ISSN-0039-2502

Journal of the Association of Lunar & Planetary Observers

Association of Lunar & Planetary Observers
ALPO
Founded in 1947

The Strolling Astronomer

Volume 54, Number 3, Summer 2012

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

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

Inside this issue

- ***ALCon 2012 / ALPO updates***
- ***William H. Pickering and Life on the Moon***
- ***Venus and Jupiter apparition reports, plus ALPO section news and much, much more!***

Venus transit at sunset 2012-06-06

by Rik & Dolores Hill

(See page 4 for commentary by Rik on this image.)

Your Affordable Astro-Imaging Source

ED80T Carbon Fiber Triplet Apochromatic Refractor

Light weight and portable so you can view and photograph anywhere.

$799.99 #9534

ED102T Carbon Fiber Triplet Apochromatic Refractor

Beautiful 102mm aperture f/7 “apo” provides sharp astrophotos and visual displays.

$1,999.99 #9530

M8 (Lagoon Nebula), M20 (Trifid Nebula) and NGC 6559 *– Taken with the Orion Parsec 8300C, Orion ED80T CF, Orion Sirius EQ-G Mount, Orion StarShoot AutoGuider, and Orion 100mm f/6 Refractor used as a guidescope. Orion Image.*

Parsec™ 10100C Color Astronomical Imaging Camera

$1,799.99 #52078

The huge 10.1 megapixel Kodak imaging sensor takes great astrophotos.

StarShoot™ AllSky Camera

$899.99
#52187
NTSC Std.

Magnificent Mini AutoGuider Package

$349.99 #24781

StarShoot™ Deep Space Video Camera

$499.99
#52185
NTSC Std.

StarShoot™ G3 Deep Space Imaging Camera

$499.99 #53082 Color
$499.99 #53083 Mono

1.25" Astrophotography Flip Mirror

$149.99 #5523

Deluxe Off-Axis Guider

$139.99 #5521

SteadyStar™ Adaptive Optics Guider

$1,499.99 #53076

SteadyPix™ Photo Adapter for iPhone®

Take pictures through your telescope with the iPhone’s built-in camera.

$59.99 #5303

iPhone is a trademark of Apple Inc., registered in the U.S. and other countries.

Prices subject to change. Dealer pricing and/or promotions may vary.

Orders: (800) 447-1001
Customer Service: (800) 676-1343

OrionTelescopes.com

Check out the Orion page on Facebook
www.facebook.com/oriontelescopes

Journal of the Association of Lunar & Planetary Observers

The Strolling Astronomer

Volume 54, No.3, Summer 2012
This issue published in June 2012 for distribution in both portable document format (pdf) and also hardcopy format.

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

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

For membership or general information about the ALPO, contact:

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

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

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

Founded in 1947

In this issue

Inside the ALPO

Feature Stories

ALPO Resources

Our Advertisers

ALCon2012

Celebrate Starlight

CHICAGO, JULY 4-7, 2012

Celebrating 150 Years of Organized Astronomy: 1862–2012

FEATURED SPEAKERS:

- **Mike Simmons**, *President, Astronomers Without Borders*
- **Dr. Donald Parker**, *ALPO, Planetary Astrophotographer*
- **Dr. Dave Crawford**, *Co-founder IDA (remote presentation)*
- **Wally Pacholka**, *TWAN, Landscape Astrophotographer*
- **Dr. Jason Steffen**, *Kepler Mission Scientist*
- **Dr. Mark Hammergren**, *Adler Asteroid Expert*
- **Dr. Philipp Heck**, *Field Museum Meteorite Curator*
- **Dr. Hasan Padamsee**, *Physics Professor/Playwright, Cornell Univ.*
- **Vivian Hoette**, *Astronomy Educator at Yerkes Observatory*
- **Jeff Talman**, *Artist, Star Sound Installation, "Nature of the Night Sky"*
- **Dr. David Blask**, *Expert in circadian disruption/cancer/light pollution*
- **David Eicher**, *Editor-in-Chief, Astronomy Magazine*
- **Dr. George "Bud" Brainard**, *Expert in human health effects of light*

- Morning talks: **Marriott Lincolnshire Resort** on Wed, Thur, Fri; Morning & afternoon talks on Sat; Day trips*
- **Very special early booking room rate at the Marriott $69+tax** (reg $169)
- Daytrips: Fermilab, Yerkes, Sailing, Field Museum, Adler Planetarium
- Workshop at Yerkes: Outreach for the sensory impaired
- Saturday Awards Banquet, documentary *Saving Hubble*, Star Party on Resort golf course
- July 4th Fireworks, StarParty
- StarBQue, StarParty, chamber music concert at Ravinia
- AL Urban Observing Challenge
- Official **NCRAL, ALPO, AWB** events
- **MWAIC** Astro-Imaging Conference, Wed, Thu, Fri
- Qualified **Teacher CPDU credits**
- Dark Sky Advocacy presentations and roundtable forum
- Celestial Arts Contest: photos, songs, poetry, 3-min videos, art

*Day trips on Wednesday, Thursday, Friday dependent on required sign-ups

CALL FOR MATERIAL:

Call for Material for commemorative **"Celebrate Starlight" book and poster.** Will be released at ALCon2012! Submissions extended until **May 15, 2012.**

Kids: *submit drawings for the Moonbounce on Why Stars are Important to You. Include the words "Celebrate Starlight" in your native language. Ages to 17 years old. Deadline* **April 7**.

Celebrate Starlight Book

We invite your astronomy organization to submit one to four pages describing its history. How do you want your association to be remembered? Let your organization's achievements, members & outreach SHINE on these pages!

Celebrate Starlight Poster

This commemorative poster will be a montage of club logos, famous faces, astrophotos and special projects. We invite organizations to send logos and any other pertinent images to have included in this very unusual poster.

What constructed image will the montage represent? Come to ALCon 2012 and find out!

More information and registration:
alcon2012.astroleague.org

Special additions to the program:

- Visual Moonbounce by OPTICKS on July 4! directed by Daniela De Paulis
- *Creation's Birthday*, the play by Hasan Padamsee about Hubble and the birth of the Big Bang Theory

PARTNERS:

ROBERT A. PRITZKER CENTER FOR METEORITICS AND POLAR STUDIES · Field Museum · ADLER PLANETARIUM · ASTRONOMICAL LEAGUE · Fermilab · Yerkes Observatory · Chicago Astronomical Society · ALPO Association of Lunar & Planetary Observers · Lincolnshire Resort Marriott · one star at a time · Astronomers Without Borders · Illinois Coalition for Responsible Outdoor Lighting · RAVINIA FESTIVAL · ida · MWAIC

StarShip Sail – July 5

Registered Tall Ship Windy II, a 149' 4-masted schooner. Evening sail to learn celestial navigation and mythology.

Inside the ALPO
Member, section and activity news

Association of Lunar & Planetary Observers (ALPO)

Board of Directors
Executive Director (Chair); Julius L. Benton, Jr.
Associate Director; Ken Poshedly
Member of the Board; Sanjay Limaye
Member of the Board; Donald C. Parker
Member of the Board; Ken Poshedly
Member of the Board; Michael D. Reynolds
Member of the Board; Richard W. Schmude, Jr.
Member of the Board; John E. Westfall
Member of the Board & Secretary/Treasurer; Matthew Will
Founder/Director Emeritus; Walter H. Haas

Publications
Editor & Publisher, Ken Poshedly

Primary Observing Section & Interest Section Staff
(See full listing in *ALPO Resources*)
Lunar& Planetary Training Section: Timothy J. Robertson
Solar Section: Kim Hay
Mercury Section: Frank Melillo
Venus Section: Julius L. Benton, Jr.
Mercury/Venus Transit Section: John E. Westfall
Lunar Section:
Lunar Transient Phenomena; Anthony Cook
Lunar Meteoritic Impact Search; Brian Cudnik
Lunar Topographical Studies & Selected Areas Program; Wayne Bailey
Mars Section: Roger Venable
Minor Planets Section: Frederick Pilcher
Jupiter Section: Richard W. Schmude, Jr.
Saturn Section: Julius L. Benton, Jr.
Remote Planets Section: Richard W. Schmude, Jr.
Comets Section: Gary Kronk
Meteors Section: Robert D. Lunsford
Meteorites Section: Dolores Hill
Computing Section: Larry Owens
Youth Section: Timothy J. Robertson
Historical Section: Richard Baum
Eclipse Section: Michael D. Reynolds
ALPO Website: Larry Owens

Point of View
The time has come . . .

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

They say that all good things must come to an end. And so it is with my career as editor & publisher of your Journal of the ALPO.

After much soul-searching and considerable thought, I've submitted my notice to the ALPO Board that I will be retiring from this position no later than the completion of Volume 56, No. 4 (Autumn 2014 issue).

Having done this job since early 2001, I believe that the time has come for someone else to put their own personality on our fine Journal.

With our membership including professionals of all kinds worldwide, I believe that surely there are at least several of you who are capable of handling the Journal and wish to do so.

At the very least, we need at least one person to compile a list of what should appear in the next issue, contact the authors of our papers, proofread them and then forward them on to another person who will actually do the publication layout via computer software. You would also make sure the completed files — one version for our web site and another version for our printer to use for producing the hard copy — are handled correctly.

Or, if you're a real hands-on person (like me), you can do it all — your choice. If you're interested, e-mail me at *ken.poshedly@alpo-astronomy.org*

Note that I am not leaving the organization or the hobby. Nor am I doing this out of frustration or anger of any kind. I simply wish to rearrange my priorities to free up more time for me to spend with my family, etc. I will be age 65 in the autumn of 2014 and I just need to let this part of my career pass to someone else.

Of course I will work with anyone who follows in my footsteps for a reasonably long time, if necessary.

Please note that I am in line to follow Julius Benton as executive director, and I plan to do my best during my two years in that office.

By the way, other than a slightly larger midsection, I still look pretty much like that nice guy in the photo taken in the late '90s!

Inside the ALPO
Member, section and activity news

News of General Interest

Venus Transit Reports

With reports still being submitted as this is written (one week after the event), the June 2012 transit of Venus will certainly be noted as one of the most-watched astronomical events.

The event was viewed by everyone from professionals down to amateurs and even the general public, thanks to low-cost or no-cost methods of presenting the solar image safely for individuals or even groups of people to see together.

A formal report of this event is currently being compiled by John Westfall and will be based on the results submitted to him.

if you have not already done so, please send your contact timings, written notes, drawings and images to him via e-mail to *johnwestfall@comcast.net* or regular mail to him at P.O. Box 2447, Antioch, CA 94531-2447 USA.

Regarding the beautiful image by Rik Hill on the front cover of this issue of The Strolling Astronomer, here's Rik's own commentary:

> "Dolores and I did the Venus transit from Mt. Bigelow in the Catalina Mountains north of Tucson where the Sun would set behind Mt. Lemmon. Our 3.5-inch Questar was set up next to the venerable 61-inch Catalina reflector (now the Kuiper telescope). We had a great time, very memorable. This image was done with our Questar as the Sun set with Venus still on the disk."

ALCon 2012 News

Look to the inside back cover of this issue for a full-page ad with the latest info about this summer's next astro get-together when the ALPO joins the Astronomical League in Chicago.

Note that the Midwest Astrophotography and Imaging Conference (MWAIC) will be held in conjunction with ALCon 2012 at the Marriott Lincolnshire Resort near Chicago. Also, one of the keynote speakers will be our own Dr. Donald C. Parker.

ALCon 2012 will be held Wednesday through Saturday, July 4-7, while the MWAIC will be held July 4-6.

The deadline for early registration deadline for the event was June 1. Phone the Marriott directly at 1-888-236-2427 to make your room reservation and be sure to state that you are with the Astronomical League to get this special rate.

Various tours and other items are priced separately.

Register either online at *http://alcon2012.astroleague.org/alcon-2012-2/registration/* or print out the hard copy registration form at *http://alcon2012.astroleague.org/wp-content/uploads/2012/02/General-5.pdf* and pay with check by regular mail.

Visit the official ALCon2012 website for scheduling news and paper presentation times.

ALPO Paper Presentations

The following schedule of paper presentations is hereby published:

Friday, July 6

8 a.m. - The Apparitions of Mercury 2010-2011 by Frank Melillo.

8:30 a.m. - Messenger Images Compared with ALPO Observations by Frank Melillo.

9 a.m. - Early Results of the June 5-6 Transit of Venus by John Westfall.

9:30 a.m. - Observing Saturn and the Great NTrZ Storm of 2010-2011 by Julius Benton.

10 a.m. - Break

Inside the ALPO
Member, section and activity news

10:15 a.m. - Brightness Measurements of Uranus and Neptune by Richard Schmude.

10:45 a.m. - The Rise of the ALPO and How It Succeeded by Matt Will.

Saturday, July 7
8 a.m. - Venus Phase and Twilight Arc by Richard Schmude.

8:30 a.m. - Venus Exploration: Current Missions and Future Prospects by Sanjay Limaye.

9 a.m. - White Oval Storms on Jupiter by Richard Schmude.

9:30 a.m. - The Terminator Clouds On Mars by Roger Venable.

10 a.m. - Break

10:15 a.m. - Mars in 2011-2012 by Richard Schmude.

Venus Volcano Watch

By Michael F. Mattei
micmattei@comcast.net

Beginning on 05 February, 2012 the watch begins with the volcanoes on the bright limb of the planet. Contact me directly at the e-mail address above for a list of times to be watching Venus for cloud activity both on the terminator and on the bright sun lit side. Watch for a bulge on the terminator where the up lifted sun lit clouds would show on the dark side of the terminator, and on the sun lit side watch for bulges of circular cloud formation like the tops of cumulus clouds. There are three volcanoes that are believed to be active, they are, Maat Mons, Ozza Mons and Sapas Mons. All three are near the equator centered near CM 165.

From research of cloud formations and bright clouds on the dark side of the terminator and circular sun lit clouds on the bright side it may be possible to determine if a volcano has erupted. A correlation of these observations can be made to locate volcanoes on the surface of Venus. Observations should be made at all times because there may be many more volcanoes that could be active.

I would be happy to receive observations, drawings, sketches, CCD images. Please be sure the time is in UT and the location of the observer.

See JALPO51, No. 1, page 21 for an article of the events and what they look like. You can find the article by going to http://www.alpo-astronomy.org/djalpo/51-1/JALPO51-1%20-%20Free.pdf

ALPO Interest Section Reports

Web Services

Larry Owens, section coordinator
Larry.Owens@alpo-astronomy.org
Follow us on Twitter, become our friend on FaceBook or join us on MySpace.

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

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

Computing Section

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

Important links:

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

Lunar & Planetary Training Program

Tim Robertson, Section Coordinator
cometman@cometman.net

For information on the ALPO Lunar & Planetary Training Program, go to www.cometman.net/alpo/; regular postal mail to Tim Robertson, 195 Tierra Rejada Rd. #148, Simi Valley CA, 93065; e-mail to cometman@cometman.net

ALPO Observing Section Reports

Mercury / Venus Transit Section

John Westfall, section coordinator
johnwestfall@comcast.net

Well, it's happened - the last transit of Venus across the face of the Sun for 105 years. We welcome your observations of the June 5-6, 2012, transit of Venus; if you have not already done so, please send your contact timings, written notes, drawings and images to John Westfall at either johnwestfall@comcast.net or at P.O. Box 2447, Antioch, CA 94531-2447 USA.

Although there will not be another transit of Venus until 2017, the more frequent transits of Mercury will continue, with the next two taking place in just a few years; 2016 and 2019. We also will be happy to receive observations of those events.

Inside the ALPO
Member, section and activity news

Annular eclipse digital image by Michael D. Reynolds, taken 21 May 2012 at 1:39 UT, in Page, Arizona, USA. Equipment: Explore Scientific 80mm ED APO (refractor) equipped with a Baader Glass filter; image taken with a Canon EOS 5D Mark II, Photoshop processed: unsharp masking and noise reduction. Imaging details: 1/1000 second at ISO 100; multiple images taken; both seeing and transparency were top of the scale on both!

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

Eclipse Section

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

With the 20 May 2012 Annular Solar Eclipse now history, I invite all to submit eclipse reports. These can include photos, timings and any other observations you may have made during the eclipse.

Electronic submissions are encouraged (see my e-mail address above at the beginning of this report).

Images too large for an e-mail attachment can be sent either via yousendit.com or on DVD or other media to my regular mail address (below).

Dr. Mike Reynolds
Florida State College at Jacksonville
3939 Roosevelt Blvd
Jacksonville FL 32205

A full report on observations submitted will be prepared for both this Journal and the ALPO website. Reports on the 4 June 2012 partial lunar eclipse would also be welcomed.

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

Meteors Section

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

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

Meteorites Section

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

This past quarter, the ALPO Meteorites Section received a request from the International Meteorite Collectors Assn (IMCA) to post an edited version of our "Aims and Goals of the New Meteorite Section of the ALPO: Bringing the Solar System Closer to Home" in their May 2012 "Insights Newsletter" as "Introduction to Meteorites". We hope to collaborate with the IMCA in the future.

We have plans to post a short slide show called "Meteorites: A Pictorial History of the Solar System," to the ALPO website that includes a variety meteorite images from the microscope with brief audio descriptions. Meteorite aficionados will be inspired to dust off their micro-scopes on cloudy nights and look more closely at their specimens from minor planets.

A great deal of interest was generated by the "Sutter's Mill" daylight meteorite fall that occurred April 22, 2012 in northern California. Radar observations by Marc Fries, Robert Matson and others enabled Robert Ward to recover the first small stone on April 24.

Hundreds of persons searched the area for more fragments of this rare carbonaceous meteorite. Although Bill Cooke of NASA-Marshall Spaceflight Center estimated the pre-atmospheric mass of the meteoroid was 70 metric tons, less than 500 *grams* have been recovered so far. New finds should be reported online to Petrus.M.Jenniskens@nasa.gov so a complete record can be maintained.

Thankfully, several individuals donated or loaned samples of this important meteorite to research institutions and to NASA's OSIRIS-REx asteroid sample return mission for study. This is an area where meteorite finders can make an invaluable contribution to science.

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

Comets Section

Gary Kronk, section coordinator
kronk@cometography.com

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

Solar Section

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

Two great events for our solar aficionados to brag on in this report. For those who take note of such things, the transit of Venus was across the face of our Sun in Carrington Rotation 2124. The accompanying image by Jerry Fryer shows not only Venus, but the many sunspot groups that indicate the dynamics of the Sun. Truly impressive. [The image was taken using TV102 Baader Herschel wedge CP4500 afocal method.]

The next time Venus transits the Sun will be in December 2117 and again eight

Inside the ALPO
Member, section and activity news

years later in December 2125. There are many images from SOHO *http://sohowww.nascom.nasa.gov/* and SDO *http://sdo.gsfc.nasa.gov/* that showed spectacular images from outside our atmosphere.

And previous to the Venus transit was an annular eclipse of the Sun on May 20 for observers in eastern Asia to the central United States.

Over the past several months, several sunspots (AR1429, AR1462) produced several C and M class flares which have produced several auroral activity sightings.

With us more than halfway through Cycle 24 – which will peak in 2013 – the Sun has put on some fine displays of sunspots and groups. There have been no days in 2012 when the Sun has been without sunspots.

Keep up to date on solar information and images from observers though the ALPO Solar Section Yahoo group at *http://groups.yahoo.com/group/Solar-ALPO/* There are currently 313 members on the list.

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

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

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

Solar image by Jerry Fryer. See Solar Section report for details.

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

Mercury's section has been slow in 2012, but I am hoping many ALPO members will point their telescopes toward this tiny planet. The MESSENGER spacecraft mission is extended one more year, until 2013. Scientists are still receiving spectacular images of the surface. The "former Skinakas Basin" Solitudo Aphrodites is beginning to emerge and it is believed to be the darkest feature on Mercury. I am beginning to feel that I was on the right track since 2001, that the albedo feature Solitude Aphrodites is detectable from Earth. There is more about this in the featured ALPO issue.

Venus has been getting attention lately regarding its June 2012 transit. As I wrote this, I missed the transit due to bad weather. I hope many of you had successfully observed Venus silhouetting against the Sun. Regardless if you were clouded out or did observe the transit,

Inside the ALPO
Member, section and activity news

you might ask yourself, "OK, when is the next one?"

Unfortunately, I don't think anyone alive today will see the next Venus transit in December 2117. Perhaps, I would say only a few babies that are born today may be lucky to live past 100 years old and be around for the next one.

But don't forget there are TWO inner planets that can cross the face of the Sun, so take heart because you will have the opportunity to witness another planetary transit in less than four years from now on May 9, 2016. This time it will be Mercury. It is not as rare as a Venus transit, but it can be observed the same way. The only difference is it will be smaller, thus not visible without a filtered telescope or at least filtered binoculars. I observed a Mercury transit only once, and that was in November 1973. I am sure many of you and as well as myself look forward for the next one that will be visible in USA. (Editor's Note: A quick online search indicates the transit will begin at 11:12 UT and end at 18:42 UT; and be visible in its entirety from the eastern North America.)

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

Venus Section

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

A report on Venus during its 2006-2007EE apparition appears later in this issue.

In late May 2012, Venus was situated in the western sky after sunset at apparent visual magnitude -4.1, rapidly approaching Inferior Conjunction with the Sun June 5th. During the 2011-12 Eastern (Evening) Apparition, Venus had passed through its waning phases (a progression from fully illuminated through crescentic phases) as observers witnessed the leading hemisphere of Venus at the time of sunset on Earth. Right now (late May), the narrow crescent of Venus is 57.4" across and 0.1.1% illuminated. The following Geocentric Phenomena in Universal Time (UT) are presented for the convenience of observers for the current and upcoming apparitions.

The tables of Geocentric Phenomena in Universal Time (UT) for both the 2011-12 Eastern (Evening) Apparition and the 2012-13 Western (Morning) Apparition

Inside the ALPO
Member, section and activity news

are presented here for the convenience of observers.

Observers have contributed well over 350 images and drawings for the 2011-12 Eastern (Evening) Apparition, including many high-quality digital images of the planet taken in the near-UV and near-IR, as well as other wavelengths through polarizing filters.

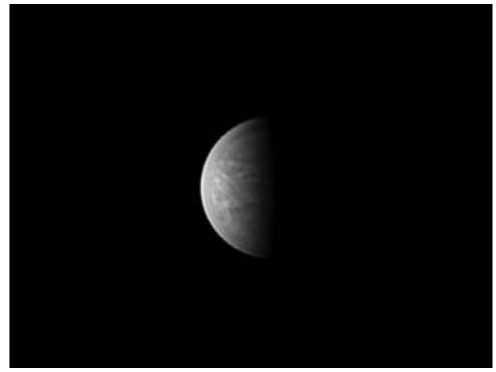
Such observations continue to be needed by the Venus Express (VEX) mission, which started systematically monitoring Venus at UV, visible (IL) and IR wavelengths back in May 2006. This Professional-Amateur (Pro-Am) effort continues, and observers should submit images to the ALPO Venus Section as well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

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

Regular Venus program activities (including drawings of Venus in Integrated Light and with color filters of known transmission) are also valuable throughout the period that VEX is observing the planet; the mission is currently funded by European Space Agency until December 31, 2014. Since Venus has a high surface brightness, it is potentially observable anytime it is far enough from the Sun to be safely observed.

By the time this report appears in the JALPO, the current apparition will have ended, ushering in the 2012-13 Western (Morning) Apparition, when Venus will pass through its waxing phases (a progression from crescent through gibbous phases). To avoid atmospheric dispersion and bad seeing near the horizon, an advantage in 2012-13 will be the opportunity to wait until Venus gains altitude in the eastern sky before sunrise even though the background sky will gradually brighten. Nevertheless, the planet is rather easy to track into daylight, affording excellent views when most of the prevailing glare associated with the planet is gone or reduced.

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



Beautifully detailed UV image of the planet Venus by Daniele Gasparri of Perugia, Italy, submitted this photo taken on March 16, 2012, at 13:45 UT (about two weeks prior to theoretical dichotomy) using a 35.6 cm (14 in.) SCT. There is considerable detail the disc of the planet. S = 8.0, Tr = good (no numerical value assigned). Apparent diameter of Venus is 21.3", phase (k) 0.567 (56.7% illuminated), and visual magnitude 4.3. South is at top of image.

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

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

Geocentric Phenomena of the 2011-2012 Eastern (Evening) Apparition of Venus in Universal Time (UT)

Superior Conjunction	2011	Aug 16 (angular diameter = 9.6 arc-seconds)
Greatest Elongation East	2012	Mar 27 (46º east of the Sun)
Predicted Dichotomy	2012	Mar 29.34 (exactly half-phase)
Greatest Brilliancy	2012	Apr 28 ($m_v = -4.6$)
Inferior Conjunction	2012	Jun 06 (angular diameter = 58.3 arc-seconds)

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

Inferior Conjunction	2012	Jun 06 (angular diameter = 58.3 arc-seconds)
Greatest Brilliancy	2012	Jul 11 ($m_v = -4.6$)
Greatest Elongation West	2012	Aug 15 (46º east of the Sun)
Predicted Dichotomy	2012	Aug 15.18 (exactly half-phase)
Superior Conjunction	2013	Mar 28 (angular diameter = 9.8 arc-seconds)

Founded in 1947

Inside the ALPO
Member, section and activity news

Lunar Calendar for the Third Quarter of 2012 - All Times in UT

July 01	18:02	Moon at Perigee (362,361 km – 225,161 miles)
July 02	03:36	Extreme South Declination
July 03	13:00	Moon 0.99 Degrees SSE of Pluto
July 03	18:51	Full Moon
July 07	09:00	Moon 5.8 Degrees NNW of Neptune
July 10	04:00	Moon 5.0 Degrees NNW of Uranus
July 11	01:48	Last Quarter
July 13	16:48	Moon at Apogee (404,782 km – 251,520 miles)
July 15	02:00	Moon 0.81 Degrees WNW of Jupiter
July 16	01:18	Extreme North Declination
July 16	17:00	Moon 3.9 Degrees N of Venus
July 19	04:53	New Moon (Start of Lunation 1108)
July 24	21:00	Moon 4.0 Degrees S of Mars
July 25	17:00	Moon 5.7 Degrees S of Saturn
July 26	08:56	First Quarter
July 29	08:31	Moon at Perigee (367,317 km – 228,240 miles)
July 29	12:12	Extreme South Declination
July 30	22:00	Moon 1.3 Degrees SE of Pluto
Aug. 02	03:26	Full Moon
Aug. 03	19:00	Moon 5.7 Degrees NNW of Neptune
Aug. 06	14:00	Moon 4.8 Degrees NNW of Uranus
Aug. 09	18:56	Last Quarter
Aug. 10	10:53	Moon at Apogee (404,124 km – 251,111 miles)
Aug. 11	22:00	Moon 0.68 Degrees E of Jupiter
Aug. 12	09:48	Extreme North Declination
Aug. 13	21:00	Moon 0.90 Degrees ENE of Venus
Aug. 16	02:00	Moon 3.4 Degrees SSW of Mercury
Aug. 17	15:53	New Moon (Start of Lunation 1109)
Aug. 22	00:00	Moon 5.2 Degrees SSW of Saturn
Aug. 22	05:00	Moon 2.4 Degrees SW of Mars
Aug. 23	19:40	Moon at Perigee (369,730 km – 229,740 miles)
Aug. 24	13:54	First Quarter
Aug. 25	18:42	Extreme South Declination
Aug. 27	01:00	Moon 0.88 Degrees SSW of Pluto
Aug. 31	01:00	Moon 5.6 Degrees NNW of Neptune
Aug. 31	13:57	Full Moon
Sept. 02	22:00	Moon 4.7 Degrees NNW of Uranus
Sept. 07	06:01	Moon at Apogee (404,295 km – 251,217 miles)
Sept. 08	10:00	Moon 0.70 Degrees SSW of Jupiter
Sept. 08	13:15	Last Quarter
Sept. 08	18:12	Extreme North Declination
Sept. 09	07:00	Moon 1.0 Degree NW of asteroid 1-Ceres
Sept. 12	16:00	Moon 3.6 Degrees S of Venus
Sept. 13	09:00	Comet Gehrels-2 0.75 Degrees ESE of Moon
Sept. 16	02:09	New Moon (Start of Lunation 1110)
Sept. 16	12:00	Moon 5.5 Degrees SSW of Mercury
Sept. 18	12:00	Moon 4.8 Degrees SSW of Saturn
Sept. 19	02:53	Moon at Perigee (365,748 km – 227,265 miles)
Sept. 19	22:00	Moon 0.83 Degrees ESE of Mars
Sept. 22	00:12	Extreme South Declination
Sept. 22	19:41	First Quarter
Sept. 23	06:00	Moon 1.1 Degrees WSW of Pluto
Sept. 27	06:00	Moon 5.8 Degrees NNW of Neptune
Sept. 30	02:00	Moon 4.7 Degrees NNW of Uranus
Sept. 30	03:17	Full Moon

Table courtesy of William Dembowski

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

A paper about the believe by William H. Pickering of life on the Moon appears later in this issue.

The ALPO Lunar Topographical Studies Section (ALPO LTSS) received a total of 151 new observations from 15 observers during the January-March quarter. These included 11 Banded Crater program observations, two Ray observations, and full-disk images highlighting various classes of features from Howard Eskildsen. In addition, four contributed articles were published.

The" Focus-On" series in *The Lunar Observer* newsletter continued with articles on Copernicus and Archimedes.

Upcoming Focus-On subjects include the Pyrenees Mountains, Bullialdus, and Aristillus.

