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Journal of the Association of Lunar & Planetary Observers

The Strolling Astronomer

Founded in 1947

Volume 57, Number 4, Autumn 2015

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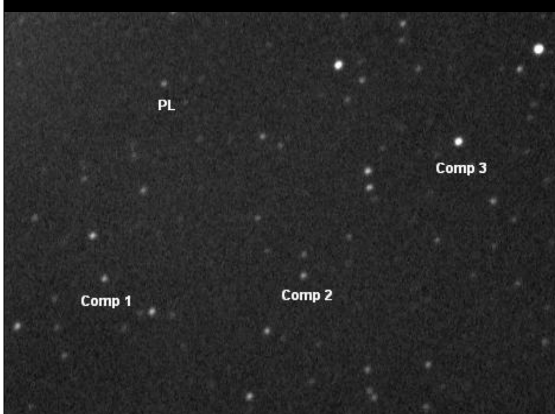
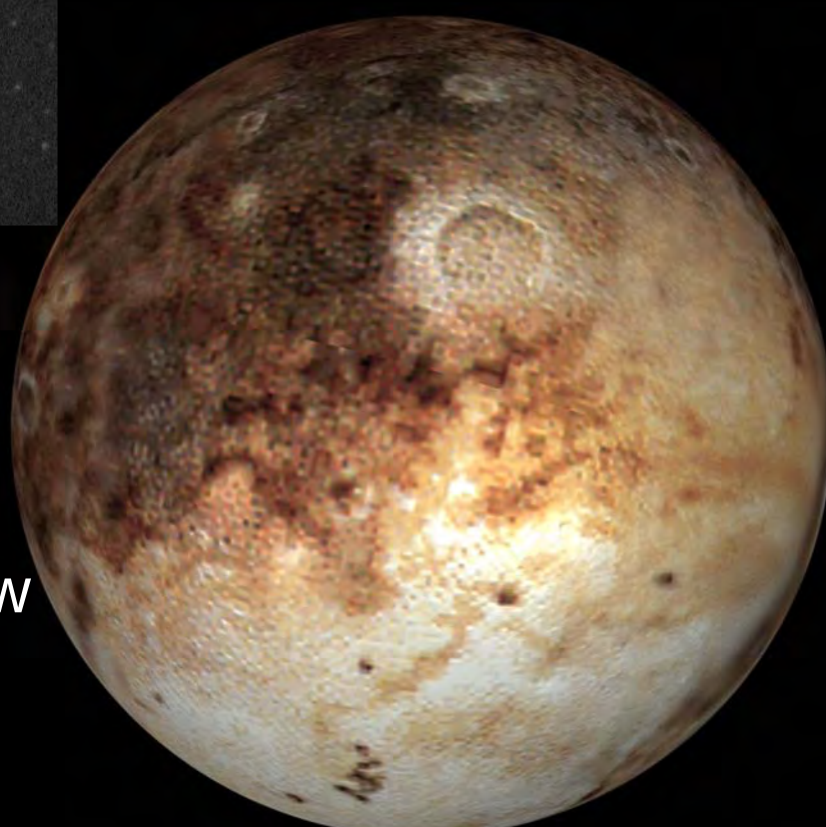
The ALPO Pluto



The New Horizons Pluto



Big Things from Little Things Grow

(See pages 23 and 37)

Journal of the Association of Lunar & Planetary Observers

The Strolling Astronomer

Volume 57, No.4, Autumn 2015
This issue published in October 2015 for distribution in both portable document format (pdf) and also hardcopy format.

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

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

For membership or general information about the ALPO, contact:

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

Founded in 1947

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Association of Lunar & Planetary Observers (ALPO)

Point of View
Hey Pluto! - We Were First!

It's now months after the New Horizons spacecraft whizzed past the planet Pluto, coming within just over 7,700 miles from its surface. Lots and lots of data and great images have surely been downloaded by now.

To most folks, this is no big deal -- just another piece of expensive machinery tossed into space to satisfy the whims of gearheads and eggheads. Good money after bad, say the great unwashed.

But to us — who relish and live for solar system exploration of any kind — this is monumental. After all, this was the first of sure-to-be-more exercises to study Pluto, the only planet discovered by an American (Clyde Tombaugh). Just as the first explorers sailed from Europe and elsewhere hundreds of years ago to the North American and South American continents for curiosity and various other reasons, many more explorers followed.

Even though Pluto is currently the topic-of-today, WE should be proud to remember that it was a small cadre of ALPO observers who made many attempts to try and see it in their backyard scopes for so many years. WE were the vanguard of observers who appreciated this lowly and (in my own mind) denigrated member of our solar system.

Whether it's a "planet", "dwarf planet" or something else, Pluto remains a legitimate member of the ALPO Remote Planets Section which was formed in 1956 as the ALPO Uranus-Neptune Section and first headed by the late Leonard Abbey.

Today, and for the past 15 years, the section has been admiringly headed by our own Dr. Richard Schmude, a professor of Math and Physical Sciences at Gordon State College located southwest of Atlanta. And all of us are truly appreciative of "Richard" (as we call him) and his dedicated and constant, but low-key, efforts to prod us to also take a peek at this faraway object. The newest of Richard's remote planets apparition reports is featured in this issue of the Journal of the ALPO.

Perhaps the success of the New Horizons mission will goad some of us to consider adding Pluto to our own must-see list — at least once in awhile — and do our share to help Richard and the ALPO Remote Planets Section.

No, it won't be a strikingly beautiful view like we're now seeing in the print and broadcast media. But that small point of light in YOUR scope will be "there" for you to see in real time (well, really, four hours earlier as its light left it).

Take chance and try a "new horizon" yourself.

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News of General Interest

Articles for Publication in This Journal

The ALPO appreciates articles for publications and encourages its general membership to submit written works (with images, if possible).

As with other peer-reviewed publications, all papers will be forwarded to the appropriate observing section or interest section coordinator.

Thus, the best method is to send them directly to the coordinator of the ALPO section which handles your topic.

A complete list of ALPO section coordinators and their regular addresses and e-mail address is in the ALPO Resources section of this Journal.

New Paper for the Journal

In case you hadn't noticed, beginning with JALPO57-3 (Summer 2015), the hard copy version of the quarterly Journal of the ALPO is now being printed on coated (glossy) paper stock. We've already received positive input about this type of paper retaining the sharpness of various images and we hope you agree.

ALPO Solar Section Correction

The CORRECT website address for the ALPO Solar Section e-mail list on Yahoo is https://groups.yahoo.com/neo/groups/Solar-Alpo/info

Please check into this worthwhile activity and participate actively.

Online JALPO Passwords

In response to various requests for access to older online (pdf) issues of the JALPO which may be password-protected, please contact this editor for needed passwords at ken.poshedly@alpo-astronomy.org

All online (pdf) issues of our Journal from JALPO56-1 (Winter 2014) back to JALPO43-1 (Winter 2001) can be accessed at http://www.alpo-astronomy.org/djalpo/

Memorial Donations to the ALPO

A number of you have already made donations to the ALPO in memory of both Walter Haas and Don Parker. Online contributions can be made via the URL below:

https://www.astroleague.org/store/index.php?main_page=product_info&cPath=10&products_id=50&zenid=7vfjtfsce7miss48rh3tnnh4u6

Or you can mail your the check to:

Matthew Will

ALPO Membership Secretary/Treasurer

P.O. Box 13456

Springfield, Illinois 62791-3456

Please make your check payable to "The ALPO" and add "Don Parker donation" in the lower left corner note of the check.

The ALPO wishes to thank all who have contributed funds in the names of both Walter Haas and Don Parker. Donations to the ALPO in their names are still being accepted.

Walter H. Haas — Contributions made in memory of the founder of our fine organization have so far totalled $3,500.

Below are the names of those contributors thus far.

- Matthew L. Will
- Derald D. Nye
- Frederick Pilcher
- Mike Hood
- Louise D. Olivarez
- John and Elizabeth Westfall
- Roger J. Venable
- Michael D. Reynolds

Don Parker — After his passing several months ago, several individuals made special donations to the ALPO in his memory. As of late September, those donations totaled over $2,975.

Below are the names of those contributors thus far.

- John Boudreau
- Mitch Glaze
- Julius L. Benton, Jr.
- John and Elizabeth Westfall
- Coworkers of Kathleen (Parker) Greenwood (Florida Office of Water Quality)
- Matthew L. Will
- Jeffrey Beish
- Mike Hood
- Louise D. Olivarez
- Lorne and Shirley Greenwood, Jr.
- Roger J. Venable
- Michael D. Reynolds

Donations to the ALPO in their names are still being accepted. There are two ways to contribute:

- Send your check or money order made payable to the ALPO to

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ALPO, P.O. Box 13456,
Springfield, IL 62791-3456

- Donate by credit card on the Astronomical League online store at this URL: https://www.astroleague.org/store/index.php?main_page=product_info&cPath=10&products_id=50&zenid=g29852ugiccivalvfgkjc5i185

If paying by check, please write on the check's memo line "in memory of Walter Haas" or "in the memory of Don Parker." If paying online, there should be an option for "special instructions" where one can state that the donation is in the memory of Walter Haas or Don Parker.

ALPO Interest Section Reports

ALPO Online Section

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

Follow us on Twitter, "friend" us 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

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

I, Tim Robertson, as program coordinator, heartily welcome you to the ALPO and our training program and look forward to hearing from you!

To began the first phase of training at the basic level, interested persons should contact me at the following address:

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

Or send e-mail to me at:
cometman@cometman.net

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

ALPO Observing Section Reports

Mercury / Venus Transit Section

John Westfall, section coordinator
johnwestfall@comcast.net

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

Meteors Section

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

The Meteors Section is still receiving reports from the recent Perseid meteor shower. The peak appears to have occurred near 06:00 UT on August 13. Zenith hourly rates at that time were slightly more than 100, indicating a good display. Verbal reports verify good Perseid rates as well as many bright and colorful meteors. A complete report will be featured in the next issue of the ALPO Meteors Section newsletter.

The best opportunity for viewing meteor activity during the autumn months will be near October 22, when the Orionids reach maximum activity. The Taurids may also produce some fireball activity during the last week of October and the first week of November. Unfortunately the full moon on October 27 will spoil much of the viewing for the Taurids.

Visit the Meteors Section for in depth information on upcoming meteor displays.

Visit the ALPO Meteors Section online at www.alpo-astronomy.org/meteorblog/ Be

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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

The Meteorite Section was represented at the recent Astronomical League/ ALPO meeting in Las Cruces, NM, where Dolores Hill and other ALPO members had the pleasure of visiting with Mary Alba, daughter of founder Walter Haas. The Meteorite Section strives to serve ALPO members interested in meteorites while not duplicating activities of other organizations that tend to promote meteorite hunting or collecting per se. As in other ALPO sections we want to collect and archive scientifically useful data and connect amateur meteorite aficionados with meteoriticists on specific research projects. Some of these may be good cloudy night projects for observers.

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

Comets Section

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

The past summer was slower than usual for the Comet Section. Though comet C/2014 Q1 (PANSTARRS) reached magnitude 3 and sported multiple distinct tails, it was only visible from the southern hemisphere. For the majority of observers at northern mid-latitudes there were no bright comet visible. The last three months of 2015 will see Comet C/ 2013 US10 (Catalina) brighten to 4th or 5th magnitude, first as a southern only object and then as a mainly northern one.

Comet Catalina was discovered on Halloween, 2013 by Richard Kowalski of the Catalina Sky Survey outside of Tucson, Arizona. At the time of discovery it was over 8 AU from the Sun and 18th magnitude. Perihelion occurs on November 15 at 0.82 AU from the Sun. Observations by ALPO Comet Section contributor Willian Souza of Brazil show the comet to be around magnitude 6.8 as of mid-August. Forecasting the brightness of a comet is always difficult. If it continues its recent behavior it may be around magnitude 6 at the start of October and magnitude 4 or 5 when it becomes visible for northern observers in the morning sky. It should remain around magnitude 4 or 5 throughout December when it will be an easy object for northern observers but a difficult one for southern observers.

Another 2013 discovery, C/2013 X1 (PANSTARRS), may brighten above 10th magnitude by December. With an April perihelion at 1.31 AU and June perigee at 0.64 AU, PANSTARRS will be observable for much of 2016 with a peak brightness of ~6th-7th magnitude in June.

Two short period comets, 10P/Tempel 2 and 22P/Kopff, will approach 10th-11th magnitude this winter. This is Tempel 2's 23rd observed return since 1873 and Kopff's 17th since 1906.

The following observers have contributed observations to the Comet Section this Summer. Visual observations were submitted by Salvador Aguirre, Carl Hergenrother and Willian Souza. CCD images were contributed by Carl Hergenrother, Manos Kardasis, Gianluca Masi, John Sabia and Willian Souza.

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 Rik Hill, acting section coordinator & science advisor
rhill@lpl.arizona.edu

(Editor's Note -- Shortly before publication of this issue, Ms. Hay decided to step down as the ALPO Solar Section Coordinator.)

There have been many changes in the ALPO Solar Section (ALPOSS) over the last few months. Perhaps the most noticeable change is that Kim Hay, ALPOSS Coordinator since 2005, has decided to step down to serve as ALPOSS Assistant Coordinator. Kim had been ALPOSS Assistant Coordinator-Archivist a year before becoming full coordinator. Her work and efforts kept things going for a decade and are greatly appreciated.

At the recent ALPO Board Meeting in Las Cruces, NM, a call went out for help with the ALPOSS. It was then that ALPOSS Science Advisor Richard "Rik" Hill (now retired from the Lunar & Planetary Lab at the University of Arizona) volunteered to step in. With Kim's decision to step down, and recalling that Rik had already served as ALPOSS Coordinator previously (1982-2004), and the realization that with retirement he will have lorry-loads of time on his hands, the Board pressed

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him into accepting the section coordinator spot.

Here's the new ALPOSS staff listing:

- Rik Hill - Acting Coordinator and Science Advisor
- Kim Hay - Acting Assistant Coordinator
- Theo Ramakers - Acting Assistant Coordinator (new observers and ALPOSS image gallery contact)
- Rick Gossett - Acting Assistant Coordinator (primary moderator, ALPOSS Yahoo email list)
- Brad Timerson - Assistant Coordinator (solar ephemerides)

While each individual has his own proclivity and area of expertise, others are being considered at this time, as there is plenty of work to go around! Remember, the Sun has no apparition down-time. (Sorry, night doesn't count!)

Solar activity is pretty low for a solar maximum. We are lucky to get two or three D- or E-groups per rotation and very lucky if we get a naked-eye spot group once in a rotation. This has allowed us to catch up with activity reports as will be seen in the next several ALPO Journals. Anyone with any interest in solar observing of any sort should contact one of the coordinators and begin making and submitting observations for inclusion in our reports. We use drawings (whole-disk and individual groups or regions), white-light imagery and monochromatic filtergrams in the preparation of our reports on activity.

Presentation of ALPOSS images by members on the ALPO website was previously handled by Kim Hay, but is now being handled by Theo Ramakers. His goal is to post all of our observations back to 1982 when the ALPOSS was founded - a huge task! We will soon have some news on how observers can do their own quick and easy process of uploading to the ALPOSS database, thus cutting out the middleman.

Besides the above staff changes, various individuals are now working together towards revising the Astronomical League booklet "Observe and Understand the Sun", with former ALPOSS assistant coordinator Jamey

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Jenkins serving as the team coordinator of this project. Plans are for the new version to be ready sometime in the middle of the next year. Afterwards, it will likely serve as the handbook for the ALPOSS.

To join the Yahoo Solar ALPO e-mail list, please go to https://groups.yahoo.com/neo/groups/Solar-Alpo/info

We encourage you to upload your observations or images (which should be under 250K) into our solar image archive. To request a logon ID, password and simple instructions, please send an e-mail to: solarimages@alpo-astronomy.org with the subject "ALPO Solar Section Images". Or if you want us to archive them, please include all data on the images and attach them to an e-mail to the same address.

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

During April and May 2015, the ALPO Mercury Section received a fair number of observations regarding the evening apparition. I hope that some of you will continue to observe this tiny planet during the upcoming morning apparition in October.

While I thought this would be a fine morning apparition, you will have other planets to also observe including Venus, Mars and Jupiter, with Mercury below them. Also, Regulus will be joining the group. This should be a fine sight for those of you who will brave the early, cool and crisp morning hours of the fall season.

Mercury will glow faintly as it appears shortly before sunrise during the first week of October. But a pair of binoculars is required to catch Mercury briefly. The second week should be a lot easier. Three planets — Venus, Mars and Jupiter — stand above Mercury while it shines at +0.5 magnitude. In addition to that, the nearby Waning Crescent Moon will join the gang from October 8-11 — a great opportunity to do some wide-angle astrophotography.

Mercury will reach its greatest elongation at 18 degrees west of the Sun on October 16. Also, it will brighten to -0.5 magnitude. Still, it will be much fainter than Venus and Jupiter, but still brighter than Mars.

Telescopically, it will appear as a half-moon at 6.9 arc-seconds in diameter. After mid-October, Mercury will continue to brighten to nearly -1.0 magnitude as it pulls away from the three main planets. By November, it will move slowly toward superior conjunction with the Sun on November 17.

Please send in your observations.

Raffaello Braga of Milan, Italy, submitted this excellent detailed UV image of Venus using 21.0 cm (8.3 in.) Dall-Kirkham on June 3, 2015 at 18:22 UT in good seeing. Banded and irregular dusky markings, plus a few subtle bright areas exclusive of the cusps, are readily seen in this image, as well as portions of the bright limb band. The south cusp cap and cusp band are particularly prominent, and a shaded somewhat irregular terminator is noticeable in this UV image. The apparent diameter of Venus is 22.9", phase (k) 0.515 (51.5% illuminated), and visual magnitude -4.2. South is at top of image.

We also need more drawings and images that will add to the professionalism of our apparition report.

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 Inferior Conjunction with the Sun on August 15, 2015, ending the 2014-15 Eastern (Evening) Apparition. Venus will have reappeared in the morning sky before sunrise in early September attaining its greatest brilliancy on September 21, 2015 at apparent visual magnitude -4.8, moving steadily westward relative to the Sun as the 2015-16 Western (Morning) Apparition progresses. Observers should recognize that Venus is passing through its waxing

Geocentric Phenomena of the 2015-16 Eastern (Evening) Apparition of Venus in Universal Time (UT)

Inferior Conjunction	2015	Aug 15 (angular diameter = 63.1arc-seconds)
Greatest Illuminated Extent		Sep 21 (m_v = –4.8)
Predicted Dichotomy		Oct 25.27 (exactly half-phase predicted)
Greatest Elongation (West)		Oct 26 12 (Venus will be 46º West of the Sun)
Superior Conjunction	2016	Jun 06 (angular diameter = 9.7 arc-seconds)

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Lunar Calendar for Fourth Quarter 2015 (All Times UT)

Oct	02	12:51	Moon-Aldebaran: 0.5° S
	03	23:55	Moon North Dec.: 18.1° N
	04	21:06	Last Quarter
	08	20:32	Moon-Venus: 0.8° N
	09	16:51	Moon-Mars: 3.8° N
	09	23:30	Moon-Jupiter: 3° N
	11	10:54	Moon Ascending Node
	11	13:17	Moon Apogee: 406400 km
	13	00:06	New Moon
	16	13:20	Moon-Saturn: 3.2° S
	18	18:31	Moon South Dec.: 18.2° S
	20	20:31	First Quarter
	25	07:36	Moon Descending Node
	26	12:59	Moon Perigee: 358500 km
	27	12:05	Full Moon
	29	22:45	Moon-Aldebaran: 0.6° S
	31	09:02	Moon North Dec.: 18.2° N
Nov	03	12:24	Last Quarter
	06	15:49	Moon-Jupiter: 2.5° N
	07	09:56	Moon-Mars: 2° N
	07	13:54	Moon-Venus: 1.4° N
	07	15:53	Moon Ascending Node
	07	21:48	Moon Apogee: 405700 km
	11	17:47	New Moon
	15	00:39	Moon South Dec.: 18.3° S
	19	06:27	First Quarter
	21	13:56	Moon Descending Node
	23	20:06	Moon Perigee: 362800 km
	25	22:44	Full Moon
	26	09:33	Moon-Aldebaran: 0.7° S
	27	20:13	Moon North Dec.: 18.4° N
Dec	03	07:41	Last Quarter
	04	06:21	Moon-Jupiter: 2° N
	04	18:33	Moon Ascending Node
	05	14:56	Moon Apogee: 404800 km
	06	02:40	Moon-Mars: 0.1° N
	07	16:55	Moon-Venus: 0.7° S
	11	10:29	New Moon
	12	08:15	Moon South Dec.: 18.4° S
	18	15:13	Moon Descending Node
	18	15:14	First Quarter
	21	08:53	Moon Perigee: 368400 km
	23	19:09	Moon-Aldebaran: 0.7° S
	25	07:30	Moon North Dec.: 18.4° N
	25	11:11	Full Moon
	29	20:30	Moon-Regulus: 2.9° N
	31	17:55	Moon-Jupiter: 1.6° N
	31	20:19	Moon Ascending Node

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

phases as it shrinks in angular diameter, slowly changing from a thin crescent to a gibbous and ultimately a fully illuminated disk as it reaches Superior Conjunction in early June 2016. It will attain Greatest Elongation West of 46° on October 26, 2015, less than a day after reaching theoretical dichotomy (half-phase) on October 25.

The table of Geocentric Phenomena in Universal Time (UT) is included here for the convenience of observers for the 2015-16 Eastern (Evening) Apparition:

As of this writing (late July), the ALPO Venus Section has received several hundred drawings and images for the previous 2014-15 Eastern (Evening) Apparition, for which a full apparition report will appear in this Journal at a later date.

During the 2015-16 Western (Morning) Apparition, it is possible to wait until the planet gains altitude and the background sky brightens considerably, allowing Venus to be readily followed into daylight. It is perfectly desirable to observe Venus during daylight hours when most of the prevailing glare associated with the planet is gone or reduced, but observing Venus too far into the daylight hours can become a problem as solar heating produces turbulent air and resulting poor seeing.

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

The ALPO Venus Section continues to routinely share visual observations and digital images at various wavelengths

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with the professional community. As readers are aware, ESA's Venus Express (VEX) mission, that started systematically monitoring Venus at UV, visible (IL) and IR wavelengths back in May 2006, ended its highly successful campaign early in 2015 as it made its final descent into the atmosphere of the planet. It was a remarkably successful Pro-Am collaborative effort involving ALPO Venus observers around the globe, and those who actively participated are commended for their perseverance and dedication.

It should be pointed out that it is still not too late for those who have not yet sent their images to the ALPO Venus Section and the VEX website (see below) to do so. Sought after also are drawings of Venus in Integrated Light and with color filters of known transmission. These collective data are important for further study and will continue to be analyzed for several years to come as a result of this endeavor.

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 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

NEW --The ALPO Lunar Topographical Studies Section (ALPO LTSS) received a total of 82 new observations from 10 observers during the April-June quarter. Six contributed articles were published in addition to numerous commentaries on images submitted. The *Focus-On* series continued with an articles on Rimae Sirsalis. Upcoming *Focus-On* subjects include Mare Tranquilitatis and Dionysius-dark ray craters.

All electronic submissions should now be sent to both me and Assistant Coordinator Jerry Hubbell (*jerry.hubbell@alpo-astronomy.org*).

Hard copy submissions should continue to be mailed only 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/*

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Mars Section

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

Mars is now in the morning sky, with solar elongation of greater than 30 degrees. Though its angular diameter is only about 4 arc seconds, many useful observations have been made at such a small size. At many observing sites, the best seeing of the night is in the hours before dawn. Please get out early to make some observations this autumn.

In the article about this apparition of Mars in the Summer issue of The Strolling Astronomer (JALPO 57-3: pages 33-38), two tables were omitted. Here they are

Table 1: Important Dates of This Apparition*

Event	Date	Earth Dist	Diam
Solar conjunction	2015 Jun 14	2.568	3.65
6 arcsec diam	2016 Jan 13	1.561	6.00
Western quadrature	2016 Feb 07	1.305	7.17
Retrograde begins	2016 Apr 17	0.665	14.08
Opposition	2016 May 22	0.509	18.38
Closest approach	2016 May 30	0.503	18.61
Retrograde ends	2016 Jun 30	0.570	16.42
Eastern quadrature	2016 Sep 13	0.968	9.68
6 arcsec diam	2016 Dec 19	1.561	6.00
Solar conjunction	2017 July 27	2.656	3.53

Earth Dist is distance from Earth in astronomical units.
Diam is apparent angular diameter in arc seconds.
*Data from the Horizons ephemeris of Jet Propulsion Laboratory on the world widw web at *ssd.jpl.nasa.gov/horizons.cgi*

Table 2: Stellar Occultations By Mars

UT Date	2015-10-18	2017-05-13
UT HH:MM	19:28	08:36
Maximum Duration*	165 sec	134 sec
Star Magnitude	4.63	6.55
Star Name	HIP 54182	HIP 22743
Spectral Class	F0	K0
Elongation	40.4° Morning	22.3° Evening
Mars Diameter†	4.1 arc sec	3.82 arc sec
Mars Illumination (percent)	96.1	98.5
Illuminated Defect Side#	Reappearance	Disappearance
Mars Magnitude	1.75	1.63
Visible From	Japan & Far Eastern Russia	SE Australia

* Duration witnessable from a location on centerline of the occultation path (see Figure 7 in the report). Centerline may not be accessible.
† Apparent angular diameter subtended as seen from Earth.
# The crescent-shaped, unilluminated part of the disc of Mars may be on either the preceding side or the following side of the planet, affecting the observation at disappearance or at reappearance, respectively.

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

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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

If you think that you see an 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

Minor Planets Section

**Frederick Pilcher,
section coordinator**
pilcher35@gmail.com

Some of the highlights published in the *Minor Planet Bulletin*, Volume 42, No. 3, 2015, July-September, are hereby presented. These represent the recent achievements of the ALPO Minor Planets Section.

Lorenzo Franco used a Paton Hawksley Education SA-200 diffraction grating mounted inside the filter wheel to obtain a reflection spectrum of the near-Earth asteroid (357439) 2004 BL86 in its flyby 2015 January 26. He stacked 62 images to increase the SN ratio and used Sirius (A1V spectral class) and HD 76151 (G2V spectral class, same as the Sun) for calibration. By comparing the graph of the spectrum of 2004 BL86 with the spectra of several asteroids of taxonomic classes O, Q, T, V, and Vesta, from the SMASS II catalog, he established that 2004 BL86 has a spectrum very similar to that of Vesta, and may be a fragment from a cratering event on Vesta.

