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Journal of the Association of Lunar & Planetary Observers

The Strolling Astronomer

Founded in 1947

Volume 51, Number 3, Summer 2009

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Inside this issue . . .

- ***Book report: Care of Astronomical Telescopes and Accessories***
- ***Upcoming eclipses of Saturn's brighter satellites for the rest of 2009***
- ***Galilean satellite eclipse timings for 1998-1999***
- ***Apparition reports: Mercury in 2007, Venus in 2005-06***

. . . plus reports about your ALPO section activities and much, much more

Venus as imaged in UV on December 10, 2005 by David Arditti, Edgeware, Middlesex, UK. 254 mm Dall-Kirkham Cassegrain @ 120, mono Philips Toucam (Modern Astronomy). Filters: Bader UV (320-390 nm), Baader R-IR (685 nm+). Altitude 14-13°. See the Venus 2005-06 report inside for more..

Journal of the Association of Lunar & Planetary Observers

The Strolling Astronomer

Volume 51, No. 3, Summer 2009
This issue published in June 2009 for distribution in both portable document format (pdf) and also hardcopy format.

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

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

For membership or general information about the ALPO, contact:

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

Founded in 1947

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Point of View
Astronomy in the poorhouse

By Ken Poshedly, JALPO editor & publisher

Well, the pollsters and researchers say the worst financial downturn since either the Great Depression or the post-World War II period (depending on who you talk to) is nearing an end and that things are kinda-sorta looking up (so to speak).

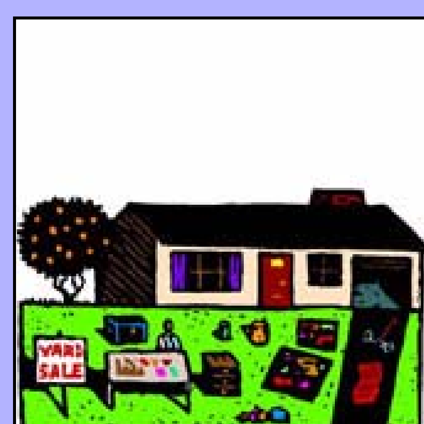
Even if that is true, millions upon millions of jobs have been lost, and who-knows-how-many thousands upon thousands of houses have been lost. Whether it's the fault of unscrupulous banks or ignorant home buyers, the fact is there's lots of guilt to throw around.

Many folks who lived their lives responsibly were — and are — the victims of circumstances, and are now still trying to pick up the pieces.

On the scale of importance in their lives, surely astronomy is not too high on the list. For many, it's nowhere on the radar. However for some, setting up the equipment and getting behind a nice eyepiece are therapeutic.

How about you? If you were able to at least somehow weather the current economic storm but still took a big punch in the gut, is observing still an activity you look forward to, or have you just lost interest until who-knows-when?

If you were hit badly, did you dispose of your beloved equipment, or did you hold it closely, knowing that at least it keeps you from crumbling completely?



Or do you know someone who apparently had no choice but to let it all go?

Let us know.

Make Plans To Attend ALCON EXPO 2009 In the New York City Area
Where It All Began 70 Years Ago.
ALCON EXPO 2009 Convention Dates: August 7-8, 2009
ALCON Area Tours and Events: August 2-6, 2009
Sponsored By: Amateur Observers' Society Of New York & Hofstra University Physics Department
To Register, Refer to our Website (alcon2009.org) or use the Registration Form below:

ALCON EXPO 2009 EARLY REGISTRATION FORM (Until July 1, 2009)

NAME ________________________________ **SOCIETY OR CLUB _____________________**
STREET ________________________________ **MEMBER OF AL? (check if yes) ___**
CITY ________________________________ **ALPO MEMBER? (check if yes) ___**
ZIP _______________________ **AAVSO MEMBER? (check if yes) ___**
CELL # (preferred) or HOME#_____________________ **EMAIL __________________________**

Please indicate below which Days you will be Attending; whether you need a Hofstra Dorm Room and how many nights you will be staying; whether you will be going to the Starbeque and Banquet, and which Tours (if any) you would like to attend. For a description of Tours, see the *alcon2009.org* Website. Send a Check for the Total made out to the *Amateur Observers' Society* to the following Address: ALCON 2009, PO Box 1517, West Babylon, NY 11704

Check One:
___ Basic 2 Day Registration ($60.00)……………………………………………..….$__________
___ 1 Day Registration ($35.00) Date Of Attendance ________..........................__________
Hofstra Dorm Room($65.00 per Night 1 Person Per Room) times ____ Nights = __________
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Please indicate: Arrival Day/Date __________ Departure Day/Date __________
Starbeque ($40.00)…………………………………..……………………………..__________
Choose Meal: L.I. Duckling ___ Chicken ___ Fish ___ Vegetarian ___
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Aug. 4 NYC Rose Center Of Earth and Space Tour ($85.00)….......__________
Aug. 5 LI Beach and Lighthouse Tour ($65.00)………………...…__________
Aug. 6 Cradle of Aviation Tour ($20.00)……………....…...…….__________
(Shuttle Bus Transportation To Cradle Of Aviation Included)
Check if you want any of the following and then put subtotal on line at right:
ALCON T Shirt ($15.00) ___ Mug ($12.00) ___..__________
Check Size of Shirt: Sm ___ Med ___ Lg ___ Ex Lg ___ 2X ___ 3X ___
If you want to make a Donation to the Astronomical League, include that here...…__________

Check Total (Add Up All Amounts From Above)..$__________

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News of General Interest

ALPO website news: Schmidt Moon map now available, paper monographs dropped

German astronomer Johann Friedrich Julius Schmidt spent most of his career since his youth making drawings of the Moon, preparing a map of it. By 1868 his own map of the Moon was almost ready, although he did not put the finishing touches to it until 1874. *Charte der Gebirge des Mondes* (Chart of the Mountains of the Moon) was the most detailed lunar map of its time and represents a continuation of the German school of lunar mapping, following the charts of Lohrmann (1824, 1878); it was the first map of the Moon to surpass the celebrated four-section map by Wilhelm Beer and Johann Heinrich Mädler which had been published in 1834-1836.

Now, *Charte der Gebirge des Mondes* — all 25 sections of it — is now available for the first time on the ALPO website as a series of nine pdf files (including an accompanying guidebook in German) for free download. The monograph was edited by the ALPO's own John Westfall and reproduced from an original in the collection of Robert A. Garfinkle, F.R.A.S.

According to an 1879 review of the map carried on Chuck Wood's Lunar Photo of the Day web page at *http://www.lpod.org/?page_id=1358*, the 25 sections would form a map of six French feet diameter, about 6 feet 6 inches English. The sections, however, are intended to remain separate, each one forming a map in itself, graduated at the edges, and they are thus evidently more convenient for reference than if joined together. They are in photo-lithograph, made from the original chart at the office of the Prussian General Staff.

The *Charte der Gebirge des Mondes* is available at *http://www.alpo-astronomy.org/publications/Monographs%20page.html*

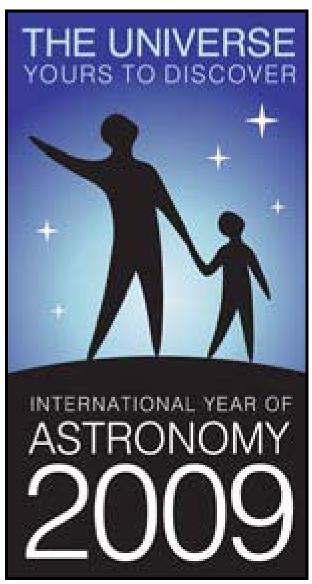
Effective immediately, all ALPO monographs are available freely as downloadable pdf files and paper (hard copy) version are no longer available.

