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Journal of the Association of Lunar & Planetary Observers

Founded in 1947

The Strolling Astronomer

Volume 55, Number 1, Winter 2013

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

Annular Solar eclipse, 2012 May 21 UT; formation of Baily's beads near Contact II. 48 frames from 01:28:22.5-01:29:17.9 UT at a 1.05-second cadence with a 7.0-second gap between frames 24 and 25; Contact II predicted at 01:29:06.7 UT (frame 38). North at right; site 16 km NNE of southern limit of annularity. 127-mm f/10 SCT, Thousand Oaks solar filter, 1/60 sec, ISO 100. J. Westfall.

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Journal of the Association of Lunar & Planetary Observers

The Strolling Astronomer

Volume 55, No.1, Winter 2013
This issue published in December 2013 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.

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

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Point of View
Goodbye and . . . Hello?

By Ken Poshedly, editor & publisher
The Strolling Astronomer

Greetings, Merry Christmas, Happy New Year, Happy Holidays. Take your pick. Say good-bye to 2012 and a hopeful hello to 2013.

As for good byes, two notable ones are mentioned a few pages after this column. The first is Lenny Abbey, a personal friend of mine here in Atlanta, and the other is Sir Patrick Moore, whose astronomical books and appearances as host of the BBC television program *The Sky at Night* endeared him to millions.

I met Lenny back in 1990 as I re-entered the astronomy hobby after having been away from it for 24 years. He and I attended meetings of a local astronomy club and got to chatting occasionally afterwards. After some months and when I joined another local club, I found out how valuable Lenny was to the local astro-club scene and how absolutely learned this man really was. Astronomy, classical music, history, stamps — you name it, he had his hand in it somehow. But he never talked about these things until someone else brought them up. Only then did his wondrous knowledge make itself obvious.

Sadly, he was only an occasional sky observer by the time I met him, though he did hold onto his 8-inch (or was it a 10-inch?) Cave reflector. He even brought it out to my home where we viewed the edgewise presentation of Saturn's rings in 1995.

I believe the world was truly a better place while Lenny was still with us.

As for Sir Patrick, I remember borrowing his book, *The Moon*, many times from a local public library as a preteen and how it was one of my earliest inspirations to just keep diving into astronomy. It is also very interesting that so many years later, Sir Patrick became best friends with — of all people — Brian May, guitarist with the British rock band Queen. Cripe! Someone of my generation and MY musical tastes proved to be “instrumental” (so to speak) in helping Sir Patrick hold on until the very end. Read about it at *http://www.dailymail.co.uk/news/article-2248952/Queen-guitarist-Brian-May-bought-Sir-Patrick-Moores-house-2008-ensure-astronomer-live-final-years.html*

As for 2013, PLEASE consider attending this summer's ALCon 2013 event here in Atlanta. This time, all technical talks will be included as part of the main program. More about the event on the following pages.

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News of General Interest

ALCon 2013 Set for Atlanta

Arrangements

The Astronomical League's 2013 convention, ALCon2013, will be held in Atlanta, Georgia, July 24 through 27.

This year, all technical papers will be mainstreamed and presented at one location. At previous ALCon events, the ALPO technical papers were presented separately from the others.

Local arrangements are being coordinated by the Atlanta Astronomy Club, which was founded shortly after Assn of Lunar & Planetary Observers.

The venue for all presentations will be the 500-seat Jim Cherry Planetarium at Atlanta's Fernbank Science Center; the location equipped with a full array of audio-visual equipment and is well-known to many who live in the metro Atlanta area or who have visited there in the past. The ALPO 2006 conference was also held at the Fernbank location, though one of the center's large classrooms were used for the presentations instead.

Besides the daily technical presentations, there will several optional side-trips; one will be for Friday night dinner at the Agnes Scott College Bradley Observatory, which was the actual location where the AAC was founded; another side-trip will be a mid-day Saturday venture to the AAC's William Barber Observatory site, where several buildings with telescopes and a club meeting building is located. A third side-trip to the AAC's other observing site well east of Atlanta may be offered, depending on the interest level.

Lodging for out-of-towners will be at the nearby Emory Conference Center Hotel, which is lowering its standard room rate considerably for attendees of ALCON 2013.

Solicitations to vendors to also be present are being sent at this time.

Registration and other fees will be announced in the coming weeks and in the next JALPO (March 2013).

Look to the inside back cover of this issue for a full-page ad with the latest info.

Call for ALPO Papers

Participants are encouraged to submit research papers, presentations, and experience reports concerning Earth-based observational astronomy of our solar system for presentation at the event.

Suggested topics for papers and presentations include the following:

- New or ongoing observing programs and studies of solar system bodies, specifically, how those programs were designed, implemented and continue to function.
- Results of personal or ALPO group studies of solar system bodies possibly including (but not limited to) Venus cloud albedo events, dust storms and the polar caps of Mars, the various belts and Great Red Spot of Jupiter, the various belts and ring system of Saturn, variances in activity of periodic meteor showers and comets, etc.
- New or ongoing activities involving astronomical instrumentation, construction or improvement.
- Challenges faced by Earth-based observers including increased or lack of interest, deteriorating observing conditions brought about by possible global warming, etc.

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The preferred format is Microsoft PowerPoint, though 35mm slides or overhead projector 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 (if any) from the audience.

May 15, 2013 is the deadline for submitting the titles of papers to be presented along with a four- or five-sentence abstract of each paper and in what format the presentation will be.

Address all ALPO materials to:

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Noted Deaths

Leonard (Lenny) Abbey of Atlanta, whose membership in the ALPO goes back its earliest years, died unexpectedly on Thursday, December 13, 2012. He was 74.

Lenny – the name he preferred – became our organization's first Uranus-Neptune Section Recorder in November 1955 when he was about age 17 and held that title until February 1969. (The Uranus-Neptune Section was renamed the "Remote Planets Section" when James Young became recorder in February 1969.)

Lenny was also Mars Section Assistant Recorder from December 1957 to January 1963, serving under Mars Section recorders Frank R. Vaughn and Ernst E. Both.

Lenny Abbey, 74: Self-taught astronomer 'did real science'

Source: The Atlanta Journal Constitution & *http://www.ajc.com/news/news/lenny-abbey-74-self-taught-astronomer-did-real-sci/nTdRj/*

By J.E. Geshwiler of The Atlanta Journal Constitution

Lenny Abbey had the self-taught know-how that made him an astronomer to be taken seriously. He was a nearly lifelong observer of the heavens. He wrote articles and lectured about stars, planets and the history of celestial discovery. All he lacked was an academic degree in the subject.

As a fellow astronomy devotee, Alex Langoussis of Acworth, put it, "Lenny may have been an amateur, but he did real science."

Abbey got interested in astronomy in the 1960s as a Decatur High School student, often visiting Agnes Scott College's Bradley Observatory and working with its longtime director, the late Bill Calder. The current director, Chris DePree, said that when he took the post in the 1990s, Abbey was a valuable resource on the observatory's history.

"Lenny also was a bridge between amateur and professional astronomers," DePree said. "Amateur astronomers in this part of the country, like Lenny, are quite talented. The amateur-hour connotation doesn't apply to them."

Leonard Broughton Abbey Jr., 74, of Atlanta died Dec. 14 at Piedmont Hospital of blood clot complications. In observance of his wishes, no service is planned. A.S. Turner & Sons Funeral Home was in charge of arrangements.

In 1970 Abbey became a Fellow of Britain's Royal Astronomical Society "in recognition of his body of work," according to Richard Jakiel, president of the Atlanta Astronomy Club. He added that Abbey held each of the club's officer posts more than once.

"Lenny was a fantastic contributor to our club," said Pixie Bruner of Lithia Springs, the AAC's recording secretary. "He was our go-to guy on early cutting-edge astro-photographic equipment, an unparalleled authority on astronomy history, a debunker of dubious science — and he set up a website for us."

Abbey also was a member of the American Association of Variable Star Observers, which honored him in 2007 for his more than 50 years of service to the AAVSO. The association said it appreciated his numerous star observations and the software packages he created that are used by hundreds of observers and researchers worldwide.

One of his software creations enabled users to gauge the precise position of the sun and moon at a given time of the day at any point on the globe, simply by entering the time in question and a specific longitude and latitude.

Larry Abbey of Tucker said his brother sold several of these software units to movie makers who found it helpful in filming on location. "That way," he said, "they would know, for instance, exactly when to film the sun rising over a church steeple."

Abbey attended Emory University and Georgia Tech, studying physics at both schools. He worked for Diebold Inc. during the 1970s and 1980s, managing its film laboratory. In that capacity he processed photographs recorded by Diebold-installed equipment showing bank robberies in progress.

"Lenny was called to testify as a witness for the prosecution in a number of criminal cases because of that," said his wife, Eugenia Abbey. "He told me that in scanning all those photos he felt he had developed a sixth sense for spotting suspicious characters."

He also worked at the Georgia Tech Research Institute on top-secret Defense Department projects. "When his colleagues got together socially, they had to take care to not talk about what was going on at the lab," Mrs. Abbey said.

His last position before retirement was with Microsoft, managing an online astronomy forum, "a job he loved," Mrs. Abbey said.

There are no immediate survivors aside from his wife and brother.

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Lenny assisted with other ALPO activities in the past, for instance, helping ALPO Membership Secretary/Treasurer Matthew Will as he compiled the booklet *Exploring the Solar System With the ALPO*, an introduction to ALPO observing programs for people interested in joining the ALPO. Lenny edited much of the text and assembled the publication.

Patrick Moore, long regarded as THE authoritative source about virtually all things astronomy, died December 9 at his home in England at the age of 89. He would have been 90 on March 4, 2013.

Announcements and tributes can be found throughout the Internet. For an extensive look at his life and career, go to:

http://www.ft.com/cms/s/0/97da7312-8c0e-11da-9efb-0000779e2340.html

E-mail Address Update

Please note that the e-mail address for ALPO Remote Planets Section Coordinator Richard Schmude has been changed to schmude@gordonstate.edu.

Eight Years of International Comet Quarterly Looking for a Good New Home

From ALPO Minor Planets Section Coordinator Frederick Pilcher: ALPO founder and Director Emeritus Walter Haas is donating eight years of the *International Comet Quarterly* to any ALPO member who can provide long term retention.

I am keeping these in temporary custody until the permanent recipient can be found. Included are all issues from whole number 113, January 2000, Vol. 22 No. 1, through whole number 145, January 2008, Vol. 30, No. 1, except that whole numbers 117, 118, 120, and 126 are missing.

Also included is *The Comet Handbook*, edited by S. Nakano and D. W. E. Green, for all years 2000 - 2006.

Any ALPO member who may be interested in acquiring and retaining these journals is invited to please contact me (Frederick Pilcher) at 4438 Organ Mesa Loop, Las Cruces, NM 88011-8403 USA; e-mail pilcher@ic.edu

****

From ALPO Membership Secretary Matt Will: Walter’s new address (Mary's home) is 4885 Poose Creek Road, Las Cruces, NM 88011. Her phone number (where you can get in touch with Walter) is 575-382-0088.

ALPO Interest Section Reports

Web Services

Larry Owens, section coordinator

Larry.Owens@alpo-astronomy.org

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

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:

- 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/*

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ALPO Observing Section Reports

Mercury / Venus Transit Section

John Westfall, section coordinator
johnwestfall@comcast.net

A comparison by William Sheehan of the 2004 and 2012 Venus transits appears later in this issue.

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

Eclipse Section

Mike Reynolds, section coordinator
m.d.reynolds@fscj.edu

A report on the May 20, 2012 annular eclipse appears later in this issue.

Reports on ALL of the following eclipses are still being accepted:

- 20 May 2012 Partial and Central (Annular) Solar Eclipse (note the first section report in JALPO 54-4; this issue);
- 4 June 2012 Partial Lunar Eclipse (only one report received to date); and
- 13 November 2012 Total Solar Eclipse

Your eclipse report(s) can be as simple as noting that you did observe the eclipse, to a more-detailed eclipse observing and submission of an ALPO Eclipse Report form which can be downloaded from the ALPO Website (http://alpo-astronomy.org/index.htm) or by requesting the appropriate form from this ALPO Eclipse Section coordinator via e-mail (m.d.reynolds@fscj.edu). Photographs of the eclipse as well as observers and/or their equipment and set-ups are also invited and welcome.

Besides my e-mail address, materials can also be sent to me at my regular mail address:

Dr. Mike Reynolds
Dean of Mathematics & Natural Sciences
Florida State College
3939 Roosevelt Boulevard
Jacksonville FL 32205

Please visit the ALPO Eclipse Section online at www.alpo-astronomy.org/eclipse

Meteors Section

Report by Bob Lundsford, section coordinator
lunro.imo.usa@cox.net

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

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

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

Comets Section

Gary Kronk, section coordinator
kronk@cometography.com

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

Solar Section

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

Despite the most recent activity of the Sun unleashing solar coronal mass ejections (CME's) resulting in many auroras being seen all across Canada and the U.S., and the fact that the Sun is on the cusp of its Solar Maximum, the Sun has actually been fairly quiet.

The images included on the next page show the intensity of ion excitement in the Earth's atmosphere. There were sheets, pulsating, and ribbons, while taking these photos.

Both were taken at about 8:30 p.m., October 8, 2012, by this writer using a Canon PowerShot A2400 IS digital camera. The exposure time was approximately 15 seconds and the GPS coordinates from my location were latitude 44.22.39 N, longitude 76.45.47 W.

There have been several large groups over the last three months that have grown in intensity to produce large flares both towards Earth and on the far side of the Sun unleashing powerful CME's. There have also been large filaments with the expectation of flares.

The accompanying chart shows the groups that have grown intense enough to unleash a CME towards and away from Earth over the course of a few months.

To follow the predictions of auroras, please check out the Current Auroral Oval on www.spaceweather.com, which will show the effects on the extent of the activity, as well as http://www.aurorawatch.ca/ Aurora watch. STD Solar Monitor is one program you can use on your computer.

Many of our imagers are taking photos and doing sketches of the sunspots and groups on the Sun and submitting them to the ALPO Solar Section for archiving. This is a great way of keeping the images in the Carrington Rotation format and

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Aurora borealis as imaged by Kim Hay of Canada. See text for specific data.

then following the sunspot groups as they intensify or decay as they move across the Sun. These images should be sent to kim.hay@alpo-astronomy.org.

Archived Carrington Rotation data as available online at www.alpo-astronomy.org/solarblog

Keep up to date on solar information and images from observers though the Solar ALPO Yahoo group at http://groups.yahoo.com/group/Solar-ALPO/ http://tech/solar-alpo/yahoo. There are currently 315 members on the list.

Please send in your images, sketches (250 kb max.) to *kim.hay@alpo-astronomy.org*. PLEASE make sure your images are corrected for North on top, includes the correct Universal Time (UT), all instrumentation used to obtain the image, and the correct Carrington

Table of Recent Sunspot Groups & Their Potentials

Date	Group Number	Comments
September 3 and 4	AR1560	Geomagnetic storm
September 8th	AR1564	M1-class flare producing aurora on Sept 12
September 17th		September 20th produced 3 CME's
September 23rd	AR1575	Large explosion on the far side of the Sun; image captured by SOHO
September 28th	AR1577	Produced auroras on Sept 30
October 2nd	AR1583	Group on far side of the Sun flared
October 2nd	AR1579 & AR1582	Large groups seen with solar glasses and welders glass #13 without magnification
October 5th	AR1582	Produced auroras on Oct 8th
October 13th		G1 magnetic storm; causes aurora
October 20th	AR1598	M9-class flare; also producing C& M class flares
October 23rd	AR1598	X1-class flare; 4th flare produced by this group
November 14th		Total solar eclipse viewed from Australia (2 minute totality); see *http://www.youtube.com/watch?v=Hn5nKlMY5cI* for a detailed information on the science of the Sun being studied from Science at NASA

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Rotation (CR) number which can be found at *www.alpo-astronomy.org/solarblog*

We are always looking for members to submit an article to the JALPO on solar work. Please send to myself (*kim.hay@alpo-astronomy.org*) and to Ken Poshedly (*ken.poshedly@alpo-astronomy.org*)

Remember to visit the ALPO Solar Section webpage at *www.alpo-astronomy.org/solarblog* for information and updated observations.

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

2012 was a slow year for the ALPO Mercury Observing section. But as 2013 opens, I hope to get at least some observations — especially during the first evening apparition. It will be favorable as seen from the northern hemisphere.

Mercury will be visible most of the time in February. Greatest elongation occurs on the 16th of the month approximately 18.1° east of the Sun. With -0.2 magnitude, Mercury should be easily visible about 30 to 45 minutes after sundown. Looking through a small telescope, Mercury reveals a half-phase disk. But towards the end of February, it will become difficult to see as the crescent narrows.

Furthermore, I am hoping for many observations throughout the remainder of 2013. If you prefer to observe Mercury in the morning, late July and November will be your best time to see it If you can only observe Mercury in the evening, February (as mention above) and June are the good months to do. Also, the MESSENGER spacecraft is still orbiting and imaging Mercury, and it will continue to do so at least most of 2013.