Visit the following online web sites for more info:

- The Moon-Wiki: *the-moon.wikispaces.com/Introduction*
- Chandrayaan-1 M3: *pds-imaging.jpl.nasa.gov/portal/chandrayaan-1_mission.html*
- LROC: *lroc.sese.asu.edu/EPO/LROC/lroc.php*

Inside the ALPO
Member, section and activity news

- ALPO Lunar Topographical Studies Section *moon.scopesandscapes.com/alpo-topo*
- ALPO Lunar Selected Areas Program *moon.scopesandscapes.com/alpo-sap.html*
- ALPO Lunar Topographical Studies *moon.scopesandscapes.com/alpo-topo*
- The Lunar Observer (current issue) *moon.scopesandscapes.com/tlo.pdf*
- The Lunar Observer (back issues) *moon.scopesandscapes.com/tlo_back.html*
- Banded Craters Program: *moon.scopesandscapes.com/alpo-bcp.html*
- The Lunar Discussion Group: *tech.groups.yahoo.com/group/Moon-ALPO/*

Lunar Meteoritic Impacts

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

Dr. Anthony Cook,
Program Coordinator
tony.cook@alpo-astronomy.org

Nine Lunar Transient Phenomena (LTP) observations have come to light since the last LTP report and have been assigned weights on a scale of 1 (slight chance of being an LTP) to 5 (unquestionably a LTP).

Further details, including images, about these LTP can be found in *The Lunar Observer* (TLO) newsletters from December 2011 to July 2012.

- October 3rd 2011 UT 21:00-21:20 Francis Power (Meath, Ireland) observed visually, near the terminator, a crater rim to be changing color: blue, white and red. Eyepieces swapped and there was independent confirmation of effect using same scope. Images were taken and one showed orange on the W rim of Apianus D but not elsewhere. Tests rule out obvious spectral dispersion. However as the Moon was only 6°-4° above the horizon, the LTP has been given a precautionary weight of 1.
- October 7th 2011 UT 21:45 Peter Grego (St Dennis, UK) observed visually a faint point of light inside shadow filled Gassendi, two thirds of the way out from where the central peaks should have been, towards the SE rim. The effect was not seen later, but due to observer uncertainty a weight of 1 is assigned.
- 2011 December 31st 2011 UT 16:39-17:30 Raffaello Braga (Milan, Italy) observed visually that the N rim of Torricelli was bright at the start, but had dimmed by 17:00. Due to seeing conditions, and use of a small scope, a weight of 1 is assigned.
- January 9th 2012 UT 21:01-21:06 Nick Hazel (Beverley, UK) imaged a grey column like effect across the floor and onto on the E rim of Hahn clearly on one image and hinted at on others. Could image resolution/ noise and seeing be a cause? Weight=1.
- January 30th 2012 UT16:30-16:40 Lajos Bartha (Budapest, Hungary) saw that Aristarchus was bright in Earthshine, but Copernicus was weak. The previous night both craters were weak. A precautionary weight of 1 is assigned.
- February 28th 2012 UT19:45-20:00 Raffaello Braga (Milan, Italy) found that the central peak of Maurolycus, was visible in red but not in blue light. Weight=2.
- March 28th 2012 UT 21:40-21:51 Peter Grego (St Dennis, UK) observed a patch of light just inside the NW rim of Menelaus on the shadowed wall or floor. Attempts to find this in similar illumination images have so far failed. Weight=3.
- May 25th UT 05:35 Maurice Collins (Palmerstone North, New Zealand) recorded in one image out of 108, a light spot just outside the W illuminated rim of Brenner F. Two non-lunar explanations have been suggested, but not proved. Weight=1.
- May 26 UT 21:21 Jim Moeller (Syracuse, NY, USA) recorded an image of a bright spot on the dark SW limb of the Moon. There could be some non-lunar explanations for this, but these remain unproven as yet. Weight=1.

Dates and UTs on which to see features under similar illumination conditions to past LTPs, can be found at *http://users.aber.ac.uk/atc/tlp/tlp.htm*

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

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

Mars Section

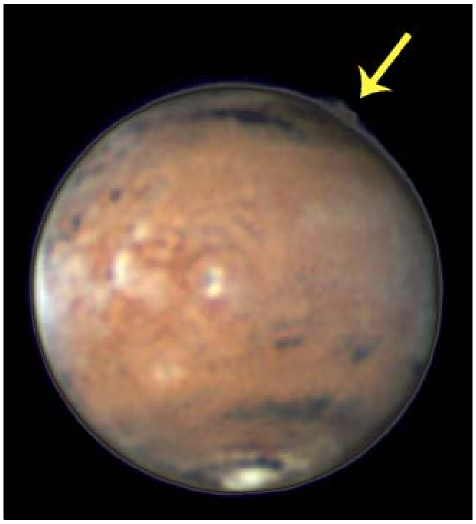
Roger Venable, section coordinator
rjvmd@hughes.net

These days, it is rare for an amateur to identify a planetary phenomenon that has never before been detected. But that is exactly what Wayne Jaeschke has done.

On his images of March 20, he spied a high cloud on the sunrise terminator in the southern hemisphere of Mars (Figure 1.) He immediately informed the ALPO

Inside the ALPO
Member, section and activity news

Mars Section of his finding, and a number of other observers were able to image it in the next few weeks. ALPO



One of Wayne Jaeschke's discovery images, taken on March 20, 2012, at 02:34 UT, with central meridian (CM) of 144°. This image has been significantly enhanced to bring out the terminator irregularity created by the high terminator cloud, which is marked by the arrow. A composite of red, green, and blue images taken with a Schmidt-Cassegrain telescope of 14 in. (356 mm) aperture.

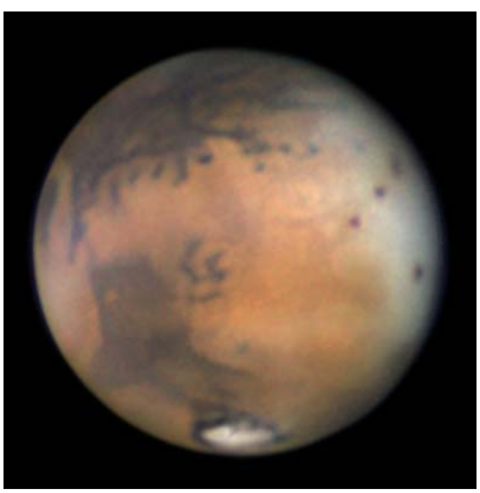


Image by Damian Peach taken March 19, 2012, at 21:28 UT, with CM = 69°. Schmidt-Cassegrain telescope of 14 in. (356 mm) aperture, composite of red, green and blue filtered images.

Mercury Section Coordinator Frank Melillo even found it on an image he had taken the previous night (March 19).

The surface of a planet near the terminator is always poorly lit and appears dark in images, while this cloud was in direct sunlight above the terminator, giving the appearance of a projection beyond the terminator.

At this time in Mars's seasonal cycle, the planet has many clouds of various types, to which Wayne has added a new type. In the last several months, the cloudiness of Mars has been well documented by many observers. Among the best depictions of the clouds is this one by Damian Peach (Figure 2,) in which Olympus Mons and the Tharsis Montes protrude above the cloud banks on the right (western) side of the image, to be seen as dark spots against the light background.

Mars is now past its prime, in the western sky at sunset. Nevertheless, many observers are still documenting its changing cloud patterns and the shrinking residua of the North Pole's seasonal ice cap.

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

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

Minor Planets Section

Frederick Pilcher,
section coordinator
pilcher@ic.edu

The following results are the highlights of Minor Planet Bulletin Vol. 39, No. 2, 2012 April-June. Small asteroids with long rotation periods often show, in addition to rotation about the principal axis, tumbling about an axis perpendicular to the principal axis. For these the time for relaxation to pure principal axis rotation can be longer than the age of the solar system. A consortium led by Julian Oey publish for 1278 Kenya publish their finding of a primary period of 188 hours, amplitude 0.8 magnitudes, with a superimposed 122 hour, 0.2 magnitude variation caused by tumbling. Brian Warner also publishes tumbling behavior for the even smaller Hungaria type asteroids (6461) 1993 VB5, (14764) 7072 P-L, and (36316) 2000 LC12, although with less well defined parameters.

Several new studies have provided reliable and accurate values of the absolute magnitude H at 1 AU from both Earth and Sun and zero phase angle, and a parameter G which defines the magnitude change at increasing phase angle.

These have been obtained for 1077 Campanula by Lorenzo Franco and Andrea Ferrero; for 1151 Ithaka by Franco, Ferrero, and Russel Durkee; and for 1188 Gothlandia by Ronald Baker, Frederick Pilcher, and Daniel A. Klinglesmith III.

Lightcurves with derived rotation periods are published for 131 other asteroids, numbers 31, 65, 92, 154, 177, 180, 200, 413, 555, 613, 724, 802, 833, 880, 918, 962, 964, 970, 971, 987, 1020, 1028, 1082, 1097, 1123, 1133, 1145, 1178, 1253, 1256, 1470, 1525, 1688, 1718, 1771, 1786, 1940, 1946, 1987, 2015, 2130, 2177, 2324, 2423, 2573, 2632, 2731, 2840, 3015, 3033, 3080, 3229, 3260, 3343, 3419, 3438, 3523, 3751, 3880, 3910, 4172, 4217, 4274, 4339, 4433, 4456, 4482, 4600, 4713, 4729, 4868, 4898, 5042, 5384, 5425, 5426, 5427, 5483, 5486, 5560, 6029, 6042, 6192, 6306, 6382, 6485, 6646, 6699, 6746, 6823, 6901, 7750, 7829, 8497, 9143, 10046, 10133,

Inside the ALPO
Member, section and activity news

10707, 12045, 12453, 14982, 15585, 16681, 16686, 16959, 19251, 20699, 23143, 24260, 26287, 28553, 30019, 32753, 34817, 46037, 59926, 63633, 71734, 84890, 96253, 105844, 106620, 114086, 114367, 134507, 138666, 178734, 203095, 303013, 2000 YA, 2005 YU55.

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

The *Minor Planet Bulletin* is a refereed publication and that it is available online at *http://www.minorplanet.info/mpbdownloads.html*. Annual voluntary contributions of $5 or more in support of the publication are welcome.

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

Jupiter Section

Richard W. Schmude, Jr., section coordinator
schmude@gdn.edu

A report on Jupiter during its 2010-2011 apparition appears later in this issue.

Since a tutorial last February by ALPO member Theo Ramakers of Oxford, Georgia (near Atlanta) on how to use WinJupos, I have been using this software package to measure the size and location of several features on Jupiter. I am currently working on the 2011-2012 Jupiter apparition report and plan to submit this report on about July 1, 2012 for publication in this Journal. This will be my first report based on measurements obtained from my use of the WinJupos program.

Tony Mallama and the writer compiled a paper about Jupiter's brightness over the last 49 years. This paper has been accepted for publication in the American Astronomical Society journal *Icarus*; we expect publication in or shortly after September 2012.

I believe that the biggest event on Jupiter during the 2011-2012 apparition was the changing North Equatorial Belt (NEB). During early 2012, the NEB reached a width of just four to five degrees of latitude, less than half of its average width. Please keep up the good observations.

Please continue making images of Jupiter. I am also interested in methane band images and visual intensity estimates.

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

Galilean Satellite Eclipse Timing Program

John Westfall, program coordinator
johnwestfall@comcast.net

By the time you read this, Jupiter will have become visible in the predawn sky and its 2012-2013 Apparition is underway. We have placed a schedule of Galilean satellite eclipses for 2012-2013 on the Jupiter page of the ALPO website which also provides observing instructions and an observation reporting form. Go to *http:www.alpo-astronomy.org*

Note that the somewhat unusual series of Europa eclipse disappearance-reappearance pairs is continuing, with these events taking place from 2012 Aug 06-Oct 05 and 2013 Feb 03-Mar 25.

There are 18 remaining occurrences when we will be able to see these complete (beginning and ending) eclipses of Europa during the time period 2012 August 06 thru Oct 05.

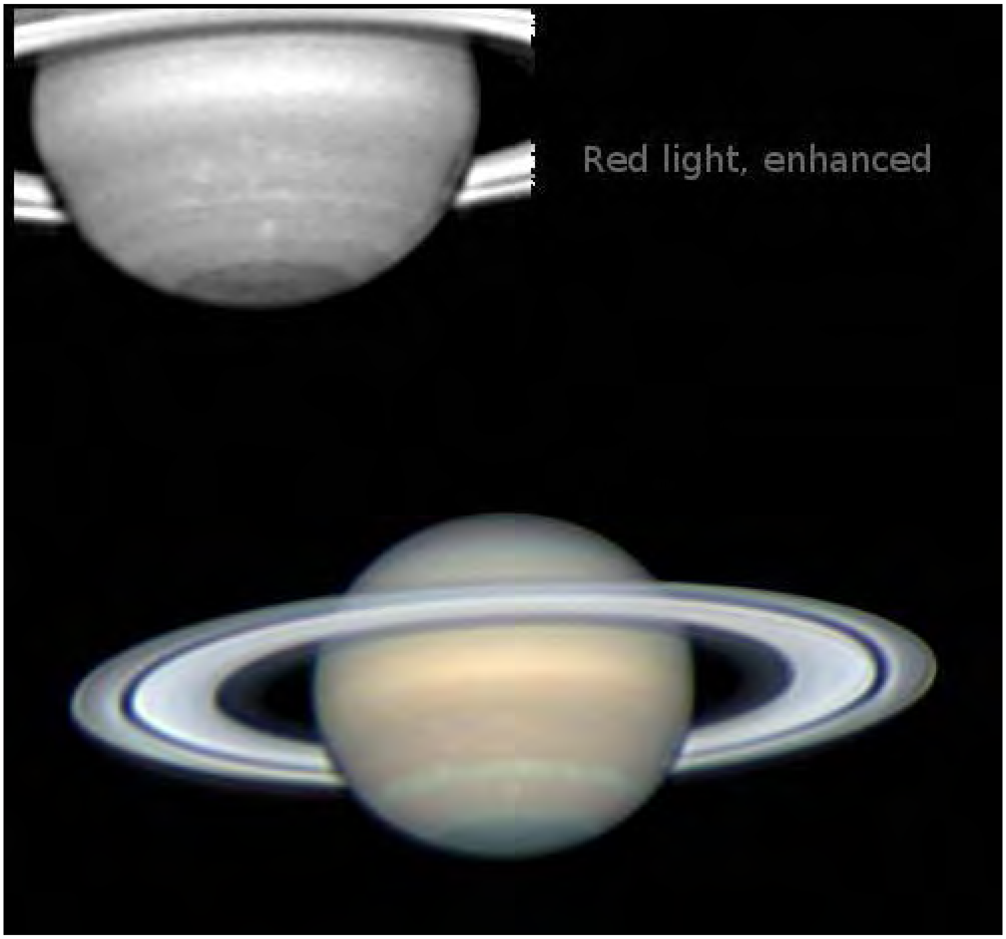
As stated in previous reports for this ALPO observing section, three circumstances have come together to allow us to view something we see only rarely – both the beginnings and endings of the same eclipses of Europa. For the great majority of the time, we can see only disappearances of the satellite before opposition, and only reappearances after opposition (indeed, some literature incorrectly states that this is always the case).

The first condition that helps create this series of events is that Jupiter is closer than average to the Sun, having reached perihelion on 2011 March 17 (4.9494 AU from the Sun). The second situation is that the Earth is well north of Jupiter's equator (and thus the orbital planes of the Galilean satellites; 3.89° north on 2011 October 01). Finally, the Sun also is north of the Jupiter's equator (3.57° north on 2012 March 10). This allows us to peek past the planet and, before opposition, see both eclipse

Completely Visible Eclipses of Europa by Jupiter, 2012

Series 3 (18 eclipses)		
TT Date	Begin	End
Aug 06	hh mm 07 28	hh mm 09 51
Aug 09	20 45	23 08
Aug 13	10 02	12 25
Aug 16-17	23 19	01 42
Aug 20	12 36	14 59
Aug 24	01 53	04 16
Aug 27	15 10	17 33
Aug 31	04 27	06 50
Sep 03	17 44	20 07
Sep 07	07 01	09 24
Sep 10	20 18	22 41
Sep 14	09 35	11 58
Sep 17-18	22 52	01 15
Sep 21	12 09	14 32
Sep 25	01 26	03 49
Sep 28	14 43	17 06
Oct 02	04 00	06 24
Oct 05	17 18	19 41

Inside the ALPO
Member, section and activity news



Recent digital image showing the appearance of the NTrZ region in the aftermath of the impressive storm discovered last year. The bright storm remnants quite noticeably still encircle the globe of Saturn at this latitude, but continuing to fade in overall prominence. Accompanying image was taken on April 12, 2012 at 16:38UT (three days before opposition) by Anthony Wesley observing from Australia using a 36.8 cm (14.5 in) Newtonian in visible light (RGB) and red wavelengths in good seeing. Notice how the NNTrZ white spot is particularly prominent in red light as well as other discrete whitish features in the Northern hemisphere of the planet. Apparent diameter of Saturn's globe is 19.0" with a ring tilt of +13.8º. CMI = 299.2°, CMII = 26.7°, CMIII = 311.3°. S is at the top of the image.

disappearances and reappearances; the last very close to Jupiter's limb. After opposition, we have the opposite, with the disappearances next to Jupiter's limb and the reappearances well away from the planet.

Geocentric Phenomena for the 2011-2012 Apparition of Saturn in Universal Time (UT)	
Conjunction	2011 Oct 13^d
Opposition	2012 Apr 15^d
Conjunction	2012 Oct 25^d
Opposition Data:	
Equatorial Diameter Globe	19.0 arc-seconds
Polar Diameter Globe	16.9 arc-seconds
Major Axis of Rings	43.0 arc-seconds
Minor Axis of Rings	28.6 arc-seconds
Visual Magnitude (m_v)	0.2 m_v (in Virgo)
B =	+13.7º

We hope that some of our readers will watch and time some of these events. (Normally, we must time Europa's eclipse reappearances months after we time its disappearances.) The table that accompanies this report gives the dates and terrestrial times (TT) of these events. (Subtract about one minute to convert TT to UT.)

We invite new and potential observers to participate in this ongoing ALPO visual observing program.

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

Inside the ALPO
Member, section and activity news

Saturn Section

Julius Benton, section coordinator
jlbaina@msn.com

Saturn, at apparent visual magnitude +0.5 at the end of May, passed opposition to the Sun on April 15th and is well-placed for observing most of the night from middle northern latitudes The planet's northern hemisphere and north face of the rings are now visible as the ring tilt toward Earth increases throughout the next several years, with regions south of the rings becoming progressively less favorable for viewing. Right now, the rings are inclined about +13.0 towards Earth.

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

Observers have been submitting impressive images of the planet since earlier in the apparition, calling attention to remnants of the massive white storm in the region of Saturn's North Tropical Zone (NTrZ) that became so prominent during the 2010-11 observing season. Indeed, it was the brightest feature seen on the planet in for over a decade, showing considerable brightening over time, then undergoing rapid evolution and differentiation into bright and dusky structures along its length eventually encircling the entire planet.

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

For example, a tiny white spot appeared on submitted images near the North North Tropical Zone (NNTrZ) during mid-April, followed by sporadic occurrences of what appeared to be discrete transient white and dark features at various locations in the north.

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

So far, the small NNTrZ white spot has been presumably below the threshold of visual detection. Continued consistent digital imaging at visual, infrared, UV, and methane (CH_4) wavelength bands is particularly important.

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

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

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

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

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

Remote Planets Section

Richard W. Schmude, Jr., section coordinator
schmude@gdn.edu

Fifteen people submitted observations of the remote planets (Uranus, Neptune and Pluto) during 2011 and early 2012. Additional people submitted their observations to the "ALPO Japan Latest" and the "Arkansas Sky Observatory" websites.

The writer has finished a first draft of the 2011-2012 Remote Planets Apparition Report. Both Uranus and Neptune were one to two percent brighter in late 2011 than in late 2010.

High quality infrared images of Uranus show irregularities on that planet. David Gray also submitted some high quality drawings of Uranus. Frank Melillo used unfiltered CCD images to measure Pluto's brightness and reports that as Pluto rotates, its brightness changes by 0.2 stellar magnitudes. This is much lower than the corresponding value in 2000.

We need measurements of Pluto's brightness using standard V and R filters. Only in this way can we measure its albedo.

Uranus and Neptune will be visible in the early morning hours during July and August. By late August, Neptune will also be visible in the late evening. Pluto will reach opposition at the end of June and should be visible for most of the night. Due to its southerly declination, observers in the southern hemisphere will get the best view of Pluto.

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

Visit the ALPO Remote Planets Section online at *http://www.alpo-astronomy.org/remote*.

Feature Story: Venus

ALPO Observations of Venus During the 2006-2007 Eastern (Evening) Apparition

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

An ALPO Venus Section Observing Report Form is located at the end of this report.

Abstract

Thirty-three observers from the United States, Canada, France, Germany, Japan, United Kingdom, Italy, and The Netherlands contributed digital images and visual observations (drawings and descriptive reports) to the ALPO Venus Section during the 2006-07 Eastern (Evening) Apparition. This report summarizes the results of the 426 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, including imaging of the dark side of Venus in the near-IR.

Introduction

The ALPO Venus Section received 426 observations for the 2006-07 Eastern (Evening) Apparition, comprised of visual drawings, descriptive reports, and digital images from thirty-three observers residing in the United States, Canada, France, Germany, Japan, United Kingdom, Italy, and The Netherlands. Geocentric phenomena in Universal Time (UT) for this observing season are given in *Table 1*, while *Figure 1* shows the distribution of observations by month during the apparition. *Table 2* gives the location where observations were made, the number of observations submitted, and the telescopes utilized.

Observational coverage of Venus throughout this apparition was very good, with several observers beginning their studies of the planet very early, just a few days after Superior Conjunction on October 27, 2006. The observing season on which this report is based ranged from November 3, 2006 through August 17, 2007, with 89.0% of the observations occurring from March through July 2007. A few observers continued to follow Venus up to within a day of Inferior Conjunction on August 18, 2007. All observers should make it their goal to carry out systematic observations of Venus when seeing conditions permit from conjunction to conjunction, and the ALPO Venus Section is quite fortunate to have a growing team of persistent, dedicated observers who have tried very hard to do that in recent observing seasons. For the 2006-07 Eastern (Evening) Apparition of Venus, the planet passed through maximum elongation from the Sun (45.0°), dichotomy, and greatest brilliancy ($-4.7m_v$).

Figure 2 shows the distribution of observers and contributed observations by nation of origin for this apparition, where it can be seen that slightly less than half (45.5%) of the participants in

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.

our programs were located in the United States. They accounted for only 37.8% of the total observations, however. Continued strong international cooperation took place during this observing season, and the ALPO Venus Section seeks to develop an even wider global team of observers in the future.

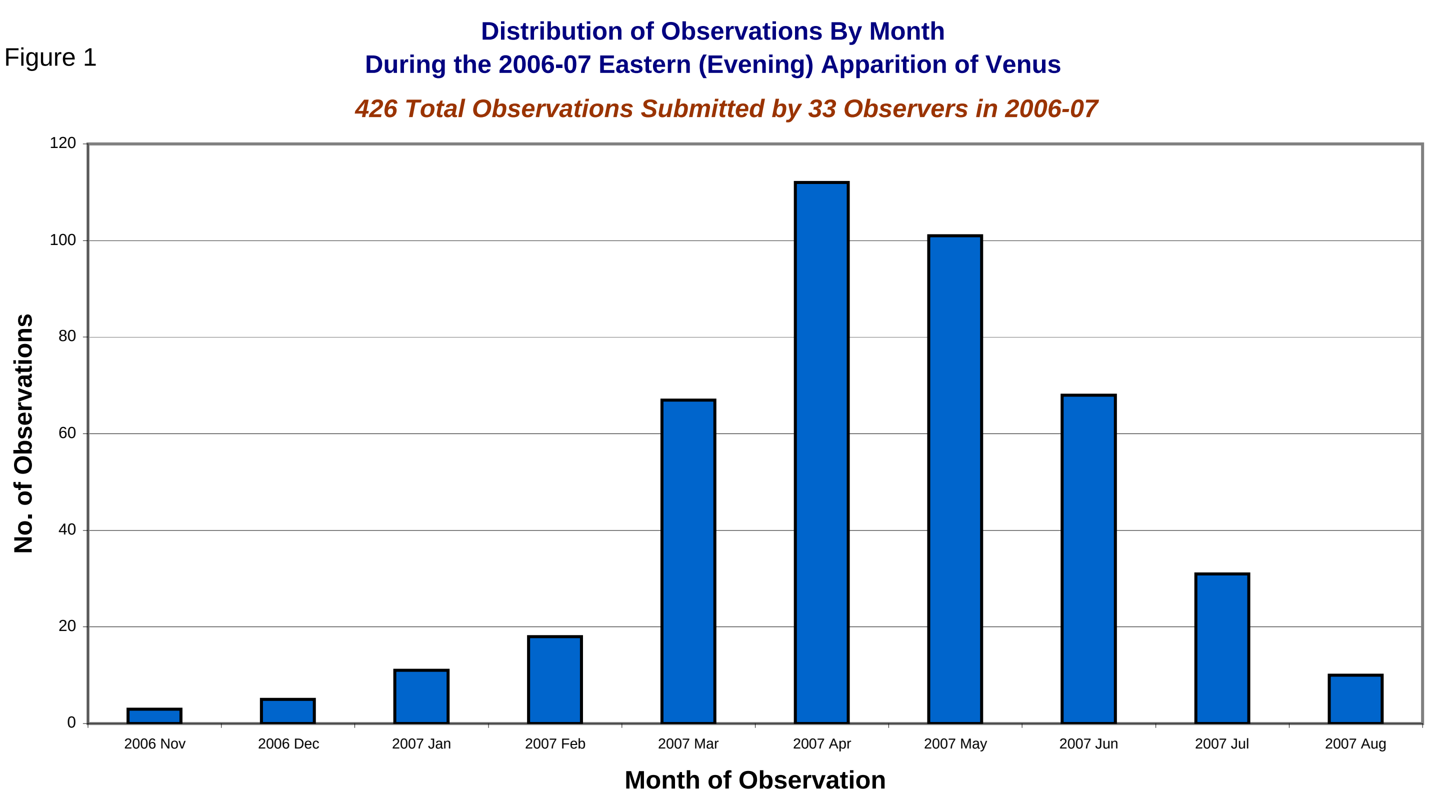
The types of telescopes used to observe and image Venus are shown in Figure 3. The majority of all observations were made with telescopes ³15.2 cm (6.0 in) in aperture. During the 2006-07 Eastern (Evening) Apparition of Venus, the frequency of use of classical designs (refractors, Newtonians, and Cassegrains) was 50.2%, while utilization of catadioptrics (Schmidt-Cassegrains and Maksutovs) was 49.8%, a nearly even split between classical and non-classical designs. All but 1.4% of the visual and digital observations were performed under twilight or daylight conditions, generally because more experienced Venus observers have found that viewing the planet during twilight or in full daylight substantially reduces the excessive glare associated with the planet. Also, viewing or imaging Venus when it is higher in the sky substantially cuts down on the detrimental effects of atmospheric dispersion and image distortion prevalent near the horizon.

Table 1. Geocentric Phenomena in Universal Time (UT) for the 2006-07 Eastern (Evening) Apparition of Venus

Superior Conjunction	2006 Oct 27^d 18.00^h UT
Initial Observation	Nov 03 12.86
Dichotomy (predicted)	2007 Jun 08 15.60
Greatest Elongation East	Jun 09 03.00 (45.0°)
Greatest Illuminated Extent	Jul 12 14.00 (m_V = –4.7)
Final Observation	Aug 17 28.00
Inferior Conjunction	Aug 18 04.00
Apparent Diameter (observed range): 9.8 (2006 Nov 03) ↔ 58.3” (2007 Aug 17)	
Phase Coefficient, ***k*** (observed range): 0.999 (2006 Nov 03) ↔ 0.009 (2007 Aug 17)	

The writer extends his gratitude to all thirty-three observers who made this report possible by faithfully sending in their drawings, descriptive reports, and digital images of Venus in 2006-07. Readers who wish to follow Venus in coming apparitions are urged to join the ALPO and start participating in our observational studies. Then brightness of Venus makes it easy to find, and surrounding around the dates of greatest elongation from the Sun, it can be as much as 15 times brighter than Sirius and can even cast shadows when viewed from a dark, moonless observing site. Getting started in the Venus Section programs requires only minimal aperture, ranging from 7.5 cm (3.0 in) for refractors to 15.2 cm (6.0 in) reflectors.

Figure 1



Observations of Atmospheric Details on Venus

The methods and techniques for visual studies of the notoriously 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 a some of digital images used for this analytical report were made at visual wavelengths, but many observers routinely image 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.

