ISSN-0039-2502

Journal of the Association of Lunar & Planetary Observers

The Strolling Astronomer

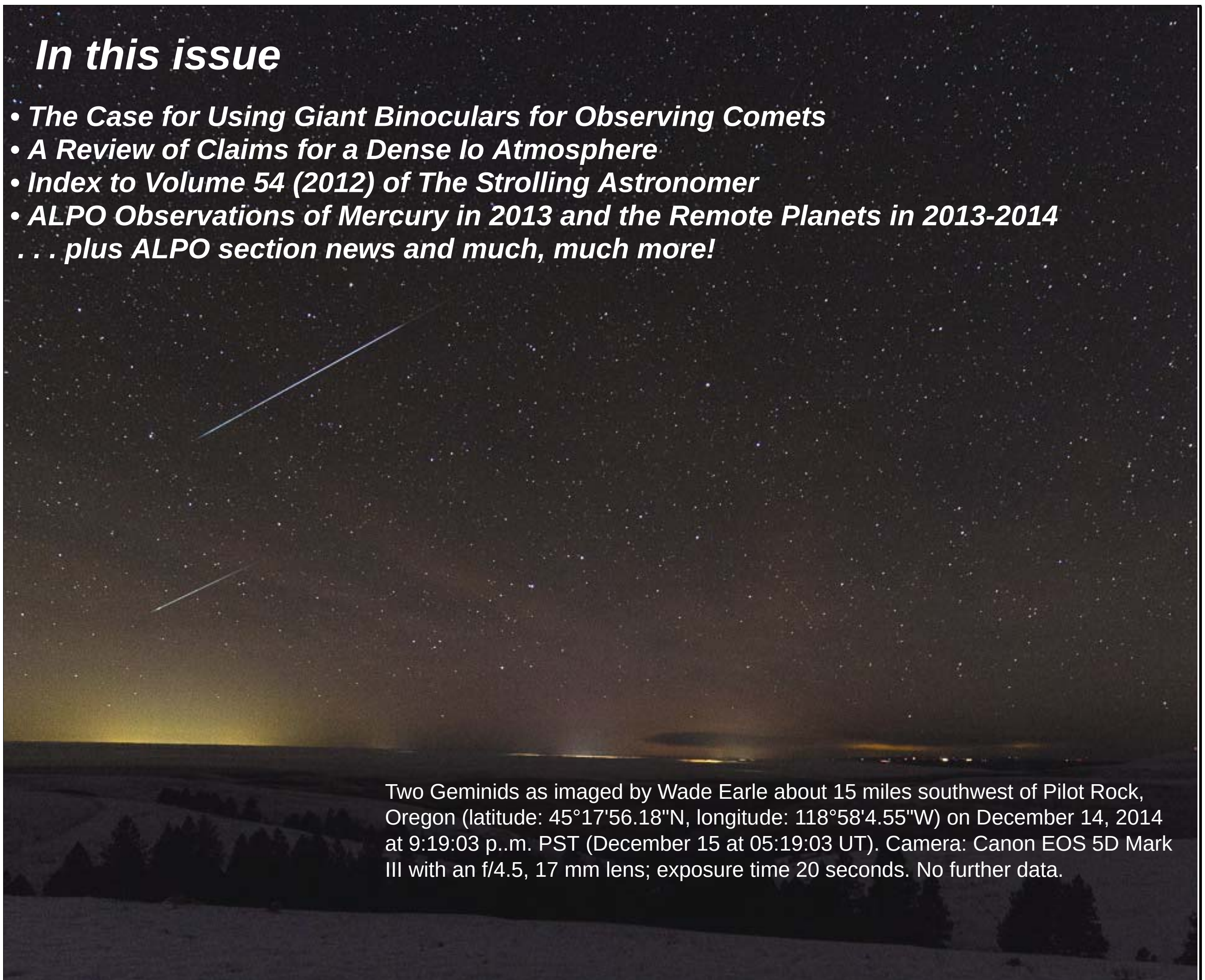
Volume 57, Number 1, Winter 2015

Now in Portable Document Format (PDF) for Macintosh and PC-compatible computers

Online and in COLOR at http://www.alpo-astronomy.org

Founded in 1947

In this issue



Two Geminids as imaged by Wade Earle about 15 miles southwest of Pilot Rock, Oregon (latitude: 45°17'56.18"N, longitude: 118°58'4.55"W) on December 14, 2014 at 9:19:03 p..m. PST (December 15 at 05:19:03 UT). Camera: Canon EOS 5D Mark III with an f/4.5, 17 mm lens; exposure time 20 seconds. No further data.

Journal of the Association of Lunar & Planetary Observers

The Strolling Astronomer

Volume 57, No.1, Winter 2015
This issue published in December 2014 for distribution in both portable document format (pdf) and also hardcopy format.

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

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

For membership or general information about the ALPO, contact:

Matthew Will
ALPO Membership Secretary/Treasurer
P.O. Box 13456
Springfield, Illinois 62791-3456

E-mail to: matt.will@alpo-astronomy.org

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

Founded in 1947

Inside the ALPO

News of General Interest

ALPO Interest Section Reports

ALPO Observing Section Reports

Feature Stories

ALPO Resources

Inside the ALPO
Member, section and activity news

Point of View
New Astro Hardware for Us

By Richard W. Schmude, Jr., ALPO board member, ALPO Remote Planets Section coordinator

In the last few years there have been many new instruments, software and techniques that have been introduced to the amateur community. These provide abundant opportunities to the well-informed astronomer. Many of these are summarized in a large review article in the book Experimental Astronomy published by Springer. In essence, there has been a large increase of contributions made by amateur astronomers in CBET, IAUC telegrams, scientific papers and oral/poster contributions at astronomy conferences. Below, I will describe four recent observations which are: 1) near infrared imaging of Venus' lower atmosphere, 2) monitoring giant planet impacts, 3) red and near-infrared images of albedo features on Uranus and 4) J and H photometry of the bright planets.

Different wavelengths of light penetrate different depths of Venus' atmosphere. Visible light reflects off of the cloud tops, whereas near-infrared light penetrates deeper. Because of this, some people have been able to record images deeper into that planet's atmosphere.

In 2009, Anthony Wesley of New Zealand imaged a dark spot on Jupiter which was later proven to be caused by an asteroid or comet impact. Others have recorded small, bright flashes on that planet. This has led to the development of software that can search for bright flashes in images of the giant planets.

A third recent development has been the successful imaging of albedo features on Uranus. For example, Damian Peach of England has succeeded in imaging two bright belts on Uranus. And I myself have been able to measure the latitudes of these belts as described in my 2012-2013 remote planets report. It is my hope that others will join Damian in imaging Uranus in red and near infrared light.

The development of the SSP-4 photometer has allowed the small telescope operator to record J and H filter brightness measurements of the planets. The J and H filters transmit light with wavelengths near 1.25 and 1.65 micrometers, wavelengths that are beyond the sensitivity of commercially available CCD cameras. But with this photometer, I have been able to measure the brightness of the planets Mars, Jupiter and Saturn. These measurements will help us learn more about these planets and extrasolar planets.

In summary, there are new instruments and techniques available today that were not around 15 years ago. And it is important for ALPO members to keep up with the latest developments and utilize them in their observations.

Inside the ALPO
Member, section and activity news

News of General Interest

ALPO 2015 Conference News

All ALPO members are urged to try and attend the Astronomical League convention (ALCon 2015) to be held in Las Cruces, New Mexico, home of our ALPO founder, Walter Haas.

We thought we'd have details of the event by now (late November), but it's still in the planning stage.

Look for details in JALPO57-2, due for release in mid-March 2015.

Meteorite Impact in Nicaragua May Not Be

There have been no updates regarding what was originally thought to be a new meteor crater near Managua that could have resulted from a breakaway piece of Near Earth Asteroid 2014 RC on September 6.

To quote more from the story carried by *Universe Today* at http://www.universetoday.com/114397/the-nicaragua-crater-the-result-of-a-meteorite-impact-or-not/, software engineer Ron Baalke at the Jet Propulsion Laboratory posted an update to the close pass by asteroid 2014 RC on the NASA's Near Earth Object website, saying, "Since the explosion in Nicaragua occurred a full 13 hours before the close passage of asteroid 2014 RC, these two events are unrelated."

Also quoting from *Universe Today*: "There are a few other problems with the Managua crater, though of course, we'd love to be proven wrong. Many observers have noted that the crater does not appear to look fresh, and the trees and soil around it appear to be relatively undisturbed. A first visual impression of the site looks more like a ground slump or sinkhole than an impact, or perhaps an excavation. Others have also noted the similarity of the crater with a military blast, a very good possibility with an air force base nearby.

More here if and when we hear of it.

ALPO Interest Section Reports

ALPO Online Section

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

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

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

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

Computing Section

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

Important links:

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

Lunar & Planetary Training Program

Tim Robertson, section coordinator
cometman@cometman.net

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

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

Send e-mail to:
cometman@cometman.net

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

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

ALPO Observing Section Reports

Mercury / Venus Transit Section

John Westfall, section coordinator
johnwestfall@comcast.net

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

Inside the ALPO
Member, section and activity news

Meteors Section

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

2014 had all the makings of a fine year for meteor enthusiasts, but the two predicted outbursts fizzled and even the major annual showers were subpar. Back in May, the highly touted “Camelopardlids” caused great excitement as the Earth intercepted the orbit of comet 209P/LINEAR. It turned out, though, that this comet was dust-poor and produced very little activity. Astronomers can pinpoint the date and time of future possible outbursts, but they do not know the particle density the Earth may encounter, therefore the exact activity is only a guess.

This matters greatly to those travelling great distances to view heavenly spectacles. No one wants to travel half-way around the world to see a dud of a meteor shower.

The same thing happened with the recent Phoenicids. This shower is produced by an asteroid that was once a comet. Once again the date and time was right, but little activity appeared. Yet there were those who traveled from Japan to the Canary Islands “just in case”.

And we knew the annual Perseids would be subpar this year due to the presence of a waning gibbous moon. What was surprising was how poor the Orionids of October were. Zenith hourly rates barely reached 20! And actual visual rates were much less than that with my own personal top hourly rate only being 11. Just a few years ago, this shower was producing 60+ meteors per hour!

Despite the disappointments this year, the meteor section continues to receive many observations throughout the year. I wish to thank those who made the effort to view these showers (or lack of) and shared their data with us. If not for you, those unable to view can get some idea of what they missed. 2015 appears to be a good year, so I wish to take this opportunity to wish all meteor enthusiasts the best of luck in the upcoming months.

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

Meteorites Section

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

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

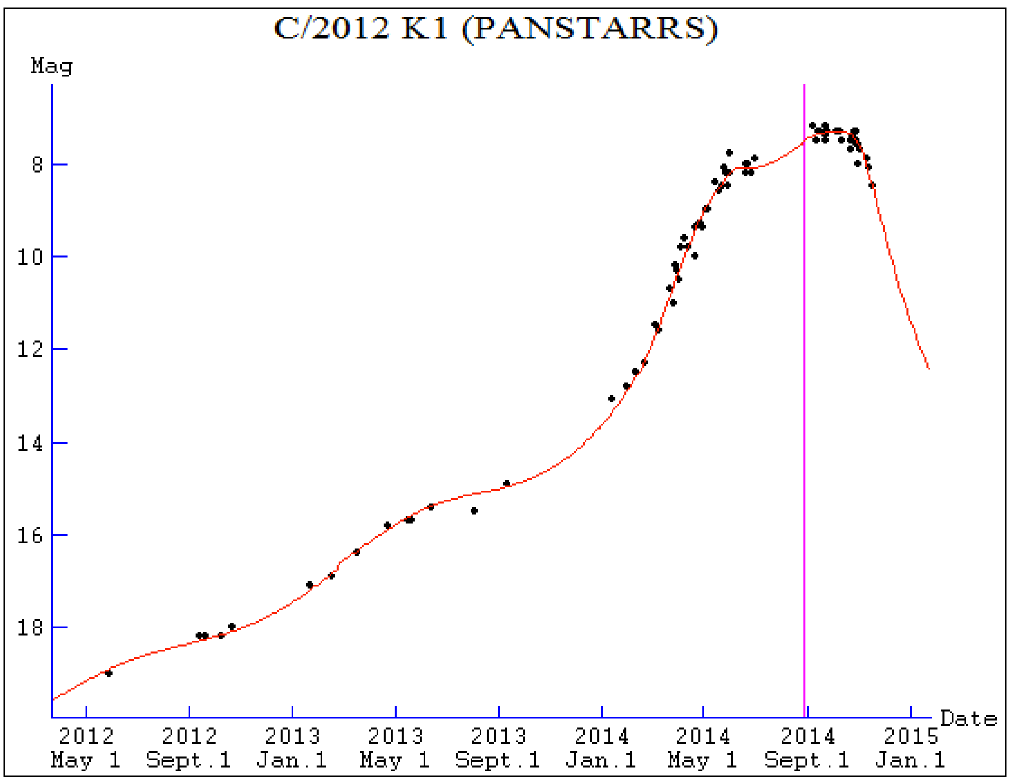
Comets Section

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

As 2014 draws to a close, the ALPO Comet Section members have been busy. Salvador Aguirre, Carl Hergenrother, Gary T. Nowak and Willian Souza all have contributed visual and CCD magnitude estimates for C/2012 K1 (PANSTARRS), C/2012 X1 (LINEAR), C/2013 A1 (Siding Spring), C/2013 US10 (PANSTARRS), C/2014 E2 (Jacques), C/2014 Q1 (PANSTARRS), C/2014 Q2 (Lovejoy) and C/2014 Q3 (Borisov).

CCD images were also submitted by Denis Buczynski, Manos Kardasis and Gianluca Masi.

The best observed comet of the past few months was C/2012 K1 (PANSTARRS).



Light curve of C/2012 K1 (PANSTARRS)

Inside the ALPO
Member, section and activity news

Peaking at 7th magnitude in September/ October, the comet has slowly faded as it moves away from the Sun. Now a southern object, the comet is rapidly fading and will be a difficult visual object as 2015 begins. The lightcurve accompanying this report shows how the comet's apparent brightness changed from discovery nearly 2.5 years ago to the present.

Looking ahead to 2015, the following comets are predicted to become 10th magnitude of brighter.

- C/2014 Q2 (Lovejoy) - Terry Lovejoy has done it again by discovering a bright comet out from under the vigilant gaze of the professional asteroid/comet surveys. When first seen on 2014 August 17, Comet Lovejoy was around 14th magnitude. As it approaches perigee in early January at 0.47 AU perihelion on 2015 January 30 at 1.29 AU, the comet has rapidly brightened and is 8th magnitude as of the start of December. If it continues its rapid rate of brightening, it should peak at 4th to 6th magnitude comet in January/ February.

- 88P/Howell - This short-period comet was discovered in 1981. It is expected to reach 9th magnitude near its 2015 April 6 appearance [q = 1.36 AU]. It will be a morning object when at brightest.

- C/2013 US10 (Catalina) - Perihelion occurs on 2015 November 15 [q = 0.82 AU] when C/2013 US10 may reach 4th magnitude. Predicting any comet's brightness is fraught with uncertainty and C/2013 US10 may be much fainter or brighter than expected. If its current brightness trend holds, the comet will become brighter than 10th magnitude by mid-summer and brighter than 6th magnitude from October 2015 through the following January. Now for the bad news, the comet will not be visible for northern observers until December 2015. Southern observers will be able to follow the comet with the exception of a few weeks around perihelion when it will be too close to the Sun.

Inside the ALPO
Member, section and activity news

- C/2014 Q1 (PANSTARRS) - C/2014 Q1 (PANSTARRS) may vie with C/2013 US10 for the title of brightest comet of 2015. It reaches perihelion on 2015 July 6 [q = 0.31 AU]. Unfortunately, this comet will also be hard to observe, as it will be invisible for northern observers for much of 2015 except as a very difficult object low in the morning sky in June. Southern observers have a better view but not till after perihelion. Assuming usual brightening rates suggest a peak around 2nd magnitude, but the comet has been intrinsically fading recently so it may be much fainter.

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

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

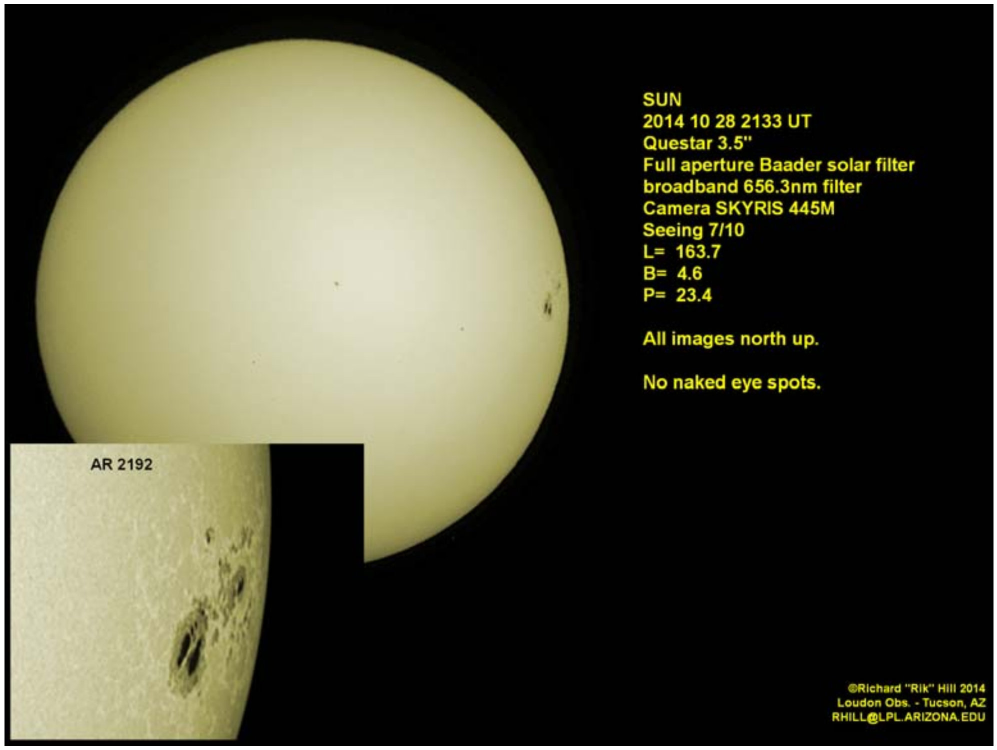
Please send all observations and images to Carl Hergenrother at the e-mail address shown at the beginning of this section report.

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

Solar Section

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

Since our last note, the Sun has produced the largest sunspot group in Cycle 24. AR2192 started innocently

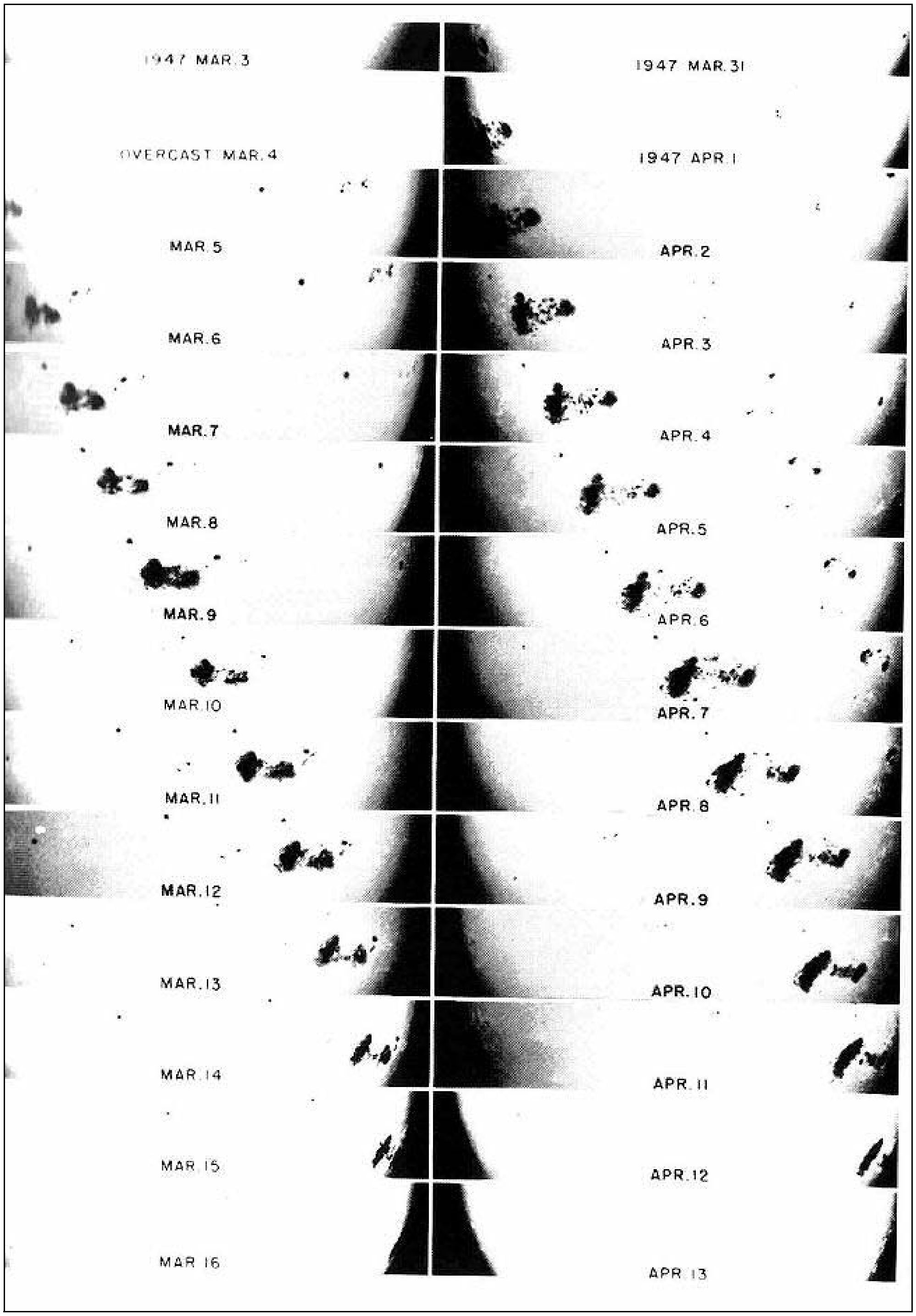


Sunspot group AR2192 as it rotates out of view on October 28, 2014. Image by Rik Hill of Tuscon, AZ USA. See image for more details.