ALCon 2009 News

The ALPO will be meeting with the Astronomical League at Hofstra University, Hempstead, NY, near New York City this summer as a part of the League's **ALCon 2009** event Friday and Saturday, August 7 and 8, with the closing banquet on Saturday evening. The ALPO board of directors will hold its annual meeting at the event.

ALPO and IYA 2009

The Assn of Lunar & Planetary Observers is pleased to be accepted as an "Organizational Node" by the secretariat of the International Year of Astronomy 2009, a global effort initiated by the International Astronomical Union (IAU) and UNESCO to help the citizens of the world rediscover their place in the Universe through the day- and night-time sky.



The ALPO joins a number of other international institutions which have a history of successful science communication and education, and are lending their valuable expertise by supporting and implementing activities around the globe. Because IYA2009 is such a large endeavor, the support of these Nodes is central to achieving the goals set out for the Year.

The ALPO itself already reaches out to professional astronomers and other serious students of solar system astronomy by way of this Journal and annual meetings with other organizations at Astronomical League conventions (ALCon) each year.

In 2009, the world will celebrate the International Year of Astronomy as it commemorates the 400th anniversary of Galileo's use of a telescope to study the skies, and Kepler's publication of *Astronomia Nova*. This year is also the anniversary of many other historic events in science, including Huygen's 1659 publication of *Systema Saturnium*.This will be modern astronomy's quadricentennial, and the IYA2009 will be an international celebration of numerous astronomical and scientific milestones.

The IYA 2009 international home page can be found at *www.astronomy2009.org/general/*

The IYA 2009 United States node home page is at *www.astronomy2009.us/*

A full list of all Organizational Nodes can be found online at *www.astronomy2009.org/organisation/nodes/organisational/*

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Reminder: Address changes

Unlike regular mail, electronic mail is not forwarded when you change e-mail addresses unless you make special arrangements.

More and more, e-mail notifications to members are bounced back because we are not notified of address changes. Efforts to locate errant members via online search tools have not been successful.

So once again, if you move or change Internet Service Providers and are assigned a new e-mail address, please notify Matt Will at will008@attglobal.net as soon as possible.

As of early June, ALPO representation is very low at the event – even though a strong roster of ALPO speakers is scheduled. Here is the schedule of the ALPO speakers and presentations:

Friday, August 7, Room 4

9 a.m.- Dr. Mike Reynolds, welcoming remarks

9:10 a.m.- Frank Melillo, ALPO Mercury Observations at the 40th DPS Meeting

9:30 a.m.- Thomas Dobbins, Mercury, MESSENGER & Memories

10 a.m. - Stewart Parker, Imaging the Planet Mercury from the Southern Hemisphere

10:30 a.m. - Frank Melillo, Mercury 2008 Observations

11 a.m. - John Boudreau, Amateur Imaging of the Planet Mercury

11:30 a.m. - Frank Melillo, Results of the Second MESSENGER Flyby

Noon - Lunch

1 p.m. - Dr. Julius Benton, Venus

1:30 p.m. - Dr. John Westfall, Timing of Venus Contacts & Venus Transits

2 p.m. - Wayne Bailey, The ALPO Banded Crater Program on the Moon

2:30 p.m. - ALPO Business meeting

Saturday Aug. 8, Room 4

9 a.m. - Dr. Roger Venable, Features of the North Polar Hood of Mars

9:30 a.m. - Richard Schmude, Recent Developments on Jupiter

10 a.m. - Dr. Julius Benton, Saturn

10:30 a.m. - Richard Schmude, Uranus, Neptune, and Pluto

110 a.m. - Alan Friedman

11:30 a.m. - Open

Refer to the full-page ad on page 4 for registration information.

Wanted: Assistant to the ALPO Secretary/Treasurer

Report by Matthew Will, ALPO Secretary/Treasurer

As reported in JALPO51-1, ALPO Membership Secretary Matthew Will continues to accept inquiries concerning the appointment of a possible assistant.

Some of the duties of this office include helping with:

- Membership correspondence and accounting
- Meeting our legal obligations as a nonprofit IRS Code 501(c)(3) organization
- Special projects to help the ALPO run more smoothly and with other endeavors that expand the ALPO's exposure to the nonmember astronomical community

Ideally, having someone to handle various secondary issues as assigned would help immensely.

Please respond (regular mail) to Matthew Will, P.O. Box 13456, Springfield, IL 62791-3456; or (e-mail to) *will008@attglobal.net*

Join/ renew your ALPO Membership Online

Save yourself the postage and either join or renew your ALPO membership at

www.galileosplace.com/ALPO/

The ALPO thanks *Telescopes by Galileo* for providing this service. See the ALPO membership application form near the back of this issue of your Journal for dues and other details.

ALPO Interest Section Reports

Web Services

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

Visit the ALPO home page online at *www.alpo-astronomy.org*

Computing Section

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

Important links:

- To subscribe to the ALPOCS yahoo e-mail list, *http://groups.yahoo.com/group/alpocs/*

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- 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

Orion® StarShoot Solitaire™ AutoGuider
Orion Telescopes & Binoculars
Watsonville, CA

The Orion StarShoot Solitaire AutoGuider makes it possible for almost anyone to start enjoying the fascinating and rewarding world of astrophotography, without the need for an expensive or overly complicated imaging setup. The StarShoot Solitaire is ideal for DSLR users who don't necessarily need a computer to control their imaging system.
The built-in logic behind the Solitaire's control pad allows you to guide with pushbutton ease.

The StarShoot Solitaire AutoGuider includes a control box and all the necessary cabling to begin autoguiding right out of the box. The control interface is intuitive and user-centric, allowing anyone to masterfully operate the autoguider right away. Simply connect the Solitaire to the control box and mount, plug-in to a power source, and start autoguiding!

The Solitaire's sensor is powered by a 1/3” format Aptina MT9V032 CMOS chip, with a 752x480 pixel layout and 6µm x 6µm pixel size for high sensitivity and accurate guiding. As such, the Solitaire can be used with smaller, less-expensive guide scopes. The autoguider camera also features a machined aluminum design with a black anodized finish, and weighs just 3.8 oz.

This smart autoguider automatically calibrates itself and detects guidestars, adjusting the exposure accordingly. It works with all equatorial mounts equipped with an autoguide port that is ST-4 compatible, including the Sirius EQ-G and Atlas EQ-G mounts.

The total package includes the autoguider camera, control box, 6mm parfocal eyepiece for easy guide star acquisition and focus, 7' camera cable (to control box), 7' autoguide cable (to mount), 10' power cable, and hard carrying case.

Price: $599.95 (sku 52074)
(t): 800.447.1001
(w): www.oriontelescopes.com

ALPO Observing Section Reports

Eclipse Section

Mike Reynolds, section coordinator
alpo-reynolds@comcast.net

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

Comets Section

Gary Kronk, acting section coordinator
kronk@cometography.com

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

Meteors Section

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

2008 was another successful year for the ALPO Meteors Section. Nine observers were able to view on 83 different nights, contributing 137 hours of meteor observations. A total of 2,105 meteors were recorded, not bad for a year that suffered from bright moonlight during a majority of the major meteor showers.

Bad weather and cold conditions prevented many from viewing the Quadrantids in early January. While conditions improved for the Lyrids in April, a nearly full Moon prevented many from attempting meteor observations. The Moon was out of the way for May's Eta Aquariids and successful observations were received. Many thanks to George Gliba, Robert Togni, and Associate Recorder Robin Gray for enduring cold temperatures and viewing during the normally slow winter and spring seasons.