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

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

Table 2. ALPO Observing Participants in the 2006-07 Eastern (Evening) Apparition

Observer and Observing Site	No. Obs.	Telescope(s) Used*
Adelaar, Jan; Amhem, The Netherlands	16 5	23.5 cm (9.25 in.) SCT
Amato, Michael; New Haven, CT	77	15.2 cm (6.0 in.) NEW 25.4 cm (10.0 in.) NEW
Arditti, David; Middlesex, UK	4	25.4 cm (10.0 in.) DAL 28.0 cm (11.0 in.) DAL
Benton, Julius L.; Wilmington Island, GA	4 1	15.2 cm (6.0 in.) REF
Bosman, Richard; Enschede, The Netherlands	2	28.0 cm (11.0 in.) SCT
Cudnik, Brian; Weimar, TX	22	20.3 cm (8.0 in.) SCT 31.8 cm (12.5 in.) NEW
Delcroix, Marc; Tournefeuille, France	1	25.4 cm (10.0 in.) SCT
Gasparri, Daniele; Perugia, Italy	2	23.5 cm (9.25 in.) SCT
Greenwood, Andrew; Cheshire, UK	6	15.0 cm (5.9 in.) MAK
Haas, Walter H.; Las Cruces, NM	5	20.3 cm (8.0 in.) NEW
Ikemura, Toshihiko; Osaka, Japan	5	31.0 cm (12.2 in.) NEW
Kingsley, B.A.; Maidenhead, UK	11	28.0 cm (11.0 in.) SCT
Kivits, Willem; Siebengewald, The Netherlands	6	35.6 cm (14.0 in.) SCT
Lazzarotti, Paolo; Lucca, Italy	2	31.5 cm (12.4 in.) CAS
Lomeli, Ed; San Francisco, CA	1	23.5 cm (9.25 in.) SCT
Mattei, Michael; Littleton, MA	9	35.6 cm (14.0 in.) SCT
Maxson, Paul; Phoenix, AZ	2	25.4 cm (10.0 in.) SCT
Melillo, Frank J.; Holtsville, NY	1	25.4 cm (10.0 in.) SCT
Melka, Jim; St. Louis, MO	2	30.0 cm (11.8 in.) NEW
Mobberley, Martin; Suffolk, UK	102	24.5 cm (9.6 in.) NEW
Moore, David M.; Phoenix, AZ	5	36.2 cm (14.25 in.) CAS
Niechoy, Detlev; Göttingen, Germany	12	20.3 cm (8.0 in.) SCT
Parker, Donald C.; Coral Gables, FL	22	25.4 cm (10.0 in.) DAL
Peach, Damian; Norfolk, UK	5	23.5 cm (9.25 in.) SCT
Pellier, Christophe; Bruz, France	36	25.0 cm (9.84 in.) CAS
Robbins, Sol C.; Fair Lawn, NJ	6	24.8 cm (9.76 in.) NEW
Roussell, Carl; Hamilton, Ontario, Canada	20	15.2 cm (6.0 in.) REF
Schmude, Richard W.; Barnesville, GA	7	13.0 cm (5.1 in.) REF
Schrantz, Richard; Nicholasville, KY	2	25.4 cm (10.0 in.) NEW
Van Kranenberg, Arnaud; Vlaardingen, The Netherlands	2	23.5 cm (9.25 in.) SCT
Vandenbergh, Ralf; Maastricht, The Netherlands	16	24.5 cm (9.6 in.) NEW
Von Ruissen, Conrad; Amhem, The Netherlands	33	30.5 cm (12.0 in.) NEW
Walker, Sean; Chester, MA	426	31.8 cm (12.5 in.) NEW
Total No. of Observers	**33**	
Total No. of Observations	**426**	
*REF = Refractor, SCT = Schmidt-Cassegrain, NEW = Newtonian, MAK = Maksutov, DAL = Dall-Kirkham, CAS = Cassegrain		

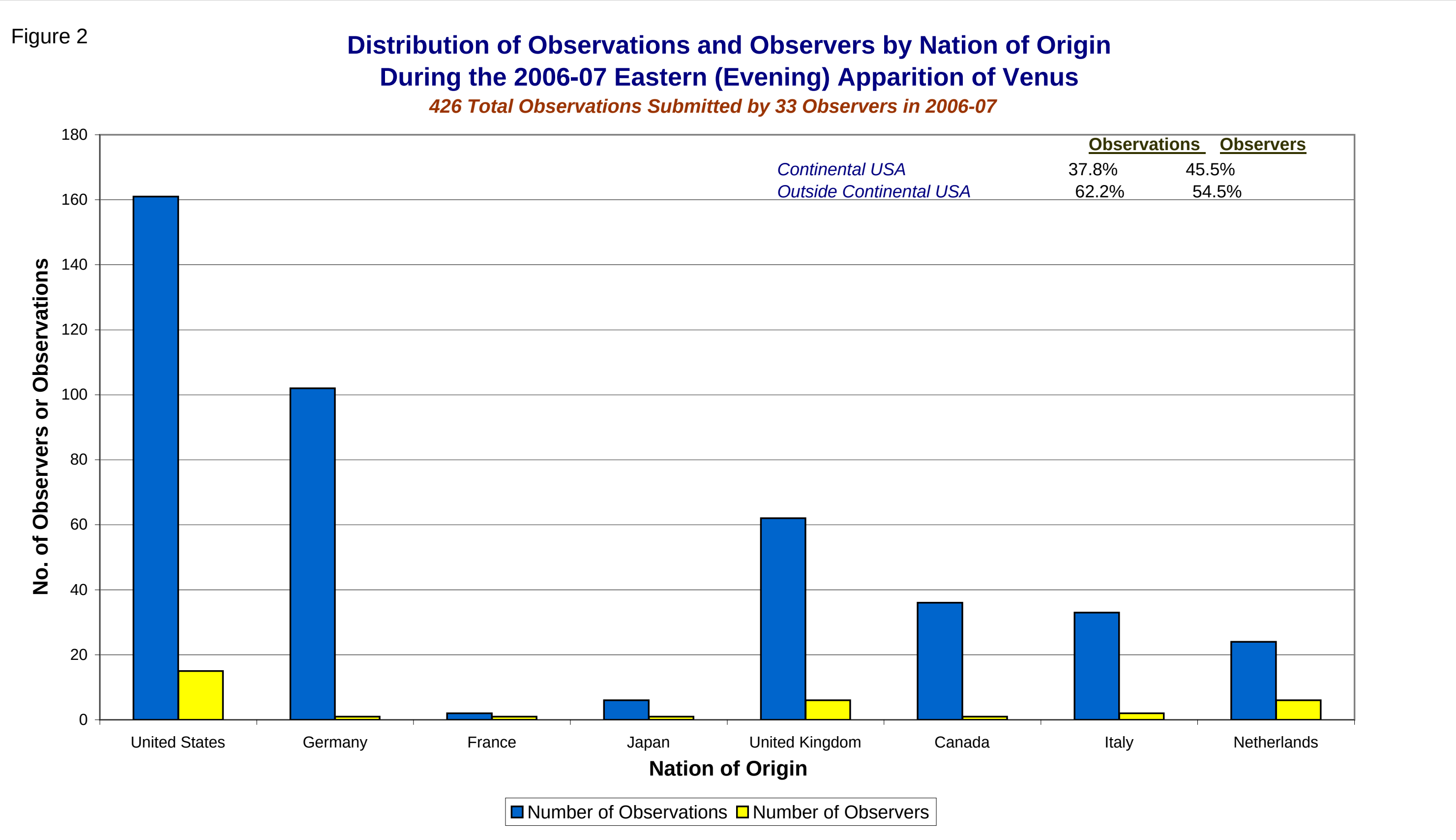


Figure 2
Distribution of Observations and Observers by Nation of Origin
During the 2006-07 Eastern (Evening) Apparition of Venus
426 Total Observations Submitted by 33 Observers in 2006-07
Observations
Observers
Continental USA
37.8%
45.5%
Outside Continental USA
62.2%
54.5%
No. of Observers or Observations
180
160
140
120
100
80
60
40
20
0
United States
Germany
France
Japan
United Kingdom
Canada
Italy
Netherlands
Nation of Origin
Number of Observations
Number of Observers

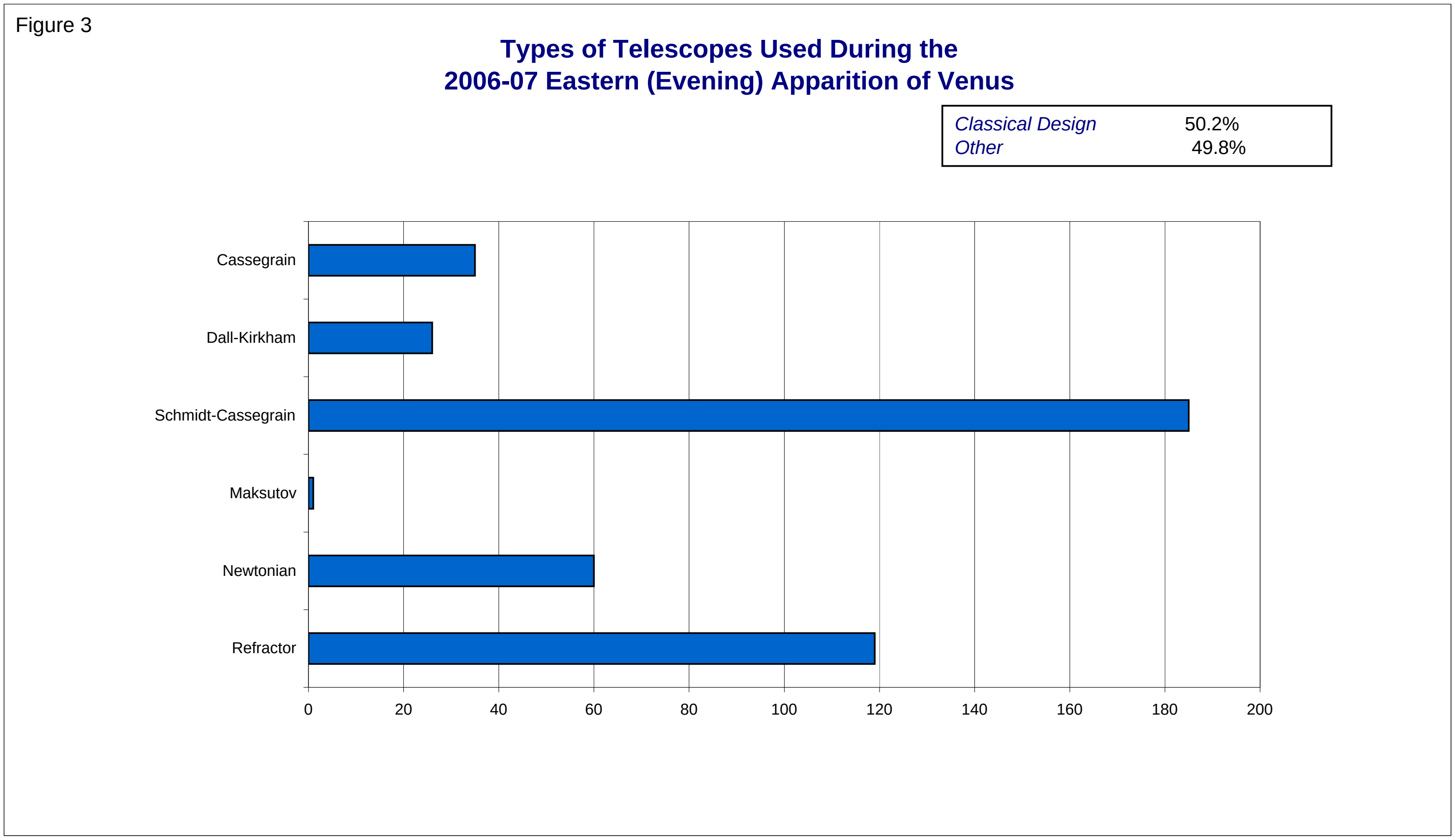


Figure 3
Types of Telescopes Used During the
2006-07 Eastern (Evening) Apparition of Venus
Classical Design
50.2%
Other
49.8%
Cassegrain
Dall-Kirkham
Schmidt-Cassegrain
Maksutov
Newtonian
Refractor
0
20
40
60
80
100
120
140
160
180
200

Figure 4

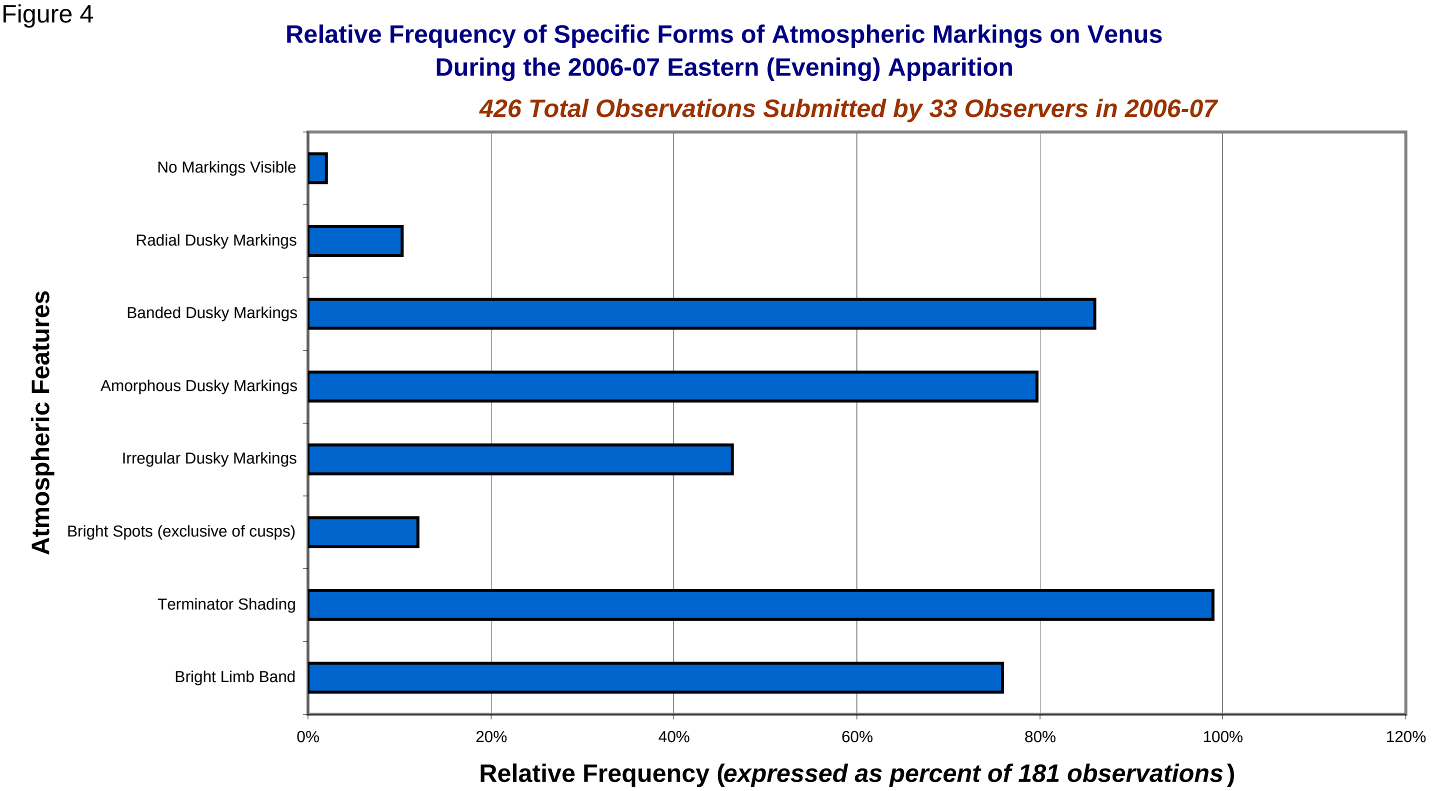
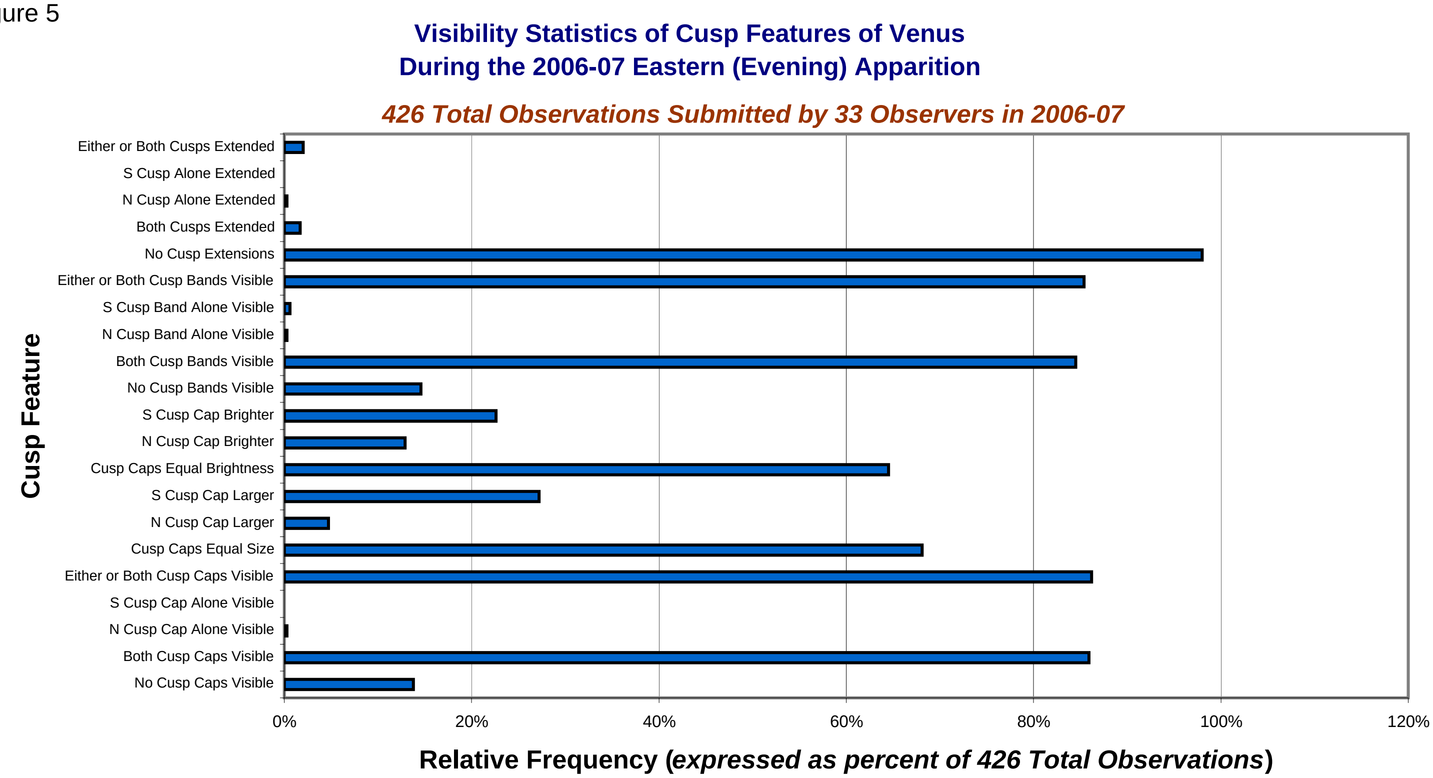


Figure 5



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.

Illustration 01. 2006 Nov 06 15:08UT by Carl Roussell of Hamilton, Ontario, Canada. 15.2 cm (6.0 in,) REF. Drawing @ 200-400X Integrated Light + alternating W25, W58, W47 filters; Seeing 5.0, Transparency (not specified), Phase (k) = 0.999, Apparent Diameter = 9.8”. Drawing depicts banded dusky markings, cusp caps, and cusp bands.

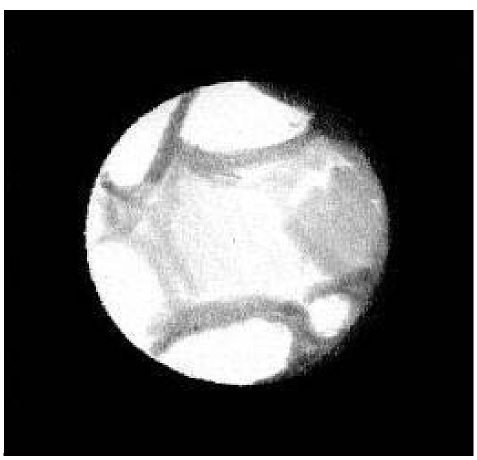


Image 2. 2006 Dec17 12:59 UT by Detlev Niechoy of Göttingen, Germany. 20.3 cm (8.0 in.) SCT. Drawing @ 225X Integrated Light; Seeing 4.0 (interpolated), Transparency (not specified), Phase (k) = 0.978, Apparent Diameter = 10.2”. Drawing shows irregular dusky features, cusp caps, and cusp bands.

Figure 4 illustrates that in only 2.0% 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” (86.0%),” followed by Amorphous Dusky Markings” (79.7%), “Irregular Dusky Markings” (46.4%), and “Radial Dusky Markings” (10.3%). The latter category typically was more apparent in UV images submitted this observing season. [Insert Illustrations No. 01 through No. 08]

Earth-based photos taken in UV wavelengths were used to establish the fact that the clouds high in Venus' atmosphere rotate east to west in about 4d, a result that was later confirmed by spacecraft. This translates into an astounding wind velocity of 0.1 km/sec in this region which is some 50 km above the solid surface of Venus! The surface winds on the planet measured by spacecraft are very gentle, but from the illuminated hemisphere to the dark side of Venus, there are winds blowing at 0.13 km/sec at an altitude of about 115 km. Several observers during 2006-07 attempted to assemble latitude-longitude cylindrical rotational maps of Venus' atmospheric features over an approximate 4d period. It was rather troublesome finding consecutive 4 days with favorable weather to image the planet, but consider for example the map made by Daniele Gasparri of Perugia, Italy using Winjupos ephemerides from April 16 through 19, 2007 [Insert Illustration No. 18]. He used a 23.5 cm (9.25 in) SCT to image the planet employing Baader UV and IR blocking filters in reasonably good seeing conditions. It was somewhat difficult to follow the atmospheric structures imaged in UV from one day to the next on the maps to help confirm the known 4d synodic period for these features. Similar rotational maps were assembled by a few other observers, and in future apparitions, such mapping projects of features images in UV are encouraged. In future apparitions, the ALPO Venus Section will attempt to make similar time-ordered maps if there are sufficient consecutive observations submitted and publish the results.

Terminator shading was reported in 98.9% 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

Image 3. 2007 Jan 31 18:12 UT by Don Parker of Coral Gables, FL. 25.4 cm (10.0 in.) DAL. SKYnyx imager, Baader UV filter 300-400nm; Seeing 3.5, Transparency 5.0, Phase (k) = 0.923, Apparent Diameter = 11.1”. UV image shows banded and amorphous dusky markings, cusp caps, North cusp band.

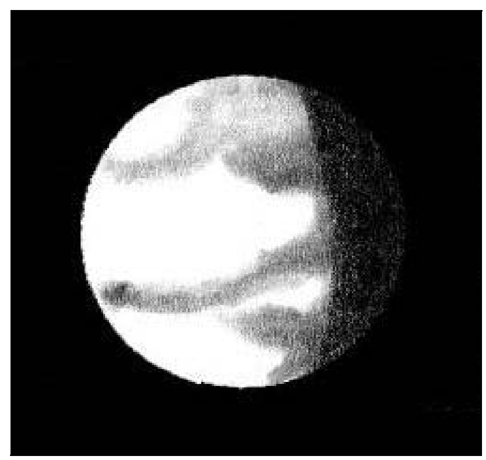


Image 4. 2007 Feb 21 16:24 UT by Detlev Niechoy of Göttingen, Germany. 20.3 cm (8.0 in.) SCT. Drawing @ 225X Integrated Light; Seeing 5.0 (interpolated), Transparency (not specified), Phase (k) = 0.885, Apparent Diameter = 11.1”. Banded dusky markings are represented in this drawing.

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. [Insert Illustration No. 09]

The mean numerical relative intensity for all of the dusky features on Venus this apparition ranged from 8.4 to 8.7. The ALPO Scale of Conspicuousness (a

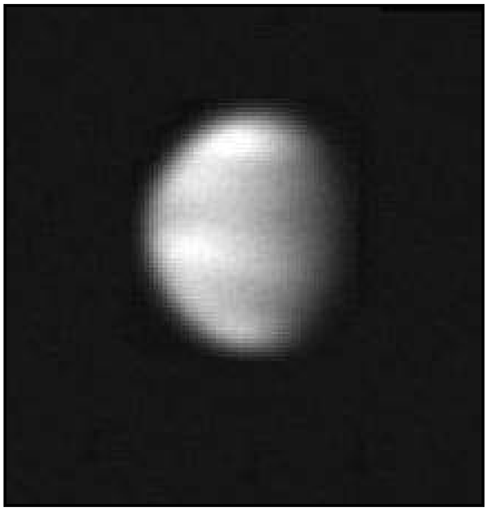


Image 5. 2007 Mar 13 00:57 UT by Ed Lomeli of San Francisco, CA. 23.5 cm (9.25 in.) SCT, DMK 21BF04 Imager, UV filter; Seeing 6.0, Transparency 3.0, Phase (k) = 0.841, Apparent Diameter = 12.6". UV image depicts banded dusky markings and bright cusp caps.

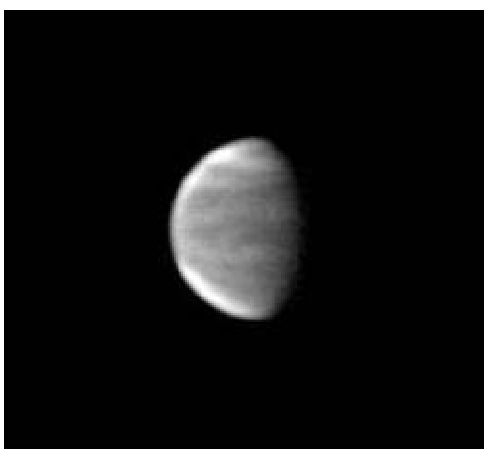


Image 6. 2007 Apr 14 18:13 UT by Christophe Pellier of Bruz, France. 25.0 cm (9.84 in.) CAS, SKYnyx imager, UV filter 365nm; Seeing 6.0, Transparency 6.0, Phase (k) = 0.743, Apparent Diameter = 14.9". Excellent detailed UV image reveals banded, amorphous, and irregular dusky markings, as well as an incomplete bright limb band, and a Southern cusp cap and cusp band.

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 ~3.2 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 only 12.0% of the submitted observations and images [Insert Illustration No. 10]. When visual observers detect such bright areas, it is standard practice for to denote them on drawings by using dotted lines to surround them.

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 slightly more than three-fourths of the submitted observations (75.9%) this apparition referred to a very conspicuous "Bright Limb Band" on the illuminated hemisphere of Venus. When the Bright Limb Band was visible or imaged, it appeared as a continuous, brilliant arc running from cusp to cusp 41.9% of the time, and interrupted or only marginally visible along the limb of Venus in 58.1% 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, was also seen on a fairly large number of digital images of Venus received. [Insert Illustration No. 11]

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 75.9% 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,

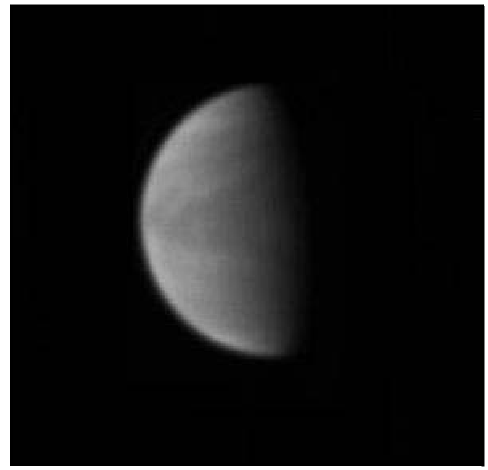


Image 7. 2007 May 15 00:39 UT by Rick Schrantz of Nicholasville, KY. 25.4 cm (10.0 in.) NEW, Philips ToUcam imager, Schuler UV filter; Seeing (not specified), Transparency (Not specified), Phase (k) = 0.624, Apparent Diameter = 18.5". Banded and amorphous dusky markings are apparent, as well as cusp caps and cusp bands.

Image 8. 2007 Jun 20 10:25 UT by Toshihiko Ikemura of Osaka, Japan. 31.0 cm (12.2 in.) NEW, ATK-2HS imager, 340nm UV filter; Seeing 4.0 (interpolated), Transparency (not specified), Phase (k) = 0.429, Apparent Diameter = 27.2". Bright cusps and amorphous dusky features are visible in this UV image.

while darker markings may appear as wispy hollows. [Insert Illustration No. 12]

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 (68.1%) of the time and in brightness in 64.5% 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 85.9% 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 84.5% of the observations when cusp-caps were visible. When seen, the cusp-bands displayed a mean relative intensity of about 7.5 (see *Figure 5*). [Insert Illustrations No. 13 and 14]

Cusp Extensions

In 98.0% of the visual observations submitted during the apparition, no cusp extensions were reported in integrated light or with color filters beyond the 180° expected from simple geometry (see Figure 5). As Venus entered crescent phases as it approached inferior conjunction on August 17, 2007, a few observers recorded cusp extensions from time to time, ranging from 2° to 25°, represented on a few drawings that were submitted. The only image submitted to the ALPO Venus Section that seemed to show even the slightest slight cusp extensions was made by Detlev Niechoy, observing from Göttingen, Germany in fair seeing conditions at 13:02UT on August 12, 2007, using a Philips ToUcam MX-5 camera with a UG3 filter coupled to a 20.3cm (8.0 in) SCT. Experience has shown that cusp extensions are notoriously troublesome 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. [Insert Illustration No. 15].

Estimates of Dichotomy

A discrepancy between predicted and observed dates of dichotomy (half-phase) is often referred to as the "Schröter Effect" on Venus. The predicted half-phase occurs when k = 0.500, and the phase angle, i, between the Sun and the Earth as seen from Venus equals 90°. Although theoretical dichotomy occurred on June 8, 2007 at 15.60h UT, visual dichotomy estimates were not submitted during this apparition.