Sunspot Number	Date	Size (MH) millionths of Solar Hemisphere	Solar Cycle
AR2192 (images Howard Eskidsen, Rik Hill) CR2155 & CR2157	October 23,2014	2700 MH	SC24-so far the largest of this cycle
AR1967[1] CR2147	February 5, 2014	1580MH	SC24 M6 flare
AR486[2] CR2009	October 30, 2003	2610MH	SC23- largest spot- gave X28 flare, November 23, 2003. Third largest solar flare.
AR9393[3,4] CR1974	March 29, 2001	2400MH	SC23 –X20 flare April 2001.
This particular group rotated around the Sun three times.[5,6] CR1250	Started Feb 5, 1947- to May 1947	4300MH- 5400 MH- this	

Counting of sunspots did not start until 1973, hence the lack of any sunspot numbers for the 1947 large group.
NOTES:
1. STCE Newsletter *http://www.stce.be/newsletter/pdf/2014/STCEnews20140213.pdf*
2. NASA *http://www.nasa.gov/audience/foreducators/k-4/features/F_Solar_Flare_Oct2803.html*
3. Spaceweather *http://spaceweather.com/sunspots/history.html*
4. Astronomy Photo of the Day *http://apod.nasa.gov/apod/ap010411.html*
5."The Sun our Star", Noyes, Robert W., pg.87
6. Sunspot Activity during 1947- Munt Wilson Observatory *http://adsabs.harvard.edu/full/1948PASP...60...98N*

Inside the ALPO
Member, section and activity news



Images of the March-April 1947 sunspot group that lasted several solar rotations, though in different forms. Images courtesy of Mt. Wilson Observatory, Carnegie Institution of Washington.

enough on October 15, 2014 as faculae, but as it moved across the Sun over the next 16 days, it unleashed several X-, M- and C-class flares. AR2192 rotated back into view on November 16 as AR2209, but now shaped like a bear paw. As it proceeded across the Sun this time, it dissipated by November 27, 2014 as faculae. Similarly, the sunspot group of early 1947 rotated into view several times.

The Sun has passed the second noted peak of Solar Cycle 24 and not really a very strong cycle. As the cycles wane, solar sunspots have been noted to become very strong and active, producing many solar eruptions and coronal mass ejections (CME's) hurtling towards Earth with possible aurora's.

We in the ALPO Solar Section urge all to continue frequent observations of the Sun, as it is always in a changing state in any medium you observe, white light, calcium or hydrogen-alpha.

The ALPO Solar Section has an e-mail list that now numbers 326 members — many of whom have considerable experience and information about different observing techniques and equipment to share with you.

We hereby welcome our newest member to the ALPO Solar Section e-mail list, David Jackson, and his solar sketches.

To join the Yahoo Solar ALPO list, please go to *https://groups.yahoo.com/neo/groups/SolarAlpo*

If you would like to send your sketches, or images of your observations, and have them archived in the Carrington Rotation periods, please send jpg or gif images no larger than 250 mb in size to myself (*kim.hay@alpo-astronomy.org*) Be sure to include all information on your image, and the CR number as well.

Inside the ALPO
Member, section and activity news

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

Mercury Section

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

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

Venus Section

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

Venus reached Superior Conjunction on October 25, 2014 bringing to a close the 2014 Western (Morning) Apparition and ushering in the 2014-15 Eastern (Evening) Apparition. Venus is now visible at dusk low in the western sky at the beginning of January 2015 at apparent visual magnitude -3.9, moving eastward relative to the Sun as the 2014-15 Eastern (Evening) Apparition progresses.

Venus is now passing through its waning phases (a progression from fully illuminated through crescent phases) as observers witness the leading hemisphere of Venus at the time of sunset on Earth. Venus will attain Greatest Elongation East of 45.4° on June 6, 2015 and reach theoretical dichotomy (half-phase) also on June 6. The planet will display Greatest Illuminated Extent (its greatest brilliancy) on July 12, 2015 at visual magnitude -4.5.

The Table of Geocentric Phenomena in Universal Time (UT) is included here with this report for the convenience of observers for the 2014-15 Eastern (Evening) Apparition for planning purposes.

The ALPO Venus Section has so far received about 200 drawings and images of Venus, with more expected as observers wrap up their observational summaries.

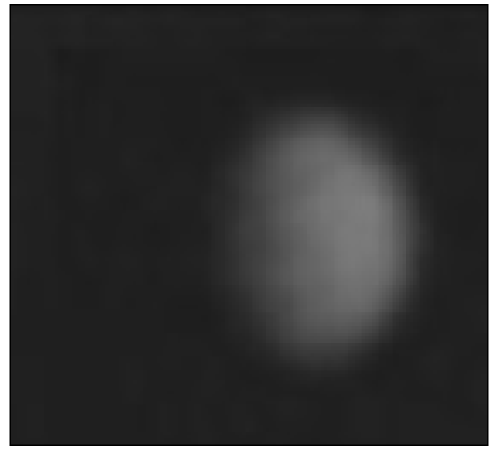
The latest information from ESA's Venus Express spacecraft, is to climb to a new orbit following its daring aero-braking experiment in mid-2014, was to resume observations of Venus for at least a few more months since the VEX mission had been extended through the end of December 2014. Nevertheless, by early 2015, it is likely that ESA's Venus Express will have made final descent into the atmosphere of the planet, bringing a fantastic scientific endeavor to an end.

Despite the impending fate of the Venus Express (VEX) mission that started systematically monitoring Venus at UV, visible (IL) and IR wavelengths back in May 2006, ALPO observers who have not yet sent their images to the ALPO Venus Section and the VEX website (see below) should do so immediately. These data are important and will continue to be analyzed for several years to come as a result of this Professional-Amateur (Pro-Am) effort. Regular Venus program activities (including drawings of Venus in Integrated Light and with color filters of known transmission) have been also valuable throughout the period that VEX was observing the planet. The VEX website is at:

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

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

Although regular imaging of Venus in both UV, IR and other wavelengths is



Frank Melillo of Holtsville, NY, submitted his UV image of Venus captured on July 22, 2014 at 14:15 UT using a 25.4 cm (10.0 in.) Schmidt-Cassegrain in fair seeing (S = 6). Radial dusky markings and dusky banded markings are seen on the disk of Venus in this UV image. The apparent diameter of Venus is 11.2", phase (k) 0.903 (90.39% illuminated), and visual magnitude -3.9. South is at top of image.

Geocentric Phenomena of the Upcoming 2014-15 Eastern (Evening) Apparition of Venus in Universal Time (UT)

Superior Conjunction	2014	Oct 25 (angular diameter = 9.7 arc-seconds)
Greatest Elongation East	2015	Jun 06 (Venus will be 45.4º East of the Sun)
Predicted Dichotomy		Jun 06.38 (exactly half-phase predicted)
Greatest Illuminated Extent		Jul 12 (m_V = -4.5)
Inferior Conjunction		Aug 15 (angular diameter = 63.1 arc-seconds)

Inside the ALPO
Member, section and activity news

Lunar Calendar for First Quarter 2015 (All Times UT)

Jan	02	11:35	Moon-Aldebaran: 1.5° S
	03	17:53	Moon North Dec.: 18.7° N
	05	04:53	Full Moon
	09	18:17	Moon Apogee: 405,400 km
	12	15:33	Moon Ascending Node
	13	09:47	Last Quarter
	16	11:52	Moon-Saturn: 1.9° S
	18	06:17	Moon South Dec.: 18.6° S
	20	13:14	New Moon
	21	20:06	Moon Perigee: 359,600 km
	22	05:01	Moon-Venus: 5.5° S
	23	04:40	Moon-Mars: 3.9° S
	25	10:23	Moon Descending Node
	27	04:48	First Quarter
	29	17:07	Moon-Aldebaran: 1.3° S
	31	00:59	Moon North Dec.: 18.5° N
Feb	03	23:09	Full Moon
	06	06:25	Moon Apogee: 406,200 km
	08	17:10	Moon Ascending Node
	12	03:50	Last Quarter
	13	00:10	Moon-Saturn: 2.3° S
	14	17:18	Moon South Dec.: 18.4° S
	17	06:20	Moon-Mercury: 3.5° S
	18	23:47	New Moon
	19	07:29	Moon Perigee: 357,000 km
	21	00:56	Moon-Venus: 2° S
	21	01:28	Moon-Mars: 1.5° S
	21	16:05	Moon Descending Node
	25	17:14	First Quarter
	25	23:02	Moon-Aldebaran: 1° S
	27	07:19	Moon North Dec.: 18.3° N
Mar	05	07:35	Moon Apogee: 406,400 km
	05	18:05	Full Moon
	07	21:04	Moon Ascending Node
	12	08:25	Moon-Saturn: 2.4° S
	13	17:48	Last Quarter
	14	01:39	Moon South Dec.: 18.3° S
	19	19:38	Moon Perigee: 357,600 km
	20	09:36	New Moon
	20	09:46	Total Solar Eclipse
	21	02:19	Moon Descending Node
	21	22:13	Moon-Mars: 1° N
	22	19:51	Moon-Venus: 2.9° N
	25	06:55	Moon-Aldebaran: 0.9° S
	26	14:29	Moon North Dec.: 18.2° N
	27	07:43	First Quarter

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

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

Routine use of the standard ALPO Venus observing forms will help observers know what needs to be reported in addition to supporting information such as telescope aperture and type, UT date and time, 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 107 new observations from 11 observers during the July-September quarter. Five contributed articles were published in addition to numerous commentaries on images submitted.

The *Focus-On* series continued with an articles on Banded Craters and the Altai Scarp. Upcoming *Focus-On* subjects

Inside the ALPO
Member, section and activity news

include ghost craters and Oceanus Procellarum-Reiner gamma.

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

Hard copy submissions should continue to be mailed to me at the address provided in the ALPO Resources section of this Journal.

****

Visit the following online web sites for more info:

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

Lunar Meteoritic Impacts

Brian Cudnik,
program coordinator
cudnik@sbcglobal.net

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

Lunar Transient Phenomena

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

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

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

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

Mars Section

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

Mars in January 2015 is less than 5 arc seconds in apparent diameter, visible in the western sky after dusk. As it receded from Earth during the last several months, only a couple of observers continued to report observations. Clyde Foster of South Africa and Maurice Valimberti of Australia documented more dust clouds in Libya and Isidis, and in Mare Ionium and Hellespontus, in late October.

Should Mars undergo a planet-encircling dust storm this apparition, those who persist in observations in the coming months may detect it. Mars will have an areocentric longitude of the Sun (LS) of 272 on January 15th. Of the 10 planet-encircling dust storms of the past, the range in onset was from LS 254 to LS 312. Thus, a large dust storm might occur late in the present apparition. It should be detectable despite the small apparent size of the planet, and I encourage you to continue to observe.

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

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

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

Minor Planets Section

Frederick Pilcher,
section coordinator
pilcher35@gmail.com

First, and as noted in the last issue of this Journal, please note my new e-mail address and delete any previous one you may have for me.

Second, some highlights published in the *Minor Planet Bulletin*, Volume 41, No. 4, 2014 October-December are hereby presented. These represent the recent achievements of the ALPO Minor Planets Section.

Inside the ALPO
Member, section and activity news

Frederick Pilcher, Raoul Behrend, Laurent Bernasconi, Lorenzo Franco, Kevin Hills, Axel Martin, and John C. Ruthroff published a comprehensive photometric investigation of 185 Eunike of dense lightcurves over four consecutive oppositions, from which they also obtained a preliminary spin/shape model with sidereal rotation period 21.8063 hours and suggestion of hemispheric albedo variegation. Brian Warner obtained another set of lightcurves for 92 Undina that allowed him to complete a preliminary spin/shape model with sidereal rotation period 15.9520 hours.

Julian Oey found that 13921 Sgarbini has a small amplitude 7.3681 hour periodicity superimposed upon a larger amplitude 43 hour periodicity. These might represent the rotation periods of the two members of a binary system.

Oey also found that (43904) 1995 WO has a small amplitude 4.5894 hour periodicity superimposed upon a larger amplitude 99 hour periodicity. It is suggested this might represent non-principal axis tumbling behavior. Both of these results are provisional and require observations at future oppositions for verification.

The first Mars Trojan asteroid to be discovered, 5261 Eureka, was found to be a binary, and the previously known binary 5381 Sekhmet was observed again, with a primary rotation period 2.8233 hours and revolution period 12.379 hours for the satellite companion. For the Earth approacher (251346) 2007 SJ a primary rotation period of 2.78 hours was well established with an uncertain suggestion of a second lower amplitude period of 1.65 hours which might represent the asynchronous rotation of a satellite companion. For the Earth approacher (274138) 2008 FU6 dips in the rotational lightcurve suggest a possible satellite companion, but this is insecure. A single dip in the rotational lightcurve of (363599) 2004 FG11 was observed, confirming the binary nature found by radar, but does not help to determine a period of revolution.

New lightcurves were published for 78 Earth approachers, a far larger number than ever before in a single issue of the Minor Planet Bulletin. Most of these were obtained at large or rapidly varying phase angles, and extend over an interval of only one to a few days. In these cases the period is not reliably found, as more than one possible period fits the data almost equally well.

In addition to asteroids specifically identified above, lightcurves with derived rotation periods are published for 167 other asteroids as listed below.

Separate lists are provided for the non Earth approachers and for the Earth approachers.

The non Earth-approaching asteroids are those with numbers 24, 65, 108, 113, 227, 232, 299, 308, 357, 398, 402, 446, 472, 488, 491, 502, 530, 624, 660, 671, 729, 749, 772, 828, 911, 1143, 1146, 1164, 1175, 1223, 1367, 1387, 1443, 1517, 1568, 1593, 1658, 1678, 1717, 1830, 1848, 1979, 2014, 2035, 2048, 2055, 2077, 2144, 2797, 2834, 2897, 3022, 3060, 3322, 3345, 3744, 3893, 3951, 4000, 4132, 4167, 4905, 5256, 5692, 5931, 6265, 6384, 6401, 6447, 7247, 7436, 9356, 9712, 10484, 10597, 11279, 11429, 11901, 12282, 12854, 13186, 13245, 15539, 17633, 26227, 26636, 30017, 34706, 48470, 49636, 52314, 53008, 67747, 70410.

The Earth approachers are those with numbers 433, 1862, 1917, 1943, 3103, 3554, 5604, 5620, 14402, 21374, 24445, 25916, 52768, 53435, 68350, 85628, 85867, 85989, 86039, 86829, 86878, 96155, 99942, 137170, 138883, 141052, 143649, 143651, 153002, 153957, 154244, 154275, 161989, 162181, 162385, 163364, 175706, 188174, 194386, 207945, 222869, 242708, 243566, 267337, 275677, 285263, 303174, 387733, 388468, 388838, 392211, 395289, and unnumbered objects with provisional designations 2001 FE90, 2005 GP128, 2008 WL60, 2009 DO111, 2009 FD, 2009 JM2, 2010 LJ14, 2010 NG3, 2011 JR13, 2013 SU24, 2013 WF108, 2013 WT44, 2013 XY8, 2014 EZ48, 2014 FH33, 2014 GY48, 2014 HM2, 2014 HO132, 2014 HS184.

Secure periods have been found for some of these, and for others only tentative ones. Some are of asteroids with no previous lightcurve photometry, others are of asteroids with previous period determinations which may or may not be consistent with the previously determined values. The latter are of more value than the unitiated may realize.

Observations of asteroids at multiple oppositions widely spaced around the sky are necessary to find axes of rotation and highly accurate sidereal periods.

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

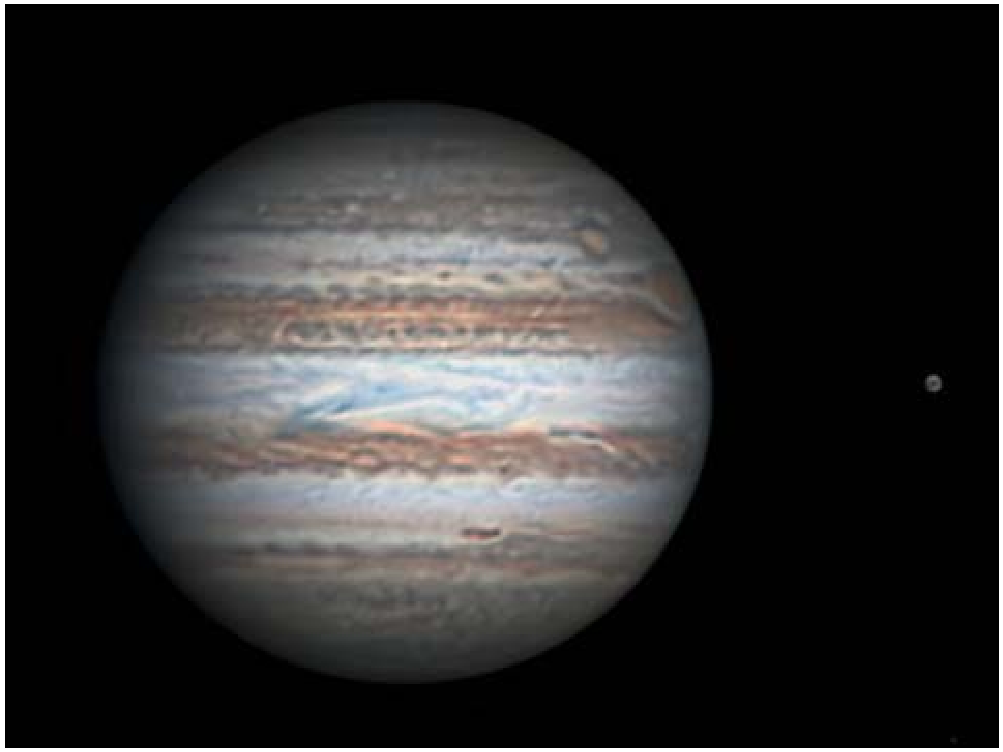
Annual voluntary contributions of $5 or more in support of the publication are welcome.

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

Inside the ALPO
Member, section and activity news

Jupiter Section

Report by Ed Grafton, acting section coordinator
ed@egrafton.com



Jupiter image captured by Dan Llewellyn on November 10, 2014 at 11:30 UT showing the GRS and Oval BA near the limb and the moon Callisto.

Jupiter reaches opposition on February 6, 2015 and is well placed for northern hemisphere observers this apparition. At opposition, Jupiter will have a declination of +16 degrees and a diameter of over 44 arc seconds when it will be 4.35 AU from Earth and shining at magnitude -2.6.

One of the more interesting aspects of the 2014-2015 apparition is the occurrence of mutual satellite events. The Jupiter system will be edge-on to the Earth and Sun near opposition, allowing observers to capture mutual satellite occultations and mutual satellite shadow transits.

Dan Adamo produced a graphic showing the Jupiter-centered geometry that sets up these mutual phenomena, which tend to occur near when Earth's Jovian latitude is zero.

Galilean satellite orbits appear edge-on in October/November 2014 and April/May 2015. It should be noted that the Jovian satellite system has an inclination of a few tenths of a degree from the Jovian equator and therefore, an edge-on perspective of the satellite system will occur when Earth's latitude is within a few tenths of a degree from the Jovian equator.

Don's graphic can be seen at *http://www.egrafton.com/d_adamo_jovianlat.jpg*

Paul Maxson captured Europa being occulted by Ganymede on May 18th 2009. See his image at *http://www.sunspot51.com/Animations/Ganymede-Europa051809.gif*

In August 2009 Christopher Go observed Io casting its shadow on Ganymede. See Chris's image at *http://astro.christone.net/jupiter/jupiter2009/gany-io20090816.gif*

A table of mutual satellite prediction events for 2015 produced by Jean Meeus of the British Astronomical Association Computing Section can be found at *http://britastro.org/computing/handbooks_jocc2015.html*

Richard Schmude has recently been observing the brighter planets in the near infrared using J and H filters. The J and H filters are sensitive to light with wavelengths of 1.25 and 1.65 micrometers. For those with photometric capability, the mutual satellite events present opportunities to obtain light curves of mutual satellite shadow transits and occultations.

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

Galilean Satellite Eclipse Timing Program

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

In 2015, Jupiter remains well north of the celestial equator throughout the apparition, favoring observers in the Earth's northern hemisphere. The 2014-2015 Jupiter Apparition is notable in that it includes a season of satellite mutual events - eclipses and occultations of the satellites by each other.

Mutual-event seasons take place every six years when the Earth and Sun cross the planet's equator and thus the planes of the orbits of its Galilean satellites. The coming mutual-event season contains almost 500 predicted events - 270 mutual occultations and 207 mutual eclipses. Their schedule corresponds remarkably well with the Jupiter apparition itself:

- 2015 Feb 04 – Sun crosses Jupiter's equator (from north to south)
- 2015 Feb 06 – Jupiter in opposition to the Sun

Inside the ALPO
Member, section and activity news

- 2015 Apr 10 – Earth crosses Jupiter's equator (from south to north)*
- 2015 May 03 – Earth crosses Jupiter's equator (from north to south)*
- 2015 Aug 13 – Last mutual event predicted (Io occults Europa)
- 2015 Aug 26 – Jupiter in conjunction with the Sun

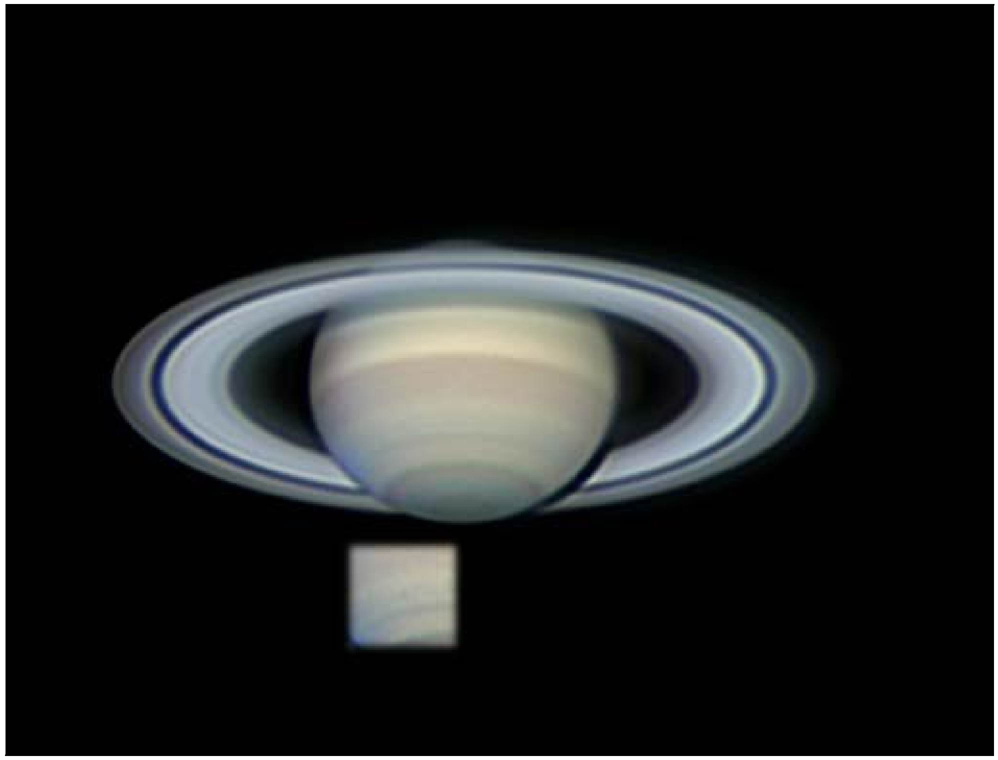
(*The last time the Earth crossed Jupiter's equator three times was during the 1919-20 Apparition.)