The Delta Aquariids of July had no Moon but only one observer was able to take

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advantage of these conditions. A waxing gibbous Moon hindered viewing of the Perseids in August 2008, but nearly all of the ALPO meteor observers made an attempt to view this activity. Rates as high as 33 Perseids per hour were recorded.

The Moon once again interfered with the Orionids, but ALPO observers still obtained rates as high as 20 meteors per hour. No one was able to catch the quick activity of the Leonids, which was badly affected by a waning gibbous Moon.

Lastly, a nearly full Moon spoiled the normally impressive Geminid display, yet newcomer George Robinson made the effort on several nights around maximum to view the little activity that was available.

I would like to thank our dedicated observing team for their efforts during the past year and I look forward to their continued support during 2009!

Visit the ALPO Meteors Section online at *www.alpo-astronomy.org/meteor*.

Meteorites Section

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

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

Solar Section

Kim Hay, section coordinator,
kim@starlightcascade.ca

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

The MESENGER scientists are gearing up for the third flyby of Mercury on September 29, 2009. This will be the last one before it goes into orbit in March 2011. Most likely, the MESSENGER spacecraft will face the same part of the surface as during the second flyby on Oct. 6, 2008.

For the two to three weeks after the third flyby, Mercury will display a fine appearance in the morning sky. Much more anticipation is expected. The same part of the surface with white eject rays will be visible again as in November 2008. Hopefully, John Boundrea and Ed Lomeli will pull it through again! They have done an excellent job last time!

More information will follow in the next issue of this Journal.

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

Venus Section

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

Venus emerged west of the Sun during April 2009 and is now visible in the eastern sky before sunrise. During the current 2009-10 western (morning) apparition, the planet will pass through its waxing phases (a progression from crescent through gibbous phases). At the time of this report (mid-May), the disk of Venus is about 30.0" across and roughly 40.0% illuminated. Venus reached Greatest Illuminated Extent (greatest brilliancy) on May 2 at visual magnitude -4.7, and will attain Greatest Elongation West on June 5, followed by theoretical dichotomy (half phase) on June 6. During the 2009-10 western (morning) apparition, observers are seeing the trailing hemisphere of Venus at the time of sunrise on Earth. The Geocentric Phenomena in Universal Time (UT) are presented in the table on this page for observational planning purposes:

The Venus Express (VEX) mission started systematically monitoring Venus at UV, visible (IL) and IR wavelengths back in late May 2006, and as part of an organized Professional-Amateur (Pro-Am) effort, and a few ALPO Venus observers submitted high quality digital images of the planet taken in the near-UV and near-

A recent digital image of Venus' crescent disk on April 19, 2009, at 16:13UT by Mike Mattei of Littleton, MA, USA, using a 35.6 cm (14.0 in.) SCT, UV and IR blocking filters. S = 4.5, Tr = daylight sky. Apparent diameter of Venus is 47.6", phase (k) 0.147 or 14.7% illuminated, and visual magnitude -4.5. South is at top

Geocentric Phenomena of the 2009-10 Western (Morning) Apparition of Venus in Universal Time (UT)

Inferior Conjunction	2009	Mar 27 (angular diameter = 59.7 arc-seconds)
Greatest Brilliancy	2009	May 2 (m_v = – 4.7)
Greatest Elongation West	2009	Jun 05 (46º west of the Sun)
Predicted Dichotomy	2009	Jun 06.61 (exactly half-phase)
Superior Conjunction	2010	Jan 11 (angular diameter = 9.7 arc-seconds)

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IR, as well as other wavelengths through polarizing filters. The observations should continue to be submitted in JPEG format 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*.

Routine observations of Venus are needed throughout the period that VEX is observing the planet, which continues in 2009-10 and a year or so afterwards. Since Venus has a high surface brightness, it is potentially observable anytime it is far enough from the Sun to be safely observed.

Key observational endeavors:

- Visual observations and drawings in dark, twilight, and daylight skies to look for atmospheric phenomena including dusky shadings and features associated with the cusps of Venus
- Visual photometry and colorimetry of atmospheric features and phenomena
- Monitoring the dark hemisphere for Ashen Light
- Observation of terminator geometry (monitoring any irregularities)
- Studies of Schröter's phase phenomenon near date of predicted dichotomy
- Routine digital imaging of Venus at visual, UV, and IR wavelengths
- Special efforts to accomplish simultaneous observations. Observers are always encouraged to try to view and image Venus simultaneously; that is, as close to the same time and date as circumstances allow, which improves confidence in results and reduces subjectivity. The subjective effects which we seek to reduce with simultaneous observations are visual observations.
- Contribution of observation data and images to the Venus Express mission is encouraged
- The ALPO Venus Section encourages 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 at *www.alpo-astronomy.org/venus*.

Lunar Section:

Lunar Topographical Studies / Selected Areas Program

Report by Wayne Bailey, acting program coordinator
wayne.bailey@alpo-astronomy.org

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Lunar Phenomena Calendar for July thru September 2009 (all times in UT)

July 07	09:21	Full Moon (Penumbral Lunar Eclipse)
July 07	21:40	Moon at Apogee (406,232 km - 252,421 miles)
July 10	19:00	Moon 3.3 degrees NNW of Jupiter
July 10	19:00	Moon 2.7 degrees NNW of Neptune
July 13	07:00	Moon 5.2 degrees NNW of Uranus
July 13	19:00	Moon 1.3 degrees NNW of asteroid Juno
July 15	09:53	Last Quarter
July 18	11:00	Moon 4.8 degrees N of Mars
July 19	05:00	Moon 5.9 degrees N of Venus
July 21	20:17	Moon at Perigee (357,464 km - 222,118 miles)
July 22	02:34	New Moon (Start of Lunation 1071)
July 22	19:00	Moon 2.7 degrees SSW of Mercury
July 25	10:00	Moon 6.0 degrees SSW of Saturn
July 28	21:59	First Quarter
Aug. 04	00:43	Moon at Apogee (406,026 km - 252,293 miles)
Aug. 06	00:55	Full Moon (Penumbral Lunar Eclipse)
Aug. 06	19:00	Moon 3.1 degrees NNW of Jupiter
Aug. 06	24:00	Moon 2.7 degrees NNW of Neptune
Aug. 09	12:00	Moon 5.1 degrees NNW of Uranus
Aug. 13	18:55	Last Quarter
Aug. 16	03:00	Moon 3.2 degrees N of Mars
Aug. 17	22:00	Moon 1.7 degrees NNE of Venus
Aug. 18	07:00	Moon 0.48 degrees NNW of asteroid Vesta
Aug. 19	04:54	Moon at Perigee (359,641 km - 223,471 miles)
Aug. 20	10:01	New Moon (Start of Lunation 1072)
Aug. 21	05:00	Moon 0.97 degrees NNE of asteroid Pallas
Aug. 22	01:00	Moon 6.1 degrees SSW of Saturn
Aug. 22	09:00	Moon 2.6 degrees SSW of Mercury
Aug. 27	11:41	First Quarter
Aug. 31	11:05	Moon at Apogee (405,267 km - 251,821 miles)
Sept. 02	19:00	Moon 2.9 degrees NNW of Jupiter
Sept. 03	05:00	Moon 2.6 degrees NNW of Neptune
Sept. 04	16:03	Full Moon
Sept. 05	16:00	Moon 5.0 degrees NNW of Uranus
Sept. 12	02:16	Last Quarter
Sept. 13	17:00	Moon 1.1 degrees NNE of Mars
Sept. 15	10:00	Moon 1.4 degrees SSW of asteroid Vesta
Sept. 16	07:57	Moon at Perigee (364,053 km - 226,212 miles)
Sept. 16	16:00	Moon 3.0 degrees SSW of Venus
Sept. 18	17:00	Moon 6.2 degrees SSW of Saturn
Sept. 18	18:43	New Moon (Start of Lunation 1073)
Sept. 18	24:00	Moon 1.1 degrees SSW of Mercury
Sept. 26	04:48	First Quarter
Sept. 28	03:34	Moon at Apogee (404,431 km - 251,302 miles)
Sept. 29	22:00	Moon 2.8 degrees NNW of Jupiter
Sept. 30	11:00	Moon 2.7 degrees NNW of Neptune