Lorenzo Franco has also published lightcurve inversion models including accurate sidereal rotation periods, approximate pole orientations, and shapes, for 65 Cybele and 2455 Somville.

In some circumstances, following a rotational spinup fissioning, tidal evolution can transform the system into a rapidly rotating secondary orbiting at a large distance from a slowly rotating primary. In this case the chance of the line of sight being close enough to the orbital plane for observation of transit/occultation/eclipse events is extremely small, but the secondary may still be detected from its rotational lightcurve. Frederick Pilcher, Caroline Odden and several high school students at Phillips Academy, Andover, Massachusetts, and other colleagues performed a major observational campaign on one candidate asteroid, 1220 Crocus. They found a well defined primary period of 491.4 hours with very large one magnitude amplitude, but no evidence of a secondary. Brian Warner investigated (23615) 1996 FK12 and found separate rotation periods of 368 hours for the primary and 3.6456 hours for the secondary. These studies found two different cases: 1220 Crocus does not have a satellite companion of significant size while 1996 FK12 does have a satellite companion.

Warner also found that 2449 Kenos is a probable binary with transit/occultation/eclipse events and that 4868 Knushevia and 5426 Sharp are possible binaries for which confirmation at future oppositions is required.

In addition to asteroids specifically identified above, lightcurves with derived rotation periods are published for 122 other asteroids as listed below: 30, 128, 249, 279, 884, 930, 1027, 1172, 1468, 1511, 1627, 1708, 1864, 2036, 2064, 2241, 2245, 2491, 2501, 2895, 3131, 3395, 3416, 3759, 4340, 4348, 4401, 4535, 4678, 4707, 4708, 4715, 4791, 4832, 4867, 4898, 5131, 5144, 5579, 5685, 6029, 6087, 6382, 6388, 6646, 6870, 7829, 8077, 8400, 9030, 9347, 9732, 9928, 11066, 11089, 11488, 11509, 11552, 12753, 12920, 15502, 15552, 16070, 16585, 17083, 17172, 17314, 18137, 18368, 18493, 22099, 22771, 24446, 25318, 30705, 30935, 30942, 32482, 32800, 34642, 34817, 37519, 39791, 39796, 41327, 51364, 51365, 54656, 71765, 76841, 76857, 76867, 79316, 85990, 86067, 90416, 99248, 137924, 137925, 159454, 214088, 311554, 361071, 410088, 416071, 416151, 427684, 429584, 2002 EX8, 2007 ED125, 2011 WK15, 2013 BK18, 2014 QK434, 2014 UF206, 2014 YM9, 2014 YV34, 2015 AZ43, 2015 BO510, 2015 BW92, 2015 CN13, 2015 DN215, 2015 EZ.

Secure periods have been found for some of these asteroids, and for others only tentative or ambiguous periods. Some are of asteroids with no previous lightcurve photometry, others are of asteroids with previously published periods that may or may not be consistent with the newly determined values.

Newly found periods that are consistent with periods previously reported 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.

At ALCon 2015, the combined convention of the Astronomical League and the ALPO, held 2015 July 6-11, this author presented a talk on asteroid CCD photometry and lightcurve analysis. This

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included a description of routine data acquisition and lightcurve construction as well as ambiguous periods, detection of satellites, and tumbling behavior. Bert Stevens made a presentation at this convention on the topic of minor planet astrometry. He recently posted his 30,000th precise astrometric position on the Minor Planet Center's data base.

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

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

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

Jupiter Section

Report by Ed Grafton, section coordinator
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Jupiter reached solar conjunction on August 26, when its apparent diameter was about 30 arc seconds in diameter. At that time, Jupiter was at its maximum distance from the Earth at 6.4 astronomical units.

One of the more interesting aspects of the 2014-2015 apparition was the occurrence of mutual satellite events. The Jupiter system was nearly edge-on to the Earth and Sun this past apparition, allowing observations of mutual satellite occultations and mutual satellite shadow transits. Marc Delcroix on April 21, 2015 captured images and a light curve of Ganymede eclipsing Io.

Image animation of Ganymede eclipsing Io:

http://www.astrosurf.com/delcroix/images/planches/phemu20150421a-3occ1-MDe.gif

Light curve of Ganymede eclipsing Io:

Image by Anthony Wesley of Rubyvale, Australia, in IR wavelengths greater than 685 nm showing Io's shadow.

http://www.astrosurf.com/delcroix/images/planches/phemu20150421b-3occ1-MDe.jpg

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

Galilean Satellite Eclipse Timing Program

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

Saturn Section

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

Saturn will reach conjunction with the Sun on November 30, 2015, ending a highly successful 2014-15 apparition where observers have contributed a multitude of excellent drawings and digital images at visual and other wavelengths. Those who have not yet submitted their observing reports,

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drawings, and images should do so as soon as possible. Some brief highlights of the 2014-15 observing season, at this writing, include the following:

- The Pro-Am effort that began back in 2004 when Cassini started monitoring Saturn at close range remained very active in 2014-15.
- Recurring dark spots have been imaged at +41o and +64o Saturnigraphic latitude that have displayed increasing complexity and evolving morphology with time (especially the feature at +64°).
- A recurring bright feature in the EZn was imaged since about June 20, 2015.
- Based on visual numerical relative intensity estimates, the EZn has been slightly brighter than usual.
- Multiple small bright spots have been imaged in the NTrZ (possible remnants of the 2010-11 storm).
- Despite Saturn's more southerly declination of -18o observations have approached near-record numbers in 2014-15.

Readers should stay tuned for a comprehensive apparition report that will appear in a later issue of this Journal.

The accompanying table for the 2015-16 apparition is presented for the convenience of readers for planning observations.

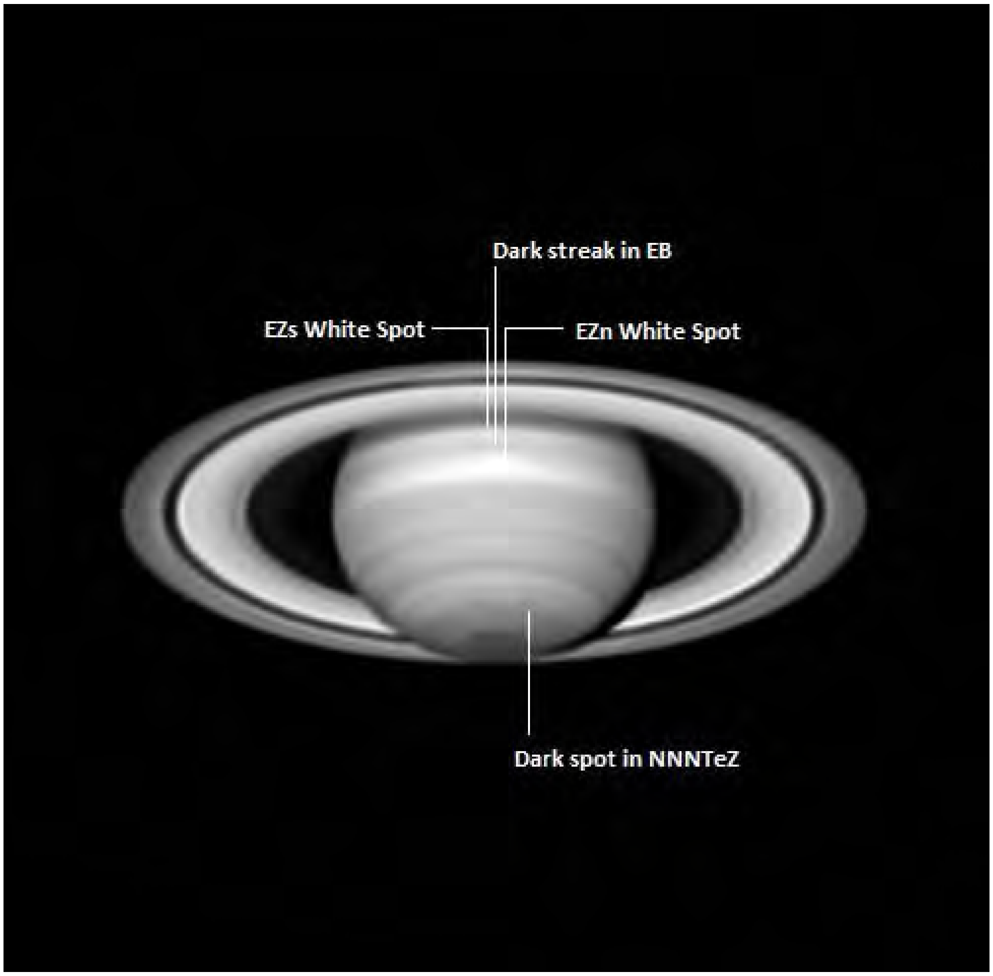

Image of Saturn taken at infrared wavelengths (685 nm) on July 13, 2015, by Anthony Wesley of Rubyvale, Australia, at 12:18 UT using a 36.8 cm (13.5 in.) Newtonian showing an extremely small dark spot within the NNNTeZ, as well as a small but conspicuous bright spot near the CM in the EZn and a much smaller EZs diffuse white area just south of the EB. An elongated dark streak is also barely discernable near the CM in the EB. Numerous other belts and zones are seen on the globe, including the 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). Also visible 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 since it is after opposition. Seeing was excellent and transparency was not specified. The apparent diameter of Saturn's globe was 17.7" with a ring tilt of +24.0° CMI = 55.7°, CMII = 329.0°, CMIII = 262.2°. S is at the top of the image.

Saturn will be visible before sunrise by the third week of December 2015, and observers should begin viewing the planet and submitting reports to the ALPO Saturn Section as quickly as possible. Saturn will slowly progress toward opposition to the Sun on June 3, 2016 with the rings tilted about +26° toward Earth, affording near optimum views of the northern hemisphere of the globe and north face of the rings in 2015-16. It will be very interesting to see how activity seen or imaged on Saturn during 2014-15 persists and continues to evolve and what new discrete phenomena will emerge.

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

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ALPO Saturn Section for further information.

Observers are strongly encouraged to 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*

Geocentric Phenomena for the 2015-16 Apparition of Saturn in Universal Time (UT)

Conjunction	2015 Nov 30^{d} UT
Opposition	2016 Jun 03^{d}
Conjunction	2016 Dec 10^{d}
Opposition Data:	
Equatorial Diameter Globe	18.4 arc-seconds
Polar Diameter Globe	16.4 arc-seconds
Major Axis of Rings	41.6 arc-seconds
Minor Axis of Rings	18.2 arc-seconds
Visual Magnitude (m_v)	0.0
B =	+25.9°
Declination	-20.6°

Remote Planets Section

Report by Richard W. Schmude, Jr., section coordinator
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(Editor's Note -- With the recent success of the New Horizons flyby mission to study Pluto, perhaps more of you will at least consider assisting Dr. Schmude with reports of your own attempts to locate and observe this object.)

Pluto reached opposition on July 6 and will be visible in the southern sky during September in the evening. Neptune will reach opposition on September 1 and will visible in the late evening sky in September. Uranus will reach opposition on October 12 and will be visible in the late evening and early morning during September.

Mark Delcroix submitted an image of Neptune on July 20, 2015, which shows two bright spots. I am hoping that others with a red filter will be able to image both Uranus and Neptune. The writer was also able to measure the brightness of Uranus in the early morning hours of June 16 of this year. Uranus was about as bright as it was last year.

I submitted the 2014-2015 remote planets report to JALPO editor Ken Poshedly on July 2; that report appears later in this issue of your ALPO Journal. I am hoping to send out a finder chart for Uranus and Neptune later this month.

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*.

Letter to the Editor

I commend Richard Schmude for his long-term commitment to measuring the brightness of Mars (Schmude, JALPO57-3, pp. 39-45), and I thank him for making this fine contribution to the Mars Section's work. I want to point out a couple of things that are present in the data he sets forth that may not be readily evident to the casual reader.

First, he shows how Hellas is brightest from Ls 80 to Ls 110, that it is often as bright or brighter than a polar cap (his Table 3), and that it may remain bright until Ls 165 (his Figure 1B), and explains that this is due to seasonal clouds in Hellas.

I have noted that the cloudiest season on Mars is from Ls 70 to Ls 123 (Venable 2015), at which time in Tharsis, Arcadia, and Amazonis the sunrise terminator and morning sky are covered with dense clouds. Thus, there is an interesting correspondence in Ls between the cloudiest times of Hellas, which is at southern latitudes, and Arcadia at northern latitudes

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and Tharsis and Amazonis at equatorial latitudes.

In the effort he makes to ascertain whether Hellas is responsible for brightening of the planet's overall magnitude at that time of the Martian year, it is reasonable to also include considerations of these other three provinces as a possible cause of brightening. However, since only the morning side of Mars is involved with the Tharsis/Arcadia/Amazonis clouds, the brightness of the planet at this Ls will be related to Mars's elongation from the Sun in our sky, as the bright morning side is much better seen after opposition.

From this consideration, it is evident that optimization of a model of the apparent brightness of Mars will require inclusion of solar elongation effects as well as the phase angle and the more obvious factors of central meridian, Ls, axial tilt, and distances from Sun and Earth.

Second, the deviations in his measures of brightness from Mallama's model (his Figure 1D) appear to be correlated with neither the brightness of Hellas, nor by inference the brightnesses of Tharsis, Arcadia, and Amazonis. Since the NPC was visible for essentially the entire apparition, it too does not account for the deviations. However, the occurrence of opposition may be correlated with the deviations, inasmuch as Figure 1D suggests a reduction in the overall brightness of Mars shortly before and shortly after the 2012 March 3 opposition. This single-apparition data is necessarily preliminary, but if this effect is borne out, it suggests that Mallama's model does not fully account for either the dimming due to the phase effect, or the opposition surge on Mars. [Mallama did incorporate phase effects and opposition effects into his model (Mallama 2007).]

Thirdly, I want to point out that the error estimates in Schmude's 2011-2012 measurements (his Table 4) are larger than they were in his measurements of recent years (also in Table 4). If one uses a significance criterion of 1 chance in 20 as being random, then one should double the one-sigma error to define the confidence interval. By this criterion, only the early summer (Ls 90 to 135) data from the 2011-2012 apparition is significantly different from his data from previous years. So, one will have to reserve judgment on the significance of the findings until longer-term data is compiled.

It is clear that continued measurements of the apparent brightness of Mars are needed, and I appreciate Schmude's statement that he plans to continue until 2031. The assistance of other photometrists in this endeavor could contribute to the success and significance of this work. As coordinator of the ALPO Mars Section, I invite others to take on such photometry as a long-term project.

References:

Mallama, A. The magnitude and albedo of Mars. Icarus 192:404-416. (2007) 2007Icar..192..404M

Schmude, R. Whole disc brightness measurements of Mars: 2011-2012. Journal of the Assn. of Lunar & Planetary Observers, 57(3):39-45. (2015) *http://www.alpo-astronomy.org/djalpo/57-3/JALPO57-3-Summer2015.pdf*

Venable, R. A preview of the 2015-2017 apparition of Mars. Journal of the Assn. of Lunar & Planetary Observers, 57(3):33-38. (2015) *http://www.alpo-astronomy.org/djalpo/57-3/JALPO57-3-Summer2015.pdf*

-- Roger Venable
Coordinator, ALPO Mars Section

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Richard Schmude replies:

The points which Roger brings up in his letter are reasonable. Undoubtedly the MAVEN Mars orbiter is already yielding valuable cloud data. Earth-based observers, however, have the advantage of obtaining a "birds-eye" view of the planet. I believe that amateurs can still contribute to our understanding of Mars. How can this be done?

One way that amateurs can make a valuable contribution is to take CCD images to the next level. Images have photometric information. This means that quantitative brightness data of different albedo features on Mars can be obtained. Furthermore, the use of color and polarizing filters can improve the brightness data in images. It has been shown that dust affects the amount of polarized light (Schmude, 2009, 30). Furthermore, the late Don Parker emphasized the importance of using color filters to distinguish between dust, clouds and ground frost.

Mallama (2007) published an excellent photometric model of Mars. I believe that this model can serve as a standard for studies extending to beyond 2030. Measuring the whole-disk brightness of Mars is one area where amateurs can still make a contribution to our knowledge of the red planet. Meteorological events, the season (or L_s value) the solar phase angle, the location of the evening and morning terminators on the disk and the longitude and latitude of the sub-Earth point can all affect the brightness of Mars. Once again, properly calibrated CCD cameras can yield improvements on the current brightness and color model of Mars. Therefore, I make a challenge to everyone: Begin to analyze your images for brightness data. This can be done with the proper software.

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Mallama, A. "The Magnitude and albedo of Mars" Icarus, 192, pp. 404-416 (2007). *www.sciencedirect.com/science/article/pii/S0019103507003156*

Schmude, R. W. "Mars: Photometric and Polarization Studies in 2005-2008" *Journal of the Assn of Lunar & Planetary Observers*, Vol. 51, No. 1 (Winter) pp. 29-34 (2009). *adsabs.harvard.edu/abs/2008JALPO..51a..25S*

-- Richard W. Schmude, Jr.
Assistant Coordinator, ALPO Mars Section

Feature Story:

ALPO Board Meeting Minutes, July 11, 2015, Las Cruces, New Mexico

Minutes provided by Matt Will, ALPO Secretary / Treasurer
matt.will@alpo-astronomy.org

Call to Order

On Saturday, July 11, 2015, at 9:03 a.m. MDT (Mountain Daylight Time) ALPO Executive Director and Board Chairman Ken Poshedly called the ALPO Board of Directors to order via our teleconference phone line from Georgia with the balance of our Board members meeting in the Cimarron Room of the Hotel Encanto de Las Cruces in Las Cruces, New Mexico. The ALPO Board meeting was held during the 2015 AL/ALPO Las Cruces Conference (ALCon 2015).

Board Members Present

ALPO Board members Kenneth T. Poshedly (Executive Director and Chairman), Julius L. Benton, Jr., Michael D. Reynolds (Associate Executive Director), Richard W. Schmude, Jr., John E. Westfall and Matthew L. Will (Secretary and Treasurer) participated in the Board meeting. Board member, Sanjay Limaye could not attend this year's conference and was absent on the teleconference phone line during the meeting. Due to circumstances beyond his control, Richard Schmude also was absent during a portion of the meeting. Also in attendance were various ALPO staff and members including Comets Coordinator Carl Hergenrother, Mars Coordinator Roger Venable, Solar Section Scientific Advisor Rik Hill, Meteorites Coordinator Dolores Hill, Mercury Coordinator Frank Melillo, Minor Planets Coordinator Fred Pilcher and ALPO Lunar Section Coordinator Wayne Bailey. ALPO members in attendance included Phil Plante, Derald Nye, Don Starkey, and the daughter of our late founder Walter Haas, Mary Haas Alba.

Due to the limited amount of time that Executive Director and Chairman Ken Poshedly could devote to chairing this meeting, meeting issues were discussed out of order so that Ken could chair certain topics personally and participate in the discussion. Associate Executive Director Mike Reynolds chaired the rest of the meeting in Ken's absence. Each issue presented in the minutes follows the official agenda order with an additional heading of who chaired the meeting when these issues were discussed.

Issue One: Approval of the Board Meeting Minutes of 2014

(Introduced by Matthew Will)

Board meeting minutes for our 2014 ALPO Board meeting were approved by all the Board members present.

Issue Two: Locations for the ALPO to Convene Its Annual Meeting in Future Years

(Introduced by Richard Schmude and Matthew Will, chaired by Mike Reynolds)

At last year's Board meeting, the ALPO approved meeting with the Astronomical League in 2016, Washington, DC. The actual location of ALCon 2016 will be at the REA Center in nearby Arlington, Virginia. There are nearby hotels where the League has established group rates for the ALCon. The ALPO has not decided on a location for its 2017 annual meeting. Since various ALPO staff and members have their own observing plans for the upcoming total solar eclipse on August 21, 2017, to be viewed here in the United States, it was suggested by Mars Coordinator Roger Venable that the ALPO meet by itself after the eclipse to have its annual meeting and share observational results of the eclipse. The annual meeting format that would also include the usual scientific presentations, the annual business meeting, and the evening banquet. The meeting could be scheduled over a series of days in late October. Richard Schmude said that GRAM (Georgia Regional Astronomers Meeting), which is a group consisting of educational institutions devoted to astronomy and whose primary purpose is to meet once a year, will be scheduling its 2017 annual conference for October or November of that year, at the University of Georgia at Athens. This would be a great venue for the ALPO's annual meeting, with exposure to more presentations and activities that could also reduce planning efforts on our part. While institutionally sponsored, amateurs are also welcome and often participate in giving presentations.

Richard Schmude also talked with the RASC (Royal Astronomical Society of Canada) recently about meeting with them in the near future. The RASC was very receptive to a joint meeting and suggested that the ALPO meet with them in 2018 as they celebrate the 150th anniversary. The meeting site for this RASC meeting will be in Toronto, Ontario, their birthplace city. The ALPO last met with the RASC in Calgary, Alberta, in 2007, and had a most enjoyable time.

Figure 1. ALPO board members in attendance at the July 11 meeting. From left to right are Mike Reynolds, John Westfall, Matt Will and Julius Benton. Photo by Frank Melillo.

Figure 2. “Downtime at the Star-B-Q” with ALPO Meteorites Section Coordinator Dolores Hill and ALPO Solar Section Assistant Coordinator & Scientific Advisor Rik Hill. Photo by Frank Melillo.

Matthew Will also suggested a possible meeting with the SAS (Society of Astronomical Sciences) in 2019 or later. The SAS is an organization heavily involved in professional/amateur research collaborations in various areas of astronomy including lunar and planetary work. They produce a quarterly journal and have annual meetings. In even numbered years, the SAS meets with the AAVSO (American Association of Variable Star Observers). In recent years, the SAS has been open to meeting away from their traditional meeting site of Big Bear Lake, California, to more accessible urban venues near airports and transportation hubs. The SAS has expressed some interest in meeting with the ALPO in the past, though this hasn't been followed up. SAS will be contacted for a possible future joint meeting with the ALPO.

Issue Three: Review of ALPO Finances and Endowment

(Introduced by Matthew Will).

ALPO Secretary and Treasurer Matthew Will reported to the ALPO Board the ALPO's finances for the preceding year in the annual report submitted to the Board last February. A supplemental report was submitted in June covering the first half of 2015.

The ALPO finished the Year 2014 in the black with a surplus of $1,244.95. This resulted in part from a response to a notice for a dues increase to begin early in 2015, which was an opportunity for members to renew their memberships at the pre-increase membership rates. Conversely, it is expected that fewer renewals coming in this year may reduce our income slightly this year. However, for the first six months of this year, we have earned more income than anticipated and have less expenses than predicted, so the ALPO seems to be breaking even. The Springfield (IL) business account currently holds $8,880.73 as of June 15.

With the passing of both Donald Parker and Walter Haas, the ALPO has received contributions totaling $4,175.00 having been made in their names. The contributions have strengthened the ALPO Endowment to a value of $40,041.97.

The ALPO membership numbers look stable. The ALPO has hovered between 360 to 390 members over the past five years. We currently have about 383 “paid” members. We have many more that observe for the ALPO but are not paid members. While the ALPO is grateful for their observational work, ALPO program and section coordinators continue to encourage observers that are not already members to become members, which entitles them to have access to our more recent issues of our Journal, and in turn supports and promotes the organization. With membership priced as low as $14.00 per year, the digital Journal is an extraordinary value in content as well as price when compared to membership in other astronomical organizations.

The membership workgroup is currently focused on constructing two survey questionnaires, one for ALPO members and another for non-members. It was thought that the survey should be conducted first before any future projects would be acted upon, to have a better understanding of the membership, non-members, and their interest. Hopefully, this survey can be launched in the near future.

Issue Four: Central Office Concept, an Update

(Introduced by Matthew Will).

Progress on the front for a central office is contingent on the funding we can develop. Currently fundraising for the ALPO Endowment is still evolving. We have had a positive response from our membership concerning expanded memberships and donations in general. We are also looking into better ways to accelerate growth. Our overall strategy should be, for now, to focus on fundraising capabilities while looking ahead to development of a business plan for the central office, assembling personnel to help coordinate the formation of various aspects of a central office, and communications to contributors and the public. To the last aspect, we are presently maintaining communications through the ALPO website and the web pages dedicated to the growth of the central office concept. As time progresses, I hope to have more substance to these areas of planning.

Issue Five: Proposal for Offering a Free, One-year ALPO Membership, Receiving the Digital Journal Only, With the Purchase of a Telescope from Orion and/or Explore Scientific

(Introduced and chaired by Ken Poshedly)

Associate Executive Director Mike Reynolds has approached Scott Robertson of Explore Scientific about inserting invitations to persons purchasing Explore Scientific telescopes to become members of the ALPO free of charge for one year. Something similar was offered to purchasers of Galileo Telescopes some years ago, however, without much success. There were probably two key reasons for the lack of success with Galileo customers. For starters, purchasers of Galileo Telescopes were novices that didn't have much of an interest in amateur astronomy whereas Explore Scientific markets their scopes to advanced amateur astronomers. Secondly, the memberships are now being offered free for a trial period of one year as opposed to simply inviting a purchaser to pay for a membership as with Galileo. Mike also said that David Levy is working on providing articles that touch on lunar and planetary work in the Explore Scientific electronic newsletter that could further promote the ALPO. Mike also said that Explore Scientific might be interested in placing ads in the Journal ALPO.

Issue Six: A Brief Report to the ALPO Board About the Walter Haas Papers

(Introduced by Matthew Will, chaired by Mike Reynolds)

Matthew Will met with Dr. Larry Creider, who leads the Archives Department at the New Mexico State University Library on Wednesday, July 8, 2015. The purpose of this visit was to get acquainted with the papers and the terms, policies, and plans for Walter's papers and the collection as a whole. The discussion centered over the status of the Walter Haas papers and its relationship to the greater Rio Grande Collection to which the Haas papers are a part of. The meeting was very informative and cordial, as Dr. Creider discussed with me various aspects of access, availability, and preservation of the Walter Haas' papers. While the papers are being preserved under a rigorous, climate-controlled environment, there are no plans to make these papers available online due to limitations of resources and manpower. However, a complete catalog of the Walter Haas papers is available online at http://rmoa.unm.edu/docviewer.php?docId=nmlcu1ms0399.xml

Dr. Creider also gave the ALPO insights into the historical preservation of documents the ALPO currently holds. It was a very interesting, illuminating, and productive visit.