Satellite mutual events take many forms – eclipses versus occultations – but they also include total, partial and annular versions of both. You can simply view them, draw them, or take sequential photographs or videos of them. This program coordinator will be happy to receive these forms of observation (as well as your timings of the "normal" eclipses of the four satellites by Jupiter itself).

Furthermore, if you conduct sequential photometry of mutual events, your resulting "light curve" can provide the accurate mid-time, duration and "depth" (light drop) of the event, with potential scientific value in terms of refining the satellites' orbits.

You can find out more about observing these phenomena, obtain a schedule of events, and even learn how to participate in the "PHEMU15" event-photometry campaign (all this in English), at the website of the Institut de Méchanique Céleste et de Calcul des Éphémérides (IMCCE): *www.imcce.fr/phemu*. (Note that all photometric observations should be submitted to the IMCCE.)

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



One of the last images received to date of Saturn taken on October 1, 2014 at 09:17UT by Trevor Barry observing from Broken Hill, Australia, using a 40.6 cm (16.0 in.) custom Newtonian at visual (RGB) wavelengths showing an extremely small recurring NTrZ dark spot [inset emphasizes the location of the dark spot in the image]. Numerous belts and zones are seen on the globe of Saturn, including the hexagonal North polar hexagon and the major ring components. Cassini's division (A0 or B10) clearly runs all the way around the circumference of the rings (except where the globe blocks our view of the rings); looking carefully at this image, it is possible to see the southern hemisphere of the globe through Cassini's division as it crosses the globe. Also visible in this image is Encke's "complex" (A5), Keeler's (A8) gap, and other "intensity minima" at the ring ansae. The dark shadow of the globe on the rings is situated toward the West (right) in this image, having shifted from the East (left) side of the globe right since opposition occurred on May 10. Seeing = 5.5 and transparency was not specified. The apparent diameter of Saturn's globe was 15.5" with a ring tilt of +22.4º. CMI = 166.2°, CMII = 289.3°, CMIII = 206.4°. S is at the top of the image.

Saturn Section

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

Saturn entered conjunction with the Sun on November 18, 2014 marking the end of the 2013-14 apparition. The planet will rise about three hours before sunrise as of January 2015, and observers will be able to follow the planet throughout the New Year during the 2014-15 observing season when the rings will be tilted about +24 toward Earth, which means that the northern hemisphere of the globe and north face of the rings remain visible to greatest advantage.

The accompanying table for the 2014-15 apparition are presented for the convenience of readers for planning observations.

As this report goes to press, observers had submitted well over 750 reports, images, and drawings of Saturn for the 2013-14 apparition, although this number should

Founded in 1947

Inside the ALPO
Member, section and activity news

Geocentric Phenomena for the 2014-15 Apparition of Saturn in Universal Time (UT)	
Conjunction	2014 Nov 18^{d}
Opposition	2015 May 23^{d}
Conjunction	Nov 30^{d}
Opposition Data:	
Equatorial Diameter Globe	18.5 arc-seconds
Polar Diameter Globe	16.5 arc-seconds
Major Axis of Rings	41.9 arc-seconds
Minor Axis of Rings	17.2 arc-seconds
Visual Magnitude (m_v)	0.0 m_v
B =	+24.2°
Declination	-18.3°

increase as Saturn Section participants finalize their reports and send them in.

Although there were no reports of significant atmospheric outbursts during 2013-14 as was the case in 2010-11, observers did report a brightening along the EZn, and a few observers with larger apertures captured images of at least one recurring small dark spot in the NTrZ and more transient dark features in the far north near the periphery of the NPR.

During the new 2014-15 apparition, it will be interesting to see if the aforementioned features persist along with any other discrete phenomena within the zones and belts of the planet's northern hemisphere. So, observers are urged to continue to keep Saturn under careful scrutiny once the planet is well-placed for detailed viewing and imaging in the 2014-15 observing season.

Our observing programs are listed on the Saturn page of the ALPO website at *http://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 strongly encouraged pursue digital imaging of Saturn at the same time that others are imaging or visually watching the planet (i.e., simultaneous observations). And while routine imaging of the Saturn is very important, far too many experienced observers neglect 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.

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

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

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

Remote Planets Section

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

The planet Uranus will be visible in the western sky after sunset in early January. Neptune will also be visible, but will be approaching the Sun. It will reach conjunction in late February. Pluto will be at conjunction with the Sun in early January 2015.

Members of the ALPO Remote Planets Section have been busy studying Uranus, Neptune and Pluto during mid- and late-2014. Frank Melillo recorded images of Pluto with an unfiltered CCD camera on seven different nights between September 13 and 27. His data are consistent with Pluto growing brighter and dimmer as it rotates. His results are consistent with that planet's light curve having an amplitude of 0.1 magnitude.

Marc Delcroix and others have imaged albedo features on both Uranus and Neptune. One feature on Uranus was distinct over a period of at least several days. This writer has also made brightness measurements of Uranus and Neptune. Uranus is near its 2013 brightness in the V filter, but it was brighter in red and near infrared wavelengths than two years ago.

This writer hopes that others will image these planets in early 2015. Please be sure to submit your observations to the recorder so that he can include your results in the 2014-2015 apparition report. Please make a special effort to observe both planets on the 15th of each month.

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

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

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

Feature Story:
Index to Volume 54 (2012) of The Strolling Astronomer

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

PUBLICATION DATA

Issue Number:

1. Winter 2012 .... pp. 1-43
2. Spring 2012 .... pp. 1-75
3. Summer 2012 .... pp. 1-59
4. Autumn 2012 .... pp. 1-59

AUTHOR INDEX

SUBJECT INDEX

Feature Story:

Equipment for Observing Comets: A Case for Giant Binoculars

By Gary T. Nowak,
Member, the ALPO Comets Section
chergen@lpl.arizona.edu

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.

The bracketed numbers within the text refer to sources located at the end of this paper.

Abstract

This article explores some of the benefits of using "Giant Binoculars" to observe comets. Note that the term "Giant Binoculars" will be used as shown here throughout this paper. Technical specifications and visual specific gains are discussed for Giant Binoculars. The author makes some recommendations for 15 x 70 or 20 x 80 Giant Binoculars based on his many years of observing comets.

Background

Since his early days as a teenage "newbie" (new) amateur astronomer, the author has been interested in observing comets. The author made his first comet observation of Comet Tago-Sato-Kosata (1969 IX) on February 4, 1970 using a pair of 7 x 50 binoculars and a 3 in., f/15 Refractor at 54x. The author's interest in comets grew and so did his search for a good comet scope because that 3 in., f/15 refractor left a lot to be desired. By March 1979, the author had ground and polished a mirror for a homemade 4.25 in. (108 mm), f/4 portable Newtonian telescope. This "Richest Field Telescope" was specifically designed to do comet observations at 16x and 25x. Observations of Comet Panther (1980u) with the 4.25 in. scope at 16x still seem to indicate that there should be a better instrument for observing comets.

A few years later, the author was able to use and compare a friend's new pair of Giant Binoculars (11 x 80) to his 4.25 in. telescope at 16x and quickly noticed the advantages which the Giant Binoculars had to offer. In 1984, the author purchased his first pair of Giant Binoculars, a pair of Celestron 11 x 80 Giant Binoculars for the then-high price of $500 USD. These 11 x 80 Giant Binoculars were used to produce fully valid comet observations (coma, DC, and total magnitude) on Comet Levy-Rudenko (1984t) and Comet Shoemaker (1984s) for the ALPO Comets Section. This author has observed 110 comets over the years with various pairs of binoculars and is still actively enjoying and pursuing observations of comets with Giant Binoculars.

A Tale of Two Commuter Comet Observers

It's a clear dark night, a good night to do some comet observations. Two comet observers drive or commute by car to their favorite observing site. The first observer has the latest, super, very large aperture, Schmidt-Cassegrain telescope (SCT) on a fully optioned out and computerized "Go-To" German Equatorial Mount (GEM). This observer will be known as "Observer SCT". The second observer has a pair of Giant Binoculars and a simple, sturdy tripod.

Figure 1. A pair of 15x70 binoculars offered by Orion Telescopes & Binoculars.
Source: *http://www.telescope.com/Binoculars/Astronomy-Binoculars/pc/5/72.uts*

This observer will be known as “Observer GB”.

Observer SCT arrives at the observing site and starts the unloading and set-up process for all the SCT equipment. Forty-five minutes later, Observer SCT is still in set-up mode. The mount and tube have been successfully put together and now the Go-To process mode is being set-up, where the observer “trains” the computer chip in the telescope mount to know where it is located and to identify certain key bright stars.

Observer GB arrives at the same time at the same site as Observer SCT. Observer GB quickly unloads the car and starts to set up. The sturdy tripod is erected, the binocular tripod adapter is attached and the Giant Binoculars are finally attached as well. Within five minutes, Observer GB is set up and ready to observe while Observer SCT is still in set-up mode.

The comet is soon located by both observers. Observer SCT is having trouble seeing the whole comet and tail due to the telescope’s narrow field of view. You can hear the slewing motors hum as the Observer SCT moves back and forth across the visual field of the eyepiece; trying to see the whole comet. The slewing motors are certainly getting a workout as Observer SCT moves the scope around trying to estimate the magnitude of the comet against the known comparison stars which are not in the same visual field of view as the comet. Observer SCT must adjust the telescopic view to the comparison star charts. The telescopic view seems to be backward or upside-down when compared to the star charts.

Meanwhile, and thanks to the wide field and erect view of the Giant Binoculars, Observer GB uses both eyes to enjoy the view of the entire comet. The comet’s coma and tail and most of the comparison stars are all in the same field of view. It’s nice to have the comparison stars of known accurate brightness within the same binocular field as the comet. The Giant Binoculars can be moved very quickly to the adjacent field while Observer SCT works with a narrower field of view which results in a much slower process that could possibly result in less accurate estimates.

It’s now the end of the observing session. Both observers are happy that they saw the comet and now it’s time to pack up and go home. Observer SCT starts the long process of taking the mount and telescope apart and placing them into their cases. This is going to take awhile and isn’t going to be a short-duration event.

Observer GB places the Giant Binoculars, tripod adapter and tripod into their cases and into the car. Within five minutes, the equipment is packed into the car, and Observer GB is in the car, starting to drive home. It’s going to be a while before Observer SCT is all packed up and ready to go home. Observer GB left the observing site long before Observer SCT was all packed up.

Other Observing Situations

A new comet has been discovered. Both observers want to see this comet because it has a short observing window before the comet moves into another hemisphere skies. The weather forecast is going to be “iffy” and not favorable for the next few days. Suddenly the sky clears up, leaving a short opportunity to observe the comet before it sets. What is needed is a quick “grab-and-go” instrument that can be deployed swiftly. Observer GB can quickly place the Giant Binocular equipment in the car and drive off long before Observer SCT even has the Super SCT equipment packed in the car. The Giant Binocular and tripod makes a great grab-and-go scope. You may have only minutes to locate and make your observations of a comet. Taking quick advantage of such circumstances is likely to result in another comet added to your observing records. The instrument which will be used the most for commuter astronomy is the one which is easiest to transport and easiest to set up.

The winter observing season is now in full force for the two comet observers. On this night, the temperature has already fallen below freezing (+32° F, 0° C). But both comet observers are hardy folks and ready to take on the cold night sky [1]. Both observers have their equipment set up and start their night observing session. The temperature continues to fall. About an hour into the cold observing session, the Observer SCT telescope starts to malfunction. The motors seem to be slowing down and the lighted control paddle seems to be dimming. After more time passes, the telescopes slewing motors have stopped completely and the hand control paddle is not lighted and is not functioning at all. The cold weather has depleted all the electrical energy from the telescope’s batteries. All of the telescope’s electrical dependent functions are dead due to the cold weather affecting the battery power.

Observer GB is immune to the “cold weather vampire” problems because there are no batteries in the tripod to go dead. The Giant Binoculars can be moved about on the tripod at will and continue to reveal the wonders of comets and other deep sky objects.

Giant Binocular Technical Specifications

When astro folks talk about their Giant Binoculars or for that matter, any binoculars, they rattle off terms such as “20 by 80” or “15 by 70”. So what do those numbers mean? Let’s take a closer look at a common Giant Binocular such as 20 x 80. The first number, in this case the “20”, represents the binocular magnification. The second number, in this case the “80”, represents the objective lens diameter in millimeters.

So what constitutes a binocular to be considered a Giant Binocular? For the purpose of this article, any binocular with a magnification of 11x or greater and has an objective lens of 70 mm or larger is considered a Giant Binocular. Thus a pair of 11 x 70 binocular is at the lower limits of the qualification to be a Giant Binocular.

An important factor in having a user friendly Giant Binocular is to have the proper eye relief or "high end point" or eye position behind the eyepiece. Proper eye relief is a place to comfortably locate your eye to see the entire view in the binocular eyepieces without pushing against or touching the binocular eyepieces. This is especially true if you wear glasses while observing. A range of 17 - 22 mm eye relief is a comfortable distance to locate your eye behind the eyepiece. It's this author's opinion that 20 mm eye relief is his favorite distance for eye relief. The author can wear his glasses and still see the whole field of view; his glasses are not pushed up against the eyepiece. Some observers may prefer a different eye relief value based on their own preference. Another problem with having one's eye too close to the eyepiece is eye moisture which may fog or transfer moisture onto the eyepiece. An eye position farther from or longer than the eye relief means your eye will not see the whole field of view in the Giant Binocular.

One nice feature that most Giant Binoculars and, for that matter, other smaller size binoculars, have is their wide, erect field of view. Most observers who use binoculars want to know how much of the sky or field of view they can see. Most good binocular manufactures supply or print the field of view in degrees for the portion of the sky visible in said binoculars. If your binocular doesn't have the degrees posted, you can use the information printed on the prism covers of the binoculars and plug that information into these formulas [2].

Benefits and Advantages of Using Giant Binoculars

Giant Binoculars (and other binoculars) have some very nice benefits for astronomical observing. Due to the fact that an observer is using both eyes, there is a gain in contrast for observing diffused objects such as comets or nebulae. That gain contrast due in binoculars is spectacular – up to 40% [3]. Thus, a Giant Binocular view of a comet will make the appearance of that object seem to stand out more. Experimentation has shown that a Giant Binocular will out-perform a telescope of matching aperture and magnification [4]. A diffuse object viewed through a Giant Binocular will appear to have "a more contrasted view" than a telescope of similar aperture size and magnification. This improved contrast view gives the illusion that the Giant Binoculars are acting like a larger aperture telescope. The view of a comet through a pair of 20 x 80 Giant Binoculars will outperform the same view through an 80 mm telescope at 20x. A pair of 20 x 80 Giant Binoculars can also compete with the same view of the comet in a 4.25 in. (108 mm) aperture telescope at 20x. Mel Bartels summed up the advantage this way: "True binocular viewing will result in a 0.5-magnitude gain in stellar limited magnitude and 1.0-magnitude gain for extended (nebulous) objects." [5].

Another theory on why binocular vision will allow you to see fainter is that the eyes / brain always work together to form the final images that we see. If just one eye detects some very faint feature (like a star), yet the other eye does not, the reaction of the brain is to delete that weak / questionable bit of input from the final images it forms. Thus, it is lost. As the brain perceives it, simultaneous input from both eyes is re-enforcing, just like the stacking of CCD images. The brain sees two inputs from the same weak source / point source of light and then knows it to be real and you perceive it as actually being there. Very faint stars glimpsed with just one eye are steadily seen only when both eyes are used. In my own case, (John Bortle) the gain has always amounted to about 0.75 magnitudes [6].

The other apparent gain increase for using binoculars is a small gain in resolution. Using both eyes while observing with binoculars will give you an apparent resolution gain up to 15% [7]. Giant Binoculars have the ability to see more fine detail than using a telescope of similar aperture size and magnification. However the apparent resolution gain in binoculars can be quickly erased by changing an eyepiece in a telescope. Most types of Giant Binoculars can't change eyepieces. For example, in the comparison case of the 20 x 80 Giant Binoculars vs the 3 in. (80 mm) telescope at 20x, the Giant Binoculars will seem to have a tad better resolution. However, if one changes the eyepiece in the telescope to increase the magnification, the resolution gain of the Giant Binoculars is very quickly lost and the telescope easily outpaces the binoculars. There is also the fact that binoculars always show a larger coma diameter than a matching aperture telescope with matching magnification [8].

Another advantage that Giant Binoculars has for observing comets is the wide field with an erect (correct) view. Until the advent of Mel Bartels Homemade Super Richest Field Telescope, "The Zip Dob", Giant Binoculars had the advantage of a wider field and erect view. (An example of Mel Bartels Super Richest Field Telescope is his homemade 13 in. (330 mm), f/2.8 Newtonian equipped with coma corrector and super wide field eyepieces) [9]. The more common Richest Field Telescopes don't offer the wider, erect field of view of the Giant Binocular. The author's 20 x 80 Giant Binoculars has an erect field of view of 3.2 degrees and his 15 x 70 Giant Binoculars has an erect field of view of 4.3 degrees. The author's homemade 4.25 in., f/4 Newtonian only has an inverted field of view of 3 degrees at 20x. Despite the advent of the "Zip Dob", binoculars still offer the advantage of an erect field of view, a feature none of the Richest Field Telescopes can offer.

Binocular observers find that it's easier to use both eyes than one. David A. Seargent notes "that the ability to use both eyes while observing is more restful than squinting through one eye" [10].

The advantages of Giant Binocular for comet observations should be carefully considered by an observer in choosing their comet observation instrument. One of the reasons why a comet observer may want a telescope is based on the idea that there is a scarcity of observable comets, that is, those bright enough for Giant Binoculars. Some observers may think that it will be years before the appearance of a comet bright enough to be seen in Giant Binoculars. That reasoning is not based on factual data gathered from the author's many years of observing. Since 1984 to the present day, this author has observed an average of 3.66 comets per year from Vermont, where the weather is 75% cloudy for most of the year [11]. This author has used Giant Binoculars to observe all the comets he seen since 1984.

It may come as a surprise to some folks as to how dim a comet can be seen in Giant Binoculars. The author has assembled a chart of limiting magnitude of comets, based on binocular size [12].

Binocular Size:	7 x 35	8 x 42	9 x 60	15 x 70	20 x 80	25 x 100
Faintest Comet Magnitude:	+8.0	+8.5	+9.0	+9.5	+10.0	+10.5

This chart should be considered as an estimate or rule-of-thumb for binocular observations. Actual results may vary with observer's own experience, sky conditions, comet size and condensation, comet's altitude, and light pollution factors. Fully valid observations of comets (coma, D.C. & total magnitude) are possible at or above the cited level of brightness. But even though comets of fainter magnitudes may be detected, those comet observations are not accurate enough for useful valid information to be recorded.

Author Suggestions: Giant Binoculars

Spending lots of time under cold, damp, night conditions; a comet observer may want to consider ways to make the Giant Binoculars less weather effected. One of the biggest enemies of extended night observing is the presence of moisture which manifests itself as fog, dew, or frost / ice crystals. Here are some suggestions by the author to help make your Giant Binoculars more moisture resistant. There is an advantage of using Individual Focus Eyepieces (sometimes called Independent Focus) over Central Focus Eyepieces on binoculars. Although the Central Focus Eyepieces are a speedier way to focus; an Individual Focus Eyepieces can be made to be much more waterproof than Central Focus Eyepieces. This is why the US Army Armored Forces are issued binoculars with individual focus [13]. The Individual Focus are much more water resistant and better at keeping out dust and dirt from getting into the optical train.

Another simple devise which will help you extend your observing session and helps keep moisture from forming on the binocular objectives is the use of dew shields or sometimes called "dew caps". These are simply hollow cylinder tubes fitted over the objective lens housing (sometimes called objective bell) to shield or protect the objective lens from various forms of moisture. The author has made several pairs of dew shields from simple cardboard shipping tubes and painted them flat black inside and out. The author even has dew shields on his hand held binoculars. The author has found through experience that a dew shield should be about twice as long as the objective size. The dew shields also serve another function to help keep out stray light from entering through the objectives and ruining the view.

If the comet observer is serious about observing comets, the observer should consider a "Dual Binocular Observing System". A Dual Binocular Observing System consists of a pair of hand held binoculars, a pair of Giant Binoculars, and a sturdy homemade stand or

Figure 2. Giant binoculars with homemade dewshields attached. Image source: *http://www.astromart.com/common/image_popup.asp?image=/images/forums/41000-41999/41461.jpg&caption=*

commercial tripod. This system is used by the author and some of the observers in the ALPO Comets Section.

Here are some of the binoculars used by comet observers:

Salvador Aguirre 7 x 50
John Bortle 10 x 50, 15 x 70, 20 x 120
Carl Hergenrother 10 x 50, 30 x 125
Gary Nowak 7 x 35, 8 x 42, 9 x 60, 11 x 70, 15 x 70, 20 x 80, 25 x 100
John Sabia 10 x 50
William Souza 10 x 50, 15 x 70, 20 x 80, 25 x 100

A Dual- or Multiple-Binocular Observing System has a few advantages as well. One should always try to use the smallest aperture binocular that definitely shows the comet. Use of the smallest binocular that definitely shows the comet for visual magnitude estimates is extremely important for data quality [14].