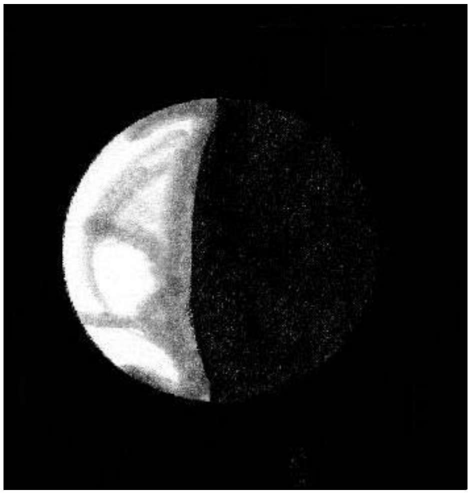


Image 9. 2007 Jun 24 20:10 UT by Detlev Niechoy of Göttingen, Germany. 20.3 cm (8.0 in.) SCT. Drawing @ 225X W47 filter. Seeing 4.0 (interpolated), Transparency (Not specified), Phase (k) = 0.400, Apparent Diameter = 28.9". Irregular and amorphous dusky markings are depicted on this drawing, as well as terminator shading.

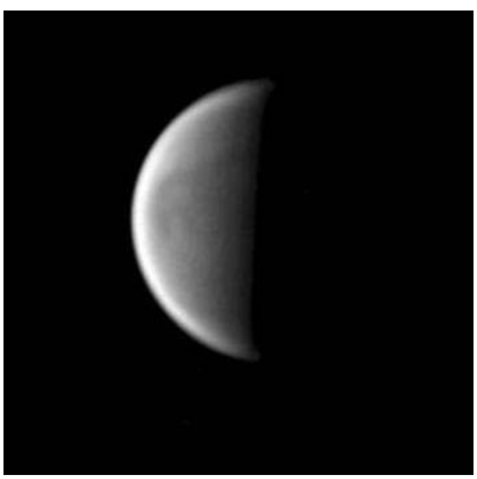


Image 10. 2007 Jun 05 22:50 UT by Damian Peach of Norfolk, UK. 23.5 cm (9.25 in.) SCT, Digital Imager, W47 filter; Seeing (not specified), Transparency (not specified), Phase (k) = 0.515, Apparent Diameter = 22.9". Aside from amorphous dusky markings, the Bright Limb Band is quite obvious in this image.

Image 11. 2007 May 13 17:35 UT by Daniele Gasparri of Perugia, Italy. 23.5 cm (9.25 in.) SCT, ST-7XME imager, UV filter; Seeing (not specified), Transparency (not specified), Phase (k) = 0.630, Apparent Diameter = 18.3". In addition to a bright limb band, a prominent bright spot appears centrally in this UV image.

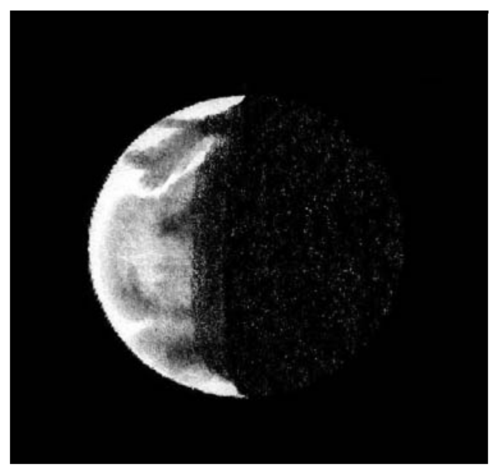


Image 12. 2007 Jun 16 17:00 UT by Detlev Niechoy of Göttingen, Germany. 20.3 cm (8.0 in.) SCT, Drawing @ 333X BG3 filter, Seeing 4.0 (interpolated), Phase (k) = 0.452, Apparent Diameter = 26.0". Terminator shading and irregularities, with associated dusky banded features, are noticeable in this drawing.

Dark Hemisphere Phenomena and Ashen Light Observations

The Ashen Light, reported the first time by G. Riccioli in 1643, is an extremely elusive, faint illumination of Venus' dark hemisphere. Some observers describe the Ashen Light as resembling Earthshine on the dark portion of the Moon, but the origin of the latter is clearly not the same. It is natural to presuppose that Venus should ideally be viewed against a totally dark sky for the Ashen Light to be detectable, but such circumstances occur only when the planet is very low in the sky where poor seeing adversely affects viewing. The substantial glare from Venus in contrast with the surrounding dark sky is a further complication. Nevertheless, the ALPO Venus Section continues to receive reports from experienced observers, viewing the planet in twilight, who are convinced they have seen the Ashen Light, and so the controversy continues.

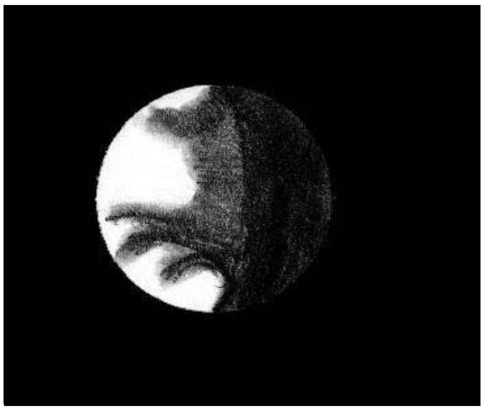


Image 13. 2007 Apr 11 19:56 UT by Detlev Niechoy of Göttingen, Germany. 20.3 cm (8.0 in.) SCT. Drawing @ 225X Integrated Light; Seeing 5.0 (interpolated), Transparency (not specified), Phase (k) = 0.753, Apparent Diameter = 14.6". Cusp caps and cusp bands are represented in this drawing.

Image 14. 2007 Apr 11 17:40 UT by Daniele Gasparri of Perugia, Italy. 23.5 cm (9.25 in.) SCT, Philips ToUcam Pro II imager, W47 + BG38 filters, Seeing 5.5, Transparency (not specified), Phase (k) = 0.754, Apparent Diameter = 14.6". Considerable detail appears in this image taken in blue light, showing cusp caps and cusp bands along with amorphous dusky features.

There were no visual reports or digital images of the Ashen Light contributed to the ALPO Venus Section during the 2006-07 Eastern (Evening) Apparition. 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 encourages observers to pursue systematic imaging of the planet in the near-IR. At these wavelengths the hot surface of the planet becomes quite apparent, and occasionally mottlings show 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.

There were sporadic instances this apparition when observers suspected the dark hemisphere of Venus appearing *darker* than the background sky, a phenomenon that is probably nothing more than a curious contrast effect.

Occultation of Venus

A daylight occultation of Venus by the waxing 3.7 day old crescent Moon occurred on June 18, 2007, observable from Europe, India, and the Middle East. Venus had passed Greatest Elongation East of 45° from the Sun back on June 9th, so the -4.0 visual magnitude planet was still positioned at sufficient angular distance from the Sun to be detected with ease in a clear daylight sky with binoculars or perhaps the unaided eye. With a telescope the occultation of Venus could easily be observed. The only observer who submitted digital images of the June 18, 2007 occultation was Detlev Niechoy of Göttingen, Germany, capturing the reappearance of Venus at the bright limb of the Moon at 15:36UT using a 20.3 cm (8.0 in) SCT. [Insert Illustration No. 16]

Image 15. 2007 Aug 12 13:02 UT by Detlev Niechoy of Göttingen, Germany. 20.3 cm (8.0 in.) SCT, Philips ToUcam Pro II imager, UG3 filter; Seeing 3.0 (interpolated), Transparency (not specified), Phase (k) = 0.019, Apparent Diameter = 57.3". Minute cusp extensions are barely visible in this image.

Image 16. 2007 Jun 18 15:36 UT by Detlev Niechoy of Göttingen, Germany. 20.3 cm (8.0 in.) SCT, Philips ToUcam Pro II imager; Seeing 3.0 (interpolated), Transparency (not specified), Phase (k) = 0.440, Apparent Diameter = 26.6". Image depicts reappearance of crescent Venus following occultation by the Moon.

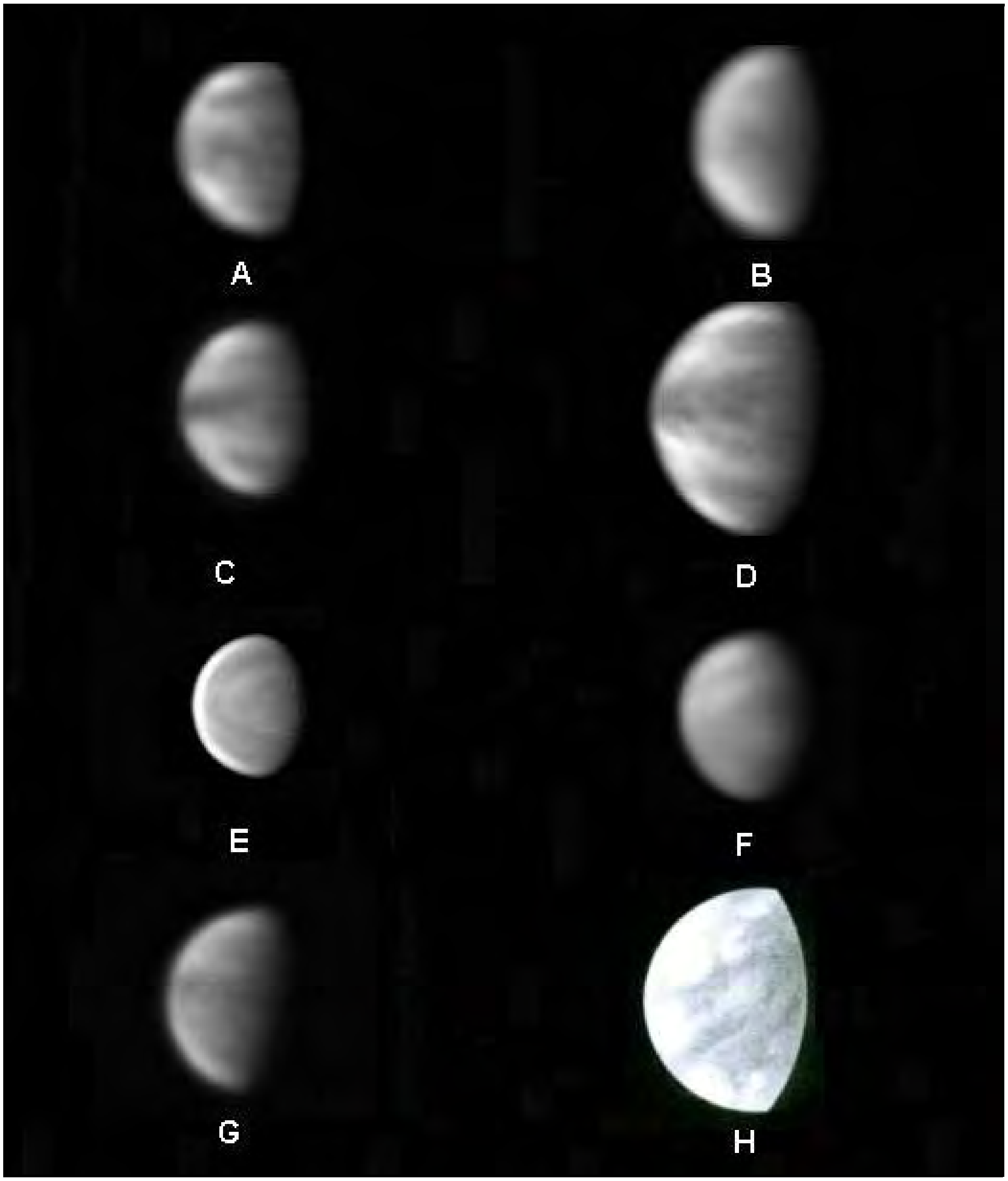


Image 17. Simultaneous Observations; Compare similarities in features, such as cusp caps and cusp bands, as well as amorphous dusky markings, in these near-simultaneous images in UV light.
Left Image (a) – 2007 Apr 18 17:35 UT by Daniele Gasparri of Perugia, Italy. 23.5 cm (9.25 in.) SCT, ST7-XME imager, Baader UV + BG48 filters, Seeing (not specified), Transparency (not specified), Phase (k) = 0.729, Apparent Diameter = 15.2".
Right Image (b) – 2007 Apr 18 17:53 UT by David Arditti of Edgware, Middlesex, UK. 25.4 cm (10.0 in.) DAL, Digital imager, Baader UV filter, Seeing (not specified), Transparency (not specified), Phase (k) = 0.729, Apparent Diameter = 15.2".
Left Image (c) – 2007 Apr 19 17:00 UT by Daniele Gasparri of Perugia, Italy. 23.5 cm (9.25 in.) SCT, ST7-XME imager, Baader UV + BG48 filters; Seeing 5.0 Transparency (not specified), Phase (k) = 0.726, Apparent Diameter = 15.3".
Right Image (d) – 2007 Apr 19 17:58 UT by Paolo Lazzarotti of Lucca, Italy. 31.5 cm (12.4 in.) CAS, Lumenera Infinity 2-1 imager, 320-380nm UV + BG48 filters; Seeing 6.0, Transparency (not specified), Phase (k) = 0.726, Apparent Diameter = 15.3".
Left Image (e) – 2007 Mar 26 17:42 UT by Christophe Pellier of Bruz, France. 25.0 cm (9.84 in.) CAS, SKYnyx imager, Blue 440nm filter; Seeing 5.0 Transparency 6.0, Phase (k) = 0.804, Apparent Diameter = 13.4".
Right Image (f) – 2007 Mar 26 17:55 UT by Willem Kivits of Siebengewald, The Netherlands. 35.6 cm (14.0 in.) SCT, ATK-2HS imager, Hoya 360nm filter; Seeing (not specified), Transparency (not specified), Phase (k) = 0.804, Apparent Diameter = 13.4".
Left Image (g) – 2007 May 04 00:04 UT by Sean Walker of Chester, MA. 31.8 cm (12.5 in.) NEW, Lumenera imager, Baader UV filter; Seeing (not specified), Transparency (not specified), Phase (k) = 0.671, Apparent Diameter = 16.9".
Right Image (h) – 2007 May 04 00:06 UT by Sol C. Robbins of Fair Lawn, NJ. 24.8 cm (9.76 in.) NEW. Drawing @ 317X W47 filter; Seeing (not specified), Transparency (not specified), Phase (k) = 0.671, Apparent Diameter = 16.9".

Simultaneous Observations

Any opportunity that substantially increases the incidence for confirmed observational data should be taken advantage of as a means for reducing subjectivity. It is well-known to visual observers that atmospheric phenomena on Venus are very elusive, and it not unusual for two observers looking at Venus at the same time to see somewhat different features. Our challenge is to establish which features are real and which ones are illusory on any given date of observation. So, to build confidence in our results, observers are encouraged to carry out simultaneous visual work, including concurrent digital imaging, at various wavelengths, all on the same date and at the same time, employing standardized techniques, equipment, and observing forms. Therefore, the ideal scenario would be to have as comprehensive a simultaneous observational database throughout any apparition as possible. During the 2006-07 observing season several instances of near-simultaneous visual reports and digital imaging occurred [Insert Illustration No. 17], and it is hoped such observations will continue in subsequent apparitions. 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 at various wavelengths.

A Continuing Amateur-Professional Cooperative Program

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

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

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

Conclusions

Analysis of ALPO observations of Venus during the 2006-07 Eastern (Evening) 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 that 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.

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

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.

References

Benton, Julius L., Jr., (1973). *An Introduction to Observing Venus*. Savannah, GA: Review Publishing Co.

—, (2006), *"ALPO Observations of Venus During the 2002-2003 Western (Morning) Apparition of Venus." JALPO, 48,* No. 4 (Autumn), 17-26.

—, (2007), "*ALPO Observations of Venus During the 2003-2004 Eastern (Evening) Apparition of Venus." JALPO, 49,* No. 4 (Autumn), 27-42.

—, (2008), "*ALPO Observations of Venus During the 2004-2005 Western (Morning) Apparition.*" *Journal of the Assn of Lunar & Planetary Observers, 50* (3), 30-40.

—, (2009), "*ALPO Observations of Venus During the 2005-2006 Eastern (Evening) Apparition of Venus." JALPO, 51,* No. 3 (Summer), 26-37.

Hunten, D.M., et al, eds. (1983). *Venus.* Tucson: University of Arizona Press.

United States Naval Observatory. *The Astronomical Almanac*. Washington: U.S. Government Printing Office. (Annual Publication; the 2006 and 2007 editions, which were published in 2005 and 2006, respectively, were used for this report.

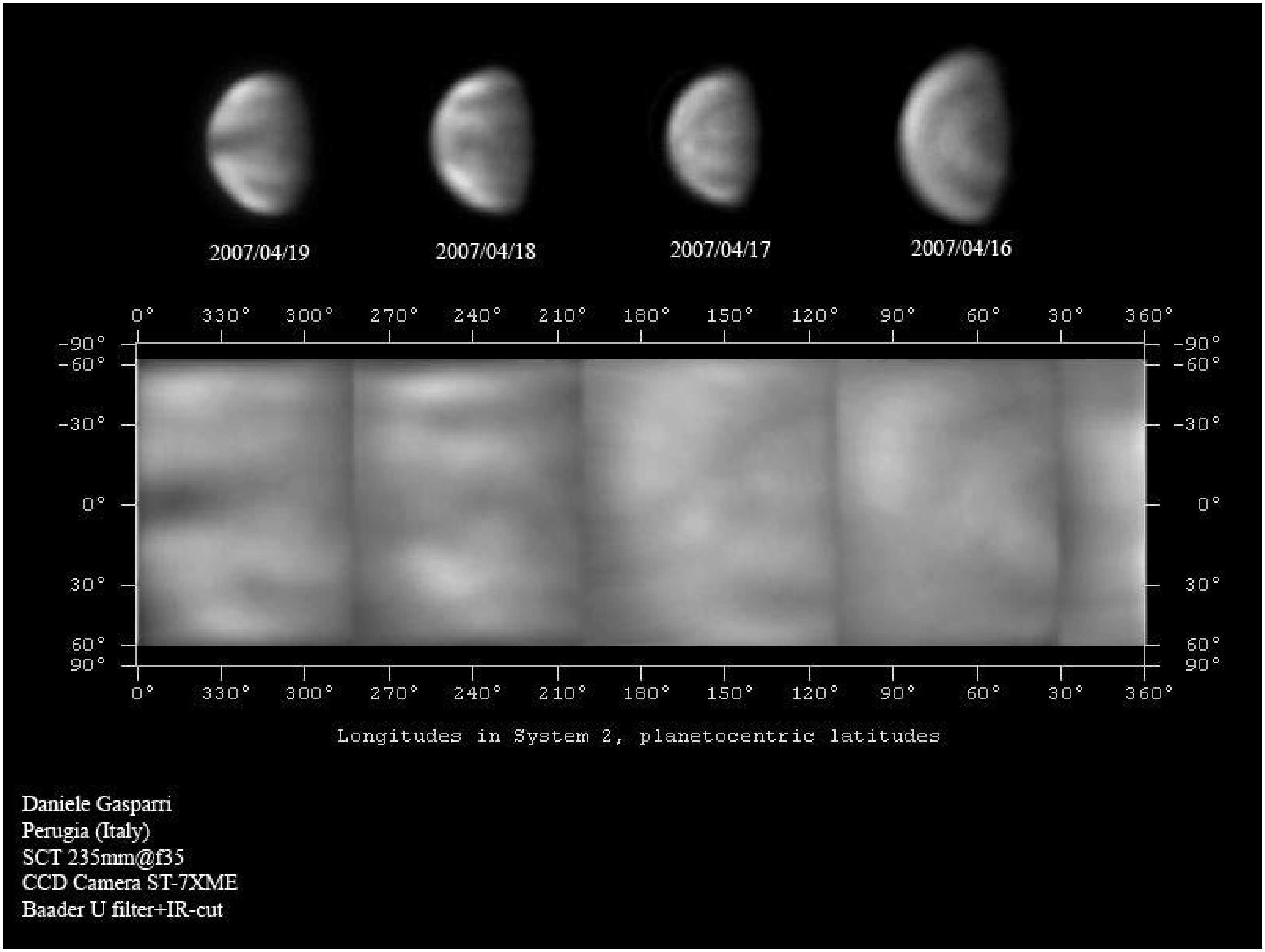


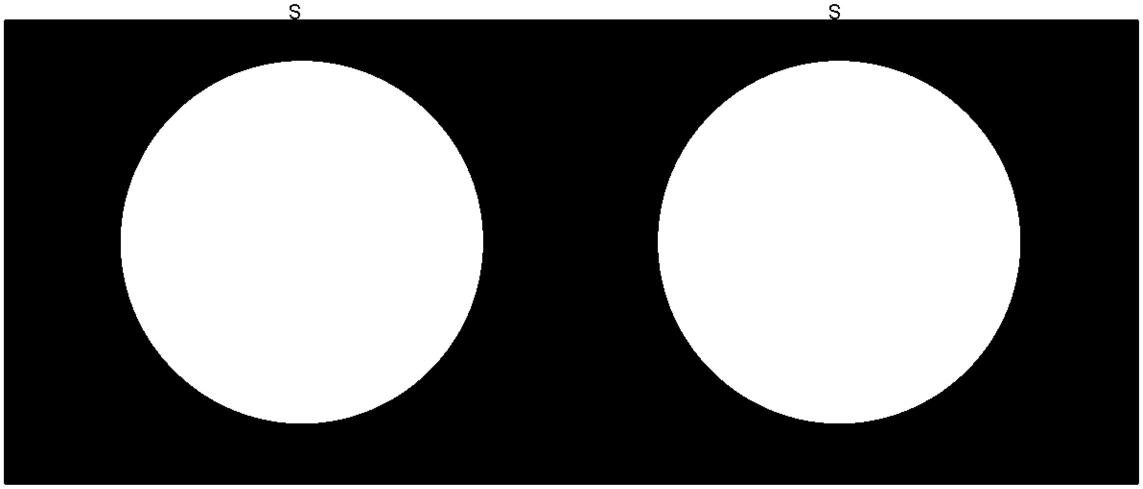
Image 18. 2007 Apr 16-19, Rotational Sequence by Daniele Gasparri of Perugia, Italy. 23.5 cm (9.25 in.) SCT, ST7-XME imager, Baader UV, IR Blocking filters; Seeing 5.0, Transparency (not specified), Phase (k) = 0.739 to 0.728, Apparent Diameter = 15.3" to 15.2". Example of a latitude-longitude cylindrical rotational map of Venus' atmospheric features over an approximate 4^d period, assembled using *Winjupos* from UV images taken over 4 consecutive days. Map reads from right to left.

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

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

Drawing Blank — S   *Intensity Estimates Blank* — S

p



f

N   (*all coordinates are IAU*)   N

Observer________________________________Location____

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

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

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

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

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

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

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

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

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

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

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

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

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

Feature Story:

William H. Pickering and Life on the Moon

By Wayne Bailey, FRAS, Coordinator, ALPO Lunar Topographical Studies/ Selected Areas Program
wayne.bailey@alpo-astronomy.org
Charles Galdies, PhD, Znith-observatory, Malta,
znith.observatory@gmail.com

Note to Readers

Online readers may left-click their mouse on an author's e-mail addresses in blue text to contact the author of this article.

Introduction

William H. Pickering (1858-1938) was a well-known observer of the early 20th century. He was a prolific observer, noted for both his detailed observations and his somewhat fanciful interpretations. A drawing of Eratosthenes (Fig. 1) was submitted by Galdies to the ALPO Lunar Topographical Studies/Selected Areas Program along with the comment, "Way back in 1924, Pickering noted dark patches in the crater that varied in a regular manner with time. He attributed these mobile patches to around 36 different flowering plants" and a reference to Maggini's (1925) paper. This ignited our interest in this (mostly) forgotten episode in lunar studies. In this article, we will use Pickering's papers on vegetative changes in the crater Eratosthenes to examine the interplay of observation and interpretation.

Background

William Pickering and his brother Edward were both astronomers at Harvard College, but William, although a competent observer (among his accomplishments, he pioneered the use of photography in astronomy and discovered Saturn's ninth satellite, Phoebe), is remembered mostly for his exotic interpretations of observations (a characteristic that increased throughout his career, and purportedly led to his assignment to remote locales), in contrast to his brother who was director of Harvard College Observatory from 1877 until his death in 1919. During his tenure at the Harvard Observatory station in Mandeville, Jamaica, William took advantage of the site's good seeing to make extensive observations of, and publish numerous papers on, the Moon and planets. These papers included a series on the crater Eratosthenes published between 1919 and 1924. In these, he described periodic and near periodic changes of markings within the crater and interpreted them in terms of the seasonal changes of vegetation and weather.

Summary of Pickerings Eratosthenes Papers

The *Monthly Notices* paper (Pickering 1921b) is more concise and less speculative than the series of six *Popular Astronomy* magazine papers (Pickering 1919, 1921a, 1922, 1924a, b, c).

In this paper, Pickering describes observations of changes in size, shape, color and position of both dark and light markings within Eratosthenes along with changes of the brightness or darkness of the markings, and points out that since it is near the center of the Moon, librational effects should be minimal. His observations, over several lunations, are well-documented with sketches, micrometer measurements and some photographs. Repeating these is well within the capabilities of today's amateurs, one paper (Pickering 1919) mainly addresses observations that can be made with a 3-inch telescope. He even pointed out that some changes occur rapidly enough that they can be detected within a few hours.

At the coarsest level, Pickering compares the changes in Eratosthenes to those of Copernicus. When near the terminator, these craters appear similar (Fig. 2), but near Full Moon, Copernicus brightens while Eratosthenes darkens to blend into its surroundings (Fig. 3). He attributes this to the development of snow (fog & frost are also considered) on Copernicus, while growth of vegetation darkens Eratosthenes.

He then addresses the changes of details within Eratosthenes and identifies those that he claims cannot be explained as shadows. In general, these dark features are grouped into two categories, plats and runs (or canals). Plats are extended areas, while runs are narrow, linear features. Both types were found to vary throughout the lunation, changing size, shape, location and/or orientation, as well as visibility. Most, but not all, changes were found to repeat each lunation, and were verified at the time by different lunar observers (Christie 1921,

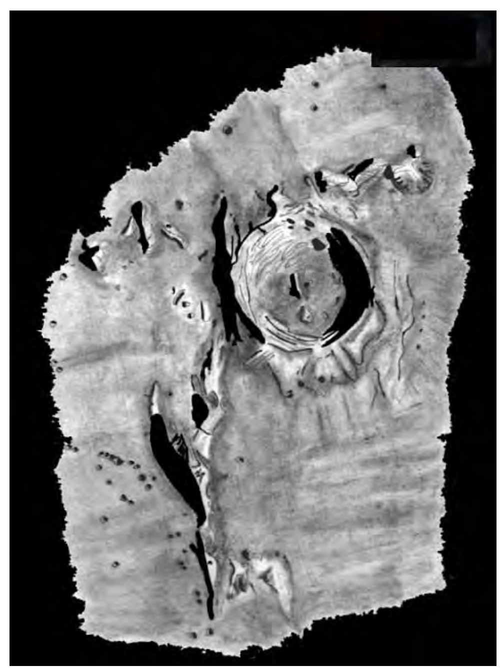


Figure 1. Eratosthenes as drawn by Charles Galdies, Naxxar, Malta. December 4, 2011 22:17 UT. Colongitude 25º.

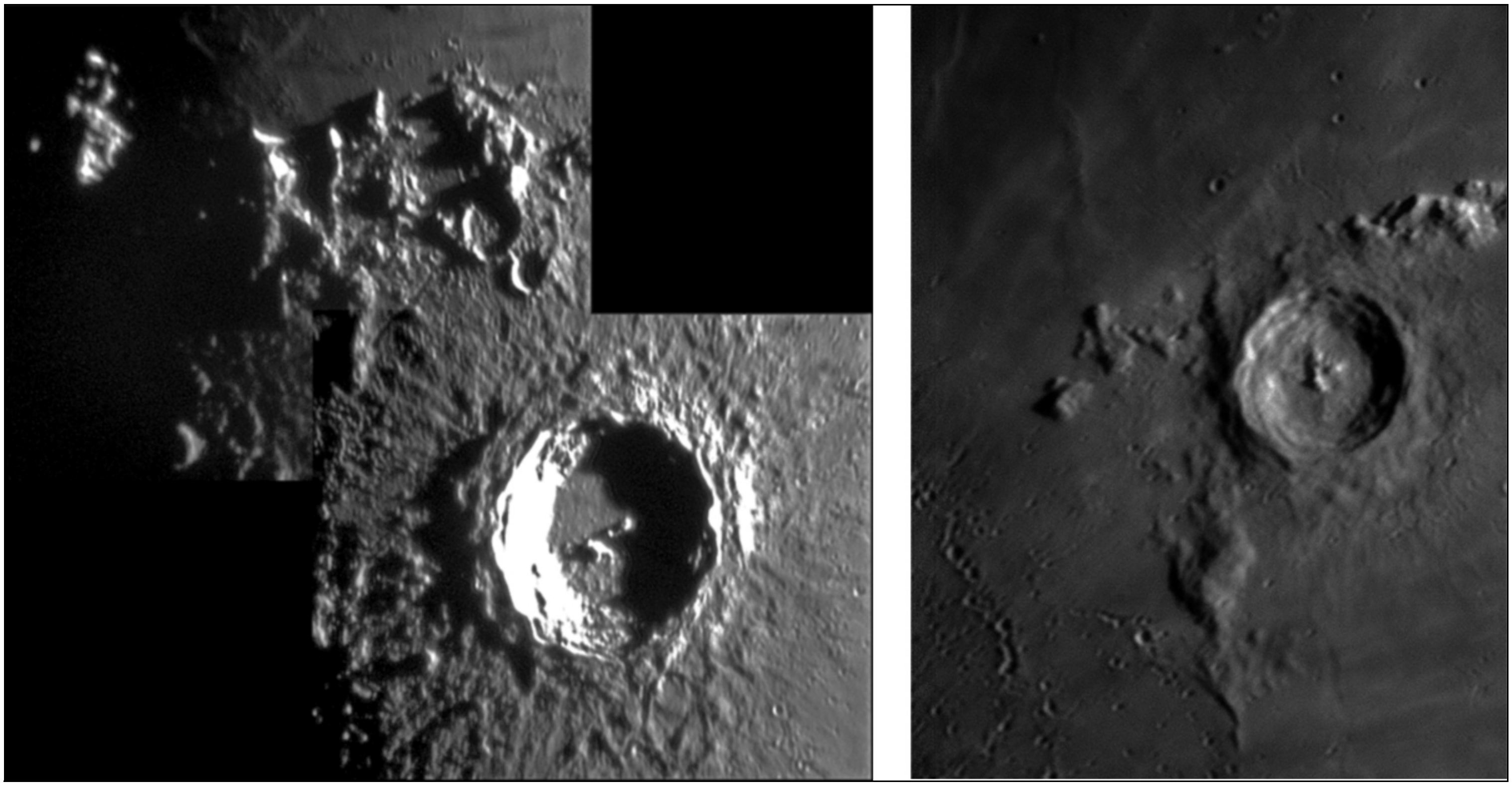


Figure 2. Copernicus & Eratosthenes during low Sun as imaged by Charles Galdies, Naxxar, Malta. (Left) Copernicus, August 8, 2011 17:31 UT. Colongitude 24º; (right) Eratosthenes, December 4, 2011 22:05 UT. Colongitude 25º.

