ] S Cusp-Cap brighter [ ] S Cusp-Cap larger
[ ] Neither N or S Cusp-Band visible [ ] N and S Cusp-Bands both visible
[ ] N Cusp-Band alone visible [ ] S Cusp-Band alone visible

Cusp Extensions (*check, as applicable*): [ ] No Cusp extensions visible [ ] N Cusp extended (angle = _____°)
[ ] S Cusp extended (angle = _____°)

Conspicuousness of Atmospheric Features (*check one*): [ ] 0.0 (nothing seen or suspected) [ ] 3.0 (indefinite, vague detail)
[ ] 5.0 (suspected detail, but indefinite) [ ] 7.0 (detail strongly suspected)
[ ] 10.0 (detail definitely visible)

IMPORTANT: Depict morphology of atmospheric detail, as well as the intensity of features, on the appropriate blanks at the tope of this form. Attach to this form all supporting descriptive information, and please <u>do not</u> write on the back of this sheet. The intensity scale is the *Standard A.L.P.O. Intensity Scale*, where 0.0 = completely black ⇔ 10.0 = very brightest features, and intermediate values are assigned along the scale to account for observed intensity of features.

Feature Story:

A Tale of Two Transits – Visual Observations of the Transits of Venus in 2004 and 2012

By William Sheehan
sheehan41@charter.net

Introduction

Transits of Venus are exceedingly rare events, occurring in 8-year pairs with gaps of either 105.5 or 121.5 years between the pairs. The first transits of the new century — and indeed the new millennium — occurred on June 8, 2004 and June 5, 2012. I describe my own observations from Bakebung Lodge, Pilanesburg, South Africa, in 2004, and from Lowell Observatory in Flagstaff, Arizona, in 2012. A number of interesting phenomena are reported.

The Black Drop

The last transit of Venus prior to 2004 took place in 1882, so that no one now living had ever seen a transit. Historically, transits were the occasion for expeditions on a global scale to attempt to observe the contacts of the limbs of Venus with the edge of the Sun, so as to apply Edmond Halley's 1716 method of triangulating the solar parallax and working out the all-important distance from the Earth to the Sun (Woolf, 1959; Sellers, 2001; Sheehan and Westfall, 2004). (Fig. 1.) The resulting measures at the 1761, 1769, 1874 and 1882 transits were less accurate than Halley's expectation (to within 1 part in 500). This was in large part owing to the inconvenient appearance of the so-called "black drop", a glutinous strip that seemed to tether the limb of the Sun to that of Venus, and "snapping" or dissipating only after Venus was well advanced upon the Sun. What had appeared to be an elegant and straightforward solution of what Halley called the "noble problem" was thus spoiled by this unexpected and rather sinister-appearing phenomenon.

Even as late as 2001, as was pointed out at an American Astronomical Society meeting by Louisiana State University astronomer Bradley Schaefer, many authors continued incorrectly to assert that the black drop was an effect produced by the atmosphere of Venus (Schaefer, 2001). At the 2004 transit, most interest centered on attempts, with modern instruments (and GPS) to apply Halley's method and find out how well it could do under optimal conditions. Of course there was also great interest in seeing whether the black drop would make an appearance. It did, though with some qualifications. In contrast to the striking blobs and dark ligatures seen by 18th century observers, most observers of the 19th century transits and the 2004 transit, if they saw anything at all, saw rather muted effects. Joseph Ashbrook summed up the 19th century experience (Ashbrook, 1984) thus: "Although the black drop features in many reports from 1761 and 1769, it was less often seen at the next two transits... The better equipment used in 1874 and 1882 sometimes showed instead a dusky, hazy appearance between Venus and the Sun's limb, causing an uncertainty of several seconds in timing contacts II and III." This was also the case in 2004.

The 21st century transits have settled once and for all the actual causes of the black drop. It has nothing to do with the atmosphere of Venus; instead, it is an effect due to blurring of images by imperfect optics and enhanced by poor atmospheric seeing caused by turbulence in the Earth's atmosphere and — in the case of satellite results obtained in ideal

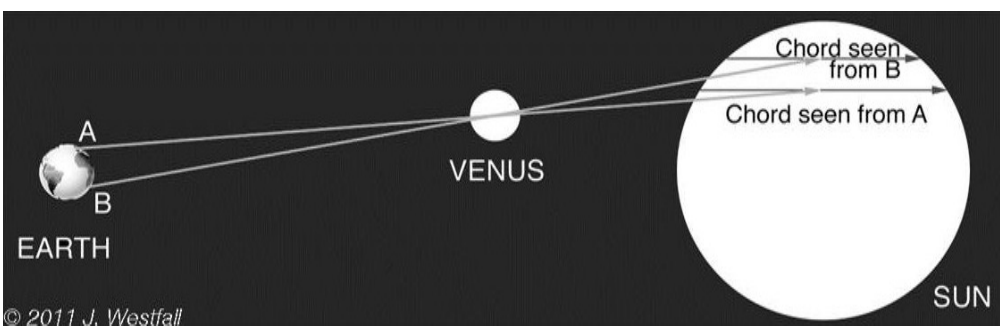


Fig. 1. Halley's method for determining the Earth-Sun distance by observing the transit of Venus across the face of the Sun. Chords across the Sun from two stations, A and B, widely separated by latitudes within the zone from which the entire transit is visible, traverse chords of different lengths (and thus different durations) when crossing the Sun's disk. The distance to the Sun can be worked out using simple trigonometry if the distance between the stations A and B is known. Source: Sheehan and Westfall, *The Transits of Venus*, p. 130.

All Readers

Your comments, questions, etc., about this report are appreciated. Please send them to: *ken.poshedly@alpo-astronomy.org*

Online Features

Left-click your mouse on:

• The author's e-mail address in blue text to contact the author of this article.
• The references in blue text to jump to source material or information about that source material (Internet connection must be ON).

("seeing"-free) conditions above the Earth's atmosphere — the contribution of the Sun's rapidly varying limb darkening playing an important role (Schneider, Pasachoff, and Golub, 2004). Nowadays, the blurring of images is frequently described in terms of the "point spread function (PSF)" of telescopes, "contrast resolution" as described by the "modulation transfer function (MTF)," or "phase transfer function (PTF)." However, the basic principle involved — it used to be referred to as "irradiation" — has been known for a very long time. Irradiation is the tendency of light from a bright area seen in juxtaposition to a dark area to bleed into the dark area. As pointed out by the 18th century French astronomer Jerome Lalande to explain the black drop seen at the 1761 and 1769 transits, irradiation caused the apparent disk of Venus on the Sun to appear smaller than the real disk. At the same time, the apparent limb of the Sun appears larger than the actual solar limb. (Fig. 2.) The black drop occurs when the

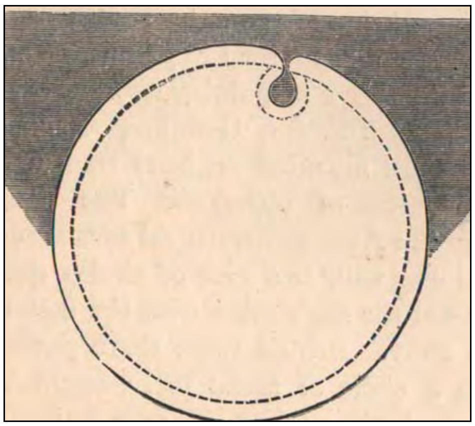


Fig. 2. Explanation of the origin of the black drop effect. A bright area seen in juxtaposition to a dark area will appear to bleed into the dark area. In the case of Venus in transit, this causes the apparent disk of Venus on the Sun to appear smaller than the real disk, while the apparent limb of the Sun appears larger than the real limb. The black drop occurs when the real disk of Venus comes into contact with the apparent limb of the Sun. In this region, there is no point at which the light can get in, so the area appears dark. Source: George Forbes, The Transit of Venus (London: MacMillan, 1874), p. 51.

Fig. 3. South African amateur Trevor Gould demonstrates his set-up for observing the transit of Venus to French galactic astronomer Françoise Combes at Pilanesburg National Park, June 8, 2004. Photograph by William Sheehan.

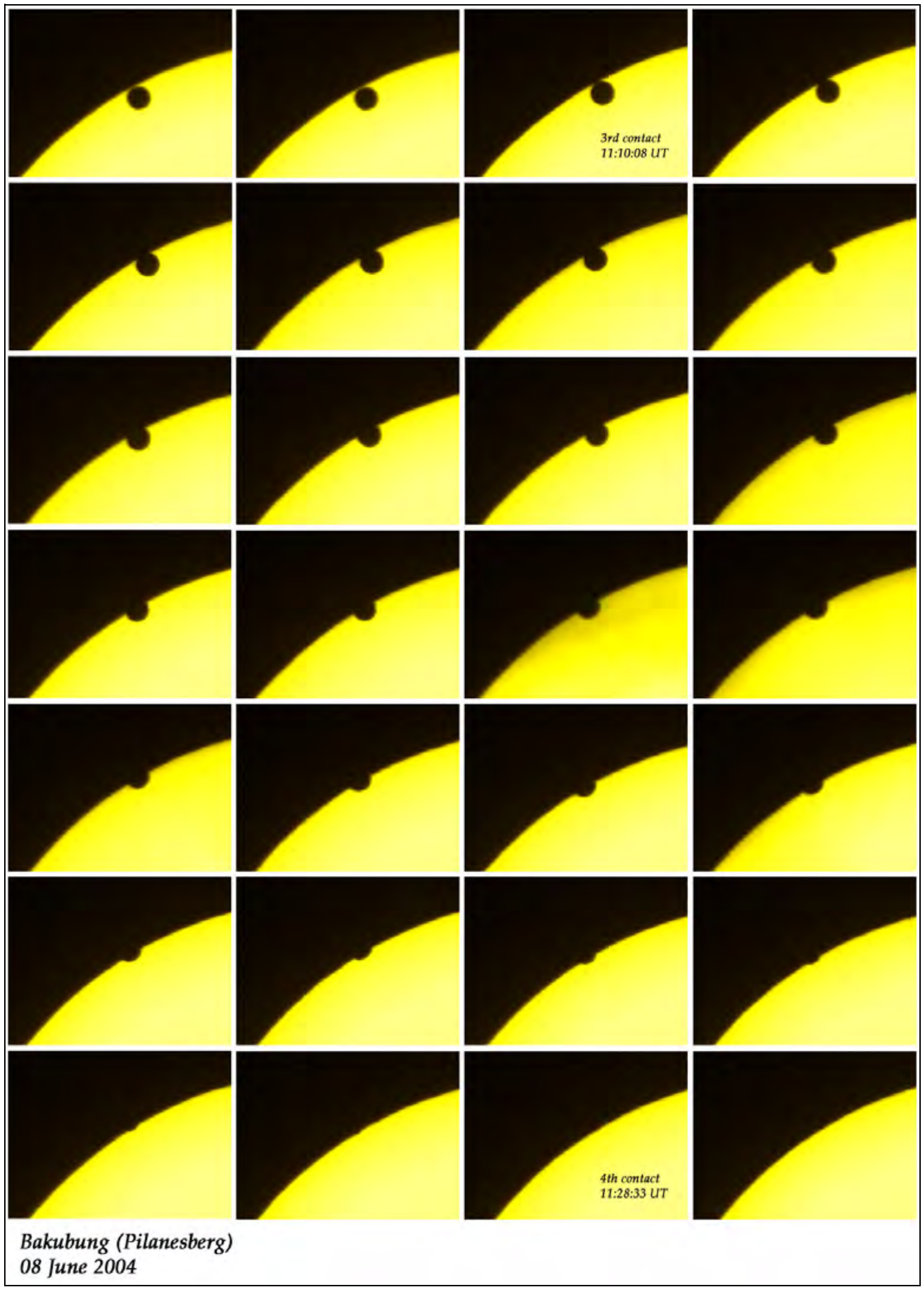


Fig. 4. A series of CCD images by Bert van Winsen showing contacts III and IV at the June 8, 2004 transit of Venus; courtesy Daniel Fischer.

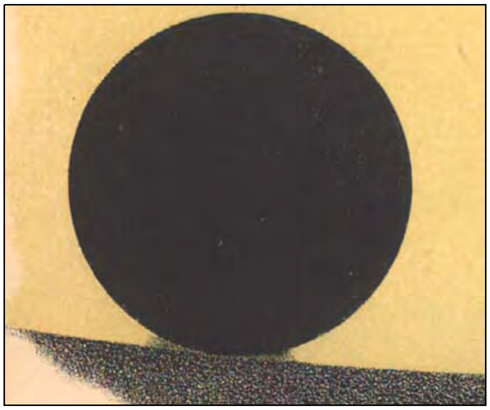


Fig. 5. The black drop (or shading) at Contact III during the transit of Venus, December 9, 1874, as observed by H.C. Russell with the 11½-inch refractor of the Government Observatory in Sydney, New South Wales. Note the instrument was stopped down to 5 inches. From Sydney Observatory, *Observations of the Transit of Venus*, 1892.