One consideration for choosing binoculars for a Dual- or Multi-Binocular Observing System is the ability for binoculars to lower the sky brightness or have a darker sky background. Choosing the proper binoculars avoids the comet image simply fading away into the background starfield due to lack of contrast. The basic principle is that a lower sky brightness allows fainter diffuse objects to be seen. This is especially important for large diffuse comets. Binoculars are really the only instruments that combine a large field with low sky brightness. In order to achieve a similar surface brightness with an SCT requires high magnifications. This is fine for small, faint comets, but results in the loss of the outer coma for brighter larger comets and a fainter magnitude estimate. There is a formula which calculates sky brightness (SB):

SB = (Aperture [mm] / Magnification) ↑2 {this formulae also equals exit pupil ↑2} [15].

To achieve this principle is to choose a binocular which gives you a lower sky brightness. Let's compare the 7 x 50 binocular to the 8 x 42 binocular:

7 x 50 (50 / 7) ↑2 = 51.02

8 x 42 (42 / 8) ↑2 = 27.56

The contrast in the 8 x 42 with the SB of 27.56 will provide a darker background for comet observations than with the 7 x 50 with the SB of 51.02.

If this author was to pick a pair of only hand-held binoculars, it would be a pair of 8 x 42. (Of course fitted with homemade dew shields). The author's 8 x 42 pair of binoculars is used hand-held and have excellent eye relief of 22 mm and have a very wide field of 8.2 degrees. The 8 x 42's are easy to hold and light enough not to tire out your arms quickly. (Of course you could have them tripod-mounted). The wide erect field of 8.2 degrees makes it easy to locate comets. Seeing both the entire comet and the comparison stars all in the same field of view makes it easy to do visual photometry. (See footnote [12] for an alternative pair of hand-held binoculars recommended by Comet Expert John Bortle)

The main instrument for a serious comet observer would be the Giant Binocular. The author recommends either a pair of 15 x 70 or 20 x 80 as good choices for comet observations. The author owns both pairs of binoculars [16]. The 20 x 80 would be the 1st choice of the 2 recommended binoculars. If one wishes to have a more lightweight, less expensive Giant Binocular, then the 15 x 70 would be a good choice. The author's 20 x 80 has an 80 mm triplet objective, a field of view of 3.2 degrees, 18 mm of eye relief, and weighs only 7.0 lb (3 kg). The author's 15 x 70 has a 70 mm doublet objective, a 4.3 degree field of view, 18 mm of eye relief and weighs 3.1 lbs (1 kg). The 15 x 70 can be purchased for under $175 USD (135.29 €) and the 20 x 80 can be bought for under $350 USD (270.52 €). (A comet observer may wish to spend more money and purchase larger Giant Binoculars than the two suggested).

A dual binocular observing system would be ideal to handle a variety of comet observations and visual comet photometry. Giant Binoculars also work well on showing the large deep-sky wonders such as open star clusters, emission and reflective nebulae, dark nebulae, and the Milky Way star clouds [17]. The author would like to comment that some of the views of Barnard's large dark nebulae are a real treat to behold in a Giant Binoculars.

Author Suggestions on Tripod Features

The author would like to recommend a few features to consider for mounting your Giant Binoculars onto a tripod. Some observers have built very sturdy homemade Giant Binocular mounts which work very well. A quick-release plate is a vital feature for mounting / dismounting you binoculars quickly, especially in cold weather. This feature snaps in / out quickly without tools, is easy to use and allows the next feature to be easily mounted and used.

The quick-release plate, along with a tripod adapter, will allow Giant Binoculars – or any binoculars with a tripod adapter built-in socket – to be quickly and sturdily attached to a tripod. Some binoculars have the tripod adapter built into the binocular as a center post mount. Other binoculars need to attach an extended bracket that is usually "L" shaped or a "slanted pillar shape". The author's 20 x 80 have the built-in center post mount. The author's 15 x 70 need the external binocular tripod adapter.

If one observes in cold weather (below freezing), it would be wise not to have a fluid head or fluid motion tripod. The heavy fluid inside the tripod head which gives that smooth motion usually freezes in less than an hour after being exposed to below freezing temperatures. This freezing completely immobilizes the tripod head and all movement is lost. Also check the manufacturer's tripod cold-weather ratings. Some tripods have fine lubricants in them and this lubricant freezes faster than the fluid motion heads.

Also one should avoid the so-called "studio tripod". The problem with the studio tripod is that it's built very sturdily but has a short raise height on the central column. This short height may not elevate the binoculars high enough to get a view of high-altitude or near-zenith objects. Studio tripods usually have a very poor cold-weather rating because they are made for in-studio use with inside temperatures. One should try and purchase a really solid tripod. Giant Binoculars can really magnify the shake of flimsiness in a light tripod. One should make sure that the tripod can elevate the tripod head above the top of your head while you are standing fully upright. This will make observing easier for viewing the high altitude objects with your binoculars without bending or crouching down to use your Giant Binoculars.

Another nice accessory to consider is a tripod carrying case for your tripod. It will make carrying your tripod a lot easier and will help keep it clean.

Summary

There are many good reasons to use Giant Binoculars for observing comets. Some of these reasons are: wide, erect field of view; 40 percent contrast gain; 15 percent resolution gain; and easy transportation and set up. A Dual Binocular Comet Observing System featuring a pair of smaller hand held binoculars and a pair of Giant Binoculars can handle observational and visual photometry of comets. Giant Binoculars must have a sturdy tripod or homemade mount to be placed on. The author recommends either a pair of 15 x 70 or 20 x 80 as a good Giant Binocular size. These two Giant Binoculars will work well for comet observations and other types of deep sky observing such as open star clusters, Milky Way star clouds, and dark nebulae.

Footnotes, Sources

1. Vermont (VT) (USA) weather data:

   • VT averages 92 days per year below +32° F (0° C).

   • VT averages 154 days per year that the minimum temperature per a 24-hour-period is below +32° F (0° C).

   • VT average meteorological winter temperature at night: +8° F (-13.3° C).

   • VT average winter humidity: 42%.

   • Lowest (Coldest) official temperature: -50° F (-45.5° C).

   (Weather Statistics from NOAA (National Oceanic and Atmospheric Administration).

2. Field of View (F.O.V.) is measured in Feet at 1,000 Yards. Feet ⁄ 52.5 (53) = Degrees.

Seyfried, J.W., *Choosing, Using & Repairing Binoculars*, University Optics, Ann Arbor, Michigan, pp. 36-37.

F.O.V. is also measured in Meters per 1,000 Meters. Real degrees F.O.V. is divide number of meters by 2000 then take the inverse tangent of result and double your answer. See ISO: 14132-1: 2002 for the fully specific optical formulas.

3. Harrington, Philip S. *Touring the Universe with Binoculars*, John Wiley & Sons, New York, 1990, p. 2.

Kozak, John T. *Deep Sky Objects for Binoculars*, Sky Publishing Corp. Cambridge, Mass, 1988, p. 34.

4. RASC (Royal Astronomical Society of Canada) Handbook 2014, Lee Johnson & William Robert Article on Binoculars, p. 55.

Sidgwick, J. B., *Amateur Astronomers Handbook*, Dover Publications, New York, 1971, p. 400.

Crossen, Craig & Tirion, Wil, *Binocular Astronomy*, Willmann-Bell, Inc. Richmond, VA, 1992 p. 25.

5. Mel Bartels, "Visual Astronomy at Telescope Eyepiece", www.bbastrodesigns.com/visual.html

6. Comet Expert John Bortle; from private communication with the comet expert.

7. Harrington p.1, Sidgwick p. 400, Crossen & Tirion p. 25.

8. Comet Expert John Bortle; from private communication with the comet expert.

9. Mel Bartels, "The Zip Dob", Super Richest Field Telescope, *www.bbastrodesigns.com/zipdob, html*

10. Seargent, *David A. Comets: Vagabonds of Space*, Doubleday &Company, Inc. Garden City, New York, 1982, p. 72.

11.The author has observed 110 comets over a period of 30 years. The author has used Giant Binoculars to observe comets since the purchase of his first Giant Binoculars; 11 x 80 in 1984.

12. Kozak p. 37. Comet Expert John Bortle has reviewed the magnitude limits for given binocular size and has this additional information: The first two binocular magnitude limits: (7 x 35 and 8 x 42) are a bit over-optimistic for observations in the light-polluted skies which most observers now have to contend with. John Bortle would recommend using a larger pair of binoculars such as 10 x 50 to reach comet magnitude limits down to about +8.5 magnitude. John agrees with the rest of the chart values. (From private correspondence with John Bortle).

13. The author was a former US Army armor officer and tank platoon leader.

14. Carl Hergenrother, from private communications with the author.

15. Seargent p72-73, Carl Hergenrother, from private communications with the author.

16. Author's "Cheval de Bataille" of Binoculars, 8 x 42,15 x 70, 20 x 80, 25 x 100.

17. Crossen & Tirion p. 25, Sidgwick p. 400, Kozak pp. 58-62 and Harrington pp. VI, 1-2.

Feature Story

ALPO Observations of Mercury During the 2013 Apparitions

By Frank J Melillo, coordinator,
ALPO Mercury Section
E-mail: *frankj12@aol.com*

Abstract

During the six apparitions of Mercury in 2013, there were four observers who submitted 9 observations, of which 5 were drawings and 4 were webcam images. Observers used telescopes of 25 to 35.5 centimeters aperture. Some of the features they depicted show good correlation with the images from the MESSENGER flybys and with the IAU's albedo chart prepared by Murray, Smith and Dollfus (Murray, Smith, and Dollfus, 1972). Other features they depicted are not identifiable but might be incorporated into future albedo maps.

Introduction

This paper is the report of the observations of Mercury made in 2013. There were three evening and three morning apparitions during the year, as described in Table 1. As in the last several years, the number of observations submitted to the ALPO Mercury Section decreased from the year before. Observations from previous years have been reported in this journal (Melillo, 2010a; Melillo, 2010b; Melillo, 2011a; Melillo 2011b; Melillo, 2013; Melillo, 2014). In 2013, five drawings and four webcam images were received. The drawings are important in that they show what the planet actually looks like, and making a drawing serves to train an observer to notice the most subtle features visible through the eyepiece. However, webcam images can provide more accurate information and serve to verify the actual position of any features that are seen visually on Mercury.

March 2013 marked the second anniversary of the MESSENGER spacecraft's insertion into orbit around Mercury. Scientists are still getting high resolution images of the surface. Readers are encouraged to visit the MESSENGER website at *http://messenger.jhuapl.edu* . Because the spacecraft is still productive, NASA has requested that Congress fund the operation of the spacecraft through 2015 (Harwood, 2014).

Mercury is the most difficult of the naked-eye planets to observe (Melillo, 2004), but John Boudreau has made recent advances in its observation (Boudreau, 2009). Readers should understand that the albedo features of Mercury are not definitively worked out. Since its orbital insertion, the MESSENGER spacecraft's images, though excellent for identifying surface topography, are not optimal for the display of albedo features that are seen from Earth. The drawings and images made by participants in the ALPO Mercury Section continue to be important for the verification of elusive albedo features. Each observer's observations display the challenges of observing this elusive planet, as low altitude, proximity to the Sun, and small apparent size often combine to frustrate observers.

Aron Kiss of Hungary sent in some excellent drawings. John Boudreau of Massachusetts continued to image Mercury with excellent results. Two new observers made outstanding

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 a the end of this paper in blue text to jump to source material or information about that source material (Internet connection must be ON).

Special Note

East is defined as the direction toward which a planet rotates, and in the case of Mercury, east on the planet is approximately the same direction as west on the sky. With north up as it is in the images in this paper, this east-west convention is the same as it would be if you were looking at a globe of Earth. When referring to east and west on Mercury, the author is using planetary map directions, not sky directions.

In this paper, the planetographic longitude convention, with increasing longitude toward planetary west, is used exclusively. This is the convention that ALPO Mercury and Mars observers have long used, and it differs from the planetocentric longitude system, in which longitude increases to the east.

Table 1: Characteristics of the Apparitions of Mercury in 2013 (all dates UT)

Number and Type	Beginning Conjunction*	Greatest Elongation	Final Conjunction*	Aphelion	Perihelion
1. Evening	17 Jan (s)	16 Feb	3 Mar (i)	4 Jan	17 Feb
2. Morning	3 Mar (i)	31 Mar	11 May (s)	2 Apr	
3. Evening	11 May (s)	12 Jun	9 Jul (i)	29 Jun	16 May
4. Morning	9 Jul (i)	30 Jul	24 Aug (s)		12 Aug
5. Evening	24 Aug (s)	9 Oct	1 Nov (i)	25 Sep	
6. Morning	1 Nov (i)	18 Nov	29 Dec (s)	22 Dec	8 Nov

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

Table 2: ALPO Observers of Mercury in 2013

Name	Location	Instrument*	No. & Type of Observation†	Apparitions Observed
John Boudreau	Saugus, MA, USA	27.5 cm SCT	1 W	3
Daniele Gasparri	Perigia, Italy	35.5 cm SCT	2 W	3
Aron Kiss	Vac, Hungary	25 cm RR	5 D	1, 4, 6
Emmanuel Subes	Dax, Aquitaine, FR	27.5 cm SCT	1 W	3
* SCT = Schmidt-Cassegrain, RR = refractor, W = webcam lucky imaging, D = drawing				

contributions -- Daniele Gasparri in Italy and Emmanuel Subes in France. As coordinator of the ALPO Mercury Section, the author greatly appreciates the efforts that each of these observers made to observe Mercury during 2013. Some details about the observers are in Table 2.

Apparition 1: Evening, 17 January – 3 March

After Superior Conjunction with the Sun on 17 January, Mercury became an evening object. Greatest elongation and perihelion occurred only 5 hours apart, so this was not a favorable apparition.

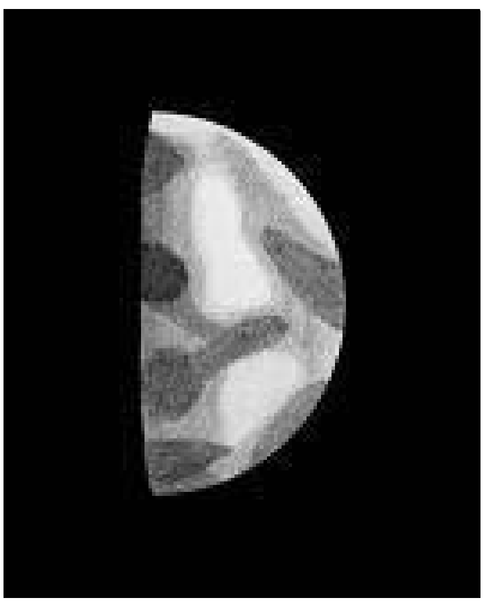


Figure 1. One observation of apparition 1. In this and all other figures in this article, north is up and planetary east (celestial west) is to the right. Drawing by Aron Kiss, 16 Feb 2013, 16:45 UT, CM = 88 degrees.

Only one observation was received. Aron Kiss made a drawing of Mercury on 16 February (CM = 88 degrees). This was only 5 hours before greatest elongation from the Sun, and 10 hours before the perihelion of 17 February, so his observation at greatest elongation was made at nearly the smallest "greatest" elongation possible (18 degrees from the Sun)!

He drew it slightly gibbous, and depicted some features on the disk (see Figure 1). The darkest feature (located above the center near the terminator) appears to be Solitudo Lycaonis, and the dark feature below it is likely Solitudo Martis, drawn with an extension toward the northeast where it ends in Tricrena. This connection between Martis and Tricrena is not usually identified. The other dark features in the drawing do not appear to coincide with previously identified features and thus may represent new findings.

Mercury quickly dropped out of sight in the glare of the evening horizon, and went through Inferior Conjunction on 3 March.

Apparition 2: Morning, 3 March – 11 May

Mercury became a morning object for more than two months – a long apparition. Unfortunately, this was an unfavorable apparition for Northern Hemisphere viewers and no observations were made.

Apparition 3: Evening, 11 May – 9 Jul

After Superior Conjunction with the Sun, Mercury moved to a moderately favorable position in the evening sky. In late May, Mercury was in conjunction with two planets, Venus and Jupiter. From 25 May to 27 May, all three planets were within 3 degrees of each other, visible as a spectacular naked eye event after

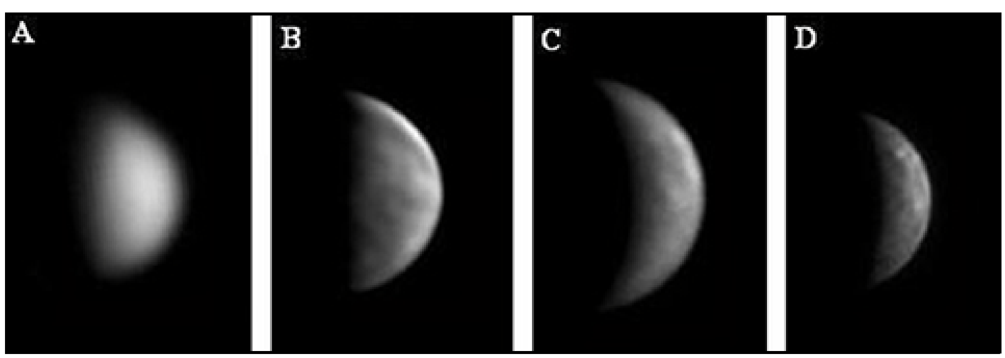


Figure 2. Four images of apparition 3:
A. Image by Emmanual Subes, 4 Jun 2013, 20:07 UT, CM = 282 degrees.
B. Image by Daniele Gasparri, 6 Jun 2013, 18:40UT, CM = 291 degrees.
C. Image by John Boudreau, 15 Jun 2013, 22:55 UT, CM = 338 degrees.
D. Image by Daniele Gasparri, 17 Jun 2013, 12:50 UT, CM = 347 degrees.

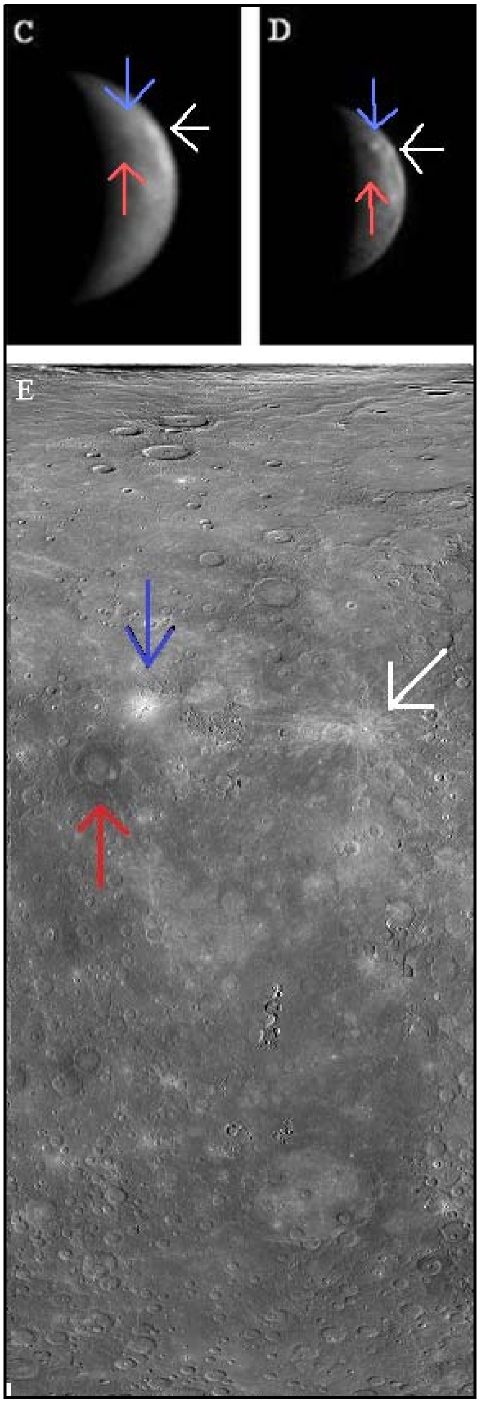


Figure 3. Panels C and D are copied from Figure 2. Panel E is an image taken by the MESSENGER spacecraft from orbit around Mercury. The white arrow in each image is the crater Forteyn and its bright ejecta. The blue arrows point to a crater that is, as yet, unnamed, with its bright ejecta. The red arrows denote crater Rachmaninoff and the dark surface around it.

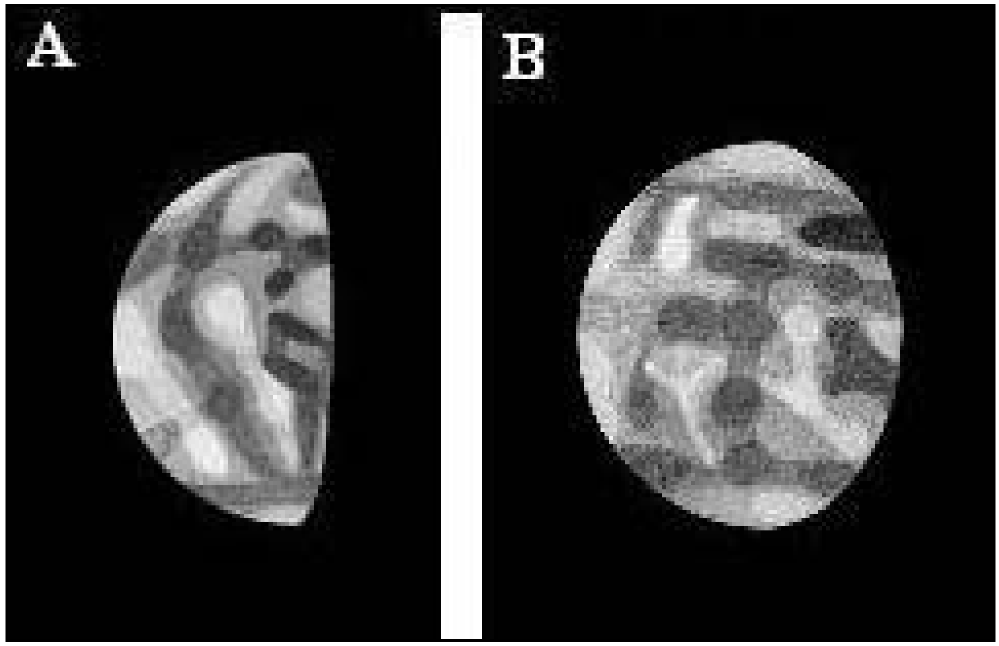


Figure 4. Two drawings of apparition 4.
A. Drawing by Aron Kiss, 04 Aug 2013, 4:00 UT, CM = 276 degrees.
B. Drawing by Aron Kiss, 12 Aug 2013, 4:05 UT, CM = 312 degrees.

sundown. See *http://apod.nasa.gov/apod/ap130613.html* .