(Table courtesy of William Dembowski)

During the first quarter of 2009, the ALPO Lunar Topographical Studies Section (ALPO LTSS) received a total of 129 new observations from 18 observers in 10 countries and six of the United States. Of these, 26 observations were submitted on Banded Crater Observing Forms, four were submitted as ray observations, and 28 were submitted for Focus On topics. The Focus On articles for Albategnius and Tycho were published in *The Lunar Observer* newsletter. Ariadaeus to Triesnecker, Mare Fecunditatis, and Deslandres were announced as the next subjects for emphasis. At the suggestion of Charles Galdies, I sent out a request for contributions to an article on the drawing techniques used by contributors. So far the responses have exceeded my expectations, so a series of individual short articles will appear in *The Lunar Observer*.

The transition to a new website (*moon.scopesandscapes.com*) for the section is complete. Suggestions for, or comments on, the content are solicited. All section documents are available for download, but printed copies are still available from me if needed.

Visit the following online web sites for more info:

- The Moon-Wiki: *http://the-moon.wikispaces.com/Introduction*
- ALPO Lunar Topographical Studies Section *www.zone-vx.com/alpo-topo*
- ALPO Lunar Selected Areas Program *www.zone-vx.com/alpo-sap.html*
- ALPO Lunar Topographical Studies Smart-Impact WebPage *www.zone-vx.com/alpo-smartimpact*
- *The Lunar Observer (current issue)* *www.zone-vx.com/tlo.pdf*
- *The Lunar Observer* (back issues): *www.zone-vx.com/tlo_back.html*
- Selected Areas Program: *www.zone-vx.com/alpo-sap.html*
- Banded Craters Program: *www.zone-vx.com/alpo-bcp.html*

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Lunar Domes Survey
Marvin Huddleston, FRAS, program coordinator
kc5lei@sbcglobal.net

Visit the ALPO Lunar Domes Survey on the World Wide Web at *www.geocities.com/kc5lei/lunar_dome.html*

Lunar Transient Phenomena
Dr Anthony Cook, program coordinator
tony.cook@alpo-astronomy.org

Visit the ALPO Lunar Transient Phenomena program online at

- *www.alpo-astronomy.org/lunar/ltp.html*
- *www.ltpresearch.org/*

Lunar Meteoritic Impact Search
Report by Brian Cudnik, program coordinator
cudnik@sbcglobal.net

Since our last report dated August 2008, the ALPO-Lunar Meteoritic Impact Search (LMIS) program continues to monitor the Moon when it is favorably placed during significant annual showers such as the Orionids and the Taurids. Several observers, most notably George Varros, have been actively observing the Moon inside and outside of shower times. Mr. Varros has recently scored a confirmed impact on 28 April 2009. Images of this and earlier impact events can be seen at:

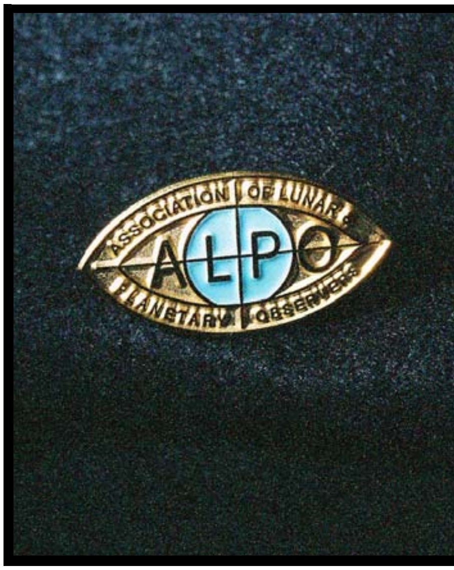
http://www.lunarimpacts.com/lunarimpacts.htm

Robert Spellman recorded a very likely impact on 9 August 2008 at 4:06:22 UT, which is shown in images posted on the link below. Included in his website is a video which shows the impact in real time, then slows it down to show the detail of the changing brightness of the impact event. He ends the video with a brief animation on what the impact area may look like on the surface of the moon.

http://www.angelfire.com/space2/robertspellman/observationarchive.html

Work has begun on coordinating efforts for the 2009 LCROSS ("Lunar CRater Observation and Sensing Satellite") mission which will feature two man-made impacts at one of the Moon's poles. The purpose of the two impacts is to search for water in the permanently shadowed polar regions. Another purpose is to refine our current models of impact dynamics.

As of this writing, the liftoff of the Lunar Reconnaissance Orbiter (LRO) which carries LCROSS has been delayed to June 17, 2009, at the earliest. When information on



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We ask all who are considering an online purchase of Orion astronomical merchandise to do so via this online method to support the ALPO.

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Mars Globe from Sky & Telescope

Mars may not be as far away as you think, so put down your telescopes and pick up your very own Mars Globe. Created with more than 6,000 images taken by the Viking orbiters, our 12-inch scale model of the Red Planet depicts more than 100 identified topographic features as well as the major bright and dark regions visible from Earth. It was produced in cooperation with NASA and the U.S. Geological Survey.

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the timing of the impacts becomes available, that will be posted on the LMIS website. At this point, it appears the timing of the pair of impacts will favor observers in the Western United States, Hawaii and Canada. Those who are interested in making observations are encouraged to contact me at *cudnik@sbcglobal.net* or visit the LMIS website at *http://www.alpo-astronomy.org*. The LRO/LCROSS mission is described on this website:

http://www.nasa.gov/mission_pages/LCROSS/main/index.html

The projected date that the book *Lunar Meteoroid Impacts and How to Observe Them* (ISBN: 978-1-4419-0323-5) will be available is September 2009. The following website has more information on this book:

http://www.springer.com/astronomy/book/978-1-4419-0323-5

This book not only discusses possible lunar meteors, but also includes information about lunar craters and how to observe them. Crater information includes crater morphology versus size, morphology versus age, and other aspects to look for when observing lunar craters. Craters elsewhere in the solar system are also discussed. Finally the book gives practical guidelines for observing the phenomena with both visual and video means.

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

Mars Section

Roger Venable,
acting assistant section coordinator
rjvmd@hughes.net

Join us on the Yahoo Mars observers' message list at *http://tech.groups.yahoo.com/group/marsobservers*. There you can share in discussions of observing Mars and post your images and drawings.

Visit the ALPO Mars Section online at *www.alpo-astronomy.org/mars*.

Minor Planets Section

Report by Frederick Pilcher, section coordinator
pilcher@ic.edu

Minor Planet Bulletin Volume 36, No. 2, 2009 April-June, publishes the following highlights. Coordinating radar observations with lightcurves, the latter in these cases by amateurs, helps to remove ambiguities unresolved by either method used alone. These have been obtained for 110 Lydia and 135 Hertha and have enabled an improved spin/shape model to be constructed for 110 Lydia. An improved spin/shape model for 683 Lanzia has also been prepared by amateur astronomers.

New lightcurves of three asynchronous binary asteroids, main-belt 1717 Arlon, Hungaria type 76818 2000 RG79, and Earth approacher 185851 2000 DP107, have improved the physical models of all three systems. For 1717 Arlon, no eclipse/occultation events were observed, but the lightcurves of the two components were devolved to yield a primary rotation period of 5.148 hours and a secondary rotation period of 18.236 hours. For both 76818 and 185851 eclipse/occultation events as well as rotational variation of the primary were observed. For 76818 system data are primary rotation period 3.1664 hours, orbital period 14.123 hours; ratio of secondary to primary diameters Ds/Dp = 0.32. For 185851 these data are respectively 2.77447 hours, 42.201 hours, and 0.35.