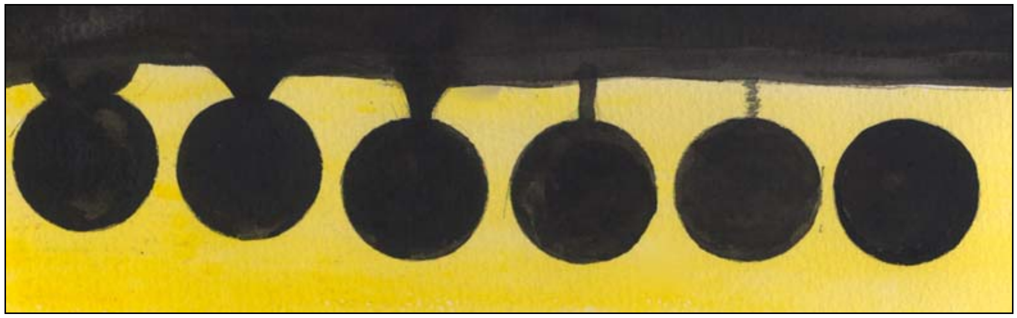


Fig. 6. Black drop sequence by William Sheehan at Lowell Observatory at the June 5, 2012 transit, observed visually with a C-11 equipped with a 3-inch filter aperture.

real disk of Venus comes into contact with the *apparent* limb of the Sun. Within this zone, there is no point at which the light can get in, thus the area appears dark (Forbes, 1874).

The correctness of this explanation is now attested by numerous observations of the transits of 2004 and 2012 (see, for instance, Duval et al., 2005, and Duval et al., in press). Because the effect described is more pronounced in small and optically inferior instruments and in bad seeing, the 18th century reports of the black drop tended to be much more dramatic than the subtle and sometimes effectively nonexistent effects reported by 19th and 21st century observers. As an aside, it is now evident that the actual 2nd and 3rd contacts whose precise timings were sought as the key to the methods of triangulating the solar parallax correspond to the moment when black drop disappears at Contact II and reappears at Contact III. Observers in the 18th and 19th century could not have known this: using telescopes that were of poor optical quality by modern standards — sometimes in appalling conditions (Captain Cook in Tahiti in 119 degree F. heat!) — they saw a confusing train of phenomena that stretched over a considerable period of time and were confounded in their measurements. We can only commiserate with their perplexity, though in their defense, as pointed out to me by David Sellers (personal communication, August 20, 2012), at least some of them (Pingré in 1761, Cook and Green in 1769) did take care to time the *end* of the black drop effect at ingress and the *beginning* of it at egress (in addition to the apparent internal contacts), so that their timings were much more accurate than has generally been supposed.

My own observations of the black drop in 2004 and 2012 are consistent with this analysis. In 2004, I observed the transit at Bakebung Game Lodge in Pilanesburg National Park in South Africa with South African amateurs Trevor Gould (who kindly supplied a homebuilt 8-inch Newtonian) and Val Fraser. (Fig. 3)

(As the transit was observed in connection with an international conference on galactic bars, there were lots of astronomers as well as a healthy contingent of South African school children and their teachers nearby. Real estate for setting up instruments was at a

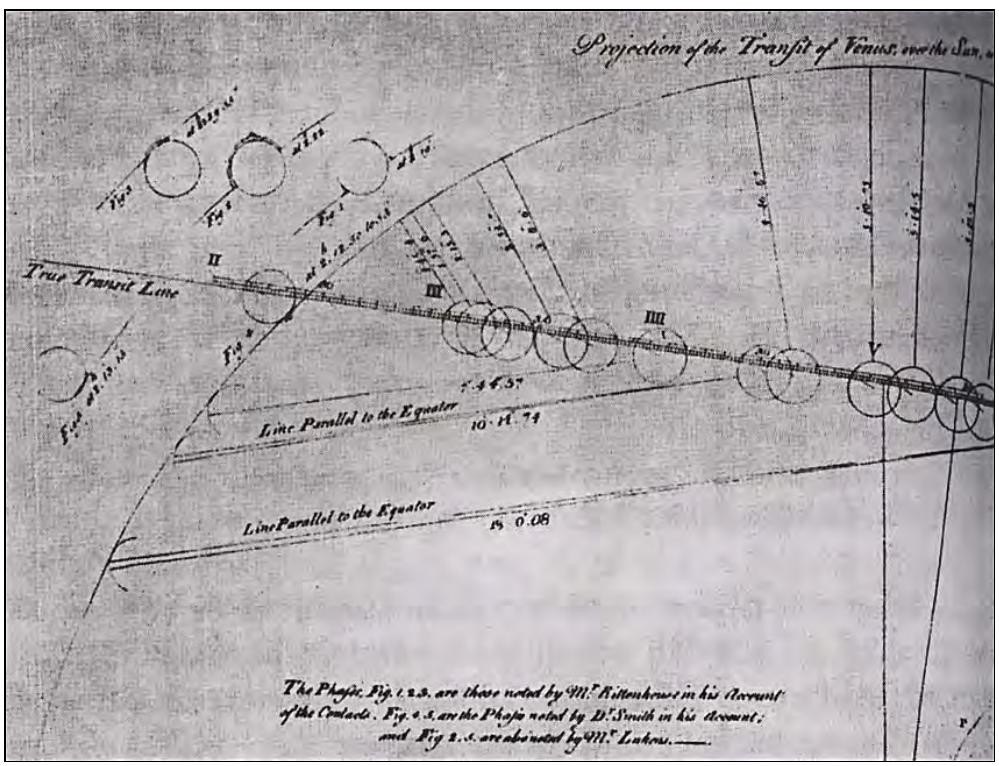


Fig. 7. David Rittenhouse's sketches showing the aureole at the 1769 transit of Venus. From Brooke Hindle, David Rittenhouse. Princeton, New Jersey: Princeton University Press, 1964.

premium because we all wanted the most unobstructed view, so everyone set up just shy of an electric fence beyond which was the open veld where wildebeests and other potentially dangerous animals roamed at large; Daniel Fischer, the noted German astronomy writer, and his associate Dr. Susanne Hüttemeister set up next to us.

We missed Contact I and Contact II because of clouds, but Contact III and Contact IV occurred in very steady daytime conditions. Though the Sun was high in the sky, the seeing was estimated to be 1-2 seconds of arc. With the large aperture and in the steady seeing, the black drop was noted but it was extremely subtle and would have been easy to miss. (Fig. 4.) There was little more visible than a dusky shading between the limb of Venus and that of the Sun, which appeared for only a few seconds just before the limb of Venus merged with the surrounding darkness of space, and it looked exactly as depicted in the splendid drawing by Henry Chamberlain Russell in New South Wales in 1874 (Fig. 5). Here, as in the case of high-resolution ground-based and spacecraft imaging of the transit (Schneider, Pasachoff, Golub, 2004), solar limb darkening — the falling off of light at the Sun's edge — probably contributes significantly to the effect.

Having had this rather typical experience in 2004, I was rather surprised that at the 2012 transit, I observed a rather classical black drop from Lowell Observatory in Flagstaff, Arizona, which would have done any 18th century observer proud. The instrument used was a C-11 (Celestron 11-inch, Schmidt-Cassegrain) equipped with a 3-inch, off-axis filter aperture and belonging to Flagstaff amateur astronomer Bill Burke. It was set up, perhaps somewhat injudiciously, in a parking area covered with oyster shells near the residence of Lowell Observatory trustee William Lowell Putnam III, just north of the Pluto telescope dome. The oyster shells reflected a great deal of solar radiation, which did not help the ground-level seeing. On the other hand, the conditions proved to be ideal for the production of an impressively sinister black drop, for as I had told a member of the audience at a public lecture I gave at Sun City, South Africa, on the eve of the 2004 transit and who had asked how best to observe the black drop, what was needed was a smallish telescope — preferably with appalling optics — set up on a broiling asphalt surface (or oyster bed!). These conditions, I predicted, would give rise to a very splendid black drop indeed.

I attribute the small effective aperture and poor seeing (resolution cannot have been much better than 4 or 5 seconds of arc, and at times probably deteriorated to 6 or 7 seconds of arc) to the production of the black drop seen at Lowell. At first, Venus appeared like a small black globe to which was attached a virtual thunderhead of blackness. As Venus continued its progress onto the Sun, the black drop became pyramid-shaped, then turned into the classic ligament and finally, after some two minutes, dissolved. (Fig. 6.)

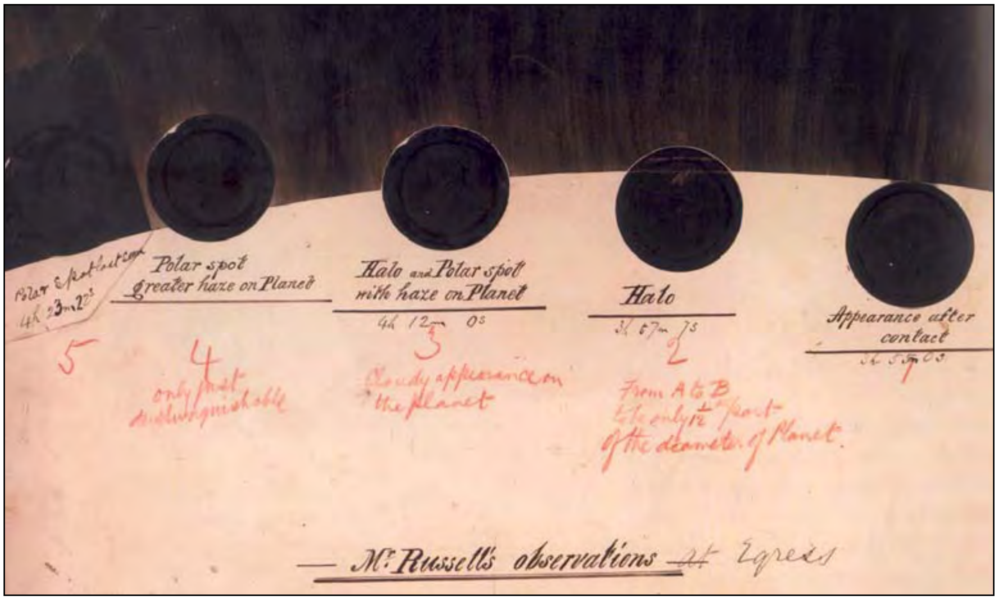


Fig. 8. The polar spot and aureole as recorded by H.C. Russell, director of the Sydney Observatory, in 1874. Courtesy Nick Lomb. Cre "State Records NSW A3003, Box 216,

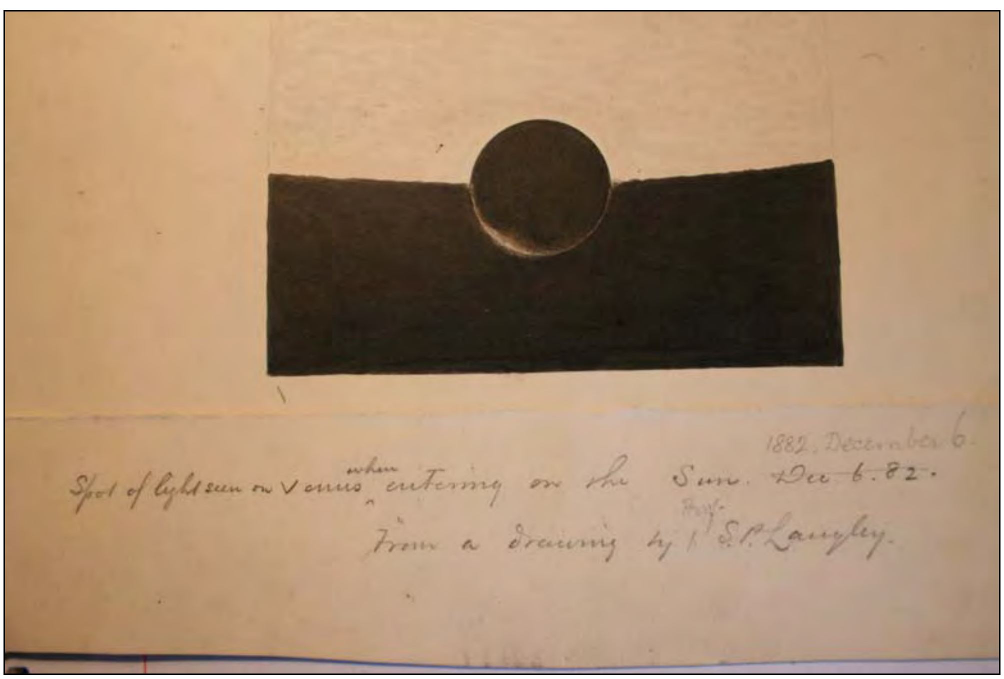


Fig. 9. S.P. Langley's impression of the aureole, as observed with the 13-inch refractor of the Allegheny Observatory at the 1882 transit. Courtesy Peter Hingley, Royal Astronomical Society Library.

Fig. 10. Klaus Brasch looks on as Paolo Tanga assembles the coronographs in the apartment of the Slipher building at Lowell Observatory. Photograph by William Sheehan.

Fig. 11. The coronographs in place on the bed of oyster shells. Photograph by Jan Millsapps.