After 26 May, Mercury stood above Venus and Jupiter, and was easily visible above them. It is rare to see two bright planets shining below Mercury in this way.

This apparition yielded the most contributions during the year, with 4 observations submitted (see Figure 2).

Emmanuel Subes imaged Mercury on 4 Jun (CM = 282 degrees), 8 days before greatest elongation. The image nicely displays the phase at slightly more than half, and no albedo features are discernable.

Daniele Gasparri made an excellent image of Mercury on 6 Jun (CM = 291 degrees). He used an IR-pass filter to increase the contrast. It shows a half-phase even though the planet was 6 days before greatest elongation, a situation unique to Mercury.

Some of the details he detected on the disk are known features; adjacent to the terminator, the dark area just north of center is Solitudo Aphrodites, and the dark area at the center is Solitudo Alarum. The dark terminator feature south of Alarum is previously documented but unnamed.

John Boudreau also made an excellent image on 15 Jun (CM = 338 degrees), revealing a crescent phase with many dark and bright surface features. Solitudo Alarum is seen along the equatorial terminator, with Solitudo Aphrodites north of it. He used a 685nm longpass filter to increase the contrast on the disk. Two days later, on 17 Jun (CM = 347 degrees), Gasparri made another excellent image showing albedo features similar to those in Boudreau's image.

Both images show, very near the limb in its northern half, a white area that is the ejecta rays of Fonteyn Crater, together with other albedo areas that are present in images taken by the MESSENGER. See Figures 2 and 3.

Mercury ended the evening apparition on 9 Jul.

Apparition 4: Morning, 9 Jul – 24 Aug.

This was the most favorable morning apparition of the year, but only two observations were received (see Figure 4).

Aron Kiss made both drawings, on 4 Aug (CM = 276 degrees) and 12 Aug (CM = 312 degrees). The drawings show many details, of which many cannot be clearly associated with known albedo features and thus may represent new findings.

The darkest feature is probably Solitudo Aphrodites, near the terminator in its northern half, and depicted in slightly different rotations in the two drawings. (Solitudo Aphrodites is known to be the darkest feature on the entire surface.) The dark terminator feature in the equatorial area may be Solitudo Alarum, and the small bright area to its upper left (NW) may be Pentas.

Although the reader may find it difficult to compare the two drawings, it appears likely that the 4 vertically arrayed dark spots near the center of the 12 August image can be seen in the 4 August image to the left of center as 3 vertically arrayed spots and below them a cross of dark lines.

Mercury went into Superior Conjunction on 24 Aug.

Apparition 5: Evening, 24 Aug - 1 Nov

This apparition was rather poor for Earth's Northern Hemisphere observers. Unfortunately, no observations were received.

Apparition 6: Morning, 1 Nov – 29 Dec

This was perhaps the second most favorable morning apparition of the year, with Mercury easily seen before sunrise for observers in our Northern Hemisphere. Only two observations were received.

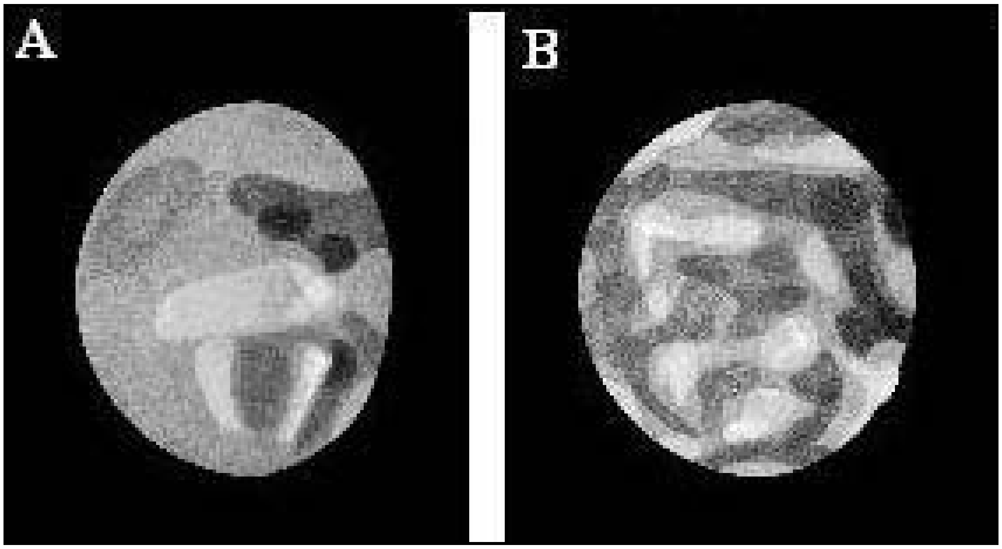


Figure 5. Two drawings of apparition 6.
A. Drawing by Aron Kiss, 27 Nov 2013, 6:00 UT, CM = 148 degrees.
B. Drawing by Aron Kiss, 03 Dec 2013, 6:03 UT, CM = 175 degrees.

Aron Kiss made two drawings, on 27 Nov (CM = 148 degrees) and 03 Dec (CM = 175 degrees), with the apparent diameter of the planet only about 5 arc seconds (see Figure 5). Mercury displayed a gibbous phase on both days. In the 27 Nov drawing, the large, dark, curved feature in the north may be a combination of Solitudos Horarum, Neptuni and Phoenicis, while in the south the dark features may be Solitudos Jovis near the terminator and Helii near the central meridian. The features depicted on 3 Dec can be associated with previously identified albedo features only in a speculative way.

This apparition ended at Superior Conjunction on 29 Dec.

References

Boudreau J (2009). *Imaging Elusive Mercury*. *Sky & Telescope 118*(4):70-74.

Harwood W (2014). "NASA unveils FY 2015 budget; commercial space funding urged." Available online at *www.cbsnews.com/network/news/space/home/spacenews/files/fy15_nasa_budget.html* . CBS news.

Melillo FJ (2004). *Mercury in the Morning*. *Sky & Telescope 108*(3):78-80.

Melillo FJ (2010a). *Mercury Observations During the Second and Third MESSENGER Flybys*. *Journal of the Assn Lunar & Planetary Observers, 52*(3):19-22.

Melillo FJ (2010b). *ALPO Observations of Mercury During the 2008 Apparitions*. *Journal of the Assn Lunar & Planetary Observers, 52*(4):23-28.

Melillo F J (2011a). *ALPO Observations of Mercury During the 2009 Apparitions. Journal of the Assn of Lunar & Planetary Observers, 53*(1):21-26.

Melillo FJ (2011b). *ALPO Observations of Mercury During the 2010 Apparitions. J Assn Lunar Planetary Obs 53* (4):19-24.

Melillo, F J (2013). *ALPO Observations of Mercury During the 2011 Apparitions*. Journal of the Assn of Lunar & Planetary Observers, Vol 55 (1): 24 – 29.

Melillo FJ (2014). *ALPO Observations of Mercury During the 2012 Apparitions*. Journal of the Assn of Lunar & Planetary Observers, 56(2):17-21.

Murray JB, Smith BA and Dollfus A (1972). *Cartography of the Surface Markings of Mercury*. *Icarus,* 17(Dec):576-584.

ALPO MERCURY SECTION

NAME______________________________

ADDRESS___________________________

____

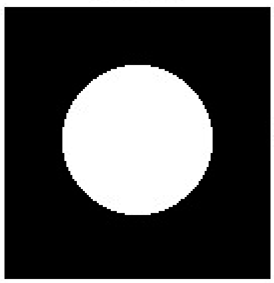
APPARITION:
Morning_____
Eveining_____

ARC SECONDS____"
ELONGATION:
_____° 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
ALPO Mercury Coordinator
14 Glen-Hollow Dr., E-#16
Holtsville, NY 11742

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

Feature Story:

A Review of Claims for a Dense Io Atmosphere

By: John Menke
ALPO Member
john@menkescientific.com

The ALPO Galilean Satellite Eclipse Timing Program welcomes and urges observers to participate in its activities. Please see page 12 of this Journal for a list of these events for 2015.

For information about this ALPO program, go to http://www.alpo-astronomy.org/jupiter/GaliInstr.pdf

For more on Jovian (Galilean) satellite mutual occultations (including graphics and a video by Christopher Go of the Philippines), go to http://www.universetoday.com/115814/observing-challenge-catch-a-series-of-mutual-eclipses-by-jupiters-moons/

Abstract

Degenhardt has interpreted apparent dimming of the rear satellite (Europa) during a Jovian satellite mutual occultation as evidence that the front satellite (Io) has substantial atmosphere. However, there are numerous deficiencies in the work. For example, eclipses should show the same effect as occultations, but they do not. A computer simulation of merging satellite images showed that the apparent dimming could be the result of camera saturation. Inspection of the data files showed extensive saturation of the occulting satellites actually occurring during the period of interest. Finally, unsaturated Ganymede images were used as a surrogate to test the effect of applying saturation with the test showing the same apparent dimming as seen in the original data files. The conclusion of this study is that the apparent dimming was caused by incorrect use of the cameras, and that Degenhardt's conclusion that the dimming is caused by satellite atmosphere is not supported.

Introduction

Degenhardt in SAS2010 and SAS2013, and on his website, has interpreted video recordings of mutual occultations of the Jovian satellites as evidence that substantial atmospheres exist around Io. The recordings showed apparent substantial (15-20%) dimming in the period (15-30 minutes) before and after the actual occultation of Europa by Io (in front of Europa). Degenhardt interprets the apparent dimming as the result of atmosphere around the front satellite Io casting a shadow on the rear satellite when near occultation. The recordings were made by Degenhardt, as well as by other observers.

At this time, it appears that Degenhardt is the only person who has written or presented substantial detail concerning the alleged phenomena. He has termed these Jovian Extinction Events (JEE), and refers to the period of dimming before and after the occultation as "wings" on the occultation light curve (see below).

Although Degenhardt has several coinvestigators, his conclusions have not received independent verification outside of this group. On the other side, there is only one written argument as of now against JEE via a paper by Anthony Mallama. Mallama presents several lines of evidence from past Earthbound and space probe investigations that he argues would have shown the alleged atmospheres, but which have not done so. Mallama thus argues that the Degenhardt JEE hypothesis is wrong, and that the dense atmosphere does not exist.

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 at the end of this paper in blue text to jump to source material or information about that source material (Internet connection must be ON).

The first part of this paper lists the issues that arose as the result of a detailed review of the Degenhardt data, paper and website, including those issues raised by Mallama. These issues raise additional questions regarding the interpretation of the data, and several go to the heart of the JEE claim. The second part of this paper describes a new investigation of samples of the actual Degenhardt video data. The investigation has clearly identified that the data contain increasing levels of sensor saturation as the occultation nears, and that the saturation caused the apparent dimming. The conclusion is that Degenhardt incorrectly interpreted the wings as evidence for an Io atmosphere.

Major Problems in Degenhardt Papers

By referring to Degenhardt "papers", we include the two presentations made by Degenhardt at Society for the Astronomical Sciences (SAS) in 2010 and 2013 and the subsequent publication by SAS, as well as all materials on the Degenhardt website www.scottysmightymini.com/JEE. All of these were reviewed in detail.

As noted, Mallama has documented a series of contradictory evidence that cast doubt on the existence of the satellite atmospheres. However, review of the Degenhardt papers led to the identification of a number of additional issues. It should be noted that these are all considered to be particularly serious issues, given the extraordinary claims being made for the JEE phenomena.

1. *Documentation*. The Degenhardt papers include almost no information describing what cameras, recording equipment, telescopes, and software were used in the observations. He cites no records of exactly how data were taken, nor how the reduction of the data, and the subsequent analysis were done. There is no description of data flow, nor the steps taken to assure all data were treated the same, or at least, in a systematic manner. There are no suggestions in the papers of methods used to assure accuracy, e.g., the injection of standard or synthesized data into the system to assure that the whole collection and analysis procedure was valid. Although the term "JPL Model" is used as part of his description of the wings, exactly how JPL (Jet Propulsion Laboratory) data were used is not explained. Therefore, it is extremely difficult ever to assure that someone can or has actually duplicated exactly what he has done.

2. *Observational Data*. Degenhardt claims that there are a large number of observations that support the JEE finding, and these are listed on his website. However, a review of the list shows that over half are not applicable for a variety of stated reasons that include weather, equipment problems, etc. Of the remainder, several had null results (i.e., did not show wings). The large majority of observations in support of JEE were his own. Thus, the claimed quantity of data and range of observers supporting JEE is less than initially appears.

3. *Observational Results*. Nowhere is there a complete, comparative, listing of the relevant observations and JEE findings, and what each observation (including the null measurements) showed. For example, he uses several measures to describe the length/duration of the wings, but does not tabulate these parameters across all the relevant observations. Without such a consistent summary of comparisons, it is very difficult to achieve understanding as to the range of the measurements or their uncertainties.

4. *Linearity*. Degenhardt asserts that extensive work was done to assure that the measuring system is linear, but presents almost no information to show how this was done generally, nor how it was done in each observation, nor what tests were applied during each observation and in subsequent analysis of each. This is especially important when using video equipment and analysis, as video is far more susceptible to linearity errors, as compared to more typical CCD cameras and related photometric analytic methods. He does document an effort to simulate an occultation in a laboratory setting. However, the test does not appear to have been carefully performed, and the resulting graph that claims to prove the system works properly is so noisy as to allow no conclusion. In perhaps a related criticism, there is no apparent use in the video observations or analysis of the use of reference objects such as a star or satellite in the same field of view. In fact, many of the videos do have other Jovian satellites in view that can be used as reference "stars". This would have helped assure that the systems are well-behaved, but this was not done.

5. *Normalization*. Degenhardt refers at several points to "normalizing" his data, but does not say why, nor what he is doing in the process. Results with and without normalization are not presented. It is not known which

Figure 1. Diagram of typical Jovian satellite (Galilean) mutual events as they occurred in late 2014. Source: http://www.universetoday.com/115814/observing-challenge-catch-a-series-of-mutual-eclipses-by-jupiters-moons/

data have been normalized, nor how the conclusions might have been affected.

6. *Null Observations*. Several observations by others, both in Degenhardt's group and outside of it, did not display wings even on the same occultation event when Degenhardt did observe wings. In all the cases examined, all were using video recording using similar systems. The failure for other observers to verify JEE during the same observation raises a very serious question concerning the reality of the JEE interpretation of the observation.

7. *Photon Doubling Effect*. Degenhardt explains the failed wing detection by others in his group by asserting that the lower signal levels were subject to a threshold effect in the video camera. However, there is no evidence given nor known to this author to support this assertion. Indeed, inspection of the video files show reasonable detection levels of relatively faint background light, and so contradict such an effect. In addition, Degenhardt claims that when low signal levels are present, there is a Photon Doubling Effect (PDE) that apparently moves photon signals from wings into positive humps in the light curve. However, there is again no proof that such an effect exists, nor is it a known effect in the literature, nor is there any mechanism of action given. The work reported below offers a different, much simpler, explanation for why some observations show JEE wings but others do not.

8. *Eclipses*. An eclipse often has an almost identical geometry as does an occultation. If a thick atmosphere were present on the front satellite, its shadow as well as that of the satellite itself must sequentially fall on the rear satellite, and should show the same dimming (wings) as postulated in the JEE. Although multiple eclipses have been recorded (including his original "discovery" observation), none showed the JEE dimming. Degenhardt has neither noted that fact, nor offered any commentary on it. This is a fundamental and serious contradiction to the JEE. Again, the findings below provide a very simple reason for why he recorded wings with occultations but not eclipses.

9. *CCD Verification*. There have been no documented observations of the JEE using CCD cameras and related techniques, i.e., all the JEE evidence is from video observation. This lack of corroboration raises serious questions, as there are literally thousands of observers using CCD cameras who know good photometry techniques. CCD cameras are, of course, fully suited to these observations — more so than are video cameras.

10. *Misuse of References*. Degenhardt makes frequent reference to several professional papers (Schneider, Brown) that discuss Jovian satellite atmospheres. However, in each case, Degenhardt makes claims that are not supported in the papers. The papers actually report very tenuous atmospheres that require very sophisticated efforts to detect, but Degenhardt's references to the papers generally refer to the composition or the measured extent of the atmosphere, but do not discuss the papers' findings of the (very low) density (i.e., contradictory to JEE). So far as known, none of the authors of the papers referenced have supported the JEE findings.

11. *Mallama Rebuttal*. There have been no substantive rebuttals by Degenhardt or others of the criticisms raised by Mallama. Those criticisms included the non-detection of the atmosphere by the Hubble Space Telescope, Earthbound telescopes and space probes in the Jovian system. Mallama also noted that a probe passed within several hundred kilometers of Io, and not only did it not detect the atmosphere, but that the atmosphere would have caused a major change in the velocity of the probe or even destruction of it — yet no effect was observed. The proponents of JEE have not suggested plausible physical reasons why the Mallama citations are incorrect or misapplied, nor have they answered the other issues raised by Mallama.

12. *Atmosphere Physics*. The presumed JEE atmosphere extends some 10-15 Io radii. Although apparently no detailed calculations of density have been performed, no other planet or moon has such a deep atmosphere relative to the radius of the body. It is also obvious that an atmosphere whose density and extent is primarily controlled by gravity cannot extend to such extreme altitudes.

13. *Saturated Video Data*. As noted, the second part of this paper reports

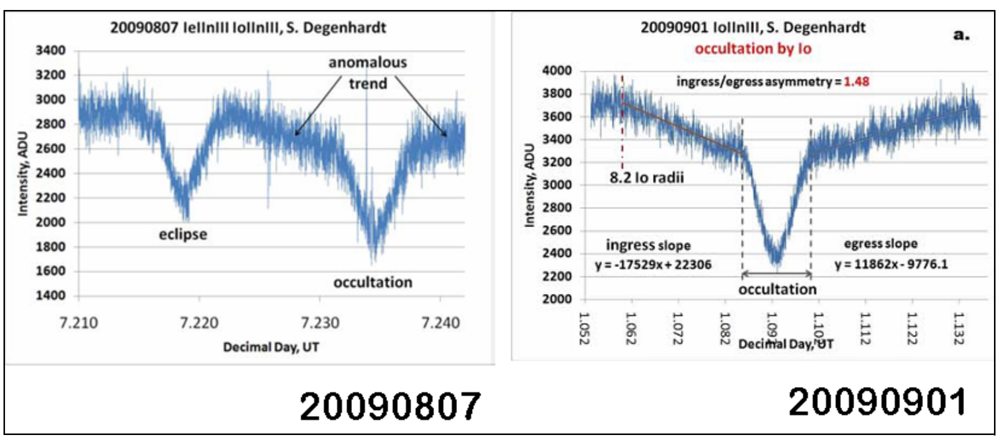


Figure 1a,1b Examples of Degenhardt light curves.

on an investigation of actual video data on which JEE claims are based. Upon examination of the actual Degenhardt data, many saturated (i.e., overexposed) pixels were found in the images of the occulting satellites as they approached one another. A simple computer simulation showed that saturated pixels can lead to exactly the "wings" observed. In addition, in using actual data from the video file, it was shown that the degree of saturation observed was, in fact, sufficient to cause the observed wings. That is, saturation **can** cause the wings, and in fact **did** cause the wings. Thus, the evidence for Jovian satellite atmospheres appears instead to be an instrumental effect.

In sum, the claimed Io atmosphere has never been observed by others in either direct imaging or other occultation observations, is inconsistent with observations spanning several centuries both from Earth and space, is not supported by atmospheric physics, and has not been verified by others. Degenhardt's explanations for why other observers have not detected this atmosphere appear very weak or ad hoc in nature, and explanations for his own group's failures to observe the wings are unsubstantiated. A single null observation of JEE is a serious challenge to the Io atmosphere claim, but there are in fact many null observations. Given the challenge to the extraordinary body and quality of historical and current data on the Jovian system from many platforms, it would appear that the JEE claim should be subject to very stringent review.

Investigation of Degenhardt Video Observational Methods

At predictable times, one Jupiter satellite may cross in front of another, as seen from the Earth. Degenhardt and his group (and many others) have made video recordings of many of these mutual occultation events.

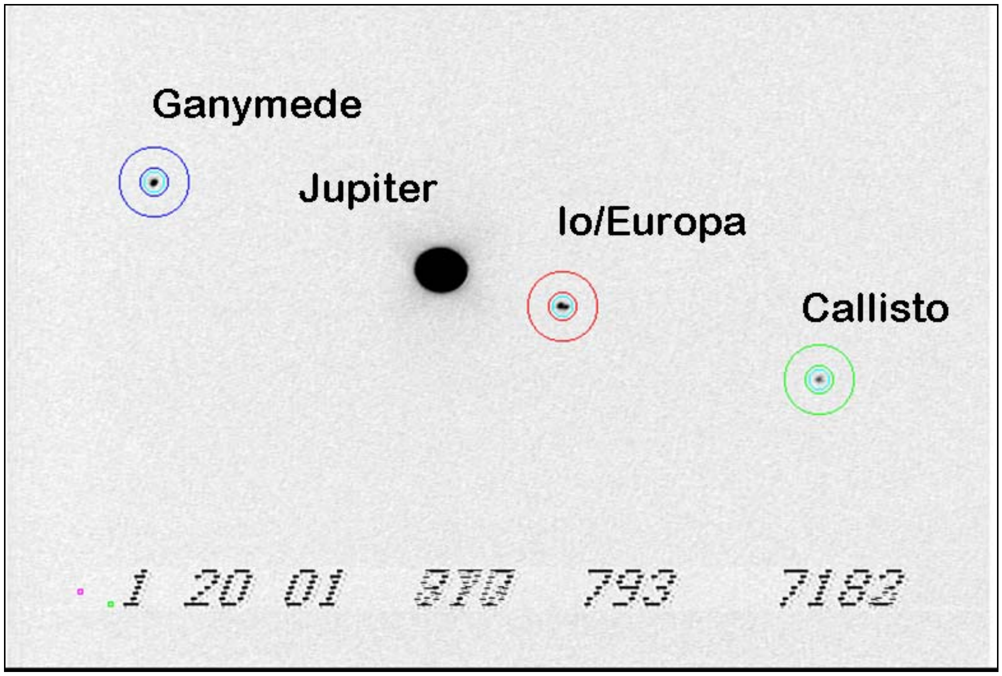


Figure 2. Typical video frame.