Maggini 1925). He combines these observations of change with his claim that shadows cannot exist during the interval between Full Moon and meridian passage of the Sun at Eratosthenes, and that extensive shadow areas cannot exist at high Sun angle to conclude that minerals or topography cannot be the cause. The remaining explanations are growth of vegetation, and precipitation.

The series of six papers in *Popular Astronomy* develop the biological/ meteorological explanations in considerable detail while also exhorting observers to view these phenomena for themselves. They are fascinating (if sometimes tedious) to read, especially considering they were written less than 100 years ago. He uses his meticulous drawings, measurements, and photographs to determine the rate and direction of motion of features, the timing of changes within the lunar day, and how well they repeat from one lunation to another. Then he draws analogies to the seasonal growth and spread of vegetation, animal migration, and weather phenomena on the Earth. An entire ecology of the Moon is the result, which we leave for the reader to investigate in the series of *Popular Astronomy* papers. The paper by Maggini (1925) can serve as a shorter introduction to what to expect in Pickering's papers.

Discussion

In light of current knowledge of the lunar surface, where did Pickering go wrong? There was nothing fundamentally wrong with his observations. The 12-inch refractor of great focal length (135 feet) available to him in Jamaica must have offered excellent views under the best of conditions, even though amateur astronomers with a modest sized telescope can reproduce his results with diligent observations. But we now know that the Moon definitely has no appreciable atmosphere, and hence no weather, vegetation or animals. What led Pickering to conclude otherwise?

Pickering arrived at his conclusions by a process of eliminating other possibilities. The assumptions that were made, while seemingly reasonable at the gross level, are not valid when looked at in more detail. Incorrect assumptions then eliminated the explanations that are now considered correct, leaving only the fanciful biological and meteorological explanations from which to choose. Now let's examine a few of the assumptions that led Pickering astray.

Possibly the most problematic assumption that Pickering makes is that changes in the boundaries and darkness of extended areas under high solar angle illumination (i.e., near Full Moon) require something to move. He makes a point of stating that shadows cannot be responsible for extended dark features near Full Moon, these must be surface features. Then, since the boundaries and intensity of the dark features change through the lunation, he decides they also cannot be mineral or topographical, since these can't move. This narrows the possible explanations to meteorological or biological effects. His assumption about shadows is true for large scale features with gentle slopes, such as mountains, but doesn't hold when the collective effect of tiny shadows due to small scale, very steep structures (such as dust or small-grained regolith) is considered. The effect of surface structure on the reflectivity of the lunar surface is quite noticeable in the lunar photometric function. Reflectivity increases strongly as the phase approaches Full Moon. This is the well-known increase of the Moon's surface brightness as the phase angle (the Sun-

Moon-observer angle) decreases, a fact that was well-known in Pickering's time. So a faulty assumption about shadows led him to reject the correct interpretation of the changes.

The different behavior of Copernicus' and Eratosthenes' brightness with phase also led to a faulty conclusion. Pickering assumed that because the size and topographical features of the two craters are similar, they must be similar in all respects. Then the fact that Copernicus brightens conspicuously near full, while Eratosthenes fades into the background, must imply a change in surface covering. The logical choice for him to make then is snow or ice covering Copernicus, since clouds (which would also provide a high albedo) would obscure the surface. We now know that this is due to the different ages of the two craters. Exposure to micrometeoroid bombardment and radiation changes the physical properties and reflectivity of the surface.

What can we learn from this episode? First, the distinction between observation and interpretation is important. Pickering made good observations. His interpretations, although they were based on a logical progression of inferences, made no allowance for uncertainty in his knowledge. A famous Sherlock Holmes quote says, "Once you eliminate the impossible, whatever remains, no matter how improbable, must be the truth**"**. Pickering's interpretations follow this reasoning, but unfortunately, what he thought to be impossible is not**.**

To be fair with this restless, far-ranging and highly imaginative person (Plotkin, 1993, provides an interesting summary), one must not underestimate Pickering's personal and cultural milieu, combined with what Plotkin (1993) refers to his "nearly total isolation at his Woodlawn observatory in Mandeville, Jamaica… from his scientific peers…as a virtual outcast from the astronomical community of his day". At the same time, being so much intrigued and fascinated by common perceptions about life on the Moon and Mars as advocated by contemporary minds of Schiaparelli, Lowell and Flammarion, he continued maintaining his outdated outlook even after their death.

There's nothing inherently wrong with following observations down exotic pathways (accelerating expansion of the universe is a recent example). But Pickering mentions several times in his papers that his conclusions seem difficult to believe. This would have been the time to step back and ask which is more unbelievable, the conclusion reached or the possibility that there may be a flaw in my reasoning. Pickering seems to have considered the latter to be the less likely.

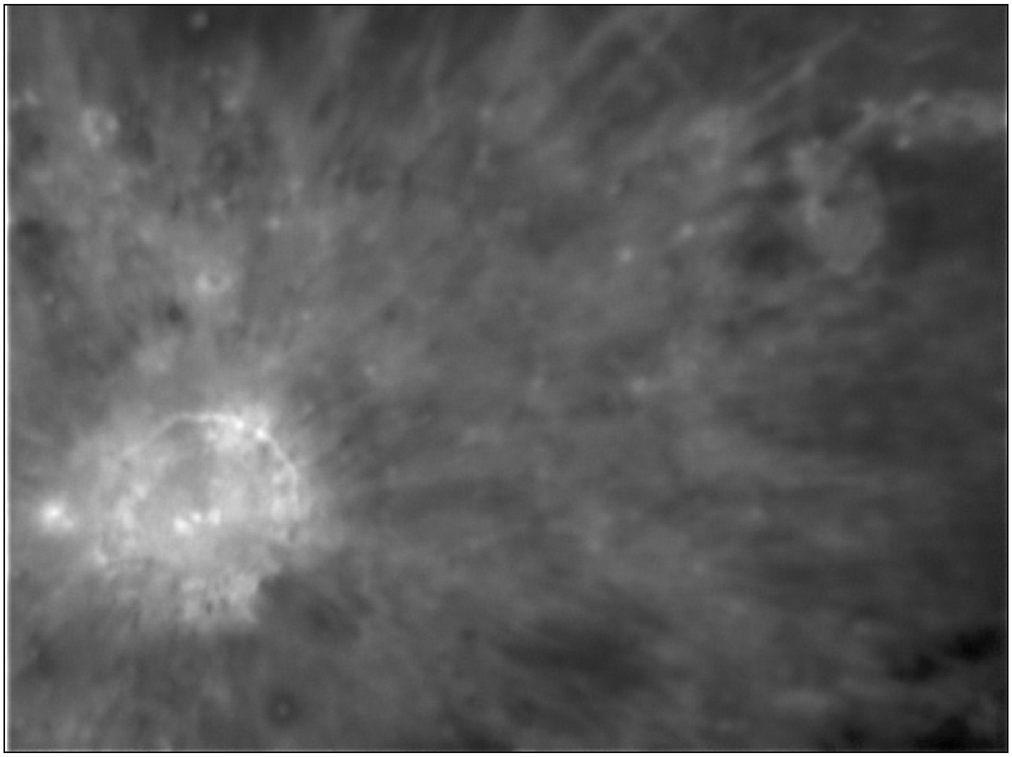


Figure 3. Copernicus & Eratosthenes Near Full Moon as imaged by Wayne Bailey, Sewell, NJ USA. November 18, 2005 05:44 UT. Colongitude 112º. Copernicus at lower left, Eratosthenes at upper right.

References

Note: All of the following papers are available for download from the SAO/NASA Astronomical Data System at *http://adsabs.harvard.edu/abstract_service.html*

Christie, W.H.M. 1921. Changes in the Lunar Craters Aristillus and Eratosthenes observed at the Harvard College Observatory, Mandeville, Jamaica. *Monthly Notices of the Royal Astronomical Society,* Vol. 81, p. 451.

Maggini, M. 1925. The Lunar Crater Eratosthenes. Popular Astronomy, Vol. 33, p. 629.

Pickering, W.H. 1919. Eratosthenes I. A Study for the Amateur. Popular Astronomy. Vol. 27, p. 579.

— 1921a. Eratosthenes II. Popular Astronomy. Vol. 28, p. 389.

— 1921b. Seasonal Changes occurring in certain Lunar Craters. Monthly Notices of the Royal Astronomical Society, Vol. 81, p. 490.

— 1922. Eratosthenes III. Dr. Maggini's Drawings. Popular Astronomy. Vol. 28, p. 389.

— 1924a. Eratosthenes No. 4. Popular Astronomy. Vol. 28, p. 389.

— 1924b. Eratosthenes No. 5. Darkness, Snow, and Color. Popular Astronomy. Vol. 28, p. 389.

— 1924c.Eratosthenes No. 6. Migration of the Plats. Popular Astronomy. Vol. 28, p. 389.

Plotkin, H. 1993. JHA. William H. Pickering in Jamaica: The Founding of Woodlawn and Studies of Mars. Vol. 24, p. 101.

A.L.P.O. Lunar Section: Selected Areas Program

Albedo and Supporting Data for Lunar Drawings

Lunar Feature Observed : ______________________________

(use *Drawing Outline Chart* for making drawings and attach to this form)

Observer: ____________________________________ Observing Station: ________________________________

Mailing Address: ____

street city state zip

Telescope: ____

instrument type aperture (cm.) focal ratio

Magnification(s): __________X __________X __________X Filter(s): F1 ________ F2 ________

Seeing: ____________________ [A.L.P.O. Scale = 0.0 (worst) to 10.0 (perfect)]

Transparency: _______________________ [Faintest star visible to unaided eye]

Date (UT): ______________________ Time (UT): __________ ___________

year month day start end

Colongitude: ________________° ________________°

start end

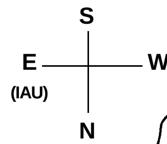
Albedo Data

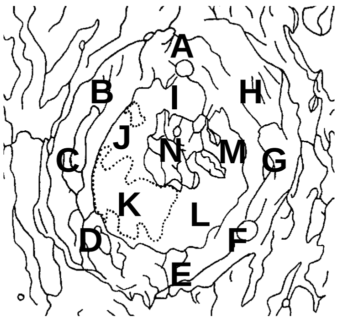
(refer to *Albedo Reference Chart* which shows "Assigned Albedo Indices" for feature and attach to this form)

Assigned Albedo Index	Albedo IL	Albedo F1	Albedo F2	Assigned Albedo Index	Albedo IL	Albedo F1	Albedo F2
A				J			
B				K			
C				L			
D				M			
E				N			
F				O			
G				P			
H				Q			
I				R			

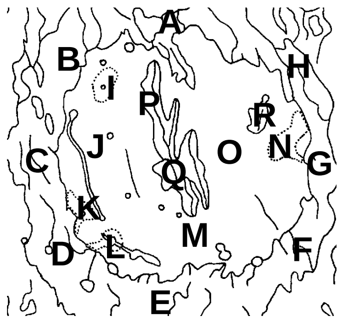
NOTES:

A.L.P.O. Lunar Selected Areas Program

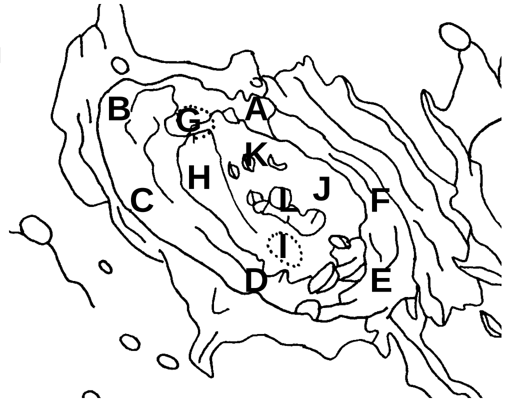




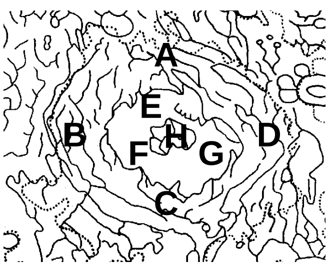
Theophilus



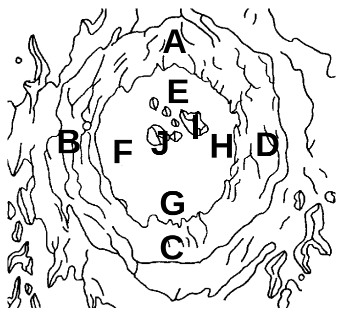
Alphonsus



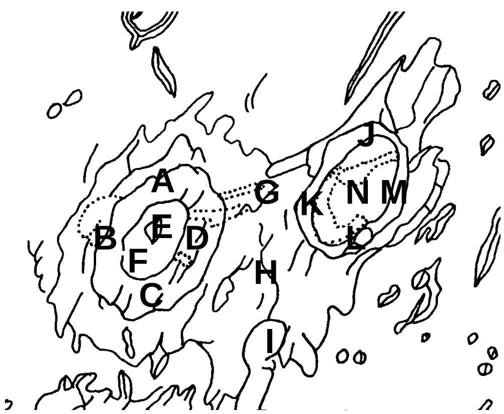
Atlas



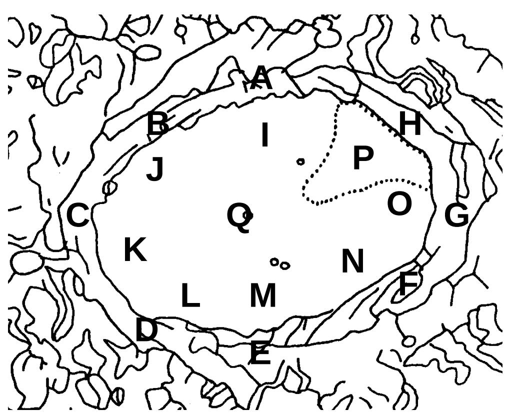
Tycho



Copernicus



Aristarchus



Plato

Feature Story: Jupiter

Observations During the 2010-2011 Apparition

By: Richard W. Schmude, Jr., coordinator, ALPO Jupiter Section
schmude@gdn.edu

This paper includes Jupiter images submitted by a number of observers.

Abstract

Drift rates of 223 different features in over 20 currents are reported. In almost all cases, drift rates are consistent with historical values. The one possible exception is a dark spot, F10, at 27.5° N, which has a drift rate between the NTC and NTC-B. Two flashes, imaged on June 3 and August 20, are believed to be fragments of a small asteroid or comet. The selected normalized magnitudes of Jupiter are: B(1,0) = -8.65±0.02, V(1,0) = -9.46±0.02, R(1,0) = -9.92±0.02 and I(1,0) = -9.79±0.02.

Introduction

Abbreviations for belt, zone and current names used in this report are listed in Table 1.

Several important Jupiter papers were published in 2010 and early 2011. In one study, de Pater et al (2010) carried out studies of the July 2009 impact spot on Jupiter. They report that a large amount of dark particles, with a diameter of about 0.75 microns, was deposited in Jupiter's upper troposphere and lower stratosphere. They also report that the downward jet from the impact explosion reached the troposphere at a pressure of about 0.7 atmospheres of pressure. Fast et al (2011) report that there was a higher concentration of ethane in the stratosphere 23 days after the July 19, 2009 impact. Two groups also examined the GRS and Oval BA. Sussman et al (2010) measured the wind speeds inside of oval BA. They report peak speeds of 139 m/s (or 311 mile/hour), based on images made by the New Horizons spacecraft. They also report that Oval BA shifted 0.9° southward between 2001 and 2007. Shetty and Marcus (2010) report that the GRS area dropped by 18% between 1996 and 2006. They also report that this feature has become rounder. These conclusions are based on wind speeds inside of the GRS and not the shape of this feature in visible light images. Lii Wong and de Pater (2010) examined near infrared images of Jupiter with the Hubble Space Telescope. They report that the latitude of peak haze reflectivity shifted from 7° N in 1995 to 1° S in 2007. They also report that equatorial zone clouds became less reflective during the global upheaval in 2006-2007. Asay-Davis et al (2011) carried out a study of Jupiter's wind speed. Their study covered the time period between 1979 and 2008. They report that the peak wind speed at 24° N increased between 2000 and 2008. They also report that there were no statistically significant changes in wind speeds between 70° N and 70° S.

Amateur astronomers also made important contributions in 2010. For example, Go and Wesley independently recorded a flash on June 3. Tachikawa recorded a similar flash on August 20 (18:22:12 UT) that was also confirmed by others. Many others drew or imaged the South Equatorial Belt Revival in late 2010. The writer counted 10,494 Jupiter images posted to the "ALPO-Japan Latest" website during the 2010-2011 apparition period. Almost all of these were made by amateur astronomers.

The characteristics of Jupiter for 2010-2011 are listed in Table 2. Those who submitted observations, images or measurements of Jupiter to either the writer, the websites *http://alpo-j.asahikawa-med.ac.jp/Latest/Jupiter2008Apparition.htm* or *http://www.arksky.org* or to the ALPO Jupiter group are listed in Table 3.

This paper will follow certain conventions. The planetographic (or zenographic) latitude is always used. Latitudes are measured using the procedure outlined in Peek (1981, 49). West refers to the direction of increasing longitude. Longitude is designated with the Greek letter λ, followed by a subscript Roman numeral that is the longitude system. As an example, λ_I = 54° means that the system I longitude equals 54° W. The three longitude systems are described in (Rogers, 1995, 11; 2006, 334). All dates and times are in Universal Time (UT). Unless stated otherwise, all data are based on visible light images. All methane band images were made in light with a wavelength near 0.89 mm. Currents, except where noted, are named in accordance with Rogers (1990, 88). In all cases the drift rate, except where noted, is for the center of the feature. Feature names contain a letter and a number. Names are assigned based on the description in Schmude (2010, 31). All features are renamed every apparition except for the GRS and Oval BA. Therefore, feature B1 is probably not the same as B1 in the previous apparition.

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:
- Magnitude of the faintest star visible near Jupiter when allowing for moonlight and twilight

Table 1: Names and Abbreviations of Belts and Zones on Jupiter

Belt and Zone Name	Abbreviation	Current Name	Abbreviation
South Polar Region	SPR	South Polar Current	SPC
South Polar Belt	SPB	South South South South Temperate Current	S^4TC
South Temperate Zone	STZ	South South South Temperate Current	S^3TC
South Tropical Zone	STrZ	South South South Temperate Current Jetstream	S^3TC jetstream
South Equatorial Belt	SEB	South South Temperate Current	SSTC
Equatorial Zone	EZ	South Temperate Current	STC
Equatorial Band	EB	South Tropical Current	STrC
North Equatorial Belt	NEB	North Equatorial Current	NEC
North Tropical Zone	NTrZ	North Temperate Current	NTC
North Temperate Belt	NTB	North North Temperate Current Jetstream	NNTC jetstream
North Temperate Zone	NTZ	North North Temperate Current	NNTC
North North Temperate Belt	NNTB	North North North Temperate Current	N^3TC
North Polar Region	NPR	North North North North Temperate Current	N^4TC
Great Red Spot	GRS	North Polar Current	NPC

Disk Appearance

Adamoli, Cudnik, Plante, Roussell, Sweetman and the writer made over 600 light intensity estimates of Jupiter's belts and zones. These estimates were made between April 2010 and February 2011. The average light intensities based on the ALPO scale (10 = white and 0 = black) are: SPR (5.9), STrZ (9.1), SEB (6.4), EZs (8.6), EB (7.2), EZn (8.6) NEB (3.3), NTrZ (8.1), NTB (5.7), GRS (6.0) and NPR (5.8). The biggest change between 2009 and 2010 is that the SEB faded.

Adamoli reports average intensities for additional features based on a scale of 0 = white to 10 = black. I have converted his values to light intensities using equation (1)

Light intensity = 10.0 – Adamoli's intensity value (1)

Adamoli's average light intensities are: S^3TZ (7.0), SSTB (5.1), STZ (8.2), STB (5.4), Oval BA (8.0), NEB rifts (7.4), NTZ (7.5), NNTB (5.5), NNTZ (7.1), N^3TB (6.0) and N^3TZ (7.5).

The average light intensity of the GRS between 1994 and 2009 is 6.1 (Schmude, 2005b, 22; 2007a, 34; 2003, 41; 2008a, 33; 2009a, 26; 2009b, 29; 2011b, 30; 2011c) (Schmude and McAnally, 2006, 43). This is almost the same value that it had in 2010-2011. Therefore, there is no evidence here that the GRS was darker in this apparition than in previous ones.

Table 4 lists the latitudes of a few belts based on September 2010 images made in visible light. Values are averages from several different system II longitudes. The northern and southern components of the SEB were faint. The biggest change in belt position, compared to the previous apparition, was the northward shift of the northern edge of the NEB. As a result of this, the NEB was wider in September 2010 than in August 2009.

Table 5 lists the latitudes of a few features on Jupiter based on methane-band images. As in Table 4, the latitudes are average values made at different system II longitudes. The biggest changes are the wide NEB and the narrow NTB.

Figures 1 and 2 show the general appearance of Jupiter. Three important events of the apparition were the following:

- The fading and revival of the SEB
- The formation of over four dozen dark ovals that followed the South Temperate Belt North Jetstream
- Two flashes that were probably impacts

Figures 3 – 5 show the longitude of various features versus time. A total of 5,371 longitude measurements were

Table 2: Characteristics of the 2010 - 2011 Apparition of Jupiter[a]

First conjunction date	2010 Feb 28
Opposition date	2010 Sept 21
Second conjunction date	2011 April 6
Brightness at opposition (stellar magnitude)	-2.9
Equatorial angular diameter at opposition	49.9 arc-seconds
Right Ascension at opposition	23h 57m
Declination at opposition	2.1º S
Planetocentric latitude of the Earth at opposition	2.7° N
Planetocentric latitude of the Sun at opposition	2.3° N

[a]Data are from the Astronomical Almanac (2008 and 2009)

Table 3: Contributors to the 2010-2011 Jupiter Apparition Report[a, b]

Name; location (type of observation)	Name; location (type of observation)	Name; location (type of observation)	Name; location (type of observation)
P. Abel, UK (D, DN, TT)	I. Esquivel, Mexico (I)	S. Kowollik, Germany (I)	E. Rivera, USA (I)
M. Abgarian, Belarus (I)	I. Falcon, Spain (I)	E. Kraaikamp The Netherlands (I)	S. Robbins, USA (D)
F. Acquarone, Italy (I)	C. Fattinnanzi, Italy (I)	T. Kumamori, Japan (I)	J. Rogers, UK (Re)
M. Adachi, Japan (D, DN)	M. Frassati, Italy (I)	A. Lasala, Spain (I)	P. Rosen, Sweden (I)
G. Adamoli, Italy (D, DN)	A. Friedman, USA (I)	P. Lawrence, UK (I)	M. Rosolina (I)
J. Adelaar; The Netherlands (I)	J. Fuertes, Spain (I)	M. Lewis, UK (I)	C. Roussell, Canada (D, DN)
H. Akutsu, Japan (I)	K. Fukagawa, Japan (I)	M. Libert, Germany (I)	J. Rozakis, Greece (I)
T. Akutsu; Philippines (I)	H. Fukui, Japan (I)	D. Llewellyn, USA (I)	J. Sacristan, Spain (I)
L. Albero, Spain (I)	C. Galdies, Malta (D)	O. Lopez, Spain (I)	T. Saitou, Japan (I)
K. Ando; Japan (I)	A. Garberlini Jr., Brazil (I)	K. Maeda (I)	S. Saltamonti, Italy (I)
G. Angelo, Italy (I)	C. Gargiulo, Italy (I)	P. Malinski, Poland (I)	A. Sanchez, Spain (I)
K. Aoki, Japan (I)	S. Ghomizadeh, Iran (I)	A. Maniero, Italy (I)	J. Sanchez; Spain (I)
D. Arditti; UK (I)	C. Go, Philippines (I)	M. Marzo, Italy (I)	T. Schmitz, Germany (I)
T. Ashcraft, USA (R)	Y. Goryachko, Belarus (I)	P. Maxson, USA (I)	R. Schmude, Jr.; USA (DN, PP)
J. Atanackov, Slovenia (I)	H. Goto, Japan (I)	M. Mattei, USA (DN)	S. Schraebler, Germany (I)
K. Banzawa, Japan (I)	F. Goujon, France (I)	P. Maxson, USA (I)	I. Sharp, UK (I)
J. Barnett, Canada (TT)	D. Gray, UK (D)	A. Medugno, Italy (I)	M. Smrekar, Slovenia (I)
T. Barry, Australia (I)	P. Grego, UK (I)	F. Melillo, USA (I)	S. Spinoso, Italy (I)
R. Barzacchi, Italy (I)	M. Guidi, Italy (I)	J. Melka, USA (I)	G. Stelmack, Canada (I)
A. Berdejo, Spain (I)	B. Haberman, Jr.; USA (I)	J. Melquist, USA (I)	M. Stenke, Germany (I)
B. Berente, Hungary (I)	T. Hansen, Germany (I)	J.-C. Meriaux, USA (I)	O. Sueyoshi, Japan (I)
A. Bianconi, Italy (I)	T. Hasebe, Japan (I)	T. Mishina, Japan (I)	M. Sugimoto, Japan (I)
D. Bleser, USA (I)	A. Hatanaka, Japan (I)	S. Mogami, Japan (I)	J. Sussenbach, The Netherlands (I)
G. Bleser, USA (I)	T. Hayashi, Japan (I)	M. Mole,Slovenia (I)	T. Suzuki, Japan (I)
S. Bruno, Romania (I)	C. Hernandez, USA (D, DN)	O. Moreno, Spain (I)	M. Sweetman, USA (D, DN)
P. Budine, USA (D)	R. Hill, USA (I)	K. Morozov, Belarus (I)	M. Tachikawa, Japan (I)
F. Carvalho; Brazil (I)	S. Hill (R)	T. Murata, Japan (I)	I. Takimoto, Japan (I)
P. Casquinha; Portugal (I)	M. Hood, USA (I)	M. Naitou, Japan (I)	G. Tarsoudis, Greece (I)
J. Castella, Spain (I)	K. Horikawa, (D)	K. Nakai (I)	A. Tasselli, UK (I)
R. Cazilhac, France (I)	C. Hsuan-Hsiao, Taiwan (I)	J. Nassr (I)	R. Tatum, USA (I)
C. Cellini, Italy (I)	J. Hubbell (I)	D. Niechoy, Germany (D)	K. Tokujiro, Japan (I)
D. Chang; Hong Kong, China (I)	M. Hui, China (I)	M. Notoya, Japan (I)	Y. Tomita, Japan (I)
R. Chavez, USA (I)	J. Ignacio, Spain (I)	Y. Okamoto, Japan (D)	D. Tyler, UK (I)
G. Chester; USA (I)	T. Ikemura, Japan (I)	T. Olivetti, Italy (I)	F. Ucha, Spain (I)
K. Christodoulopoulos, Greece (I)	T. Ishibashi, Japan (I)	S. Ota, Japan (I)	T. Usude, Japan (I)
J. Colorado, El Salvador (I)	W. Jaeschke, (I)	L. Owens, USA (I)	G. Vandenbulcke, Belgium (I)
B. Colville, Canada (I)	R. Jakiel, USA (I)	H. Oyamada, Japan (I)	M. Vedovato, Italy (I)
B. Combs, USA (I)	E. Jamison (D, DN, I)	K. Ozaki, Japan (I)	W. Verhesen,(I)
L. Comolli, Italy (I)	J. C. Johnson, USA (DN)	D. Parker, USA (I)	G. Walker, USA (I)
F. Contigliozzi, Italy (I)	G. Jolly, USA (I)	T. Parker, USA (I)	S. Walker, USA (I)
G. Crist, USA (I)	J. Jovani, Spain (I)	D. Peach, UK (I)	S. Walsh (I)
J. Cruz, Portugal (I)	S. Kanno, Japan (I)	C. Pellier, France (I)	A. Wesley, Australia (I)
B. Cudnik, USA (D, DN, TT)	H. Karasawa, Japan (I)	J. Phillips, USA (I)	F. Willems, USA (I)
L. Curelaru, Romania (I)	M. Kardasis, Greece (I)	M. Phillips, USA (I)	J. Willinghan (I)
V. da Silva, Jr., Brazil (I)	A. Kazemoto, Japan (I)	P. Plante, USA (D)	T. Wilson, USA (I)
J.-L. Dauvergne, France (I)	B. Kendrick, USA (I)	J. Poupeau, France (I)	B. Worsley, USA (I)
M. Delcroix, France (I)	S. Kidd, UK (I)	P. Presnyakov, Ukraine (I)	A. Yamazaki, Japan (I)
D. Dickinson, USA (I)	B. Kingsley, UK (I)	D. Pretorius, Australia (I)	S. Yoneyama, Japan (I)
K. Dimitrios, Greece (I)	W. Kivits, The Netherlands (I)	J.-P. Prost, France (I)	H. Yoon, Republic of Korea (I)
X. Dupont, France (I)	D. Koehn, Germany (I)	E. Punzo, Italy (I)	T. Yoshida, Japan (I)
P. Edwards, UK (I)	M. Koishikawa, Japan (I)	D. Put, The Netherlands (I)	K. Yunoki, Japan (I)
H. Einaga, Japan (I)	H. Kondou, Japan (I)	K. Quin, USA (I)	C. Zannelli, Italy (I)

[a]Type of observation: D = drawing, DN = descriptive notes, I = image, PP = photoelectric photometry, R = radio studies and TT = transit times
[b]All people who submitted images to http://www.arksky.org in the ALPO Jupiter archive and in the ALPO Japan Latest website in the Jupiter archive are acknowledged in this table.

used in computing drift rates for 223 different features. In all cases, the time is in terms of the number of days after March 31.0, 2010. For example, June 18.0 is 79.0 days after March 31.0. Figure 6 shows Jupiter's brightness plotted against the system II longitude. This figure shows the measurements made on the evenings of October 15-16 and 16-17 of 2010. All measurements were made through the Johnson V filter and were normalized to a distance of 1.0 astronomical unit. More details are presented in the section titled "Photoelectric Photometry". Figure 7 shows two images of Jupiter taken on June 18, 2011.