The Aureole

At the 2004 transit, much of the focus was on the attempt to time the contacts in order to repeat earlier observers' attempts to measure the solar parallax. There was also a great deal of curiosity about the black drop. Of greater scientific importance, however, were observations of the thin, bright arc ("aureole") observed at past transits at ingress and egress when a portion of the planet's disk still lies outside the solar photosphere. Because the aureole's brightness is at best 10 to 100 times fainter than the solar photosphere nearby, and the total angular height of Venus's atmosphere is only about 0.02 seconds of arc, it can only be seen in contrast to a black background, and vanishes in close proximity to the photosphere. Few observers of the 18th century transits made credible observations of the aureole; the "bump" seen by the Russian Academician M.V. Lomonosov at Contact III during the 1761 transit may — or may not — record the aureole. (See Pasachoff and Sheehan, 2012, and Koukarine, Nesterenko, Petrunin and Shiltsev, 2012 for discussions.) However, the sketches of David Rittenhouse, who observed the 1769 transit at Norriton, near Philadelphia, Pennsylvania, are entirely convincing. (Fig. 7.) However, by the next pair of transits, instruments and observing techniques had improved, so that as the black drop went out, the aureole came and was very well-seen by many serious observers of the transits (e.g., by Henry Chamberlain Russell with the 11½-inch refractor, stopped down to an aperture of 5 inches, of the Government Observatory at Sydney, New South Wales in 1874, and by Samuel Pierpont Langley with the 13-inch refractor at Allegheny Observatory in 1882 (Russell, 1892; Langley, 1883). (Figs. 8 and 9.)

These historical visual observations of the arc have long been correctly interpreted as being produced by refraction of sunlight by the outer layers of a dense atmosphere of Venus, with rays passing closer to the planet's center being more deviated than those passing farther out.

The next phase of studies of the aureole began at the June 8, 2004, transit, when it first became possible to perform photometry using electronic imaging devices to allow quantitative analysis of the phenomenon (Pasachoff, Schneider, and Widemann, 2011; Tanga, Widemann, Sicardy, et al., 2012). The 2004 results, in turn, led to extensive planning and implementation of the Venus Twilight Experiment, an ambitious global effort to make coronograph (cytherograph?) observations of the aureole during the transit of June 5-6, 2012, as part of the Transit of Venus coordinated campaign. The goal of this project, headed by Thomas Widemann of the Paris Observatory and Paolo Tanga of the Cote d'Azure Observatory in Nice, was to carry out a detailed investigation of the dynamics and composition of the mesosphere of Venus as seen by Earth-based observers and to obtain precious information about how the atmosphere of a non-habitable world observed as an exoplanet would differ from that of a habitable planet like Earth (Tanga, 2012).

The Mesosphere of Venus

Venus's mesosphere extends from the top of the upper cloud layer (approx. 60 km) to the upper thermosphere (approx. 120 km). Prior to the 2012 transit, spacecraft monitoring of thermal profiles and winds in the mesosphere had already revealed important time variability, driven by processes largely unknown.

Since the aureole is produced by the refraction of solar rays, and the solar rays passing closer to the planet's center are more deviated by refraction than those passing farther out, the image of a given solar surface element is flattened perpendicularly to Venus's limb by this differential deviation. It can be shown that the deviation due to refraction and the luminosity of the aureole are related to the local density scale height and the altitude of the refraction layer. Since the aureole brightness is the quantity that can be measured during the transit, an appropriate model allows determination of both parameters. This model was first applied to data collected during the 2004 event (Tanga et al., 2012). In general, different portions of the arc can yield different values of these parameters, thus providing a useful insight into the physical variations of the Venus atmosphere as a function of latitude.

Fig. 12. Percival Lowell's 6-inch Clark refractor about to be used for its first-ever transit of Venus, with the Pluto Dome in the background. Photograph by William Sheehan.

The Venus Twilight Experiment

The 2004 observations of the aureole, beyond confirming the presence of the aureole as it had been reported in historical records of similar events, were seminal in providing essential information about details of the phenomenon. They also hinted that the variability of the aureole as seen over the 5 transits since the 18th century could be related to the variability recently discovered in the mesosphere of the planet.

In 2004, no specific observing campaign was prepared in advance and the observations were not optimized for analyzing the signal of the aureole. In particular, the observations did not allow a reliable multi-wavelength spectrum of the aureole to constrain the role of Rayleigh or Mie scattering (a number of recent models showed that, depending on details of the scattering, the resulting signal could have a widely different wavelength dependency; see Ehrenreich et al., 2011).

The Venus Twilight Experiment was organized to provide better results during the 2012 transit by taking into account the measured brightness of the aureole and the need for multi-band observations as suggested by the modeling. The instrumentation was inspired by observations made with an amateur coronograph, using a 9-inch refractor, designed by A. and S. Rondi, and successfully deployed at the 2004 transit (Pasachoff, Schneider, and Widemann, 2011, and Tanga, Widemann et al., 2012). A number of identical coronographs with different filters were deployed at sites around the world. When I visited Paolo Tanga in Nice, France, in February 2012, we discussed a number of options for our observing site, including Hawaii, Mt. Wilson, and Lowell Observatory. Jay Pasachoff, Glenn Schneider and a number of their colleagues were already planning to set up one coronograph at Haleakala, Hawaii, so that left Mt. Wilson, which was generally thought to have the best daytime seeing, versus Lowell Observatory. (Both sites were only able to see ingress, because, unfortunately,

Fig. 13. Paolo Tanga (left) and William Sheehan relax for a moment shortly before first contact. Photograph by Klaus Brasch.

the Sun set before Venus exited the Sun.) It was not an easy decision, but Paolo and I finally settled on Lowell, partly for logistical reasons — I was going to be there already and had friends with equipment that would be suitable for our purpose — but also partly for sentimental reasons, given Lowell's historical importance in the study of the planets (it proved to be a good decision; though we did not have outstanding seeing at Lowell, conditions at Mt. Wilson would prove even worse on the day of the transit).

A complete list of the sites, with observers and filters used (B = blue, V = visual, the area of the eye's maximum visual sensitivity which is in the green, R=red, I=infrared), are as follows:

- Mees Solar Observatory, Haleakala, Hawaii
  J. Pasachoff, B. Babcock, Muzhou Lu, B (450 nm)
- Mobile Station, Hokkaido, Japan
  N. Thouvenin, M. Imai, T. Fukuhara, V (535 nm)
- Moondara Observatory, Mont Isa, Queensland, Australia
  F. Braga-Ribas, L. Fulham, (760 nm)
- Tien Shan Observatory, Kazakhastan,
  F. Colas, F. Vachier, B
- Lowell Observatory, Flagstaff, Arizona
  W. Sheehan, V (visual)
- Lowell Observatory, Flagstaff, Arizona
  P. Tanga, V (CCD)
- Taiohae, Nuku Hiva, Marquesas Islands
  C. Veillet, R (607 nm)
- Udaipur Observatory, India
  P. Machado, A. Ambastha, R

As evident from the above, Lowell was the only Venus Twilight Experiment site where two coronographs would be employed. Paolo would use one with a 535 nm filter to obtain CCD images, and I would use another with the same filter to make visual observations.

The Expedition Gets Underway

While Paolo was testing and preparing the coronographs in Nice, I flew from Minnesota to Arizona to prepare the groundwork there. There were a number of vivid touches that added to the drama. Lowell Observatory which was founded by Percival Lowell in 1894 for the study of the Solar System and which boasts a high altitude of over 7,000 feet, was in many ways the perfect place in which to carry out an investigation of the atmosphere of Venus — ironically, a transit had never been witnessed from Lowell (the 2004 transit was not visible from the southwestern or western United States, while the previous transit, in 1882, occurred the year Flagstaff was founded). Also, despite climate-change deniers, it was a summer of searing heat; much of the United States lay under a heat advisory, all-time records were routinely being broken during the month of June and when I left for Arizona to observe the atmosphere of Earth's sister-planet which has become synonymous with the runaway Greenhouse Effect, much of the western U.S. was burning. In fact, flying in to Phoenix a few days before the annular eclipse which I was headed into Utah to observe with friends two weeks before the transit, I saw plumes of smoke from the Crown King Fire. The smoke gave the sky a translucent milky quality as far north as Flagstaff. An even larger fire broke out in New Mexico before the eclipse, and made for some surreal images of the annular ring of the Sun burning through billowing smoke.

Visual Observations of the Aureole at Lowell Observatory

Paolo arrived with the coronographs on Saturday and the transit was the following Tuesday. With Klaus Brasch, another member of our team, we assembled them in the Slipher apartment in the Administration Building, which had been built in 1916 on Mars Hill. (Fig. 10.) (It was in this apartment, by the way, that Clyde Tombaugh was living in February 1930, when he discovered Pluto using the blink comparator in a room below, so we certainly had a great ambience.) We were very anxious about the weather. Though there were clouds in the forecast for Monday, they were supposed to clear out by Tuesday; but the winds on Mars Hill can be very high — even gale-like — at this time of the year, and high winds were predicted for transit-day. We considered a back-up option of observing from Williams. However, we had all the logistical supports, including Klaus's AstroPhysics 400, which supported Paolo's coronograph, and Bill Burke's Losmandy G-11 that would support the one I was to use, as well as electricity and other amenities (including a tremendous and growing amount of interest) on Mars Hill. The evening before the transit, we set up all the instruments on the oyster-shells near Bill Putnam's residence, near the Pluto dome where they would be far from the crowds. (Fig. 11.) (In fact, the crowds materialized; paid admissions to Mars Hill on the transit day was 1,000, the most that had ever attended a daytime event, which rather surprised us; clearly we did not lack public interest!) That night the mounts remained under tarps and the coronographs spent a final night with me in the Slipher apartment before their day of destiny.

On the morning of the transit (which did not occur until close to 3 p.m. local time), we had the coronographs in place, and also set up the beautiful 6-inch Clark refractor that Percival Lowell had taken with him to Japan and sent west with A.E. Douglass for the site-surveys that led to Mars Hill's being chosen for the site of the observatory. The instrument, though it dated back to the 1890s, had never been used to observe a transit of Venus. (Fig. 12.)

The sky was blessedly clear; there were not even the usual orographics over the San Francisco Peaks. The transparency was reasonably good despite a slight pallor lingering from the wildfires which were still raging in New Mexico; however, we could not claim that they were "coronal," as solar physicists refer to skies so clear and pure that the sky looks the same color blue, with no scattering, when you block out the Sun with your thumb held at the end of your outstretched arm. The winds, as expected, were high, but there was nothing to be done about that; our spirits were high, too. (Fig. 13.)

We fiddled with the telescopes all morning, and Klaus, Bill Burke, and I took turns monitoring the field and adjusting the occulting disk on the coronograph for the first glimpse of the aureole from a full hour before first contact. Paolo at the other side of the oyster bed, with a table to support his video monitor and pieces of apparatus, tweaked his equipment. We all were worried that we might not have the telescopes oriented the right way; Paolo, in fact, discovered that he had the telescope oriented 180 degrees in the wrong direction, but in plenty of time to make the correction.

Contact I was due at 15:05:58.4 Arizona time (MST), when the Sun's altitude was 52.9 degrees. The aureole first made its appearance on Paolo's video screen about 3 minutes before Contact I. (Fig. 14.) Klaus, Bill and I did not at first see it, but Paolo ran over and pointed it out. Overeager, I took my place at the eyepiece — and bumped the telescope, knocking the planet out of view. (This was a near-catastrophe, obviously; losing Venus just at the critical moment things were getting interesting, and I momentarily pondered adding my tale to

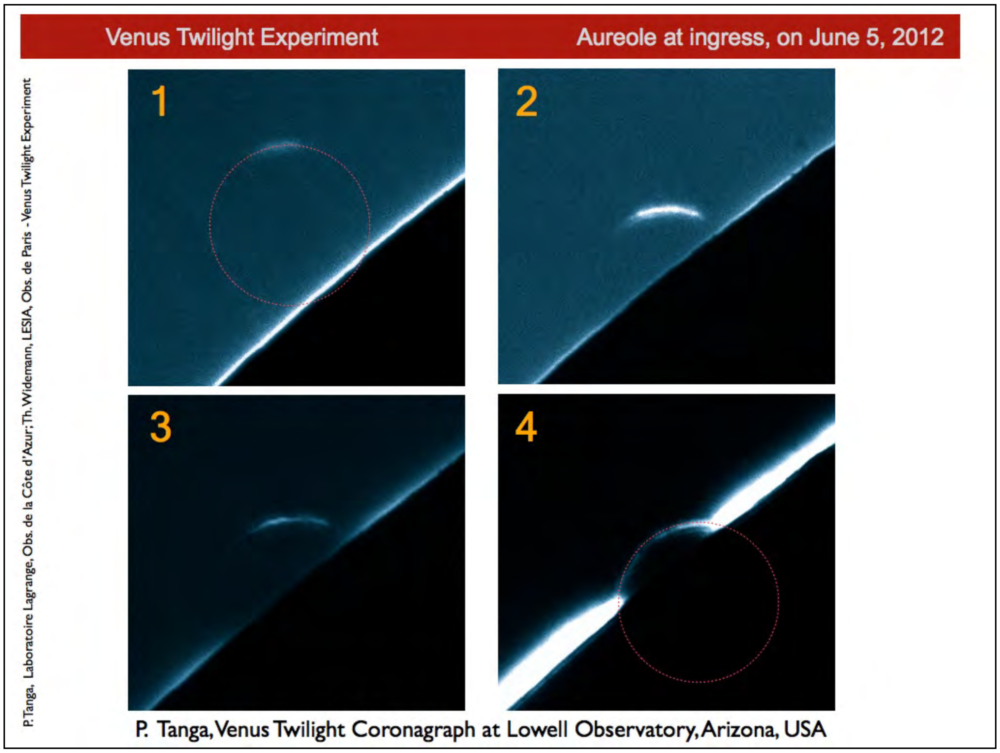


Fig. 14. The aureole as imaged by Paolo Tanga at Lowell Observatory. Photographs by Paolo Tanga.