Issue Seven: Digital Journal Access to Non-members and Researchers, a Proposal

(From Matt Will, initially brought up by Richard Schmude, chaired by Mike Reynolds)

The digital version of the Journal can be accessed by members that pay for the digital version. This includes members that voluntarily pay for ALPO membership at higher levels such as sustaining members, sponsors, patrons, et cetera. These members are entitled to both the paper and digital Journal in recognition of paying more than the usual amount for membership. In the past, membership dues have been structured in a way that maximizes affordability, especially for those that still receive the paper Journal, while encouraging members to accept the digital Journal at a lower dues level.

Lately, the issue of accessibility of the digital Journal has been raised, particularly, with outside parties, generally professional researchers that are not ALPO members but still want access. Roger Venable said that he has received request for papers that he has published to the Journal from professional researchers wanting to use and reference his observational findings. The professional astronomer that is interested in a paper printed in a publication such as *Icarus*, may not have access to the publication personally or through an institutional subscription (subscriptions can range into the thousands of dollars for professional publications), can have access to the research paper in electronic format for a nominal cost. The paper itself is furnished by the publisher without any other extraneous material from that issue of the periodical, in other words, just the paper and nothing more. Roger wondered if the ALPO could offer that same sort of service. The Board decided that this needed to be looked into and would inform our Journal editor, Ken Poshedly, about the mechanisms that would have to take place to make this happen. Comets Coordinator Carl Hergenrother suggested that this might also be done for section report updates in the Journal since these small articles also contain scientific content like featured papers.

Direct payment by credit card for such a service might not be feasible, since the ALPO does not maintain online purchasing and uses the Astronomical League's web store to facilitate these types of transactions. Since the ALPO is equipped to accept donations on the League's web store (separate from ALPO memberships) as low as $25.00, a request for an article from the Journal could be accompanied with a donation. This has been done in the past for

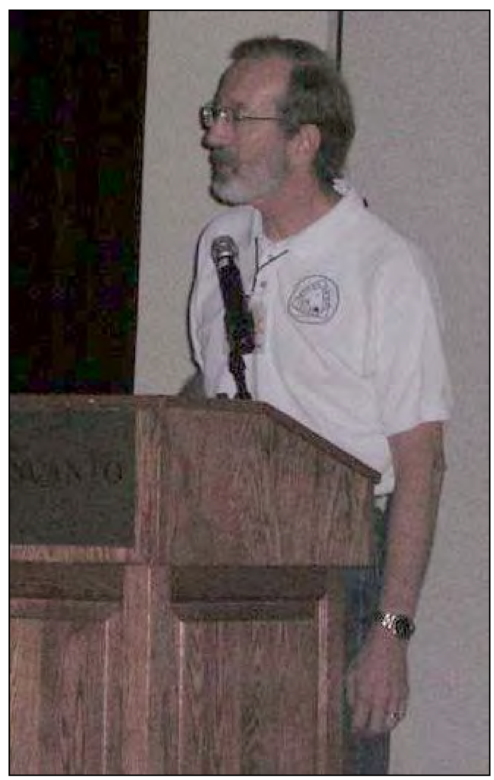


Figure 3. ALPO Mars Section Coordinator Roger Venable at his Saturday afternoon presentation, “Recent Mars Images Showing Classical Canals”. Photo by Frank Melillo.

researchers that have contacted the Secretary for articles in the Journal before 1985 that are not readily available, but are scanned and emailed to an interested researcher. Articles later than 1984 can be obtained for free from the ADS (Astrophysics Data System) maintained under the Smithsonian Astrophysical Observatory under an NASA grant, *http://adsabs.harvard.edu/journals_service.html*

Journal issues of more recent origin are offered for free on the ALPO website, later than year 2000.

Also, the past and current policy is to drop passwords to issues that are one year or older. The Board observed that lately this policy has not been practiced and should be implemented again. Since we have not used the password system for issues newer than Volume 56, Number 1, (Winter 2014), passwords on all issues before Volume 56, Number 2 and earlier should be open for easy access. Beginning with the release of the issue of the Journal, Volume 57, Number 3, former issue Volume 56, Number 2 should be available on the website without special access as we have, in line with our current policy.

Issue Eight: Review Printing Options for the Journal and the Problem With the Questionable Reproductive “Xerox type” Print Quality of the JALPO Paper Version Vol. 57. No. 2, Spring 2015

(Introduced by Julius Benton, chaired by Ken Poshedly)

Julius Benton commented about the print quality of the paper Journal Vol. 57, No. 2, having suffered compared to the usual high quality imaging from photos and figures offered in past Journal issues. This problem was confined to the print version of the Journal only for this issue. Ken Poshedly responded that it appeared to be only an anomaly for this issue, and that efforts were being made to not only correct for this but to improve the print quality of the Journal by using glossy paper for a better overall appearance. Glossy paper is easily affordable for publication of the Journal. Unfortunately, complete color printing is still an option that is too expensive to cover at current membership dues levels. Matt Will commented that our membership dues would have to increase to the level comparable to other astronomical organizations at around $80 to $100 per year. The ALPO is a small organization with a per capita cost higher than larger organizations and media outlets. Conversely, we try to price the paper Journal at a reduced cost that does not discourage people from joining and members renewing. Whether you receive the Journal's paper version or the digital version, it's the best value around for the price! Lunar Coordinator Wayne Bailey made a suggestion that color might be achievable if donations were solicited for that purpose. He has known of other publications doing this.

Issue Nine: Observer's and Service Awards

(Introduced by Matt Will, chaired by Ken Poshedly)

The ALPO has two awards to honor persons providing outstanding work for our programs. The Walter H. Haas Observers Award is bestowed annually to an amateur astronomer for excellence in observational Solar System astronomy. This award is named after our founder and director emeritus, and was established in 1985. The selection of this award is conducted by a committee convened by its committee chairman for this year, Matthew Will. The composition of the committee changes from year to year so that the responsibility of selection is shared by a wider group of well-qualified members of the ALPO, while allowing others that vote one year to be considered for the award in another year when not serving on the committee. The Award itself consists of an engraved plaque. The awardee also receives a two-year complimentary membership in the ALPO.

This year's recipient is Anthony Wesley. Anthony has been a keen amateur astronomer for more than 35 years, starting with a small refractor in the late '70s and now, after many intervening steps, owns a high-quality custom 16" reflector optimized for planetary imaging. He became addicted to planetary imaging during the Mars apparition of 2003 and since then, has spent all his spare time chasing details on Jupiter, Saturn and (when possible) Mars. While spending many hundreds of hours of observing and recording these planets with truly excellent imaging, he is most noted for discoveries of an asteroid impact on Jupiter in 2009 and

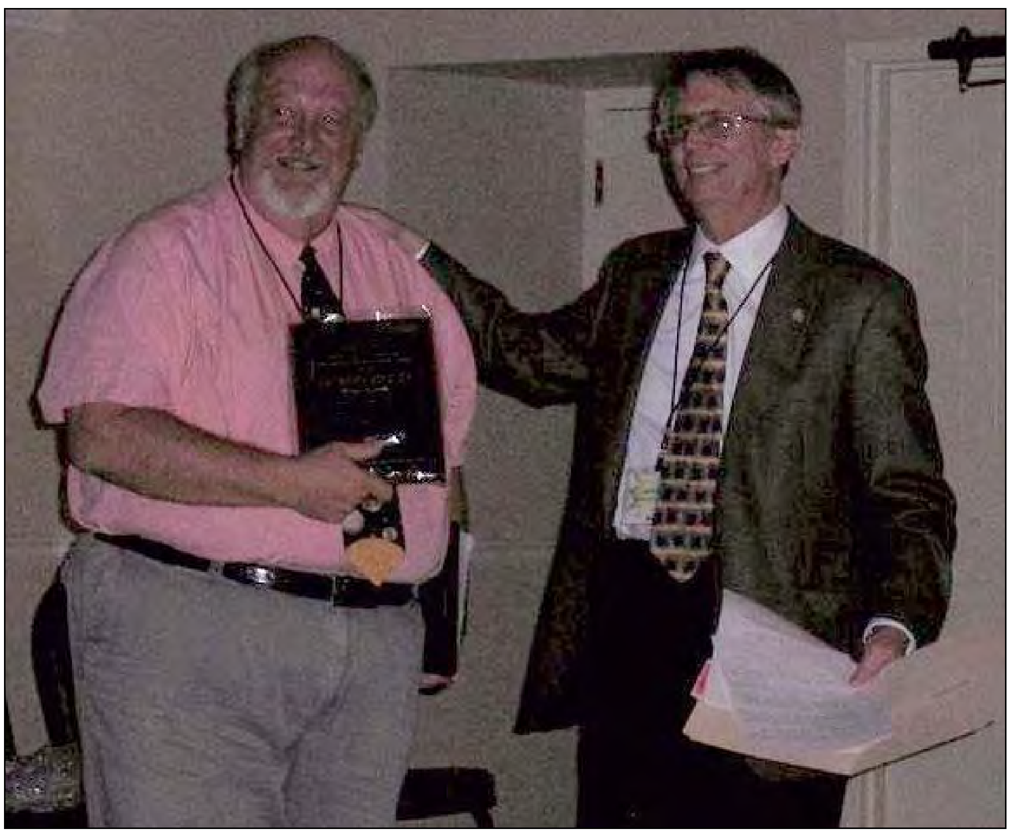


Figure 4. Incoming ALPO Executive Director Mike Reynolds and ALPO Membership Secretary Matt Will with the Walter Haas Observer’s Award. This year’s recipient is Anthony Wesley of Murrumbateman, New South Wales, Australia. Photo by Frank Melillo.

the recording of a visible atmospheric bolide on Jupiter in 2010. Anthony has been a longtime contributor to the ALPO's observing sections and to planetary imaging databases world-wide, used for both amateur and professional research. This is a well-deserved honor for Anthony Wesley, for his quality contributions to astronomy in the specialty of planetary imaging. Congratulations Anthony!

The Peggy Haas Service Award was established to recognize a member of the ALPO for outstanding service to our organization. This award was named after our founder's late wife for her past support of the ALPO in many meaningful and indispensable ways, from assisting her husband with the Journal to performing such functions the ALPO's Librarian for its book-lending service from 1966 to 1985. The award was inaugurated in 1997. The current executive director solely selects the recipient for this award. The Peggy Haas Award can recognize an ALPO officer, board member, volunteer staff member, or non-staff member who has contributed outstanding service in some way to the organization, in a capacity excluding observational skills (observational skills are recognized by the Walter H. Haas Award). Considered not to be an annual award, presentation will occur when appropriate and not at any specific time interval. The Award itself consists of an engraved plaque. The awardee also receives a lifetime membership in the ALPO. This year, the Peggy Haas Service Award was bestowed posthumously to Donald C. Parker. The original plan was to have Walter Haas present this award to Don at this year's annual meeting. Mary Alba informed the Board that Walter said to Don that he was going to receive the award in a phone conversation five days before Don passed away. Alas, both Don and then Walter passed away within two months of each other earlier this year. (The Service award was presented at this year's awards banquet at the 2015 ALCon by our new Executive Director Mike Reynolds with Mary Alba accepting on behalf of the family of Don Parker).

Don Parker needs no introduction to ALPO members and observers. His accomplishments and contributions to the field of planetary imaging are legendary. However, the ALPO meant a lot to Don and he was highly involved in the moving parts of the ALPO. Don Parker became a member of the ALPO around 1971 and was involved in the management of the Mars Section in various capacities beginning in 1979 until his death early this year. Don was also one of the ALPO's original Board members when it was incorporated as a non-profit in 1990. Don also served as our executive director for two stints, the first from 1998 to 2000 and another from 2002 to 2003. Don was certainly a positive presence in our lives, not just with many of us involved in the management of the ALPO, but to individuals that observe for the ALPO as well. Don was a true guiding light for many. Through his observing, leadership, and personal attributes, Don emulated what the ALPO is all about; goodwill, fellowship, and a common wonder and curiosity for the Solar System.

Figure 5. Incoming ALPO Executive Director Mike Reynolds and Mary Alba, daughter of ALPO founder Walter Haas, with the Peggy Haas Service Award. This year's recipient is the late Donald C. Parker who was honored posthumously. The plaque will be presented to Don's children. Photo by Frank Melillo.

The future of the Walter H. Haas Observers Award was also discussed. Our standing rules provide that the ALPO Board selects the chairman for this award committee. Caught under a tight timeframe with the sudden passing of Don Parker who was also the current awards committee chairman, the ALPO Board accepted Matthew Will's offer to chair this committee for this year. It was Matthew's intent not to serve as committee chairman next year. Matt proposed an idea that originated from a suggestion made by Richard Schmude that this chairmanship be rotated among Board members. Matthew fine-tuned this idea in the form of a motion. The motion was that the chairmanship for the Walter Haas Observers Award be rotated among persons on the Board holding the title of associate executive director, provided that the associate executive director accepts. If that person doesn't accept, the ALPO Board will vote someone in that is interested in administering the award. ALPO Secretary Matthew Will, however, will keep records for this committee and share them with next year's new committee chairman and future committee chairmen. The new committee chairman will have to select two new committee members to serve a three-year term on the committee. The Secretary can also provide support for the fabrication of the award. Julius Benton seconded the motion. The vote passed 5 to 0 with ALPO Board members Benton, Poshedly, Reynolds, Westfall, and Will, voting in the affirmative.

Issue Ten: A Proposed Award in the Name of Donald C. Parker

(Introduced by John Westfall, chaired by Ken Poshedly)

John Westfall proposed that the ALPO Board create an award in Donald C. Parker's name. The purpose of the award would be to spotlight and promote professional and amateur astronomer collaborations in astronomical research of the Solar System. While Don Parker did not originate this concept of professionals and amateurs working together and pooling their observational data to further professional research, Don was well-networked in the professional community and made great strides in not only having his own observations taken seriously, but also the entire amateur community as well. The ALPO has engendered a lot of respect over the years through the careful observations of many amateurs, and Don through his knowledgeable manner and personal charm has opened many doors with professionals in providing conduit for those observations to pass. An award in his name for this purpose would certainly keep the importance of keeping this avenue open for professional access to amateur contributions. John proposed that this award be administered by a committee, but that it not necessarily but awarded annually, just when it was appropriate. No motions were made on this topic. The ALPO Board will take the proposal under consideration.

Issue Eleven: Acting Staff for Consideration to Permanent Appointment

(Introduced and chaired by Ken Poshedly)

There are several acting staff members that were appointed by the executive director and are subject to future permanent status to these positions by a vote of the ALPO Board. The purpose of the period of acting status is to ensure that appointed staff are getting on in their positions and that they are not having problems administering programs. The follow acting staff is listed in the table that accompanies this report.

According to our standing rules, the minimum time period for acting staff to be considered for permanent status is two years. Carl Hergenrother, Alan W. Harris, and Petr Pravec certainly have been acting for more than two years. Some discussion ensued about the definition of "two years" in the standing rules. Since the rest of the acting staff would be around for longer than two and a half years when we have our next meeting in August 2016, it was thought by some that the rest of the group be granted permanent status now, especially since there wasn't any reason to question their involvement as staff. However, this isn't strictly adhering to the rule either. After further consideration, the Board exercised discretion concerning the time frame and promoted all acting staff members to permanent status. Mike Reynolds made a motion to have Steven Siedentop, Gerald Hubble, Ed Grafton, Carl Hergenrother, Alan W. Harris, and Petr Pravec moved from acting to permanent status. Ken Poshedly seconded the motion. The motion passed 5 to 0 with ALPO Board members Benton, Poshedly, Reynolds, Westfall, and Will, voting in the affirmative.

ALPO Staff Promotions — 2015

Staff Member	Section	Title	Date of Appointment
Steven Siedentop	Online	Acting Assistant Webmaster	Jan 2014
Gerald Hubble	Lunar	Acting Assistant Coordinator	Jan 2014
Ed Grafton	Jupiter	Acting Coordinator	Nov 2013
Carl Hergenrother	Comets	Acting Coordinator	Mar 2013
Alan W. Harris	Minor Planets	Scientific Advisor	Mar 2013
Petr Pravec	Minor Planets	Scientific Advisor	Mar 2013

Issue Twelve: Status of the Solar Section, Staff Changes

(Introduced and chaired by Ken Poshedly)

Solar Coordinator Kim Hay has expressed some concerns with the management of the Solar Section. Two assistant coordinators Brad Timerson and Jamey Jenkins resigned for personal reasons leaving Kim to manage the section on her own, which could be overwhelming. Rick Gossett helps in an unofficial capacity to help manage the Yahoo Solar Group, however, Kim has expressed a need for more help. Rik Hill, the scientific advisor for the Solar Section agreed to provide more assistance to the section. Rik said that with impending retirement from his work with the University of Arizona, retirement would provide more time to devote to the Solar Section. Rik agreed to an upgrade of his position in the Solar Section to assistant coordinator. Ken Poshedly made the motion to reassign Rik to this position, Mike Reynolds seconded and the motion passed 5 to 0 with ALPO Board members Benton, Poshedly, Reynolds, Westfall, and Will, voting in the affirmative. *(Editor's Note: See the ALPO Solar Section Report earlier in this Journal for an update of staff changes in that section.)*

Rik said that some time back Jamey Jenkins was working with the Astronomical League to revise the booklet that they published entitled "Observe Observer the Sun". Unfortunately, work on this booklet stalled out. Rik agreed to get in touch with Jamey to see what the problems were, to work with him on jump-starting this project, and possibly see if he might be persuaded to resume his presence in the section.

Issue Thirteen: Status of the Mars Section Archives

(Introduced Mike Reynolds, chaired by Ken Poshedly)

Mike Reynolds informed the ALPO Board that the Mars observational archives are now being held in safe keeping by Kathleen Greenwood, Don Parker's daughter in her home in Tallahassee, Florida. Mike intends to take possession of the archives later this year and will forward them to Roger Venable. Arrangements will also be made to present Kathleen, Don's son Michael, and Don's other daughter Suzanne, the Peggy Haas Service Award in their father's name later this year as well.

Issue Fourteen: Future Connectivity for Board Meetings and Staff Conference Calls Using Advanced Telecommunications Archives

(A proposal from Mars Section Assistant Coordinator Jim Melka and Mike Reynolds)

Mars Section Assistant Coordinator Jim Melka suggested to Matthew Will that the ALPO perform some sort of electronic coverage of ALPO Board meetings and that periodic staff meetings be conducted in this same format. A wider audience not attending the annual meeting could hear and view the Board meeting remotely from home. Staff conferencing done in this manner could be beneficial for staff sharing common problems and solutions. In a correspondence with Online Section Assistant Coordinator Steve Siedentop, this could be relatively easy to do using Google Hangout. For next year's Board meeting, some arrangements would have to be made with the ALCon host to make this happen. In past years, it has been difficult to obtain a speaker telephone, let alone hardware conducive for internet audio/visual communications. Mike Reynolds, our new executive director officially after the Board meeting, said that he would like to have multiple video conferences starting this fall with ALPO staff. Julius Benton commented that there is not enough dialogue between coordinators and having conversations would help the make the staff a more cohesive group.

Issue Fifteen: Board Composition

(Introduced Matthew Will, chaired by Ken Poshedly)

The ALPO By-laws call for the size of the ALPO Board of Directors not to exceed nine members. We have seven Board members currently with the passing of two Board members earlier this year. Do we want to fill these positions now or in the future? What criteria do we want for future Board members? What direction would new Board members take the organization? Matthew Will suggested that the Board might want to give serious thought about the ALPO's future and what direction or changes we would like to see the organization. This discussion should be bigger than just filling in a vacancy. Whether we eventually select a person to the Board that is someone within our ranks or outside, this person should either meet the goals of being a good staff member, or if someone on the outside, a well-accomplished individual that can meet our future needs. We have key slots that are critical to operating the organization and we should think about covering these positions as well.

Issue Sixteen: Possible Formation of a Treasury Committee

(Introduced Matthew Will, chaired by Ken Poshedly)

In his capacity as treasurer, Matthew Will also suggested that the ALPO Board consider the formation of a separate committee to oversee ALPO finances. Currently, the entire ALPO Board receives the semi-annual Treasurer's Report that will continue to be sent to the Board regardless of future plans. With respect to our growth as a non-profit, our growing endowment, and the possibility of more scrutiny with outside entities, we may want to have a small group of independent Board members designated as a treasury committee. There wouldn't be any real duties assigned to this committee other than existing as a primary oversight (advisory) group for ALPO finances. But the committee might be needed to select an independent auditor if either the regulatory agencies or independent reviewers, such as foundations awarding grants, would want audited financial statements. Naturally, the treasurer could not make such a selection of an auditor since that action would represent a conflict of interest. Matthew Will made the motion for the treasury committee to be formed of independent Board members Julius Benton, John Westfall, and Ken Poshedly. Julius Benton seconded and the motion passed 5 to 0 with ALPO Board members Benton, Poshedly, Reynolds, Westfall, and Will, voting in the affirmative.

Issue Seventeen: The Disposition of Lunar Orbiter Images

(Introduced John Westfall, chaired by Ken Poshedly)

The ALPO currently houses an extensive collection of Lunar Orbiter images in hard-copy format that includes images from Missions III through V, a total of 2,650 photos. These are currently housed at a storage facility in Antioch, California, for which rent is being paid by ALPO Board Member John Westfall. Wishing to terminate this expense for storage, John Westfall is proposing that hard copies be sold or donated. The hard copies have no scientific values, as these images are readily obtainable online. They may be of value as a collectable item and may be of some artistic or historic value. Apparently, no institutions want them, even if they are being given away for free, however, they are being purchased online by private individuals. Selling them as a complete collection may not be desirable for collectors as some individual images, such as the famous oblique view of Copernicus, could fetch a healthy sales price alone. More value could be obtained having the collection or parts of the collection auctioned. Some of the leading auction houses in the world have agents in the San Francisco Bay Area, convenient for John to contact. John considers the collection to be the ALPO's and proposes to act on behalf of the organization. Ken Poshedly made the motion to have John approach the agents of these major auction houses in the Bay Area about possibly having the Lunar Orbiter collection auctioned. Mike Reynolds said that the motion should be amended to allow John to be reimbursed for storage expenses (past and present) and sale or auction expenses incurred with the Lunar Orbiter collection. Matthew Will seconded the amended motion. The motion passed 4 to 0 with ALPO Board members Benton, Poshedly, Reynolds and Will voting in the affirmative and Westfall abstaining since this issue involves functions to be performed by Mr. Westfall.

Issue Eighteen: Vote or Consensus for Mike Reynolds as our New Executive Director, Richard W. Schmude, Jr. as Associate Executive Director, and Matthew L. Will Continuing as Secretary and Treasurer

In accordance with a long-standing agreement among the Board members, the rotation for the positions of executive director and associate executive director continues. Mike Reynolds will become our new executive director for the next two years and Richard Schmude will be the new associate executive director. Matthew Will shall continue as both secretary and treasurer.

Julius Benton made a motion to affirm the approval of these proposed officers serving for the next two years and John Westfall seconded the motion. The motion passed 6 to 0 with ALPO Board members Benton, Poshedly, Reynolds, Schmude, Westfall and Will voting in the affirmative.

Issue Nineteen: Mew Business and Adjournment

(Introduced Matthew Will, chaired by Ken Poshedly)

Mike Reynolds said that he would look into more merchandizing for the ALPO, particularly with apparel. Mike originated the ALPO lapel pin that has been a must-have item among many members.

Without any more new business to conduct, the meeting adjourned at 11:35 a.m. MDT on July 11, 2015.

Feature Story:
The ALPO and Pluto Before 'New Horizons'

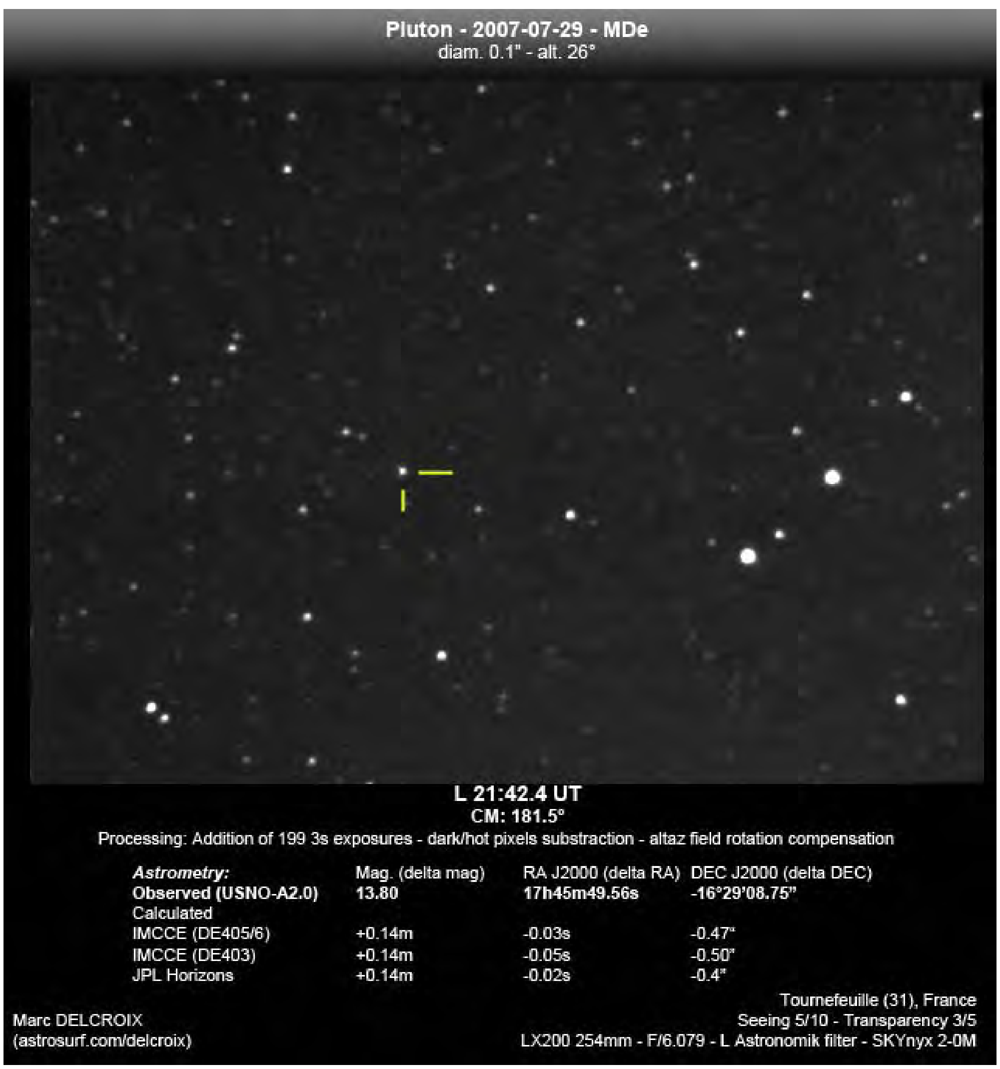
Abstract

With the absolutely spectacular findings by the New Horizon spacecraft as it whizzed by Pluto last July still being released even now in the autumn to the general media, this editor reached out to two chief individuals associated with the ALPO Remote Planets Section for their recollections and other thoughts about Pluto observations during their tenure with that section.