New lightcurves and rotation periods have been published for 82 other asteroids. Some of these are new determinations, with some secure and others still provisional, some are improvements on previous determinations, and some are of objects with secure periods to aid the determination of spin/shape models. The asteroids for which these data have been obtained are 31, 35, 56, 99, 137, 145, 155, 178, 182, 216, 222, 264, 313, 343, 482, 541, 624, 813, 872, 911, 914, 923, 956, 1022, 1071, 1073, 1274, 1316, 1339, 1437, 1481, 1510, 1672, 1724, 2358, 2397, 2973, 3051, 3225, 3316, 3335, 3407, 3928, 3971, 4031, 4086, 4265, 4512, 5010, 5390, 5579, 5871, 5905, 6377, 7304, 7516, 7683, 7965, 8404, 8567, 12880, 14040, 15515, 16426, 16589, 18906, 24222, 24465, 32776, 37635, 41672, 51840, 57478, 59493,

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76864, 106121, 153462, 162900, 190637, 1998 BE7, 2008 SE, and 2008 TC3.

John Reed makes available a powerful solar system ephemeris program which can be utilized entirely off-line. The ephemerides of any major or minor planet as observed from any of the major planets can be found with arc-second accuracy between the years 1599 and 2201. Orbital data are from the JPL DE405 planetary ephemeris with asteroid orbits for all objects listed in the MPCORB.

An auxiliary program for entering in either standard asteroid or comet format the elements of any newly discovered object is included. These programs are considered freeware and available without cost. But they are too large for practical downloading through the Internet but instead can be distributed on a CD ROM or flash drive. Please contact the author for details.

We remind all users and inquirers that the *Minor Planet Bulletin* is a refereed publication and that it is available on line at www.minorplanetobserver.com/mpb/default.htm.

In addition, please visit the ALPO Minor Planets Section online at http://www.alpo-astronomy.org/minor.

Jupiter Section

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

Jupiter is now visible in the morning sky and will reach opposition later in the summer. The Red Spot Jr. is losing some of its reddish tinge. During early April, several people imaged a large rift in the North Equatorial Belt.

The 2004-05 Jupiter Apparition Report was published in the Spring 2009 issue of this Journal (JALPO51-2). The 2006 report has been refereed and will be published soon. I am planning to start working on the 2007 and 2008 apparition reports later this year or in early next year.

One other note: Please be sure to send me images of Jupiter as file attachments which I can store and then examine as time permits, even several months later. However, if you send me a website address to access images, then I am in the position of having to download and print those images immediately because some images are removed after a certain time. The current economic recession has hit my state and the college where I am employed very hard and as a result, I must be very selective about what I print and how many images I can print.

Again, I would like to remind everyone that John McAnally's book, *Jupiter and How to Observe It* is available from Springer. Just go to the Springer website to order this book.

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

Galilean Satellite Eclipse Timing Program

John Westfall, assistant Jupiter section coordinator
johnwestfall@comcast.net

New and potential observers are invited to participate in this worthwhile ALPO 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.

Saturn Section

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

Saturn passed opposition on March 8, 2009, and remains situated in the constellation of Leo where it can still be viewed much of the night. As the apparition progresses, the ring tilt is progressively diminishing from 4.2° this month toward edgewise orientation in early September. As of this writing in mid-May, 350 observations and images have been contributed, and quite a few observers have imaged small white spots in the SEBZ and EZn, dusky features along the SEB, along with transits of Saturn's brighter satellites that lie close to the ring plane.

Since the last edge-on orientation of the rings back in 1995, the southern hemisphere and south face of the rings have been inclined towards Earth; but once the Sun and Earth pass through the ring plane headed northward in August and September 2009, respectively, the northern hemisphere and north face of the rings will become increasingly visible for over a decade. At edgewise presentations, equal portions of the southern and northern hemi-

Geocentric Phenomena for the 2008-2009 Apparition of Saturn in Universal Time (UT)	
Conjunction	2008 Sep 04^d UT
Opposition	2009 Mar 08^d
Sun passes thru the Ring Plane S --> N	2009 Aug 10^d (edgewise to Sun)
Earth passes thru the Ring Plane S --> N	2009 Sep 04^d (edgewise to Earth)
Conjunction	2009 Sep 17^d
Opposition Data:	
Equatorial Diameter Globe	19.0 arc-seconds
Polar Diameter Globe	17.6 arc-seconds
Major Axis of Rings	44.6 arc-seconds
Minor Axis of Rings	2.2 arc-seconds
Visual Magnitude (m_v)	$-0.5m_v$ (in Leo)
B =	–2.7°

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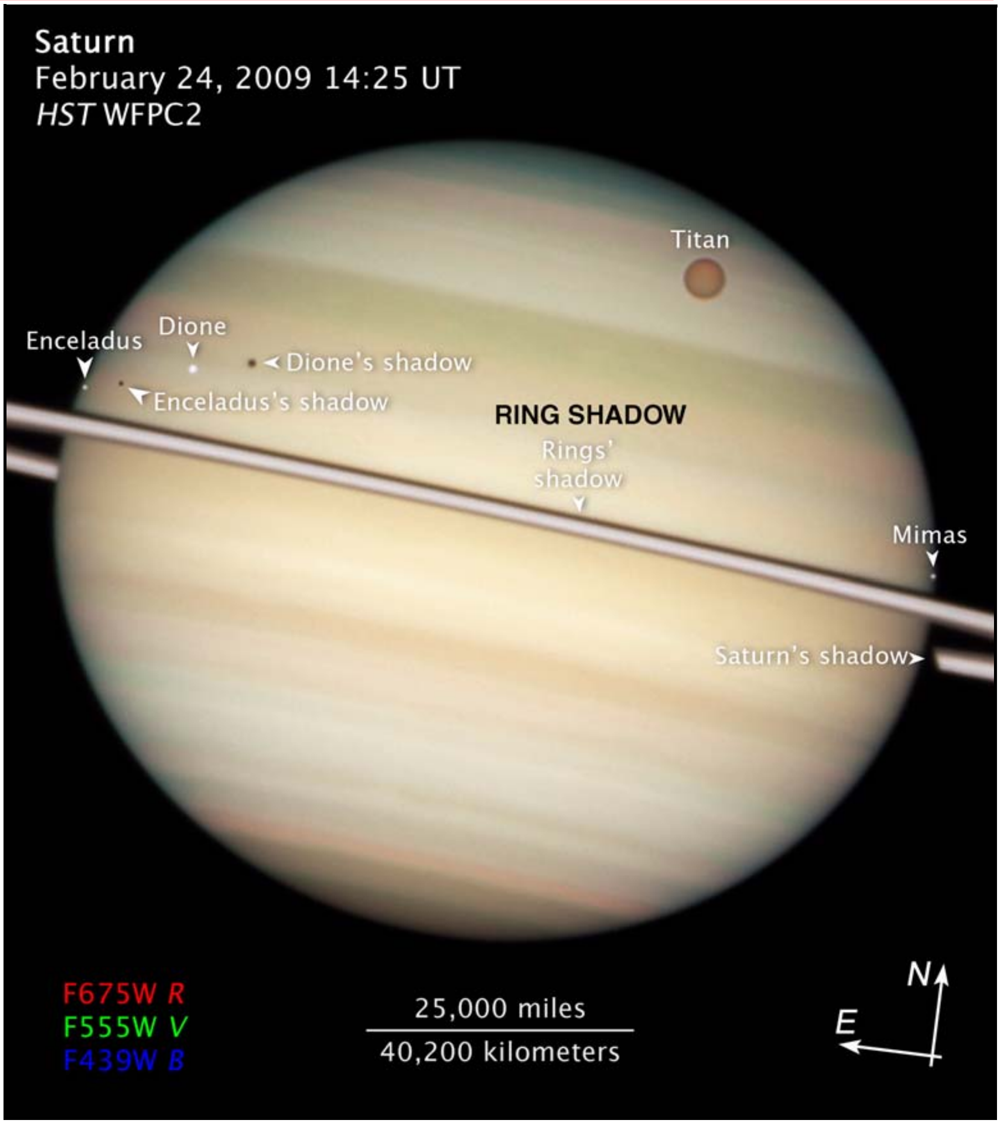
sphere are visible, separated by the ring plane. Since the ring passages this year of the Earth and Sun through Saturn's ring plane occur so close to conjunction of the planet with the Sun, observational conditions with be highly unfavorable. Conditions will be more favorable in the South Hemisphere than in the North Hemisphere in August and early September because of the greater altitude there of Saturn in the twilight sky. Nevertheless, at times of edgewise orientation of Saturn's rings, observers will want to see how close to the theoretical edge-on positions the rings can be seen or imaged with different apertures. The apparent disappearance of the ring system can be ascribed to one or more of the following geometric circumstances:

- The Earth may be in the plane of the rings so that only their edge is presented to viewers, and since the rings are quite thin, they may be temporarily lost to even the largest telescopes.
- The Sun may be in the plane of the rings so that only their edge is illuminated.
- The Sun and Earth may be on opposite sides of the ring plane, so what observers see on Earth are regions that are illuminated only by light that is passing through the rings (forward scattering). As mentioned, however, views of the actual edge-on presentation of the rings will be hampered by the close proximity of Saturn to the Sun in 2009.

This apparition, with the small inclination of the plane of the rings, observers can witness transits, shadow transits, occultations, and eclipses of satellites lying near Saturn's equatorial plane. Apertures under about 20.3 cm (8.0 in.) are usually unable to produce the best views of these events, except perhaps in the case of Titan. It will be interesting to see what imaging with various instruments produces, since controversy exists as to whether shadow transits of any of the satellites other than Titan are visible from Earth with large instruments. Nearly all of the satellites are presumed to be too small to cast umbral shadows onto the globe of the planet Saturn. Those individuals who can image and obtain precise timings (UT) to the nearest second of ingress, CM passage, and egress of a satellite or its shadow across the globe of the planet at or near edgewise presentations of the rings should send their data to the ALPO Saturn Section as quickly as possible. Notes should be made of the belt or zone on the planet crossed by the shadow or satellite, and visual numerical relative intensity estimates of the satellite, its shadow, and the belt or zone it is in front of are important, as well as drawings of the immediate area at a given time during the event.



Hubble Space Telescope (HST) image of the quadruple transit of Titan, Mimas, Enceladus and Dione on February 24, 2009, at 14:25 UT. Image includes labels to denote the specific satellites and their shadows. North is at the top of this image provided courtesy of the NASA HST team.

A rare quadruple transit of Titan, Mimas, Enceladus and Dione across the globe of Saturn was to occur on February 24, 2009, visible from the Pacific coast of North America, Alaska, Hawaii, Australia, and East Asia. (Editor's Note: See image by Hubble Space Telescope on page 14 of this issue.) The transits began at 10:54 UT with Titan, followed by Mimas, Dione, and Enceladus, and by 14:24 UT all four satellites and their shadows were predicted to appear together on the globe of Saturn. Amateurs in those regions hopefully were able to view and image the events at various wavelengths, including methane (889 nm) and UV (320-

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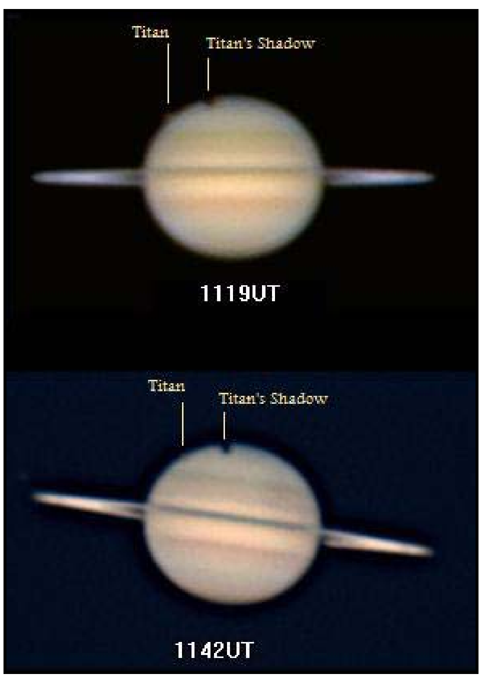
290 nm), and the ALPO Saturn Section is awaiting their results which will be published in this Journal. In addition to Earth-based telescopes, the HST was expected to image these events as well, and comparative analysis of observations from all sources should prove interesting. Also, on the same date, observers had a special treat: 5th magnitude Comet Lulin (C/2007 N3) was situated less than 3° from Saturn!

In addition to watching and digitally imaging phenomena specific to the edge-on ring presentation, observers should continue their routine ALPO Saturn Programs as follows:

- Visual numerical relative intensity estimates of belts, zones, and ring components.
- Full-disc drawings of the globe and rings using standard ALPO observing forms.



Images of Saturn taken on the date of the quadruple satellite transits (February 24, 2009) at 11:14-11:42 UT by Paul Maxson of Phoenix, AZ, showing transit of Titan and its shadow with 25.4 cm (10.0 in.) CAS. Compare this image with the HST image accompanying this report (for comparison purposes with the HST image, N appears at the top). Ring tilt is roughly -2.2º.

- Central meridian (CM) transit timings of details in belts and zones on Saturn's globe.
- Latitude estimates or filar micrometer measurements of belts and zones on Saturn.
- Colorimetry and absolute color estimates of globe and ring features.
- Observation of “intensity minima” in the rings plus studies of Cassini's, Encke's, and Keeler's divisions.
- Systematic color filter observations of the bicolored aspect of the rings and azimuthal brightness asymmetries around the circumference of Ring A.
- Observations of occasional stellar occultations by Saturn's globe and rings.
- Visual observations and magnitude estimates of Saturn's satellites.
- Multi-color photometry and spectroscopy of Titan at 940nm - 1000nm.
- Imaging Saturn using a 890nm narrow band methane (CH4) filter with apertures of 31.8cm (12.5in) or larger to alert the Cassini team of interesting large-scale targets and suspected changes in belt and zone reflectivity.
- Regular digital imaging of Saturn and its satellites.
- Simultaneous visual observations and imaging (i.e., independent observations by two or more individuals on the same night using similar equipment and methods).

All observers should compare what can be seen visually with what is apparent on their images, without overlooking opportunities to make visual numerical intensity estimates using techniques as described in the author’s new book, *Saturn and How to Observe It* (available from Springer, Amazon.com, etc.). Although regular imaging of Saturn is extremely important and encouraged, far too many experienced observers have neglected making 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 work of so many dedicated observers worldwide who continue to submit observations and images, prompting more and more professional astronomers to request drawings, digital images, and supporting data from amateur observers.

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

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

Remote Planets Section

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

The 2007 Remote Planets Apparition Report was published in the Spring 2009 issue of this Journal, JALPO51-2.