As one example, the graph in Figure 1 shows the result of Degenhardt following the event of Sept 1, 2009. One would expect that as Io crosses in front of Europa, the Point Spread Functions (PSFs or individual satellite images) merge and the light of each satellite combines into a single, smaller image of more intense pixel values but continuing same total intensity. Only after the actual occultation begins (when the physical shadow of the front object falls onto the rear object) does the total brightness of the pair decrease.

However, instead of a constant Io + Europa intensity before and after the occultation, he observed decreasing brightness in the hour before the event, and a rising brightness after, a feature of the light curve that he called "wings". He ascribed the cause to be a previously undetected atmosphere around Io that blocked some (up to 15-20%) of the light from reaching Europa. He and others then made additional observations with some recordings showing the same effects, but other recordings showed reduced wings, and some showing not wings but small "humps". As shown in Fig 1a, he also observed eclipses with virtually identical geometry, but the eclipses did not show wings. As noted above, his papers and web site have very little information describing the telescopes, methods of observation, camera, and methods of analysis for the various observations.

Examination of the video data for this and other events shows that the wings occur at the same time that the Io Europa images are coalescing, with the attendant increase in pixel intensity values. Because the geometry (size) of the combined satellite image is changing and the pixel values are increasing, one might suspect that some aspect of this merger of images might be the cause of the wings. Any non-linearity of the system, including saturation of some pixels in some of the video frames, or a Roll-off (decrease) of video camera sensitivity as saturation is approached, could be affecting the light curve, rather than an Io atmosphere. Whether this is the case is what was investigated in the work reported here.

It should be noted that this investigator requested several data sets from Degenhardt, including the above event

(20090901) which Degenhardt frequently cites. The data were received as 14 DVDs as copies of the original AVI video files. Most of the investigation concentrated on the data relating to the left-hand wing in Fig. 1b as representative of the data used to support JEE claims. If the claims for this dimming are not valid, then absent extraordinary evidence, the related claims are also reasonably considered not valid. All data received (six events) were either analyzed or spot-checked, to verify that the conclusions reached from the sample were in fact correct.

Image/File Characterization

The Degenhardt AVI files of the 20090901 event were examined by this writer to clarify the conditions of recording, with particular concentration on the files beginning at 01:20UT and 02:00UT (occultation occurred at about 02:13UT). Additional event files were also examined, as discussed below.

The files were examined using the tools in LiMovie, the video analysis software used by Degenhardt in his work LiMovie is software widely used to analyze asteroid occultation video files, where the goal is to determine the time of occultations (rather than the magnitude). Because LiMovie is not suited for examining individual pixels in detail, for purposes of this study, sections of the video file were also converted into discrete images (JPGs) which were examined in MaxIm DL, a popular photometric software. MaxIm DL can accurately measure pixel values, image sizes, and measure overall image intensities via aperture photometry. One can also use MaxIm DL to manipulate images in a variety of ways, as will be noted below.

Figure 2 shows a typical image from the 01:20UT AVI file as shown in LiMovie. Ganymede is at upper left, then overexposed (saturated) Jupiter, then Io and Europa close together but not yet coalesced, and finally Callisto. The numbers are the universal time applied to the video during the observations. By 02:00UT, the Io/Europa images have coalesced. Also shown are the measurement apertures, which include a central aperture where the intensity measurement is done, and an outer annulus to measure the background (to be subtracted from the gross aperture measurement). Although Degenhardt provides no scale information, the disc of Jupiter is presumably about 40 arc-seconds in diameter. There are no stars apparent in the images.

Examination of pixels in individual frames in the 01:20UT data shows that no objects (except for Jupiter itself) showed saturation. However, in the 02:00UT data, while Ganymede shows few and Callisto no saturated pixels, the now almost-coalesced Io/Europa image shows many saturated pixels.

Examination shows that the seeing and/or focus improved between 01:20UT and 02:00UT. The Ganymede image FWHM tightened from 4.7 to 4.0 pixels while the merging Io changed from 5.7 (images spaced apart) to 4.1 (images largely coalesced). By 02:00UT, the Ganymede images contain substantially higher pixel values (and some saturation) due to squeezing the light into a smaller area due to the seeing improvement. Of course, by 02:00UT, Io shows an even greater change in the number of pixels having maximum pixel levels due to the better seeing plus coalescing of images. If the observing system were linear (and no shadowing occurs), the ratio of Ganymede to Io+Europa intensities should remain the same for both 01:20UT and 02:00UT files.

Preliminary Tests

Three preliminary tests were run on the video file data.

The first test was to attempt to reproduce the Degenhardt light curve showing the wings (as in Figure 1). Using standard video processing software (LiMovie), the video file was analyzed. As occultation approached, the light curve of Io+Europa

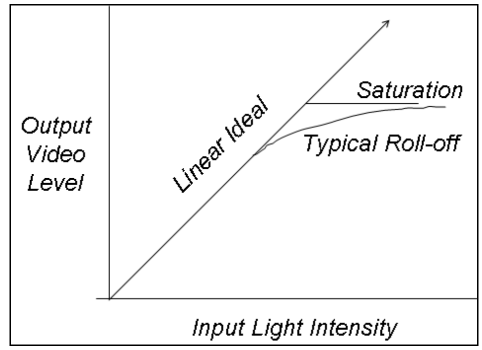


Figure 3. Schematic of video camera sensitivity.

showed the same wings, i.e., the observed dimming, as seen by Degenhardt. Thus, the JEE wings are **not** artifacts of Degenhardt's analysis — they are in the data itself.

The second test was to determine whether a completely different analytic approach using photometric techniques would also show the wings. Sections of the video file were converted to groups of about 100 JPG image files (about three seconds of video). Using standard non-video photometry programs (primarily MaxIm DL), the separate images could then be combined (average) and intensities measured. Comparing the earlier (01:00UT) images to the later (02:00UT) ones, in fact, showed the same dimming as claimed for the JEE wings. Thus, the JEE wings are **not** an artifact of LiMovie, nor are they some subtle result of how parameters are set in the LiMovie measurements, and they are

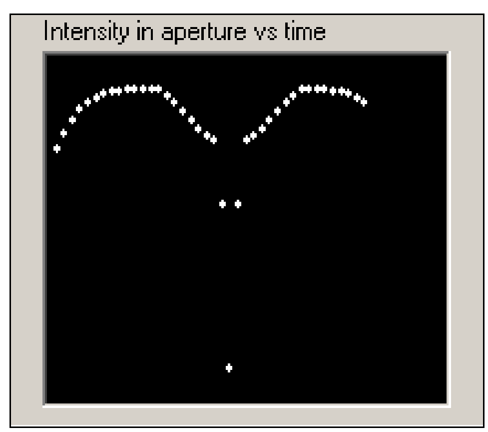


Figure 4. Computer simulation of coalescing.

not the result of some subtle error in background subtraction.

This test also validated the use of JPGs and photometric methods in analyzing the video data. This is important because the range of tests one can do when using photometric software and methods is much more sophisticated than using video software.

The third test was to determine whether gross non-linearities (other than saturation) were present in the data. Because there was a suspicion that saturation and/or gamma non-linearities could cause the dimming and wings, the general issue of linearity is very important. Unfortunately, the observations and reports contain virtually no discussion of this issue, nor any substantive experimental work to show that the observing system is linear to the degree necessary. There are several potential issues related to linearity: “gamma”, and saturation/Roll-off.

Video cameras (and related equipment) for consumer uses generally incorporate a gamma correction. Because of the limits of the human eye and video displays, the video data is manipulated according to the equation Vout=Vin^gamma. A gamma of about 0.45 increases the intensity values in the dark regions of the image, and reduces the brightness of the intense areas as compared to a linear system of gamma=1. When one analyzes video data, software such as LiMovie allows the user to decode using a gamma correction (e.g., 0.45, a common value) or not. If the data are known to be linear (gamma=1), one uses no gamma correction. In any case, video taken or analyzed with incorrect gamma settings will not show a linear relationship of input to output.

Video camera specifications may or may not include a statement as to whether the output is deliberately encoded with gamma, and rarely is there information regarding accuracy of the gamma value. In contrast, typical astronomy CCD cameras are in fact built to be highly linear to fractions of a percent over many orders of magnitude, and are highly specified as to accuracy. Modern video camera outputs are nearly all digital with 8-bit (255 levels) with the digitization either done internally or in an external converter. On the other hand, astronomy CCD cameras are usually 16-bit/65K levels or more, i.e., they have a dynamic range about 250 times as wide as video cameras. See Figure 3.

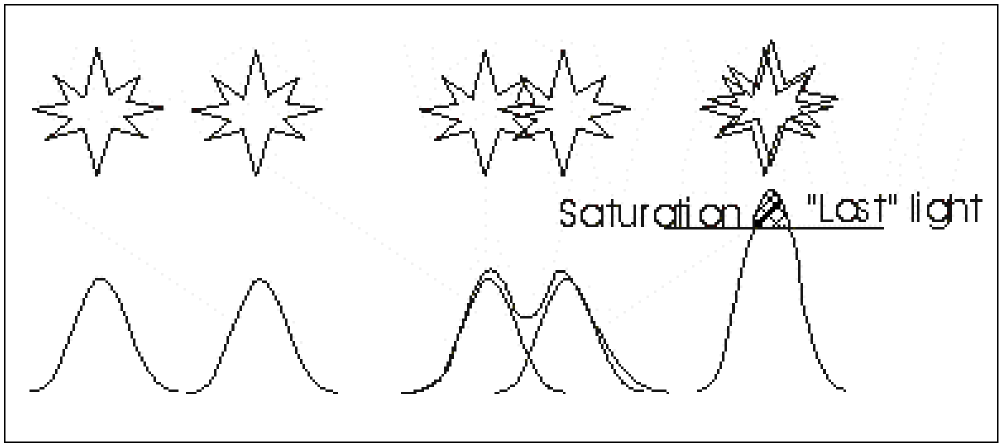


Figure 5. Pixel intensity values during image coalescing.

There is also little knowledge for video cameras concerning saturation as the light intensity approaches and exceeds the proper range of the instrument either in small or large areas of the Field of View (FOV). Obviously, an 8-bit camera will have a maximum digital output of 255; however, there is no a priori knowledge of how the response rolls off (relative dimming) as signals approach total saturation. In many cameras, Roll-off begins as low as 75% of full-scale.

While the issue of linearity is not one that can be satisfied by a simple examination of these data, careful measurements of the Degenhardt video data do allow some conclusions, as discussed below.

Finding 1: Software Simulation of Merging Images

As the pre-occultation phase proceeds, the occulting satellite images approach and merge together in the sensing camera, i.e., the images coalesce. It was determined to run a simulation to test whether or not merging images would actually be expected to produce wings or other artifacts if saturation or other substantial non-linearities (Roll-off) were present.

A Visual Basic program was developed, using Gaussian Point Spread Functions (PSF) for each “satellite” image. The software built in selectable levels of “camera” gamma, saturation, separation

Table 1: Ratios of Satellite Brightnesses

	Prediction		If Gamma=1		If Gamma=0.45		
	(I+E)/Gany	Gany/Cal	(I+E)/Gany	Gany/Cal	(I+E)/Gany	Gany/Cal	
01:20UT	1.20	2.75	1.19	2.66	1.01	NA	
02:00UT	1.20	2.75	1.07*	2.43	*	4.57	
* known saturation present							

of images, etc. The "satellite" images were then stepped across and/or nearby one another to simulate the coalescing of the individual images on a video or CCD sensor. After each step, a "measurement" of total intensity (signal minus background) was computed, which closely matches the software measurement methods used in LiMovie.

Note that there was no effort made to match exactly the Jovian satellite movements. Rather, the purpose was to see qualitatively as the images coalesced what one would measure as the resulting total intensity. Would it show wings as the "event" proceeded?

In fact, the simulations of coalescing images **did** show wings very similar to JEE wings over wide ranges of parameters whenever even modest (gamma=1.05) nonlinearity **or** significant saturation was present. An example of a "run" of the simulation is shown in Figure 4.

In this simulation, one can see the central narrow "occultation" and the wings rising on each side. One can also see hints even of the relatively flat regions just before and after the occultation (as seen in the JEE data Fig. 1b).

However, while compelling, the simulations do not **prove** that these were the mechanisms involved in the actual JEE wings — only data from the observing system or actual data files can help prove or disprove the question.

Finding 2 - Is the Degenhardt System Generally Linear?

An immediate question was whether the Degenhardt observing system was generally operating linearly, that is, was gamma present or not (for the moment excluding saturation as an issue)? The first goal is to use the actual data to determine if whether the observing system was at least approximately linear, i.e., gamma=1 vs, or significantly non-linear, for example, gamma=0.45 a common value. In general, one would evaluate linearity by using the system to

Table 2: Results of Test Performed with MaxIm DL Software

Simul-A	02:00UT	3336	Ganymede Original
Simul-B	02:00UT	3923	G. times 1.20=Io/E w/no saturation
Simul-C	02:00UT	3619	G.=Io/E showing effect of saturation

measure targets of known brightness ratios. However, being limited only to the video file data, the only target options for comparison are the satellites in the images.

Table 1 shows the ratios of satellite brightnesses as compared to the ratios of brightness taken from standard references (Norton 2000, others).

Clearly, predicted ratios of brightness are matched quite well over a substantial range using gamma=1 and very poorly using gamma=0.47, thus indicating that except when saturation/Roll-off occurs, the system is operating in a reasonably linear range using a gamma=1. This is in contradiction to claims in e-mails by Degenhardt that he uses a gamma=0.45 system.

Finding 3 - Is Saturation Present in the Data?

Again, referring to the table, the big question then is what caused the **decrease** in the total intensity ratio of (Io + Europa)/Ganymede as shown by the intensity ratio decreasing from about 1.19 to 1.07. This decrease is simply another way to measure the dimming shown in the JEE wings.

To assess these data, pixel values in the images of Ganymede and in Io and Europa were examined using the photometric methods outlined above. Ganymede typical average maximum pixel values increased from approximately 161 to 221 in that time period (due to seeing/focus improvement). However, though the PSF became smaller and the pixel values higher as time passed, only a small fraction of pixel values for Ganymede even at 02:00UT were fully saturated (value approaching 255).

The situation is very different for Io/Europa (as shown in Figure 5). At 01:20UT when the images are still separate, pixel values are low for the individual images. However, as the images coalesce, and as the seeing improved, the intensity of the pixels rises rapidly, as expected. An increasing fraction of pixels become saturated, i.e., showing a value approaching or equaling 255, rather than the even higher value they should have shown. As saturation occurs, when the total intensity is measured (by adding up the pixel intensities in the image), some light is no longer being "counted". Instead of unchanging, the **total** measured brightness (intensity) **decreases** as the coalescing proceeds. When the light curve is plotted against time, the decrease shows as the JEE wings — but due to saturation, not to an atmosphere.

It should be emphasized that this is what the actual original video data show: Increasing amounts of saturation as one nears the occultation must inevitably reduce the observed total intensity. This is in the raw data — it is **not** a derived conclusion.

Obviously, in an 8-bit camera (or an analog camera file run through an 8-bit frame-grabber or other device), saturation is occurring whenever the signal is shown having a value of 255. However, Roll-off in sensitivity is beginning below that value — the question is at what intensity value Roll-off begins. Unfortunately, it is very difficult even to estimate at what point Roll-off begins unless detailed linearity data are available. Many sensors (including CCD cameras) may have Roll-off beginning as low as 75% of the saturation level. In this report, when saturation effects are cited, the term implicitly includes the fall-off of sensitivity as the signals enter the Roll-off region.

In summary, saturation is present in the raw data. It only occurs at a significant level as the pre-occultation merging of the Io/Europa images proceeds, and does not otherwise occur in the data in significant amounts. Saturation and Roll-off **inevitably** reduce the apparent brightness and show in the light curve as the dimming seen in the JEE wings.

Finding 4 - Ganymede Simulation

Although the above analysis would seem to explain the JEE wings, technically the question still remains: Does the observed extent and character of saturated pixels fully explain the observed JEE wings? To answer this question directly, one would have to measure just how much light was being "lost" due to saturation and Roll-off. That is, one would have to know how bright the pixels should have been — but that, of course, is exactly the problem!

However, there is another approach to answer this question. There are the images of (unsaturated) Ganymede that are nearly as bright as the Io/Europa merged images. One can therefore use the actual unsaturated Ganymede images from the video files as a surrogate to estimate the amount of dimming due to saturation of the Io/Europa images.

The video images contain good images of Ganymede (unsaturated) that have the same PSFs, background, etc, as the individual images of Io and Europa. Ganymede is about 20% less bright than the combined Io and Europa. If Ganymede were actually as bright as Io and Europa after they coalesce, it would show the same saturation as does Io/Europa. To make Ganymede appear as "intense" as Io+E, one can increase the Ganymede pixel values by 20%, thus simulating the unsaturated Io+E.

Saturation and Roll-off effects can be approximated by using the 255 saturation limit, then decreased by 10% as an estimate of the effect of Roll-off. This limit of 230 can then be imposed (via software) on the pixels in the enhanced Ganymede image, thus reducing the overall Ganymede intensity showing the effect of saturation/Roll-off. The question, of course, is whether one sees about the same dimming as in the JEE wings.

Because software to do this within the video file itself is not available, this test was performed using the technique (validated above) of converting video to JPGs, which are then measured using photometric software. After converting 01:20UT and 02:00UT sections of the video file to approximately 100 JPGs each, the images were imported into MaxIm DL (an image processing and measurement program) where the following steps were performed:

1. Multiply all Ganymede pixel intensities by 1.20 in each of the 100 images. This will cause the overall Ganymede intensity to match that of the combined Io and Europa if no saturation were present. This process preserves the same range and statistics of pixel intensities as in Ganymede (and Io/Europa).

2. Create an average of the 100 images (without saturation) and measure the average apparent brightness of the unsaturated Io/Europa surrogate.

3. In the individual JPGs generated in step 1, use MaxIm DL functions to limit pixel values to 230 to simulate saturation and Roll-off (note that saturation effects will be obscured if one uses average intensities vs. actual pixel-by-pixel intensities in the raw images).

4. Create a new average of the 100 images (some now having saturation) and remeasure the average apparent brightness of the now-saturated Io/Europa surrogate.

The results are as shown in Table 2.

Simul-A intensity of 3336 for Ganymede is the average intensity of the 100 JPGs. This compares to 3497 from LiMovie. There is no surprise that the values may be somewhat different. There is always some variation in how the measuring aperture is placed, plus, the 3497 is the average over about 20 seconds or about 700 frames vs the 100 frames used in this test. What is important is how the result subsequently changes with imposed saturation.

Simul-B intensity of 3923 is the average value after the 1.20 factor is applied to each pixel. (The resulting ratio turned out to be 1.17.) This simulates the unsaturated Io/Europa. Again, the match will not be perfect, as the 3923 is a difference between gross counts in the aperture and the measured background.

Simul-C is after the saturation limit was applied to each pixel. The saturation "function" used was linear up to 230, then capped at 230, which is the assumed effect of saturation and Roll-off. Tests using different saturation values show the general conclusion is not changed by varying these assumptions.

Simul-C intensity of 3619 is to be compared to the intensity measure of Io/E of 3727 as measured by LiMovie on the original video, i.e., the Ganymede surrogate shows approximately the same dimming as the original JEE wings.

Conclusion: The simulation shows that saturation is the cause of the observed JEE dimming/wings, and there is no need to assume the presence of an Io atmosphere.

Additional Events Evaluated

In addition to the recordings of the event of 20090901 discussed in detail above, the remaining three video recorded events provided by Degenhardt were checked.

20090923 is a recording of observations taken by Redding using a longer focal length instrument (unspecified). The purpose was to magnify the views of Io and Europa so that they could be seen and measured as separate images, with the result of their analysis as Fig. 4 in SAS2010. By tracking the images separately, Degenhardt claimed to show that Europa was dimming while Io (the front satellite) remained constant, consistent with the JEE claims.

Unfortunately, there are a number of problems with the conclusion. As with all the JEE studies, reference stars (or satellites) were not used to control for sky transparency or other effects. Further, examination of the images shows that only in the very early images are the satellites separated sufficiently to allow separate brightness measurements. Accurately measuring the brightness of two close images is virtually impossible without very sophisticated efforts.

Interestingly, measuring the **total** intensity of the two satellites showed NO dimming as occultation approached, thus contradicting the JEE predictions. The maximum pixel values associated with the merged images in the data were approximately 150 counts maximum, and no saturation was present (due primarily to the long focal length).

The claimed dimming of Europa vs Io was not only based on highly doubtful measurements of individual image brightness. The scale of the SAS2010 Figure 4 was unclear as to just what was measured. The supposed dimming was only about 6%, but this was relative to Io. Relative to the **total** intensity (which is what is relevant to JEE claims), dimming would only be about 2%, which is not only well below JEE claims for dimming, but is too small to be a reliable measurement using this kind of method. But, even if true, because there is no third object used as a reference standard, one could not rule out that Io was in fact brightening rather than Europa dimming!

The conclusion supporting JEE is not warranted. The data do support the conclusion that when saturation is not occurring, there are no wings.

20091101 was an event observed by Degenhardt, who observed JEE wings, and by Redding, who again did not observe wings. A review of the video data showed that the Degenhardt data included large amounts of saturation as the occultation approached, as shown in the similar 20090901 analysis. The saturation caused the wings in that analysis. The Redding files for the same event were taken with a long focus system (presumably the same as above, but not specified). As expected, pixel values are all relatively low even when the images coalesce, so there was no saturation, and no JEE wings.

The lack of dimming in the Redding data, is ascribed by Degenhardt (SAS2010 and elsewhere) to the phenomenon of Photon Doubling Effect. Evidently, in this theory, certain telescopes under certain conditions will undercount certain photons in the Airy Disc due to a threshold effect in the sensor chip, with the light instead showing as a raised (more intense) region in the light curve.

Neither the threshold effect nor any kind of Photon Doubling Theory is in the literature, nor in the experience of other observers. No physics is given, nor are predictions made, nor is there any independent evidence for either effect. On the other hand, neither theory is needed to explain the lack of dimming in the Redding data, as it is clear the Redding data were taken while operating without saturation in a relatively linear mode, so dimming caused by saturation did not occur.