The Early Days

While it wasn't until 1930 that the late Clyde Tombaugh discovered Pluto, it wasn't until some years after the ALPO was founded that systematic observations of Pluto by amateurs occurred. What is now the ALPO Remote Planets Section started off in the mid-1950s as the Uranus-Neptune Section headed by the late Leonard Abbey of Atlanta, Georgia.

From February 1969 through December 1977, James W. Young (no longer an ALPO member), a friend of the late Chick Capen, led the section. Today, he is a retired professional astronomer. His e-mail address is astroyoung@verizon.net and his web page is located at: http://www.w7ftt.net/index.html



This Issue's Cover

The small inset image of Pluto amongst a field of stars was taken by ALPO member Frank Melillo. Details about that image can be found later in this issue in Richard Schmude's "ALPO Observations of the Remote Planets in 2014-2015."

The larger image of Pluto is, of course, one of the many sent back by the New Horizons spacecraft.

Richard Hodgson

Mr. Hodgson was the ALPO Remote Planets Section "recorder" (as the chief position was then known) from December 1977 through November 1990. He is still an ALPO member and resides in Waukesha, Wisconsin. He can be reached at dnhodgson2888@gmail.com

Lucky Pluto

"The planet Pluto was very lucky from the time of its discovery by Clyde Tombaugh in 1930. It had been sought for earnestly by astronomers, particularly those at Lowell Observatory, for over two decades. In the whirlwind months after its discovery it was thought to be larger than the Earth, perhaps significantly larger. Venitia Burney, an English school-girl, with some parental advice, came up with the name. Her choice, "Pluto," was approved promptly by Lowell Observatory, probably for two reasons: first, it was a classical name for the Roman god of the underworld, and being beyond Neptune, Pluto was thought to be a dark and dreary place; and second, its first two letters matched the initials of Percival Lowell who had long advocated finding it. Lowell Observatory, like many astronomical institutions, rejoices in finding double meanings wherever possible.

"Unlike most Trans-Neptunian Objects (TNO's) found today, Pluto was not left nameless in a dog shelter for years, with only a provisional designation and perhaps an official number. In the early 1930's, there was no crowd of over 1,500 TNO's to be held for sorting out. If Pluto had started out with an official number instead of a name – perhaps something like (134340) – it would never have gone anywhere in the public mind. The New Horizons spacecraft would never have flown past it. The public could, however, remember a five-letter name.

"Then Pluto got very, very lucky! Walt Disney had learned about Pluto and used its name for a cute dog character in movie cartoons. Pluto was seen and loved by hundreds of millions. The name was like a walk-off Grand Slam Homerun! Planet Pluto made it big-time!

"Pluto is still a certified planet, but 85 years later, it is now known to be much smaller than our Moon. It is not properly called a major planet or "the ninth planet." With its binary companion Charon, Pluto now heads the vast Plutino Tribe locked in 3:2 resonance with Neptune. Now officially regarded as a dwarf planet, Pluto is one of more than one hundred already-known TNO's classified as likely, highly likely or certain to be dwarf planets. The tragedy for the other large TNO's is that most have never received names, and some have yet to receive numbers, even after more than a decade of waiting. Without names the public cannot talk about them.

ALPO Pluto Observations, circa 1975 – 1985

"When Walter Haas helped transform a network of American observers into the ALPO in 1947, he brought to the organization a knowledge of the "Observing Section" structure that had been adopted by the British Astronomical Association (BAA) at its founding in 1890 and used successfully since.

"When I joined the ALPO in 1960, I had just joined the BAA as well, and commented to Walter on the parallel observing sections in each of the organizations. He was well aware of the parallel. He had copied the BAA he said, and drew strength from their reinforcing each other in making contributions to science. We were both convinced serious amateurs could make a difference and believed that, in time, the split between amateur and professional observers would heal. (It did!)

"Two areas of planetary study were then absent from the observing programs of both the BAA and the ALPO. Neither organization then thought amateur observers using amateur equipment could produce useful Solar System observations beyond Saturn. They also doubted that asteroids offered amateurs a field for serious study. Through the 1960's, as Uranus came to its perihelion and showed its brighter satellites edge-on to us, opinion shifted. An ALPO Remote Planets Section was created, focusing on Uranus and Neptune; Pluto was tossed into the bargain as an extra.

"As the ALPO Remote Planets Section coordinator in the late 1970's and early 1980's, observations were about 80% Uranus, 18% Neptune, and 2% Pluto. Pluto was neglected, being merely a very faint wandering point of light, lost in a starry background. This was, of course, before big Dobsonian telescopes and hi-tech astro-imaging. We urged our few observers to monitor Pluto's light variations, but no amateur did in those years."

Richard Schmude

Mr. Schmude has been the ALPO Remote Planets Section "coordinator" (as the position is now known) since November 1990. He is also an ALPO board member, an assistant coordinator (photometry and polarimetry) with the ALPO Mars Section and an assistant coordinator (apparition reports) with the ALPO Jupiter Section. He resides in Barnesville, Georgia (southwest of Atlanta) where he is a professor at Gordon State College. He can be reached at schmude@gordonstate.edu

"As a child in the late 1960s, I remember looking at a small astronomy book. Pluto was a mystery then. Astronomers were not sure of the planet's mass or size. While in college, I first learned that Pluto had a moon. With this discovery, along with some of the largest telescopes in the world, astronomers were able to trace the orbit of this moon and determine Pluto's mass. It had about one-fifth the mass of our Moon. During the 1980s, Pluto moved in front of a star and astronomers once again used some of the largest telescopes in the world to measure its diameter. Once again, this body was smaller than our Moon. In spite of its small size, Pluto was still the ninth planet.

"In November 1990, I began serving as the "Remote Planets Recorder" of the Association of Lunar & Planetary Observers. The following month, I purchased an SSP-3 solid state photometer. In 1991, I learned how to use this instrument and dreamed of using it to measure the brightness of Pluto. But before I could do this, I had to find that planet. With a 14-inch Schmidt-Cassegrain telescope and good star charts, I was finally able to find it after 45 minutes. I realized that Pluto would be a challenging object to study. Others have submitted Pluto observations to me and I have included them in my remote planets observing reports.

"The images from the New Horizons probe have shown us that Pluto continues to be a mysterious world. My belief is that it will remain this way for many more years. This, however, is a good reason for ALPO members to continue studying this dwarf planet."

Feature Story: Venus

ALPO Observations of Venus During the 2010-2011 Western (Morning) Apparition

By Julius L. Benton, Jr., coordinator
ALPO Venus Section
jlbaina@msn.com

Abstract

Eight observers from the United States, Canada, France, Germany, Italy, and Poland contributed digital images and visual observations (drawings and descriptive reports) to the ALPO Venus Section during the 2010-11 Western (Morning) Apparition. This report summarizes the results of the 114 total observations. Types of telescopes and accessories used in making the observations, as well as sources of data, are discussed. Comparative studies take into account observers, instruments, visual and photographic results. The report includes illustrations and a statistical analysis of the long-established categories of features in the atmosphere of Venus, including cusps, cusp-caps, and cusp-bands, seen or suspected at visual wavelengths in integrated light and with color filters, as well as digital images captured at visual, ultraviolet (UV), and infrared (IR) wavelengths. Terminator irregularities and the apparent phase phenomena, as well as results from continued monitoring of the dark hemisphere of Venus for the enigmatic Ashen Light are discussed.

Introduction

The ALPO Venus Section received 114 observations for the 2010-11 Western (Morning) Apparition, comprised of visual drawings, descriptive reports, and digital images from eight observers residing in the United States, Canada, France, Germany, Italy, and Poland. Geocentric phenomena in Universal Time (UT) for this observing season are given in *Table 1*, while *Figure 1* shows the distribution of observations by month during the apparition. *Table 2* gives the location where observations were made, the number of observations submitted, and the telescopes utilized.

Observational coverage of Venus during this apparition was not nearly as good as in the immediately preceding 2010 Eastern (Evening) Apparition. Nevertheless, a few individuals began their monitoring of the planet early on, and one observer, Detlev Niechoy, sketched the crescent Venus only a couple of days after Inferior Conjunction, which occurred on October 29, 2010 [Refer to Illustration No. 001]. The observational reports upon which this report is based spanned the period starting October 31, 2010 through July 28, 2011, with 81.6% of the total contributions for January through June 2011. For the 2010-11 Western (Morning) Apparition of Venus observers witnessed the trailing hemisphere of Venus at the time of sunrise on Earth (a progression from crescent through gibbous phases) as the planet passed through greatest brilliancy ($-4.6m_v$), dichotomy, and maximum elongation from the Sun (47.0°). Observers are urged to try to carry out systematic

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 Features

Left-click your mouse on:

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

Observing Scales

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

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

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

IAU directions are used in all instances.

Terminology: Western vs Eastern

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

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

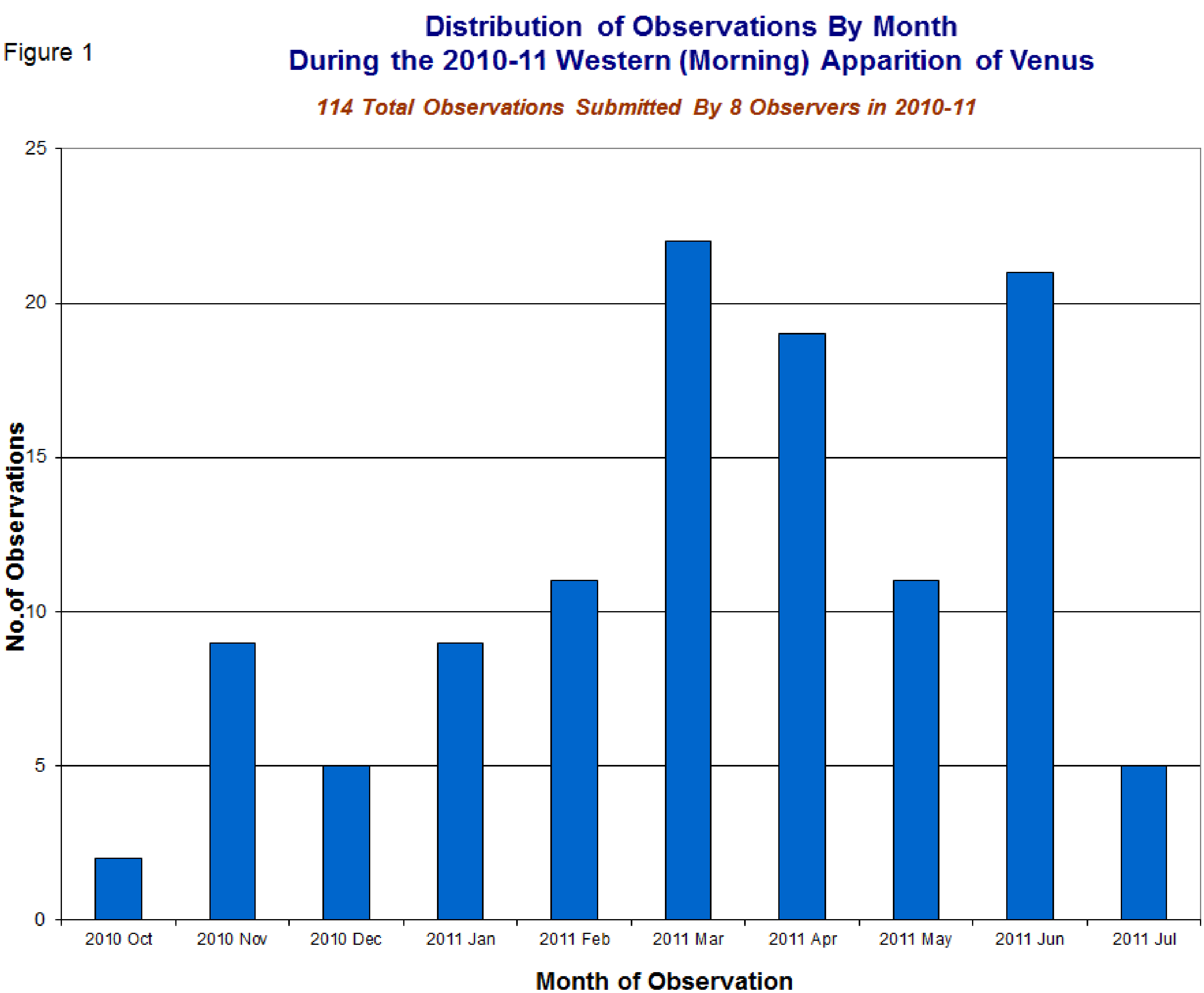
observations of Venus when seeing conditions permit from conjunction to conjunction, and the ALPO Venus Section is quite fortunate to have a growing team of persistent, dedicated observers who have tried very hard to do that in recent observing seasons.

Figure 2 shows the distribution of observers and contributed observations by nation of origin for this apparition, where it can be seen that 37.5% of the participants in our programs were located in the United States, and they

Table Geocentric Phenomena in Universal Time (UT) for the 2010-11 Western (Morning) Apparition of Venus

Inferior Conjunction	2010 Oct 29^d 01^h UT
Initial Observation	Oct 31 12:36
Greatest Brilliancy	Dec 04 10:005 (m_V = –4.6)
Dichotomy (predicted)	2011 Jan 08 06:43:12 (08.28^d)
Greatest Elongation West	Jan 08 16:00 (47.0°)
Final Observation	Jul 28 11:10
Superior Conjunction	Aug 16 00
Apparent Diameter (observed range): 61.8” (2010 Oct 31) ↔ 9.9” (2011 Jul 28)	
Phase Coefficient, ***k*** (observed range): 0.007 (2010 Oct 31) ↔ 0.985 (2011 Jul 28)	

Figure 1



***General Caption Note for Illustrations 1-20**. REF = Refractor, SCT = Schmidt-Cassegrain, NEW = Newtonian, DALL = Dall-Kirkham; UV = Ultra Violet light; Seeing on the Standard ALPO Scale (from 0 = worst to 10 = perfect); Transparency = the limiting naked-eye stellar magnitude.*

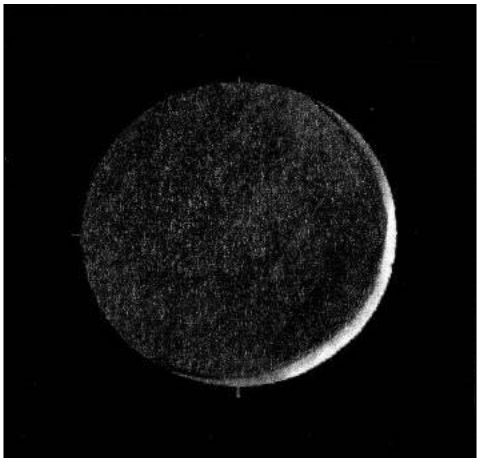


Illustration 001. 2010 Oct 31 12:53 UT, Detlev Niechoy, Göttingen, Germany, 20.3 cm (8.0 in.) SCT, Drawing @ 225X, UG3 filter, Seeing 4.0 (interpolated), Transparency (not specified), Phase (k) = 0.006, Apparent Diameter = 61.4”. Drawing shows very thin crescent of Venus approximately 2 days after Inferior Conjunction; S is at the top of the image.

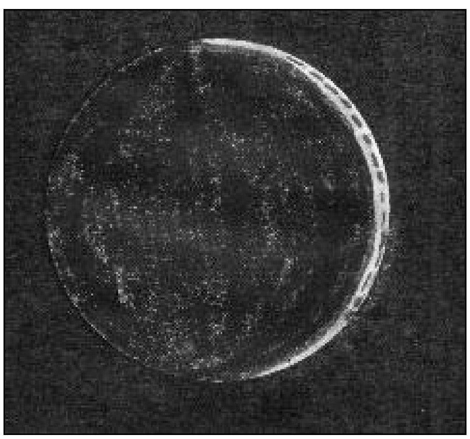


Illustration 002. 2010 Nov 11 15:25-15:52 UT, Carl Roussell, Hamilton, Ontario, Canada, 15.2 cm (6.0 in.) REF, Drawing @ 200-400X, Integrated Light, W25, W58, W47 filters , Seeing 6.5, Transparency (not specified), Phase (k) = 0.057, Apparent Diameter = 57.1”. Narrow crescent just two weeks after Inferior Conjunction; hints of banded dusky markings and the bright limb band (complete from cusp-to-cusp) are notable in this drawing. S is at the top of the image.

Table 2: ALPO Observing Participants in the 2010-11 Western (Morning) Apparition of Venus

Observer and Observing Site	No. Obs.	Telescope Used*
Benton, Julius L. Wilmington Island (Savannah), GA	27	9.0 cm (3.5 in.) MAK
Frassati, Mario Crescentino, Italy	1	20.3 cm (8.0 in.) SCT
Jakiel, Richard Lithia Springs (Atlanta), GA	1	30.5 cm (12.0 in.) SCT
Malinski, Piotr Warsaw, Poland	2	20.3 cm (8.0 in.) SCT
Mattei, Michael Littleton, MA	1	20.3 cm (8.0 in.) SCT
Niechoy, Detlev Göttingen, Germany	65	20.3 cm (8.0 in.) SCT
Roussell, Carl Hamilton, Ontario, Canada	13	15.2 cm (6.0 in.) REF
Viladrich, Christian Paris, France	4	15.2 cm (6.0 in.) REF
Total No. of Observers	**8**	
Total No. of Observations	**114**	
*REF = Refractor, SCT = Schmidt-Cassegrain, MAK = Maksutov-Cassegrain		

accounted for 25.4% of the total observations. Continued international cooperation took place during this observing season, whereby 62.5% of the observers resided outside the United States and contributed 74.6% of the overall observations. The ALPO Venus Section welcomes a widening global team of observers in the future.

The types of telescopes used to observe and image Venus are shown in Figure 3. All observations submitted were made with telescopes >9.0 cm (3.5 in.) in aperture. During the 2010-11 Western (Morning) Apparition of Venus, the frequency of use of classical designs (refractors) was only 14.9%, while utilization of catadioptrics (Schmidt Cassegrain and Maksutov Cassegrain) was 85.1%. All visual and digital observations were performed under twilight or daylight conditions, generally because more experienced Venus observers realize that viewing the planet during twilight or in full daylight substantially reduces the excessive glare associated with the planet. Also, viewing or imaging Venus when it is higher in the sky substantially cuts down on the detrimental effects of atmospheric dispersion and image distortion prevalent near the horizon.

Illustration 003. 2010 Nov 19 05:55 UT, Mario Frassati, Crescentino, Italy, 20.3 cm (8.0 in.) SCT, Drawing @ 160X using W38A filter, Seeing 6.0, Transparency (not specified), Phase (k) = 0.128, Apparent Diameter = 51.1”. A very nice drawing of the crescent Venus; Banded and amorphous dusky markings are quite apparent adjacent the geometrically regular terminator. S is at the top of the image.

Figure 2

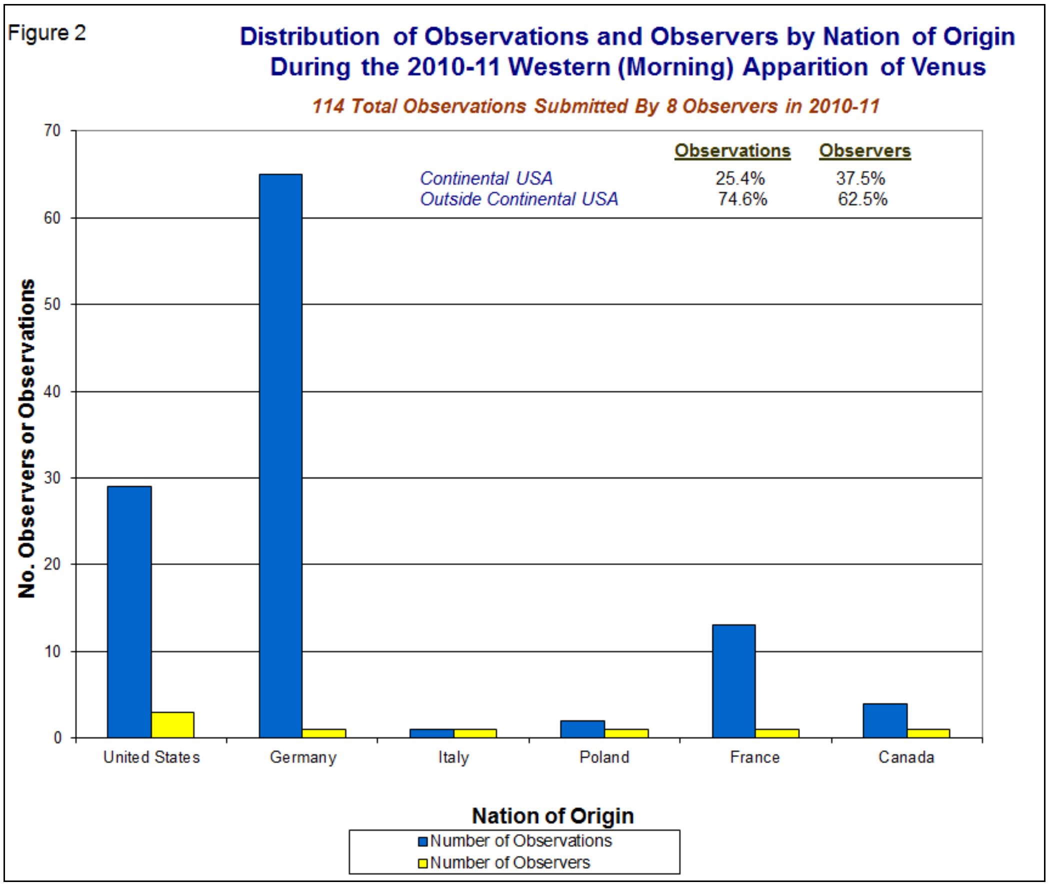
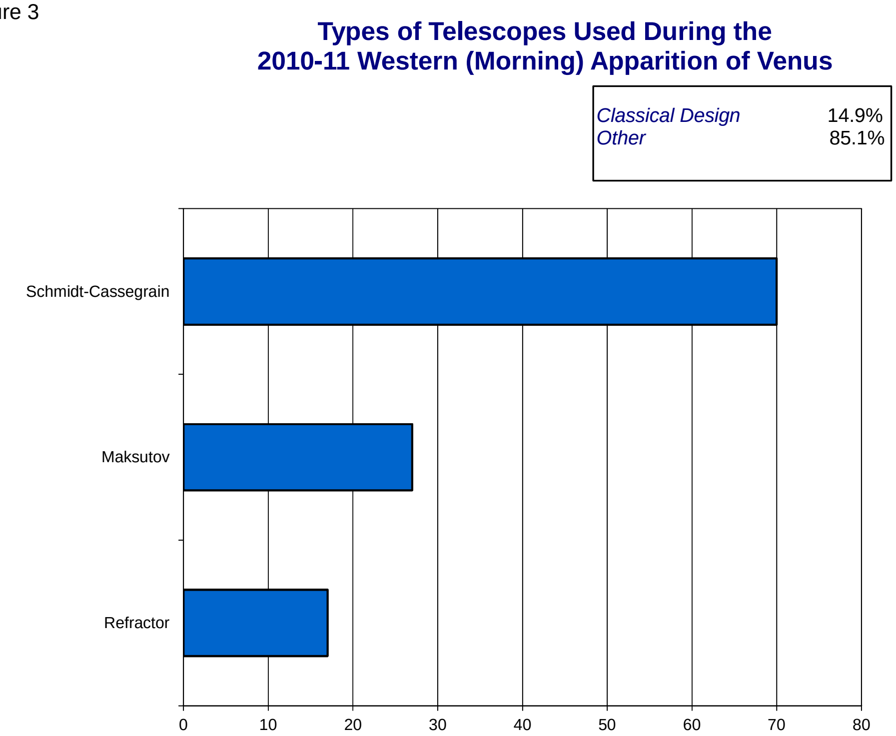


Figure 3



The writer extends his gratitude to the eight observers who made this report possible by regularly sending in their drawings, descriptive reports, and digital images of Venus in 2010-11. Readers who want to follow Venus in coming apparitions are urged to join the ALPO and start participating in our observational studies. There is no doubt that the brightness of Venus makes it an easy object easy to find, and around the dates of greatest elongation from the Sun, it can be as much as 15 times brighter than Sirius and can even cast shadows when viewed from a dark, moonless observing site. Getting started in the Venus Section programs requires only minimal aperture, ranging from 7.5 cm (3.0 in) for refractors to 15.2 cm (6.0 in) reflectors.

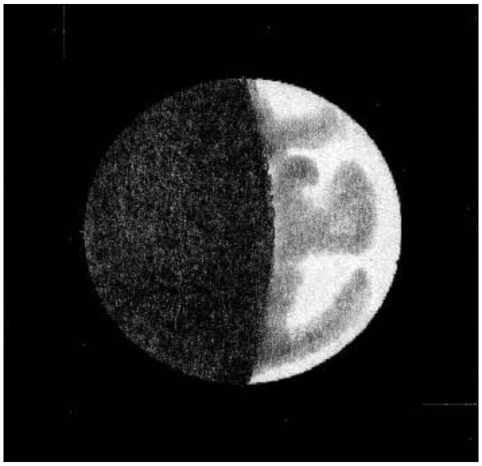


Illustration 004. 2010 Dec 28 07:19 UT, Detlev Niechoy, Göttingen, Germany, 20.3 cm (8.0 in.) SCT, Drawing @ 225X in Integrated Light (no filter), Seeing 3.0 (interpolated), Transparency (not specified), Phase (k) = 0.541, Apparent Diameter = 22.8”. Drawing depicts amorphous and irregular dusky features, along with terminator shading. S is at the top of the image.