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

Venus Section

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

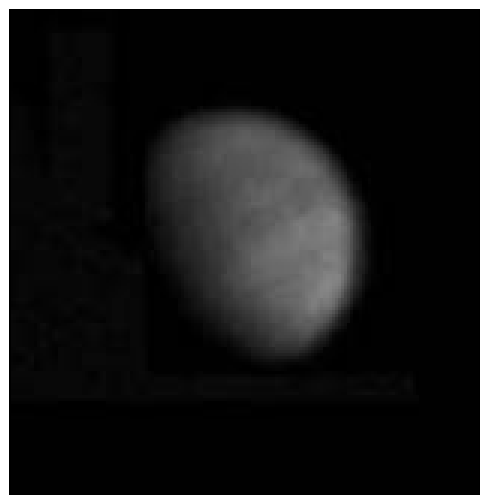
Venus is situated in the eastern sky before sunrise at apparent visual magnitude -4.0. During the current 2012-13 Western (Morning) Apparition, the planet is passing through its waxing phases (a progression from crescent through gibbous phases). Venus attained its Greatest Illuminated Extent (its brightest for this apparition) on July 12th at visual magnitude -4.6 and was predicted to reach theoretical dichotomy (half phase) on August 15, 2012. At the time of this report (mid-November), the disk of Venus is about 12.8 arc-seconds across and roughly 83.0% illuminated.

The accompanying table of Geocentric Phenomena in Universal Time (UT) for the 2012-13 Western (Morning) Apparition is presented here for the convenience of observers.

Observers have continued to submit images and drawings of Venus this apparition, totaling a little over 100 so far. To avoid atmospheric dispersion and bad seeing near the horizon, an advantage during 2012-13 is the opportunity to wait until Venus gains altitude in the eastern sky before sunrise even though the background sky will gradually brighten. Nevertheless, the planet is rather easy to track into daylight, affording excellent views when most of the prevailing glare associated with the planet is gone or reduced. Since Venus has a high surface brightness, it is potentially observable anytime it is far enough from the Sun to be safely studied and imaged.

ALPO observations continue to be 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 continues, and observers should submit images to the ALPO Venus Section as well as to the VEX website at:

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



H.G Lindberg of Skultina, Sweden submitted this excellent UV image of Venus taken November 6, 2012 at 07:44 UT using a 18.0 cm (7.0 in.) MAK. There is a fair amount of detail on the gibbous disc of the planet. Seeing was considered fair as rated on the ALPO seeing scale. Apparent diameter of Venus is 12.9", phase (k) 0.830 (83.0% illuminated), and visual magnitude 4.0. South is at top of image.

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Geocentric Phenomena of the 2012-2013 Western (Morning) Apparition of Venus in Universal Time (UT)

Inferior Conjunction	2012	Jun 06 (angular diameter = 58.3 arc-seconds)
Greatest Illuminated Extent	2012	Jul 12 (m_V = – 4.6)
Greatest Elongation West	2012	Aug 15 (46º east of the Sun)
Predicted Dichotomy	2012	Aug 15.18 (exactly half-phase predicted)
Superior Conjunction	2013	Mar 28 (angular diameter = 9.8 arc-seconds)

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, which continues into 2012-13.

The observation programs conducted 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 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).

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 (e.g., 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, 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 88 new observations from 11 observers during the July-September quarter. These included three banded crater reports, one ray observation, and three sets of elevation measurements. Four contributed articles were published in addition to numerous commentaries on images submitted.

The *Focus-On* series continued with an article on Bullialdus and Aristillus. Upcoming *Focus-On* subjects include Atlas, Alphonsus and Wrinkle Ridges & Rilles.

Visit the following online web sites for more info:

- The Moon-Wiki: *the-moon.wikispaces.com/Introduction*
- Chandrayaan-1 M3: *pds-imaging.jpl.nasa.gov/portal/chandrayaan-1_mission.html*
- LROC: *lroc.sese.asu.edu/EPO/LROC/lroc.php*
- ALPO Lunar Topographical Studies Section *moon.scopesandscapes.com/alpo-topo*
- ALPO Lunar Selected Areas Program *moon.scopesandscapes.com/alpo-sap.html*
- ALPO Lunar Topographical Studies *moon.scopesandscapes.com/alpo-topo*
- 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/*

Lunar Meteoritic Impacts

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

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Lunar Calendar for First Quarter 2013 (All Times in UT)

Jan. 05	03:58	Last Quarter
Jan. 06	24:00	Moon 3.7 Degrees SSW of Saturn
Jan. 09	15:24	Extreme South Declination
Jan. 10	10:27	Moon at Perigee (360,047 km – 223,723 miles)
Jan. 10	11:00	Moon 2.8 Degrees NNW of Venus
Jan. 11	00:00	Moon 0.32 Degrees NNW of Pluto
Jan. 11	12:00	Moon 5.8 Degrees N of Mercury
Jan. 11	19:44	New Moon (Start of Lunation 1114)
Jan. 13	07:00	Moon 6.2 Degrees NNW of Mars
Jan. 15	10:00	Comet Enke 1.2 Degrees SE of Moon
Jan. 17	02:00	Moon 4.5 Degrees NNW of Uranus
Jan. 18	23:45	First Quarter
Jan. 22	02:00	Moon 0.81 Degrees SW of Jupiter
Jan. 22	10:53	Moon at Apogee (405,311 km – 251,849 miles)
Jan. 22	18:00	Moon 1.2 Degrees NE of asteroid 4-Vesta
Jan. 23	05:12	Extreme North Declination
Jan. 27	04:39	Full Moon
Feb. 03	07:00	Moon 3.5 Degrees SSW of Saturn
Feb. 03	13:57	Last Quarter
Feb. 06	00:24	Extreme South Declination
Feb. 07	11:00	Moon 0.57 Degrees NW of Pluto
Feb. 07	12:10	Moon at Perigee (365,313 km – 226,995 miles)
Feb. 09	10:00	Moon 5.8 Degrees NNW of Venus
Feb. 10	07:22	New Moon (Start of Lunation 1115)
Feb. 11	01:00	Moon 5.5 Degrees NNW of Neptune
Feb. 11	10:00	Moon 9.0 Degrees NNW of Mars
Feb. 11	16:00	Moon 5.0 Degrees NNW of Mercury
Feb. 12	07:00	Comet Enke 1.1 Degrees ESE of Moon
Feb. 13	15:00	Moon 4.2 Degrees NNW of Uranus
Feb. 17	20:30	First Quarter
Feb. 18	12:00	Moon 0.90 Degrees S of Jupiter
Feb. 19	01:00	Moon 0.97 Degrees SSW of asteroid 4-Vesta
Feb. 19	07:00	Moon at Apogee (404,473 km – 251,328 miles)
Feb. 19	13:36	Extreme North Declination
Feb. 25	20:28	Full Moon
Mar. 02	15:00	Moon 3.3 Degrees S of Saturn
Mar. 04	21:54	Last Quarter
Mar. 05	06:42	Extreme South Declination
Mar. 05	23:21	Moon at Perigee (369,953 km – 229,878 miles)
Mar. 06	21:00	Moon 1.3 Degrees NE of Pluto
Mar. 10	13:00	Moon 5.5 Degrees NNW of Neptune
Mar. 10	22:00	Moon 2.2 Degrees N of Mercury
Mar. 11	12:00	Moon 5.9 Degrees NNW of Venus
Mar. 11	19:53	New Moon (Start of Lunation 1116)
Mar. 12	12:00	Moon 4.5 Degrees NNW of Mars
Mar. 13	01:00	Moon 4.0 Degrees NNW of Uranus
Mar. 18	01:00	Moon 1.5 Degrees S of Jupiter
Mar. 18	21:54	Extreme North Declination
Mar. 19	03:14	Moon at Apogee (404,261 km – 251,196 miles)
Mar. 19	17:26	First Quarter
Mar. 27	09:29	Full Moon
Mar. 29	20:00	Moon 3.4 Degrees S of Saturn
Mar. 31	03:56	Moon at Perigee (367,493 km – 228,350 miles)

Table courtesy of William Dembowski

Lunar Transient Phenomena

Dr. Anthony Cook,
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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*

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

Finally, please visit the ALPO Lunar Transient Phenomena site online at *http://alpo-astronomy.org/lunar/ltp.html*

Mars Section

Roger Venable, section coordinator
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Mars is now approaching the part of its orbit farthest from Earth, and it is near the Sun in the sky. It subtends a diameter of only 4.3 arc seconds. Furthermore, it is at a southern latitude so that it is very difficult for northern observers to observe in the dusk. It will become observable in the morning sky during the summer of 2013.

Join us on the Yahoo Mars Observers Group, where you can post your images and drawings and see those of others, while participating in discussions of what we are seeing: *tech.groups.yahoo.com/group/marsobservers.* This forum also provides a good resource for you to store your images online.

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

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Minor Planets Section

Frederick Pilcher,
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The following results are the highlights of *Minor Planet Bulletin* Vol. 39, No. 4, 2012 October -December.

Brian Warner and colleagues have obtained a spin/shape model for the small asteroid (47035) 1998 WS from a single opposition, an achievement dependent upon the asteroid being observed over a much larger arc than is ordinarily possible. Lorenzo Franco and colleagues published a spin/shape model for main belt asteroid 161 Athor, based on the usual circumstance of observations at six oppositions well spaced around the sky plus additional sparse data (single data points) from USNO patrol images.

Warner also found a sufficient number of dips in the lightcurves of 5477 Holmes and (79472) 1998 AX4 due to transit/ shadow/occultation events for the revolution period of the binary companion to be found in addition to the rotation period of the primary. He also found for 7758 Poulanderson and 7958 Leakey a small number of suspected dips likely due to these binary events, although the evidence for these two asteroids is far from secure.

Lightcurves with derived rotation periods are published for 94 other asteroids, 47, 205, 225, 247, 252, 412, 482, 611, 627, 648, 756, 801, 852, 862, 1055, 1089, 1090, 1180, 1311, 1394, 1424, 1428, 1656, 1660, 1714, 1985, 2074, 2145, 2234, 2423, 2464, 2550, 2698, 2903, 2927, 3169, 3266, 3397, 3493, 3810, 3968, 4116, 4419, 4483, 4490, 4790, 4892, 4950, 5374, 5968, 6107, 6254, 6321, 6354, 6517, 6574, 6670, 6972, 7036, 7087, 8077, 8345, 8882, 11304, 15269, 17129, 17590, 19774, 20996, 21976, 23482, 24702, 30185, 30432, 31182, 31881, 33736, 42811, 44443, 47143, 48307, 49674, 51302, 51381, 51386, 74081, 83574, 88259, 326732, 2011 WV134, 2012 AA11, 2012 DO, 2012 KP24, 2012 LZ1.

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

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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

Jupiter Section

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Jupiter is rising in the late evening and will be visible nearly all night during late 2012 and into early 2013.

Several people submitted images of Jupiter. The images cover the wavelength range from the ultraviolet to the near infrared (wavelength of 2.3 microns). The 2.3 micron images were taken by Manos Kardasis and may be the first attempt that an amateur has made at this wavelength. With these images, we will be able to monitor Jupiter's hot spots near 7° N.

The biggest development has been the growth of the North Tropical Zone. During mid-2012, the NTrZ was thin or not visible, but it is now more distinct. The North Temperate Belt is narrower in late 2012 than in mid 2012.

This writer has carried out brightness measurements in filters transformed to the Johnson B, V, R and I system. Up to October 25, Jupiter was a few percent dimmer than expected. On October 25, that planet was a little brighter than expected. There are plans to measure Jupiter's light curve in the V and I filters in November and December.

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

Galilean Satellite Eclipse Timing Program

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Contact John Westfall via regular mail at P.O. Box 2447, Antioch, CA 94531-2447 USA or e-mail to johnwestfall@comcast.net to obtain an observer's kit, also available on the Jupiter Section page of the ALPO website.

Saturn Section

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Saturn entered conjunction with the Sun on October 25, thereby ending the 2011-12 apparition. It emerged from the solar glare in the eastern morning sky in late November.

The planet's northern hemisphere and north face of the rings will be visible to greater advantage during the 2012-13 observing season since the ring tilt towards Earth will continue to increase throughout the next several years, with global regions south of the rings becoming less favorable for viewing.

The accompanying table of geocentric phenomena for the 2011-12 apparition is presented for the convenience of readers who wish to plan their Saturn observing activities.

Observers have so far contributed over 600 images and drawings of Saturn during the 2011-12 apparition. Remnants of the great white storm of 2010-11 across the globe in the region of the North Tropical Zone (NTrZ) were still detectable in most images. Readers will recall that the NTrZ white spot was the brightest feature seen on the planet in over a decade, showing considerable brightening over time, then undergoing rapid evolution and differentiation into bright and dusky structures along its length eventually encircling the entire planet.

As the inclination of Saturn's northern hemisphere toward the Sun increases, with subsequently greater solar insolation affecting these regions, conditions remain favorable for activity to develop similar to the NTrZ white storm.

At the close of the 2011-12 apparition, submitted images showed tiny white spot

Geocentric Phenomena for the 2012-13 Apparition of Saturn in Universal Time (UT)	
Conjunction	2012 Oct 25^d
Opposition	2013 Apr 28^d
Conjunction	2013 Nov 06^d
Opposition Data:	
Equatorial Diameter Globe	18.7 arc-seconds
Polar Diameter Globe	16.7 arc-seconds
Major Axis of Rings	42.5 arc-seconds
Minor Axis of Rings	13.3 arc-seconds
Visual Magnitude (m_v)	0.1 m_v (in Libra)
B =	+18.2°

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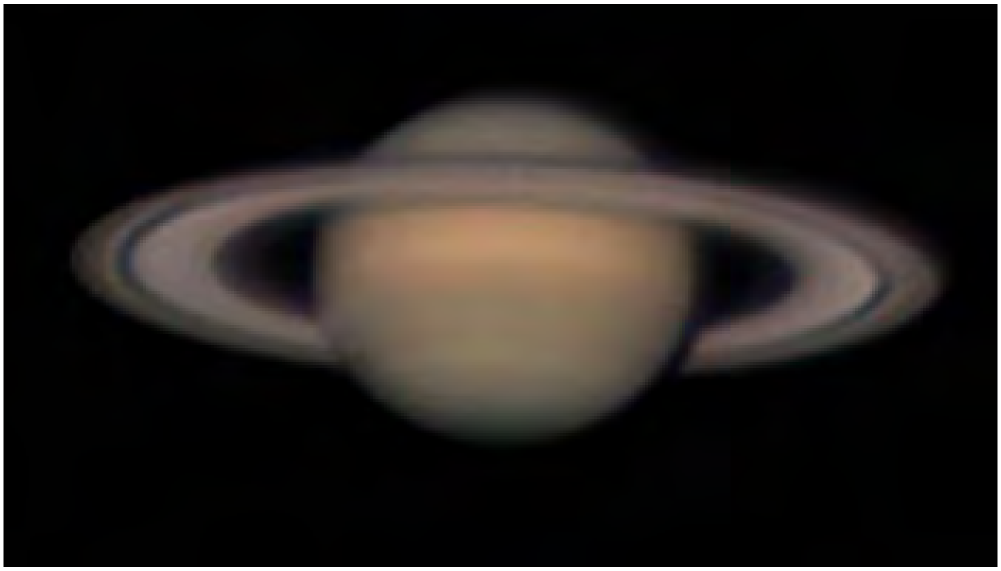

Image taken on September 9, 2012 at 09:03 UT by Trevor Barry observing from Australia using a 40.6 cm (16.0 in.) Newtonian in visible light (RGB) in fair seeing. Notice that the NTrZ is rather wide and still fairly bright as it extends across the globe of Saturn in the aftermath of the huge white storm of 2010-11. Apparent diameter of Saturn's globe is 15.7" with a ring tilt of +14.5°. CMI = 308.2°, CMII = 241.3°, CMIII = 345.3°. S is at the top of the image.

activity in the NNTrZ during mid-April, presumably below the threshold of visual detection. Continued digital imaging at visual, infrared, UV, and methane (CH_4) wavelength bands suggested that the tiny NNTrZ white spot was shot-lived. There were also sporadic occurrences of what appeared to be discrete transient white and dark features at various locations in the north.

Color filter techniques can be used by visual observers to determine which visual wavelengths produce the best views of the NTrZ region in the aftermath of the storm as well as other similar features that might emerge

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 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

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Uranus and Neptune will be visible in the evening during late 2012.

Christophe Pellier, John Boudreau and Marc Delcroix submitted high-quality near infrared images which show cloud belts on Uranus. They used a filter which was sensitive to wavelengths longer than 685 nm. These images are excellent and I believe they are the finest that amateurs have ever taken of the seventh planet.

Jim Fox and this writer are carrying out brightness measurements of Uranus and Neptune. Based on my results in October, Uranus is close to its brightness in 2011 in the V filter.

This writer is currently compiling a short summary of professional-amateur collaboration of Uranus and Neptune studies. This will be submitted to Heidi Hammel who may include it as part of a paper on professional-amateur collaboration.

It is important that people submit their observations before the conjunction of Uranus in March of 2013. Please keep up the good work.

A reminder that the book *Uranus, Neptune and Pluto and How to Observe Them* is now 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 http://www.alpo-astronomy.org/remote.