Conclusion of JEE Data Examination

The claims for JEE as showing the presence of viewing through (or shadowing by) a satellite atmosphere are clearly not supported by the evidence. The observed artifacts in the light curve of the occultation are shown to be caused by saturated pixels in the original files. This was proven in three ways: (1) reproduction of the effects using a computer simulation of the images; (2) observing substantial saturation in the data files as occultation was approached; and (3) using data for a different satellite from the same video files and showing that the observed saturation would result in a dimming that is the same as the alleged JEE events.

The cause of this erroneous JEE finding is that the video cameras used were operating outside their linear regions as proven by the presence of saturated (and near-saturated) pixels. The observers have made no apparent measurements of the overall linearity of their systems, nor published information on which to base an instrumental review.

These findings of error in the conduct of the observations, coupled with the many other major problems in the JEE record discussed above, show clearly that the claims for having proved a Jovian satellite atmosphere are not just unproven, but are clearly based on incorrect information. As very sophisticated measurements have shown, there are atmospheres around the Jovian satellites, but they are very faint, and simply unobservable by this kind of observation.

References

SAS2010. Proceedings of the 2010 Society for Astronomical Sciences. http://www.socastrosci.org/publications.html

SAS2013. Proceedings of the 2013 Society for Astronomical Sciences. http://www.socastrosci.org/publications.html

Degenhardt website. This site contains many supporting documents and papers concerning the JEE work. See http://scottysmightymini.com/JEE/

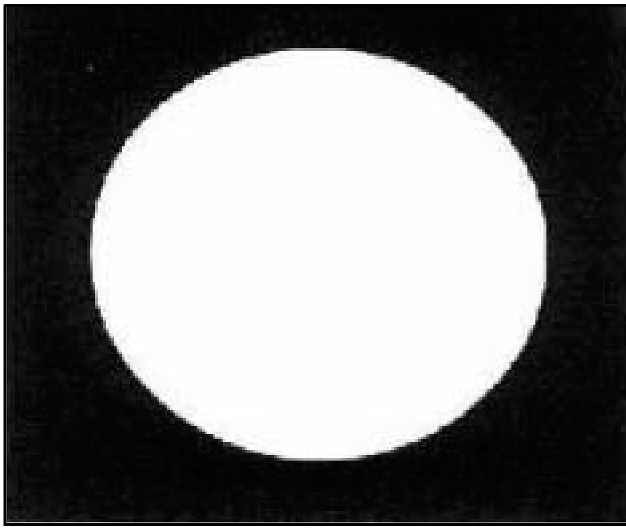
Limovie is a free software program obtainable at http://www005.upp.so-net.ne.jp/k_miyash/occ02/limovie_en-html

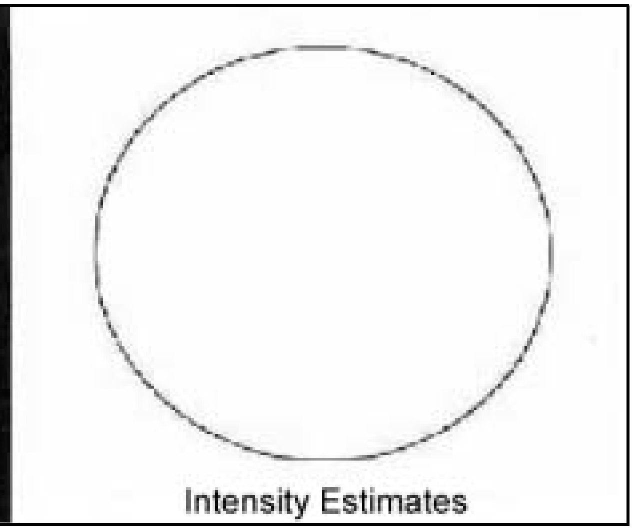
Mallama. "The Atmospheres of Io and Europa Are Transparent" JALPO 55-4. http://www.alpo-astronomy.org/djalpo

MaxIm DL software details and purchasing information can be found at http://www.cyanogen.com/maxim_main.php

Menke1. Menke website. http://www.menkescientific.com/johnspage.html

ALPO Jupiter Section Observation Form No. _____





Date (UT): ______________________________________

Time (UT): _____________________________________

CM I _____ CM II ____ CM III _______

Begin (UT): _____________ End (UT) ____________

Telescope: f/ ___ Size: __________ (in./cm.; RL/RR/SC)

Magnification: _______x ________x ________x

Filters: __________________________________(W / S)

Trnasparency (1 - 5): ____ (Clear / Hazy / Int. Clouds)

Seeing (1 - 10): _________ Antoniadi (I - V): _________

Name: _______________________________________

Address: _______________________________________

____

City, State, ZIP: _____________________________

____

Observing Site: _______________________________

____

E-mail: _______________________________________

No.	Time (UT)	S I (°)	S II (°)	S III (°)	Remarks

Notes

ALPO Galilean Satellite Eclipse
Visual Timing Report Form

Describe your time source(s) and estimated accuracy

Observer Name:

Apparition: 20_____-20_____
(conjunction to conjunction)

Event Type (a)	Predicted UT		Observed UT Time (9d)	Telescope Data (e)			Sky Conditions (0-2 scale) (f)			Notes (g)
	Date (b)	Time (c)		Type	Aperture (cm)	Mag.	Seeing	Transparency	Field Brightness	

(a) 1 = Io, 2 = Europa, 3 = Ganymede, 4 = Callisto; D = Disappearance, R = Reappearance
(b) Month and Day
(c) *Predicted* UT to 1 minute
(d) *Observed* UT to 1 second; corrected to watch error if applicable; indicate in "Notes" if Observed UT date differs from Predicted UT date
(e) R = Refractor, N = Newtonian Reflector, C = Cassegrain Reflector, X = Compound/Catadioptric System; indicate in "Notes" if other type.
(f) These conditions, including field brightness (due to moonlight, twilight, etc.), should be described as they apply to the actual field of view, rather than to general sky conditions. Use whole numbers only, as follows:
0 = Condition not perceptible; no effect on timing accuracy
1 = Condition perceptible; possible minor effect on timing accuracy
2 = Condition serious; definite effect on timing accuracy
(g) Include here such factors as wind, drifting cloud(s), satellite near Jupiter's limb, moonlight interference, etc.

At the end of the apparition, return this form to:
John E. Westfall, ALPO Assistant Jupiter Coordinator, P.O. Box 2447, Antioch, CA 94531-2447 USA
E-mail to: johnwestfall@comcast.net

Feature Story:

ALPO Observations of the Remote Planets in 2013-2014

By Richard Schmude, Jr.,
coordinator, ALPO Remote Planets Section,
E-mail to: Schmude@gdn.edu

Abstract

This report summarizes observations of Uranus and Neptune which were submitted to the writer in late 2013 and early 2014. Several red/near-infrared images of both planets show albedo features. Uranus shows bright belts, whereas Neptune shows a large bright spot. Furthermore, the writer suggests that a single bright spot developed on Neptune between August 8 and 15, 2013, was centered at 48° ± 7° S and had a rotation period of 16.13 hours. The selected normalized magnitude values of Uranus are: B(1,0) = –6.654 ± 0.009 and V(1,0) = –7.125 ± 0.012. The corresponding values for Neptune are: B(1,0) = –6.613 ± 0.012 and V(1,0) = –7.011 ± 0.009.

Introduction

During 2013-2014, professional astronomers reported several new results of experiments related to the remote planets. For example, de Pater et al. (2013) carried out a study of Uranus' rings in infrared light (wavelength = 2.2 micrometers). They report that the Epsilon Ring brightens as its inclination angle and solar phase angle decrease. They also report that a broad sheet of dust, within the ring plane, extends down to the planet. Fletcher et al. (2014) conclude that the tropospheric temperature did not change between 1989 and 2003-2007. They based this conclusion on a multiwavelength study of Neptune. Uckert et al. (2014) carried out measurements of the star USNO-B1.0 0759-0739128 as it was occulted by Neptune on July 23, 2008. They report temperatures of Neptune's upper stratosphere. They also compared occultation data from 1983 to 2008 and conclude that upper stratosphere temperatures have not changed much. Irwin et al. (2014) conclude that the CH_3D to CH_4 ratio on Neptune is almost identical to that on Uranus. They base this on an analysis of infrared spectra. (Methane with one deuterium atom is CH_3D. The CH_3D to CH_4 ratio tells us how much deuterium is in a planet's atmosphere. The amount of deuterium gives astronomers information on how a planet's atmosphere has developed and evolved.) Finally, Tamayo et al. (2013) carried out calculations on the transport of dust from the outer moons of Uranus to its four largest moons (Oberon, Titania, Umbriel and Ariel). They suggest that this dust could account for the redder color on the leading hemispheres of the four largest moons.

Table 1: Characteristics of the 2013 - 2014 Apparitions of Uranus and Neptune[a]

Parameter	Uranus	Neptune
First conjunction date	March 29, 2013	February 21, 2013
Opposition date	October 3, 2013	August 27, 2013
Angular diameter	3.7 arc-seconds	2.4 arc-seconds
Sub-Earth latitude (opposition)	23.5° N	27.6° S
Right ascension (opposition)	0h 40m	22h 24m
Declination (opposition)	3.5° N	10.7° S
Second conjunction date	April 2, 2014	February 23, 2014
[a]Data are from the Astronomical Almanac for the years 2013 - 2014		

All Readers

Your comments, questions, etc., about this report are appreciated. Please send them to: ken.poshedly@alpo-astronomy.org for publication in the next Journal.

Online Readers

Left-click your mouse on:

- The 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).

Members of the Association of Lunar & Planetary Observers (the ALPO) also made important contributions to our knowledge of the remote planets in 2013-2014. I will summarize these.

Table 1 lists characteristics of Uranus and Neptune during their 2013-2014 apparitions. Those who submitted observations of these planets are summarized in Table 2. This report summarizes brightness measurements and images made in the 2013-2014 apparitions of both planets.

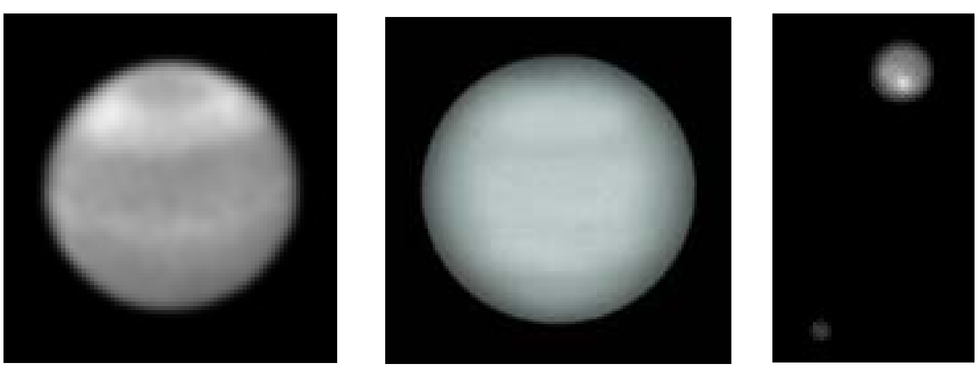
Brightness Measurements: Photoelectric Photometry

Jim Fox and this writer made brightness measurements with an SSP-3 solid state photometer, along with filters transformed to the Johnson B and V system. More information on the equipment is located elsewhere (Optec., Inc, 1997), (Schmude, 1992, 20; 2008, Chapter 5). The transformation coefficients for Jim's equipment are 0.0749 and –0.050 for the B and V filters, respectively. The transformation coefficient for this writer's equipment is –0.0555 for the V filter. The comparison stars and their brightness values are summarized in Table 3.

Tables 4 and 5 summarize brightness measurements of Uranus and Neptune. The date, observer's initials, filter, measured brightness value and normalized brightness (in magnitudes) value are listed in columns 1-5 and 6-10. Values of the normalized brightness, B(1,α) and V(1,α) are computed in the same way as in Schmude (2012, p. 33). Extinction and color transformation corrections are included in all brightness measurements in the same way as is described in Schmude (2008, Chapter 5).

Jim Fox and the writer used specific comparison and check stars for their Uranus measurements. The writer used δ-Piscium as a comparison star and did not use a check star. Jim used 44-Piscium and 60-Piscium as the comparison and check star, respectively for all measurements between September 6, 2013 and January 29, 2014. The writer computed brightness values of 6.913 ± 0.004 and 5.997 ± 0.003 for the B and V filter magnitudes of 60-Piscium based on Jim's data. These values are in excellent agreement with those in Table 3. Jim used 60-Piscium and 44-Piscium for the comparison and check star, respectively for his September 4, 2013 measurement. The check star magnitudes for that date are consistent with those in Table 3. Since the check star 60-Piscium was only five degrees from the Full Moon on October 18, 2013, its brightness on that date was not considered.

Jim used 38-Aquarii and σ-Aquarii as the comparison and check star for his Neptune measurements, respectively. Once again, the writer computed average B and V filter magnitude values for s-Aquarii from Jim's data. The corresponding values are 4.800 ± 0.005 and 4.832 ± 0.003 for the B and V filters, respectively. These values are in good agreement with those in Table 3. The close agreement between measured and literature magnitude values of the check stars for the Uranus and Neptune measurements is evidence that Jim's brightness values have a high degree of accuracy.



A B C

Figure 1. Images of Uranus and Neptune. A: Uranus on October 6, 2013 (0:07 UT) by D. Peach who used an RG610 filter. B: Uranus on December 17, 2013 (18:40 UT) by D. Gray who used a 0.42 m Dall Kirkham telescope with a binoviewer at 365X and 535X. C: Neptune on August 21, 2013 (4:46 UT) by P. Gorczynski who used a 685 nm filter and a 0.36 m Schmidt-Cassegrain telescope. North is at the top in all images.

The selected normalized magnitudes for Uranus are B(1,α) = -6.654 ± 0.009 and V(1,α) = -7.125 ± 0.012 and the corresponding values for Neptune are B(1,α) = -6.613 ± 0.012 and V(1,α) = -7.011 ± 0.009. The uncertainties are based on a combination of random error and the difference between the observed and measured brightness of the check stars. As in previous studies, the effect of the solar phase angle was neglected. The selected values for Uranus are just a little brighter than in the previous years. The V(1,α) value for Neptune is comparable to those in 2010, 2011 and 2012 of -7.005, -7.014 and -7.00, respectively (Schmude, 2012, 33; 2013, 41; 2014, 50). This is evidence that Neptune's brightness has leveled off. That planet's sub-Earth latitude is gradually moving towards the equator and this may lead to a gradual drop in brightness over the next three decades.

Brightness Measurements: Visual Photometry

The writer made brightness estimates of Uranus and Neptune using binoculars. The selected Vvis(1,0) values are –7.1 (Uranus) and –6.9 (Neptune). These values are based on 19 brightness estimates of Uranus and 16 estimates of Neptune. The value of Vvis(1,0) is computed in the same way as in (Schmude, 2012, pp. 35).

Drawings and Images

Astronomers submitted several drawings and digital images of Uranus and Neptune. I will describe these in the next four paragraphs.

The most common features on Uranus were two bright belts which I call the "Equatorial Belt" and the "North Temperate Belt" (see figures 1A and 1B). The north and south boundaries of these belts were measured from four images which were taken with a 685 nm filter. Three of these were made with the 1-m telescope at Pic du Midi Observatory and the fourth was made by S. Quaresima with a 0.41-meter Schmidt-Cassegrain telescope. The Pic du Midi images were of higher resolution and, hence, each received a weight of three. The average planetographic latitude range for the Equatorial Belt is 2° S to 9° N and the corresponding range for the North Temperate Belt is 43° N to 57° N. An uncertainty of 3° is selected for these values. Both belts had nearly the same position as in the previous year.

P. Gorczynski, P. Maxson and P. Jones all used telescopes with apertures of almost 0.4 meter to image a bright feature on Neptune (see Figure 1C). Measurements shown in Figure 1C are consistent with latitude 48 ± 7° S. P. Gorczynski imaged a similar irregularity four days earlier at almost the same location. If the same feature was imaged on both days, some possible rotational periods are 19.2 hours (five rotations), 16 hours (six rotations) or 13.7 hours (seven rotations). All three periods lie within the range measured for Neptune (Sromovsky et al., 1995, p.32). P. Maxson also imaged a similar bright feature on September 2 at 7:02 UT. Once again, if it is assumed that there is only one bright feature on Neptune, the August 21 and September 2 positions would be consistent with rotational periods of 17.07 hours (17 rotations), 16.13 hours (18 rotations) or 15.28 hours (19 rotations). Taking the three images together and assuming that the same feature was imaged on August 17, 21 and September 2, a rotational period of 16.13 hours best matches the data. This period, for a feature at 48° S, is also consistent with the trend in Figure 4 of Sromovsky et at. (1995, p. 32).

When did the bright area on Neptune form? Gorczynaki first imaged the bright feature on August 15 at 5:17 UT. A. Obukhov used a 685 nm filter along with a 0.28 m Schmidt-Cassegrain telescope to image Neptune three times on August 8, 9 and 10, 2013. None of the images showed the bright feature imaged on August 15. More than likely, it would have been visible in one of the images had it been as bright as it was in Figure 1C. Therefore, it is concluded that this spot developed sometime between August 8 and 15, 2013.

Linear fits of B(1,α) and V(1,α) versus α for Uranus and Neptune based on data in Tables 4 and 5 are:

$$B(1,\alpha) = -6.664 + 0.0048\alpha \quad \text{Uranus} \quad (1)$$

$$V(1,\alpha) = -7.131 + 0.0033\alpha \quad \text{Uranus} \quad (2)$$

$$B(1,\alpha) = -6.632 - 0.0149\alpha \quad \text{Neptune} \quad (3)$$

$$V(1,\alpha) = -7.059 + 0.0365\alpha \quad \text{Neptune} \quad (4)$$

The last terms in these equations for Uranus are consistent with previous measurements (Schmude, 2013, p. 46), but this is not the case for Neptune. The

Table 2: Contributors to the ALPO Remote Planets Section in 2013-2014

Observer (country)	Type[a]	Instrument[b]	Observer (country)	Type[a]	Instrument[b]
Kevin Bailey (United Kingdom)	D, DN, I	0.25 m RL	A. Manach (France)	I	1.0 m
J. Boudreau	DN		P. Maxson (USA)	I	0.25 m M
F. Colas (France)	I	1.0 m	B. Noiret (France)	I	1.0 m
M. Delcroix (France)	I	0.32 m RL & 1.0 m	R. Paret (France)	I	1.0 m
J. Fox (USA)	PP	0.25 m SC	C. Pellier (France)	I	0.25 m & 0.62 m C
P. Gorczynski (USA)	I	0.36 m SC	R. Schmude, Jr. (USA)	PP, VP	0.09 M and B
E. Grafton (USA)	I	0.36 m SC	P. Tortech (France)	I	1.0 m
P. Jones (USA)	I	0.38 m RL	P. Valeau (France)	I	1.0 m
S. Maksymowicz (France)	D, DN	0.28 m C			

[a]Type of observation: D = drawings, DN = descriptive notes, DI = digital images, PP = photoelectric brightness measurement, VP = eyeball brightness measurement.

[b]Telescope: B = binoculars, C = Cassegrain, DK = Dall Kirkham, RL = reflector, and SC = Schmidt-Cassegrain

The writer would also like to acknowledge the following individuals who posted images on the ALPO Japan Latest and Arkansas Sky Observatory websites: P. Abel, M. Adachi, D. Bleser, G. Bleser, S. Bouley, G. Chester, J. Dauvergne, X. Dupont, L. Fernandez, L Finocchi, D. Gasparri, D. Gray, P. Gregorio, T. Ikemura, D. Kananovich, M. Kardasis, A. Maniero, A. Obukhov, D. Peach, D. Put, S. Quaresima, P. Rosen, G. Tarsoudis, A. Trivisano and A. Vaccaro.

Table 3: Comparison and Check Stars Used in 2013-2014 Photometric Studies of Uranus and Neptune

Star	Brightness (in stellar magnitudes)		Source
	B filter	V filter	
38-Aqr (SAO 164910)	5.314	5.425	a
σ-Aqr (SAO 165134)	4.790	4.825	a
60-Psc (SAO 109461)	6.914	5.985	a
44-Psc (SAO 109192)	6.606	5.778	a
δ-Psc	5.926	4.426	b

[a]http://simbad.harvard.edu/simbad/
[b]Westfall (2008)

reason for this discrepancy is largely because of the September 4, 2013 measurements. The B(1,α) and V(1,α) values on this date are 0.069 and 0.104 magnitudes brighter than the respective mean values for 2013. The standard deviations of the mean normalized magnitudes (which include the September 4 measurements) for the B and V filters are 0.028 and 0.031 magnitudes, respectively. One explanation for the discrepancy is the bright feature imaged on August 17, 21 and September 2. If a rotational period of 16.13 hours is used, then this feature would transit the central meridian at 7:25 UT on September 4. Jim recorded three sets of measurements within a few minutes of 4:37 UT on September 4. Therefore, this feature would have been 62° from the central meridian at 4:37 UT. Jim also made measurements on September 6 and 8, 2013; however, the feature would have been farther from the central meridian on these dates and may not have had an impact on the brightness measurements.

Satellites

Several people imaged the satellites of Uranus and Neptune but there were no measured brightness values. The writer hopes that people will measure the relative brightness of the satellites of Uranus in the future.

Acknowledgements

The writer is grateful to Truman Boyle for his assistance. He is also grateful to everyone who submitted observations in 2013-2014.

References

Astronomical Almanac for the Year 2013, Washington DC: US Govt. Printing Office, 2012.

Astronomical Almanac for the Year 2014, Washington DC: US Govt. Printing Office, 2013.

de Pater, I. et al. *"Keck and VLT AO observations and models of the uranian rings during the 2007 ring plane crossings"* Icarus, Vol. 226, pp. 1399-1424, 2013.

Fletcher, L.N., de Pater, I., Orton, G.S., Hammel, H.B., Sitko, M.L. and Irwin, P.G.J. *"Neptune at summer solstice: Zonal mean temperatures from ground-based observations, 2003-2007"* Icarus, Vol. 231, pp. 146-167, 2014.

http://simbad.harvard.edu/simbad/

Irwin, P.G.J. et al. *"Line-by-line analysis of Neptune's near-IR spectrum observed with Gemini/NIFS and VLT/CRIRES"* Icarus, Vol. 227, pp. 37-48, 2014.

JPL Ephemeris at *http://www.alpo-astronomy.org*

Optec, Inc. Model SSP-3 "*Solid-State Stellar Photometer Technical Manual for Theory of Operation and Operating Procedures*" Lowell, MI: Optec, Inc., 1997.