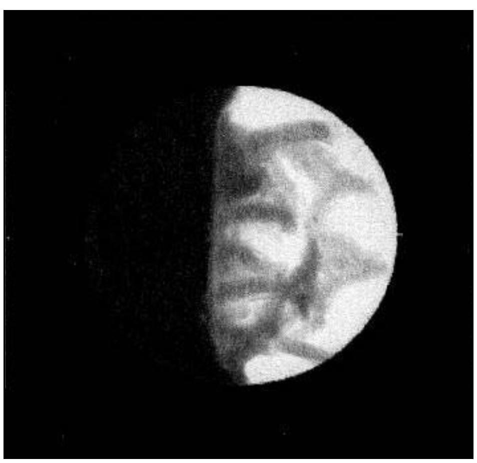


Illustration 005. 2011 Jan 16 07:41 UT, Detlev Niechoy, Göttingen, Germany, 20.3 cm (8.0 in.) SCT, Drawing @ 225X in Integrated Light (no filter) and W25 filter, Seeing 3.0 (interpolated), Transparency (not specified), Phase (k) = 0.083, Apparent Diameter = 53.0”. Drawing shows banded, amorphous, and irregular dusky features, along with terminator shading. Terminator irregularities are apparent. S is at the top of the image.

Observations of Atmospheric Details on Venus

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

Most of the drawings and digital images used for this analytical report were made at visual wavelengths, but several

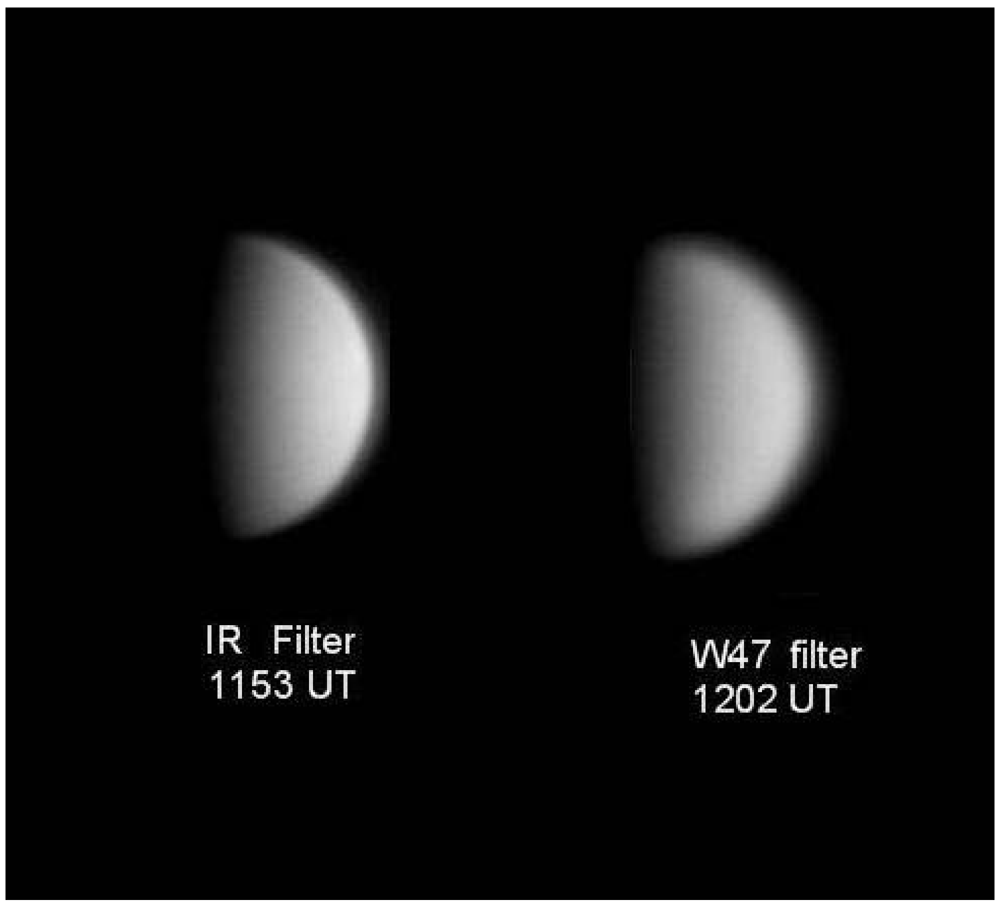


Illustration 006. 2011 Jan 29 11:53–12:01 UT, Richard Jakiel, Lithia Springs, GA, 30.5 cm (12.0 in.) SCT, IR and W47 filters, Seeing 3.0, Transparency 6.0, Phase (k) = 0.601, Apparent Diameter = 20.0”. IR and W47 images of bright disk of Venus; terminator shading and the bright limb band from cusp to cusp are apparent, as well as hints of amorphous dusky features, especially in the W47 image. S is at the top of the image.

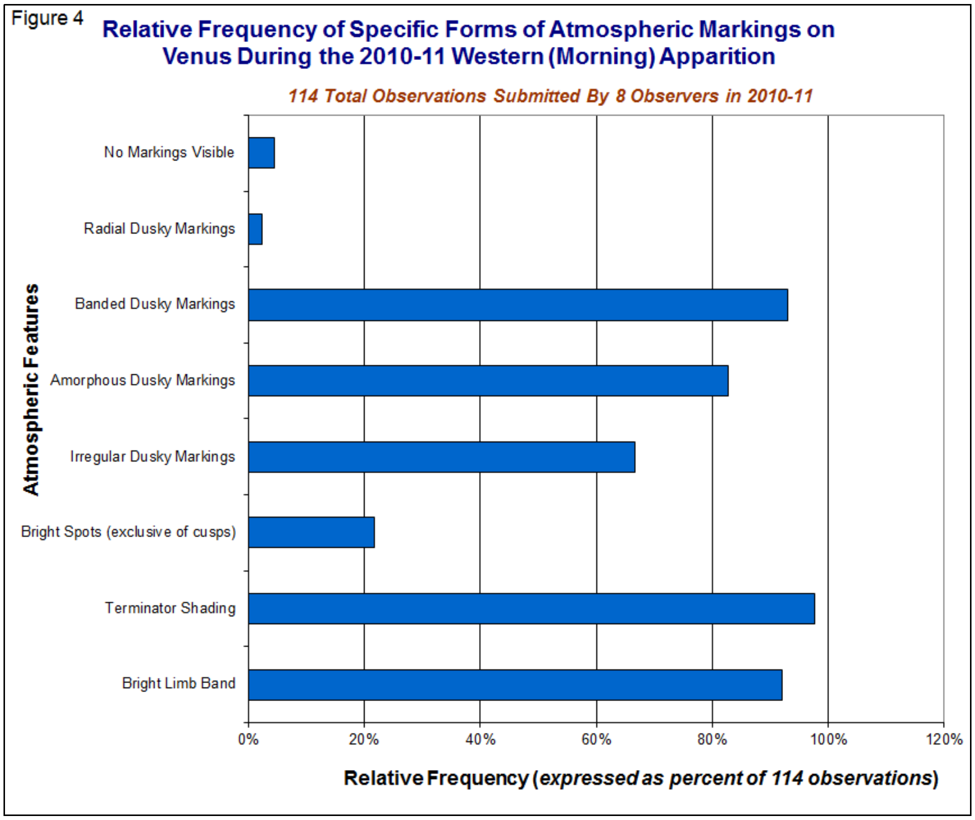


Figure 4
Relative Frequency of Specific Forms of Atmospheric Markings on Venus During the 2010-11 Western (Morning) Apparition
114 Total Observations Submitted By 8 Observers in 2010-11
Atmospheric Features
No Markings Visible
Radial Dusky Markings
Banded Dusky Markings
Amorphous Dusky Markings
Irregular Dusky Markings
Bright Spots (exclusive of cusps)
Terminator Shading
Bright Limb Band
0%
20%
40%
60%
80%
100%
120%
Relative Frequency (expressed as percent of 114 observations)

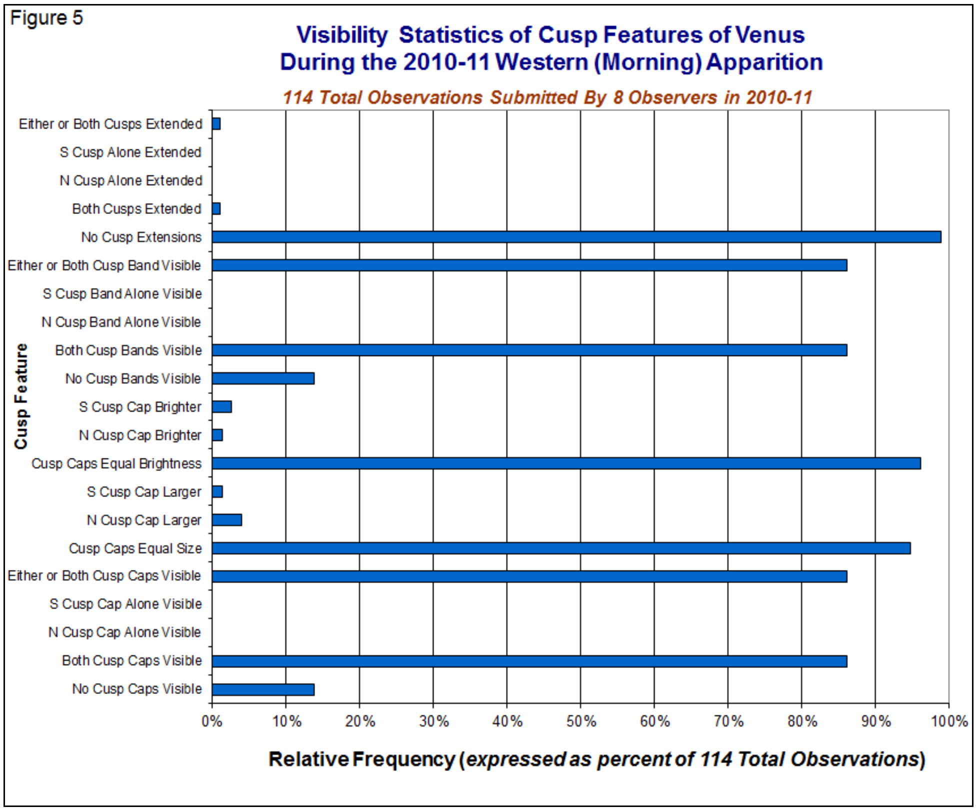


Figure 5
Visibility Statistics of Cusp Features of Venus During the 2010-11 Western (Morning) Apparition
114 Total Observations Submitted By 8 Observers in 2010-11
Cusp Feature
Either or Both Cusps Extended
S Cusp Alone Extended
N Cusp Alone Extended
Both Cusps Extended
No Cusp Extensions
Either or Both Cusp Band Visible
S Cusp Band Alone Visible
N Cusp Band Alone Visible
Both Cusp Bands Visible
No Cusp Bands Visible
S Cusp Cap Brighter
N Cusp Cap Brighter
Cusp Caps Equal Brightness
S Cusp Cap Larger
N Cusp Cap Larger
Cusp Caps Equal Size
Either or Both Cusp Caps Visible
S Cusp Cap Alone Visible
N Cusp Cap Alone Visible
Both Cusp Caps Visible
No Cusp Caps Visible
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Relative Frequency (expressed as percent of 114 Total Observations)

observers routinely imaged Venus in infrared (IR) and ultraviolet (UV) wavelengths. Some examples of submitted observations in the form of drawings and images accompany this report to help readers interpret the level and types of atmospheric activity reported on Venus this apparition.

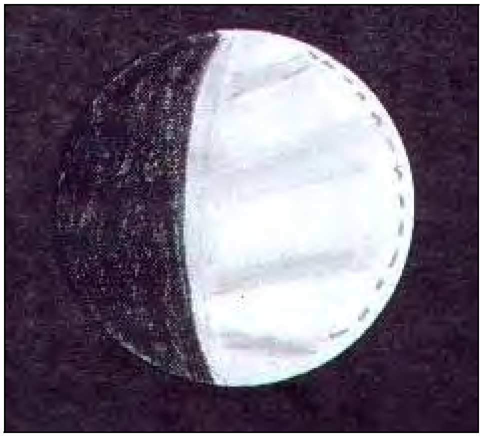


Illustration 007. 2011 Feb 10 15:15-15:35 UT, Carl Roussell, Hamilton, Ontario, Canada, 15.2 cm (6.0 in.) REF, Drawing @ 200-400X, Integrated Light, W25, W58, W47 filters , Seeing 5.0, Transparency (not specified), Phase (k) = 0.649, Apparent Diameter = 18.1. Gibbous disk of Venus depicting banded dusky markings, cusp caps and cusp bands, terminator shading, and the bright limb band complete from cusp to cusp. S is at the top of the image.

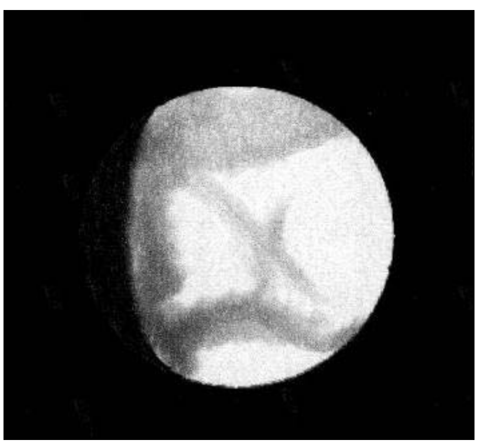


Illustration 008. 2011 Feb 25 05:36 UT, Detlev Niechoy, Göttingen, Germany, 20.3 cm (8.0 in.) SCT, Drawing @ 216X, Integrated Light (no filter), Seeing 3.0 (interpolated), Transparency (not specified), Phase (k) = 0.701, Apparent Diameter = 16.2”. Amorphous and irregular dusky markings are represented in this drawing along with the N cusp cap and cusp band, and terminator shading. S is at the top of the image.

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

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

Figure 4 illustrates that in only 4.6% of the observations submitted this apparition the dazzlingly bright disc of Venus was considered as being completely devoid of atmospheric features. When dusky features were seen or suspected, or imaged, on the brilliant disc of Venus, the highest percentage was Banded Dusky Markings” (93.1%), followed by “Amorphous Dusky Markings” (82.8%),”Irregular Dusky Markings” (66.7%) [Refer to Illustrations No. 002 thru 009], and “Radial Dusky Markings” (2.3%) [Refer to Illustration

Table 3: Ashen Light Observations During the 2010-11 Western (Morning) Apparition of Venus

UT Date and Time		X	k	Observational Notes
2010 Nov 14	10:33	225	0.085	Ashen Light suspected in W47 filter.
2010 Nov 27	07:57	225	0.203	Ashen Light suspected in Integrated Light (no filter).
2010 Dec 04	06:16	225	0.264	Ashen Light is definite in Integrated Light (no filter), and with W15 and W25 filters.

No. 010], whereby the latter are normally only revealed in UV images.

Terminator shading was reported in 97.7% of the observations, as shown in *Figure 4*. Terminator shading normally extended from one cusp of Venus to the other, and the dusky shading was progressively lighter in tone (higher intensity) from the region of the terminator toward the bright planetary limb. Many observers described this upward gradation in brightness as ending in the Bright Limb Band. A considerable number of images at visual wavelengths showed terminator shading, but it was most obvious on many UV images [Refer to Illustrations No. 004, 006, 011 and 012].

The mean numerical relative intensity for all of the dusky features on Venus this apparition averaged about 8.7. The ALPO Scale of Conspicuousness (a numerical sequence from 0.0 for "definitely not seen" up to 10.0 for "definitely seen") was used regularly, and the dusky markings in *Figure 4* had a mean conspicuousness of ~3.8 throughout the apparition, suggesting that the atmospheric features on Venus were within the range from very indistinct impressions to fairly strong indications of their actual presence.

Figure 4 also shows that "Bright Spots or Regions," exclusive of the cusps, were seen or suspected in 21.8% of the submitted observations and images. As a normal practice, when visual observers detect such bright areas, it is standard practice for to denote them on drawings by using dotted lines to surround them [Refer to Illustrations No. 013 thru 015].

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

The Bright Limb Band

Figure 4 illustrates that a little over two-thirds of the submitted observations (92.0%) this apparition referred to a conspicuous "Bright Limb Band" on the illuminated hemisphere of Venus. When the Bright Limb Band was visible or imaged, it appeared as a continuous, brilliant arc running from cusp to cusp 86.2% of the time, and interrupted or only marginally visible along the limb of Venus in 13.8% of the positive reports. The bright limb band was more likely to be incomplete in UV images than those captured in the visible spectrum as well as submitted drawings. The mean numerical intensity of the Bright Limb Band was 9.8, seemingly a bit more obvious when color filters or variable-density polarizers were used. This very bright feature, usually reported by visual observers this apparition [Refer to Illustrations No. 002 and 007], was also seen on a fairly large number of digital images of Venus received [Refer to Illustration No. 006].

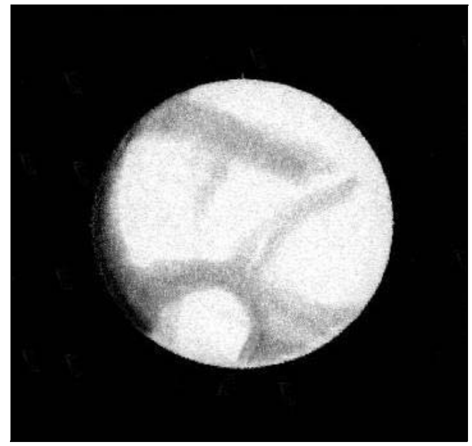


Illustration 009. 2011 Jul 28 11:10 UT, Detlev Niechoy, Göttingen, Germany, 20.3 cm (8.0 in.) SCT, Drawing @ 136X, UG3 filter, Seeing 3.0 (interpolated), Transparency (not specified), Phase (k) = 0.996, Apparent Diameter = 9.7". Banded and irregular dusky markings appear in this sketch of the nearly full disk of Venus. S is at the top of the image.

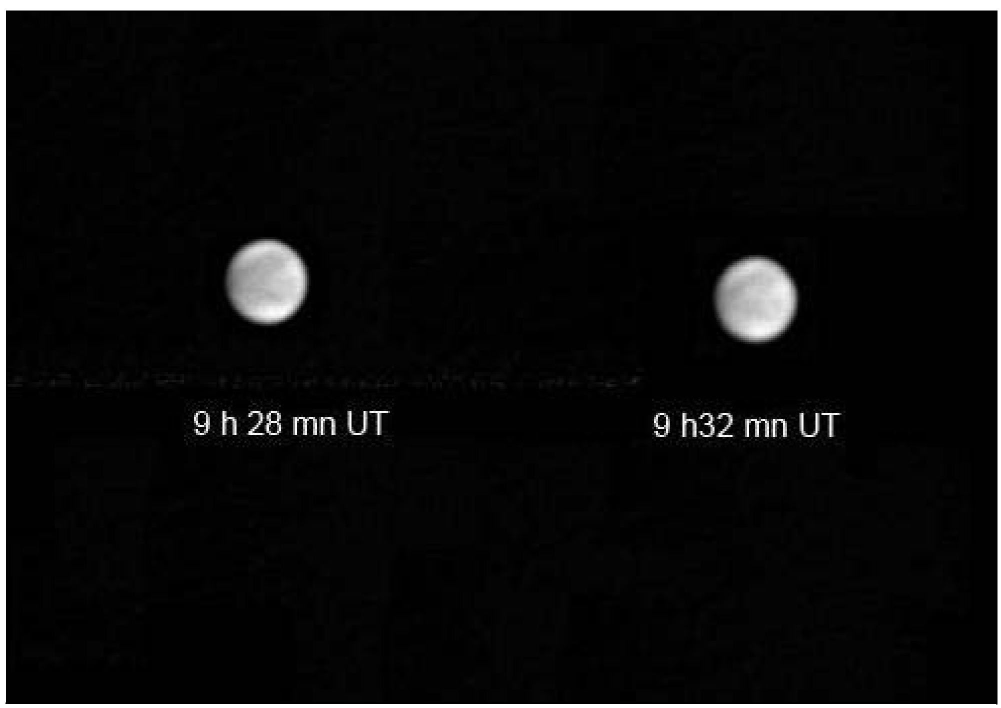


Illustration 010. 2011 Jul 09 09:28-09:32 UT, Christian Viladrich, Paris, France, 15.2 cm (6.0 in.) REF , Schuller UV filter, Seeing (not specified), Transparency (not specified), Phase (k) = 0.983, Apparent Diameter = 9.8". UV image of the gibbous disk of Venus showing banded and radial dusky markings, as well as both cusp caps. S is at the top of the image.

Terminator Irregularities

The terminator is the geometric curve that separates the brilliant sunlit and dark hemispheres of Venus. A deformed or asymmetric terminator was reported in 67.8% of the observations. Amorphous, banded, and irregular dusky atmospheric markings often seemed to merge with the terminator shading, possibly contributing to some of the reported incidences of irregularities. Filter techniques usually improved the visibility of terminator asymmetries and associated dusky atmospheric features. Bright features adjacent to the terminator can occasionally take the form of bulges, while darker markings may appear as wispy hollows [Refer to Illustration No. 005].

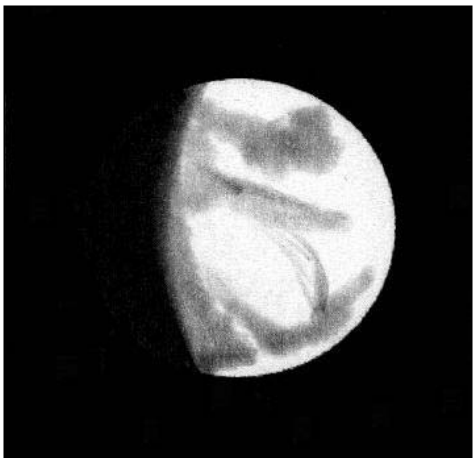


Illustration 011. 2011 Jan 14 05:24 UT, Detlev Niechoy, Göttingen, Germany, 20.3 cm (8.0 in.) SCT, Drawing @ 225X, W15 filter, Seeing 3.0 (interpolated), Transparency (not specified), Phase (k) = 0.531, Apparent Diameter = 23.3". Banded and irregular dusky markings, together with terminator shading, are noted on this drawing of the disk of Venus. S is at the top of the image.

Illustration 012. 2011 Mar 20 14:00 UT, Michael Mattei, Littleton, MA, 20.3 cm (8.0 in.) SCT, IR filter 742nm, Seeing 4.5, Transparency (not specified), Phase (k) = 0.774, Apparent Diameter = 14.1". IR image of the gibbous disk of Venus with terminator shading. S is at the top of the image.

Cusps, Cusp-Caps, and Cusp-Bands

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

When the northern and southern cusp-caps of Venus were reported this observing season, *Figure 5* graphically shows that these features were equal in size the majority (94.7%) of the time and in brightness in 96.1% of the observations. Also, there were several instances when the southern and northern cusp-caps were larger and brighter than each other. Both cusp-caps were visible in 86.2% of the observational reports, and their mean relative intensity averaged 9.8 during the observing season. Dusky cusp-bands were detected flanking the bright cusp-caps in 86.2% of the observations when cusp-caps were visible. When seen, the cusp-bands displayed a mean relative intensity of about 7.6 (see *Figure 5*) [Refer to Illustrations No. 010, 013, 015, 016 and 017].

Cusp Extensions

In 98.9% of the submitted visual observations during the apparition, cusp extensions were not reported in integrated light or with color filters beyond the 180° expected from simple geometry (see *Figure 5*). While Venus

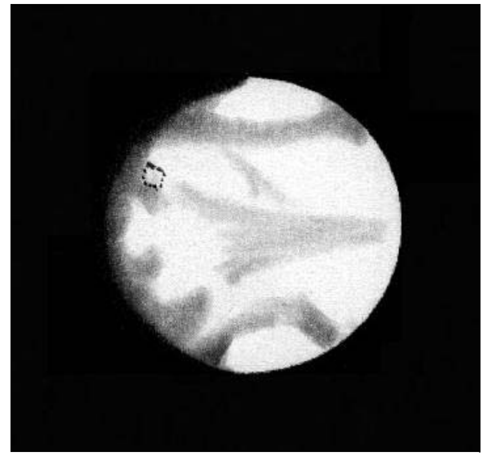


Illustration 013. 2011 May 09 05:48 UT, Detlev Niechoy, Göttingen, Germany, 20.3 cm (8.0 in.) SCT, Drawing @ 136X, Integrated Light (no filter), Seeing 3.0 (interpolated), Transparency (not specified), Phase (k) = 0.893, Apparent Diameter = 11.3". Banded and irregular dusky markings, together with terminator shading, cusp caps and cusp bands, and a small bright spot along the terminator in this drawing of the gibbous disk of Venus. S is at the top of the image.

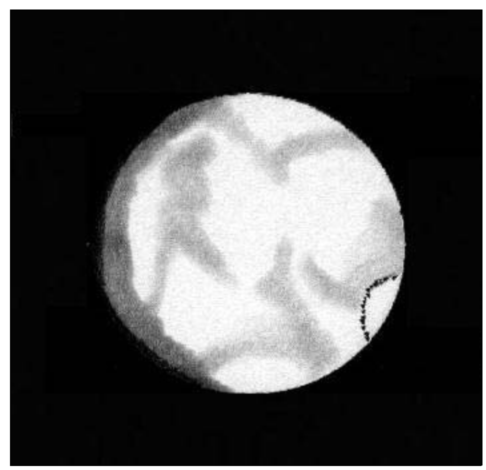


Illustration 014. 2011 May 22 06:33 UT, Detlev Niechoy, Göttingen, Germany, 20.3 cm (8.0 in.) SCT, Drawing @ 225X, Integrated Light (no filter), Seeing 3.0 (interpolated), Transparency (not specified), Phase (k) = 0.918, Apparent Diameter = 10.8". Drawing illustrating amorphous and irregular dusky markings, together with terminator shading, cusp caps and cusp bands, and a bright feature on the limb of Venus. S is at the top of the image.

was passing through its crescent phases following inferior conjunction on October 29, 2010, rare instances of cusp extensions were detected from time to time, ranging from 3° to 12°, but not particularly noticeable on any contributed drawings and rather vague in images

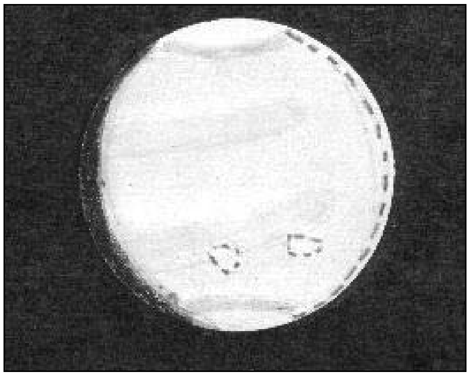


Illustration 015. 2011 Jun 06 13:38-14:11 UT, Carl Roussell, Hamilton, Ontario, Canada, 15.2 cm (6.0 in.) REF, Drawing @ 200-400X, Integrated Light, W25, W58, W47 filters , Seeing 4.5, Transparency (not specified), Phase (k) = 0.944, Apparent Diameter = 10.4". Sketch of Venus' gibbous disk with banded dusky markings, a pair of small white spots, cusp caps and cusp bands, terminator shading, and the bright limb band complete from cusp to cusp. S is at the top of the image.