Book Review

The Cambridge Photographic Moon Atlas

Review by Robert A. Garfinkle, FRAS, ALPO Book Review editor
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The Cambridge Photographic Moon Atlas by Alan Chu, Wolfgang Paech & Mario Weigand; translated into English by Storm Dunlop. Copyright 2012. Published in New York by Cambridge University Press. Hardcover, 191 pages, 388 illustrations. List price $44.95 (£35.00), ISBN 978-1-10701973-7

From cover to cover, this book is full of the most incredible non-spacecraft images of the Moon you will have the privilege to look at for some time to come. A few images are from NASA, but it is hard to tell which are Earth-based and which are from a spaceprobe camera. This book definitely is not a collection of old blurry or pixelated CCD images of the Moon. This atlas is the work of master astrophotographers Alan Chu of Hong Kong and Mario Weigand of Germany, author and amateur astronomer Wolfgang Paech of Germany, and was translated from its original 2010 German publication by Storm Dunlop of the UK.

The book is divided into three main parts. The first part contains information about the structure of the Moon and gives advise on how to use the book. The main part then follows with 180 pages of lunar images and descriptive text divided into 68 sections on the nearside features with the last section (number 69) covering the farside.

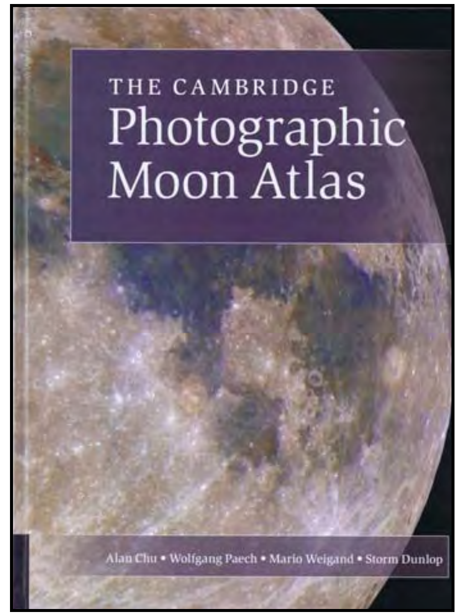
The third part of the book consists of a brief glossary, an index to the features covered in the book, photo credits, and finally suggestions for further reading about the Moon.

The book begins by explaining the structure of the Moon. Here, the authors cover the geological ages and periods of the Moon and its chemical makeup, comparing the black basalts of the maria with the white anorthositic rocks of the highlands. The book covers in a brief one paragraph the theory of the megabasin impact that may be the cause of there being such a difference between the nearside and the farside. The Moon's nearside is covered with the dark maria areas and the farside lacks these lava-flooded areas. The authors also cover the different types of surface features with images showing these features. The book also covers the evolution of a crater from its initial impact to the modifications they go through by erosion caused by impacts of smaller bodies.

As part of this first section, the authors also cover the basics of observing the Moon, such as the selenographic coordinate system, the height of elevated features, colongitude, and librations. Then they briefly discuss telescopes to use for lunar observation. The best part of this section is the coverage that they give to imaging the Moon. They talk about the types of CCD sensors and which color of filters work best for digital images of the Moon. Since this book is mainly an atlas of electronic images, the authors devote over a full page with instructions on how to take and then process your own lunar images to get as sharp a final version of the image as possible.

The heart of this atlas is, of course, the 300-plus great high-resolution images of the Moon. In most cases, they have used four images of the same area in order to show it under different lunation phases. This part of the book covers 68 areas plus the last section covering the farside. Some features are covered on two pages and some are covered on four pages. The authors did a great job in clearly identifying lunar features with thin white lines for the placement of the feature names.

One minor thing that bugs me is when a certain incorrect phrase is repeated from one Moon guide to another. In this case, the authors have repeated the incorrect phrase that under a high sunlight angle, the mare wrinkle ridges become "invisible." Saying that a wrinkle ridge is "invisible" tends to indicate that you would see a strip of nothingness on the mare surface where the "invisible" wrinkle ridge runs. But those wrinkle ridges do not become "invisible," you can still see them — it's just that under a high sun, they do not cast a shadow and are therefore not recognizable as an elevated feature.



The only problem that I see with this book is that gray dots are used with a white number in the dot to identify in the images the features covered in the text. This arrangement works fine for most of the features and keeps the images from being covered with feature names, but when the number/dot is placed near a feature with a high-albedo (bright), the dot almost disappears and can be a challenge to locate. Since a few of the sections are on four pages, the numbered feature may be discussed on a following page instead of the page with the dot. This can be confusing as you hunt around the first page only to discover that the descriptive text is on the following page.

Overall, this photographic atlas of the Moon should be an addition to any and all lunar observer's library. The book is not designed to serve as an at-the-telescope guide, but instead for cloudy-night reference. I certainly would not want to take this book out into the damp night air and watch the dew destroy it.

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Book reviews appropriate for the ALPO from other ALPO members are welcome and very much suggested for publication in this journal. Please send your reviews to the ALPO Book Review Editor Bob Garfinkle at *ragarf@earthlink.net*.

Feature Story:

The Recent Evolution of the Planetary Telescope: Part 1

By Thomas Dobbins,
assistant coordinator,
ALPO History Section
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> **Note to Readers**
>
> Online readers may left-click their mouse on an author's e-mail addresses in blue text to contact the author of this article.

Introduction

When the ALPO was founded in 1947 the telescopes wielded by amateur astronomers had changed very little since the latter half of the 19th century. Lunar and planetary observing was still overwhelmingly a visual enterprise. The finest photographic images of the Moon and planets obtained with the largest instruments fell far short of what a visual observer equipped with a modest telescope could see. The last six decades, however, have witnessed a flurry of advances that have given amateur astronomers capabilities that were the stuff of dreams only a generation ago. (See Figure 1.)

During the first decade of the 21st century the means and methods of amateur lunar and planetary observing were radically transformed in the span of only a few years. This paradigm shift was the result of combining inexpensive webcams with powerful image-processing software like Registax. At a rather trifling expense it suddenly became possible to obtain a permanent, objective record of every lunar and planetary feature that even the most skilled visual observer could have discerned through the same instrument under the same conditions. Although drawings by visual observers still appear in the pages of this journal and other publications, they have been largely supplanted by electronic images. While the study of the Moon and planets will continue to be the traditional eyeball-to-eyepiece activity for the majority of observers, only a hopeless romantic would maintain that the visual observer has not been eclipsed by the imager as far as research and discovery.

This paper will trace the recent development and attempt to forecast the future of various types of telescopes as we enter this new era, which has called into question much of the conventional wisdom about planetary telescopes.

Refractors

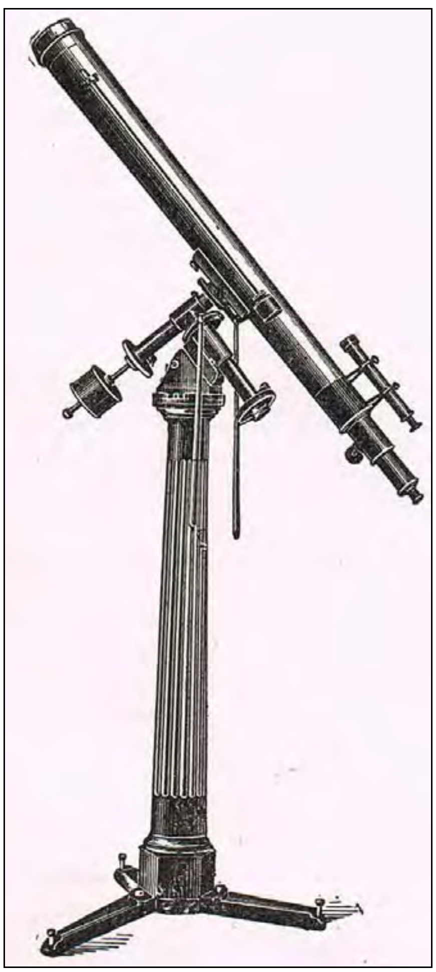
During the long epoch when the capabilities of the visual observer of the Moon and planets were unrivalled, the refractor was widely regarded as the instrument of choice. Half a century ago it was not uncommon to encounter advice like that given by Günter Roth in his authoritative **Handbook for Planet Observers**: "Roughly speaking a Newtonian or Cassegrain reflector needs to be about twice the size of a refractor giving equivalent definition… the possessor of a 4-inch refractor has at his disposal an optical system which is roughly the equivalent of an 8-inch Newtonian or Cassegrain reflector."[1]

By far the most highly touted advantage of the refractor was its lack of a central obstruction. The diffraction introduced by the secondary mirror and mechanical supports of a reflector lowers the visibility of low-contrast features. The larger the obstruction presented by the secondary mirror, the more injurious its effects on image quality.

The image of a star at high power in any well-made telescope is a diffraction pattern consisting of the so-called Airy disc surrounded by a set of several concentric, faintly luminous rings. Assuming perfect optical quality, in an unobstructed telescope like a refractor the Airy disc contains 84% of the light in the image, the remaining 16% being distributed in the rings. The brightest, innermost ring contains 7.2%. In a telescope with a central obstruction one-fifth the diameter of its clear aperture (typical for an f/8 Newtonian; most Cassegrains and catadioptrics have a central obstruction of one-third their clear aperture or more), the diffraction pattern is disrupted so that the Airy disc contains only 76% of the light in the image and the innermost ring 14%. With the extended image of a planet, which consists of a mosaic of many overlapping diffraction patterns, a continuous haze spreads across the disc and bleeds over the limb, effacing subtle, low-contrast markings at the threshold of perceptibility. (See Figure 2.)

In 1993 optical engineer William Zmek published a widely cited quantitative study of the effects of central obstructions of varying sizes on telescopic performance. He concluded:

> *The performance of a centrally obstructed telescope on low-contrast detail is the same as that of an unobstructed telescope of somewhat smaller diameter. Thus we can think in terms of an "effective diameter," smaller than the true diameter, that applies to any instrument with a*



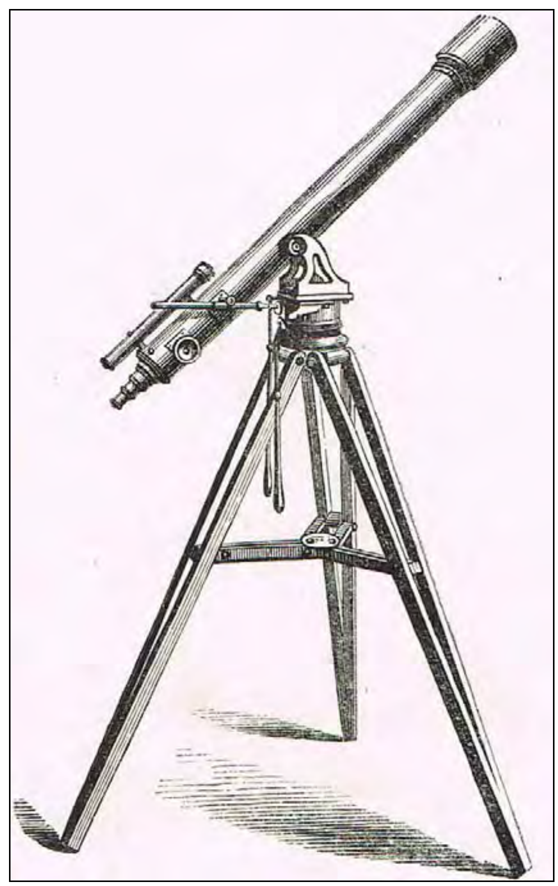


Figure 1. Commercial refractors of the mid-20th century like the 4-inch Unitron equatorial (top left) and the Tinsley "Saturn" altazimuth instruments (top right) were little changed either optically or mechanically from their late 19th century counterparts like the 4-inch equatorial by the Munich firm Reinfelder und Hertl (bottom right) or the altazimuth refractor by the firm Watson & Sons (bottom left).

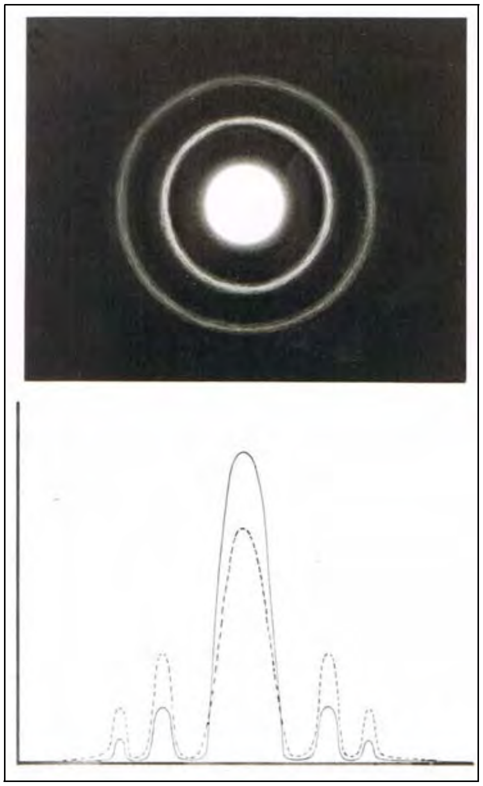


Figure 2. The distribution of light in the Airy disc and first two diffraction rings depicted graphically for an unobstructed optical system (solid line) and for a system with a 20% central obstruction.

secondary mirror... This simple rule applies:

$$D_{effective} = D_{primary} - D_{secondary}$$

Where D stands for diameter. For example, a 10-inch telescope with a 3-inch secondary mirror will perform the same on planetary detail as a 7-inch unobstructed telescope of equal quality. [2]

While Zmek conceded that the larger obstructed instrument will be handicapped by its greater sensitivity to atmospheric turbulence, his analysis dispelled a long-standing and widely held prejudice against reflectors. Nevertheless, two other factors contributed to the refractor's reputation as a superior breed of telescope — forgiving optical tolerances and ideal thermal properties.

If the two optical surfaces of a reflecting telescope are made with the same degree of precision as the four optical surfaces of a two-element refractor objective, the reflector's wavefront error will be nearly three times greater than the refractor's. Furthermore, the spherical surfaces of an objective lens are far easier to produce than the paraboloidal primary mirror of a Newtonian reflector. As Henry Paul noted in his popular 1966 work ***Telescopes for Skygazing***: "Most of the early comments on the marked superiority of refractors over reflectors were based on comparison between fine commercially made refractors against mediocre (or worse) amateur mirrors."[3]

Sealed at one end by an objective lens and by an eyepiece at the other end, the refractor is also virtually immune to the tube currents that can cripple the performance of open-tubed reflectors. Moreover, a refractor's converging light cone avoids the walls of the tube, where heat exchange induces turbulence in the adjacent air.

Despite these undeniable advantages, doublet refractors made with ordinary flint and crown optical glasses suffer from chromatic aberration that scatters *secondary spectrum* across lunar and planetary images, reducing contrast. A doublet achromatic objective brings two widely separated wavelengths of light, typically in the red and blue regions of the spectrum, to a common focus. Intermediate wavelengths in the yellow-green region of the spectrum come to focus at an appreciably shorter distance from the objective. However, the human eye is far more sensitive to yellow-green light and focuses on the image formed by those rays. Consequently, the defocused red and blue rays appear as a magenta haze that is most evident as a purple halo surrounding bright objects.

In order to keep the magnitude of this annoying color error negligible in conventional achromats, the focal ratio of the objective must be no less than three times the lens diameter measured in inches. This formula, proposed by the prolific British astronomical writer J.B. Sidgwick, yields the following f-ratios and focal lengths: 3" f/9 (27"); 4" f/12 (48"); 5" f/15 (75"); 6" f/18 (108"); 8" f/24 (192").

While sensitivity to color error varies quite markedly among individuals, very few planetary observers would find the secondary spectrum of objectives meeting Sidgwick's criterion in the least bit objectionable. Unfortunately, achromatic refractors quickly become prohibitively long with increasing aperture if they are to maintain this level of color correction. The focal length of the 40-inch Yerkes refractor would have to be an utterly impractical 400 feet!

For many years most commercial achromatic refractors featured focal ratios of about f/15 and were carried on tall, rather unwieldy mountings. As a rule of thumb, the mass of such an instrument increases in proportion to the cube of its aperture. A 4-inch f/15 refractor is quite imposing, a 5-inch f/15 approaches the limits of portability, while an 8-inch f/15 is a behemoth requiring a permanent observatory.

During the 1950s through the 1970s, equatorially mounted achromats like the prestigious Unitrons commanded prices that are truly startling when one compensates for inflation. In 1960 a 4-inch Unitron refractor equipped with a clock drive fetched the whopping sum of $785, the equivalent of almost $5,900 in 2012 dollars, while the mechanically and cosmetically inferior 4-inch refractor produced by Edmund Scientific was priced at $276.50, the equivalent of just over $2,000 today thanks to the wonders of fiat currency.

Perusing old issues of this journal reveals that over the years only a minority of ALPO contributors have used refractors, and then only rarely in apertures larger than 6 inches. During the 1950s through the 1970s modest apertures of 2.4 to 4 inches were the norm, hardly surprising given the high prices that refractors commanded.

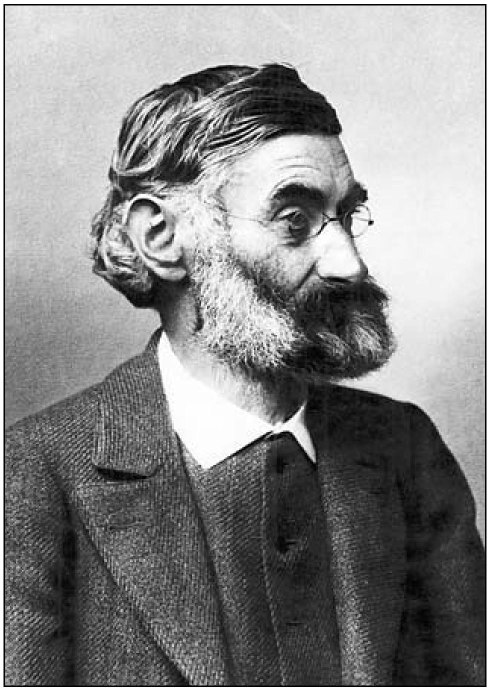


Figure 3. The first optical designer to rigorously apply sound optical theory and calculations rather than an empirical hit-or-miss approach, Ernst Abbe (1840-1905) coined the term "apochromat" to define an objective lens that brings three widely spaced wavelengths of light to a common focus and is corrected for spherical aberration and coma at two widely separated wavelengths.