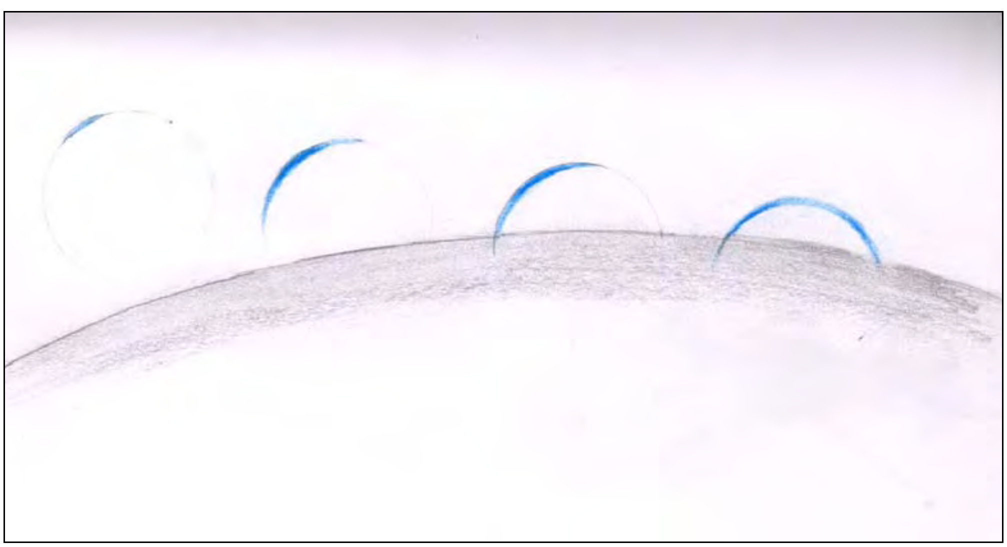


Fig. 15. The aureole as sketched by William Sheehan at Lowell Observatory.

those of frustrated transit of Venus observers of the past, such as the ill-fated LeGentil!)

Fortunately, Klaus remained calm, and — reciting repeatedly to himself the mantra, "Klaus, don't panic" — managed to recapture Venus and set the coronograph's central obstruction over the Sun. He had nerves of steel, and his feat will in my mind rank with that of Neil Armstrong clearing a field of boulders and setting the Eagle down by manual controls in the Sea of Tranquillity just as he was about to run out of fuel.

There were no more mishaps. I now noted with astonishment the small polar spot, shining brilliantly in the blackness of space just over a minute of arc from the solar limb. As I continued to observe, it began to turn slightly peaked or crescentic, and gradually widened into a bright, asymmetric arc, in the manner shown in the drawings. (Fig. 15.)

The arc continued to remain visible and even brilliant—growing ever brighter and more asymmetric — right up to Contact II, which occurred at 15:23.26.4, when it seemed to swirl around and mix together with the black drop forming at the limb of the Sun and then disappeared. The aureole's maximum magnitude had to be at least -6. After Contact II, I switched from the coronograph to the off-axis 3-inch aperture on the Mylar filter on Bill Burke's C-11, and observed, fascinated, the well-developed thunderhead of a black drop as it elongated and faded and finally dissipated like a black cloud on a summer day. I could no longer make out the aureole, but there was a faint bright ring (due to contrast, or perhaps this corresponded to the outline of the real image of Venus into which light from the photosphere was bleeding to produce the apparently smaller image). This aureole is well-known from previous transits and remained visible for the duration. It was very evident in Percival Lowell's old refractor.

Venus then continued to carry on its majestic march across the Sun. All in all, it was a euphoric afternoon, and one we will never experience again. The Sun, with Venus still stuck to it like a determined beetle, descended into the ponderosa pines to the west of the Slipher building. I sat alone and in the gloaming in the upstairs porch for awhile and contemplated all that we had done, until at last my revery was interrupted by a request to trot down to the Steele Visitors' Center on the Lowell campus and sign a copy of my book (with John Westfall) *Transits of Venus;* the dedication was to the granddaughter of the woman who presented it to me, born that very day. I wished both grandmother and granddaughter the best, and hoped the granddaughter would live to see the next transit, in 105 ½ years.

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A.L.P.O. Solar Section

OBSERVER____

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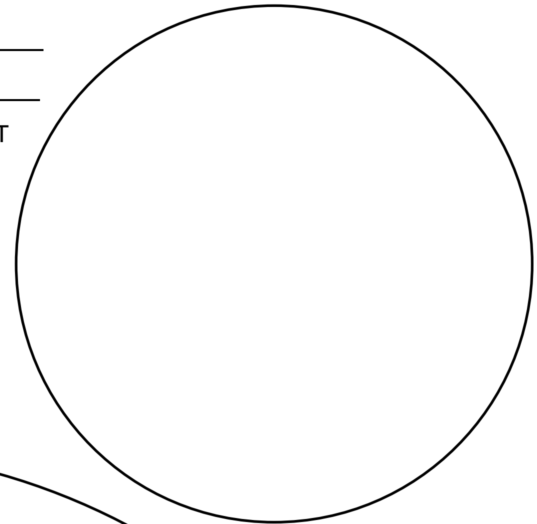

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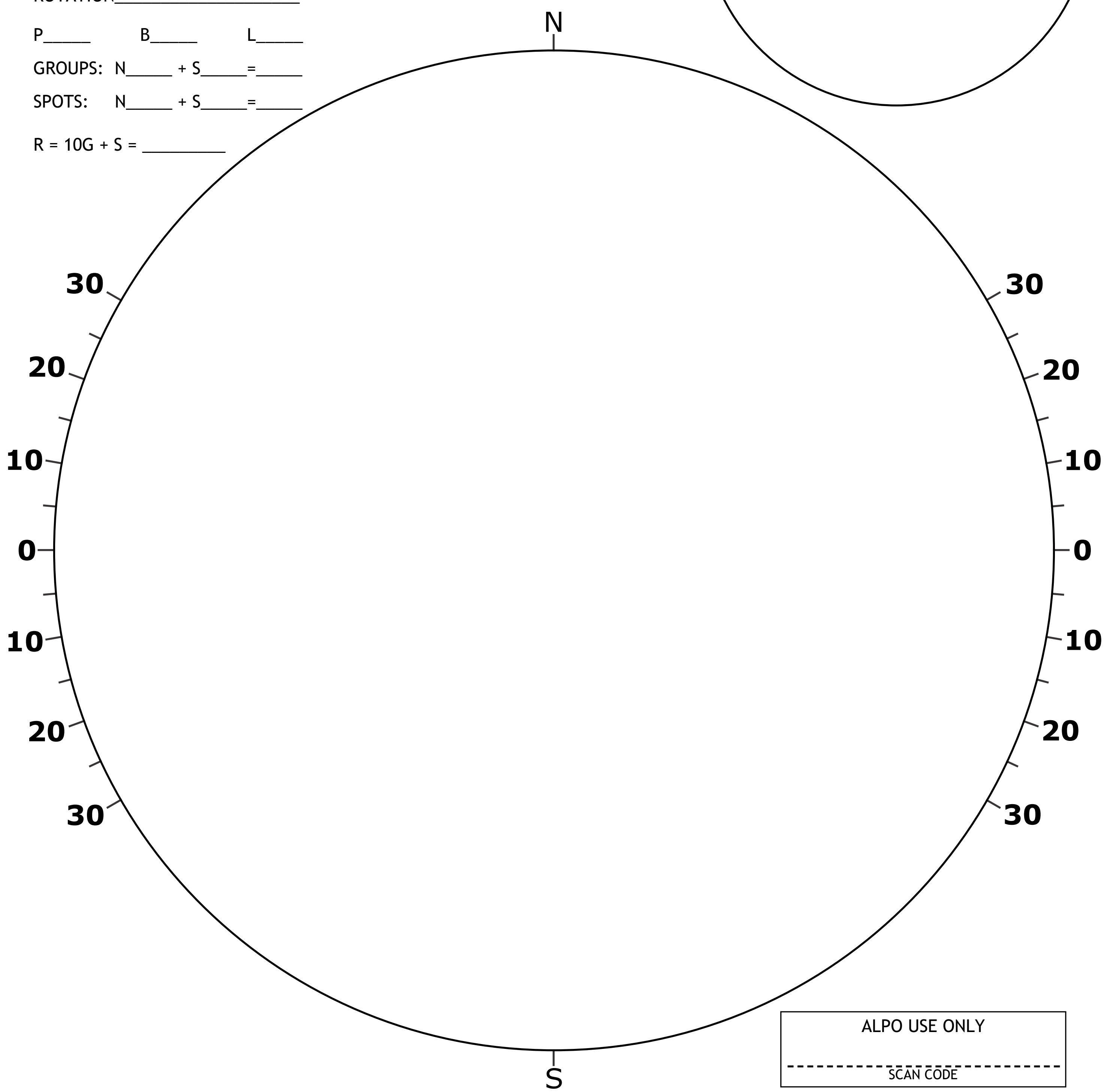

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Feature Story: A Study of the Southern Lunar Highlands

The Identification and Measurement of a Peak 27 km South of Kinau P, 66 km West of the Terminator at Colongitude 335.9°

By G. R. Hubbell,
Acting Assistant Coordinator,
Lunar Topographic Studies Program
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Abstract

The identification and analysis of a lunar mountain peak 66 ±3 km west of the terminator was performed from images obtained on 11 November 2010 from 23:13 to 23:21 UTC and a colongitude of 335.9°. Through the use of various software tools available to the amateur astronomer, the height of the identified peak located at approximately 17.2° E and 62.7° S was calculated. The minimum value for the height of the peak is 2,470 (+750, -100) meters above the floor of crater Kinau A.

Figure 1. AVIStack image of lunar southern region on 11 November 2010 at 23:17 UT.

Introduction

During the initial analysis of images of the Moon obtained on the evening of 11 November 2010, a series of images (88 frames) of the southern region were examined. These images were obtained between 23:13:33 UTC and 23:20:44 UTC, with the mean time of 23:16:54 UTC. Using AVIStack 2.0 (Ref. 1), a stacked image was obtained. (Figure 1).

The Lake of the Woods Observatory (MPC I24) where the imaging was performed is located in Locust Grove, VA, USA.

The equipment used in this observation was an Astronomy Technologies AT8RC Ritchey-Chretien telescope of 0.2-m (8-in.) aperture, f/8, with a measured focal length of 1,610 mm (63 in.). An ATIK 314e TEC CCD imager was used; this camera provides a field of view (FOV) of 13.8 arc-minutes x 10.3 arc-minutes (1,391 x 1,039 pixels). The plate scale was 0.6 arcsec/pixel.

The seeing was fair at 6/10, and the transparency was very good at 5/6. Future imaging with this configuration will add a 2-inch 2x Barlow lens to increase the effective FL to approximately 3,200 mm and increase the plate scale to a value of 0.3 arcsec/pixel.

Analysis

As can be seen in Figure 1, there are several peaks lit west of the terminator. This paper will concentrate on the peak

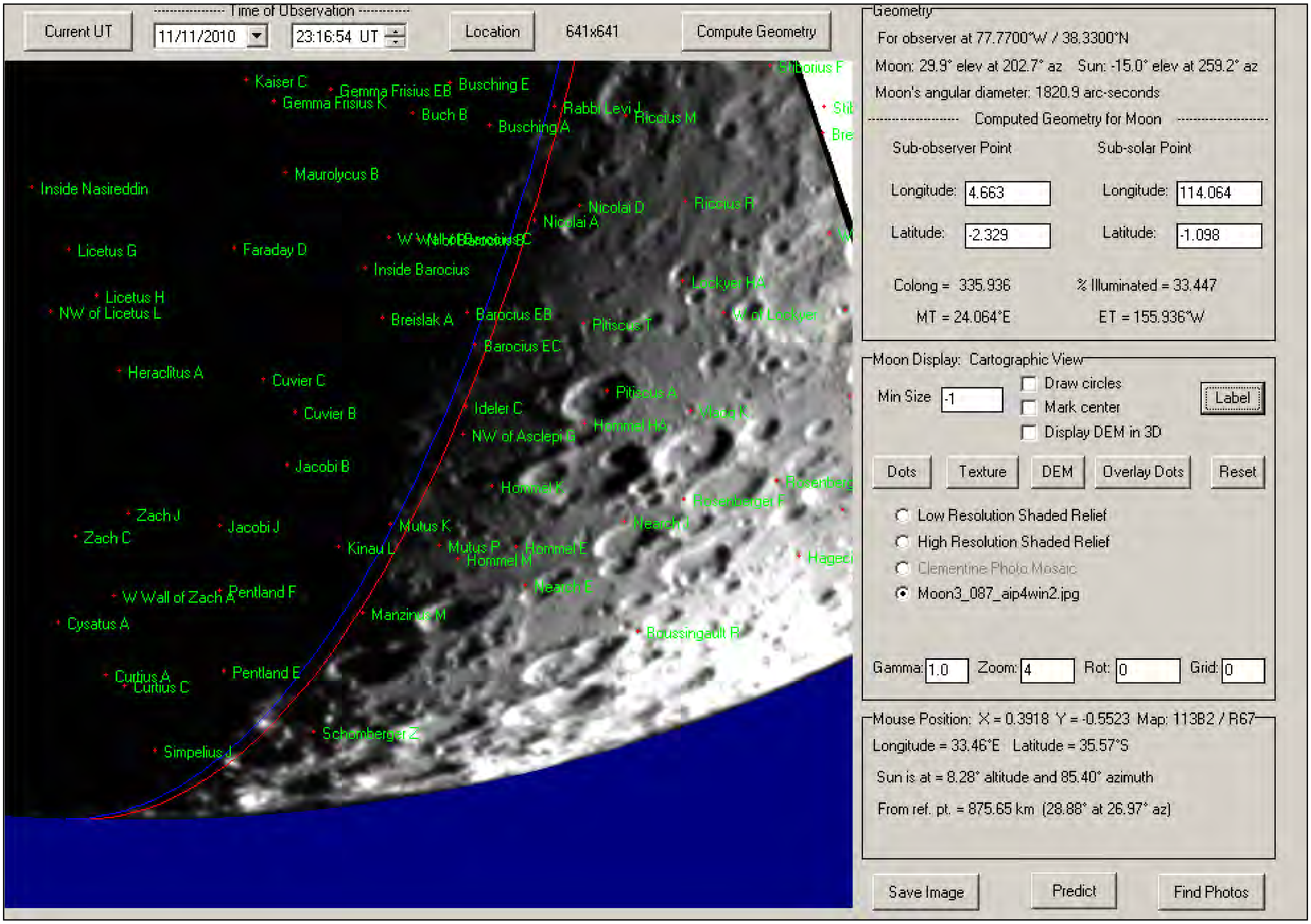

Figure 2.The Lunar Terminator Visualization Tool (LTVT) view of the image.

west of Mutus, a 190-km crater at 30° E, and 64° S. This image was resized and processed to bring out more details and loaded into the software application *Lunar Terminator Visualization Tool* (LTVT) (Ref. 3).