Tables 6 through 8 list feature names, a one- or two-letter symbols that describes the appearance of the features, the number of data points used in determining the drift rate, pantographic latitudes and drift rates. Table 9 summarizes wind speeds for the various currents. Table 10 lists characteristics of a few red and white spots/ovals. Tables 11 and 12 summarize whole-disk brightness measurements of Jupiter.

Region I: Great Red Spot

The general appearance of the GRS is shown in figures 1E, 2A, 2D and 2L. In methane band light (near 0.89 mm), the GRS appears as a white oval (Figure 2F). Cudnik reports a pinkish-orange color for the GRS on June 13 and a red-orange color on December 26. Abel describes the GRS as having an intense orange-red color. Abel reports that it was a bit fainter on December 8. He reports a bright area in the GRS on January 8, 2011, and that the GRS was difficult to observe three days later. Images by Peach on January 9 show a brownish rim around an orange-white GRS. Rogers (2011b) reports that part of the new SEB interacted with the GRS in January 2011, and this may have let to changes in the GRS.

Between September 6 and October 6, 2010, the average system II longitude of the GRS was 157.0° W ± 0.2°. This is 18.4° further west than 13 months ago.

Several images between August 25 and August 31 show a dark spot in the GRS. The movement of this spot is consistent with a rotation rate of 3.6 days. This rate is faster than that of 4.5 days reported in Rogers (2008) for July of 2006.

The dimensions of the GRS can be used in estimating the speed of the dark spot in meters/second. The GRS extended from 16.2° S to 27.5° S. Its span in longitude is listed in Table 10. These values are consistent with a north-south dimension of 13,600 km (8,500 miles) and an east-west dimension of 20,300 km (12,600 miles). The center of the dark spot is estimated to be 0.9 radii from the GRS center. The approximate wind speed is:

- Wind speed = [0.9 × (13,600 km + 20,300 km x 0.5) × 3.1416] ÷ 3.6 days, or
- Wind speed = 13,000 km/day or 150 m/s.

Region II: South Polar Region to the South Tropical Zone

The appearance of the Polar Regions, in visible light, was similar to that in previous apparitions. The SPR and NPR were about equally dark. Cudnik stated that both regions had an orange-gray color during the middle of 2010. The SPB was visible in images made in 2010 (figures 1A and 2E). Hernandez drew a long dark feature near the latitude of the SPB. The SPB has been visible in the previous five apparitions (Schmude, 2009a, 27; 2009b, 31; 2010, 31; 2011b, 30; 2011c).

Currents in the SPR and NPR are not well established. Accordingly, a feature in the SPR follows the South Polar Current and one in the NPR follows the North Polar Current. Different currents in the SPR and NPR are distinguished by latitude. For example, a feature at 60° S follows the South Polar Current at 60° S. I will adopt this naming system until the currents in these regions are better established.

Once again, small white ovals in 2010-2011 have a drift rate consistent with the S^3TC Jetstream. They are about one-third the size of a typical SSTC white oval. My belief is that the improved resolution of the images is why the S^3TC jetstream features can now be studied.

During 2010-2011, the STBn jetstream continues to be active. What usually happens is that dark ovals form in a region about 160° following the GRS. They then drift to the GRS and in many cases move around this feature. These ovals, now on the preceding side of the GRS, continue to drift eastwards with respect to the System II longitude. The average system II drift rate of 49 ovals following the GRS (170° W < λ_{II} < 310°

Table 4: Planetographic Latitudes of Belts on Jupiter (based on images made in visible wavelengths, September 2010)

Feature	South Edge	North Edge
South Polar Belt	69.2° S ± 1°	63.2° S ± 0.5°
South Equatorial Belt	20.5° S ± 0.5°	7.6° S ± 0.5°
North Equatorial Belt	8.2° N ± 0.5°	22.1° N ± 0.5°
North Temperate Belt	25.5° N ± 0.5°	32.1° N ± 1.0°

Table 5: Planetographic Latitudes of Belts on Jupiter (based on methane-band images made at a wavelength of 0.889 µm, September 2010)

Feature	South Ege	North Ege
South Polar Cap	—	65.1° S ± 1.0°
South Equatorial Belt	20.7° S ± 0.5°	5.1° S ± 0.5°
North Equatorial Belt	9.9° N ± 1.0°	20.3° N ± 1.0°
North Temperate Belt	22.8° N ± 0.5°	26.5° N ± 1.0°
North Polar Cap	70.5° N ± 3.0°	—

Table 6: Planetographic Latitudes and Drift Rates of Features South of the EZ (2010-1011 Apparition)

Feature (descr.)	Number of Points	Planetographic Latitude	Drift rate Deg./30 days System II	Feature (descr.)	Number of Points	Planetographic Latitude	Drift Rate Deg./ 30 days System II
South Polar Current at 66° S to 70° S							
A16 (wo)	7	70° S	-18	A19 (wo)	5	66° S	-18
Average		= *68° S*	*-18*				
South Polar Current at 60° S							
A1 (wo)	91	60.4° S	-10	A7 (wo)	34	58.2° S	-8
A8 (p)	5	61.5° S	-19	A15 (wo)	18	59.7° S	-19
Average		*60.0° S*	*-14*				
South South South South Temperate Current							
A3 (ds)	19	55.6° S	-17	A4 (ds)	19	55.3° S	-18
A9 (wo)	22	56.8° S	14	A18 (b)	7	54.4° S	-12
Average		*55.5° S*	*-9*				
South South South Temperate Current							
A2 (ds)	6	47.7° S	-10	A5 (ds)	7	48.6° S	6
A6 (ds)	14	48.1° S	0	A10 (wo)	65	49.7° S	-15
A11 (ds)	8	49.4° S	-17	A12 (ds)	9	49.6° S	0
A13 (ds)	14	49.8° S	6	A14 (ds)	14	49.2° S	2
A20 (wo)	12	51.3° S	-22	A21 (wo)	29	50.3° S	-18
Average		*49.4° S*	*-7*				
South South South Temperate Current Jetstream							
A30 (wo)	12	43.5° S	-89	A32 (wo)	8	43.4° S	-95
A33 (wo)	7	44.1° S	-84	A38 (wo)	14	44.0° S	-94
Average		*43°.8 S*	*-91*				
South South Temperate Current							
B1 (wo)	67	40.9° S	-29	B2 (wo)	80	40.3° S	-27
B3 (wo)	84	40.9° S	-26	B4 (wo)	77	40.5° S	-29
B5 (wo)	82	40.7° S	-31	B6 (wo)	82	40.7° S	-29
B7 (wo)	80	40.4° S	-28	B8 (wo)	80	41.2° S	-30
B9 (wo)	34	40.9° S	-30	B11 (wo)	52	40.5° S	-23
B14 (wo)	10	41.0° S	-21	B15 (wo)	51	39.0° S	-26
B16 (wo)	31	40.2° S	-28	B17 (wo)	17	40.4° S	-23
Average		*40.5° S*	*-27*				
South Temperate Current							
BA (ro)	106	33.1° S	-14	C7 (ds)	9	33.4° S	-11
C8 (wo)	14	32.6° S	-15	C36 (do)	14	33.0° S	-7
C37 (do)	9	32.2° S	-9	C49 (ds)	12	33.5° S	-12
C50 (wo)	20	33.7° S	-11	C51 (ds)	14	33.9° S	-17
C52 (wo)	47	33.0° S	-10	C53 (ds)	15	34.0° S	-10
Average		*33.2° S*	*-12*				
South Temperate Belt North Jetstream, preceding the GRS (graphs 1, 8 and 9)							
C43 (ds)	30	28.2° S	-83	C44 (ds)	23	28.4° S	-82
C46 (ds)	22	28.5° S	-82	C83 (ds)	15	27.7° S	-86
C84 (ds)	29	27.9° S	-82	C85 (ds)	28	28.1° S	-81
C86 (ds)	14	27.0° S	-82	C87 (ds)	20	27.8° S	-82
C88 (ds)	9	27.7° S	-86	C89 (ds)	8	27.8° S	-86
C91 (ds)	13	27.8° S	-86	C92 (ds)	13	28.0° S	-84
Average		*27.9° S*	*-84*				

W) is -75°/30 days with a standard deviation of 4.0°/30 days. The spots on the preceding side of the GRS have an average system II drift rate of -84°/30 days with a standard deviation of 1.9°/ 30 days. Rogers et al (2010b) report similar drift rates. The writer believes that there is a statistically significant difference in the average drift rates of spots on the preceding and following sides of the GRS. The east-west length of 32 different ovals is 1.7 degrees of

Table 6: Planetographic Latitudes and Drift Rates of Features South of the EZ (2010-1011 Apparition, continued)

Feature (descr.)	Number of Points	Planetographic Latitude	Drift rate Deg./30 Days System II	Feature (descr.)	Number of Points	Planetographic Latitude	Drift rate Deg./30 Days System II
South Temperate Belt North Jetstream, following the GRS (graphs 1-7)							
C19 (ds)	13	26.9° S	-84	C20 (ds)	22	27.5° S	-79
C21 (ds)	24	27.3° S	-79	C22 (ds)	20	27.5° S	-79
C23 (ds)	24	27.3° S	-79	C24 (ds)	23	27.8° S	-79
C25 (ds)	27	28.3° S	-77	C26 (ds)	31	29.0° S	-72
C27 (ds)	27	29.0° S	-70	C28 (ds)	17	29.0° S	-72
C29 (ds)	28	28.6° S	-71	C30 (ds)	21	28.7° S	-72
C31 (ds)	27	28.5° S	-64	C32 (ds)	14	29.0° S	-77
C38 (ds)	16	29.0° S	-76	C39 (ds)	17	28.4° S	-71
C40 (ds)	14	28.8° S	-74	C41 (ds)	15	28.7° S	-72
C42 (ds)	13	28.2° S	-71	C47 (ds)	9	28.2° S	-77
C48 (ds)	8	28.7° S	-71	C54 (ds)	28	27.5° S	-72
C55 (ds)	27	28.1° S	-74	C56 (ds)	24	27.8° S	-76
C57 (ds)	25	27.8° S	-79	C58 (ds)	22	26.8° S	-77
C59 (ds)	20	26.7° S	-79	C60 (ds)	21	27.7° S	-78
C61 (ds)	15	27.1° S	-82	C62 (ds)	17	27.1° S	-84
C63 (ds)	17	27.6° S	-85	C64 (ds)	24	28.3° S	-71
C65 (ds)	24	28.5° S	-72	C66 (ds)	24	28.9° S	-72
C67 (ds)	33	28.6° S	-75	C68 (ds)	28	28.4° S	-74
C69 (ds)	7	28.1° S	-77	C70 (ds)	18	28.2° S	-75
C71 (ds)	23	28.5° S	-73	C72 (ds)	24	28.6° S	-76
C73 (ds)	24	28.5° S	-75	C74 (ds)	24	28.8° S	-76
C75 (ds)	19	27.6° S	-74	C76 (ds)	21	27.2° S	-74
C77 (ds)	18	27.3° S	-73	C78 (ds)	16	27.3° S	-74
C79 (ds)	16	27.7° S	-71	C80 (ds)	13	27.2° S	-73
C81 (ds)	12	27.7° S	-75				
Average		*28.0° S*	*-75*				
South Tropical Current							
GRS (ro)	187	22.0° S	2.0				
South Equatorial Belt Current, tiny dark spots							
D2 (ds)	7	13.7° S	-72	D3 (ds)	7	13.7° S	-60
D4 (ds)	7	14.0° S	-54				
Average		*13.9° S*	*-62*				
South Equatorial Belt Current, barges							
D5 (bs)	15	13.9° S	1	D6 (b)	48	15.9° S	0
D7 (b)	53	16.5° S	10	D8 (ds)	54	15.7° S	8
D9 (ds)	16	15.4° S	3	D10 (lp)	14	15.2° S	5
Average		*15.4° S*	*5*				
South Equatorial Belt revival, south end							
D13 (ds)	9	19.6° S	130	D15 (ds)	8	22.0° S	111
D16 (ds)	8	20.5° S	134	D17 (ds)	8	20.7° S	123
D18 (ds)	8	21.6° S	120				
Average		20.9° S	124				
South Equatorial Belt revival, north end							
D14 (ds)	9	11.8° S	-69				

longitude, 1,900 km (1,200 miles). This is consistent with similar features in the previous apparition. During this apparition, the east-west dimension of the ovals is between 1° to 2.5°. Figures 1E, 2D and 2E show some of these ovals.

Oval BA was centered at the same longitude of the GRS on August 29. On August 29, both features were at λ_{II} = 155° W. The drift rate of Oval BA was -14°/30 days during April – August but increased to -18°/30 days during September – December (Figure 3).

Region III: South Equatorial Belt

The SEB was often drawn or imaged during the first half of the apparition. It was usually reported as two thin bands separated by a bright zone (Figure 2A). During November, the SEB began to reappear.

The SEB revival started with a white oval that was imaged by Go on November 9. This oval was inside barge D7 at a latitude of 16.3° S (±0.3°) at λ_{II} = 290° W and at λ_{III} = 149° W on that date. It was followed by the writer for the next 4.5 days. Its approximate system II drift rate was -18°/30 days. Rogers et al (2011c) reported a drift rate of -12°/30 days for this feature (their WS1) for the time interval November 9 - 17. The initial white oval was also bright in a November 9 methane band image (figures 2G and 2H). The writer followed a few dark spots near the south end of the SEB revival. The average drift rate of these spots was 124°/30 days. Rogers (2011d) reported similar drift rates for these spots. The north end of the SEB revival (D14) had a drift rate of -69°/30 days.

During 2010, the SEB was faint in visible light; however, it was dark and distinct in methane band light (figures 2E and 2F). This situation had reversed by June 18, 2011. On this date the SEB was dark in visible light but faint in methane band light (Figure 7). According to Fix (2011, 276), gases in the belts descend whereas they rise in a zone. Perhaps the fading of the SEB affected the circulation of bright hazes at high altitudes.

Three small dark spots D2, D3 and D4 had an average latitude and drift rate consistent with the white spots that follow the GRS. Unlike these white spots, D2 – D4 maintained a fairly stable appearance. The lengths of D2, D3 and D4, in degrees of longitude, were 2.5°, 1.5° and 2°, respectively. I tentatively assign D2 – D4 to the mid-SEB outbreak current (Rogers, 1995, 161).

Region IV: Equatorial Zone

Abel describes the EZ as having a light bluish gray color in early October.

The Equatorial Zone was usually the second brightest zone on Jupiter after the STrZ. Several people reported faint spots near the center of the EZ.

The average system I drift rate of the large festoons is consistent with the rate of similar features examined by Rogers et al (2010c).

Region V: North Equatorial Belt

The NEB grew about 35% wider in late 2010. Its average width between March and September was 9.7°, whereas between October and December (2010), its average width was 13.2°. For a comparison, Rogers (1995, 113) reports an average width of 10.5° for 1913-1991. During late 2009 the average width of the NEB was about 10° of latitude or 12,000 kilometers. During the first half of 2010, the belt expanded to a width of 14° of latitude or almost 17,000 kilometers. At nearly the same time as the NEB was expanding, the SEB was fading. The NEB kept nearly the same width of 17,000 km during the second half of 2010.

The NEB had several rifts. One of these, N16, started out as a small white spot at λ_{II} = 141° W. It was bright in visible wavelengths, but it did not appear bright in methane band images on August 1 and 3 (images by Hatanaka, Einaga, Yamazaki, Yunoki and Yoneyama). It was, however, bright on an August 10 methane band image by Einaga. Therefore, this rift started at a low altitude but had expanded to a higher altitude by August 10. Rift N6 was also not visible in methane band images during its early stage.

Table 7. Planetographic Latitudes and Drift Rates of Festoons in the Equatorial Current (2010-2011 Apparition)

Feature	Number of Points	Planetographic Latitude	Drift rate Deg./30 Days System I	Feature	Number of Points	Planetographic Latitude	Drift rate Deg./30 Days System I
North Equatorial Current, festoon bases							
E1 (f)	5	8.2° **N**	25	E2 (f)	22	8.2° **N**	9
E3 (f)	9	8.2° **N**	7	E4 (f)	35	8.2° **N**	7
E5 (f)	8	8.2° **N**	14	E6 (f)	6	8.2° **N**	25
E7 (f)	16	8.2° **N**	15	E8 (f)	10	8.2° **N**	19
E9 (f)	28	8.2° **N**	6	E10 (f)	12	8.2° **N**	5
E11 (f)	20	8.2° **N**	14	E12 (f)	25	8.2° **N**	10
E13 (f)	16	8.2° **N**	8	E14 (f)	12	8.2° **N**	6
E15 (f)	13	8.2° **N**	8				
Average		*8.2 ° N*	*12*				

Table 8: Planetographic Latitudes and Drift Rates of Features North of the Equatorial Zone (2010-2011 Apparition)

Feature (descr.)	Number of Points	Planetographic Latitude	Drift Rate Deg./30 Days System II	Feature (descr.)	Number of Points	Planetographic Latitude	Drift Rate Deg./30 Days System II
North Tropical Current, barges							
N8 (b)	86	15.8° N	-6	N9 (b)	17	16.4° N	-7
N10 (b)	11	16.4° N	-4	N11 (b)	39	17.1° N	-2
N12 (b)	13	19.7° N	-11	N13 (b)	12	19.8° N	-14
N15 (b)	10	16.5° N	2	N17 (b)	23	16.4° N	-2
N18 (b)	20	19.1° N	1	N19 (b)	23	17.3° N	-3
N20 (b)	36	19.9° N	-2	N23 (b)	43	15.2° N	-7
N27 (b)	32	15.7° N	-5	N28 (b)	20	16.6° N	-1
N29 (b)	14	15.8° N	-6	N30 (b)	17	15.8° N	-5
N31 (b)	16	16.4° N	-7				
Average		*17.1° N*	*-5*				
North Tropical Current, ovals							
N2 (wo)	85	19.6° N	-9	N3 (wo)	90	19.3° N	-5
N4 (wo)	31	20.6° N	-4	N5 (wo)	41	20.0° N	-16
N14 (wo)	7	19.0° N	-15	N21 (wo)	20	19.5° N	-4
N22 (wo)	43	19.4° N	-6	N26 (wo)	5	20.1° N	-21
N32 (wo)	11	19.6° N	-8	N34 (wo)	14	19.2° N	-2
Average		*19.6° N*	*-9*				
North Intermediate Current							
N6 (ws)	5	13.9° N	-52	N16 (ws)	9	15.1° N	-40
Average		*14. 5° N*	*-46*				
North Temperate Current							
F1 (b)	90	30.7° **N**	17	F2 (ws)	8	30.2° N	12
F3 (ws)	8	31.6° **N**	15	F4 (b)	7	31.8° N	20
F5 (p)	16	32° N	24	F6 (b)	59	31.2° N	17
F8 (wo)	12	30°.1 N	25	F9 (do)	34	33.3° N	18
Average		*31.4° N*	*19*				
North Temperate Current B							
F10 (ds)	24	27.5° N	-58				
North North Temperate Current B							
H2 (ds)	10	36.1° N	-100	H3 (ds)	10	36.0° N	-101
H8 (ds)	10	36.1° N	-73	H9 (ds)	20	35.4° N	-86
H10 (ds)	19	35.0° N	-80	H11 (ds)	15	34.5° N	-85
H12 (ds)	16	34.6° N	-83	H13 (ds)	14	34.7° N	-83
H14 (ds)	13	34.9° N	-72	H15 (ds)	8	34.8° N	-78
H16 (ds)	17	35.0° N	-86	H17 (ds)	5	35.7° N	-91
H18 (ds)	21	35.6° N	-84	H19 (ds)	21	34.8° N	-87
H20 (ds)	22	35.1° N	-90	H21 (ds)	22	34.9° N	-87
H22 (ds)	20	35.3° N	-86	H23 (ds)	8	35.3° N	-81
Average		*35.2° N*	*-85*				
North North Temperate Current							
G1 (ro)	68	42.9° N	-11	G5 (wo)	68	42.5° N	-9
G6 (wo)	64	43.4° N	-11	G7 (b)	23	39.1° N	0
G24 (b)	31	39.8° N	-1	G25 (b)	16	37.9° N	-8
G26 (wo)	20	41.9° N	-13				
Average		*41.1° N*	*-8*				
North North North Temperate Current							
G32 (b)	18	47.6° N	-16	G33 (b)	18	47.2° N	-18
G34 (ds)	12	45.2° N	-19	G35 (wo)	25	47.1° N	-25
G36 (wo)	15	46.7° N	-19	G37 (wo)	15	46.8° N	-21
G39 (wo)	30	47.1° N	-20	G42 (wo)	7	48.3° N	-18
G43 (wo)	10	46.5° N	-12	G44 (wo)	9	46.3° N	-14
G45 (wo)	8	46.7° N	-16	G48 (wo)	12	46.8° N	-20
Average		*46.9° N*	*-18*				
North North North North Temperate Current							
I1 (wo)	10	54.6° N	-4	I8 (wo)	44	52.2° N	6
I16 (wo)	16	52.2° N	2	I17 (wo)	16	54.3° N	7
I19 (wo)	15	53.9° N	6	I20 (wo)	9	54.1° N	6
I21 (wo)	10	54.6° N	-4				
Average		*53.7° N*	*3*				
North Polar Current at 63° N							
I22 (wo)	14	63.3° N	-11				

Region VI: North Tropical Zone to the North Polar Region

Longitude measurements were made of a dark spot, F10, between November 23, 2010, and January 10, 2011. In Ikemura's December 8, 2010, image (9:06:36 UT) F10 was nearly circular and had an east-west length of two degrees of longitude. This feature had a system II drift rate of -58°/30 days. This lies in between the NTC with a mean system II drift rate of 17.0°/30 days (Rogers, 1995, 102) and the NTC-B with an average system II drift rate of -111.7°/30 days (Rogers, 1995, 107). The drift rate of F10 is similar to that of a spot observed in 1891 having a system II drift rate of -51°/30 days (Rogers, 1995,

Table 9: Average Drift Rates, Rotation Periods and Wind Speeds[a] for Several Currents on Jupiter (2010-2011 Apparition)

Current	Feature(s)	Drift Rate (degrees/30 days)			Rotation Rate	Wind Speed (m/s)
		Sys. I	Sys. II	Sys. III		
SPC 70° S	A16	211	-18	-10	9h 55m 16s	1.7 ± 2[a]
SPC 66° S	A19	211	-18	-10	9h 55m 16s	2.1 ± 2[a]
SPC 60° S	A1, A7, A8, A15	215	-14	-6	9h 55m 22s	1.5 ± 0.6
S^4TC	A3, A4, A9, A18	221	-8	0	9h 55m 30s	0 ± 3[a]
S^3TC	A2, A5, A6, A10-A14, A20, A21	222	-7	1	9h 55m 31s	-0.3 ± 1.0
S^3TC Jetstream	A30, A32, A33, A38	138	-91	-83	9h 53m 37s	29.7 ± 0.8
SSTC	B1-B9, B11, B14-B17	202	-27	-19	9h 55m 04s	7.1 ± 0.4
STC	Oval BA, C7, C8, C36, C37, C49-C53	217	-12	-4	9h 55m 24s	1.6 ± 0.4
STBn Jetstream following GRS	C19-C32, C38-C42, C48, C54-C81	154	-75	-67	9h 53m 58s	28.8 ± 0.3
STBn Jetstream preceding GRS	C43, C44, C46, C83-C89, C91, C92	145	-84	-76	9h 53m 46s	32.7 ± 0.3
Mid-SEB outbreak, dark spots	D2-D4	167	-62	-54	9h 54m 16s	25.3 ± 2.0
SEBC, barges	D5-D10	234	5	13	9h 55m 47s	-6.1 ± 0.7
SEB revival south end	D13, D15-D18	353	124	132	9h 58m 31s	-59.8 ± 1.6
SEB revival north end	D14	160	-69	-61	9h 54m 6s	28.8 ± 1[a]
STrC	GRS	231	2	10	9h 55m 43s	-4.5 ± 1
NEC	E1-E15	12	-217	-209	9h 50m 14s	99.6 ± 0.8
NTrC, barges	N8-N13, N15, N17-N20, N23, N27-N31	224	-5	3	9h 55m 34s	-1.4 ± 0.5
NTrC, white ovals	N2-N5, N14, N21, N22, N26, N32, N34	220	-9	-1	9h 55m 28s	0.5 ± 1.0
NIC	N6, N16	183	-46	-38	9h 54m 38s	17.8 ± 2.0
NTC	F1-F6, F8, F9	248	19	27	9h 56m 7s	-11.3 ± 0.6
NTrC-B	F10	171	-58	-50	9h 54m 21s	21.6 ± 1
NNTCs Jetstream	H2, H3, H8-H23	144	-85	-77	9h 53m 45s	30.9 ± 0.7
NNTC	G1, G5-G7, G24-G26	221	-8	0	9h 55m 30s	0 ± 1[a]
N^3TC	G32-G37, G39, G42-G45, G48	211	-18	-10	9h 55m 16s	3.8 ± 0.4
N^4TC	I1, I8, I16, I17, I19-I21	232	3	11	9h 55m 45s	-3.3 ± 0.5
NPC	I22	218	-11	-3	9h 55m 26s	0.7 ± 2[a]

[a] Estimated uncertainty.

107). I have, therefore, assigned F10 to the NTC-B.

A red oval, G1, had a distinct reddish color in 2010. It followed the NNTC and it was also very bright in methane band images. G1 was undoubtedly G4 in the previous apparition and "LRS-1" in Rogers et al (2011a).

Wind Speeds

Table 9 summarizes wind speeds. The wind speeds are with respect to the system III longitude and represent how fast large features are moving. They are computed in the same way as in Rogers

Table 10: Characteristics of Selected Red and White Spots/Ovals on Jupiter (2010-2011 Apparition)

Feature	Bright in Methane Band Light	Length (degrees Longitude)	Feature	Bright in Methane Band Light	Length (degrees Longitude)	Feature	Bright in Methane Band Light	Length (degrees Longitude)
SPC								
A1	Yes	8.5	A7	---	4	A16	Yes	~18
SSSSTC								
A9	---	4						
SSSTC								
A10	Yes	4.5	A21	Yes	2.5			
SSSTC Jetstream								
A30	Yes	3.5	A32	---	3	A33	---	2.5
SSTC								
B1	Yes	4	B2	Yes	7	B3	Yes	7
B4	Yes	6	B5	Yes	4.5	B6	Yes	5.5
B7	Yes	4	B8	Yes	6.5	B9	---	3.5
B11	Yes	3	B14	---	2.5	B15	No	10.5
B16	Yes	3.5	B17	---	2.5			
STC								
BA	Yes	13	C8	Yes	---	C50	---	4
C52	Yes							
STrC								
GRS	Yes	17.5						
NTrC ovals								
N2	Yes	4.5	N3	Yes	7	N4	Yes	4
N5	Yes	5	N14	Yes	5	N21	No	9
N22	Yes	6.5	N34	Yes	4.5			
NIC								
N6	No	---	N16	No*	---			
NTC								
F8	No	3						
NNTC								
G1	Yes	7	G5	Yes	7	G6	Yes	---
G26	---	4						
N^{3}TC								
G35	Yes	5	G36	No	3	G37	---	3
G39	Yes	2.5	G42	No	3	G43	Yes	3
G44	Yes	1.5	G45	---	2.5			
N^{4}TC								
I1	Yes	5.5	I8	Yes	3	I19	---	3
NPC								
I22	---	4						

* Was bright after August 10.0, 2010; see text for details.

(1995, 392). Uncertainties are computed in the same way as in Schmude (2003, 50).

Flashes

Go and Wesley independently imaged a bright flash in Jupiter's SEB region on June 3, 2010. Both imaged this flash at around 20:31:30 UT. Wesley reports longitudes of λ_{II} = 342.7° W and λ_{III} = 159.4° W. My measurement of Go's image is consistent with these values. Its latitude was measured as 15.2° S (±0.5°). There was no visible dark spot larger than 1° or 1,200 km (745.6 miles) across on Akutsu's June 5 (21:06:11 UT) image in the area of the impact.