During the late 1990s remarkably affordable achromatic refractors with respectable apertures but comparatively fast focal ratios appeared on the market. Manufactured in China, these popular 5-inch f/9.4 and 6-inch f/8 instruments offered unprecedented portability in a refractor, but their chromatic aberration compromised their performance on the Moon and planets. (Traditionally these focal ratios would have only been employed in "comet seekers," an application that requires a large field of good definition and is quite forgiving of color error.) This failing prompted a host of firms to offer so-called *minus violet* filters as aftermarket accessories. Employing dielectric interference films to selectively attenuate the defocused light at the extremes of the visual spectrum, early versions produced images with a pronounced yellow or yellow-green cast. However, the latest generation (notably the "semi-Apo" filter developed by Baader Planetarium in Germany) is remarkably neutral and preserves the color information in the image, albeit at the cost of a perceptible decrease in image brightness. This technology has a bright future and promises to maintain the popularity of compact, inexpensive achromats with planetary observers.

As early as 1881 the famous German optical designer Ernst Abbe took advantage of the unusual dispersion properties of fluorspar (calcium fluoride or fluorite).[4] By employing a fluorite element in a doublet microscope objective, Abbe achieved *apochromatic* performance -- essentially complete freedom from chromatic aberration. However, only small crystals of natural fluorite were obtainable, so there was no possibility of making fluorite apochromat telescope objectives until the technology of growing large artificial crystals of fluorite was developed during the Second World War.

The first commercial fluorite apochromat refractors were produced by the Japanese firm Takahashi Seiko working in close collaboration with the Canon Corporation, which was growing sizable artificial fluorite crystals for their line of single lens reflex camera lenses. By 1981 Takahashi was offering doublet fluorite apochromats as large 5 inches in aperture. Essentially perfect color correction in a truly portable refractor only half as long as a conventional doublet achromat was now available, albeit at a hefty price tag.

Despite its highly desirable optical properties, fluorite is a brittle, shock-sensitive crystal rather than an amorphous material like glass. It is also soft and difficult to work using conventional optical fabrication techniques. The real revolution in apochromat refractor design occurred in the late 1970s and early 1980s with the introduction of oil-spaced triplet objective lenses made with glass rather than fluorite elements.

The first apochromatic refractors, designed by H. Dennis Taylor of the Cooke and Sons firm of York, England, were produced as early as the mid-1890s. Taylor's air-spaced triplets were soon mimicked by the Carl Zeiss firm in Germany. All of these designs were extremely sensitive to the slightest error in the squaring on and centering of each lens element. Adding insult to injury, some employed unstable glasses that slowly devitrified and grew cloudy. In apertures greater than six inches or so, the steep curves of the lens elements combined with the comparatively high thermal coefficients of their substrates introduced considerable spherical aberration in rapidly falling evening temperatures. Consequently, for many decades apochromatic refractors remained rather small, delicate, expensive curiosities. During the mid-1960s, Henry Paul sensibly characterized apochromats as "wonderful instruments indeed when in perfect adjustment," but "primarily in a class for millionaires and ultra-fastidious individuals."[5] (See Figure 4.)

In 1977 Wolfgang Busch published the design of a novel series of triplet apochromat refractor objectives with three elements having equal but opposite internal curves, separated by a vanishingly thin layer of oil retained by capillary action.[6] It is not necessary to accurately figure the four oiled interior surfaces of such a lens since they

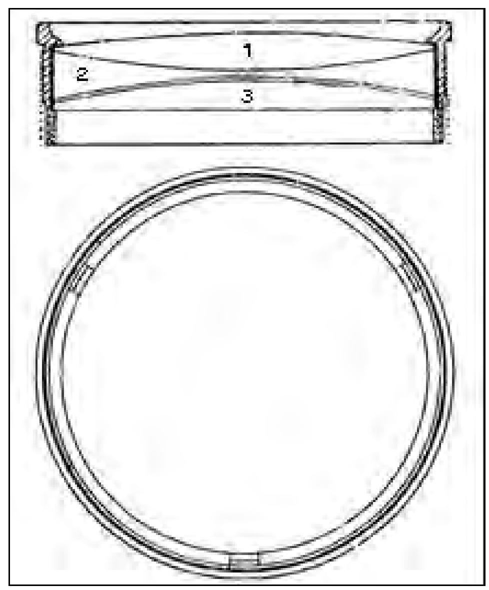


Figure 4. Designed by H. Dennis Taylor (1862-1943), the Cooke triplet employed three different types of glass. The biconvex forward element (1 in the diagram), made from a light barium flint glass, was separated by a narrow air space from the biconcave second element (2 in the diagram), made from a borosilicate flint glass. The third element, made from a light silicate crown glass, was separated by a wider air space

contribute virtually nothing to the wavefront error of the objective. Moreover, oiling eliminates the extreme sensitivity to tilt and decentering errors that plagued the old Cooke and Zeiss triplets.

During the early 1980s, Roland Christen employed Busch's oil-spacing technique when he designed a series of triplet objectives derived from Taylor's designs using state-of-the-art optical glasses that permitted virtually perfect color correction at focal ratios as fast as f/7.[7] Christen sealed the edges of these objectives using a pressure-sensitive polyimide tape called Kapton. Their sensational performance made the refractors produced by his AstroPhysics firm among the world's most coveted -- and imitated -- telescopes. (See Figure 5.)

Sub-aperture chromatic aberration correctors employing exotic glasses like the Chromacor introduced by the Ukrainian firm Aries Optics a decade ago offer apochromatic levels of color correction over a narrow field when retrofitted close to the focal plane of conventional achromats. However, these accessories have commanded prices rivaling those of the telescopes themselves and have not enjoyed commercial success commensurate with their excellent performance. The concept has been recently revived by Istar Optics, who will soon introduce an affordable version called Raycorr.

The fluorocrown glasses that mimic the dispersion properties of fluorite (commonly referred to as "extra-low dispersion" or "ED" glasses) developed by Schott in Germany and Ohara in Japan have become increasingly affordable and are now incorporated in compact doublet apochromats manufactured in China. The author recently acquired a 4-inch f/9 ED doublet refractor that retailed for less than $600, complete with a fitted aluminum carrying case and 8x50mm finder. Its color correction is discernibly superior to the finest 4-inch f/15 achromat, yet its tube is no longer than the 60mm f/15 department store refractors of my youth.

In apertures up to six or perhaps seven inches, the apochromatic refractor will no doubt reign supreme in coming years as the most desirable telescopes for the visual observer of the Moon and planets. High-resolution imagers, however, will never be satisfied with the capabilities of such modest apertures, and will continue to employ reflectors or catadioptric telescopes, the subjects of the second half of this paper.

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1 Gunter Roth, ***Handbook for Planet Observers***, (London, Faber & Faber, 1970), pp. 18-20.

2 William Zmek, "Rules of Thumb for Planetary Telescopes – I" ***Sky & Telescope***, July 1993, pp. 91-95.

3 Henry Paul, ***Telescopes for Skygazing*** (New York: Amphoto, 1966), p. 120.

4 An excellent history of the development of the apochromat by the Roger Ceragioli is available on the web at *http://rohr.aiax.de/chapter%204a.htm*

5 Henry Paul, ***Telescopes for Skygazing*** (New York: Amphoto, 1966), p. 120.

6 Wolfgang Busch, "Astropraxis" ***Sterne und Weltraum***, October 1977, pp. 338-341.

7 Roland Christen, "An Apochromatic Triplet Objective" ***Sky and Telescope***, October 1981, pp. 376-380; "Revised Triplet Design" ***Sky and Telescope***, April 1982, pp. 411-412, and "Design and Construction of a Super Planetary Telescope Objective" ***Telescope Making*** 28, Fall 1986, pp. 20-23.

Figure 5. The image of Roland Christen standing beside a remarkably compact AstroPhysics 155mm f/7 apochromatic triplet refractor of recent vintage at left makes for a striking contrast with the gargantuan 1964 vintage 6-inch Unitron achromatic refractor at right. The end of the achromat's dewcap towered to a height of 14 feet above the base of its pier.

Feature Story:
A Report on the Annular Eclipse of May 20, 2012

By Dr. Mike D. Reynolds
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The highly-anticipated 20 May 2012 annular eclipse was widely viewed throughout the western United States, with many areas experiencing excellent weather, a lot of public interest, and numerous photographs / images, videos, and general observations.

Many photographs and reports were sent to popular astronomical magazines like *Astronomy* and *Sky & Telescope*. At one particular location in the Albuquerque, New Mexico, area, it was reported that over 5,000 persons turned out to view the eclipse. However, at the time of preparation of this report, only seven ALPO members submitted five reports – including this section coordinator and author of this report.

Observations submitted are listed in the table later in this article, including the location, type of observation or observations, equipment used, and other notes.

Numerous observations of contacts and contact timings, sunspot timings, and Baily's beads were submitted by observers. Baily's beads were prominent, even to those observers not located on the eclipse limits. Reynolds noted extremely clear, dry, and steady skies at Page, Arizona, which easily allowed for visual observations of the lunar limb profile throughout the eclipse with observing with a Daystar Helium III solar filter.

Figure 1. Annular eclipse in progress as imaged by John Westfall on May20, 2012, from a location near Willows, CA (Lat. 39°31'28"N, Long. 122°11'37"W).

Figure 2. Composite of video of Second Contact by John Westfall showing formation of Baily's Beads at the southern limit.

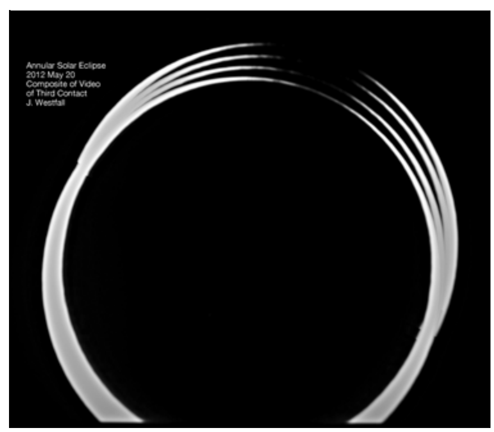
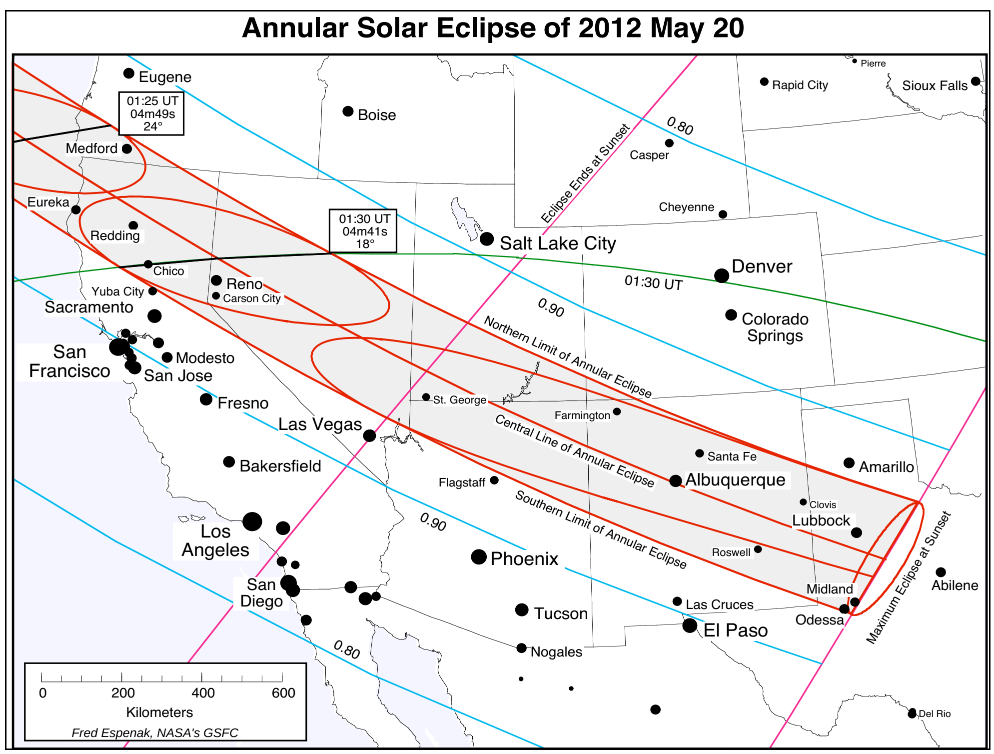


Figure 3. Composite of video of Third Contact by John Westfall showing formation of Baily's Beads at the southern limit.

Figure 4. Annular eclipse in progress at sunset as imaged on May 20, 2012 by Mike Reynolds at Page, Arizona (Lat. 36°54’51” N, Long. 111°27’35”W). 80mm (3-inch) Explore Scientific APO, Canon EOS 20Da DSLR, ½, 500-second exposure at Prime Focus. Photoshop: unsharp masking

Figure 6. Third Contact as imaged on May 20, 2012, by Mike Reynolds at Page, AZ. 103mm (4-inch) Explore Scientific APO, Canon EOS 5D Mark II CMOS, DSLR. $^{1}/_{1,000}$-second exposure at Prime Focus. Photoshop: unsharp masking

Figure 5. ALPO members Dolores and Rik Hill observing and imaging the Annular Eclipse near Petrogylphs National Monument, NM (Lat. 35°8’9”N, Long. 106°45’43”W).



Observer Location	Observations Made	Equipment	Notes
Aguirre, Salvador Grand Canyon National Park South Rim, AZ	Partial and central eclipse video	Celestron Firstscope with a Baader full aperture solar filter, Orion StarShoot Video Eyepiece and Canon MiniDV Camcorder	See video on YouTube; below
http://www.youtube.com/watch?v=v3q174sXl3Q&list=UUU6Cxkf4nAU_k6DouYw6NKw&index=1&feature=plcp			
Hays, Robert Approximately 4 km miles south of Atkinson, NE	Partial eclipse, contact timings	1. 80 mm refractor with a Thousand Oaks solar filter 2. Celestron C5 with a Thousand Oaks solar filter	Partial eclipse observed; magnitude of approximately 75%
Hill, Rik Hill, Dolores Albuquerque, NM; Near Petrogylphs National Monument	Partial and central eclipse imaging and general observations	1. Questar with a Thousand Oaks full-aperture solar filter 2. Canon Rebel with a 500mm lens and a Baader solar filter	Some 500 images converted to video
Reynolds, Mike Reynolds, Debbie Page, AZ	Partial and central eclipse imaging, general observations, and timings	1. 80mm Explore Scientific APO with a Thousand Oaks full-aperture solar filter (visual and photographic – at sunset) 2. 103mm Explore Scientific APO-Canon EOS 5D Mark II (imaging only) 3. 80mm Daystar SolarREDi 0.5Å H-α (visual only) 4. Coronado 7x50 White Light Solar binoculars (visual only)	*Excellent conditions; visual observations also made in H-α and He III (Daystar Solar Telescopes)*
Westfall, John Westfall, Beth 7.6 km north of Willows, CA	Partial and central eclipse, Southern Limit Baily's Beads Observations, imaging	1. Sanyo digital video camcorder DCR-VX2000 (6-72 mm FL w/ 5X telextender) 2. 127X1270mm f/10 Schmidt-Cassegrain (SCT) w/Thousand Oaks full-aperture solar filter (photographic only) 3. 40X400mm f/10 PST 1-Å H-α telescope at 16X (visual only)	Intermittent clouds; had to change observing site planned from Northern limit to Southern limit

Feature Story:
A Wind On The Hill

By Raymond G Rienks,
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Member-at-large, the Astronomical League
Contributing astronomer, the Royal Observatory of Belgium, Solar Influences Data Center
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An amateur astronomer's workroom is the weather. When it is benign, work proceeds, but when it is boisterous, well, some patience and optimism may be necessary.

Saturday the 15th was the scheduled date for the Oregon Trail Interpretive Center's (OTIC) annual event entitled "Starry Night 2012." The solar observing program offered views of our Sun little diminished by a persistent haze and enhanced by the presence of two major sunspot groups. Three telescopes, each with a different purpose, made it possible to gain a comprehensive perspective of the activity that powers our solar system's central star. A large number of visitors enjoyed views seen only by solar observers and researchers. As well as the spots on the Sun's disc, a large prominence was noted on the limb (or edge) of the disc. What could it mean?