This excellent program allows you to use your images to texture map a spherical model of the Moon which positions the model (and the image) to the correct orientation (sub-solar and sub-observer points) to allow the correct geometry to be calculated at any given date and time. Once the image is calibrated to the model, the program provides precise measurements of lunar longitude and latitude, and also solar altitude and azimuth at the local coordinates. The program also allows you to rotate the spherical model to where the point-of-interest (POI) is normal zenith point, simulating an aerial photograph from directly above the POI. Figure 2 depicts the view from the Earth (sub-observer) and Figure 3 depicts the aerial photo view. This view is rendered as if one was directly above the feature looking straight down.

The screen depicted in Figure 3 was used to determine the location of the peak marked with the cyan "+" symbol to the west of Mutus. The terminator (±0.25°) is marked with the red and blue lines on the image.

Once the coordinates of the face of the identified peak were measured (17.2° E, and 62.7° S, in this case), a close look at the list of LAC Charts (Ref. 4) determined that LAC-127 Hommel was the correct one. As shown in Figure 4, a close look at the chart shows a large mountain with a crater on top (unidentified on the chart) with the face of the mountain located at 17.0° E, and 62.0° S. On the chart, this mountain was measured to be approximately 68 km west of the terminator at colongitude 335.9° using LTVT.

It is noteworthy that the LAC-127 Hommel chart depicts the mountain as a little further north and slightly west of the measured position. The terminator is depicted on the chart in Figure 4 (red and blue lines, ±0.25°) and the mean terminator was calculated as 360.0° - 335.9° = 24.1° E longitude.

Unfortunately the LAC chart does not depict the height of the peak, located approximately 27 km south of Kinau P, as shown in Figure 4. The LTVT program allows one to select a measurement mode to select a reference point at the end of the shadow, and then it projects a line to the sub-solar point in order to select a measurement point at the point of the illuminated peak to determine the height of the peak.

This would not work in this case, since the peak's shadow was immersed in the depths of darkness along with the rest of the local terrain west of the peak. A new method of measuring the height of peaks west of the terminator would need to be developed. The method used is based on the fact that for a sphere, the Sun's shadow height is tangent to the sphere at the colongitude. Therefore, any peak that shows west of the terminator would be at least as high as the shadow line tangent to the sphere (Figure 5). This is because the most accurate point to measure the shadow distance is where the sunlight first hits the mountain at the lowest possible elevation. The additional height of the mountain in sunlight could be 500 m to 750 m.

Additionally, the crater Kinau A is directly east of the peak in question. The rim of this crater on the eastern side is depicted as being 1,470 m above the mean diameter of the Moon. The terminator falls right on the eastern rim (as you can see if you look closely at Figure 3), so that would add another 1,470 m to the value measured in LTVT, which will be determined shortly. So the method to measure the peak is to mark the reference at the terminator and then measure the height difference at the tip of the peak. The result of these two

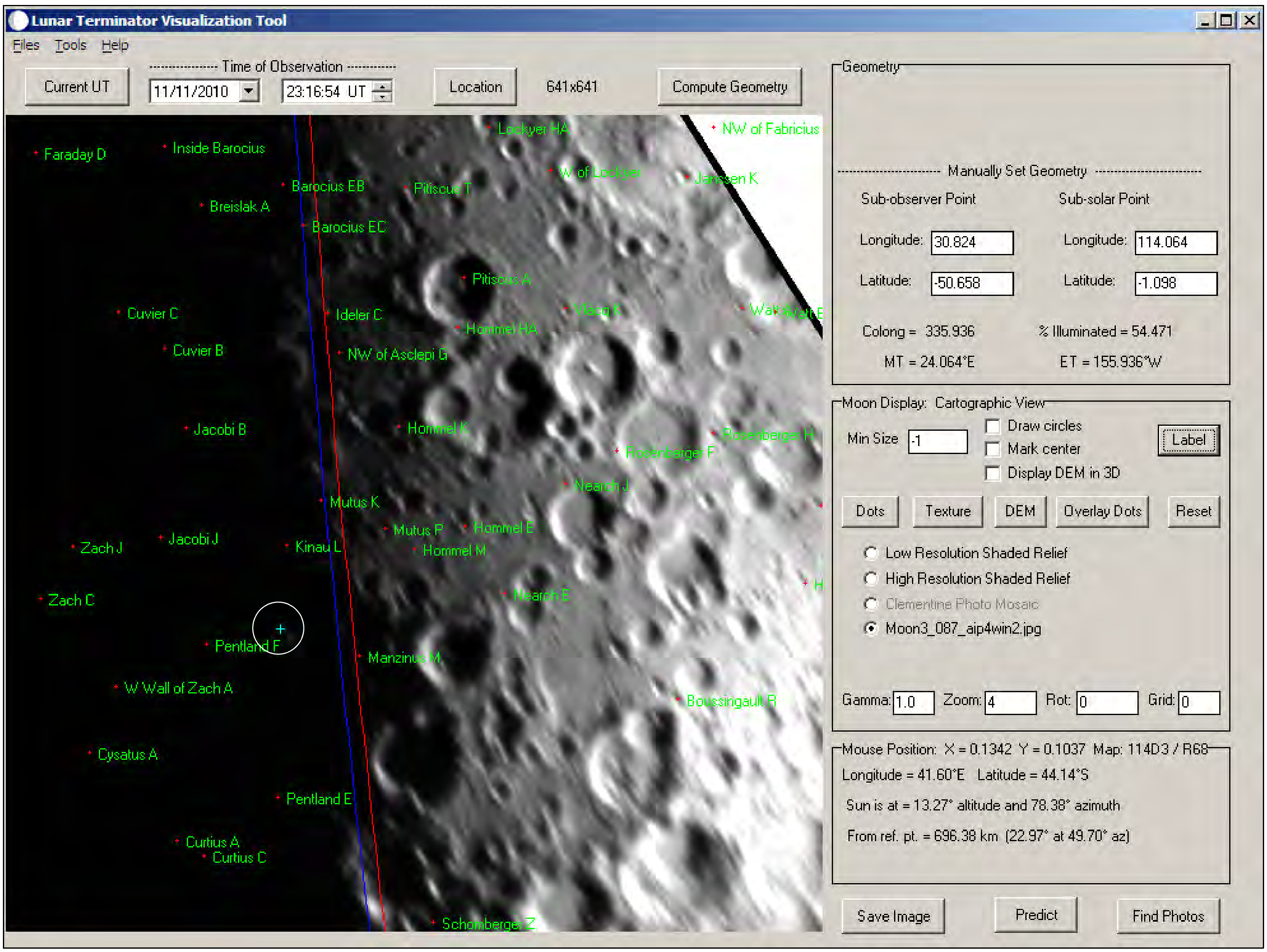

Figure 3. LTVT aerial view of lunar image. Peak is to the left of the lunar terminator and marked here with a circled cyan "+" symbol.

measurements (the minimum height of the peak and the distance from the terminator) is shown in Figure 6.

Using the Digital Elevation Model (DEM) in LTVT (LRO/LOLA Lunar Reconnaissance Orbiter Data), a measurement of the height between the floor of Kinau A and the measured location of the peak resulted in an elevation of 3,100 m (Kinau A floor 1,735.8 km, Mountain Peak 1,738.9 km) – very much in accordance with the measured value of 2,468 m +750 m / -100 m (Figure 7). The location of the peak was also measured to be at 17.2° E, and 62.7° S. on the DEM.

Conclusion

The results of the analysis have shown that the height of the identified peak at measured location 17.2° E, and 62.7 ° S to be at a minimum 2,468 meters +750 m / -100 m above the floor of Kinau A.

This was verified using the DEM in LTVT. The uncertainty in the height measurement is greatest to the + side due to the method utilized and could be as much as 750 m. The minimum height could be lower by up to 100 meters (-100 m), depending on how one places one's cursor and also on the resolution of the images obtained.

Additionally, the distance from the terminator at colongitude 335.9° is shown to be approximately 63 km. The distance from the terminator has an uncertainty of approximately 3.0 km, based on the resolution of the image plus any effect the foreshortening has on the measurement.

Finally, to properly measure this peak, one should take images during the first

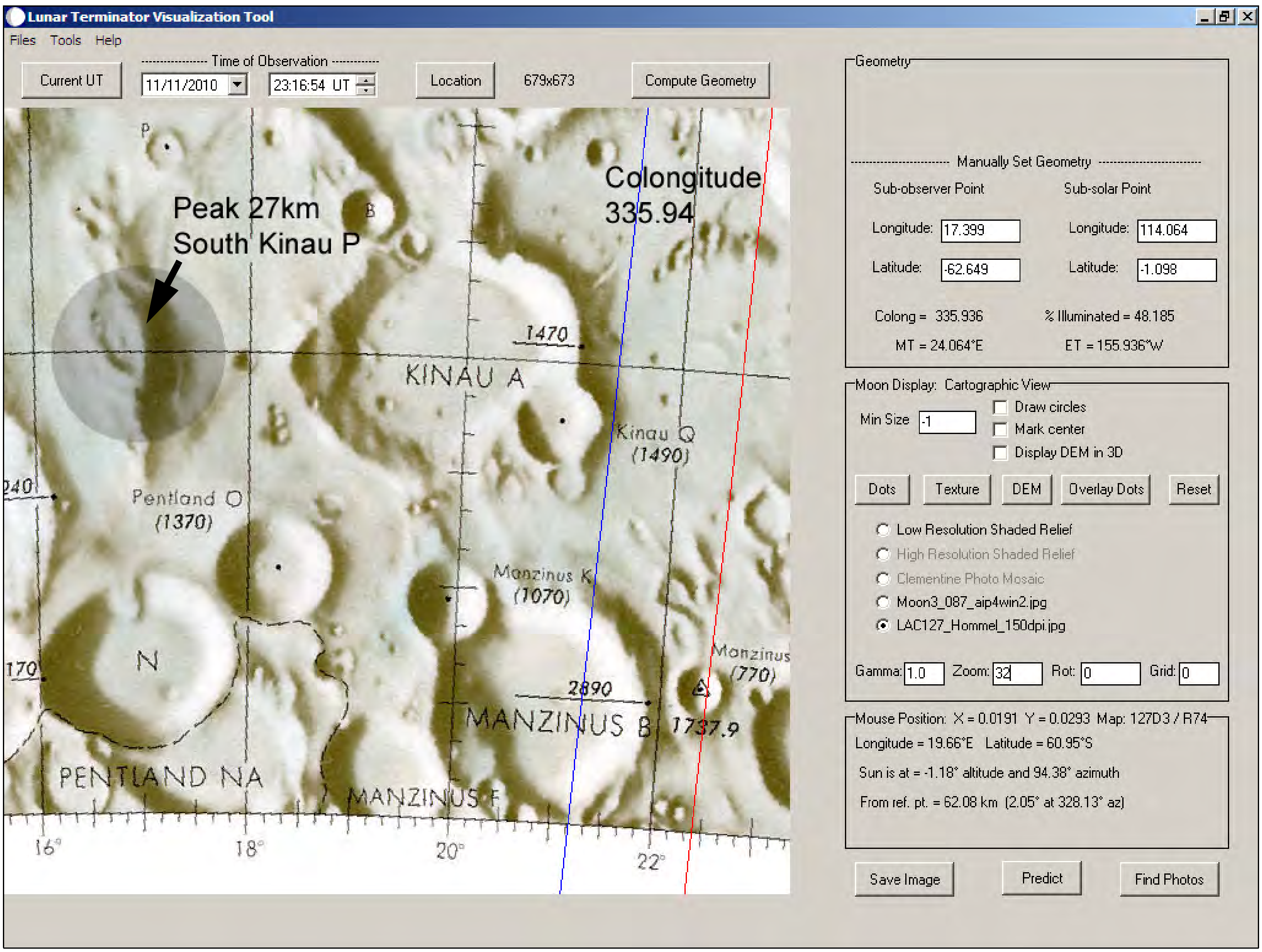

Figure 4.Mountain peak in shaded circle with arrow and identified on LAC-127 Hommel, 27 km south of Kinau P and 68 km west of the terminator.