Tachikawa recorded a flash on August 20 (18:22:12 UT). The flash was at λ_{II} = 139° W. Its latitude was 22.0° N (±1°). Rogers (2010a) reports that K. Aoki and M. Ichimaru also imaged this fireball. There were no dark spots on Bleser's August 21 image (4:52 UT) or Delcroix's August 21 (4:14.5 UT) images larger than 1° or 1,200 km (745.6 miles) in the area of the impact.

Table 11: Photometric Magnitude Measurements of Jupiter (2010-2011 Apparition)

Date (2010)	Filter	α (deg.)	Measured Magnitude	X(1,α)
Aug. 12.289	V	8.1	-2.73	-9.32
Aug. 12.304	V	8.1	-2.78	-9.37
Sept. 6.186	V	3.4	-2.97	-9.45
Sept. 6.200	R	3.4	-3.44	-9.92
Sept. 6.217	I	3.4	-3.28	-9.76
Sept. 6.230	B	3.4	-2.16	-8.64
Sept. 6.244	V	3.4	-2.98	-9.46
Sept. 8.222	V	3.0	-2.98	-9.45
Sept. 13.159	V	1.9	-2.95	-9.42
Sept. 13.178	R	1.9	-3.45	-9.91
Sept. 13.193	I	1.9	-3.33	-9.79
Sept. 14.184	V	1.7	-2.98	-9.45
Sept. 14.197	B	1.7	-2.21	-8.68
Sept. 16.226	B	1.3	-2.19	-8.65
Sept. 16.240	V	1.3	-3.00	-9.46
Sept. 17.220	R	1.1	-3.45	-9.91
Sept. 17.235	I	1.1	-3.31	-9.77
Sept. 20.166	V	0.4	-2.98	-9.44
Oct. 4.153	I	2.8	-3.29	-9.77
Oct. 4.167	R	2.8	-3.42	-9.90
Oct. 4.183	V	2.8	-3.00	-9.48
Oct. 4.196	B	2.8	-2.16	-8.64
Oct. 30.108	R	7.8	-3.29	-9.87
Oct. 30.122	I	7.8	-3.16	-9.74
Oct. 30.094	V	7.8	-2.80	-9.38
Oct. 30.149	B	7.8	-1.98	-8.56
Nov. 13.088	V	9.6	-2.73	-9.39
Nov. 13.103	B	9.6	-1.99*	-8.65*
Dec. 28.999	V	11.2	-2.39	-9.37
Dec. 29.015	B	11.3	-1.52	-8.51
Dec. 29.029	R	11.3	-2.86	-9.84
Dec. 29.055	I	11.3	-2.79	-9.78
Jan. 3.059	V	11.0	-2.35	-9.37
Jan. 13.035	V	10.5	-2.31	-9.39
Jan. 29.030	V	9.1	-2.28	-9.44

Satellite Observations

Europa was darker than the SEBZ in Akutsu's September 18, 2010 image. At that time, Europa's solar phase angle was 1° and, hence, its V filter albedo was 0.65 (Schmude, 2006, 17). The SEBZ, therefore, had a V filter albedo above 0.65 on September 18.

Ganymede was much darker than the NEB and other features on Jupiter in an October 2 image by Yoneyama. At that time, the solar phase angle was ~2.5° which means that Ganymede's V filter albedo was 0.40 (Schmude, 2006, 17). Therefore, the NEB had an albedo greater than 0.40 on October 2, 2010.

Kumamori and Einaga recorded a transit of Callisto across the SPR southward of 65° S. Callisto was darker than the surrounding area. At that time, Callisto had a V filter albedo of 0.14.

Photoelectric Photometry

The writer used an SSP-3 solid-state photometer along with color filters transformed to the Johnson B, V, R and I system in making all photometric

Table 12: Photometric Constants of Jupiter (2010-2011 Apparition)

Filter	X(1,0)
B	-8.65 ± 0.02
V	-9.46 ± 0.02
R	-9.92 ± 0.02
I	-9.79 ± 0.02

magnitude measurements in Table 11. The method and equipment are described elsewhere (Schmude, 1992, 20; 2008b, 161-167), (Optec, 1997). All measurements in Table 11 are corrected for both atmospheric extinction and color transformation in the same way as in Hall and Genet (1988, Chapter 13). The comparison star for all measurements is gamma-Piscium. The brightness values for this star are: B = 4.616, V = 3.696, R = 2.986 and I = 2.466. The V filter value is from Westfall (2008) who cites Mermilliod (1991) and the other three values are computed from the color indexes in (Irairte et al, 1965, 30).

Normalized magnitudes are computed from the equation:

$$X(1,0) = X_{mag} - 5.0 \text{ Log}[r\,\Delta] - c_X\alpha - 2.5 \text{ Log}[k] \qquad (2)$$

In this equation:

- $X(1,0)$ is the normalized magnitude for filter X.
- X_{mag} is the measured brightness of Jupiter in magnitudes.
- r is the Jupiter-Sun distance.
- Δ is the Jupiter-Earth distance.
- c_X is the solar phase angle coefficient of Jupiter for filter X.
- α is the solar phase angle of Jupiter.
- k is the fraction of Jupiter's disc that is illuminated by the Sun as seen from the Earth.

Both r and Δ are in astronomical units. Values of 0.0076, 0.0076, 0.0060 and 0.0035 magnitudes/degree are used for c_B, c_V, c_R and c_I, respectively. These are average values based on measurements made between 1999 and 2008 (Schmude 2003, 41; 2007a, 31; 2007b, 25; 2008a, 30.; 2009a, 24; 2009b, 29; 2010, 29; 2011b, 37; 2011c), (Schmude and Lesser, 2000, 67).

The normalized magnitude or V(1,0) value of Jupiter during 2009-2010 is -9.46 ± 0.02. This is close to the corresponding value in the previous apparition (Schmude, 2010b). This may seem surprising because the SEB was dark in visible wavelengths during most of 2009 but was faint in 2010. There are, however, two factors that must be considered: 1) the SEB was fading in 2009 when most of the 2009 brightness measurements were taken, and 2) the NEB became wider in late 2010. The wider NEB is believed to have compensated for the faint SEB in late 2010. These two factors are believed to be why the 2009 and 2010 V filter measurements are nearly equal.

Figure 6 shows normalized magnitude values of Jupiter based on measurements made during the nights of October 15-16 and 16-17. The measurements show that the brightness changes a little with longitude. There are, however, no large changes, > 0.05 magnitudes for different longitudes.

Acknowledgements

The writer is grateful to everyone who submitted observations during the 2010-2011 apparition, including those people who submitted images to the ALPO Japan latest website and to the Arkansas Sky Observatory website. He is also grateful to Truman Boyle, Sue Gilpin, John McAnally and Brian Sherrod.

References

Asay-Davis, X. S., Marcus, P. S., Wong, M. H. and de Pater, I. "Changes in Jupiter's zonal velocity between 1979 and 2008" Icarus 211, pp. 1215-1232, 2011.

Astronomical Almanac for the Year 2010, Washington DC, US Govt. Printing Office, 2008.

Astronomical Almanac for the Year 2011, Washington DC, US Govt. Printing Office, 2009.

de Pater I. et al "A multi-wavelength study of the 2009 impact on Jupiter: Comparison of high resolution images from Gemini, Keck and HST" Icarus 210, pp. 722-741, 2010.

Fast K. E., Kostiuk, T., Livengood, T. A., Hewagama, T. and Annen, J. "Modification of Jupiter's stratosphere three weeks after the 2009 impact" Icarus, 213, pp. 195-200, 2011.

Fix, J. D. "Astronomy: Journey to the Cosmic Frontier" Sixth edition, McGraw Hill, New York, 2011.

Hall, D. S. and Genet, R. M. "*Photoelectric Photometry of Variable Stars"* Second edition, Willmann-Bell Inc: Richmond, VA, 1988.

Iriarte, B, Johnson, H. L., Mitchell, R. I, and Wisniewski, W. K. "*Five-Color Photometry of Bright Stars" Sky & Telescope*, Vol. 30 (July) pp. 21-31, 1965.

Lii, P. S., Wong, M. H., de Pater, I." Temporal Variation of the tropospheric cloud and haze in the jovian equatorial zone" Icarus 209, pp. 591-601, 2010.

Mermilliod, J.-C. "Photoelectric Photometric Catalog of Homogeneous Measurements in the UBV system." NASA, Astronomical Data Center, Selected Astronomical Catalogues. Volume 1. (CD-ROM).

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

Peek, B. M. "*The Planet Jupiter, the Observer's Handbook"* Revised by Patrick Moore, Faber and Faber: London, 1981.

Rogers, J. H. "*The pattern of jet streams on Jupiter: correlation with Earth-based observations and consequences for belt nomenclature*." *Journal of the British Astronomical Assn*, Vol. 100, No. 2 (April), pp. 88-90, 1990.

Rogers, J. H. *The Giant Planet Jupiter*, Cambridge: Cambridge University Press, 1995.

Rogers, J. H. "*Longitudes of the central meridians of Jupiter and Saturn*." *Journal of the British Astronomical Assn.*, Vol. 116, No. 6 (December) p. 334, 2006.

Rogers, J. H. "The accelerating circulation of Jupiter's Great Red Spot" Journal of the British Astronomical Assn., Vol. 118, No. 1 (February) pp. 14-20, 2008.

Rogers, J. H. “Another Bright Fireball on Jupiter”; *http://www.britastro.org/Jupiter/2010/report07.htm*, 2010a.

Rogers, J. H, Mettig, H.-J., Adamoli, G., Jacquesson, M. and Vedovato, M. “Jupiter in 2010: Interim Report: Southern hemisphere”; *http://www.britastro.org/Jupiter/2010/report08.htm*, 2010b.

Rogers, J. H, Mettig, H.-J., Adamoli, G., Jacquesson, M. and Vedovato, M. “Jupiter in 2010: Interim Report: Northern hemisphere”; *http://www.britastro.org/Jupiter/2010/report09.htm*, 2010c.

Rogers, J. H., Adamoli, G. and Mettig, H.-J. “Jupiter’s high-latitude storms: A Little Red Spot tracked through a jovian year” Journal of the British Astronomical Association vol. 121, No. 1 (February) pp. 19-29, 2011a.

Rogers, J. H. “The SEB revival interacts with the GRS”; *http://www.britastro.org/Jupiter/2010/report20.htm*, 2011b.

Rogers, J. H., Mettig, H.-J., Adamoli, G., Jacquesson, M. and Vedovato, M. “Jupiter’s SEB Revival in 2010/11: Analysis of the early stages”; *http://www.britastro.org/Jupiter/2010/report21.htm*, 2011c.

Rogers, J. H., Mettig, H.-J., Adamoli, G., Jacquesson, M. and Vedovato, M. “Jupiter’s SEB Revival in 2010/11: Analysis of the early stages of the southern branch”; *http://www.britastro.org/Jupiter/2010/report22.htm*, 2011d.

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

Schmude, R. W. Jr. “*Jupiter: A Report on the 2001-02 Apparition.” Journal of the Assn of Lunar & Planetary Observers*, Vol. 45, No. 2 (Spring) pp. 41-62, 2003.

Schmude, R. W. Jr. “Jupiter Observer’s Handbook” The Astronomical League, p. 17, 2006.

Schmude, R. W. Jr. *Observations During the 1999-2000 and 2000-2001 Apparitions of Jupiter.* Journal of the Assn. of Lunar & Planetary Observers, Vol. 49, No. 1 (winter) pp. 31-49, 2007a.

Schmude, R. W. Jr. *Jupiter: Observations During the 2002-2003 Apparition.* Journal of the Assn. of Lunar & Planetary Observers, Vol. 49, No. 3 (summer) pp. 25-50, 2007b.

Schmude, R. W. Jr. *Jupiter: Observations During the 2003-2004 Apparition*. *Journal of the Assn. of Lunar & Planetary Observers*, Vol. 50, No. 2 (spring) pp. 30-49, 2008.

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

Schmude, R. W. Jr. *Jupiter: Observations During the 2004-2005 Apparition.* Journal of the Assn. of Lunar & Planetary Observers, Vol. 51, No. 2 (spring) pp. 24-39, 2009a.

Schmude, R. W. Jr. *Jupiter: Observations During the 2005-2006 Apparition. Journal of the Assn. of Lunar & Planetary Observers*, Vol. 51, No. 4 (autumn) pp. 29-45, 2009b.

Schmude, R. W. Jr. *The 2006-07 Apparition of Jupiter. Journal of the Assn of Lunar & Planetary Observers*, Vol. 52, No. 4 (Autumn) pp. 29-44, 2010.

Schmude, R. W. Jr. “Drift Rates and Latitudes of Jovian Currents” Paper #2260, Proceedings of the 42nd Lunar and Planetary Science Conference, 2011a.

Schmude, R. W. Jr. *The 2008 Apparition of Jupiter.* Journal of the Assn. of Lunar & Planetary Observers, Vol. 53, No. 2 (spring) pp. 28-39, 2011b.

Schmude, R. W. Jr. “The 2009-2010 Apparition of Jupiter” submitted to the Journal of the Assn. of Lunar and Planetary Observers, 2011c.

Schmude, R. W. Jr. and Lesser, H. “Wideband Photometry of Jupiter: 1999-2000.” *Journal of the Assn of Lunar & Planetary Observers*, Vol. 42, No. 2, pp. 67-72, 2000.

Schmude, R. W. Jr. and McAnally, J. “Jupiter: Observations During the 1997-98 and 1998-99 Apparitions” Journal of the Assn. of Lunar and Planetary Observers, Vol. 48, No. 3 (summer) pp. 41-63, 2006.

Shetty, S. and Marcus, P. S. “Changes in Jupiter’s Great Red Spot (1979-2006) and Oval BA (2000-2006)” Icarus 210, pp. 182-201, 2010.

Sussman, M. G., Chanover, N. J., Simon-Miller, A. A., Vasavada, A. R. and Beebe, R. F. “Analysis of Jupiter’s Oval BA: A streamlined approach” Icarus 210, pp. 202-210, 2010.

Westfall, J. E. “Photometric Catalog of Zodiacal Stars” ALPO Monograph Number 12, 2008.

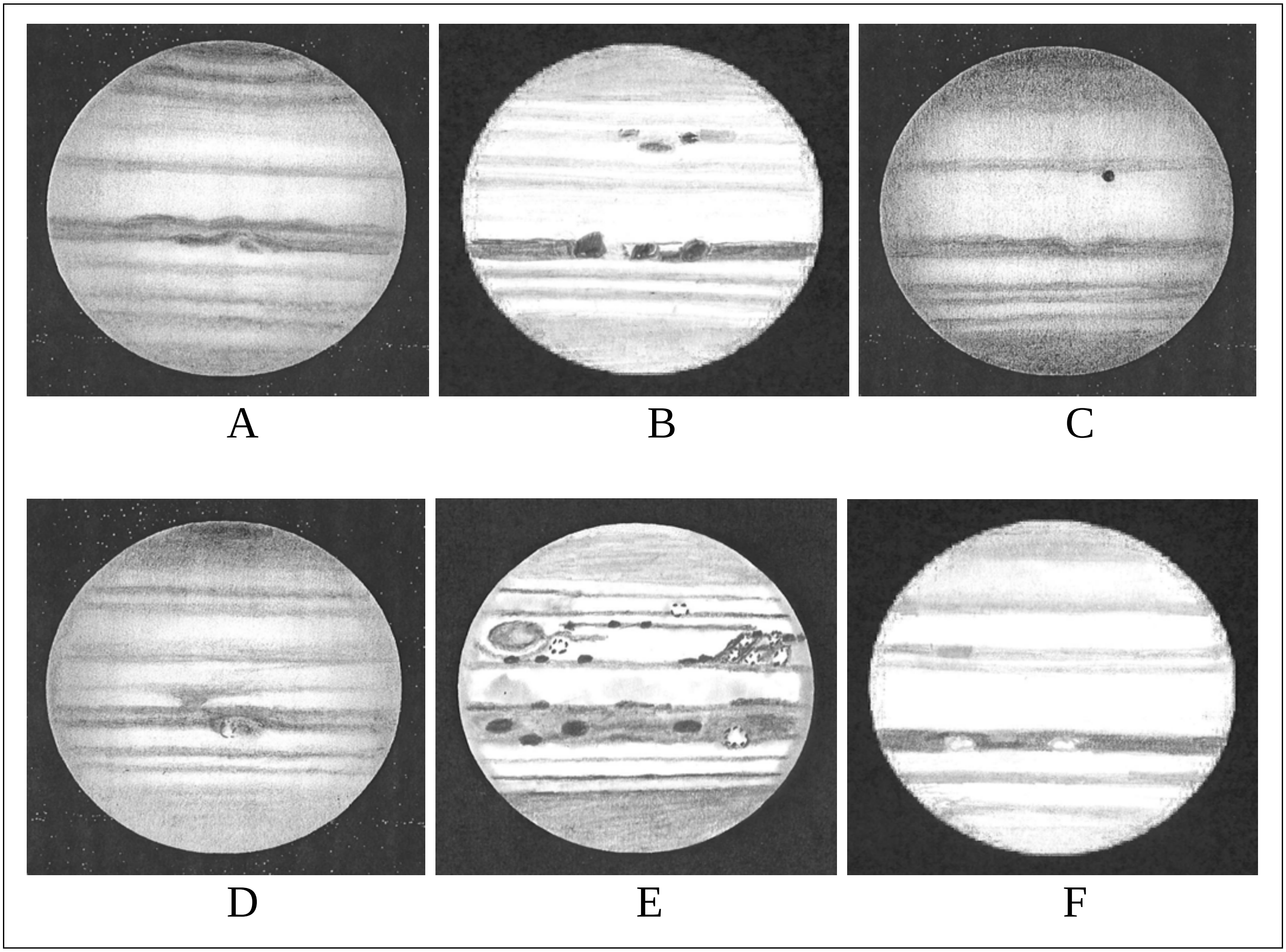


Figure 1: Drawings of Jupiter. In all cases south is at the top. Unless noted otherwise, no filters were used. A: September 13, 2010 (6:14 UT) by Phil Plante, λ_I = 48° W, λ_{II} = 88° W, 0.64 m RL, 152X, 216X, seeing = 5-6; **B**: September 14, 2010 (3:45 UT) by Carl Roussell, λ_I = 115° W, λ_{II} = 149° W, 0.15 m RR, 133X, 200X, W80A filter and integrated light, seeing = 5; **C**: October 9, 2010 (2:10 UT) by Phil Plante, λ_I = 48° W, λ_{II} = 251° W, 0.64 m RL, 295X, 370X, seeing = 4-6; **D**: October 10, 2010 (3:15 UT) by Phil Plante, λ_I = 246° W, λ_{II} = 81° W, seeing = 6-7; **E**: January 5, 2011 (23:30 UT) by Phillip Budine, λ_I = 317° W, λ_{II} = 202° W, 0.13 m Maksutov, 154X, 205X, seeing = 5-7; **F**: January 10, 2011 (0:10 UT) by Carl Roussell, λ_I = 252° W, λ_{II} = 106° W, 0.15 m RR, 133X, seeing = 4.

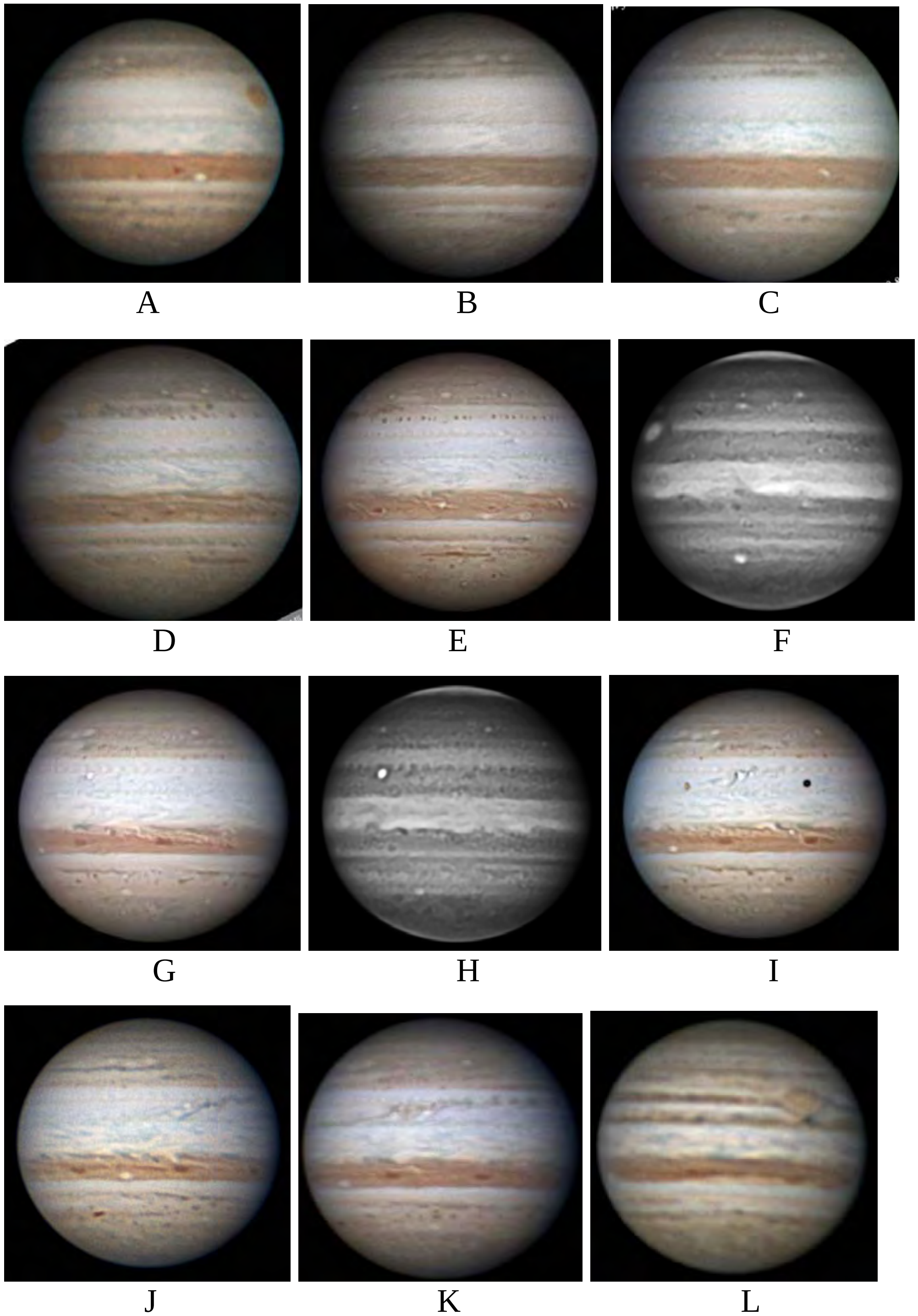


Figure 2: Images of Jupiter. In all cases, south is at the top. Unless noted otherwise these are color images shown as black and white. **A**: May 20, 2010 (10:34 UT) by Brian Combs, λ_I = 245° W, λ_{II} = 89° W; **B**: June 3, 2010 (20:31.5 UT) by Chris Go, λ_I = 299° W, λ_{II} = 33° W; **C**: June 13, 2010 (7:56 UT) by Fabio Carvalho, λ_I = 337° W, λ_{II} = 358° W; **D**: July 20, 2010 (19:01 UT) by Trevor Barry, λ_I = 105° W, λ_{II} = 201° W; **E**: September 2, 2010 (6:24:40 UT) by Don Parker, λ_I = 116° W, λ_{II} = 240° W; **F**: September 2, 2010 (5:44:22 UT) by Don Parker, methane band light, λ_I = 92° W, λ_{II} = 216° W; **G**: November 10, 2010 (0:26:03 UT) by Don Parker, λ_I = 358° W, λ_{II} = 318° W; **H**: November 10, 2010 (0:34:55 UT) by Don Parker, methane band light, λ_I = 4° W, λ_{II} = 323° W; **I**: November 17, 2010 (0:37:54 UT) by Don Parker, λ_I = 31° W, λ_{II} = 297° W; **J**: November 24, 2010 (20:26:40 UT) by Cristian Fattinnanzi, λ_I = 60° W, λ_{II} = 266° W; **K**: December 4, 2010 (9:46 UT) by Trevor Barry, λ_I = 167° W, λ_{II} = 301° W; **L**: February 6, 2011 (18:13:2 UT) by Christophe Pellier, λ_I = 129° W, λ_{II} = 131° W.

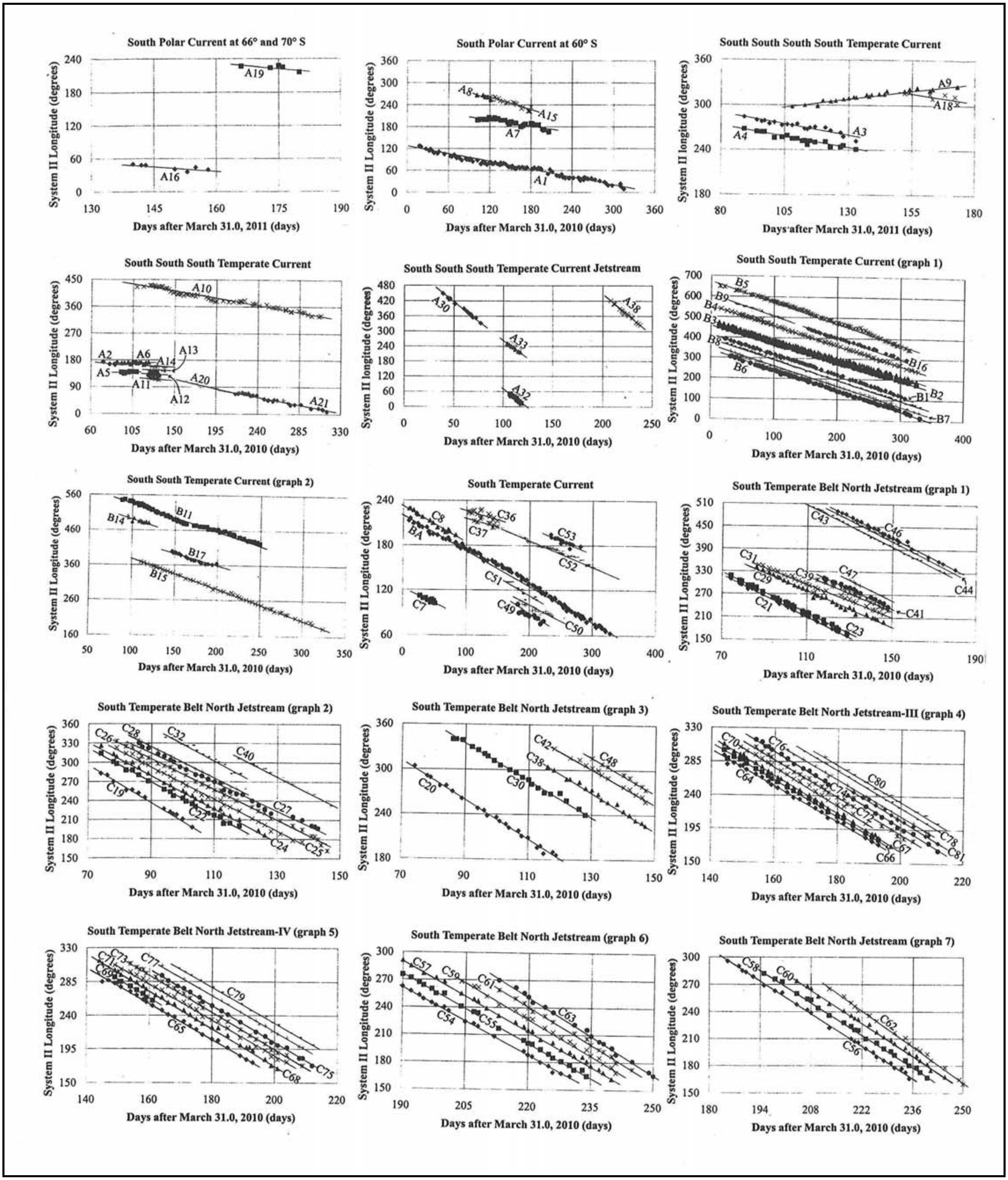


Figure 3: Drift rates of features on Jupiter between the South Polar Current and the South Temperate Belt North Jetstream.