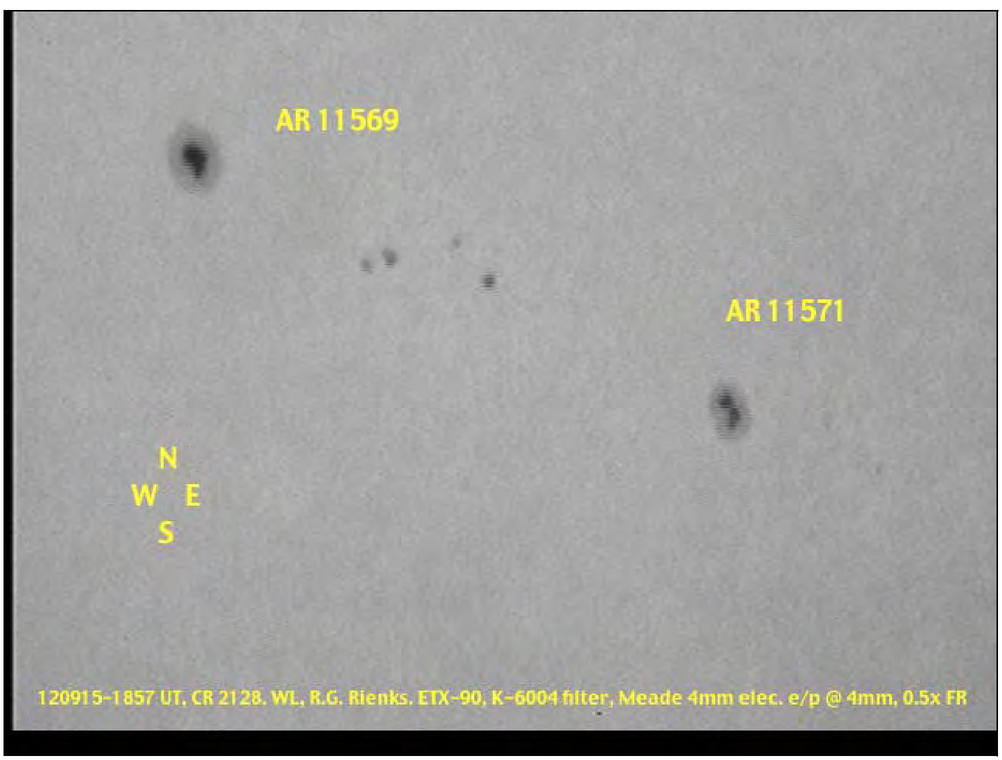
Early evening found the OTIC staff and our resident astronomers gathering to search for stars as heavy, broken clouds crossed from west to east in the clutch of strong winds. Sign boards and traffic barricades went down and the telescopes stayed tucked away, safe in their cases. Swirling haze gathered in the valley below as the light faded in the east. To the west, the mountains sat in silhouette against a ruddy band that gave no promise of clear skies.

Still, we work the skies we are given. With optimism, we began setting out the mounts and heavier objects. ***Those that wouldn't run before the wind.*** Darkness crept in stealthily and amenities and equipment were moved to our observing area. The wind finally diminished and the first telescopes emerged from their protective cocoons, seeming to blink in the odd light. Breaks in the clouds now offered tantalizing glimpses of a star here, another there.

Debate began over which star we saw, as one appeared only to be hidden just as quickly. Further east, another popped into view then slid behind the clouds. A visiting astronomer produced his Celestron Sky Scout (90 mm personal planetarium device), demonstrating its prowess by quickly identifying any star that remained in view for a few seconds. One member of the group of observers had correctly identified two of the isolated stars and was given the title of "champion star guesser."

The wind dropped off, the clouds thinned and faded, and darkness wrapped the hill. A few red lights came on near the telescopes as final adjustments were made. Soon, relative silence settled in, broken by the occasional comment on objects seen or sought. OTIC distributed star charts for the observer's to use in locating or identifying objects coming to view. Haze in the valley faded and with it, the light pollution generated by the city. Stars became sharp points of light and the Milky Way lay across the sky — a blanket aglow with the light from billions of stars. We gazed towards galaxy central, identified constellations, observed colorful double stars, found faint nebulae and had a wonderful evening. Just before the session ended, Jupiter rose in the east, showing four of its moons and glimpses of its equatorial bands through the turbulent air above the horizon. It was 11 p.m., time to go home.

Thank you skies above Baker, and especially thank you to the staff, our friends, at the National Historic Oregon Trail Interpretive Center, Baker City, Oregon. Let's do this again, and soon.



Feature Story

ALPO Observations of Mercury During the 2011 Apparitions

By Frank J Melillo, coordinator, ALPO Mercury Section
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Abstract

There were seven apparitions of Mercury in 2011. There were only six observers, who used apertures from 6.6 to 35.5 centimeters (2.5 to 14 inches). They submitted 22 drawings and 6 webcam images for a total of 28 observations. The features that they detected show good correlation with the images from the MESSENGER flybys and the 1971 albedo chart prepared by Murray, Smith and Dollfus that was adopted officially by the IAU (Murray, Smith, and Dollfus, 1972.). [Editor's Note: Because the Murray, Smith and Dollfus Mercury map was not available with north at the top for this paper, a map of Mercury with north at the top by Mario Frassati is included at the end of this paper.]

Introduction

There were three evening and four morning apparitions during 2011 (Table 1.) Observation reports were received for each of them except the first. This paper describes the ALPO observations made during these apparitions.

Though all contributors submitted high quality observations of Mercury, there were fewer observers than in previous years, and fewer observations (Table 2; see Melillo, 2009b, 2010b, 2011a, 2011b). Most of the submissions were drawings rather than webcam images. The drawings can be considered to be the more important part of the work because they portray the actual appearance of the planet. Furthermore, by drawing, an observer hones his perspicacity through the eyepiece. Still, the webcam images provide more accurate information and can verify the visual work.

Carl Roussell made a great number of contributions to the ALPO Mercury Section. All 10 of his drawings are skillful and quite accurate. Meanwhile, a new observer, Aron Kiss, made more contributions than any other observer, submitting a total of 12 excellent drawings. John Boudreau contributed only three webcam images, but they are of superb quality and correspond well with MESSENGER images. Previous ALPO Mercury Section observation reports have emphasized this good correspondence between the MESSENGER images and those of ALPO observers such as Boudreau, Lomelli, and Roussell (Melillo, 2009a, 2010a). No other ground-based observations, including those by professional astronomers, have ever captured so much detail as Boudreau's images.

In March 2011, the MESSENGER probe finally entered orbit around Mercury after 6½ years of preparatory loops around the Sun. The spacecraft has taken hundreds of images with the highest-ever resolution of surface features, as well as revealing the parts of the planet that have never before been imaged by spacecraft. Its regular mission in orbit was planned to last one Earth-year, but NASA will extend the mission through the rest of 2012 and part of 2013. We can expect to see many more discoveries on Mercury.

Apparition 1: Morning, (2010) 19 December – 25 February

After inferior conjunction with the Sun on 19 December of 2010, Mercury became a morning object. It was winter in Earth's northern hemisphere, and no reports were received for this apparition. It ended with superior conjunction on 25 February.

Apparition 2: Evening, 25 February – 9 April

Mercury became an evening object after 25 February and it made the finest

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).

Table 1: Characteristics of the Apparitions of Mercury in 2011 (all dates UT)

Number and Type	Beginning Conjunction*	Greatest Elongation	Final Conjunction*	Aphelion	Perihelion
1. Morning	19 Dec (2010) (i)	9 Jan	25 Feb (s)	31 Jan	
2. Evening	25 Feb (s)	23 Mar	9 Apr (i)		16 Mar
3. Morning	9 Apr (i)	7 May	12 Jun (s)	29 Apr	12 Jun
4. Evening	12 Jun (s)	20 Jul	17 Aug (i)	26 Jul	
5. Morning	17 Aug (i)	03 Sept	29 Sept (s)		08 Sept
6. Evening	29 Sept (s)	14 Nov	04 Dec (i)	22 Oct	
7. Morning	04 Dec (i)	23 Dec	07 Feb (2012) (s)		05 Dec

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

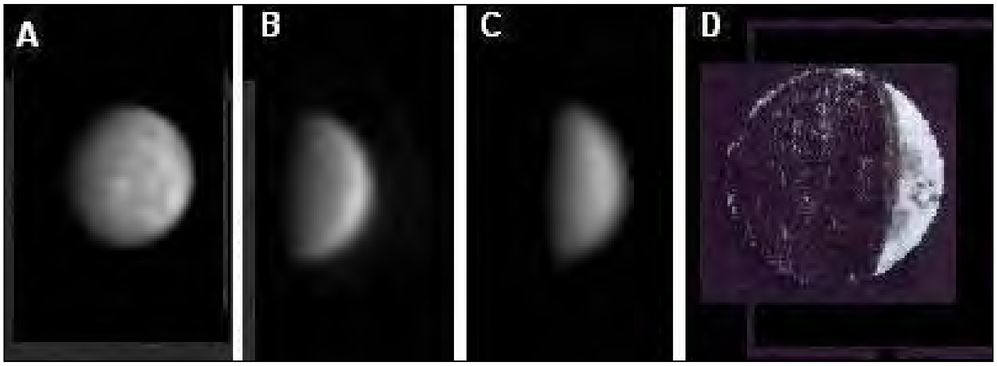

Figure 1. Three images and one drawing of Mercury during Apparition 2. In these and all other figures, celestial north is up and planetary east (celestial west) is to the right.
A. Image by John Boudreau, 08 Mar 2011, 21:18 UT, CM = 033°.
B. Image by David Arditti, 19 Mar 2011, 16:56UT, CM = 081°.
C. Image by Maurizio Morini, 20 Mar 2011, 18:18 UT, CM = 086°.
D. Drawing by Carl Roussell, 29 Mar 2011, 00:08 UT, CM = 131°.

showing of the year. Four observers provided one observation each. See Figure 1.

John Boudreau started the year's observations with his first webcam image on 8 March (CM 033°). His image shows the surface details quite well. Several rayed craters are seen as white spots, including Kuiper to the lower left (southwest) of center. This image is remarkable for an evening apparition, in which the seeing is usually poor. The image was taken in the late afternoon local time with the Sun low in the west and Mercury above it. Later in the month, David Arditti made a webcam image (19 March, CM 081°) when Mercury displayed slightly more than half-phase. It showed some surface details. The next day (20 March, CM 086°), Maurizio Morini made a webcam image showing a half-phase with no details. Carl Roussell made the apparition's final observation on 29 March (CM 131°), showing a crescent phase with some markings on the disk. The depicted markings are hard to associate clearly with known surface features. This evening apparition ended as Mercury went through inferior conjunction on 9 April.

Apparition 3: Morning, 9 April – 12 June

This morning apparition lasted just over two months, from 9 April to 12 June. It was a rather poor showing as seen from the northern hemisphere, but nevertheless two northern observers studied Mercury. See Figure 2.

John Sussenbach made a fine webcam image on 2 June (CM 137°), showing a well defined, gibbous disk. The image displays some details, but it is hard to judge what surface features they represent. Carl Roussell made drawings on 2 June (CM 138°), 5 June (CM 152°) and 6 June (CM 155°). His 2 June drawing was nearly simultaneous with the imaging by Sussenbach. Though the two observations show the same gibbous phase, there was little concordance of the details on the disk. Roussell's drawings indicated a longitudinal band in the north and a partial longitudinal band in the south. These appear to correspond to Solitudo Neptuni in the north and Solitudos Helii and Jovis in the south. Mercury ended the morning apparition at superior conjunction with the Sun on 12 June.

Apparition 4: Evening, 12 June – 17 August

Mercury made a mediocre apparition in the evening. Unfortunately, only one observation was received. See Figure 3.

Carl Roussell made a fine drawing on 29 June (CM 250°). It showed two faint, partial, dark bands, one in the north and one in the south. One cannot be certain what they represent but Solitudos Criophori (north) and Atlantis (south) are good possibilities. Mercury went through inferior conjunction on 17 August.

Table 2: ALPO Observers of Mercury in 2011

Observer	Location	Instrument*	Observation** Number & Type	ApparitionObserved
David Arditti	Edgware, Middlesex, UK	35.5 cm SCT	1 W	2
John Boudreau	Suagus, MA, USA	27.5 cm SCT	3 W	2, 5
Aron K Kiss	Vac, Hungary	9 cm RR 6.6 cm RR	12 D	5, 7
Maurizio Morini	Italy	25 cm RL	1 W	2
John Sussenbach	Houten, The Netherlands	25.4 cm SCT	1 W	3
Carl Roussell	Hamilton, Ontario, CA	15 cm RL	10 D	2, 3, 4, 5, 6

* RL = reflector, RR = refractor, SCT = Schmidt-Cassegrain
** W = Webcam lucky imaging, D = drawing

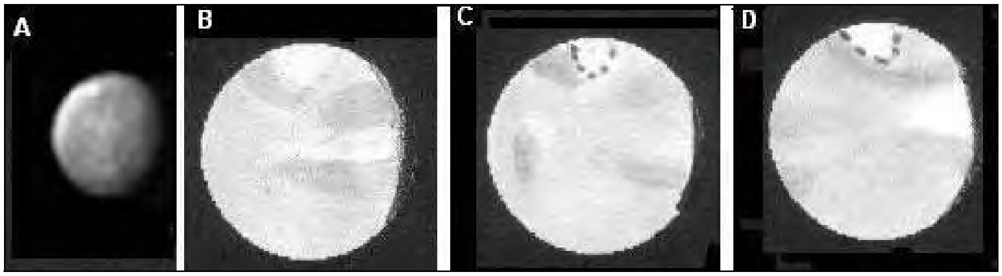

Figure 2. One image and three drawings of Mercury during Apparition 3.
A. Image by John Boudreau, 02 Jun 2011, 07:05 UT, CM = 137°.
B. Drawing by Carl Roussell, 02 Jun 2011, 14:27 UT, CM = 138°.
C. Drawing by Carl Roussell, 05 Jun 2011, 20:56 UT, CM = 152°.
D. Drawing by Carl Roussell, 06 Jun 2011, 14:20 UT, CM = 155°.

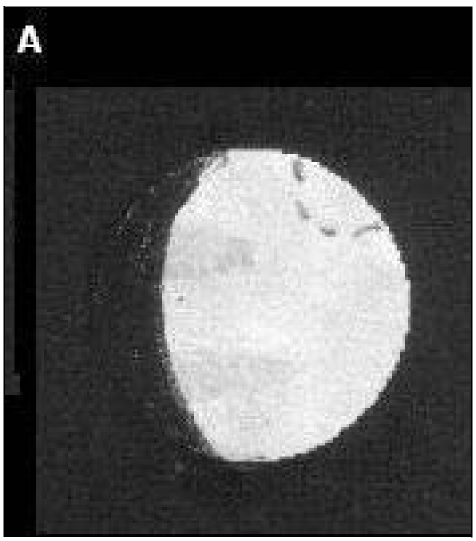

Figure 3. Drawing of Mercury during Apparition 4 by Carl Roussell, 29 Jun 2011, 21:12 UT, CM = 250°

Apparition 5: Morning, 17 August – 29 September

After inferior conjunction on 17 August, Mercury became a morning object, and it was rather favorably seen from the northern hemisphere. This was the most interesting apparition of the year, and three people contributed observations. See Figure 4.

John Boudreau imaged Mercury on 31 August (CM 250°), showing the crescent phase. The surface is seen quite clearly with the dark Solitudo Aphrodites appearing slightly north of center. Aron Kiss, a new contributor, made some excellent drawings from 3 Sept to 13 Sept (CM 264° to CM 311°). His observations consistently depict a dark albedo feature near the terminator. This may have been either Solitude Criophori or Solitudo Aphrodites near the equator, but the interpretation is uncertain. Meanwhile on 13 September (CM 313°), Boudreau made the most interesting observation of the year. Under excellent seeing, he was able to obtain high resolution. The surface features in his image can be matched easily to those in the MESSENGER images. A number of rayed craters are easily identified including the Kuiper crater near the limb, while the dark region Solitudo Aphrodites is seen remarkably well. As I have stated in previous ALPO Mercury Section reports since 2001, Solitudo Aphrodites is the most recognized feature that can be seen from Earth, and it is the darkest feature on the planet (Melillo, 2008).

Kiss made his last drawing on 17 September (CM 328°). This time, he drew a bright region near the center, where the rayed craters are located. Evidently, these craters can be detected visually, their light mingled together as a single bright area. Carl Roussell made the last two drawings of the apparition on 20 September and 22 September (CM 343° and CM 351°, respectively). Each of his observations shows a central bright area demarcated by a dotted line, which may be the rayed craters. Mercury ended the morning apparition on 29 September.

Apparition 6: Evening, 29 September - 4 December

This evening apparition was not favorable for those observing from the Earth's northern hemisphere, as the planet was so low in the southwestern sky at dusk. Nevertheless, Carl Roussell was able to observe on three days. See Figure 5.

On 8 and 9 October (CM 062° and 067°, respectively), Roussell drew Mercury in a nearly full phase. Conspicuous on his 9 October drawing are two dark features near the terminator, one on each side of the equator. They may be Solitudo Lycaonis in the north and Solitudo Martis in the south, which are the most prominent features known on this part of the surface. A final drawing for the evening apparition was made on 6 November (CM 197°). Caloris was drawn as a bright region near the upper right side of the disk. Mercury went through inferior conjunction with the Sun on 4 December.