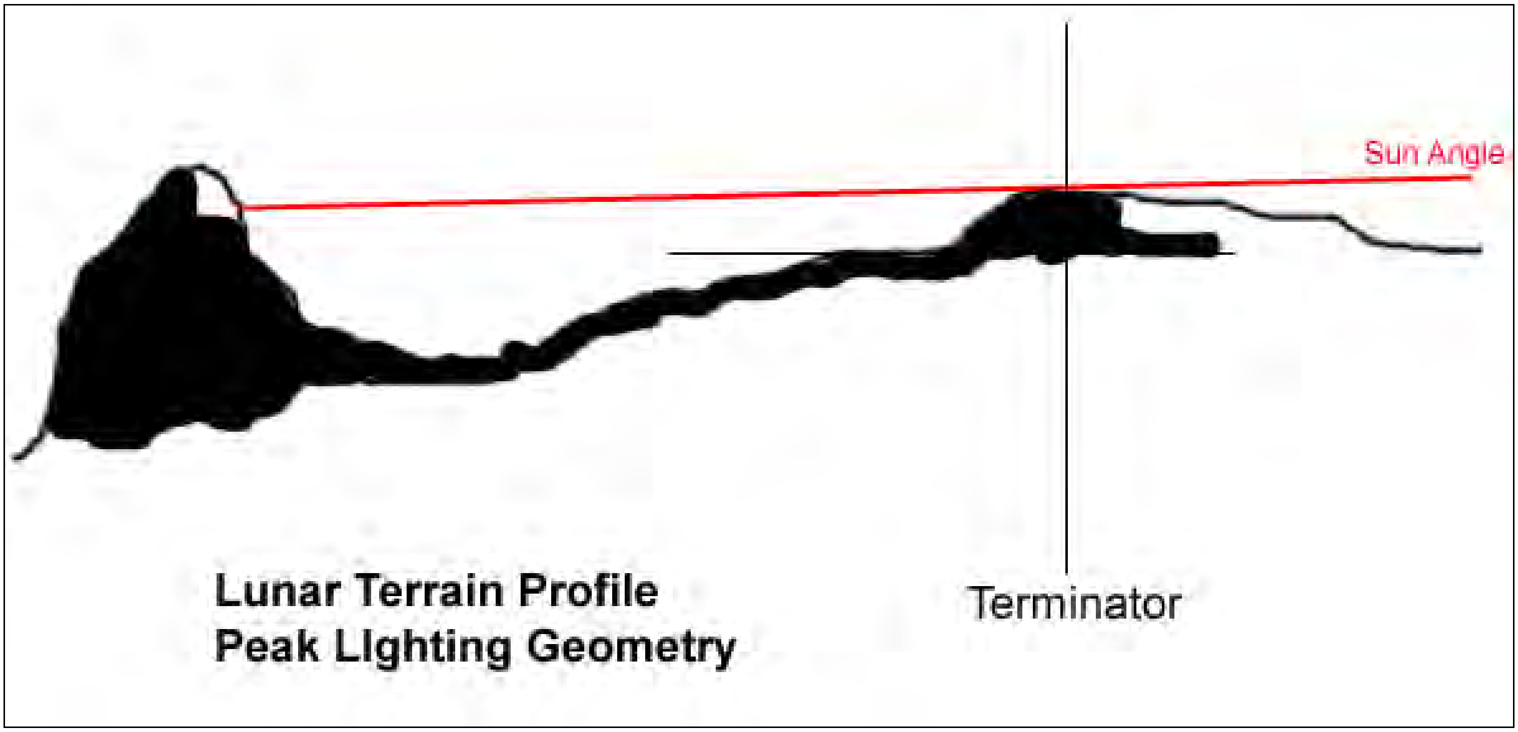

Figure 5. Geometry of lunar terrain profile.

appearance of the peak to determine the proper colongitude of the terminator and to properly account for the distance to the peak from the terminator. Only in that way will you get the true peak height value.

Using LTVT allows one to measure the selenographic data on images, but the further south one goes, the more uncertain one is as to the location of certain features depicted on Earth-based images of the lunar surface. In the case presented in this paper, it is feasible to measure features as far south as 62° south latitude on the lunar surface and identify features on the dark side of the Moon.

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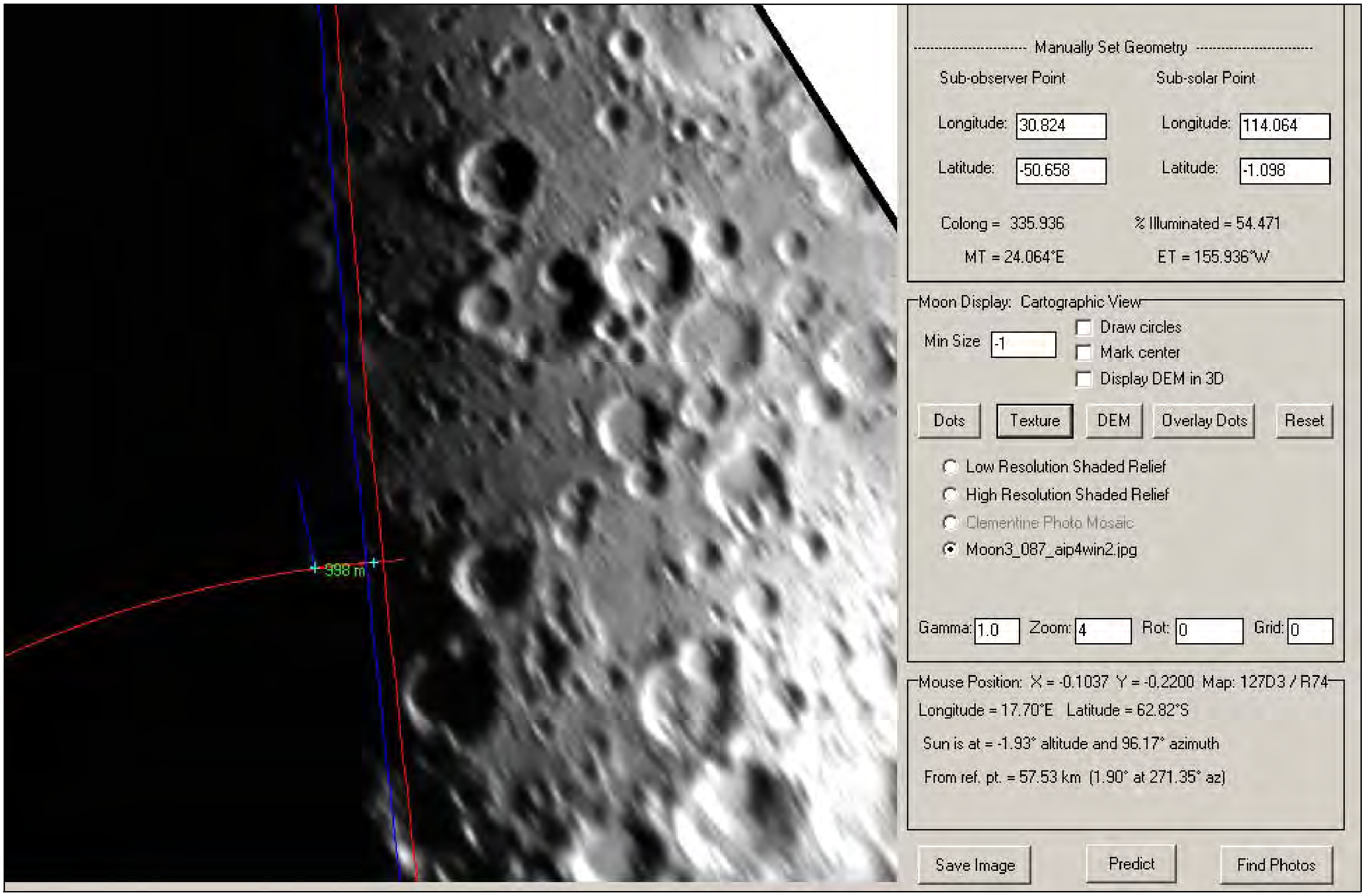

Figure 6. The LTVT measured distance from the terminator and height of the peak.

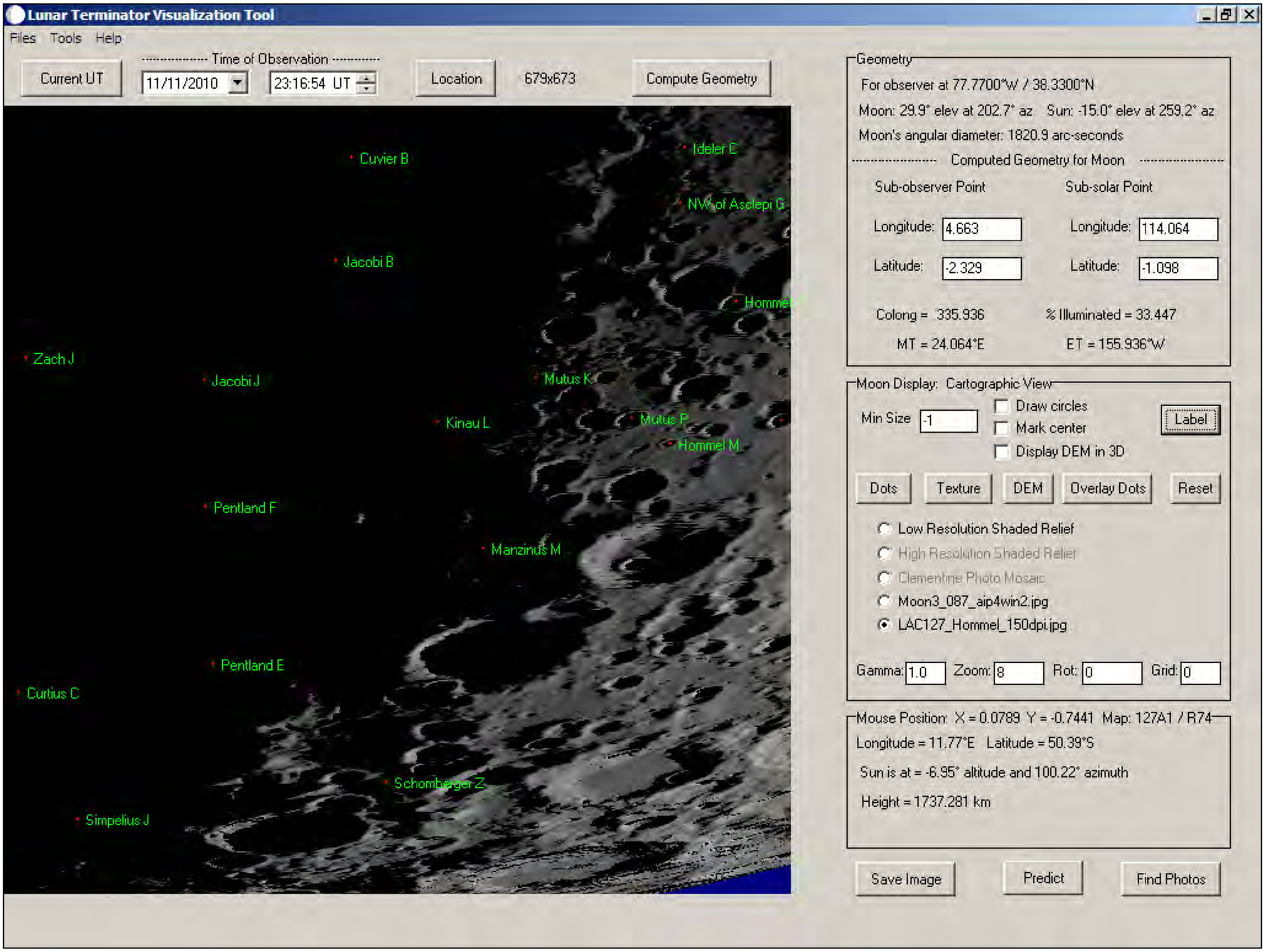

Figure 7.The DEM (LRO/LOLA) depiction of the mountain peak at the time of observation (center of image).