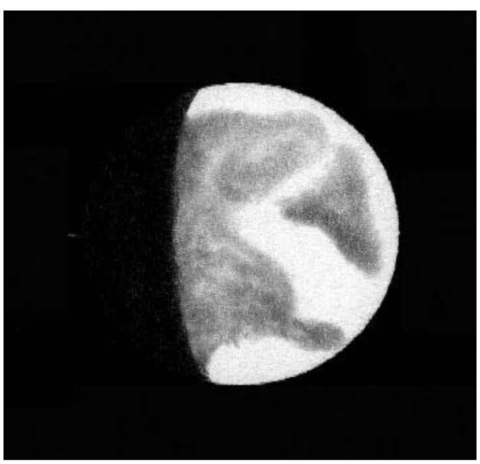


Illustration 016. 2011 Mar 22 05:23 UT, Detlev Niechoy, Göttingen, Germany, 20.3 cm (8.0 in.) SCT, Drawing @ 82X, Integrated Light (no filter), Seeing 3.0 (interpolated), Transparency (not specified), Phase (k) = 0.778, Apparent Diameter = 13.9". Amorphous dusky markings, terminator shading, and cusp caps and cusp bands are visible in this drawing. S is at the top of the image.

submitted. Experience has shown that cusp extensions are notoriously hard to image because the sunlit regions of Venus are overwhelmingly brighter than faint cusp extensions, but observers are still encouraged to try to record these features using digital imagers in upcoming apparitions.

Estimates of Dichotomy

A discrepancy between predicted and observed dates of dichotomy (half-phase) is often referred to as the "Schröter Effect" on Venus. The predicted half-phase occurs when $\boldsymbol{k} = 0.500$, and the phase angle, $\boldsymbol{i}$, between the Sun and the Earth as seen from Venus equals 90°. Although theoretical dichotomy occurred on January 08, 2011 at 08.28^d, visual dichotomy estimates were not submitted during this apparition.

Dark Hemisphere Phenomena and Ashen Light Observations

The Ashen Light, reported the first time by G. Riccioli in 1643, is an extremely elusive, faint illumination of Venus' dark hemisphere. Some observers describe the Ashen Light as resembling Earthshine on the dark portion of the Moon, but the origin of the latter is clearly not the same. It is natural to presuppose that Venus should ideally be viewed against a totally dark sky for the Ashen Light to be detectable, but such circumstances occur only when the planet is very low in the sky where poor seeing adversely affects viewing. The substantial glare from Venus in contrast with the surrounding dark sky is a further complication. Nevertheless, the ALPO Venus Section continues to receive reports from experienced observers, viewing the planet in twilight, who are absolutely convinced they have seen the Ashen Light, and so the controversy continues. There were no digital images that were submitted suggesting the presence of the Ashen Light during 2010-11 Western (Morning) Apparition, but as shown in *Table 3*, three visual observations by Detlev Niechoy called attention to its occurrence in Integrated Light (no filter) during November and December 2010 with a 20.3 cm (8.0 in.) SCT [Refer to Illustration No. 018].

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

Since the instrumentation and methodology are not really complicated, the ALPO Venus Section also urges observers to pursue systematic imaging of the planet in the near-IR. At these wavelengths the hot surface of the planet becomes quite apparent and occasionally mottling shows up in such images, which are attributed to the presence of cooler dark higher-elevation terrain and warmer bright lower surface areas in the IR. Piotr Malinski of Warsaw, Poland submitted a 1000nm IR image of the crescent of Venus on November 15, 2010 at 04:39UT just barely showing the dark hemisphere [Refer to Illustration No. 019].

There were no instances when the dark hemisphere of Venus allegedly appeared *darker* than the background sky during the 2010-11 Western (Morning) Apparition, a phenomenon that is probably nothing more than a spurious contrast effect.

Simultaneous Observations

The atmospheric features and phenomena of Venus are elusive, and it not unusual for two observers looking at Venus at the same time to derive somewhat different impressions of what is seen. Our challenge is to establish which features are real on any given date

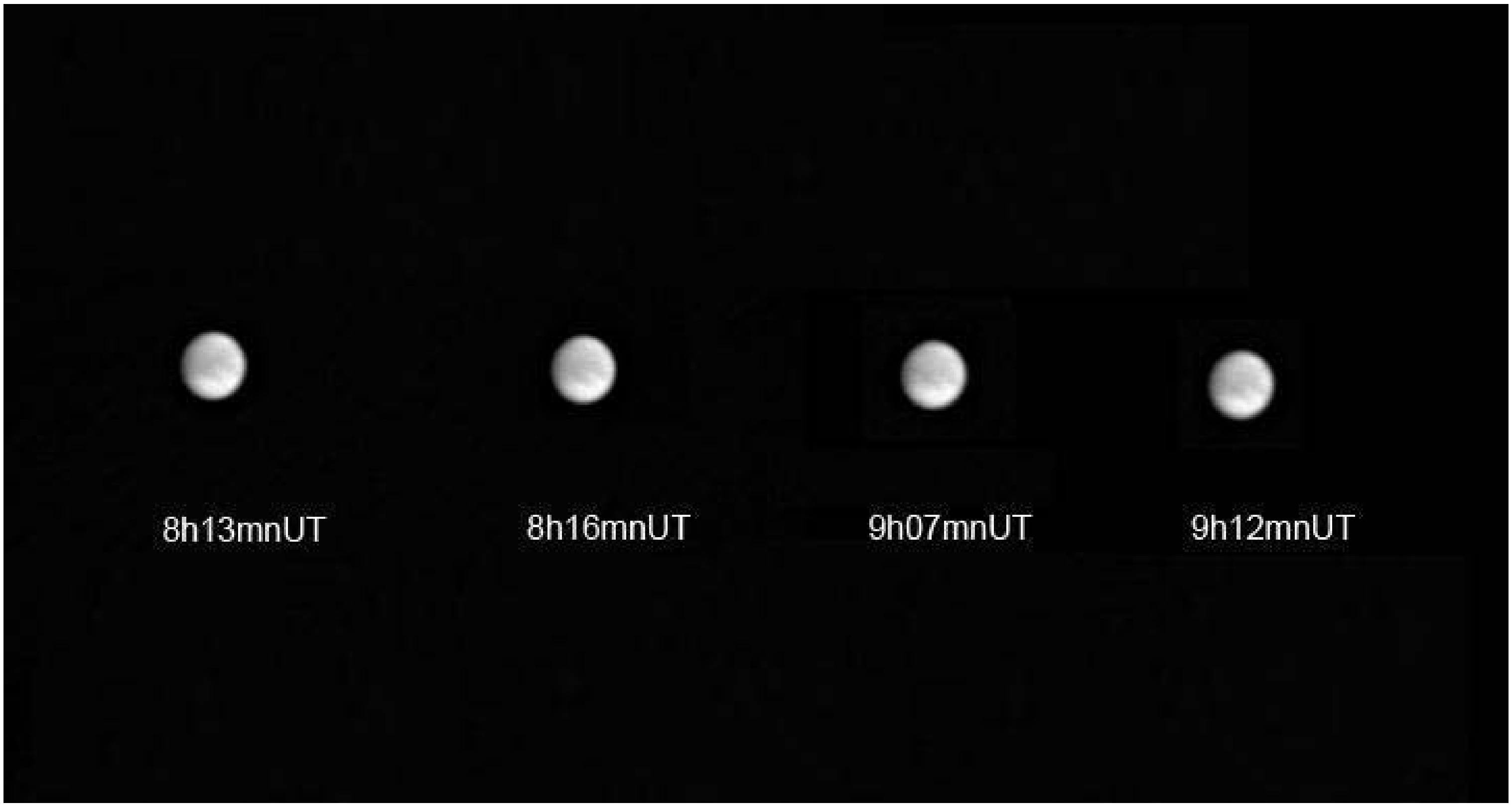


Illustration 017. 2011 Jun 25 08:13-09:12 UT, Christian Viladrich, Paris, France, 15.2 cm (6.0 in.) REF , Schuller and Astrodon UV filters, Seeing (not specified), Transparency (not specified), Phase (k) = 0.969, Apparent Diameter = 10.0". UV images of the nearly full disk of Venus showing banded and radial dusky markings, including both cusp caps and cusp bands. S is at the top of the image.

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

Amateur-Professional Cooperative Programs

Observers are reminded that images are still needed by the Venus Express (VEX) mission, which started systematically monitoring Venus at UV, visible (IL) and IR wavelengths back in May 2006. This Professional-Amateur (Pro-Am) effort continues, and observers should submit images to the ALPO Venus Section as well as to the VEX website at:

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

Regular Venus program activities (including drawings of Venus in Integrated Light and with color filters of known transmission) are also valuable throughout the period that VEX is observing the planet. On November 19, 2010 ESA's Science Program Committee approved the extension of VEX mission operations until December 31, 2014, so pro-am cooperation continues at the present time. The ALPO Venus Section looks forward to continued successful Pro-Am cooperation during the mission, and observers throughout the world are welcome to participate.

Conclusions

Analysis of ALPO observations of Venus during the 2010-11 Western (Morning) Apparition showed that vague shadings on the disc of the planet were periodically apparent to visual observers who utilized standardized filter techniques to help reveal the notoriously elusive atmospheric features. Indeed, it is often very difficult to be sure visually what is real and what is merely illusory at visual wavelengths in the atmosphere of Venus. Increased confidence in visual results is improving as more and more program participants are attempting simultaneous observations. Readers and potential observers should realize that well-executed drawings of Venus are still a vital part of our overall program as we strive to improve the opportunity for confirmation of highly elusive atmospheric phenomena, to introduce more objectivity, and to standardize observational techniques and methodology. It is especially good to see that to a greater extent Venus observers are contributing digital images of the planet at visual, near-UV, and near-IR wavelengths. It is also meaningful when several observers working independently, with some using visual methods at the same time others are employing digital imaging, to produce comparable results. For example, atmospheric banded features and radial ("spoke") patterns depicted on drawings often look strikingly similar to those captured with digital imagers at the same date and time.

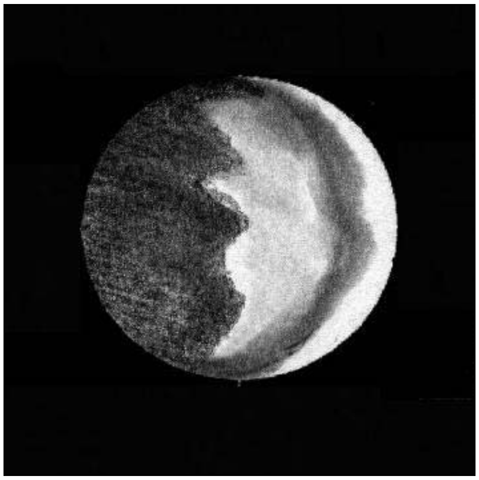


Illustration 018. 2010 Dec 09 06:09 UT, Detlev Niechoy, Göttingen, Germany, 20.3 cm (8.0 in.) SCT, Drawing @ 225X, Integrated Light (no filter), Seeing 3.0 (interpolated), Transparency (not specified), Phase (k) = 0.305, Apparent Diameter = 37.2". Crescent of Venus showing the Ashen Light, which the observer noted as "definitely present" in this drawing. S is at the top of the image.

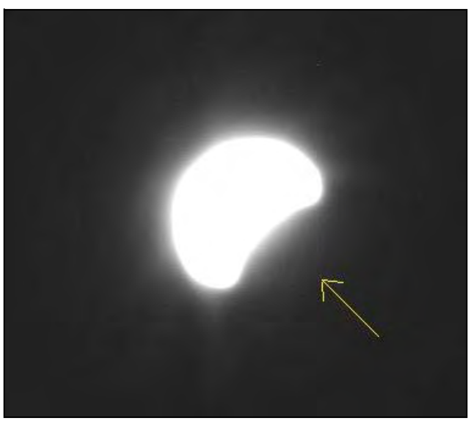


Illustration 019. 2010 Nov 15 04:39 UT, Piotr Malinski, Warsaw, Poland, 20.3 cm (8.0 in.) SCT, 1000nm IR filter, Seeing (not specified), Transparency (not specified), Phase (k) = 0.090, Apparent Diameter = 54.2". IR image capturing the thermal emission on the night side of Venus, typically revealed at wavelengths of 1000nm when the planet is a very narrow crescent, not far from Inferior Conjunction and optimally when k ≤ 0.020.

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

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

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Feature Story:

Galilean Satellite Eclipse Timings: The 2000/01 Apparition

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While this report is considerably late, we believe that it remains important for those researchers and others who require this data.

Abstract

The Galilean Satellite Eclipse Timing Program of the ALPO Jupiter Section received 178 visual timings of eclipses of Io, Europa and Ganymede from 25 observers for the 2000/01 Apparition. For each satellite, eclipse visual disappearance and reappearance timings were adjusted for telescope aperture and were then compared with the Jet Propulsion Laboratory's "E-2" Ephemeris. The effect of aperture was found to be statistically significant in four of the six cases (disappearance for Ganymede and reappearance for each of the three satellites). Taking the unweighted means of the disappearance and reappearance timings for Io, and of the disappearance and reappearance regression residuals for Europa and Ganymede, none of the three satellites differed significantly in position from the E-2 Ephemeris.

Introduction

The 2000/01 Apparition of Jupiter was the 24th observed by the ALPO Jupiter Section's Galilean Satellite Eclipse Timing Program. The satellites timed were Io (1), Europa (2) and Ganymede (3); Callisto (4) was not eclipsed during this apparition. Visual observers timed the "first speck" visible when the satellite emerged from Jupiter's shadow (reappearance), or the "last speck" seen when the satellite entered the shadow (disappearance). The method of reduction was described in our 1998/99 Apparition report, which also cited the reports for previous apparitions. [Westfall 2009: 40, 42, 48]

Table 1 lists some important dates for the 2000/01 Jupiter Apparition. All dates and times in this report are in Universal Time (UT). An *apparition* is the period between successive solar conjunctions, while an *observing season* is the period of actual observation. The 2000/01 observing season began some 37 days after solar conjunction (the start of the apparition), with Jupiter 27° west of the Sun, and ended 45 days before the next conjunction, at solar elongation 33° east.

Table 1. 2000/01 Jupiter Apparition Data

Initial Conjunction with Sun	2000 MAY 08, 04h	Jupiter 0.9°South of Sun
First Eclipse Timing	2000 JUN 14, 19h	Solar Elongation = 27.4°West
First Maximum Phase Angle	2000 SEP 01, 00h	i = 11.6160°
Closest Approach to Earth	2000 NOV 26, 15h	4.0494 au, D_{Eq} = 48.68"
Opposition to the Sun	2000 NOV 28, 02h	Dec. = 20.4°North, M_V = -2.9
Second Maximum Phase Angle	2001 FEB 21, 14h	i = 11.2659°
Last Eclipse Timing	2001 APR 30, 19h	Solar Elongation = 33.0°East
Ending Conjunction with Sun	2001 JUN 14, 13h	Jupiter 0.3°South of Sun
Sources: Meeus 1995; *Astronomical Almanac* 2000 and 2001 issues; JPL *HORIZONS* website. Dates and times are UT. au = astronomical units [1 au =149,597,871 km], Dec. = declination, D_{Eq} = apparent equatorial diameter		

At its closest approach to us, Jupiter's distance from Earth was 4.049 au (astronomical units), giving a larger-than-average apparent equatorial diameter of 48.68 arc-seconds. At its opposition on November 28, 2000, Jupiter had a visual magnitude of -2.9 and a geocentric declination of +20°, the latter favoring observers in Earth's Northern Hemisphere.

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 Features

Left-click your mouse on:

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

Observations

The 178 timings received for 2000/01 bring our 24-apparition total to 10,309 visual timings (including observations received too late to include in their respective reports), but represents a significant decrease from the 260

Table 2. Participating Observers and Their Instruments, Galilean Satellite Eclipse Timings, 2000/01 Apparition (178 observations total).

Observer			Instrument(s)		Total No. of Timings 2000/01	ALPO Timing Program Total	
I.D. No.	**Name**	**Nationality**	**Aper. (cm)**	**No. of Timings**		**No. of Appar.**	**No. of Timings**
1	Abbott, A.P.	Canada	32	1	1	5	21
2a	Abrahams. W.	Australia	20	1	4	14	54
2b			6	2			
2c			5	1			
3a	Blanksby, J.	Australia	20	1	21	13	368
3b			15	20			
4	Bock, P.H., Jr.	USA (VA)	8.9	6	6	12	73
5a	Bulder, H.	Netherlands	30.5	12	15	13	129
5b			20.3	3			
6	Büttner, D.	Germany	6	3	3	13	86
7	Chen. D.-H.	P.R. China	20.0	4	4	10	152
8	del Valle, D.	Puerto Rico	20	4	4	2	21
9a	Dickie, R.	New Zealand	25	1	2	10	112
9b			20	1			
10	Foglia, S.	Italy	11.4	1	1	7	21
11	Garey, P.	USA (IL)	20.3	1	1	1	1
12	Girling, D.	Australia	20	1	1	2	20
13a	Haas, W.	USA (NM)	31.75	4	7	16	129
13b			20.3	3			
14a	Horenz, M.	Germany	10	2	7	3	18
14b			6	5			
15	Kerr, S.	Australia	25	10	10	11	247
16	Kruijshoop, A.	Australia	20	1	1	14	202
17	Larkin, P.	Australia	20	21	21	11	338
18a	Loader, B.	New Zealand	25	8	11	19	428
18b			20	3			
19a	Macdonald, M.	New Zealand	40	6	8	12	199
19b			30	2			
20a	Parl, M.	Germany	10	25	26	4	60
20b			6	1			
21	Rowley, D.A.	USA (CA)	6.0	4	4	7	67
22	Skilton, P.	Australia	15	1	1	9	84
23a	Smith, C.	Australia	25	2	3	13	209
23b			7	1			
24	Westfall, J.	USA (CA)	12.7	10	10	23	381
25	Wolf, T.	Germany	6	6	6	2	9

submitted for the 1999/2000 Apparition. Twenty-five persons made observations in 2000/01 and are listed in Table 2 along with their nationalities, telescope apertures and numbers of timings. The timings themselves are given in Table 8, with the observers and their telescope apertures identified by the numbers given in the left-hand column of Table 2.

Table 3. Number of Observers and Timings by Nationality, Galilean Satellite Eclipse Timings, 2000/01 Apparition

Nationality	Number of Observers	Number of Timings	Timings per Observer
Australia	8	62	7.8
Canada	1	1	1.0
China (P.R.)	1	4	4.0
Germany	4	42	10.5
Italy	1	1	1.0
Netherlands	1	15	15.0
New Zealand	3	21	7.0
Puerto Rico	1	4	4.0
USA	5	28	5.6
Total	*25*	*178*	*7.1*

Table 4. Number of Galilean Satellite Eclipse Timings by Event Type, 2000/01 Apparition

Satellite	(1) Io	(2) Europa	(3) Ganymede	Total
Disappearances	41	14	20	75
Reappearances	48	34	21	103
Total	*89*	*48*	*41*	*178*

Table 5. Number of Galilean Satellite Eclipse Timings by Month, 2000/01 Apparition

Month	Solar Elongation Range (observing season only)	Number of Timings
2000 JUN	027-039°W	1
JUL	039-063°W	7
AUG	063-089°W	14
SEP	089-117°W	16
OCT	117-149°W	17
NOV	149°W-177°E	17
DEC	177-142°E	27
2001 JAN	142-109°E	40
FEB	109-083°E	16
MAR	083-056°E	15
APR	056-033°E	8
	Before Opposition	*71 (40%)*
	After Opposition	*107 (60%)*

Timings for the 2000/01 Apparition were made by observers in nine countries in four continents, and the number of observers and timings received from each nation are given in Table 3. The geographic spread of our observers is gratifying, but there continue to be longitude gaps in our coverage, including Africa, Asia outside China, and much of the Pacific Basin. Also, it is disappointing that only one-fifth of the observers were from the United States.

Contributing to this total were 83 timings (47 percent of the total) by 11 New Zealand and Australian observers coordinated by Brian Loader of the Royal Astronomical Society of New Zealand. The 2000/01 observers averaged 7.1 timings per observer, somewhat down from 8.7 in 1999/2000, with observers in Australia, Germany and the Netherlands notable for their number of timings per observer.

Telescope aperture had previously been found to affect timing results. Ten participants used two or even three instruments, usually of different apertures. The most popular aperture among the 36 different instruments continues to be the 20-cm (8-in.) class (12 instruments), which was also the median aperture. The instruments covered a wide range of sizes, with eight small telescopes (5- to 7-cm / 2- to 3-in. aperture), but also including five large ones (30-40 cm / 12-16 in.). The large range of apertures shows that almost any size of telescope can be used in our program.

Table 4 gives the number of timings by satellite and type of event. Eclipses of Io were timed more frequently than those of Europa, and Europa's more frequently than Ganymede's, because each satellite's orbital period is shorter, and thus its eclipses more frequent, the closer it orbits to Jupiter. Also, as with all previous apparitions, somewhat more

Table 6. Galilean Satellite Eclipse Timing Differences from E-2 Ephemeris, 2000/01 Apparition

Quantity	Satellite		
	(1) Io	**(2) Europa**	**(3) Ganymede**
Disappearance			
Number of Timings	41 (36)	14 (13)	20 (19)
Mean Difference (s)	+82.1 ± 3.0	+97.5 ± 7.3	+374.0 ± 17.6
Regression Coefficients			
R^2	0.0546(ns)	0.0666(ns)	0.2619*
A (s)	+89.6 ± 6.1	+107.4 ± 13.4	+435.6 ± 29.5
B (s/[1/cm])	-96 ± 70	-157 ± 178	-830 ± 338
Standard Error (s)	± 17.7	± 26.7	± 67.8
Aperture Differences (s)			
6 cm	+73	+81	+297
10 cm	+80	+92	+353
20 cm	+85	+100	+394
40 cm	+87	+103	+415
Reappearance			
Number of Timings	48 (44)	34 (28)	21 (18)
Mean Difference (s)	-86.2 ± 3.1	-86.4 ± 3.3	-405.5 ± 14.8
Regression Coefficients			
R^2	0.1897**	0.1850*	0.5494**
A (s)	-103.2 ± 6.1	-99.4 ± 6.2	-479.1 ± 19.6
B (s/[1/cm])	+232 ± 74	+169 ± 70	+980 ± 222
Standard Error (s)	± 18.6	± 16.2	± 43.4
Aperture Differences (s)			
6 cm	-64	-72	-316
10 cm	-80	-82	-381
20 cm	-92	-91	-430
40 cm	-97	-95	-455
Orbital Residuals			
From Regression			
Seconds	-6.8 ± 4.3(ns)	+4.0 ± 7.4(ns)	-21.7 ± 17.7(ns)
Orbital Arc (°)	-0.016 ± 0.010	+0.005 ± 0.009	-0.013 ± 0.010
Kilometers	-118 ± 75	+55 ± 101	-236 ± 192
From Mean Differences			
Seconds	-2.0 ± 2.1(ns)	+5.6 ± 4.0(ns)	-15.8 ± 11.5(ns)
Orbital Arc (°)	-0.006 ± 0.005	+0.007 ± 0.005	-0.009 ± 0.007
Kilometers	-43 ± 37	+77 ± 55	-171 ± 125
Residual based on CCD Photometry (calculated from Mallama *et al.* 2003)			
Number of Measures	15	14	16
Mean E-2 Residual (s)	-3.3 ± 0.8**	+14.2 ± 2.3**	-6.3 ± 3.2(ns)

Table 7. Comparison of Mean Residuals (seconds), E-2 and IMCCE Galilean Satellite Ephemerides, 2000/2001 Apparition

	Io	Europa	Ganymede
Disappearance: E-2	+82.1 ± 3.0	+97.5 ± 7.3	+374.0 ± 17.6
IMCCE	+71.6 ± 3.1	+96.8 ± 7.2	+396.3 ± 17.8
Reappearance: E-2	-86.2 ± 3.1	-86.4 ± 3.3	-405.5 ± 14.8
IMCCE	-96.8 ± 3.1	-80.8 ± 3.3	-398.3 ± 14.9
Orbital Residual: E-2	-2.0 ± 2.1(ns)	+5.6 ± 4.0(ns)	-15.8 ± 11.5(ns)
IMCCE	-12.6 ± 2.2**	+8.0 ± 4.0(ns)	-1.0 ± 11.6(ns)

reappearances were observed than disappearances; 58 percent versus 42 percent.

The outermost Galilean satellite, Callisto, experienced no eclipses during this apparition. This is the situation about half the time, when Jupiter's axial tilt causes the shadow of Jupiter to pass either north or south of that satellite.

Table 5 shows the number of timings made each month. As one might expect, events were timed most frequently just before, and then following, opposition. There was a bias toward post-opposition timings, constituting 60 percent of the timings. Pre-opposition timings must be done late at night and we appreciate those observers who observed those events creating a more even balance in coverage.

The pattern of the different eclipse phenomena for the different satellites affects the frequency of observations. Eclipse disappearances of Io are visible only before opposition, and its reappearances visible only after. This is usually true for Europa, but due to Jupiter being closer to Earth than average (perihelion 1999 May 20), its phase angle became large enough that for two periods near the date of maximum phase angle that both disappearance and reappearance could be seen for the same eclipse of that satellite (2000 Aug 10-Sep 18 and 2001 Feb 11-Mar 04). As for Ganymede, for every apparition, disappearances and reappearances for the same eclipse can be seen for most of the apparition except near opposition or conjunction.