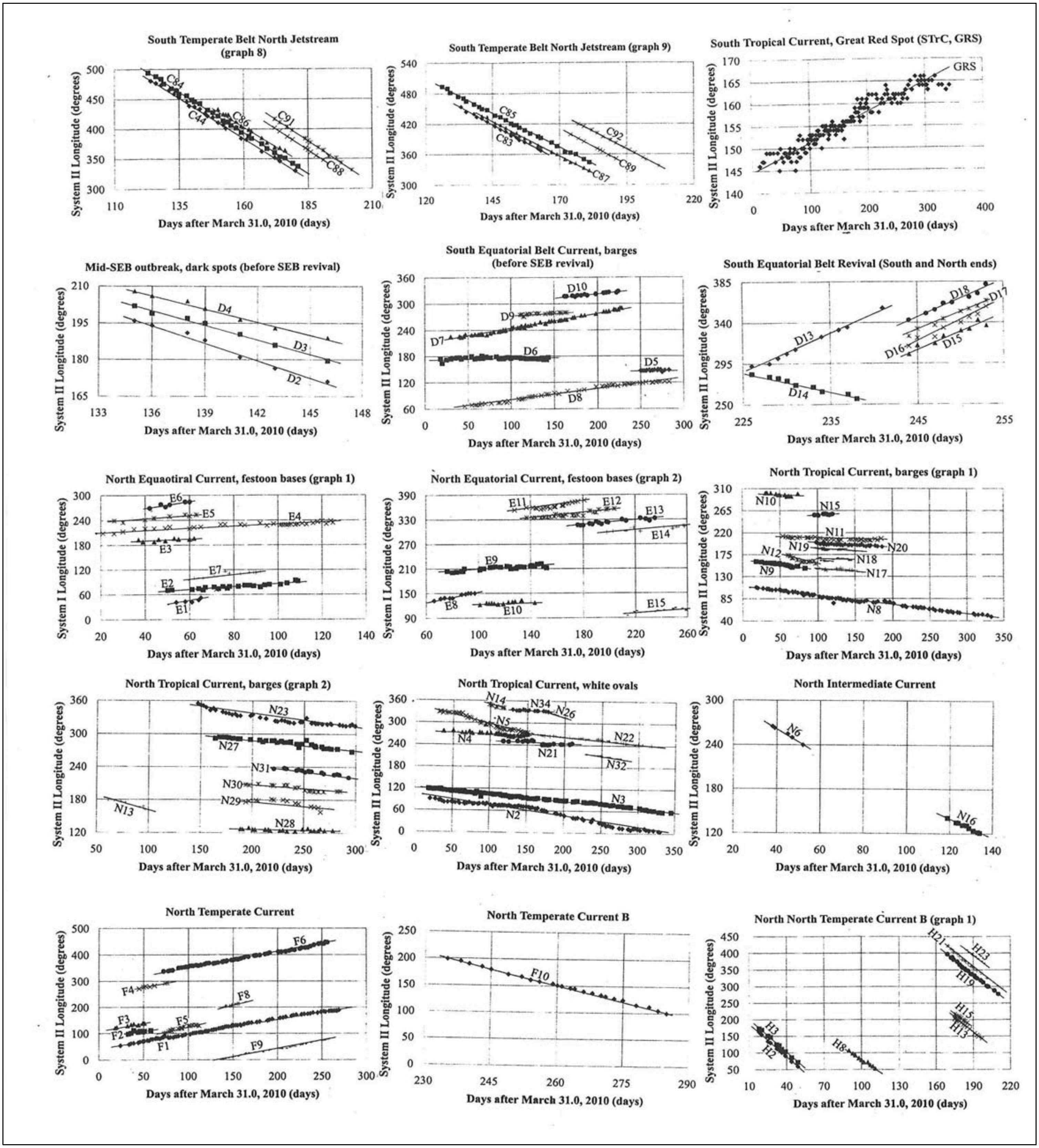


Figure 4: Drift rates of features on Jupiter between the South Temperate Belt North Jetstream and the North North Temperate Current Jetstream.

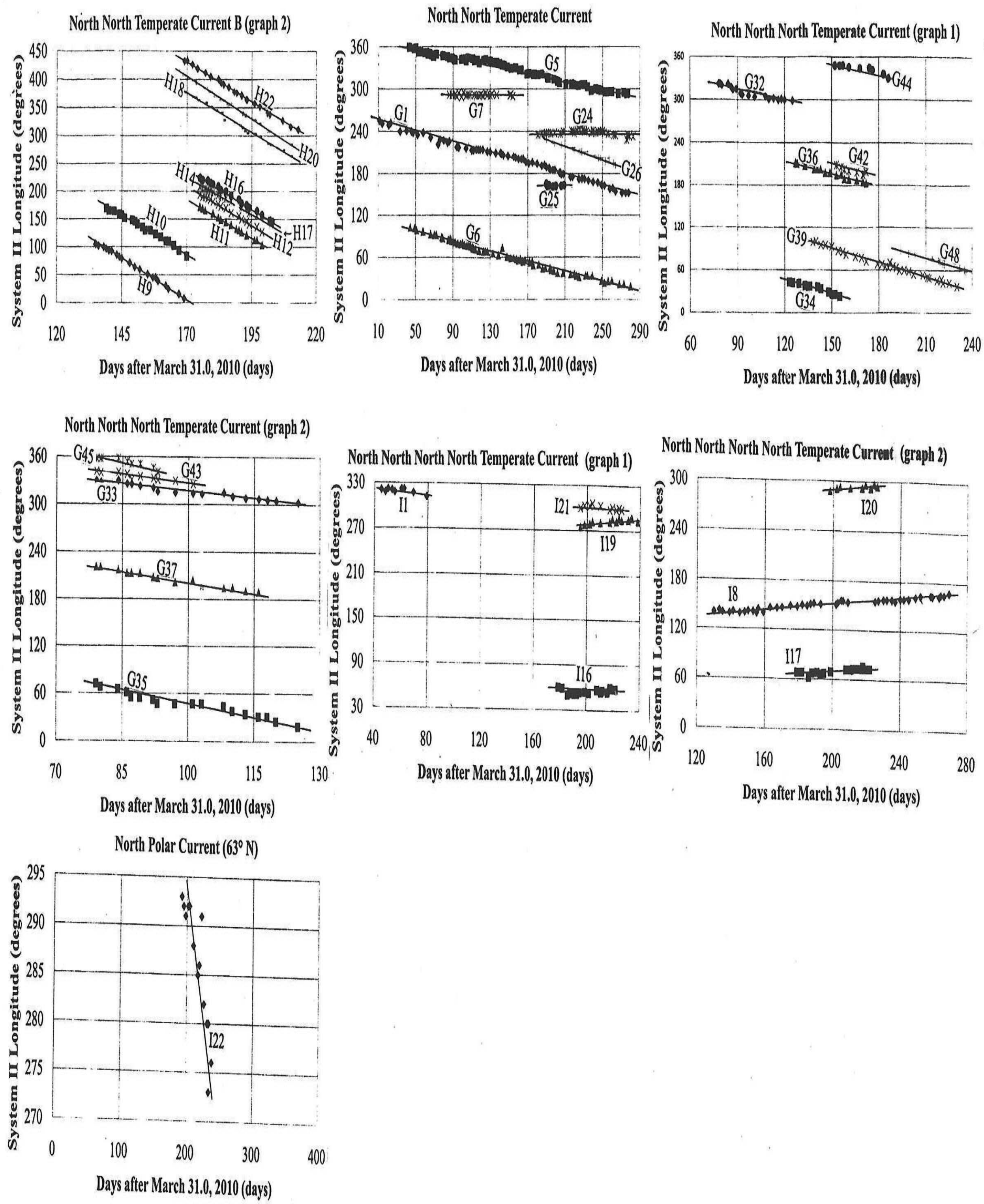


Figure 5: Drift rates of features on Jupiter between the North North Temperate Current and the North Intermediate Current.

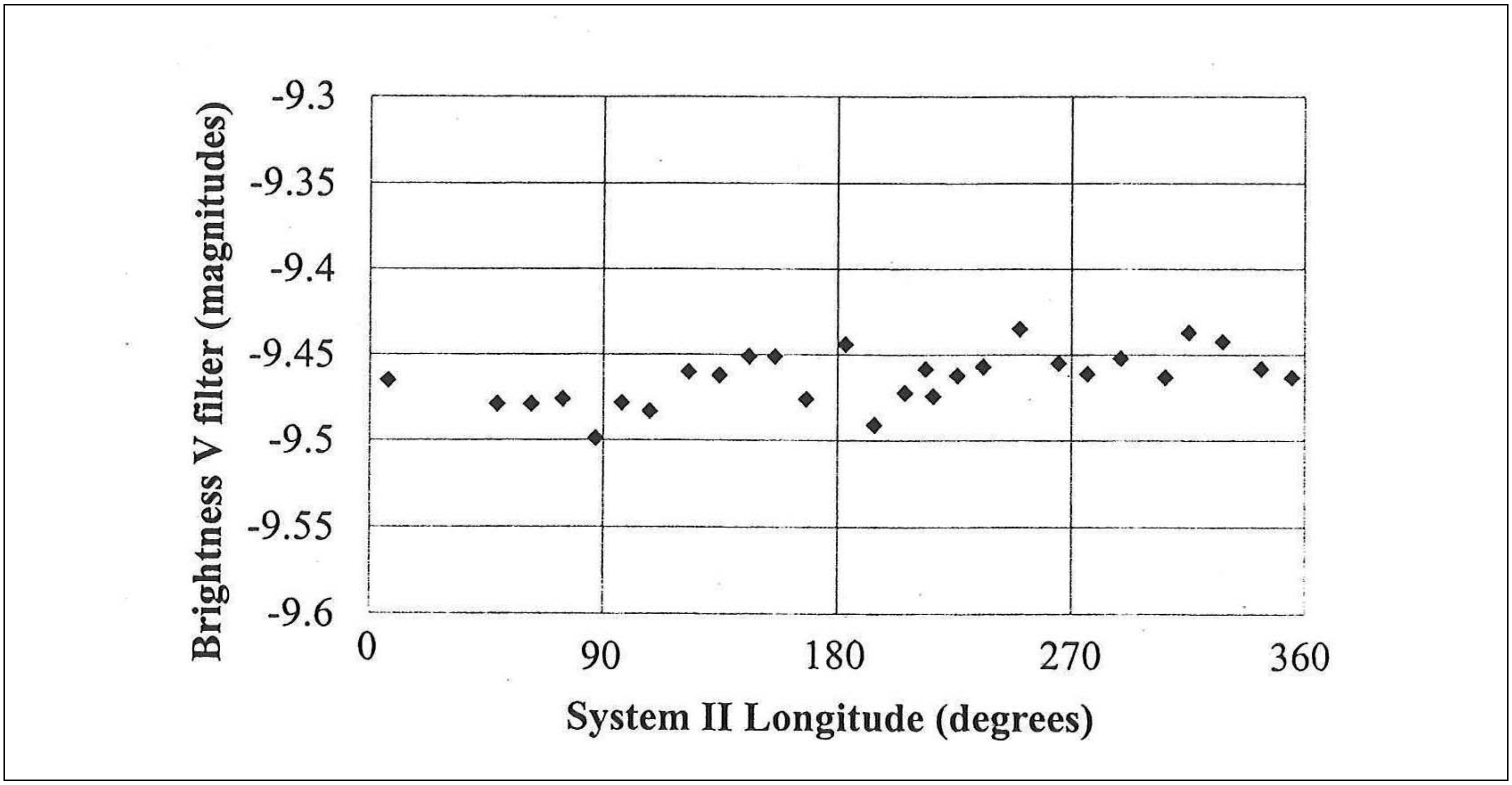


Figure 6: Normalized magnitude of Jupiter measured on the nights of October 15-16 and October 16-17, 2010.

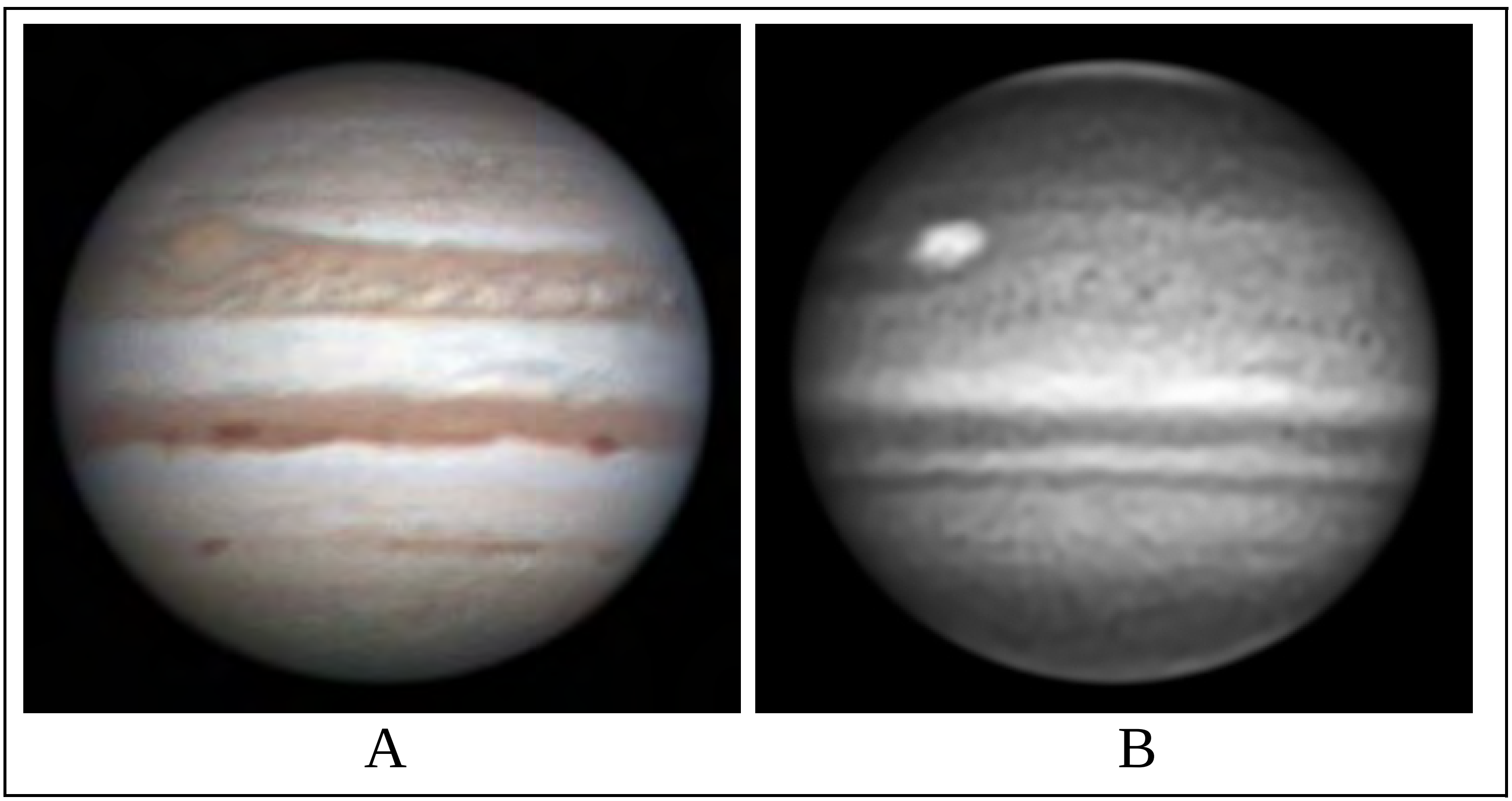
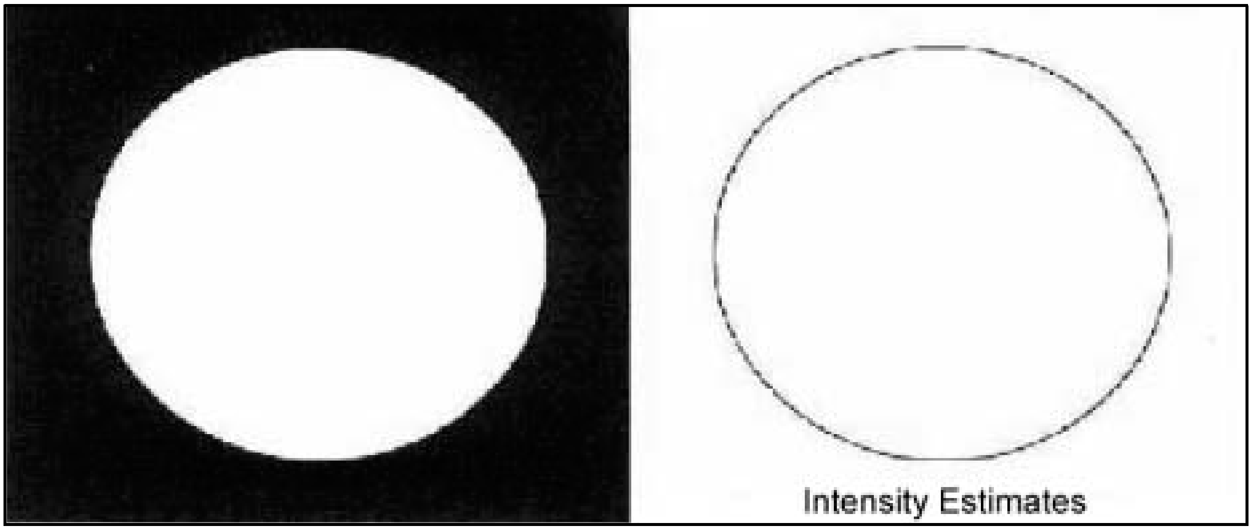


Figure 7: Images of Jupiter made on June 18, 2011 by Don Parker with a 0.41 m Reflector. Left: RGB image made at 9:57:13 UT, λ_I = 120° W, λ_{II} = 198° W; Right: Methane band image made at 9:53: 49 UT, λ_I = 118° W, λ_{II} = 196° W. Note that the SEB is dark in the RGB image but is faint in the methane band image. This is the opposite of images by Don Parker on September 2, 2010. See Figure 2E and 2F.

ALPO Jupiter Section Observation Form No. _____



Date (UT): ______________________________________

Time (UT): _____________________________________

CM I _____ CM II ____ CM III _______

Begin (UT): _____________ End (UT) ____________

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

Magnification: _______x ________x ________x

Filters: _________________________________(W / S)

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

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

Name: ______________________________________

Address: ______________________________________

____

City, State, ZIP: _______________________________

____

Observing Site: _______________________________

____

E-mail: ______________________________________

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

Notes

ALPO Galilean Satellite Eclipse Visual Timing Report Form

Describe your time source(s) and estimated accuracy	Observer Name:
	Apparition: 20_____-20_____ (conjunction to conjunction)

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

(a) 1 = Io, 2 = Europa, 3 = Ganymede, 4 = Callisto; D = Disappearance, R = Reappearance
(b) Month and Day
(c) *Predicted* UT to 1 minute
(d) *Observed* UT to 1 second; corrected to watch error if applicable; indicate in "Notes" if Observed UT date differs from Predicted UT date
(e) R = Refractor, N = Newtonian Reflector, C = Cassegrain Reflector, X = Compound/Catadioptric System; indicate in "Notes" if other type.
(f) These conditions, including field brightness (due to moonlight, twilight, etc.), should be described as they apply to the actual field of view, rather than to general sky conditions. Use whole numbers only, as follows:

- 0 = Condition not perceptible; no effect on timing accuracy
- 1 = Condition perceptible; possible minor effect on timing accuracy
- 2 = Condition serious; definite effect on timing accuracy

(g) Include here such factors as wind, drifting cloud(s), satellite near Jupiter's limb, moonlight interference, etc.

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

ALPO Resources

People, publications, etc., to help our members

Board of Directors

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

- Executive Director; Julius L. Benton, Jr., Associates in Astronomy, P.O. Box 30545, Wilmington Island, Savannah, GA 31410
- Member of the Board; Sanjay Limaye, University of Wisconsin, Space Science and Engineering Center, Atmospheric Oceanic and Space Science Bldg. 1017, 1225 W. Dayton St., Madison, WI 53706
- Member of the Board; Donald C. Parker, 12911 Lerida Street, Coral Gables, FL 33156
- Associate Director; Ken Poshedly, 1741 Bruckner Ct., Snellville, GA 30078-2784
- Member of the Board; Mike D. Reynolds, Dean of Mathematics & Natural Sciences, Florida State College, 3939 Roosevelt Blvd, F-112b, Jacksonville, FL 32205
- Member of the Board; Richard W. Schmude, Jr., 109 Tyus St., Barnesville, GA 30204
- Member of the Board; John E. Westfall, P.O. Box 2447, Antioch, CA 94531-2447
- Member of the Board, Secretary/Treasurer; Matthew Will, P.O. Box 13456, Springfield, IL 62791-3456
- Founder/Director Emeritus; Walter H. Haas, 2225 Thomas Drive, Las Cruces, NM 88001

****

Publications Staff

http://www.alpo-astronomy.org

Publisher & Editor-in-Chief

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

Science / Peer Reviewers

- Klaus R. Brasch; 10915 Sage Rd, Flagstaff, AZ, 86004
- Richard Jakiel; 8620 East Hickory Lane, Lithia Springs, GA 30122
- Roger J. Venable, MD, P.O. Box 117, Chester, GA 31012
- John E. Westfall, P.O. Box 2447, Antioch, CA 94531-2447

Book Review Editor

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

****

Interest Sections

Computing Section

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

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

Historical Section

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

- Coordinator; Richard Baum, 25 Whitchurch Rd., Chester, CH3 5QA, United Kingdom
- Assistant Coordinator; Thomas A. Dobbins, 10029 Colonial Country Club Blvd., Fort Myers, FL 33919

Lunar & Planetary Training Section

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

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

Website

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

- Webmaster; Larry Owens, 4225 Park Brooke Trace, Alpharetta, GA 30022
- Assistant Webmaster; Jonathan D. Slaton, P. O. Box 496, Mansfield, MO. 65704

Youth Section

http://www.cometman.net/youth

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

****

Observing Sections

Solar Section

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

- Coordinator (including all submissions, photo, sketches, filtergrams); Kim Hay, 76 Colebrook Rd, RR #1,Yarker, ON, K0K 3N0 Canada
- Assistant Coordinator; Brad Timerson (e-mail contact only; see listing in *ALPO Staff E-mail Directory* on page 57)
- Assistant Coordinator & Archivist; Jamey Jenkins, 308 West First Street, Homer, Illinois 61849
- Scientific Advisor; Richard Hill, Lunar and Planetary Laboratory, University of Arizona, Tucson, AZ 85721

Mercury Section

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

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

Venus Section

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

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

Mercury/Venus Transit Section

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

Coordinator; John E. Westfall, P.O. Box 2447, Antioch, CA 94531-2447

Lunar Section

Lunar Topographical Studies Program

http://moon.scopesandscapes.com/alpo-topo

Smart-Impact Webpage

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

The Lunar Observer

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

Lunar Selected Areas Program

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

Banded Craters Program

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

- Coordinator; Wayne Bailey, 17 Autumn Lane, Sewell, NJ 08080
- Assistant Coordinator; William Dembowski, 219 Old Bedford Pike, Windber, PA 15963

Lunar Meteoritic Impacts Search Program

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

ALPO Resources

People, publications, etc., to help our members

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

Lunar Transient Phenomena

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

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

Mars Section

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

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

Minor Planets Section

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

- Coordinator; Frederick Pilcher, 4438 Organ Mesa Loop, Las Cruces, NM 88011
- Assistant Coordinator; Lawrence S. Garrett, 206 River Road, Fairfax, VT 05454
- Scientific Advisor; Steve Larson, Lunar & Planetary Lab, University of Arizona, Tuscon, AZ 85721

Jupiter Section

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

- Coordinator (Section); Richard W. Schmude Jr., 109 Tyus St., Barnesville, GA 30204
- Assistant Coordinator (Section); Ed Grafton, 15411 Greenleaf Lane, Houston, TX 77062
- Assistant Coordinator & Scientific Advisor; Sanjay Limaye, University of Wisconsin, Space Science and Engineering Center, Atmospheric Oceanic and Space Science Bldg. 1017, 1225 W. Dayton St., Madison, WI 53706
- Assistant Coordinator, Transit Timings; John McAnally, 2124 Wooded Acres, Waco, TX 76710
- Assistant Coordinator, Newsletter; Craig MacDougal, 821 Settlers Road, Tampa, FL 33613
- Assistant Coordinator, Eclipses of Galilean Satellites; John E. Westfall, P.O. Box 2447, Antioch, CA 94531-2447
- Scientific Advisor; Prof. A. Sanchez-Lavega, Dpto. Fisica Aplicada I, E.T.S. Ingenieros, Alda. Urquijo s/n, 48013, Bilbao, Spain wupsalaa@bicc00.bi.ehu.es

Saturn Section

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

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

Remote Planets Section

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

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

Comets Section

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

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

Meteors Section

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

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

Meteorites Section

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

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

Eclipse Section

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

- Coordinator; Mike D. Reynolds, Dean of Mathematics & Natural Sciences, Florida State College, 3939 Roosevelt Blvd, F-112b, Jacksonville, FL 32205

****

ALPO Publications

The Monograph Series

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

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

There is NO CHARGE for any of the ALPO monographs.

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

ALPO Resources

People, publications, etc., to help our members

Lunar and Planetary Observers, Tucson, Arizona, October 19-21, 1996.20 pages. Hard copy $3 for the United States, Canada, and Mexico; $4 elsewhere.File size approx. 2.6 mb.

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

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

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

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

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

ALPO Observing Section Publications

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

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

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

ALPO Staff E-mail Directory

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

Bailey, W .... wayne.bailey@alpo-astronomy.org
Benton, J.L. .... jlbaina@msn.com
Benton, J.L. .... jlbaina@gmail.com
Brasch, K.R. .... m_brasch@earthlink.net
Baum, R. .... richard@take27.co.uk
Cook, A. .... tony.cook@alpo-astronomy.org
Cudnik, B. .... cudnik@sbcglobal.net
Darling, D.O. .... DOD121252@aol.com
Dembowski, W. .... dembowski@zone-vx.com
Dobbins, Tom .... tomdobbins@gmail.com
Garfinkle, R.A. .... ragarf@earthlink.net
Garrett, L.S. .... atticaowl@yahoo.com
Grafton, E. .... ed@egrafton.com
Gray, R. .... sevenvalleysent@yahoo.com
Haas, W.H. .... haasw@agavue.com
Hay, K. .... kim@starlightcascade.ca
Hill, D. .... dhill@lpl.arizona.edu
Hill, R. .... rhill@lpl.arizona.edu
Jakiel, R. .... rjakiel@earthlink.net
Jenkins, J. .... jenkinsjl@yahoo.com
Kronk, G. .... kronk@cometography.com
Larson, S. .... slarson@lpl.arizona.edu
Limaye, S. .... sanjayl@ssec.wisc.edu
Lunsford, R.D. .... lunro.imo.usa@cox.net
MacDougal, C. .... macdouc@verizon.net
McAnally, J. .... CPAJohnM@aol.com
Melillo, F. .... frankj12@aol.com
Melka, J. .... jtmelka@yahoo.com
Owens, L. .... larry.owens@alpo-astronomy.org
Parker, D.C. .... park3232@bellsouth.net
Pilcher, F. .... pilcher@ic.edu
Poshedly, K. .... ken.poshedly@alpo-astronomy.org
Reynolds, M. .... m.d.reynolds@fscj.edu
Robertson, T.J. .... cometman@cometman.net
Sanchez-Lavega, A. .... wupsalaa@bicc00.bi.ehu.es
Schmude, R.W. .... schmude@gdn.edu
Slaton, J.D. .... jd@justfurfun.org
Timerson, B. .... btimerson@rochester.rr.com
Venable, R.J. .... rjvmd@hughes.net
Westfall, J.E. .... johnwestfall@comcast.net
Will, M. .... matt.will@alpo-astronomy.org

ALPO Resources

People, publications, etc., to help our members

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

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

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

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

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

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

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

- **Jupiter:** *(1) Jupiter Observer’s Handbook*, $15 from the Astronomical League Sales, 9201 Ward Parkway, Suite 100, Kansas City, MO 64114; phone 816-DEEP-SKY (816-333-7759); e-mail leaguesales@astroleague.org. (2) *Jupiter*, the ALPO section newsletter, available online only via the ALPO website at http://mysite.verizon.net/macdouc/alpo/jovenews.htm; (3) *J-Net*, the ALPO Jupiter Section e-mail network; send an e-mail message to Craig MacDougal. (4) *Timing the Eclipses of Jupiter’s Galilean Satellites* free at http://www.alpo-astronomy.org/jupiter/GaliInstr.pdf, report form online at http://www.alpo-astronomy.org/jupiter/GaliForm.pdf; send SASE to John Westfall for observing kit and report form via regular mail. (5) *Jupiter Observer’s Startup Kit*, $3 from Richard Schmude, Jupiter Section coordinator.

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

ALPO Resources

People, publications, etc., to help our members

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

Other ALPO Publications

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

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

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

Back Issues of The Strolling Astronomer

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

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

$4 each:
Vol. 7 (1953), No.10
Vol. 8 (1954), Nos. 7-8
Vol. 11 (1957), Nos. 11-12
Vol. 21 (1968-69), Nos. 3-4 and 7-8
Vol. 23 (1971-72), Nos. 7-8 and 9-10
Vol. 25 (1974-76), Nos. 1-2, 3-4, and 11-12
Vol. 26 (1976-77), Nos. 3-4 and 11-12
Vol. 27 (1977-79), Nos. 3-4 and 7-8
Vol. 31 (1985-86), Nos. 9-10
Vol. 32 (1987-88), Nos. 11-12
Vol. 33 (1989), Nos. 7-9
Vol. 34 (1990), No. 2
Vol. 37 (1993-94), No. 1
Vol. 38 (1994-96), Nos. 1 and 3
Vol. 39 (1996-97), No. 1
Vol. 42 (2000-01), Nos. 1, 3 and 4
Vol. 43 (2001-02), Nos. 1, 2, 3 and 4
Vol. 44 (2002), Nos. 1, 2, 3 and 4
Vol. 45 (2003), Nos. 1, 2 and 3 (no issue 4)
Vol. 46 (2004), Nos. 1, 2, 3 and 4
Vol. 47 (2005), Nos. 1, 2, 3 and 4
Vol. 48 (2006), Nos. 1, 2, 3 and 4
Vol. 49 (2007), Nos. 1, 2, 3 and 4
Vol. 50 (2008), Nos. 1, 2, 3 and 4
Vol. 51 (2009), Nos. 1, 2, 3 and 4
Vol. 52 (2010), Nos. 1, 2, 3 and 4
Vol. 53 (2011), Nos. 1, 2, 3 and 4
Vol. 54 (2012), No. 1 and 2

$5 each:
Vol. 54 (2012), No. 3 (current issue)

THE ASSOCIATION
OF LUNAR & PLANETARY OBSERVERS (ALPO)

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

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

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

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

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

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

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

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

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

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

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

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

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