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- Assistant Coordinator (digital Journal web page); Jonathan D. Slaton, P. O. Box 496, Mansfield, MO. 65704
- Acting Assistant Coordinator (ALPO social media); Steve Siedentop, P. O. Box 496, Mansfield, MO. 65704

Youth Section

http://www.cometman.net/youth

- Coordinator; Timothy J. Robertson,195 Tierra Rejada Rd., #148, Simi Valley, CA 93065

****

Observing Sections

Solar Section

http://www.alpo-astronomy.org/solar

- Coordinator (including all submissions, photo, sketches, filtergrams); Kim Hay, 76 Colebrook Rd, RR #1,Yarker, ON, K0K 3N0 Canada
- Assistant Coordinator; Brad Timerson (e-mail contact only; see listing in *ALPO Staff E-mail Directory*
- Assistant Coordinator (New Observers); Jamey Jenkins, 308 West First Street, Homer, Illinois 61849
- Scientific Advisor; Richard Hill, Lunar and Planetary Laboratory, University of Arizona, Tucson, AZ 85721

Mercury Section

http://www.alpo-astronomy.org/Mercury

- Coordinator; Frank J. Melillo, 14 Glen-Hollow Dr., E-#16, Holtsville, NY 11742

Venus Section

http://www.alpo-astronomy.org/venus

- Coordinator; Julius L. Benton, Jr., Associates in Astronomy, P.O. Box 30545, Wilmington Island, Savannah, GA 31410

Mercury/Venus Transit Section

http://www.alpo-astronomy.org/transit

- Coordinator; John E. Westfall, 5061 Carbondale Way, Antioch, CA 94531

Lunar Section

Lunar Topographical Studies Program

http://moon.scopesandscapes.com/ALPO_Lunar_Program.htm

Smart-Impact Webpage

http://www.zone-vx.com/alpo-smartimpact.html

The Lunar Observer

http://moon.scopesandscapes.com/tlo.pdf

Lunar Selected Areas Program

http://moon.scopesandscapes.com/alpo-sap.html

Banded Craters Program

http://moon.scopesandscapes.com/alpo-bcp.htm

- Coordinator; Wayne Bailey, 17 Autumn Lane, Sewell, NJ 08080
- Assistant Coordinator; William Dembowski, 219 Old Bedford Pike, Windber, PA 15963
- Acting Assistant Coordinator; Jerry Hubbell, 406 Yorktown Blvd, Locust Grove, VA 22508

Lunar Meteoritic Impacts Search Program

http://www.alpo-astronomy.org/lunar/lunimpacts.htm

- Coordinator; Brian Cudnik, 11851 Leaf Oak Drive, Houston, TX 77065

ALPO Resources

People, publications, etc., to help our members

Lunar Transient Phenomena

http://www.alpo-astronomy.org/lunar/LTP.html; also http://www.LTPresearch.org

- Coordinator; Dr. Anthony Charles Cook, Institute of Mathematical and Physical Sciences, University of Aberystwyth, Penglais, Aberystwyth, Ceredigion. SY23 3BZ, United Kingdom
- Assistant Coordinator; David O. Darling, 416 West Wilson St., Sun Prairie, WI 53590-2114

Mars Section

http://www.alpo-astronomy.org/Mars

- Coordinator; Roger J. Venable, MD, 3405 Woodstone Pl., Augusta, GA 30909-1844
- Assistant Coordinator (CCD/Video imaging and specific correspondence with CCD/Video imaging); Donald C. Parker, 12911 Lerida Street, Coral Gables, FL 33156
- Assistant Coordinator (photometry and polarimetry); Richard W. Schmude, Jr., 109 Tyus St., Barnesville, GA 30204
- Assistant Coordinator; Jim Melka, 14176 Trailtop Dr., Chesterfield, MO 63017

Minor Planets Section

http://www.alpo-astronomy.org/minor

- Coordinator; Frederick Pilcher, 4438 Organ Mesa Loop, Las Cruces, NM 88011
- Assistant Coordinator; Lawrence S. Garrett, 206 River Road, Fairfax, VT 05454
- Scientific Advisor: Alan W. Harris, Space Science Institute, Boulder, CO
- Scientific Advisor; Dr. Petr Pravec, Ondrejov Observatory, Czech Republic
- Asteroid Photometry Coordinator; Brian D. Warner, Palmer Divide Observatory, 17995 Bakers Farm Rd., Colorado Springs, CO 80908

Jupiter Section

http://www.alpo-astronomy.org/jupiter

- Acting Coordinator; Ed Grafton, 15411 Greenleaf Lane, Houston, TX 77062
- Assistant Coordinator, Apparition Reports; Richard W. Schmude Jr., 109 Tyus St., Barnesville, GA 30204
- Assistant Coordinator/Program Coordinator, Galilean Satellites Eclipses; John E. Westfall, 5061 Carbondale Way, Antioch, CA 94531
- Assistant Coordinator, Transit Timings; John McAnally, 2124 Wooded Acres, Waco, TX 76710
- Assistant Coordinator, Newsletter; Craig MacDougal, 821 Settlers Road, Tampa, FL 33613

Saturn Section

http://www.alpo-astronomy.org/saturn

- Coordinator; Julius L. Benton, Jr., Associates in Astronomy, P.O. Box 30545, Wilmington Island, Savannah, GA 31410

Remote Planets Section

http://www.alpo-astronomy.org/remote

- Coordinator; Richard W. Schmude, Jr., 109 Tyus St., Barnesville, GA 30204

Comets Section

http://www.alpo-astronomy.org/comet

- Acting Coordinator; Carl Hergenrother, 4101 North Sunnywood Place, Tuscon, AZ 85749
- Assistant Coordinator; Gary Kronk, St.Louis, MO

Meteors Section

http://www.alpo-astronomy.org/meteor

- Coordinator; Robert D. Lunsford, 1828 Cobblecreek St., Chula Vista, CA 91913-3917
- Assistant Coordinator; Robin Gray, P.O. Box 547, Winnemuca, NV 89446

Meteorites Section

http://www.alpo-astronomy.org/meteorite

- Coordinator; Dolores Hill, Lunar and Planetary Laboratory, University of Arizona, Tucson, AZ 85721

Eclipse Section

http://www.alpo-astronomy.org/eclipse

- Coordinator; Mike D. Reynolds, Dean of Liberal Arts & Sciences, Florida State College at Jacksonville, 3939 Roosevelt Blvd, F-112, Jacksonville, FL 32205

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ALPO Publications

The Monograph Series

http://www.alpo-astronomy.org/publications/Monographs page.html

ALPO monographs are publications that we believe will appeal to our members, but which are too lengthy for publication in *The Strolling Astronomer*. All are available online as a pdf files. NONE are available any longer in hard copy format.

There is NO CHARGE for any of the ALPO monographs.

- **Monograph No. 1.** *Proceedings of the 43rd Convention of the Association of Lunar and Planetary Observers. Las Cruces, New Mexico, August 4-7, 1993. 77* pages. File size approx. 5.2 mb.
- **Monograph No. 2**. *Proceedings of the 44th Convention of the Association of Lunar and Planetary Observers. Greenville, South Carolina, June 15-18, 1994. 52* pages. File size approx. 6.0 mb.
- **Monograph No. 3**. *H.P. Wilkins 300-inch Moon Map.* 3rd Edition (1951). Available as one comprehensive file (approx. 48 megabytes) or five section files (Part 1, 11.6 megabytes; Part 2, 11.7 megabytes; Part 3, 10.2 megabytes; Part 4, 7.8 megabytes; Part 5, 6.5 mb)
- **Monograph No. 4.** *Proceedings of the 45th Convention of the Association of Lunar and Planetary Observers. Wichita, Kansas, August 1-5, 1995.127* pages. Hard copy $17 for the United States, Canada, and Mexico; $26 elsewhere. File size approx. 2.6 mb.
- **Monograph No. *5.*** *Astronomical and Physical Observations of the Axis of Rotation and the Topography of the Planet Mars. First Memoir; 1877-1878.* By Giovanni Virginio Schiaparelli, translated by William Sheehan. 59 pages. Hard copy $10 for the United States, Canada, and Mexico; $15 elsewhere. File size approx. 2.6 mb.
- **Monograph No. *6.*** *Proceedings of the 47th Convention of the Association of Lunar and Planetary Observers, Tucson, Arizona, October 19-21, 1996.20* pages. Hard copy $3 for the United States, Canada, and Mexico; $4 elsewhere.File size approx. 2.6 mb.
- **Monograph No. 7.** *Proceedings of the 48th Convention of the Association of*

ALPO Resources

People, publications, etc., to help our members

Lunar and Planetary Observers. Las Cruces, New Mexico, June 25-29, 1997.76 pages. Hard copy $12 for the United States, Canada, and Mexico; $16 elsewhere.File size approx. 2.6 mb.

- **Monograph No. 8**. *Proceedings of the 49th Convention of the Association of Lunar and Planetary Observers. Atlanta, Georgia, July 9-11,1998.122* pages. Hard copy $17 for the United States, Canada, and Mexico; $26 elsewhere.File size approx. 2.6 mb.

- **Monograph Number 9**. *Does Anything Ever Happen on the Moon?* By Walter H. Haas. Reprint of 1942 article. 54 pages.Hard copy $6 for the United States, Canada, and Mexico; $8 elsewhere.File size approx. 2.6 mb.

- **Monograph Number 10.** *Observing and Understanding Uranus, Neptune and Pluto*. By Richard W. Schmude, Jr. 31 pages. File size approx. 2.6 mb.

- **Monograph No. 11**. *The Charte des Gebirge des Mondes* (Chart of the Mountains of the Moon) by J. F. Julius Schmidt, this monograph edited by John Westfall. Nine files including an accompanying guidebook in German. Note files sizes:
  Schmidt0001.pdf, approx. 20.1 mb;
  Schmidt0204.pdf, approx. 32.6 mb;
  Schmidt0507.pdf, approx. 32.1 mb;
  Schmidt0810.pdf, approx. 31.1 mb;
  Schmidt1113.pdf, approx. 22.7 mb;
  Schmidt1416.pdf, approx. 28.2 mb;
  Schmidt1719.pdf, approx. 22.2 mb;
  Schmidt2022.pdf, approx. 21.1 mb;
  Schmidt2325.pdf, approx. 22.9 mb;
  SchmidtGuide.pdf,approx. 10.2 mb

ALPO Observing Section Publications

Order the following directly from the appropriate ALPO section recorders; use the address in the listings pages which appeared earlier in this booklet unless another address is given.

- **Solar:** *Guidelines for the Observation of White Light Solar Phenomena*, *Guidelines for the Observing Monochromatic Solar Phenomena* plus various drawing and report forms available for free as pdf file downloads at http://www.alpo-astronomy.org/solarblog.

- **Lunar & Planetary Training Section:** *The Novice Observers Handbook* $15. An introductory text to the training program. Includes directions for recording lunar and planetary observations, useful exercises for determining observational parameters, and observing forms. Available as pdf

ALPO Staff E-mail Directory

Online readers please note: Items in blue text in the ALPO Staff E-mail Directory above are links to e-mail addresses. Left-click your mouse on the names in blue text to open your own e-mail program with a blank e-mail preaddressed to the person you chose. Your Internet connection MUST be ON for this feature to work.

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ALPO Resources

People, publications, etc., to help our members

file via e-mail or send check or money order payable to Timothy J. Robertson, 195 Tierra Rejada Rd., #148, Simi Valley, CA 93065; e-mail *cometman@cometman.net*.

- **Lunar (Bailey):** (1) *The ALPO Lunar Selected Areas Program (*$17.50). Includes full set of observing forms for the assigned or chosen lunar area or feature, along with a copy of the *Lunar Selected Areas Program Manual.* (2) *observing forms,* free at *http://moon.scopesandscapes.com/alpo-sap.html*, or $10 for a packet of forms by regular mail. Specify *Lunar Forms*. NOTE: Observers who wish to make copies of the observing forms may instead send a SASE for a copy of forms available for each program. Authorization to duplicate forms is given only for the purpose of recording and submitting observations to the ALPO lunar SAP section. Observers should make copies using high-quality paper.

- **Lunar**: *The Lunar Observer*, official newsletter of the ALPO Lunar Section, published monthly. Free at *http://moon.scopesandscapes.com/tlo.pdf* or $1.25 per hard copy: send SASE with payment (check or money order) to: Wayne Bailey, 17 Autumn Lane, Sewell, NJ 08080.

- **Lunar (Jamieson):** *Lunar Observer's Tool Kit*, price $50, is a computer program designed to aid lunar observers at all levels to plan, make, and record their observations. This popular program was first written in 1985 for the Commodore 64 and ported to DOS around 1990. Those familiar with the old DOS version will find most of the same tools in this new Windows version, plus many new ones. A complete list of these tools includes Dome Table View and Maintenance, Dome Observation Scheduling, Archiving Your Dome Observations, Lunar Feature Table View and Maintenance, Schedule General Lunar Observations, Lunar Heights and Depths, Solar Altitude and Azimuth, Lunar Ephemeris, Lunar Longitude and Latitude to Xi and Eta, Lunar Xi and Eta to Longitude and Latitude, Lunar Atlas Referencing, JALPO and Selenology Bibliography, Minimum System Requirements, Lunar and Planetary Links, and Lunar Observer's ToolKit Help and Library. Some of the program's options include predicting when a lunar feature will be illuminated in a certain way, what features from a collection of features will be under a given range of illumination, physical ephemeris information, mountain height computation, coordinate conversion, and browsing of the software's included database of over 6,000 lunar features. Contact *harry@persoftware.com*

- **Venus (Benton):** Introductory information for observing Venus, including observing forms, can be downloaded for free as pdf files at *http://www.alpo-astronomy.org/venus*. The *ALPO Venus Handbook* with observing forms included is available as the *ALPO Venus Kit* for $17.50 U.S., and may be obtained by sending a check or money order made payable to "Julius L. Benton" for delivery in approximately 7 to 10 days for U.S. mailings. The *ALPO Venus Handbook* may also be obtained for $10 as a pdf file by contacting the ALPO Venus Section. All foreign orders should include $5 additional for postage and handling; p/h is included in price for domestic orders. NOTE: Observers who wish to make copies of the observing forms may instead send a SASE for a copy of forms available for each program. Authorization to duplicate forms is given only for the purpose of recording and submitting observations to the ALPO Venus section. Observers should make copies using high-quality paper.