Reduction

The reduction process was described in detail in our 1998/99 report [Westfall 2008: 38-40]. In brief, the reported times were compared with the predictions of the "E-2" Ephemeris developed by Jay H. Lieske of the Jet Propulsion Laboratory. [Lieske 1981] The predicted time of each event was then subtracted from the observed time; these (O - C) differences are listed in Table 8. A positive observed-minus-computed difference meant that an event was "late"; a negative (O - C) difference, that it was "early." We expect disappearances to be early, and reappearances late, in relation to the predicted eclipse time because the latter predicts when, as seen from the center of the satellite's disk, the limb of Jupiter bisects the Sun.

The (O - C) differences were analyzed in relation to the aperture of the telescope used by means of a linear regression model in which the dependent variable was the (O - C) difference in seconds and the independent variable was the reciprocal of the telescope aperture in centimeters. This provided estimates of the regression coefficients **A** and **B**; the first indicated how "late" (**A** > 0) or "early" (**A** < 0) a satellite was in its orbit, while **B** measured the magnitude of the aperture effect.

A total of 20 timings, or 11 percent, were not used because the reported times were given to only 1-minute precision or because they differed from the regression model at the 5-percent significance level (i.e., a difference that large would occur by chance less than 5 percent of the time) as measured by the standard error (given in Table 6). For each satellite and type of event this 5-percent significance criterion was applied twice in succession. The excluded timings are shown by italicized residuals in Table 8. Their exclusion does not necessarily imply observer error. Timings near the beginning and end of the apparition are often unsatisfactory because the event has to be observed in twilight, near the horizon, or both. Another unfavorable situation occurs when an eclipse event occurs near the glare of Jupiter's limb.

Two statistics describe how well the model fits the observed residuals. The standard error is the root-mean-square difference between the model and the timings. The coefficient of determination, R^2, measures the proportion of the variance (squared differences among the residuals) that is removed by the aperture model.

2000/01 Results

Table 6 gives the results for the 2000/01 Apparition. Each satellite's results are shown in a separate column, divided into three parts: "Disappearance," "Reappearance" and "Orbital Residuals." For both disappearances and reappearances, the number of timings made is followed in parentheses by the number finally used in the regression analysis after aberrant timings were deleted. The next entry is the mean (O - C) difference for the timings that were retained, along with its 1-standard error uncertainty range (all uncertainty ranges

Table 8. Galilean Satellite Eclipse Timings, 2000/01 Apparition

UT	LD	Lat	ObN	STB	Dif	UT	LD	Lat	ObN	STB	Dif	UT	LD	Lat	ObN	STB	Dif
Io Disappearances						**Io Reappearances – Cntd.**						**Europa Disappear. – Cntd.**					
2000 0710	0.8	+19	19b	010	+57	2000 1225	0.6	+17	4	000	-92	2000 1107	0.7	+25	3b	200	+50
0717	0.9	+19	3b	201	+41	1227	0.6	+17	20a	120	-58				17	000	+98
			17	002	+57	1229	0.6	+17	3b	100	-99	2001					
0723	0.9	+18	20a	111	-94				18a	200	-89	0218	0.0	+23	7	000	+100
0809	1.1	+18	17	000	+80	2001						**Europa Reappearances**					
			15	000	+109	0103	0.7	+17	5a	---	-107	2000					
0815	1.1	+18	20a	211	+89				20a	000	-100	0821	0.1	+25	13b	11-	*-160*
0820	1.1	+18	13b	11-	+84	0105	0.7	+17	23a	101	-105				24	100	*-28*
			24	100	+106	0107	0.8	+17	19a	000	-75	0911	0.1	+25	17	001	-85
0823	1.1	+18	20a	220	*+260*	0109	0.8	+17	13a	---	-109	1128	0.0	+24	20a	112	-93
0827	1.1	+18	24	100	+89	0112	0.8	+17	20a	112	*-35*	1202	0.1	+24	16	100	-80
0831	1.1	+18	20a	210	+97	0114	0.9	+17	15	000	-106				17	000	-73
0912	1.1	+18	13a	21-	+99				19a	000	-82				19a	000	*+18*
0917	1.1	+18	2b	002	+71	0116	0.9	+17	24	000	-98	1209	0.4	+24	17	001	-88
			15	001	+100	0117	0.9	+17	5a	---	-111				3b	102	-70
0919	1.1	+18	13a	112	+109				20a	210	-101	1213	0.5	+24	24	010	*-127*
0926	1.0	+18	18a	100	+83				14b	200	-60	1216	0.6	+24	17	001	-87
0930	1.0	+18	6	200	+75	0119	0.9	+17	14a	200	-77				10	200	-61
			20a	100	+98				20a	120	-58	1223	0.8	+24	20a	000	-107
1003	1.0	+18	3b	100	+75	0121	0.9	+17	18b	200	-66				6	100	-87
			2b	000	+82				17	020	*-48*	2001					
			18a	200	+83	0125	1.0	+17	5a	---	-93	0103	1.1	+24	17	000	-120
1008	0.9	+18	20a	110	+94	0126	1.0	+17	20a	110	-103				15	110	-112
1010	0.9	+18	17	110	+86	0128	1.0	+17	17	000	-125				3b	000	-102
1016	0.8	+18	20a	110	+82	0201	1.0	+17	24	100	-94				12	100	-86
1017	0.8	+18	5b	1--	+90	0206	1.1	+16	3b	111	-93				19a	000	-79
1021	0.7	+18	4	101	*+26*	0209	1.1	+16	5a	---	-107	0107	1.2	+24	5a	---	-106
1023	0.7	+18	4	000	+89	0211	1.1	+16	20a	000	-98				21	--1	-84
			5b	---	+99	0220	1.1	+16	7	000	-103				4	002	-82
1024	0.7	+18	20a	110	+60	0225	1.1	+16	20a	110	-98	0110	1.3	+24	3b	102	-81
1102	0.5	+18	25	001	+31	0301	1.1	+16	17	010	-82	0114	1.4	+23	4	100	-67
1104	0.5	+18	18a	010	+71				13a	101	-74				21	011	-62
			3b	110	+74	0306	1.1	+16	5a	---	-112	0124	1.6	+23	5a	---	-102
			17	000	+91				20a	111	-103	0208	1.7	+23	8	---	(-54)
			9b	101	+96	0313	1.0	+16	14b	002	-49	0225	1.8	+23	5a	---	-115
1108	0.4	+18	8	000	(+64)				25	100	*-6*				20a	110	-84
1109	0.4	+18	6	100	+83	0405	0.9	+16	25	012	-32				14b	001	-62
1120	0.2	+18	3b	200	*+18*	0409	0.8	+16	22	001	-82	0308	1.7	+22	15	100	-100
1122	0.1	+17	5b	1--	+70				3b	001	-70				17	010	-94
1124	0.1	+17	14b	120	*-34*	**Europa Disappearances**									3b	211	-50
1127	0.0	+17	17	000	+60	2000						0430	1.0	+21	20a	211	*+2*
Io Reappearances						0614	0.8	+27	19b	122	*-91*	**Ganymede Disappearances**					
1202	0.1	+17	20a	122	-71	0716	1.4	+26	17	002	+70	2000					
1206	0.2	+17	17	000	-65	0828	1.8	+26	24	200	+66	0709	1.8	+56	8	001	(+427)
			3b	111	-60	0911	1.7	+26	17	000	+93	0821	2.6	+56	24	200	+468
1217	0.4	+17	24	000	-54				9a	101	+109	0926	2.4	+55	11	00-	+479
1220	0.5	+17	17	000	-93				18a	000	+123	1024	1.5	+54	20a	210	+387
			3b	111	-90	0918	1.7	+25	2c	101	+97	1122	0.2	+53	3b	100	+380
			15	220	-61				15	010	+139	1228	0.3	+52	18a	202	+327
1222	0.5	+17	23b	001	-98	0929	1.6	+25	13a	21-	+138	2001					
			3b	202	-90	1013	1.3	+25	17	010	+101	0104	0.6	+52	15	101	+460
			19a	110	*-11*	1020	1.2	+25	3b	020	+84				23a	1.1	+468

Table 8. Galilean Satellite Eclipse Timings, 2000/01 Apparition (Continued)

UT	LD	Lat	ObN	STB	Dif		UT	LD	Lat	ObN	STB	Dif		UT	LD	Lat	ObN	STB	Dif
Ganymede Disap. – Cntd.							**Ganymede Reappearances**							**Ganymede Reappear. –Cntd.**					
2001 0111	0.8	+51	25	001	+178		2000 0723	1.2	+57	18b	210	-464		2001 0111	1.9	+52	5a	---	-462
0118	1.0	+51	20a	110	+442		0821	1.6	+56	24	100	-377					25	111	*+10*
0126	1.2	+51	21	000	+335					13b	11-	-362		0118	2.1	+52	20b	210	-307
0202	1.3	+51	1	202	+375		0904	1.6	+56	15	000	-511		0126	2.3	+51	21	000	-381
0209	1.4	+50	19a	000	+325		1010	1.0	+55	3b	101	-447		0209	2.5	+51	15	000	-475
			18a	200	+370					18a	020	*-309*					2a	101	-445
0216	1.4	+50	3b	200	+282		1024	0.5	+55	20a	110	-361					18b	200	-357
			17	000	+352		1101	0.3	+55	4	100	-370		0216	2.6	+50	7	010	-369
			7	000	+382					8	000	(-269)		0302	2.6	+50	5a	---	-460
0302	1.4	+49	25	001	+285		1206	0.4	+53	14b	100	-278		0407	2.0	+48	5a	---	-440
			14a	002	+379		1228	1.4	+53	3b	001	-433							
			5a	---	+432														

Table 8: Key to column headings. UT = Universal Time, expressed as mmdd; LD = distance of satellite from Jupiter's limb in units of Jupiter's equatorial radius; Lat = latitude of satellite on Jupiter's shadow cone, in degrees; ObN = observer number as in Table 2; STB = observing conditions, where S = seeing, T = transparency and B = field brightness, all expressed in terms of 0 = condition not perceptible, 1 = condition perceptible but does not affect accuracy and 2 = condition perceptible and does affect accuracy; and Dif = (observed – calculated) eclipse time in seconds. ***Notes:*** *[italics]* Timing excluded during regression analysis. (parentheses) Timing not used in regression analysis, due to insufficient precision or to clouds interrupting observation.

are preceded by the "±" symbol). The next row contains the coefficient of determination (R^2). If the latter is followed by "(ns)" the coefficient is not significantly different from zero and thus there is no significant aperture effect; if by "*" the chance of a false aperture effect being due to chance is 5 percent or less; if R^2 is followed by "**" the probability of a chance effect is under 1 percent. In the "A(s)" and "B(s/[1/cm])" rows, the two regression coefficients are given with their 1-standard error uncertainty ranges. Next is the standard error of estimate for the regression model. Following this are the predicted (O –C) differences for four representative telescope apertures.

Following the disappearance and reappearance statistics, Table 6 gives the orbital residual, which measures the amount the satellite is "behind" (positive) or "ahead of" (negative) its predicted position; expressed in seconds of time, kilometers, and degrees of orbital arc; along with the standard error and statistical significance of the time residual. In order to find a satellite's orbital residual it is necessary to have performed a regression analysis on observations of both its eclipse disappearance and reappearance, thus taking into account any aperture effect. If there are insufficient timings to obtain statistically significant regression results, the unweighted mean of the disappearance and reappearance means is computed instead. In either case, the orbital residuals listed in Table 6 should be considered as averages for the entire observing season; they give no information on possible short-term (within-apparition) deviations of a satellite from its predicted position. That such weeks- or months-scale deviations occur is indicated by photometric CCD timings. [Mallama *et al*., 2000, 2003]

There are six event types listed in Table 6; eclipse disappearances and reappearances for each of three satellites. As shown by the R^2 values, in two of the six cases the aperture-regression model did not significantly reduce the variance among the timings. Naturally, the uncertainties in our timings represent the combined effect of many variables that are not considered in our analysis, such as type of instrument, magnification, optical quality, atmospheric conditions, distance and phase angle of Jupiter, apparent distance of the satellite from Jupiter's limb, keenness of the observer's eye, or the use of an occulting bar (an opaque strip placed at the focus of a positive eyepiece to block out Jupiter itself). There is also the effect of atmospheric variations on Jupiter itself, informally estimated as affecting eclipses times by as much as ten seconds. Only some of these variables are quantifiable, and for most we have no data at all. Nonetheless, with the over 10,000 timings which have been logged since 1975, a more complex statistical analysis could be done, which might reduce the amount of uncertainty.

The standard error gives the uncertainty of the timings, which increased with distance from Jupiter as follows (disappearance followed by reappearance): 18 and 19 seconds for Io; 27 and 16 seconds for Europa; and 68 and 43 seconds for Ganymede. Uncertainties tend to increase with satellite distance from Jupiter because the satellites move more slowly, and Jupiter's shadow penumbra becomes broader, with increasing distance from the planet.

The values of the **B**-coefficients indicate the effect of telescope aperture on the observed time of "first speck" or "last speck." Due to the relatively few observations received for this apparition, two of the six B-coefficients were not statistically significant — those for disappearances of Io and Europa.

The orbital residuals, expressed in seconds of time, are the simple means of the disappearance and reappearance **A**-coefficients of each satellite. The four satellites' time residuals have also been converted to degrees of orbital arc and to kilometers. Because the absolute values of Io's B-coefficients differ so markedly, we believe that its residual based on mean differences (-2.5 ± 2.1 s) is more reliable than that based on regression (-6.8 ± 4.3 s).

None of the satellites' timing results differed significantly from the E-2 Ephemeris for the 2000/2001 Apparition.

Comparison with CCD Timings

For a number of apparitions, an observing team coordinated by Anthony Mallama has used CCD cameras to time the eclipses of Jupiter's four major satellites, obtaining individual eclipse results more precise than possible with visual timings. (For information about the CCD timing program, visit its website: *http://www.amsmeteors.org/mallama/galilean/index.html* . See also [Collins *et al.* 1997], [Mallama 1991] and [Mallama *et al.* 1994, 2000, 2002 and 2003].)

The final two rows of Table 6 compare the 2000/01 CCD timings with the visual timings of our program. In comparing the two sets of residuals, it is important to remember that the CCD results are the means of sets of observations of individual eclipse events; consulting the latter may well show trends within apparitions. On the other hand, our visual results merge all the individual timings to give a satellite position generalized over the entire apparition.

Given this caveat, there are no statistically significant differences between the CCD and the visual timings; the apparent differences are swallowed up by their uncertainties.

Long-Term Results

The apparent changes in satellite position between the 1999/2000 and 2000/01 Apparitions were found by subtracting mean residuals for 1999/2000 [Westfall 2012: 52] from those for 2000/01, giving:

Io	-3.5 ± 2.6 sec
Europa	-10.1 ± 8.1 sec
Ganymede	-23.8 ± 19.7 sec

Although it is interesting that the eclipses of all three satellites appear to have occurred earlier in 2000/01 than in 1999/2000, none of the three apparent changes is statistically significant.

Summarizing the entire history of our program, Figure 1 graphs the orbital residuals for Io, Europa, Ganymede and Callisto for the 23 apparitions from 1976/77 through 2000/01 (there were insufficient observations for the 1975/76 Apparition to determine its orbital deviations). In the figure, the error bars represent a ±1 standard-error range, and a deviation from the ephemeris significant at the 5-percent level would have to equal at least about 2 standard errors.

The diagram hints at cyclical variations for some of the satellites, particularly for Europa and Ganymede, perhaps in a cycle reflecting Jupiter's 12-year orbital period. A recent study by Mallama and his associates showed shorter-period cyclical variations between the three satellites and the E-5 Ephemeris (which is similar to the E-2 Ephemeris), with amplitudes/periods as follows: Io, 4.6s/1.28y; Europa, 15.0s/1.27y; Ganymede, 13.8s/1.30y. [Mallama *et al.* 2010: 354].

Conclusion

Our program of visual timings provides continuity with the many thousands of similar visual timings that go back to the 17th century. With our growing database, which includes "metadata" on the instruments used and the visibility conditions experienced, we have the potential for extensive statistical analysis of the effect of these factors on timing accuracy.

This report concludes a quarter-century program of comparing our visual timing results with the JPL E-2 Ephemeris, which is no longer published (Lieske 1981contained predictions through 1999, and he kindly supplied additional ephemerides for 2000 and 2001). Our visual timing program continues, however, and for the 2001/02 Apparition and later we will rely on the Institut de Méchanique Céleste et de Calcul des Éphémérides (IMCCE) predictions of the phenomena of the Galilean satellites, currently available for 1996 through 2014. Table 7 gives a comparison of the disappearance, reappearance and orbital residuals for the 2000/2001 Apparition, using the E-2 and the IMCCE ephemerides.

The fact that the E-2 Ephemeris gives results to 1-second precision while the IMCCE Ephemeris rounds predictions to 0.1 minutes has not inflated the statistical uncertainties of the results. (Rounding results to 0.1 minutes adds just 3.00 s^2 to the variance, which, due to variations among the timings themselves, already has values in the range 262.44-4768.56

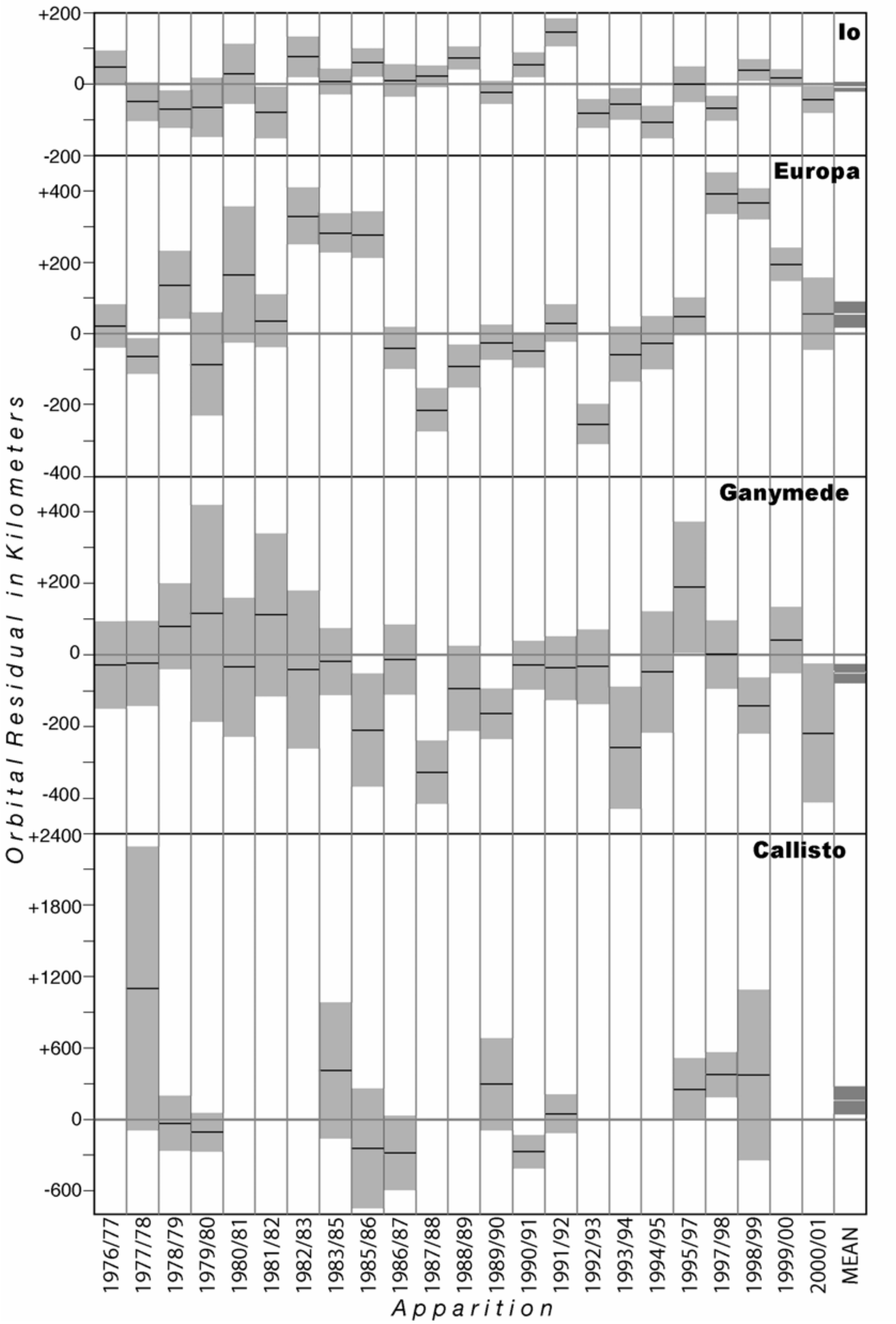

Figure 1. Deviations in kilometers of the Galilean satellites Io, Europa, Ganymede and Callisto from the JPL E-2 Ephemeris for the 1976/77 - 2000/01 Apparitions of Jupiter. The black line in the center of the grey bar for each apparition represents the estimated deviation of each satellite, while the bar itself shows its ±1-sigma uncertainty range. The black rectangle on the right margin of the graph shows the ±1-sigma range of the 23-apparition mean deviation; none of these four long-term means are significantly different from zero at the 5-percent significance level.

s^2 for this apparition.) In terms of means, for Europa and Ganymede, the E-2 and IMCCE-based orbital residuals do not differ significantly. This is not the case for Io, with a significant difference of over 10 seconds; our timings did not differ significantly from the E-2 Ephemeris, but did disagree significantly with the IMCCE predictions – it will be interesting to see if this disagreement continues in future apparitions.

We hope that present participants will continue and new ones will join us. For information on the visual timing program, please contact the writer, whose address is given in the *ALPO Resources* section of this *Journal, ALPO* and on the ALPO website. The latter provides observing instructions, an observing report form, and a set of eclipse predictions for each current apparition (all of which can also be provided by mail). The timing report form should be returned at the end of each apparition (not the calendar year). Predictions of Galilean satellite events are also published each year in the *Astronomical Almanac*, the *Observer's Handbook* of the Royal Astronomical Society of Canada, and the *Handbook* of the British Astronomical Association, as well as every month (except near conjunctions) in *Sky & Telescope* magazine.

We thank everyone who participated in this ALPO project for the 2000/01 Apparition of Jupiter. Remember that your timings become more accurate as you accumulate experience, and also that the more visual timings that we make, the more accurate and significant our results.

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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 2014-2015

By Richard Schmude, Jr.,
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Abstract

Over 40 individuals submitted images or measurements of the remote planets in 2014-2015. The selected normalized magnitudes of Uranus are -6.30 ± 0.03, -6.633 ± 0.014 and -7.133 ± 0.010 for the U, B and V filters, respectively; the corresponding values for Neptune are -6.46 ± 0.02, -6.586 ± 0.012 and -6.998 ± 0.011. The planetographic latitudes of two bright belts on Uranus are reported. Based on unfiltered CCD images, it is concluded that the amplitude of Pluto's light curve may have dropped a little since the early 1980s, and the brightness difference between Uranus' two largest moons (Titania and Oberon) has not changed much since 2002.

Introduction

Several worthwhile studies of Uranus, Neptune and Pluto were published between mid-2014 and mid-2015. For example, Sromovsky et al. (2014) used Hubble Space Telescope data to measure methane abundances across Uranus. They report that there is less methane in the North Polar Region than in latitudes farther south.

In a second study, de Pater et al. (2015) used the Keck Telescope on 5 and 6 August 2014 (Universal Time) to image Uranus in near-infrared light. They report that a very bright storm near 15° N was present along with a second storm near 32° N. This group believes that the second storm was imaged by amateur astronomers in late 2014.

In another study, Fletcher et al. (2014) used several different types of infrared data to measure the temperature of Neptune's stratosphere and upper troposphere. They report that stratospheric temperatures did not change much between 1989 and 2005. They also report a similar conclusion for the upper troposphere at mid-latitudes.

Finally, they report a temperature increase of 5 – 6 K in the stratosphere and upper troposphere poleward of 70° S between 1989 and 2005.

Delcroix, Colas and Gorczynski (2014) report that a white spot on Neptune near 46° S had a wind speed of -90 meters per second. This is close to values reported by Kaspi et al. (2013). Finally, the New Horizons Team released a color image of Pluto and its largest moon Charon. Pluto has a pinkish color and Charon has a bluish color in this image.

Members of the Association of Lunar & Planetary Observers (the ALPO) also made important contributions to our knowledge of the remote planets in 2014-2015.

This report summarizes brightness measurements and image data recorded by members of the ALPO during the 2014-2015 apparitions of Uranus, Neptune and Pluto. Table 1 lists characteristics of the remote planets during their 2014-2015 apparitions. Those who submitted observations of these planets are summarized in Table 2.

Table 1: Characteristics of the 2014 - 2015 Apparitions of Uranus and Neptune[a]

Parameter	Uranus	Neptune	Pluto
First conjunction date	April 2, 2014	February 23, 2014	January 1, 2014
Opposition date	October 7, 2014	August 29, 2014	July 4, 2014
Angular diameter (opposition)	3.7 arc-seconds	2.4 arc-seconds	0.1 arc-seconds
Sub-Earth latitude (opposition)	27.5° N	27.2° S	0.6° S
Right Ascension (opposition)	0h 55m	22h 33m	18h 52m
Declination (opposition)	5.1° N	9.4° S	20.3° S
Second conjunction date	April 6, 2015	February 26, 2015	January 4, 2015

[a]Data are from the Astronomical Almanac for the years 2014 – 2015

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

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The references in blue text to jump to source material or information about that source material (Internet connection must be ON).

Table 2: Contributors to the ALPO Remote Planets Section in 2014-2015[a]

Observer (country)	Type[a]	Instrument[b]	Observer (country)	Type[a]	Instrument[b]
K. Bailey (UK)	I	0.22 m Cass	M. Kardasis (Greece)	I	0.28 m SC
P Bayle (France)	I	0.36 m SC	Y. Le Gall (France)	I	0.37 m RL
J. Boudreau (USA)	I	0.37 m DK	P. Maxson (USA)	I	0.36 m SC
F. Colas (France)	I	1.06 m Cass	F. Melillo (USA)	PP	0.25 m SC
M. Delcroix (France)	I	Several	R. Schmude, Jr. (USA)	PP, VP	Several
J. Fox (USA)	PP	0.25 m SC	G. Tarsoudis (Greece)	I	0.36 m RL
C. Go (Philippines)	I	0.36 m SC	S. Tzikas (USA)	I	0.36 m SC
P. Gorczynski (USA)	I	0.36 m SC	A. Wesley (Australia)	I	0.41 m RL
R. Hill (USA)	I	0.20 m MC			

[a]Type of observation: I = image, PP = photoelectric photometry, VP = visual photometry.