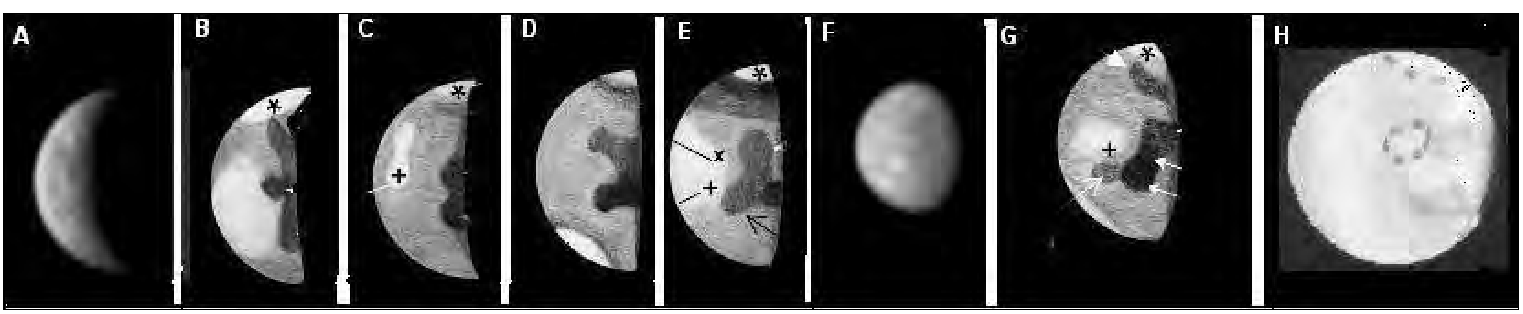

Figure 4. Two images and four drawings Mercury during of Apparition 5.
A. Image by John Boudreau, 31 Aug 2011, 12:14 UT, CM = 250°.
B. Drawing by Aron Kiss, 03 Sept 2011, 03:55 UT, CM = 264°.
C. Drawing by Aron Kiss, 05 Sept 2011, 03:50 UT, CM = 274°.
D. Drawing by Aron Kiss, 10 Sept 2011, 04:13 UT, CM = 298°.
E. Drawing by Aron Kiss, 13 Sept 2011, 04:30 UT, CM = 311°.
F. Image by John Boudreau, 13 Sept 2011, 12:49 UT, CM = 313°.
G. Drawing by Aron Kiss, 17 Sept 2011, 04:15 UT, CM = 328°.
H. Drawing by Carl Roussell, 20 Sept 2011, 13:47 UT, CM = 343°.

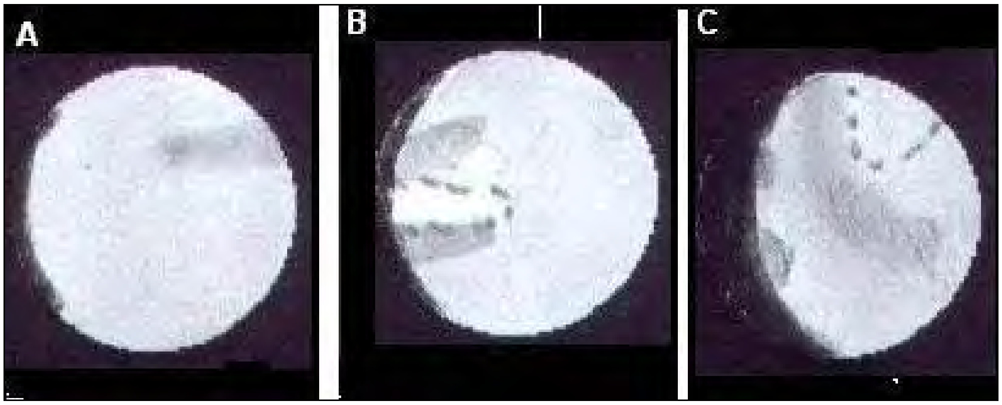

Figure 5. Three drawings of Mercury during Apparition 6.
A. Drawing by Carl Roussell, 08 Oct 2011, 17:10 UT, CM = 062°.
B. Drawing by Carl Roussell, 09 Oct 2011, 18:50 UT, CM = 067°.
C. Drawing by Carl Roussell, 06 Nov 2011, 17:48 UT, CM = 197°.

Apparition 7: Morning, 4 December – 7 February (2012)

Mercury made a moderately favorable apparition in the morning sky for Earth's northern hemisphere viewers. With his four drawings, Aron Kiss was the only contributor during this apparition. See Figure 6.

His first drawing was on 16 December (CM 082°). Though the identification of the dark markings is uncertain, they seem to be Solitudo Lycaonis in the middle and Solitudo Martis on the south side near the terminator. On 18 December (CM 093°), Kiss drew features near the terminator similar to those he had depicted two days previously. His drawing of 25 December (CM 129°) might show the bright area Phaethontias near the center of the disk. It is not clear whether the two dark features near the terminator are the same features that he drew on 16 and 18 December. His last drawing (07 January of 2012, CM 192°) shows a very large bright area near the center. Caloris, which is a large, bright basin, was to the north of center and may not correspond to bright area he depicted. Mercury went through superior conjunction on 07 February, 2012.

A Brief Note on Observing Mercury

Mercury's reputation as the most difficult planet to observe is related to its proximity to the Sun. In bright morning or evening twilight, it is often difficult to find at all. Binoculars are a great help, revealing Mercury as a rosy star against the bright background sky. Although a small telescope will show its phases, so that it resembles a small version of the Moon, the seeing is usually poor due to the long visual path through Earth's atmosphere. Furthermore, the chromatic dispersion is prominent, stretching the image into a short rainbow.

While the use of a color filter will solve the problem of chromatic dispersion, the problem of poor seeing is best solved by observing Mercury in the daytime, when it is high in the sky. Care and planning are needed in order to safely point one's telescope so close to the Sun, but many observers have done so with great success. Note that John Boudreau's fine image of 8 March, 2011, was made in broad daylight (Figure 1, panel A.) To decrease your scope's tube currents, try using a large object, a building or a screen to block the Sun's direct rays onto the telescope. Use an orange or red filter to darken the blue background and thereby increase the contrast. Mercury has a high surface brightness so it tolerates high magnification well. With some practice, you too can detect not just the phase, but some dark markings and bright regions on the disk. Mercury will reveal its secrets to you when you know how to find them!

This author is eager to correspond with observers who are working on their techniques of observing this tiny but fascinating planet.

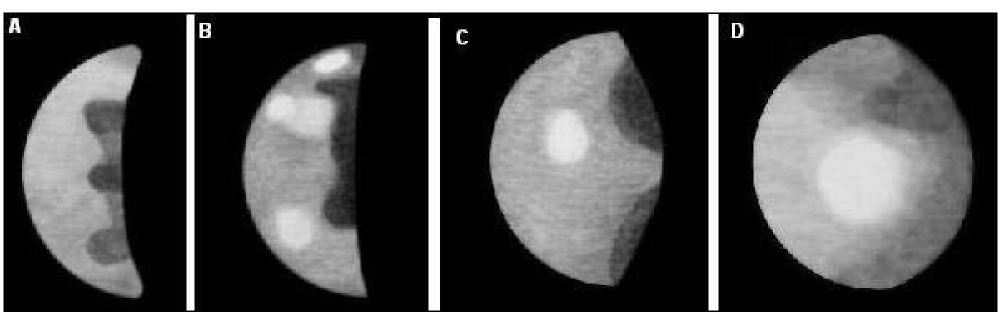

Figure 6. Four drawings of Mercury during Apparition 7.
A. Drawing by Aron Kiss, 16 Dec 2011, 06:50 UT, CM = 082°.
B. Drawing by Aron Kiss, 18 Dec 2011, 06:07 UT, CM = 093°.
C. Drawing by Aron Kiss, 25 Dec 2011, 05:47 UT, CM = 129°.
D. Drawing by Aron Kiss, 07 Jan 2012, 06:10 UT, CM = 192°.

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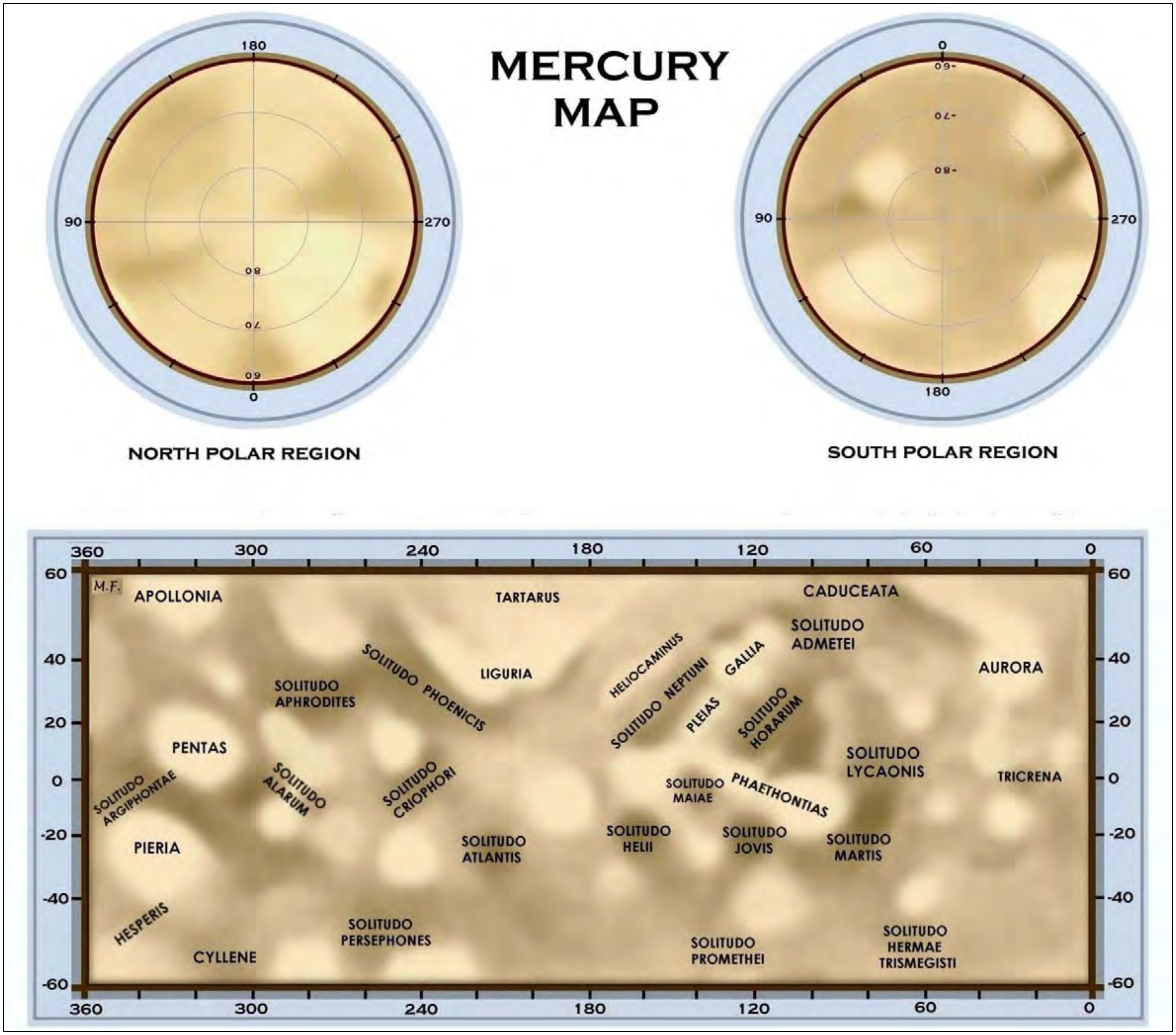

Map of the regolith albedo of Mercury based on 144 visual studies by Mario Frassati at Crescentino (VC), Piedmont, Italy, between January 1997 and January 2006 with a 203mm catadioptric telescope, 250x -400x. (Annotated with IAU nomenclature and used with permission of M. Frassati.

ALPO MERCURY SECTION

NAME______________________________

ADDRESS___________________________

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APPARITION:
Morning_____
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ARC SECONDS____"
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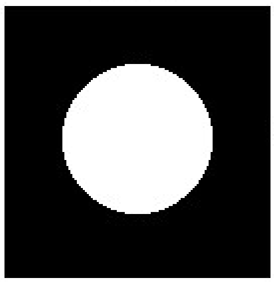
_____° from the sun

For Coordinator Only:

Sketch

NORTH



WEST

Central Meridian Longitude______°

DATE____________________
TIME (UT)_______________
Telescope___________________________
Magnification________________________
Filter(s)____________________________
Seeing (10-best/1-worst)______________
Visual Description:

Photo or CCD

DATE:_____________
TIME (UT):__________

Image 1

Central Meridian Longitude______°

Telescope:______________________
Camera Type:____________________
Exposure:_______________________
f/ratio:________________________
Filter:_________________________

Comments:

Date:________________
TIME (UT):___________

Image 2

Central Meridian Longitude______°

Telescope_______________________
Camera Type_____________________
Exposure________________________
f/ratio_________________________
Filter__________________________

Comments:

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

E-mail for questions, special observations and alerts: frankj12@aol.com

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

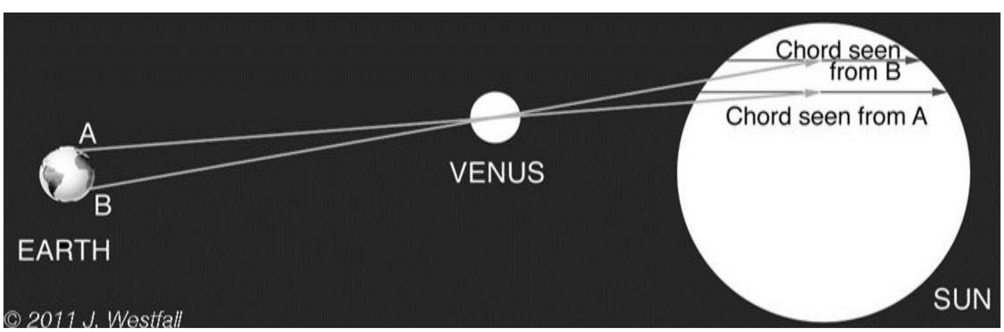

Fig. 1. Halley's method for determining the Earth-Sun distance by observing the transit of Venus across the face of the Sun. Chords across the Sun from two stations, A and B, widely separated by latitudes within the zone from which the entire transit is visible, traverse chords of different lengths (and 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

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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

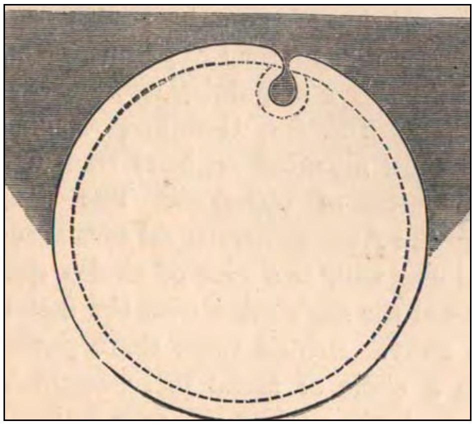

Fig. 2. Explanation of the origin of the black drop effect. A bright area seen in juxtaposition to a dark area will appear to bleed into the dark area. In the case of Venus in transit, this causes the apparent disk of Venus on the Sun to appear smaller than the real disk, while the apparent limb of the 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.

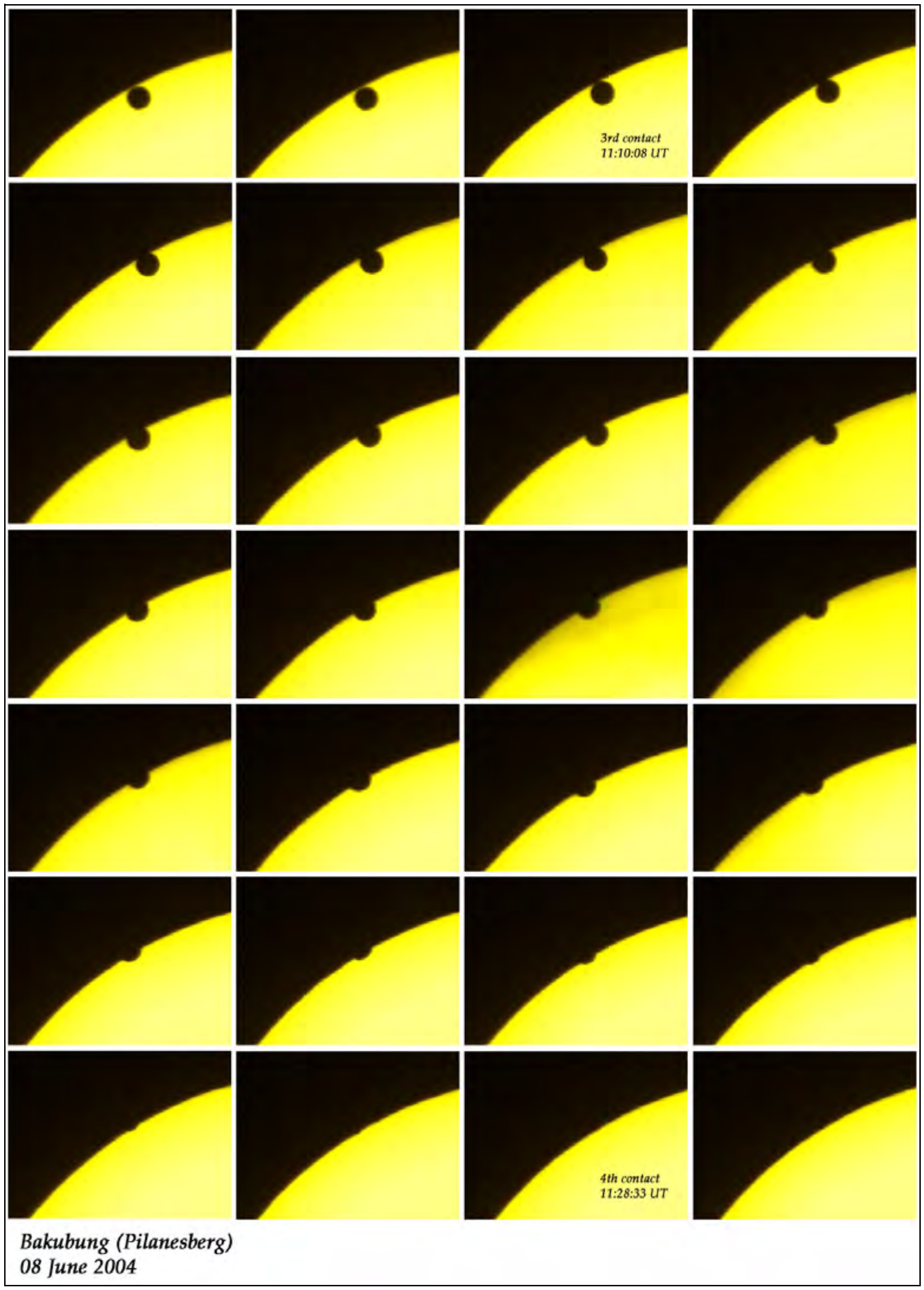

Fig. 4. A series of CCD images by Bert van Winsen showing conacts III and IV at the June 8, 2004 transit of Venus; courtesy Daniel Fischer.