- **Mars:** *(1) ALPO Mars Observers Handbook,* send check or money order for $15 per book (postage and handling included) to Astronomical League Sales, 9201 Ward Parkway, Suite 100, Kansas City, MO 64114; phone 816-DEEP-SKY (816-333-7759); e-mail *leaguesales@astroleague.org*. *(2) Observing Forms;* send SASE to obtain one form for you to copy; otherwise send $3.60 to obtain 25 copies (send and make checks payable to "Deborah Hines", see address under "Mars Section").

- **Minor Planets (Derald D. Nye):** *The Minor Planet Bulletin*. Published quarterly; free at *http://www.minorplanetobserver.com/mpb/default.htm*. Paper copies available only to libraries and special institutions at $24 per year via regular mail in the U.S., Mexico and Canada, and $34 per year elsewhere (airmail only). Send check or money order payable to "Minor Planet Bulletin", c/o Derald D. Nye, 10385 East Observatory Dr., Corona de Tucson, AZ 8564I-2309.

- **Jupiter:** *(1) Jupiter Observer's Handbook*, $15 from the Astronomical League Sales, 9201 Ward Parkway, Suite 100, Kansas City, MO 64114; phone 816-DEEP-SKY (816-333-7759); e-mail *leaguesales@astroleague.org*. (2) *Jupite*r, the ALPO section newsletter, available online only via the ALPO website at *http://mysite.verizon.net/macdouc/alpo/jovenews.htm;* (3) *ALPO_Jupiter*, the ALPO Jupiter Section e-mail network; to join, send a blank e-mail to *ALPO_Jupiter-subscribe@yahoogroups.com* (4) *Timing the Eclipses of Jupiter's Galilean Satellites* free at *http://www.alpo-astronomy.org/jupiter/GaliInstr.pdf*, report form online at *http://www.alpo-astronomy.org/jupiter/GaliForm.pdf*; send SASE to John Westfall for observing kit and report form via regular mail. (5) *Jupiter Observer's Startup Ki*t, $3 from Richard Schmude, Jupiter Section Coordinator.

- **Saturn (Benton):** Introductory information for observing Saturn, including observing forms and ephemerides, can be downloaded for free as pdf files at *http://www.alpo-astronomy.org/saturn*; or if printed material is preferred, the *ALPO Saturn Kit* (introductory brochure and a set of observing forms) is available for $10 U.S. by sending a check or money order made payable to "Julius L. Benton" for delivery in approximately 7 to 10 days for U.S. mailings. The former *ALPO Saturn Handbook* was replaced in 2006 by *Saturn and How to Observe It* (by J. Benton); it can be obtained from book sellers such as *Amazon.com*. NOTE: Observers who wish to make copies of the observing forms may instead send a SASE for a copy of forms available for each program. Authorization to duplicate forms is given only for the purpose of recording and submitting observations to the ALPO Saturn

ALPO Resources

People, publications, etc., to help our members

Section.

- **Meteors:** (1) *The ALPO Guide to Watching Meteors* (pamphlet). $4 per copy (includes postage & handling); send check or money order to Astronomical League Sales, 9201 Ward Parkway, Suite 100, Kansas City, MO 64114; phone 816-DEEP-SKY (816-333-7759); e-mail *leaguesales@astroleague.org*. (2) *The ALPO Meteors Section Newsletter*, free (except postage), published quarterly (March, June, September, and December). Send check or money order for first class postage to cover desired number of issues to Robert D. Lunsford, 1828 Cobblecreek St., Chula Vista, CA 91913-3917.

Other ALPO Publications

Checks must be in U.S. funds, payable to an American bank with bank routing number.

- ***An Introductory Bibliography for Solar System Observers.*** **No charge.** Four-page list of books and magazines about Solar System objects and how to observe them. The current edition was updated in October 1998. Send self-addressed stamped envelope with request to current ALPO Membership Secretary (Matt Will).

- ***ALPO Membership Directory.*** Provided only to ALPO board and staff members. Contact current ALPO membership secretary/treasurer (Matt Will).

Back Issues of The Strolling Astronomer

- Download JALPO43-1 thru the latest current issue as a pdf file from the ALPO website at *http://www.alpo-astronomy.org/djalpo* (free; most recent issues are password-protected, contact ALPO membership secretary Matt Will for password info).

Many of the hard-copy back issues listed below are almost out of stock and there is no guarantee of availability. Issues will be sold on a first-come, first-served basis. Back issues are $4 each, and $5 for the current issue. We can arrange discounts on orders of more than $30. Order directly from Secretary/Treasurer "Matthew Will" (see address under "Board of Directors,"):

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Vol. 35 (1991) Nos. 1, 2, and 4
Vol. 36 (1992-93) Nos. 1, 2, 3, and 4
Vol. 37 (1993-94) Nos. 1, 2, 3, and 4
Vol. 38 (1994-96) Nos. 1, 2, 3, and 4
Vol. 39 (1996-97) Nos. 1, 2, 3, and 4
Vol. 40 (1998) Nos. 2 and 3
Vol. 41 (1999) Nos. 1, 2, and 3
Vol. 42 (2000) Nos. 1 and 4
Vol. 43 (2001) Nos. 1, 2, 3, and 4
Vol. 44 (2002) Nos. 1, 2, 3, and 4
Vol. 45 (2003) Nos. 1, 2, and 3 (no issue 4)
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Vol. 47 (2005) Nos. 1, 2, 3, and 4
Vol. 48 (2006) Nos. 1, 2, 3, and 4
Vol. 49 (2007) Nos. 1, 2, 3, and 4
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Vol. 51 (2009) Nos. 1, 2, 3, and 4
Vol. 52 (2010) Nos. 1, 2, 3, and 4
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Vol. 54 (2012) Nos. 1, 2, 3, and 4
Vol. 55 (2013), Nos. 1, 2, 3 and 4
Vol. 56 (2014), Nos. 1 and 2

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Vol. 56 (2014), No. 3 (current issue)

THE ASSOCIATION
OF LUNAR & PLANETARY OBSERVERS (ALPO)

The Association of Lunar & Planetary Observers (ALPO) was founded by Walter H. Haas in 1947, and incorporated in 1990, as a medium for advancing and conducting astronomical work by both professional and amateur astronomers who share an interest in Solar System observations. We welcome and provide services for all individuals interested in lunar and planetary astronomy. For the novice observer, the ALPO is a place to learn and to enhance observational techniques. For the advanced amateur astronomer, it is a place where one's work will count and be used for future research purposes. For the professional astronomer, it is a resource where group studies or systematic observing patrols add to the advancement of astronomy.

Our Association is an international group of students that study the Sun, Moon, planets, asteroids, meteors, meteorites and comets. Our goals are to stimulate, coordinate, and generally promote the study of these bodies using methods and instruments that are available within the communities of both amateur and professional astronomers. We hold a conference each summer, usually in conjunction with other astronomical groups.

We have “sections” for the observation of all the types of bodies found in our Solar System. Section coordinators collect and study submitted observations, correspond with observers, encourage beginners, and contribute reports to our quarterly Journal at appropriate intervals. Each section coordinator can supply observing forms and other instructional material to assist in your telescopic work. You are encouraged to correspond with the coordinators in whose projects you are interested. Coordinators can be contacted either via e-mail (available on our website) or at their postal mail addresses listed in our Journal. Members and all interested persons are encouraged to visit our website at *http://www.alpo-astronomy.org*. Our activities are on a volunteer basis, and each member can do as much or as little as he or she wishes. Of course, the ALPO gains in stature and in importance in proportion to how much and also how well each member contributes through his or her participation.

Our work is coordinated by means of our periodical, *The Strolling Astronomer*, also called the *Journal of the Assn. of Lunar & Planetary Observers*, which is published seasonally. Membership dues include a subscription to our Journal. Two versions of our ALPO are distributed — a hardcopy (paper) version and an online (digital) version in “portable document format” (pdf) at considerably reduced cost.

Subscription rates and terms are listed below (effective January 1, 2012).

We heartily invite you to join the ALPO and look forward to hearing from you.

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- ..$US20 – 8 issues of the digital Journal only, all countries, e-mail address required
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- ..$US60 – 8 issues of the paper Journal only, US, Mexico and Canada
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- ..$US130 – Sponsoring Member level, 4 issues of the digital and paper Journal, all countries

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To join or renew online, simply left-click on this Astronomical League web page:
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Afterwards, e-mail the ALPO membership secretary at *will008@attglobal.net* with your name, address, the type of membership and amount paid.

If using the form below, please make payment by check or money order, payable (through a U.S. bank and encoded with U.S. standard banking numbers) to “ALPO” There is a 20-percent surcharge on all memberships obtained through subscription agencies or which require an invoice. Send to: ALPO Membership Secretary, P.O. Box 13456, Springfield, Illinois 62791-3456 USA.

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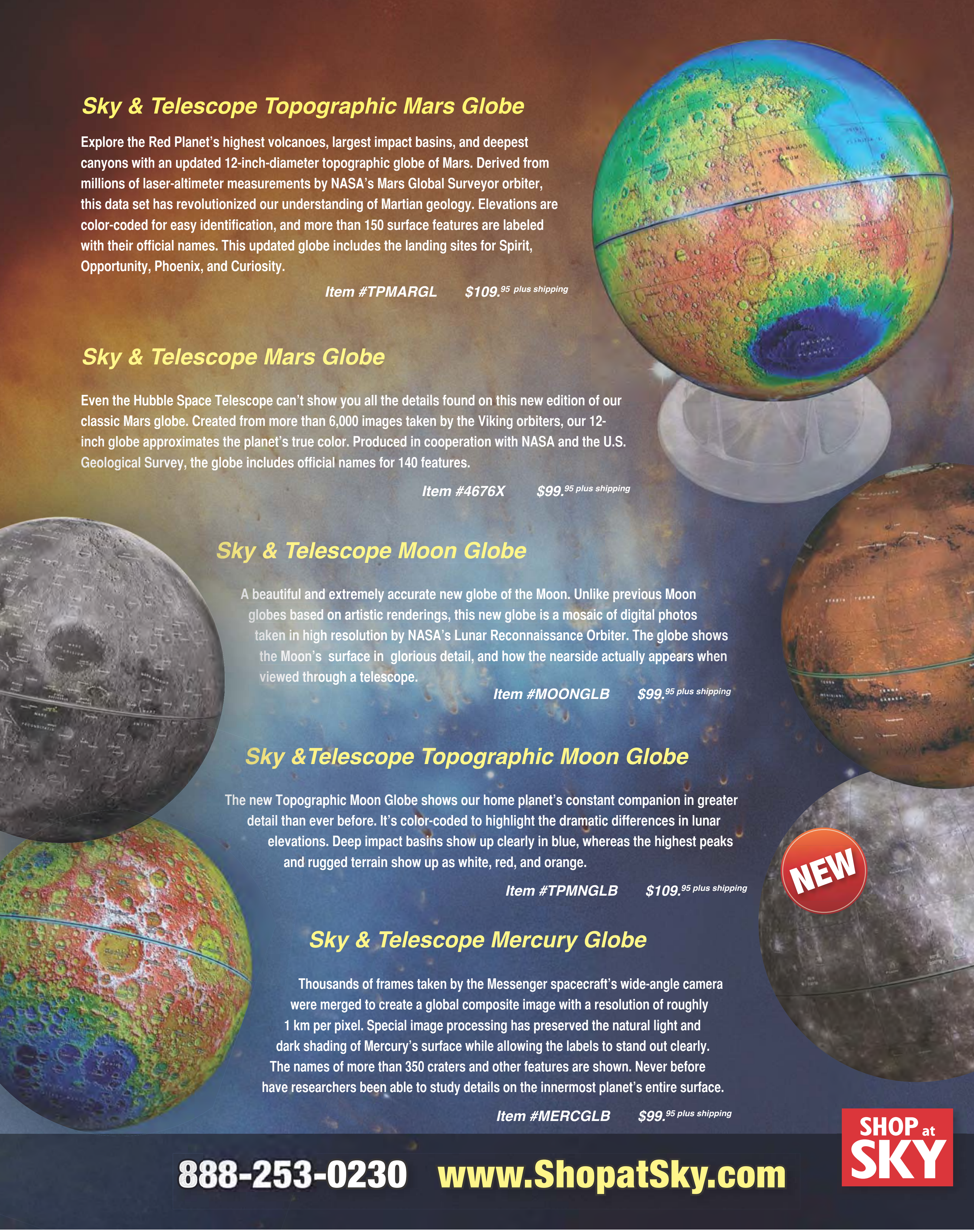
Interest____

Interest Abbreviations
0 = Sun 1 = Mercury 2 = Venus 3 = Moon 4 = Mars 5 = Jupiter 6 = Saturn 7 = Uranus 8 = Neptune 9 = Pluto A = Asteroids C = Comets D = CCD Imaging E = Eclipses & Transits H = History I = Instruments M = Meteors & Meteorites P = Photography R = Radio Astronomy S = Computing & Astronomical Software T = Tutoring & Training Program (including Youth)


Sky & Telescope Topographic Mars Globe
Explore the Red Planet's highest volcanoes, largest impact basins, and deepest canyons with an updated 12-inch-diameter topographic globe of Mars. Derived from millions of laser-altimeter measurements by NASA's Mars Global Surveyor orbiter, this data set has revolutionized our understanding of Martian geology. Elevations are color-coded for easy identification, and more than 150 surface features are labeled with their official names. This updated globe includes the landing sites for Spirit, Opportunity, Phoenix, and Curiosity.
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