By late June, the dwarf planet, Pluto, will be near opposition. I would very much appreciate brightness measurements of this object. Pluto is now gradually moving farther from the Sun, and hence most of its thin atmosphere is expected to freeze out onto its surface. It is expected that this new surface ice will cause Pluto to reflect more light.

Uranus and Neptune will be visible in the morning sky by late June. Uranus is expected to slowly brighten over the next 20 years. Any type of brightness measurements of that planet would be greatly appreciated.

I plan to write the 2008-09 Remote Planets Apparition Report in June of this year.

My book, *Uranus, Neptune and Pluto and How to Observe Them* is available from Springer. Just go to the Springer website 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*.

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Sponsors, Sustaining Members, and Newest Members

Report by Matthew L. Will, ALPO Membership Secretary/Treasurer

The ALPO wishes to thank the following members listed below for voluntarily paying higher dues. The extra income helps in maintaining the quality of the Journal while helping to keep the overall cost of the Journal in check. Thank you!

As of April 22, 2009:

SPONSORS (Members giving $120 or more per membership)

Sponsor	City	State
Wayne Bailey	Sewell	NJ
Dr Julius L Benton, Jr	Savannah	GA
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Robert English	Fairfax	CA
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David M Griffee	Indianapolis	IN
Gregory Macievic	Camden	OH
John W Mc Anally	Waco	TX
Hugh Pinkston	Hampton	VA
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Roger J Venable	Augusta	GA
Gerald Watson	Cary	NC
Matthew Will	Springfield	IL
Christopher C Will	Springfield	IL
John & Elizabeth Westfall	Antioch	CA
Thomas R Williams	Houston	TX

SPECIAL NOTE: The ALPO wishes to extend a special thanks to Richard W. Schmude, Jr. for donating to the ALPO $100 each in the names of Ken Poshedly, Roger Venable, and Richard Jakiel, for their dedicated service to the ALPO. Thank you Richard!

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SUSTAINING MEMBERS (Members giving $60 per membership)

Member	City	State	Country
Bill Black	Grayson	GA	
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Thomas Deboisblanc	Westlake Village	CA	
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Robin Gray	Winnemucca	NV	
Dr John M Hill, Ph D	Tucson	AZ	
Mike Hood	Kathleen	GA	
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James (Jim) S Lamm	Charlotte	NC	
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Robert Stock	Drexel Hill	PA	
Miami Valley Astronomical Society	Dayton	OH	
Gary K Walker	Macon	GA	
Joel Warren	Amarillo	TX	
Russell O Wheeler	Edmond	OK	

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The ALPO would like to wish a warm welcome to those who recently became members. Below are persons that have become new members from May 9, 2008 through April 22, 2009: where they are from and their special interests in lunar and planetary astronomy. The legend for the interest codes are located at the end of this table. Welcome aboard!

Newest Members

Member	City	State	Country	Interests
Thomas Bouvier	Warwick	RI		
Rolandas Andrulis			Lithuania	
William H Aulich, Jr	Rush Springs	OK		
Ed Austin	Bartlett	TN		
Luis A Rivera Bagu	Mayaguez	PR		
Stephen Berte	Middletown	MD		
Charles Binkley	Westerville	OH		
Ken Blaine	Cuyahoga Falls	OH		
Jonathan Bromus	North Tonawanda	NY		
John Brooks	Weed	CA		
Anthony Broxton			United Kingdom	
Scott J Burgess	Winterport	ME		
Albert Carlson	Carrboro	NC		
David L Desler, Sr	Chesapeake	VA		
Judy Elkins	Miami	FL		
Robert English	Fairfax	CA		
Vincent Ferme	Ottawa	ON	Canada	
Deannie Geiger	Cullman	AL		
Jeffrey Goswick	Adairsville	GA		
Wayne Green	Longmont	CO		
Bradford Griffith	Webster Groves	MO		
Mary Headley	Manteca	CA		
Richard Hendrix	Jacksonville	FL		
David Higgins			Australia	
Richard G Hodgson	Beresford	SD		
Jim Honeycutt	Covington	GA		
William Horton	Islip	NY		
John C Iacuzzo	Bridgewater	NJ		
Rebecca Jackson	Chicago	IL		
Roger Kolman	Glen Ellyn	IL		T
Jacob Lambright	Campbell Hill	IL		
Marie Lott	Atlanta	GA		
Douglas Love	Greenbelt	MD		
Luiz Martinez	Casa Grande	AZ		
Terence Medcalfe			Spain	
Corbett Mullins	Mallie	KY		
Keith Murdock	Stony Point	NY		

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Newest Members (Continued)

Member	City	State	Country	Interests
Sherry O'Neill	Pittsburgh	PA		
Pier Francesco Orsi			Italy	
Corey Oses	Bloomfield	NJ		
Jeff Patterson	Greenwood	IN		
Ibramhim G Picard	Westlake	IA		3
Paul N Powell	Bowie	MD		
Eric Pulley	Centerville	UT		
Wayne Reinhart	Fostoria	OH		
Glenn Schronce	Louisville	TN		
Rene Serio	Houston	TX		
James Shaver	Springfield Gardens	NY		
Lee E Shoemaker	Weymouth	MA		
David Sirmeyer	Fort Worth	TX		
Steven Spears	Westlake	OH		DP
William Stegeman	Lincoln University	PA		
J S Sussenbach			Netherlands	DPV
Tim Sutter	Las Cruces	NM		
Mishina Toshirou			Japan	
Margie Ussery	Stone Mountain	GA		
Web Solutions Pro	Louisville	TN		
Jan Winter	Ankeny	IA		
John R Wright	Cotter	AK		
Robert Zanger	Deerfield	FL		

Table of Interest Abbreviations

0 = Sun	6 = Saturn	D = CCD Imaging	P = Photography
1 = Mercury	7 = Uranus	E = Eclipses	R = Radio Astronomy
2 = Venus	8 = Neptune	H = History	S = Astronomical Software
3 = Moon	9 = Pluto	I = Instruments	T = Tutoring
4 = Mars	A = Asteroids	M = Meteors	V = Videography
5 = Jupiter	C = Comets	O = Meteorites	X = Visual Drawing

Book Review

Care of Astronomical Telescopes and Accessories

A Manual for the Astronomical Observer and Amateur Telescope Maker

Review by Jon Slaton,
assistant webmaster, ALPO
jd@justfurfun.org

Care of Astronomical Telescopes and Accessories by M. Barlow Pepin (part of Patrick Moore's Practical Astronomy Series), 2005, published by Springer, ISBN-978-1-85233-715-5; 252 pages, 82 illustrations, soft cover; list price $59.95, though $43.76 at Amazon.com

If you like books on making telescopes, grinding mirrors, or making mounts, there are many books available on the new and used markets.