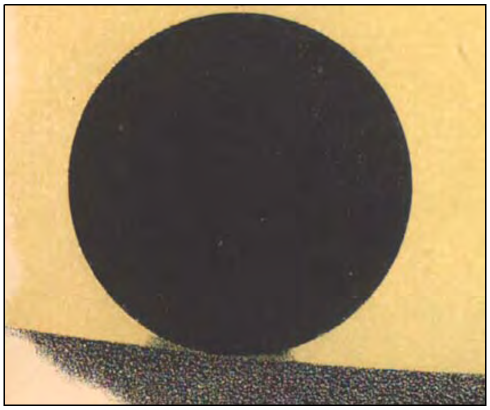

Fig. 5. The black drop (or shading) at Contact III during the transit of Venus, December 9, 1874, as observed by H.C. Russell with the 11½-inch refractor of the Government Observatory in Sydney, New South Wales. Note the instrument was stopped down to 5 inches. From Sydney Observatory, *Observations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

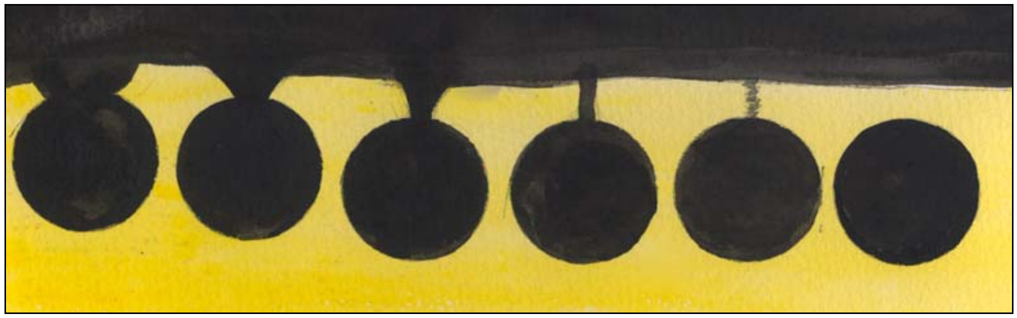

Fig. 6. Black drop sequence by William Sheehan at Lowell Observatory at the June 5, 2012 transit, observed visually with a C-11 equipped with a 3-inch filter aperture.

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

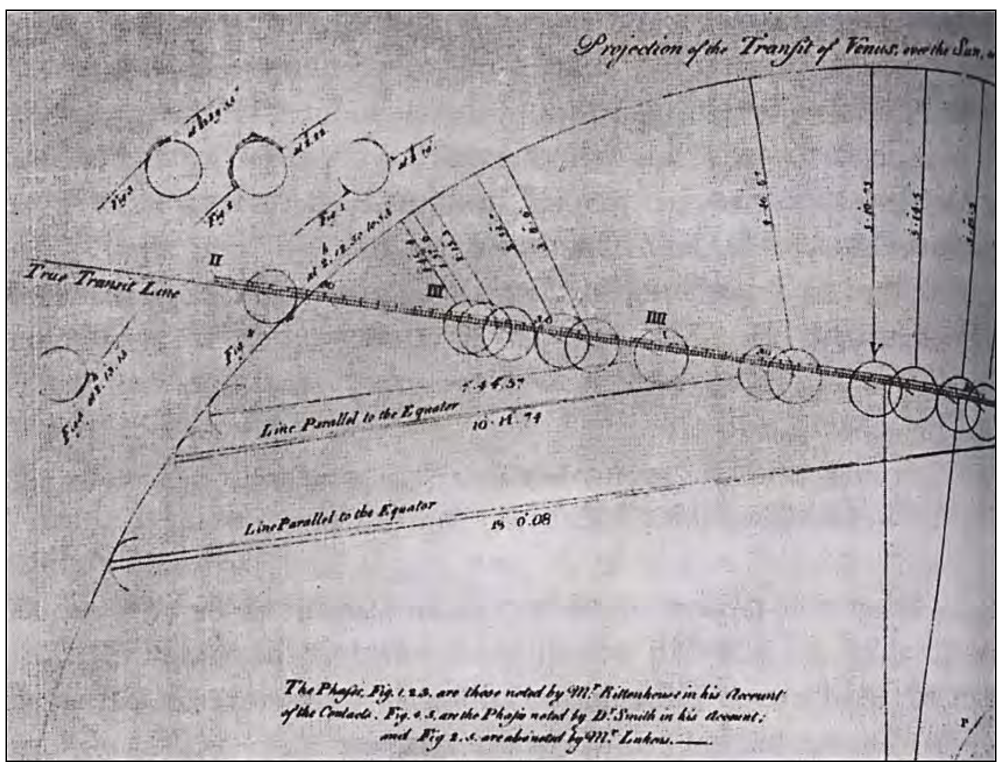

Fig. 7. David Rittenhouse's sketches showing the aureole at the 1769 transit of Venus. From Brooke Hindle, David Rittenhouse. Princeton, New Jersey: Princeton University Press, 1964.

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.)

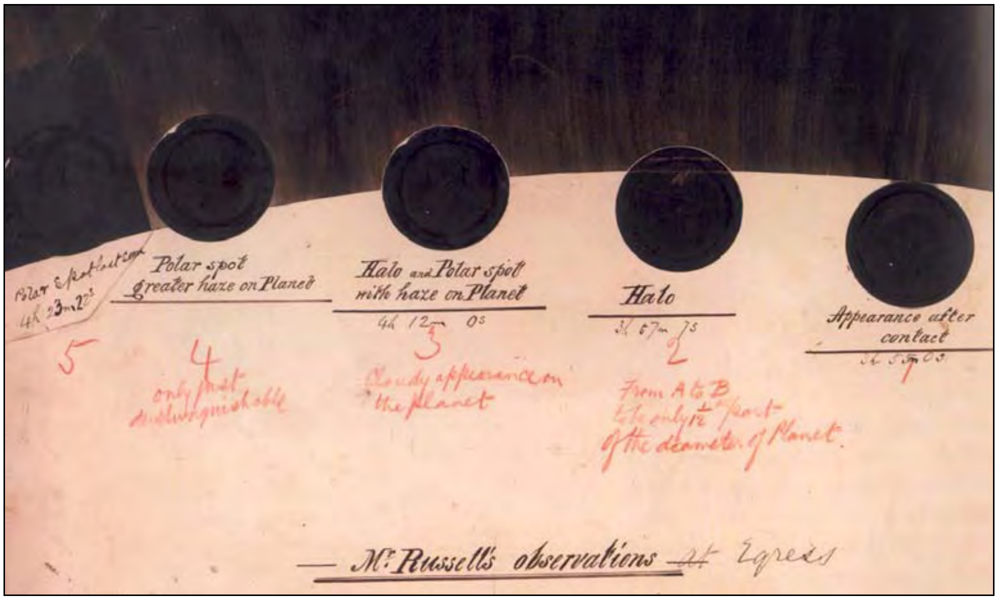

Fig. 8. The polar spot and aureole as recorded by H.C. Russell, director of the Sydney Observatory, in 1874. Courtesy Nick Lomb. Credit: "State Records NSW A3003, Box 216,

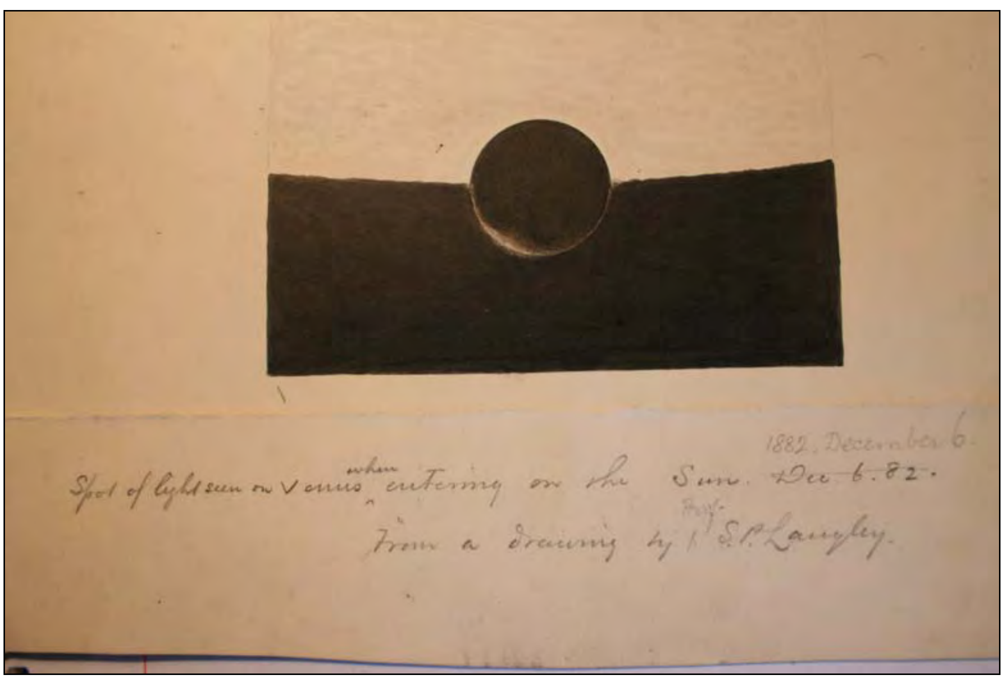

Fig. 9. S.P. Langley's impression of the aureole, as observed with the 13-inch refractor of the Allegheny Observatory at the 1882 transit. Courtesy Peter Hingley, Royal Astronomical Society Library.

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.

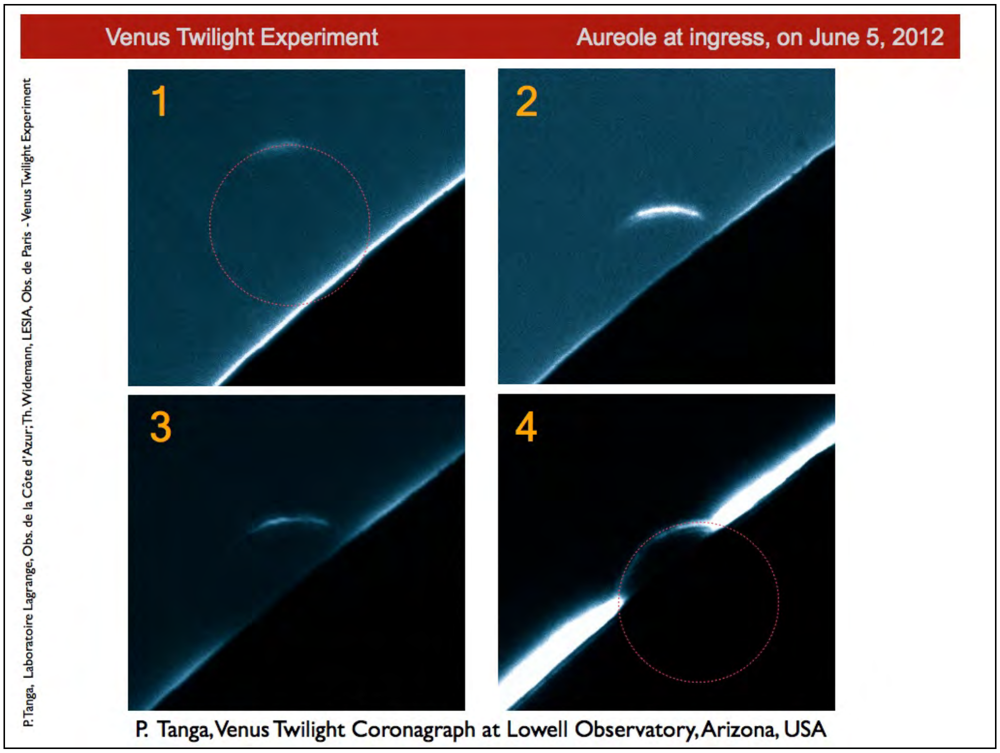

Fig. 14. The aureole as imaged by Paolo Tanga at Lowell Observatory. Photographs by Paolo Tanga.

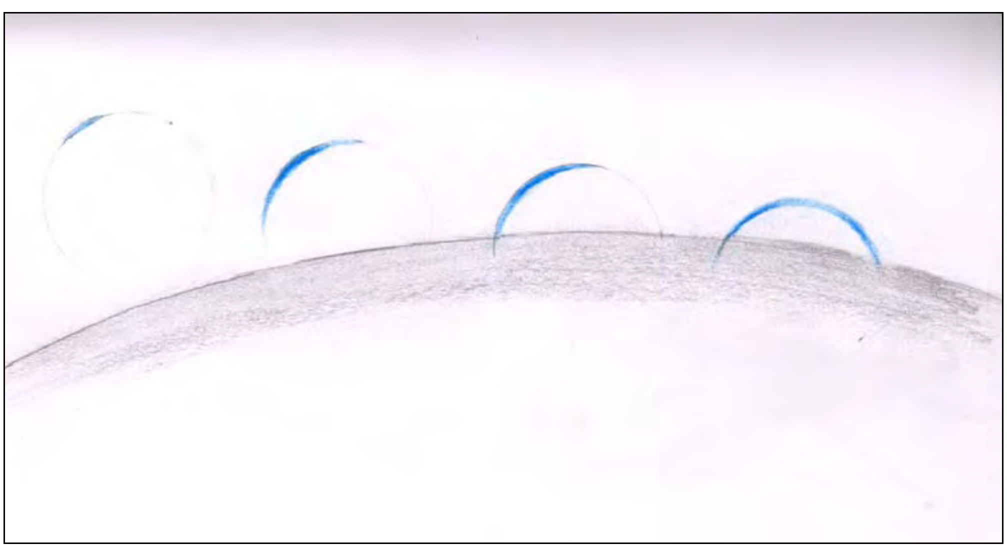

Fig. 15. The aureole as sketched by William Sheehan at Lowell Observatory.

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 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. Visual Observation of Venus

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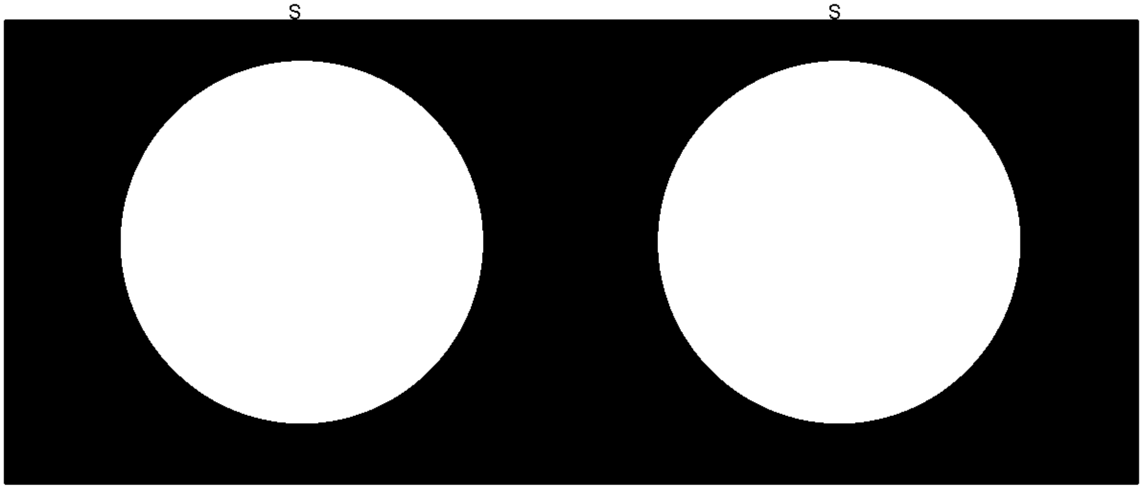
p  f

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:
Full Moon Observing: The ALPO Way

By Ken Poshedly,
Editor & Publisher,
***The Strolling Astronomer*, Journal of the ALPO**
ken.poshedly@alpo-astronomy.org

Online Readers

Left-click your mouse on the e-mail address in blue text to contact the author of this article, and selected references also in blue text at the end of this paper for more information there.