Schmude, R. W. Jr. "*The 1991 Apparition of Uranus*" *Journal of the Assn. of Lunar & Planetary Observers*, Vol. 36, No. 1 (March) pp. 20-22, 1992.

Schmude, R. W. Jr. "*Uranus, Neptune, Pluto and How to Observe Them."* New York: Springer Science + Business Media, LLC; 2008.

Schmude, R. W. Jr. "*ALPO Observations of Uranus and Neptune in 2010-2011*" Journal of the Assn. of Lunar & Planetary Observers, Vol. 54, No. 1 (winter) pp. 33-38, 2012.

Schmude, R.W. Jr. *"ALPO Observations of the Remote Planets in 2011-2012"* Journal of the Assn. of Lunar & Planetary Observers, Vol. 55, No. 4 (autumn) pp. 41-46, 2013.

Schmude, R.W. Jr. *"ALPO Observations of the Remote Planets in 2012-2013"* Journal of the Assn. of Lunar & Planetary Observers, Vol. 56, No. 1 (winter) pp. 50-54, 2014.

Sromovsky, L.A., Limaye, S.S. and Fry, P.M. *"Clouds and Circulation on Neptune: Implications of 1991 HST Observations"* Icarus, Vol. 118, pp. 25-38, 1995.

Tamayo, D., Burns, J.A. and Hamilton, D.P. *"Chaotic dust dynamics and implications for the hemispherical color asymmetries of the Uranian satellites"* Icarus, Vol. 226, pp. 655-662, 2013.

Uckert, K, Chanover, N.J., Olkin, C.B., Young, L.A., Hammel, H.B., Miller, C. and Bauer, J.M. *"An investigation of the temperature variations in Neptune's upper stratosphere including a July 2008 stellar occultation event"* Icarus, Vol. 232, pp. 22-33, 2014.

Westfall, J.E. "Photoelectric Catalog of Zodiacal Stars" ALPO Monograph No. 12, 2008.

Table 4: Brightness Measurements of Uranus in 2013 and Early 2014

Date	Obs.[a]	Filter	Brightness (magnitudes)[b]		Date	Obs.[a]	Filter	Brightness (magnitudes)[b]	
			Meas. (+)	Normalized (-)				Meas. (+)	Normalized (-)
Sep. 4.25	JF	B	6.301	6.621	Nov. 19.12	JF	B	6.279	6.665
Sep. 4.25	JF	V	5.803	7.119	Nov. 19.12	JF	V	5.819	7.125
Sep. 6.25	JF	B	6.258	6.662	Dec. 24.11	JF	B	6.363	6.641
Sep. 6.25	JF	V	5.790	7.130	Dec. 24.11	JF	V	5.889	7.115
Sep. 8.26	JF	B	6.256	6.662	Dec. 25.11	JF	B	6.353	6.653
Sep. 8.26	JF	V	5.79	7.128	Dec. 25.11	JF	V	5.866	7.140
Sep. 22.24	JF	B	6.246	6.664	Dec. 27.09	JF	B	6.352	6.657
Sep. 22.24	JF	V	5.779	7.131	Dec. 27.09	JF	V	5.88	7.129
Sep. 24.22	JF	B	6.248	6.661	Dec. 28.09	JF	B	6.358	6.653
Sep. 24.22	JF	V	5.777	7.132	Dec. 28.09	JF	V	5.885	7.126
Sep. 25.21	JF	B	6.245	6.664	Dec. 30.08	JF	B	6.358	6.657
Sep. 25.21	JF	V	5.775	7.134	Dec. 30.08	JF	V	5.889	7.126
Oct. 17.13	JF	B	6.237	6.674	Dec. 31.09	JF	B	6.358	6.659
Oct. 17.13	JF	V	5.772	7.139	Dec. 31.09	JF	V	5.888	7.129
Oct. 18.16	JF	B	6.237	6.675	Jan. 1.10	JF	B	6.376	6.643
Oct. 18.16	JF	V	5.787	7.125	Jan. 1.10	JF	V	5.897	7.122
Oct. 19.12	JF	B	6.263	6.649	Jan. 2.10	JF	B	6.387	6.633
Oct. 19.12	JF	V	5.784	7.128	Jan. 2.10	JF	V	5.901	7.119
Oct. 20.25	JF	B	6.261	6.652	Jan. 4.07	JF	B	6.377	6.647
Oct. 20.25	JF	V	5.789	7.124	Jan. 4.07	JF	V	5.899	7.125
Oct. 22.22	JF	B	6.261	6.653	Jan. 9.10	JF	B	6.39	6.643
Oct. 22.22	JF	V	5.788	7.126	Jan. 9.10	JF	V	5.911	7.122
Oct. 23.16	JF	B	6.261	6.654	Jan. 12.10	JF	B	6.375	6.664
Oct. 23.16	JF	V	5.788	7.127	Jan. 12.10	JF	V	5.931	7.108
Oct. 27.16	JF	B	6.262	6.656	Jan. 13.09	JF	B	6.376	6.665
Oct. 27.16	JF	V	5.796	7.122	Jan. 13.09	JF	V	5.92	7.121
Nov. 2.14	JF	B	6.257	6.666	Jan. 15.09	JF	B	6.397	6.647
Nov. 2.14	JF	V	5.798	7.125	Jan. 15.09	JF	V	5.918	7.126
Nov. 3	RS	V	5.81	7.12	Jan. 17.11	JF	B	6.403	6.645
Nov. 3	RS	V	5.83	7.10	Jan. 17.11	JF	V	5.926	7.122
Nov. 3	RS	V	5.79	7.13	Jan. 18.08	JF	B	6.392	6.657
Nov. 7.14	JF	B	6.271	6.657	Jan. 18.08	JF	V	5.928	7.121
Nov. 7.14	JF	V	5.795	7.133	Jan. 21.09	JF	B	6.415	6.640
Nov. 9.14	JF	B	6.281	6.650	Jan. 21.09	JF	V	5.936	7.119
Nov. 9.14	JF	V	5.809	7.122	Jan. 29.08	JF	B	6.41	6.658
Nov. 11.14	JF	B	6.275	6.658	Jan. 29.08	JF	V	5.961	7.107
Nov. 11.14	JF	V	5.803	7.130					

[a]Observer: JF = Jim Fox, RS = Richard Schmude, Jr.

[b]The distances needed to compute the normalized magnitudes are from the JPL Ephemeris at *http://www.alpo-astronomy.org*

Table 5: Brightness Measurements of Neptune in 2013

Date	Obs.[a]	Filter	Brightness (magnitudes)[b]		Date	Obs.[a]	Filter	Brightness (magnitudes)[b]	
			Meas. (+)	Normalized (-)				Meas. (+)	Normalized (-)
Aug. 8.26	JF	B	8.068	6.630	Oct. 22.18	JF	B	8.128	6.599
Aug. 8.26	JF	V	7.687	7.011	Oct. 22.18	JF	V	7.719	7.008
Sep. 4.19	JF	B	8.087	6.682	Oct. 23.12	JF	B	8.112	6.616
Sep. 4.19	JF	V	7.654	7.115	Oct. 23.12	JF	V	7.709	7.019
Sep. 6.20	JF	B	8.104	6.592	Oct. 27.12	JF	B	8.116	6.617
Sep. 6.20	JF	V	7.652	7.044	Oct. 27.12	JF	V	7.749	6.984
Sep. 8.24	JF	B	8.100	6.596	Nov. 2.12	JF	B	8.167	6.572
Sep. 8.24	JF	V	7.676	7.020	Nov. 2.12	JF	V	7.726	7.013
Sep. 22.21	JF	B	8.079	6.623	Nov. 7.10	JF	B	8.157	6.588
Sep. 22.21	JF	V	7.670	7.032	Nov. 7.10	JF	V	7.758	6.987
Sep. 24.18	JF	B	8.085	6.618	Nov. 9.10	JF	B	8.112	6.636
Sep. 24.18	JF	V	7.703	7.000	Nov. 9.10	JF	V	7.744	7.004
Sep. 25.20	JF	B	8.097	6.607	Nov. 11.12	JF	B	8.150	6.600
Sep. 25.20	JF	V	7.690	7.014	Nov. 11.12	JF	V	7.743	7.007
Oct. 17.10	JF	B	8.107	6.615	Nov. 19.10	JF	B	8.150	6.610
Oct. 17.10	JF	V	7.708	7.014	Nov. 19.10	JF	V	7.758	7.002
Oct. 18.14	JF	B	8.117	6.606	Dec. 24.08	JF	B	8.226	6.576
Oct. 18.14	JF	V	7.693	7.030	Dec. 24.08	JF	V	7.822	6.980
Oct. 19.07	JF	B	8.048	6.676	Dec. 25.06	JF	B	8.226	6.577
Oct. 19.07	JF	V	7.722	7.002	Dec. 25.06	JF	V	7.818	6.985
Oct. 20.22	JF	B	8.092	6.633					
Oct. 20.22	JF	V	7.765	6.960					

[a]Observer: JF = Jim Fox

[b]The distances needed to compute the normalized magnitudes are from the JPL Ephemeris at *http://www.alpo-astronomy.org*

ALPO Resources

People, publications, etc., to help our members

Board of Directors

http://www.alpo-astronomy.org/main/board.html

- Member of the Board; Julius L. Benton, Jr., Associates in Astronomy, P.O. Box 30545, Wilmington Island, Savannah, GA 31410
- Member of the Board; Sanjay Limaye, University of Wisconsin, Space Science and Engineering Center, Atmospheric Oceanic and Space Science Bldg. 1017, 1225 W. Dayton St., Madison, WI 53706
- Member of the Board; Donald C. Parker, 12911 Lerida Street, Coral Gables, FL 33156
- Executive Director; Ken Poshedly, 1741 Bruckner Ct., Snellville, GA 30078-2784
- Associate Executive Director; Mike D. Reynolds, Dean of Liberal Arts & Sciences, Florida State College at Jacksonville, 3939 Roosevelt Blvd, F-112b, Jacksonville, FL 32205
- Member of the Board; Richard W. Schmude, Jr., 109 Tyus St., Barnesville, GA 30204
- Member of the Board; John E. Westfall, 5061 Carbondale Way, Antioch, CA 94531
- Member of the Board, Secretary/Treasurer; Matthew Will, P.O. Box 13456, Springfield, IL 62791-3456
- Founder/Director Emeritus; Walter H. Haas, 4885 Poose Creek Road, Las Cruces, NM 88011

****

Publications Staff

http://www.alpo-astronomy.org

Publisher & Editor-in-Chief

- Ken Poshedly (all papers, submissions, etc); 1741 Bruckner Ct., Snellville, GA 30078-2784

Book Review Editor

- Robert A. Garfinkle, F.R.A.S., 32924 Monrovia St., Union City, CA 94587-5433

Interest Sections

Computing Section

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

- Coordinator; Larry Owens, 4225 Park Brooke Trace, Alpharetta, GA 30022

Historical Section

http://www.alpo-astronomy.org/main/hist.html

- Coordinator; Thomas A. Dobbins, 10029 Colonial Country Club Blvd., Fort Myers, FL 33919

Lunar & Planetary Training Section

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

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

ALPO Online Section

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

- Coordinator (ALPO website); Larry Owens, 4225 Park Brooke Trace, Alpharetta, GA 30022
- Assistant Coordinator (digital Journal web page); Jonathan D. Slaton, P. O. Box 496, Mansfield, MO. 65704
- Acting Assistant Coordinator (ALPO social media); Steve Siedentop, P. O. Box 496, Mansfield, MO. 65704

Youth Section

http://www.cometman.net/youth

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

****

Observing Sections

Solar Section

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

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

Mercury Section

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

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

Venus Section

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

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

Mercury/Venus Transit Section

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

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

Lunar Section

Lunar Topographical Studies Program

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

Smart-Impact Webpage

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

The Lunar Observer

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

Lunar Selected Areas Program

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

Banded Craters Program

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

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

Lunar Meteoritic Impacts Search Program

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

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

ALPO Resources

People, publications, etc., to help our members

Lunar Transient Phenomena

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

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

Mars Section

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

- Coordinator; Roger J. Venable, MD, P.O. Box 117, Chester, GA 31012
- Assistant Coordinator (CCD/Video imaging and specific correspondence with CCD/Video imaging); Donald C. Parker, 12911 Lerida Street, Coral Gables, FL 33156
- Assistant Coordinator (photometry and polarimetry); Richard W. Schmude, Jr., 109 Tyus St., Barnesville, GA 30204
- Assistant Coordinator; Jim Melka, 14176 Trailtop Dr., Chesterfield, MO 63017

Minor Planets Section

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

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

Jupiter Section

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

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

Saturn Section

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

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

Remote Planets Section

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

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

Comets Section

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

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

Meteors Section

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

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

Meteorites Section

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

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

Eclipse Section

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

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

****

ALPO Publications

The Monograph Series

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

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

There is NO CHARGE for any of the ALPO monographs.

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

ALPO Resources

People, publications, etc., to help our members

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

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

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

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

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

ALPO Observing Section Publications

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

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

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

ALPO Staff E-mail Directory

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

Bailey, W .... *wayne.bailey@alpo-astronomy.org*
Benton, J.L. ....*jlbaina@msn.com*
Benton, J.L................................ *jbenton55@comcast.net*
Cook, A. ....*tony.cook@alpo-astronomy.org*
Cudnik, B...................................... *cudnik@sbcglobal.net*
Darling, D.O................................. *DOD121252@aol.com*
Dembowski, W. .... *dembowski@zone-vx.com*
Dobbins, T..................................*tomdobbins@gmail.com*
Garfinkle, R.A. ....*ragarf@earthlink.net*
Garrett, L.S. .... *atticaowl@yahoo.com*
Grafton, E. ....*ed@egrafton.com*
Gray, R. ....*sevenvalleysent@yahoo.com*
Haas, W.H....................................*dmvalba@hotmail.com*
Harris, A.W. .... *awharris@spacescience.org*
Hay, K. .... *kim@starlightcascade.ca*
Hergenrother, C. .... *chergen@lpl.arizona.edu*
Hill, D. .... *dhill@lpl.arizona.edu*
Hill, R...*rhill@lpl.arizona.edu*
Hubbell, J................................*jerry.hubbell@comcast.net*
Jenkins, J. ....*jameyljenkins@gmail.com*
Kronk, G.................................*kronk@cometography.com*
Larson, S.................................... *slarson@lpl.arizona.edu*
Limaye, S....................................*sanjayl@ssec.wisc.edu*
Lunsford, R.D............................... *lunro.imo.usa@cox.net*
MacDougal, C............................... *macdouc@verizon.net*
McAnally, J. ....*CPAJohnM@aol.com*
Melillo, F..*frankj12@aol.com*
Melka, J. .... *jtmelka@yahoo.com*
Owens, L........................*larry.owens@alpo-astronomy.org*
Parker, D.C............................... *park3232@bellsouth.net*
Pilcher, F. ....*fpilcher35@gmail.com*
Poshedly, K. ....*ken.poshedly@alpo-astronomy.org*
Pravec, P...*ppravec@asu.cas.cz*
Reynolds, M. .... *m.d.reynolds@fscj.edu*
Robertson, T.J......................... *cometman@cometman.net*
Schmude, R.W. .... *schmude@gordonstate.edu*
Siedentop, S...............................*sdsiedentop@gmail.com*
Slaton, J.D..*jd@justfurfun.org*
Timerson, B. .... *btimerson@rochester.rr.com*
Venable, R.J.......................................*rjvmd@hughes.net*
Warner, B.D.................*brian@MinorPlanetObserver.com*
Westfall, J.E............................ *johnwestfall@comcast.net*
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) o*bserving forms,* free at *http://moon.scopesandscapes.com/alpo-sap.html*, or $10 for a packet of forms by regular mail. Specify *Lunar Form*s. NOTE: Observers who wish to make copies of the observing forms may instead send a SASE for a copy of forms available for each program. Authorization to duplicate forms is given only for the purpose of recording and submitting observations to the ALPO lunar SAP section. Observers should make copies using high-quality paper.

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

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

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

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

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

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

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

ALPO Resources

People, publications, etc., to help our members

Section.

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

Other ALPO Publications

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

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

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

Back Issues of The Strolling Astronomer

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

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

$4 each:
Vol. 16 (1962) Nos. 3-4
Vol. 17 (1963) Nos. 1-2
Vol. 19 (1965) Nos. 3-4
Vol. 29 (1981-83) Nos. 1-2 and 11-12
Vol. 30 (1983-84) Nos. 1-2, 7-8, 9-10
Vol. 32 (1987-88) Nos. 3-4, 10-12
Vol. 33 (1989) Nos. 10-12
Vol. 34 (1990) Nos. 1 and 3
Vol. 35 (1991) Nos. 1, 2, and 4
Vol. 36 (1992-93) Nos. 1, 2, 3, and 4
Vol. 37 (1993-94) Nos. 1, 2, 3, and 4
Vol. 38 (1994-96) Nos. 1, 2, 3, and 4
Vol. 39 (1996-97) Nos. 1, 2, 3, and 4
Vol. 40 (1998) Nos. 2 and 3
Vol. 41 (1999) Nos. 1, 2, and 3
Vol. 42 (2000) Nos. 1 and 4
Vol. 43 (2001) Nos. 1, 2, 3, and 4
Vol. 44 (2002) Nos. 1, 2, 3, and 4
Vol. 45 (2003) Nos. 1, 2, and 3 (no issue 4)
Vol. 46 (2004) Nos. 1, 2, 3, and 4
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
Vol. 51 (2009) Nos. 1, 2, 3, and 4
Vol. 52 (2010) Nos. 1, 2, 3, and 4
Vol. 53 (2011) Nos. 1, 2, 3, and 4
Vol. 54 (2012) Nos. 1, 2, 3, and 4
Vol. 55 (2013), Nos. 1, 2, 3 and 4
Vol. 56 (2014), Nos. 1, 2, 3 and 4

$5 each:
Vol. 57 (2015), 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.

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

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

- ..$US12 – 4 issues of the digital Journal only, all countries, e-mail address required
- ..$US20 – 8 issues of the digital Journal only, all countries, e-mail address required
- ..$US33 – 4 issues of the paper Journal only, US, Mexico and Canada
- ..$US60 – 8 issues of the paper Journal only, US, Mexico and Canada
- ..$US40 – 4 issues of the paper Journal only, all other countries
- ..$US74 – 8 issues of the paper Journal only, all other countries
- ..$US65 – Sustaining Member level, 4 issues of the digital and paper Journal, all countries
- ..$US130 – Sponsoring Member level, 4 issues of the digital and paper Journal, all countries

For your convenience, you may join online via the via the Internet or by completing the form at the bottom of this page.

To join or renew online, simply left-click on this Astronomical League web page:
http://www.astroleague.org/store/index.php?main_page=product_info&cPath=10&products_id=39

Afterwards, e-mail the ALPO membership secretary at *will008@attglobal.net* with your name, address, the type of membership and amount paid.

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

Please Print:
Name____
Street Address____
____
City, State, ZIP ____
E-mail Address____
Phone Number____
Please share your observing interests with the ALPO by entering the appropriate codes on the blank line below.
Interest____

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

Beautiful Planetary Globes

Sky & Telescope Mercury Globe

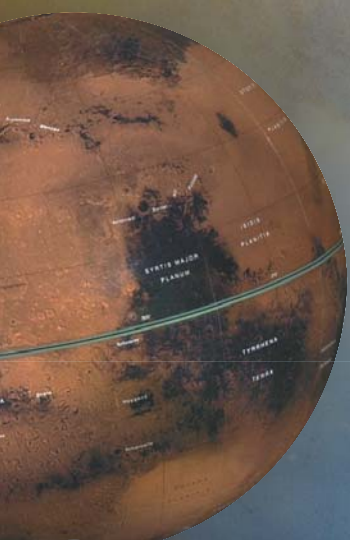
To create this dramatic portrayal, the editors of *Sky & Telescope* worked with scientists on NASA's Messenger mission to produce the globe's custom base map. Special image processing has preserved the natural light and dark shading of Mercury's surface while allowing the labels to stand out clearly. The names of more than 350 craters and other features are shown.

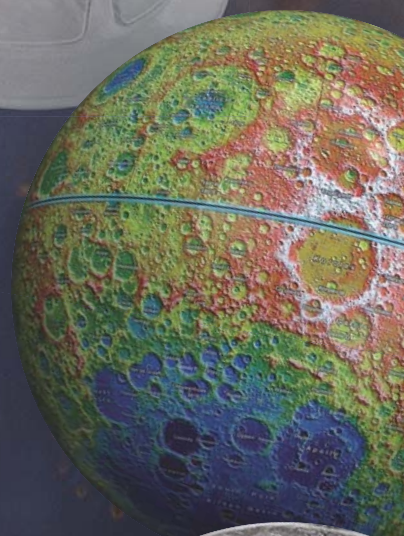
Item #MERCGLB ***$99.95*** *plus shipping*

Sky & Telescope Mars Globe

Even the Hubble Space Telescope can't show you all the details found on this updated edition of our classic Mars globe. Created from more than 6,000 images taken by the Viking orbiters, our 12-inch globe approximates the planet's true color. Produced in cooperation with NASA and the U.S. Geological Survey, the globe includes official names for 140 features.

Item #4676X ***$99.95*** *plus shipping*





S&T Topographic Moon Globe

The Topographic Moon Globe shows our home planet's constant companion in greater detail than ever before. Color-coded to highlight the dramatic differences in lunar elevations, deep impact basins show up clearly in blue, whereas the highest peaks and rugged terrain show up as white, red, and orange.

Item #TPMNGLB ***$109.95*** *plus shipping*

Sky & Telescope Moon Globe

A beautiful and extremely accurate globe of the Moon. Unlike previous Moon globes based on artistic renderings, this globe is a mosaic of digital photos taken in high resolution by NASA's Lunar Reconnaissance Orbiter. The globe shows the Moon's surface in glorious detail, and how the nearside actually appears when viewed through a telescope.

Item #MOONGLB ***$99.95*** *plus shipping*

Sky & Telescope Earth Globe

Showcasing Earth as a planetary body, this unique globe of our home world is based on NASA satellite imagery and other data. We combined two separate datasets: one showing Earth's landmasses very close to their natural color and the other depicting the fascinating topography hidden underwater.

Item #EARTHGLB ***$99.95*** *plus shipping*

888-253-0230 **www.ShopatSky.com**

SHOP at SKY