[b]Telescope: Cass = Cassegrain, DK = Dall Kirkham, MC = Maksutov-Cassegrain, RL = reflector, and SC = Schmidt-Cassegrain.

In addition to those listed above, the following individuals submitted observations to the ALPO Japan Latest website: P Abel (UK), L. Aerts (Belgium), G. Bianchi (Italy), E. de Mateo (USA), W. R. Diffin (UK), L. J. Fernandez (Spain), Y. Goryachko (Belarus), D. Gray (UK), M. Guidi (Italy), T. Hansen (Germany), R. Hill (USA), A. Lasala (Spain), S. Maksymowicz (France), P. Micca (Italy), K. Morozov (Belarus), M. Nicholas (Australia), A. Obukhov (Russia), T. Olivetti (Thailand), C. Paolo (Italy), J. J. Poupeau (France), S. Quaresima (Italy), A. Sánchez (Spain), C. Sprianu (Romania), J. Sussenbach (Netherlands), C. Viladrich (France)

Brightness Measurements: Photoelectric Photometry

Jim Fox, Frank Melillo and the writer all measured the brightness of at least one of the remote planets. Jim used an SSP-3 photometer and a 0.25 m telescope for his work. Frank used an SSP-3 photometer along with a Starlight Xpress MX-5 camera and a 0.25 m Schmidt-Cassegrain telescope for his measurements. The writer used SSP-3, 4 and 5 photometers for his measurements along with a 0.20 m Maksutov-Cassegrain telescope. Transformation coefficients for most of the instruments used in this study are listed in Table 3. The SSP-3, 4 and 5 photometers are described elsewhere (Optec Inc., 1997; 2005; 1995).

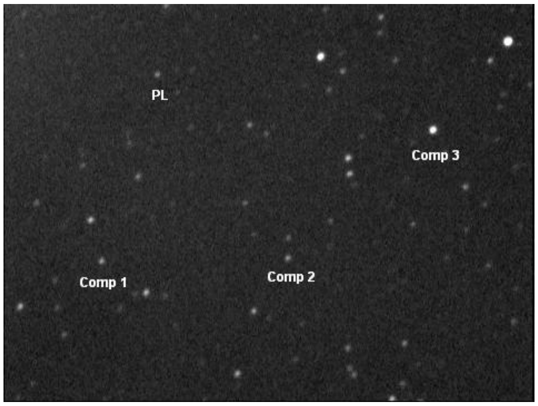
The brightness values of the comparison stars used in this study are summarized in Table 4. Unfortunately, Frank could not find the brightness of the three comparison stars that he used for his Pluto light curve work. Jim Fox and the writer used ε-Psc and σ-Aqr as comparison stars for their Uranus and Neptune measurements, respectively. The brightness measurements are summarized in tables 5 and 6 for Uranus and Neptune, respectively. The date, observers' initials, filter, measured brightness value and normalized brightness values are listed in columns 1-5 and 6-10. The normalized brightness values are computed in the same way as is described in Schmude (2012).

The writer used the SSP-5 photometer to collect all U filter measurements of Uranus and Neptune along with all measurements made on December 7, 11 and 14. This instrument has a higher sensitivity than the SSP-3 instrument. As can be seen in tables 5 and 6, the SSP-5 results are close to those made with the SSP-3 instrument. The writer used an SSP-3 photometer to collect his V filter measurements on September 20 (Uranus), October 31 (Neptune) and November 22 (Neptune). He also used the SSP-4 photometer for a single H filter measurement of Uranus on January 9, 2015. The H filter is sensitive to wavelengths of between 1500 and 1800 nm. Uranus is faint in these wavelengths. The H filter measurement in Table 5 has a low signal-to-noise ratio; the estimated uncertainty is 0.08 magnitudes.

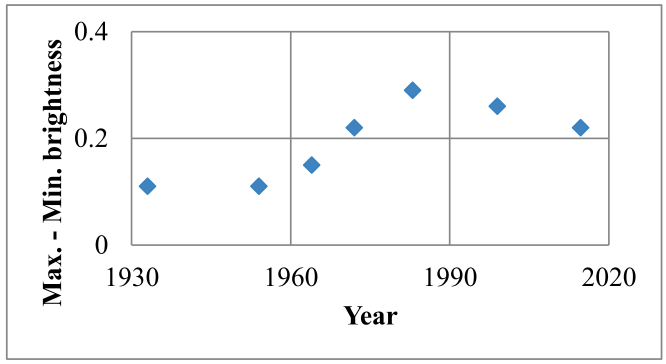
There are several sources of uncertainty in the brightness measurements summarized in Table 7. The first source is the comparison star magnitude value. The uncertainties listed in the original sources are listed. In the case of the U filter, the quoted uncertainty for a single measurement in Iriarte et al (1965) is 17 and 20 millimagnitudes in the V and U – V measurements, respectively. These quantities were divided by the square root

Table 3: Transformation Coefficients Used for Brightness Measurements of Uranus and Neptune in 2014-2015

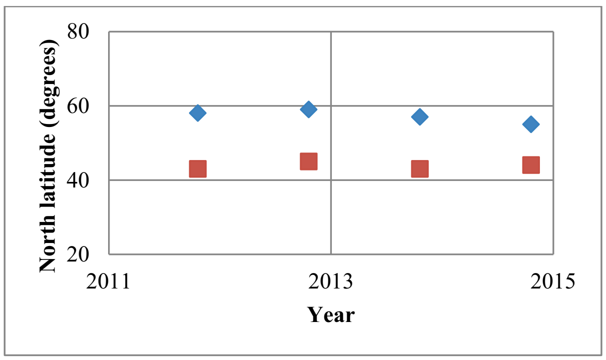
Observer	Instruments	Transformation Coefficients			
		U filter	B filter	V filter	H filter
J. Fox	SSP3 + 0.25 m SC	---	0.0749	–0.050	---
R. Schmude, Jr.	SSP3 + 0.20 m MC	0.034	0.0818	–0.00233	---
R. Schmude, Jr.	SSP4 + 0.20 m MC	---	---	---	0.0291
R. Schmude, Jr.	SSP5 + 0.20 m MC	–0.0224	–0.0405	–0.048	---



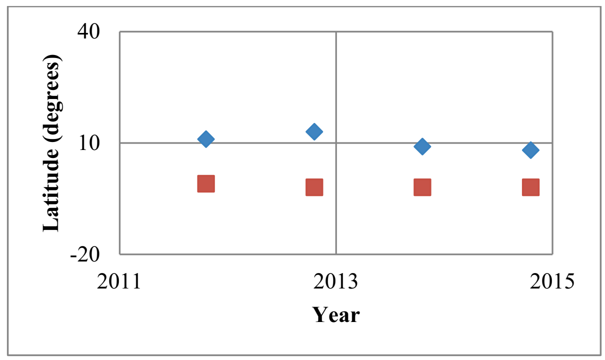
A



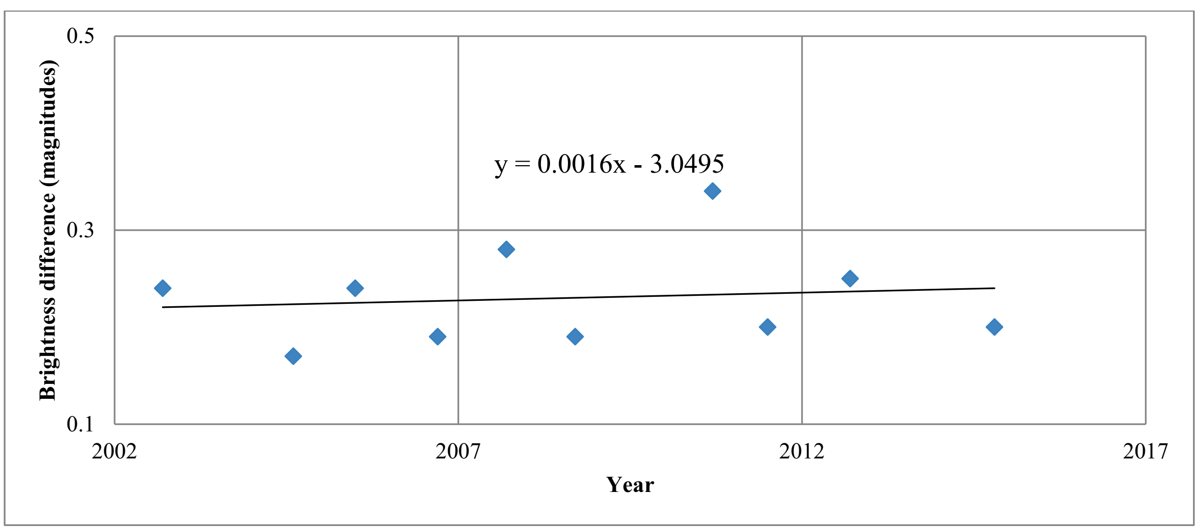
B



C



D



E

Figure 1A: An image of Pluto and the three comparison stars used by Frank Melillo in measuring Pluto's light curve. 1B: A plot of the maximum minus minimum brightness of Pluto as it rotates versus the year. 1C: A plot of the planetographic latitude of the north and south edges of Uranus' North Temperate Belt versus the year. 1D: A plot of the planetographic latitude of the north and south edges of Uranus' Equatorial Belt. Measurements in Figures 1C and 1D were made from images recorded in red and near-infrared light. 1E: A plot of the difference in brightness of Titania and Oberon (in stellar magnitudes) base on unfiltered CCD images versus the year. Data are from Schmude (2004; 2006a, b; 2008; 2009; 2012; 2013) and this work.

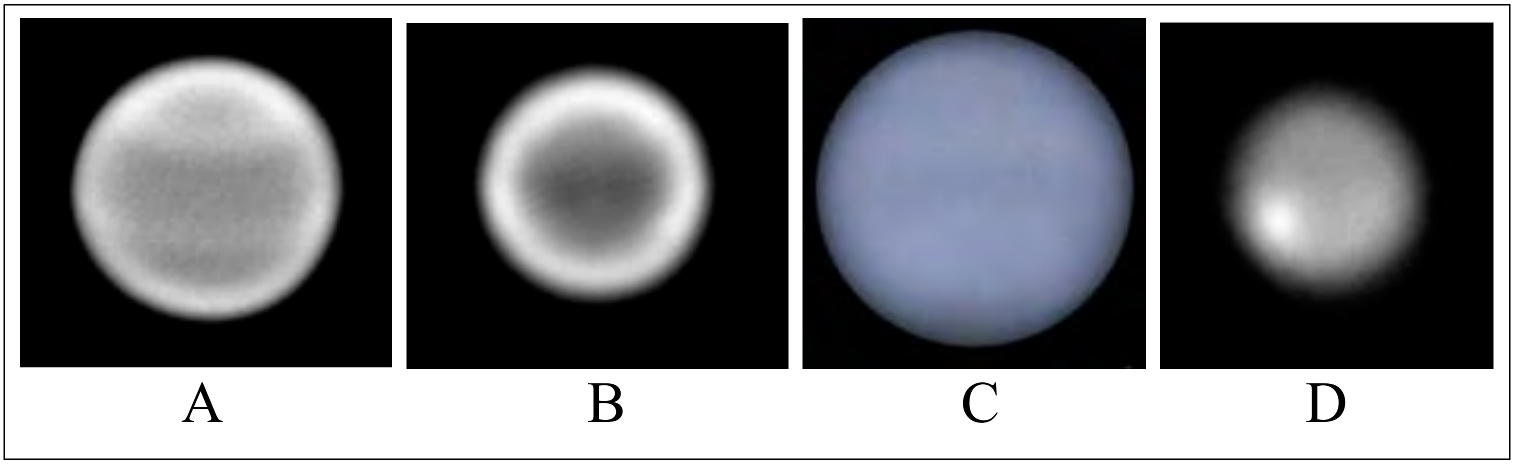


Figure 2: Images and drawings of Uranus (A, B) and Neptune (C, D) made in 2014. In all cases, north is at the top. A: October 3, 2014 (2:51.3 UT) by M. Delcroix and F. Colas, 1.06 m Cassegrain telescope with a red and near infrared filter; B: October 3, 2014 (2:02 UT) by M. Delcroix and F. Colas, 1.06 m Cassegrain telescope with a methane band (0.89 mm) filter; C: September 22 (21:20 UT), drawing by D. Gray using a 0.42m Dall-Kirkham telescope, 610 X with a bino viewer, Seeing = Antoniadi II: D: October 3, 2014 (21:40.7 UT) by M. Delcroix and F. Colas, 1.06 m Cassegrain telescope with a red and near infrared filter.

of three to account for the fact that all listed magnitudes are the mean for measurements made on at least three different nights. A second source of uncertainty is from possible micro variability which includes our Sun. The values for this source are based on the discrepancy between measured check star brightnesses and the corresponding literature values. Color transformation is a third source of uncertainty. This is estimated to be 20% of the mean transformation correction. The estimated uncertainty for extinction is also 20% of the mean correction term. The mean standard errors are listed as the random error. The selected uncertainty is the square root of the sum of the squares of each uncertainty value. Selected uncertainties are at the bottom of Table 7.

Frank Melillo collected several sets of I filter measurements of Uranus between October 13 and November 13. He found that Uranus was 2.10 magnitudes dimmer than 60 Psc. No transformation or extinction corrections, however, were made. He also noted a small brightness increase on November 11, when a bright spot was predicted to pass the central meridian but did not measure a similar increase two days later when that same spot was predicted to cross the central meridian.

Table 4: Comparison and Check Stars Used in 2014-2015 Photometric Studies of Uranus and Neptune

Check / Comparison Star	Right Ascension[a]	Declination[a]	Brightness used (magnitudes)		
			U filter	B filter	V filter
σ-Aqr	22h 30.6m	10.678° S	4.64[b]	4.790[e]	4.825[e]
58-Aqr	22h 31.7m	10.906° S	---	6.657[e]	6.387[e]
ε-Psc	1h 02.9m	7.890° N	5.95[b]	5.240[e]	4.280[e]
60-Psc	0h 47.4m	6.741° N	---	6.914[c]	5.985[c]
ι-Aqr	22h 06.4m	13.870° S	3.907[d]	4.191[d]	4.266[d]
δ-Psc	0h 49.5m	7.585° N	7.774[d]	5.926[d]	4.426[d]

[a]Values are from Hirshfeld, Sinnott and Ochsenbein (1991)
[b]Values are from Iriarte et al. (1965)
[c]Jim Fox took this value from Schmude (2008)
[d]Values are from Mermilliod et al. (1991)
[e]Jim Fox took these values are from SIMBAD in about 2013.

Solar phase coefficients of Uranus and Neptune are computed in the same way as in Schmude (2013). The selected solar phase coefficients for Uranus in 2014-2015 are -0.0035 and -0.0025 magnitudes/degree for the B and V filters, respectively. The corresponding values for Neptune are 0.0019 and 0.0065 magnitudes/degree. The small values for both planets are similar to previous measurements (Schmude, 2013).

Melillo recorded several images of Pluto between September 13 and 27. He chose September because Pluto was near its stationary point. His objective was to measure the difference between the maximum and minimum brightnesses as Pluto rotated. He used three different comparison stars and measured the brightness difference between Pluto and each of them (See Figure 1A). His data

Table 5: Brightness Measurements of Uranus in 2014 and Early 2015

Date	Obs.[a]	Filter	Brightness (magnitudes)		Date	Obs.[a]	Filter	Brightness (magnitudes)	
			Meas (+)	Normalized (–)				Meas (+)	Normalized (–)
Aug. 29	JF	B	6.290	6.637	Dec. 8	JF	V	5.803	7.158
Aug. 29	JF	V	5.792	7.135	Dec. 11	RS	B	6.366	6.600
Aug. 31	JF	B	6.299	6.626	Dec. 11	RS	B	6.383	6.584
Aug. 31	JF	V	5.796	7.129	Dec. 11	RS	B	6.393	6.574
Sep. 2	JF	B	6.296	6.627	Dec. 20	JF	B	6.338	6.645
Sep. 2	JF	V	5.793	7.130	Dec. 20	JF	V	5.849	7.134
Sep. 20	RS	V	5.772	7.135	Dec. 24	JF	B	6.356	6.634
Sep. 20	RS	V	5.775	7.132	Dec. 24	JF	V	5.852	7.138
Sep. 20	RS	V	5.782	7.125	Dec. 25	JF	B	6.369	6.623
Oct. 3	JF	B	6.273	6.629	Dec. 25	JF	V	5.882	7.110
Oct. 3	JF	V	5.766	7.136	Jan. 5	JF	B	6.371	6.641
Oct. 5	JF	B	6.287	6.615	Jan. 5	JF	V	5.874	7.138
Oct. 5	JF	V	5.780	7.122	Jan. 7	JF	B	6.326	6.690
Oct. 14	JF	B	6.280	6.623	Jan. 7	JF	V	5.865	7.151
Oct. 14	JF	V	5.768	7.135	Jan. 9	RS	H	7.82	5.20
Oct. 15	JF	B	6.271	6.632	Jan. 11	JF	B	6.386	6.637
Oct. 15	JF	V	5.777	7.126	Jan. 11	JF	V	5.883	7.140
Oct. 17	JF	B	6.277	6.627	Jan. 12	JF	B	6.389	6.636
Oct. 17	JF	V	5.775	7.129	Jan. 12	JF	V	5.878	7.147
Nov. 27	RS	U	6.661	6.282	Jan. 17	JF	B	6.392	6.642
Nov. 27	RS	U	6.653	6.290	Jan. 17	JF	V	5.896	7.138
Nov. 27	RS	U	6.655	6.288	Jan. 18	JF	B	6.392	6.644
Nov. 28	RS	U	6.621	6.324	Jan. 18	JF	V	5.920	7.116
Nov. 28	RS	U	6.586[b]	6.359	Jan. 24	JF	B	6.408	6.639
Nov. 29	RS	U	6.654	6.293	Jan. 24	JF	V	5.913	7.134
Nov. 29	RS	U	6.659	6.288	Feb. 5	JF	B	6.414	6.652
Nov. 29	RS	U	6.665	6.282	Feb. 5	JF	V	5.921	7.145
Nov. 29	RS	U	6.663	6.284	Feb. 6	JF	B	6.419	6.649
Nov. 29	RS	U	6.659	6.288	Feb. 6	JF	V	5.938	7.130
Nov. 29	RS	U	6.676	6.271	Feb. 7	JF	B	6.393	6.676
Nov. 29	JF	B	6.310	6.637	Feb. 7	JF	V	5.926	7.143
Nov. 29	JF	V	5.812	7.135	Feb. 8	RS	V	5.937	7.134
Nov. 30	JF	B	6.307	6.641	Feb. 8	RS	V	5.947	7.124
Nov. 30	JF	V	5.812	7.136	Feb. 9	JF	B	6.396	6.676
Dec. 7	RS	B	6.350	6.610	Feb. 9	JF	V	5.947	7.125
Dec. 7	RS	B	6.359	6.601	Feb. 10	JF	B	6.403	6.670
Dec. 8	JF	B	6.346	6.615	Feb. 10	JF	V	5.963	7.110

[a]Initials: JF = Jim Fox; RS = Richard Schmude, Jr.
[b]Large scatter

Table 6: Brightness Measurements of Neptune in 2014 and Early 2015

Date	Observer[a]	Filter	Brightness (magnitudes)		Date	Observer[a]	Filter	Brightness (magnitudes)	
			Meas (+)	Normalized (–)				Meas (+)	Normalized (–)
Aug. 29	JF	B	8.103	6.590	Nov. 29	JF	V	7.771	6.997
Aug. 29	JF	V	7.668	7.025	Nov. 30	JF	B	8.167	6.602
Aug. 31	JF	B	8.103	6.590	Nov. 30	JF	V	7.731	7.038
Aug. 31	JF	V	7.681	7.012	Dec. 8	JF	B	8.184	6.595
Sep. 2	JF	B	8.092	6.601	Dec. 8	JF	V	7.793	6.986
Sep. 2	JF	V	7.686	7.007	Dec. 12	RS	U	8.333	6.451
Oct. 3	JF	B	8.133	6.573	Dec. 12	RS	U	8.310	6.474
Oct. 3	JF	V	7.692	7.014	Dec. 12	RS	U	8.312	6.472
Oct. 5	JF	B	8.105	6.603	Dec. 12	RS	U	8.312	6.472
Oct. 5	JF	V	7.721	6.987	Dec. 13	RS	U	8.325	6.460
Oct. 14	JF	B	8.132	6.583	Dec. 13	RS	U	8.296	6.489
Oct. 14	JF	V	7.728	6.987	Dec. 13	RS	U	8.296	6.489
Oct. 15	JF	B	8.104	6.612	Dec. 13	RS	U	8.297	6.488
Oct. 15	JF	V	7.711	7.005	Dec. 14	RS	B	8.227	6.559
Oct. 17	JF	B	8.151	6.567	Dec. 14	RS	B	8.212	6.574
Oct. 17	JF	V	7.723	6.995	Dec. 14	RS	B	8.209	6.577
Oct. 31	RS	V	7.735	6.998	Dec. 14	RS	V	7.761	7.025
Nov. 22	RS	V	7.798	6.961	Dec. 14	RS	V	7.773	7.013
Nov. 22	RS	V	7.759	7.000	Dec. 20	JF	B	8.205	6.588
Nov. 22	RS	V	7.817	6.942	Dec. 20	JF	V	7.805	6.988
Nov. 22	RS	V	7.800	6.959	Dec. 24	JF	B	8.222	6.576
Nov. 27	RS	U	8.295[b]	6.471	Dec. 24	JF	V	7.786	7.012
Nov. 28	RS	U	8.331[b]	6.436	Dec. 25	JF	B	8.218	6.581
Nov. 28	RS	U	8.336	6.431	Dec. 25	JF	V	7.802	6.997
Nov. 28	RS	U	8.324	6.443	Jan. 11	RS	V	7.94[c]	6.85
Nov. 29	JF	B	8.176	6.592					

[a] Observer Initials: JF = Jim Fox; RS = Richard Schmude, Jr.
[b] I waited until I thought that the clouds had passed away.
[c] Large data scatter; this value is not included.

are consistent with Pluto's brightness changing by 0.22 ± 0.03 magnitudes as it rotates. Figure 1B summarizes the difference between maximum and minimum brightnesses measured from Pluto light curves dating back to the 1930s. Data are from Tholen and Tedesco (1994), Andersson and Fix (1973), Buratti et al (2003) and Schaefer et al (2008). It appears that Pluto's light curve has changed over the last 80 years.

Brightness Measurements: Visual Photometry

The writer made 34 and 20 brightness estimates of Uranus and Neptune, respectively, in 2014-2015 using binoculars. The mean normalized magnitudes of both planets are -7.1 and -7.0 for Uranus and Neptune, respectively. These values were computed in the same way as is described in Schmude (2012).

Images and drawings

Several individuals recorded images of Uranus and Neptune in visible and near-infrared light. The sharpest images were recorded with the 1.06 m Cassegrain at Pic du Midi Observatory. Two bright belts which I have called the North Temperate Belt and the Equatorial Belt were present on these images. I measured the planetographic latitudes of the edges of both belts from these images. The resulting latitudes are shown in figures 1C and 1D. I also made measurements from an October 12, 2011 (21:04 UT) image recorded at Pic du Midi observatory. (This image showed four satellites and, hence, I was able to use Uranus Viewer 2.8 to establish the orientation.) The North Temperate Belt may have moved a bit farther south in 2014. It will be interesting to see if this trend continues. Latitudes were computed in the same way as is described in Peek (1981, p. 49), except that 1.023 replaces 1.0714 because Uranus has a different polar flattening than Jupiter.

Albedo features were imaged on both Uranus and Neptune (See Figure 2). The image of Neptune in Figure 2D shows limb-darkening. Uranus, on the other hand, shows limb-brightening in Figure 2A. Both images were taken with the same filters and telescope. The difference in the limbs of Uranus and Neptune should be monitored in future years. Many of the Uranus and Neptune images were sent to professional astronomers. I am very happy to see this. Hopefully, more professional-amateur collaboration like this will take place in the future.

Satellites

Melillo reports that Titania was 0.08 and 0.31 magnitudes brighter than Oberon on October 13 and 25 respectively. These values were measured for unfiltered CCD images. The brightness difference between Titania and Oberon since 2002 is plotted in Figure 1E. The data were fitted to a linear equation. The equation shows that the magnitude difference between the two moons has remained almost constant.

Acknowledgements

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Table 7: Sources of Uncertainty in the V, B and U Filter Measurements of Uranus and Neptune.
(In all cases the stated uncertainties are in 0.001 magnitudes.)

Source	Uranus			Neptune		
	V filter	B filter	U filter	V filter	B filter	U filter
Comparison star magnitude	2.33	3.3	16	2.34	3.3	16
Possible star variability	6	10	21	5	9	12
Transformation	5	7	2	4	7	2
Extinction	3	5	8	1	1	2
Random	4	3	8	8	3	10
Selected uncertainty	10	14	28[a]	11	12	23[b]

[a] This has been rounded to 0.03 magnitude
[b] This has been rounded to 0.02 magnitude

Table 8: Selected Normalized Magnitudes for Uranus and Neptune in 2014-2015 ("n" is the number of measurements)

Planet	U(1,α) [n]	B(1,α) [n]	V(1,α) [n]
Uranus	-6.30 ± 0.03 [11]	-6.633 ± 0.014 [31]	-7.133 ± 0.010 [31]
Neptune	-6.46 ± 0.02 [12]	-6.586 ± 0.012 [17]	-6.998 ± 0.011 [21]

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- **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.

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- **Monograph No. 7.** *Proceedings of the 48th Convention of the Association of Lunar and Planetary Observers. Las Cruces, New Mexico, June 25-29, 1997.76* pages. Hard copy $12 for the United States, Canada, and Mexico; $16 elsewhere.File size approx. 2.6 mb.

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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:
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- **Lunar (Bailey):** (1) *The ALPO Lunar Selected Areas Program* ($17.50). Includes full set of observing forms for the assigned or chosen lunar area or feature, along with a copy of the *Lunar Selected Areas Program Manual.* (2) observing forms, free at http://moon.scopesandscapes.com/alpo-sap.html, or $10 for a packet of forms by regular mail. Specify *Lunar Form*s.

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- **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.

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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 quarterly periodical, the *Journal of the Assn. of Lunar & Planetary Observers*, also called *The Strolling Astronomer.* Membership dues include a subscription to our Journal. Two versions of our Journal are distributed — a hardcopy (paper) version and an online (digital) version in "portable document format" (pdf) at considerably reduced cost.

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

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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)