As an organization of and for observers and observING (emphasis added), it is encouraging when that old spirit of helpfulness makes its way out to the "information superhighway", that is, the Internet.

Even though it's been many months since this occurred, the example here might serve as an inspiration for our membership to get back to basics and reach out to offer guidance and help to those seeking it.

The whole thing started last May 3 when Lawrence Garrett (*LSGasteroid@msn.com*) decided NOT to let a Full Moon go to waste and posted an appeal for some advice on our ALPO-Member-Discussion e-mail list:

"Greetings All! With this year's nearest and largest full moon of the year on Saturday, what are the best features to hunt down? Suggestions and favorite target suggestions are most welcome. The full moon is quite the phase with the high light, I hope to make the best of it this weekend."

Not long afterwards, ALPO Lunar Topographical Section Assistant Coordinator Bill Dembowski (*dembowski@zone-vx.com*) replied

"Lawrence, One of my full-moon favorites is to trace the changes in albedo along the inner edge of Mare Serenitatis. Also, take a look at the floor of Schickard; well worth the time."

Now who would've thought almost ANYBODY is that interested in the lunar phase that allows one to practically read a newspaper by its reflected light? Well, Mr. Dembowski surely is, and it was perhaps his suggestions that spurred *Phil Plante* to chime in with a detailed message concerning not only full moon features, but comments on Phil's own addition to his equipment arsenal:

"Hi Lawrence (and the rest of ALPO!) -- One thing to look for is the dark halo around Tycho.

"That leads to this: Good opportunity to run this past the ALPO group. This past March, I purchased a Baader Solar Continuum filter for possible use during the upcoming solar events. Curiosity led me to try it on the full moon. I usually miss that dark halo around Tycho (hiding right under my nose unless I remember to look for it). But it stood out distinctly with the Baader filter. It actually caught my eye. Then I noticed the maria shadings were more pronounced and different than with a regular moon filter

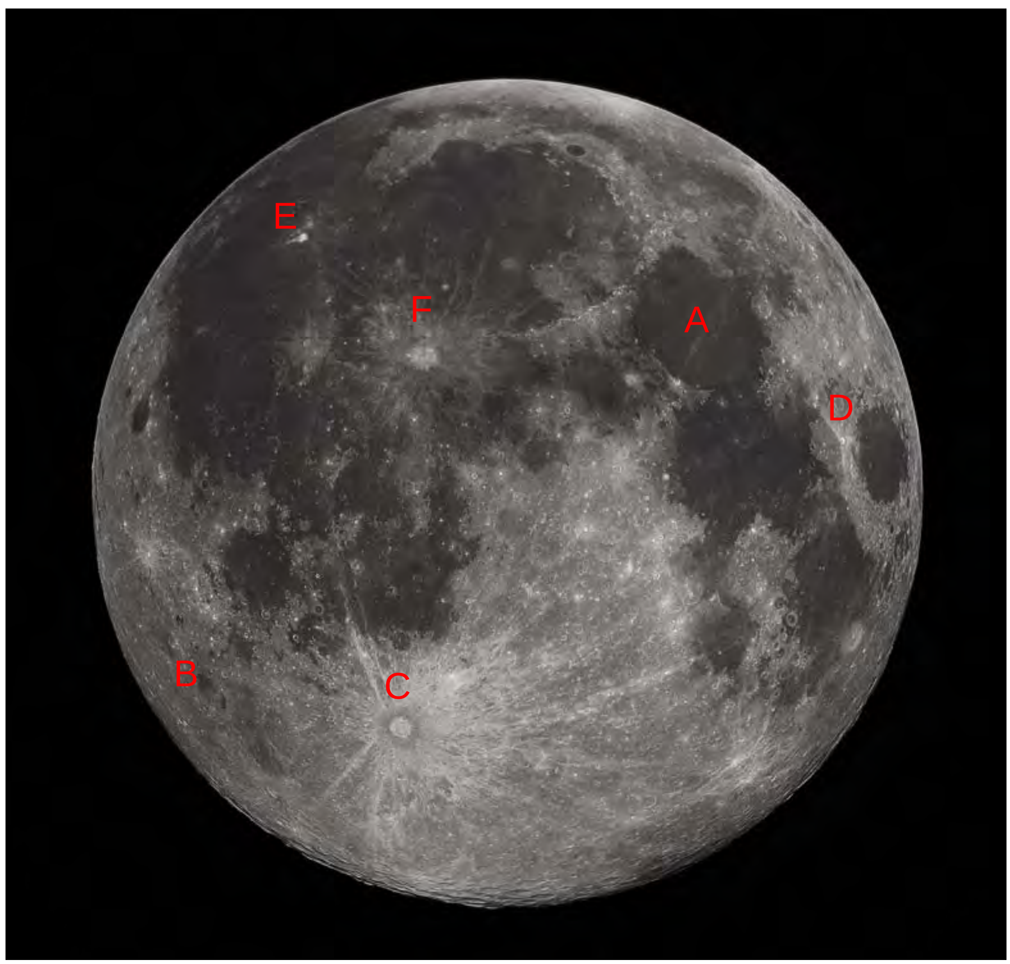


Figure 1. Lunar feature locations on the Full Moon that are mentioned within this article: A, Mare Serenitatis; B, Schickard; C, Tycho; D, Proclus; E, Aristarchus; and F, Copernicus.

Figure 2. Lunar crater Schickard. No details available Source: *http://www.mattastro.com/gallery/moon_schickard.jpg*

Figure 3. Lunar crater Tycho and part of its ray system. Photo by Steve Mandel. Technical details: Astro-Physics 7-inch f/9 Starfire refractor equipped with an SBIG ST10E CCD camera; single one-millisecond exposure using a H-a filter; images processed with MaxIm DL and Photoshop with the help of Philip Perkins in Wiltshire, England; image was taken from Hidden Valley Observatory, in Soquel (near Santa Cruz), California overlooking the Monterey Bay. Imaging date approximately August 9, 2001, time not provided. Source: *http://www.galaxyimages.com/moon.html*

(neutral density) or with no filter. Ray systems were also more distinct against darker materials, same filter comparisons. I wonder if anyone else has tried this filter for such a misuse of purpose? It seems to emphasize mineral differences. It might be a useful tool for lunar observers/imagers.

"In short, it is an interference filter with a 10nm bandpass centered on 540nm (green)…it supposedly also eliminates chromatic aberration in refractors and helps cut through poor seeing. Oh, and it works well on the Sun, too (for granulation). In any case, I had a lot of fun using this filter on the full moon and it now replaces my neutral density moon filter. It is a bit pricey — be forewarned.

"And Lawrence, Proclus is great, Aristarchus is a beacon, and the Copernican rays are other features you could look for, with or without filters."

Wow! All Lawrence asked for was a list of stuff to see on the full moon and he now has that list, but also a recommendation to consider yet another astro-tool!

Next to contribute with a great explanation of the in's and out's of this filter was Roger Venable (*rjvmd@hughes.net*);

"Phil -- I have long noted that the use of a colored filter makes detail clearer on the Moon. I think the main reason is that monochromatic light is less susceptible to aberrations caused by the eye. The eye is a rather poor optical instrument. I have long encouraged folks to use a green filter in observing the Moon -- it's much better than the so-called "Moon filter" sold by Orion, which, as a neutral gray filter, does not diminish the color aberrations. These entoptic aberrations are not seen as color effects by most persons, but simply as blurring of the image. Of course, atmospheric dispersion can also be reduced by a colored filter, as can color aberrations that are present in some telescopes, but these effects are less important, in my opinion, than the filter's hiding of the aberrations of the eye.

"The green filter is good for the Sun due to an additional effect: the contrast between sunspots and the rest of the solar surface is enhanced in green due to the difference in the amount of green light in Planck's black body radiation intensity at the temperatures of the two areas. Green also enhances visibility of granulations. Deep blue light enhances contrast even better than green at those temperatures, but with blue light the eye's aberrations are greater and the image does not appear so clear. At least, that is what I've found. I'd be interested to hear of your experiences with this."

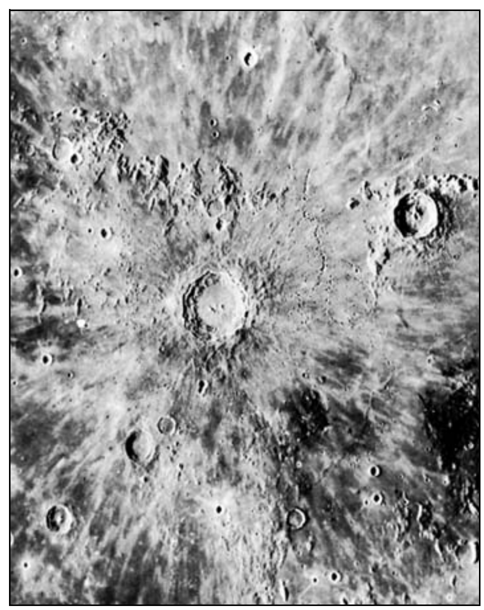


Figure 4. Lunar crater Copernicus and part of its ray system. No details available Source: Lick Observatory.

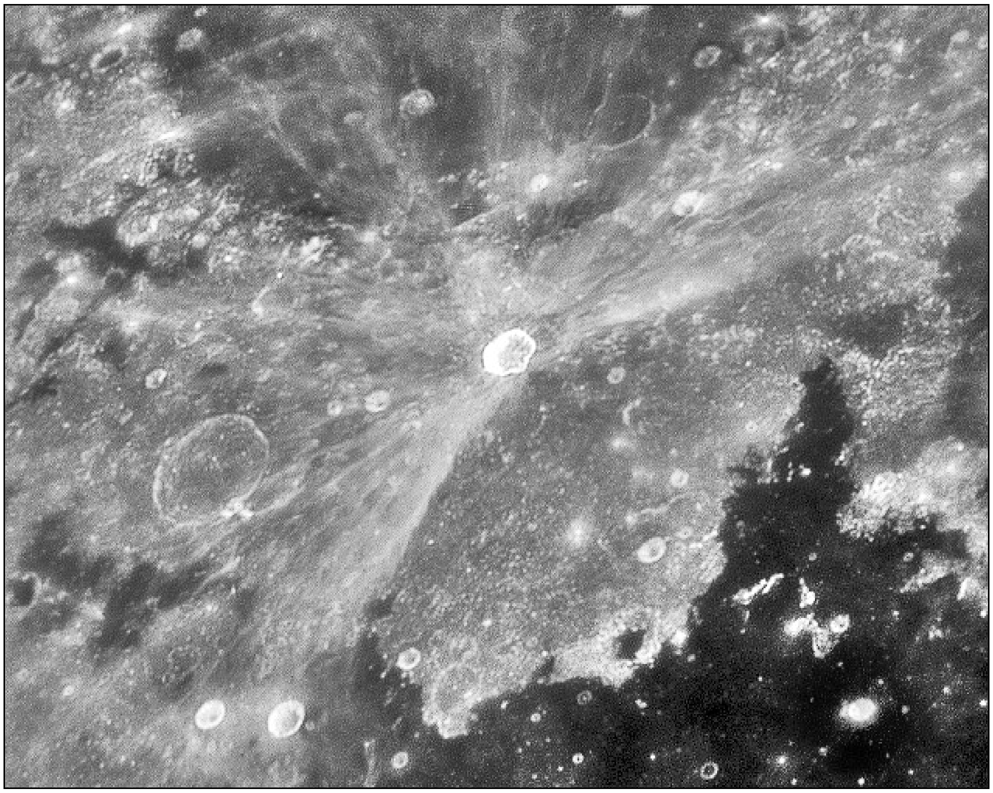


Figure 5. Lunar crater Proclus. Photo by Robert Pilz. Technical details: 12 January 2006, 04:52 UT. Takahashi FSQ-106mm refractor, 5x Televue Powermate, DMK 21BF04 B/W Firewire camera, Blue IR-block filter - Recorded at 30 fps, 1/64 second exposure, 6,000 frames - Seeing 7-8/10, Transparency 9/10 - Processed in Registax (600/ 6,000 frames stacked), ImagesPlus and Photoshop CS.Source: http://www.lpod.org/?m=200601

Now we're cookin! Mr. Garrett might have been counting his money right then in preparation for getting his own Baader filter, but we just don't know.

However, Phil Plante was so taken with the Baader filter explanation that the topic moved in that direction:

"Hi Roger -- Thanks for the explanation on the filter I referred to. I had wondered why green light was good for solar filters. Being such a narrow bandpass filter, it seems to work very well on the Sun. As it was designed to do. I have only tried it on 72 and 75mm refractors for solar photographic runs (test shots, DSLR in B&W mode). So visual solar work is in the future (with up to a C8 telescope). By the way: I looked a my clock's red LEDs thru this filter and I could not see the LEDs at all. Saw the clock plain as day, but it looked turned-off thru the filter.

"I used this solar filter on a homemade 6-inch reflector of excellent quality for my 'full moon experiment.' I was taken by the enhanced contrast of areas within the mare and of other dark features. Much more than without a filter. That is why I asked if anyone had already tried this solar filter on the Moon. It looks promising, if anything, as a better 'moon filter' than neutral density types. My first instinct was that the mineral differences were being revealed. But that is just a guess on my part.

"Haven't tried a blue filter for solar – there's hardly time for what I need to do right now! I'll consider this at some point. Anyway, I've read that longtime solar observers always used Wratten 56 or 58 green filters to enhance sunspots/ granulation. The cost for those Wratten's is far less the for the Baader filter, but they have wider bandpasses. The Baader does seems to have more 'punch' to it. I remember trying a #56 some time ago and it didn't seem to make much difference in granulation (no sunspots were out then).

"Lumicon has Wratten 58 and 56 I believe. 58's are hard to find. I checked these out before I bought the Baader. The Baader Continuum filter was also recommended by an experienced solar imager I'm in contact with."

Then last but certainly not least comes "Bruce Star Guy" (Bruce.Star.Guy@gmail.com). Alas, one of the pitfalls of anonymity is the inability to give credit where credit might be due. Maybe "Bruce Star Guy" will come forward some day, but until then, suffice it to say he saw enough to step in and warn all to be very careful:

"Please don't visually observe the Sun using only a Wratten 56 or 58. Wratten filters were developed for use with film which is insensitive to infrared light. Even if you find the brightness of the image to be suitable, you may be burning your retina.

"I know that you probably use the Wratten filter with something else, perhaps a Hershel Wedge to reduce the light intensity, but people reading this conversation may not know that."

So there you have it. A question for advice turned into a discussion on not only what to observe, but HOW to best observe those full moon features.

What a group you are!

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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

Lunar Meteoritic Impacts Search Program

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

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

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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; Steve Larson, Lunar & Planetary Lab, University of Arizona, Tuscon, AZ 85721

Jupiter Section

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

- Coordinator (Section); Richard W. Schmude Jr., 109 Tyus St., Barnesville, GA 30204
- Assistant Coordinator (Section); Ed Grafton, 15411 Greenleaf Lane, Houston, TX 77062
- Assistant Coordinator & Scientific Advisor; Sanjay Limaye, University of Wisconsin, Space Science and Engineering Center, Atmospheric Oceanic and Space Science Bldg. 1017, 1225 W. Dayton St., Madison, WI 53706
- Assistant Coordinator, Transit Timings; John McAnally, 2124 Wooded Acres, Waco, TX 76710
- Assistant Coordinator, Newsletter; Craig MacDougal, 821 Settlers Road, Tampa, FL 33613
- Scientific Advisor; Prof. A. Sanchez-Lavega, Dpto. Fisica Aplicada I, E.T.S. Ingenieros, Alda. Urquijo s/n, 48013, Bilbao, Spain
- Assistant Coordinator/Program Coordinator, Galilean Satellites Eclipses; John E. Westfall, P.O. Box 2447, Antioch, CA 94531-2447

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

- Coordinator; Gary Kronk, 132 Jessica Dr, St. Jacob, IL 62281-1246

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 Mathematics & Natural Sciences, Florida State College, 3939 Roosevelt Blvd, F-112b, 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 Astronome*r. 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,*

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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 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 coordinators; 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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Will, M.	matt.will@alpo-astronomy.org

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) *Jupiter*, the ALPO section newsletter, available online only via the ALPO website at http://mysite.verizon.net/macdouc/alpo/jovenews.htm; (3) *J-Net*, the ALPO Jupiter Section e-mail network; send an e-mail message to Craig MacDougal. (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 Kit*, $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 Section.

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- **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. 27 (1977-79), Nos. 3-4 and 7-8
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Vol. 38 (1994-96), Nos. 1 and 3
Vol. 39 (1996-97), No. 1
Vol. 42 (2000-01), Nos. 1, 3 and 4
Vol. 43 (2001-02), 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
Vol. 50 (2008), Nos. 1, 2, 3 and 4
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Vol. 55 (2013), No. 1 (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.

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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.

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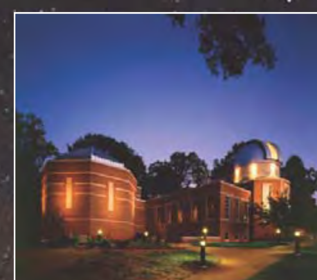

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