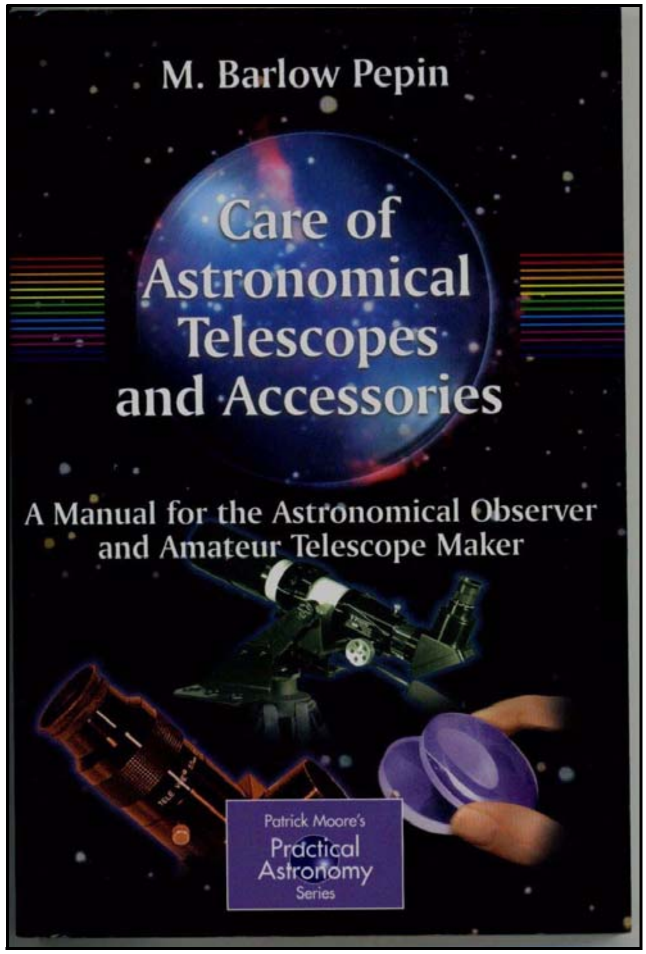
If you are looking for information about a telescope or accessory – new or used – or want to know how to care for and maintain a telescope or accessory, then this book is the book you are looking for.

This is one of the Patrick Moore's "Practical Astronomy Series", and like the rest of them, is well-written and illustrated.

Several years ago, I bought a 6-inch, f/15 Alvan Clark refractor. I took it to Astrofest, (a group of amateur and sometimes a few professional astronomers) held near Chicago.

While there, someone (Mr. Pepin, it turns out) stopped by and asked if he could take some pictures of the scope. We talked for awhile and he told me he was going to write a book on the care of telescopes. I not only found out his name, but also found him very knowledgeable about many aspects of equipment maintenance. Mr. Pepin was well aware of these problems, and he covers many of them in his book. The book is available now, and I wish I had written or even had the opportunity to assist Mr. Pepin with the project.

Yes, there is a picture of my telescope on page 4, but I did not purchase it for that reason. This book goes into detail about new and old telescopes, some of the good and bad of each, but most importantly, how to care for them. The author says, in essence, "What good does it do to have any telescope, new or old, if it doesn't work properly?"



Many times I have seen older, or even newer telescopes that did not work like they should. Many amateur and even some professional astronomers are guilty of blaming the equipment for problems that are of their own making. Things like rubbing a lightly oiled rag over the focuser tube, being careful about how tight to tighten a thumbscrew, or adjusting the tube balance are things everyone should not only know how to do, but actually do before or during an observing session.

Mr. Pepin has written short chapters about how to fix or maintain various aspects of telescopes and associated accessories. This is not a book on how to build telescopes or grind mirrors, but rather how to keep them working correctly after you make or get one.

Many of us neglect maintenance on our equipment, and it usually shows up at the worst time – like during an astrophotography session, or perhaps during a star party when there are lots of people lined up waiting to look through YOUR eyepiece.

There are chapters on buying new and used telescopes, equipment, and accessories, packing and shipping telescopes; care and maintenance; cleaning and adjusting optics, tubes; mounts and tripods; collimation; protecting and refinishing surfaces; storage; fine-tuning your equipment; and even a section on making and replacing crosshairs in eyepieces, along with the different materials to use or make.

Much of the advice Mr. Pepin gives I have heard elsewhere, possibly with a different twist, but the author puts it all together in an appropriate manner and it is thoughtfully laid out.

I highly recommend this book to anyone with a telescope, because at sometime in the life of that instrument, you'll need to fix something on it and this book will show you how.

M. Barlow Pepin passed away shortly before this book was published. He was the author of the highly acclaimed treaties on who actually invented the telescope "The Emergence of the Telescope: Janssen, Lipperhey, and the Unknown Man" (2002).

Feature Story

ALPO Observations of Mercury During the 2007 Apparitions

By Frank J Melillo, coordinator,
ALPO Mercury Section
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Abstract

There were six apparitions of Mercury in 2007. Compared to 2006, there was a slight increase to 11 observers, who submitted 23 drawings, 5 CCD images, and 37 webcam images, for a total of 65 observations. They used apertures from 9 to 31.5 centimeters (3.5 to 12.5 inches). Features described show good correlation with the 1971 albedo chart prepared by Murray, Smith, and Dollfus, and adopted officially by the IAU (Murray, Smith and Dollfus, 1972.)

Introduction

In 2007, Mercury's three evening and three morning apparitions attracted more observers than in recent years. Some apparitions favor observations from northern latitudes, and some favor observers at southern latitudes. Regrettably, we received no observations in 2007 from observers south of the equator.

It is remarkable that we did receive good observations of every apparition. The 2007 Mercury observers continued to produce outstanding webcam images. They made a significant number of independent simultaneous observations.

As readers will see, we are making progress in documenting albedo features by means of Earth-based observations. Table 1 lists the ALPO observers who contributed to this report.

The NASA MESSENGER spacecraft remained in good health on its circuitous journey to Mercury. Images of Mercury made during its first pass of that planet were compared by this author to Earth-based images in an article in this journal (Melillo, 2009.)

A Mercury map of the regolith albedo of Mercury based on 144 visual studies by Mario Frassati is provided here for reference (Figure1).

Also included here is a diagram of Mercury's position with respect to Earth at different phases (Figure 2).

It is more challenging to observe Mercury than any other bright planet. The observers of 2007 dedicated much time and

Table 1: ALPO Observers of Mercury

Observer	Location	Instrument*	Number & type of observations**	Apparitions Observed
Michael Amato	West Haven, CT, USA	10.4 cm RR	1D	3
David Arditti	Middlesex, England	31.5 cm SCT	1W	1
Richard Bosman	Enschede, Netherlands	280 mm SCT	1W	5
John Boudreau	Saugus, MA, USA	31.5 cm SCT	11W	3, 4, 6
Elias Chasiotis	Markopoulo, Greece	31.5 cm SCT	1D	6
Brian Cudnik	Houston, TX, USA	25.4 cm NT	2D	6
Mario Frassati	Crescentino, Italy	20.3 cm SCT	7D	3, 6
Robert Katz	London, England	90 mm RR	2D	1
Ed Lomeli	Sacramento, CA, USA	23.5 cm SCT	23W	1, 2, 3, 4, 5, 6
Frank J Melillo	Holtsville, NY, USA	25.4 cm SCT	5CCD	3, 6
Carl Roussell	Hamilton, ON, Canada	150 mm RR	11D	1, 3, 4, 5, 6

* NT = Newtonian, RL = reflector, RR = Refractor, SCT = Schmidt-Cassegrain
** CCD = CCD imaging, D = Drawing, W = Webcam

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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

effort to the quest of exploring its poorly documented albedo markings, especially the part of the surface that had not been imaged by spacecraft. By virtue of advanced optics, filters, and Internet communications, observing Mercury was more pleasurable in 2007 than ever before. We hope that this article will inspire more readers to observe this tiny planet.

Table 2: Characteristics of the Apparitions of Mercury in 2007 (all dates UT)

Number and Type	Beginning Conjunction*	Greatest Elongation	Final Conjunction*	Aphelion	Perihelion
1. Evening	6 Jan (s)	7 Feb	22 Feb (i)		9 Feb
2. Morning	22 Feb (i)	22 Mar	3 May (s)	25 Mar	
3. Evening	3 May (s)	2 Jun	28 Jun (i)	21 Jun	8 May
4. Morning	28 Jun (i)	20 Jul	15 Aug (s)		4 Aug
5. Evening	15 Aug (s)	29 Sept	23 Oct (i)	17 Sept	
6. Morning	23 Oct (i)	8 Nov	17 Dec (s)	14 Dec	31 Oct

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

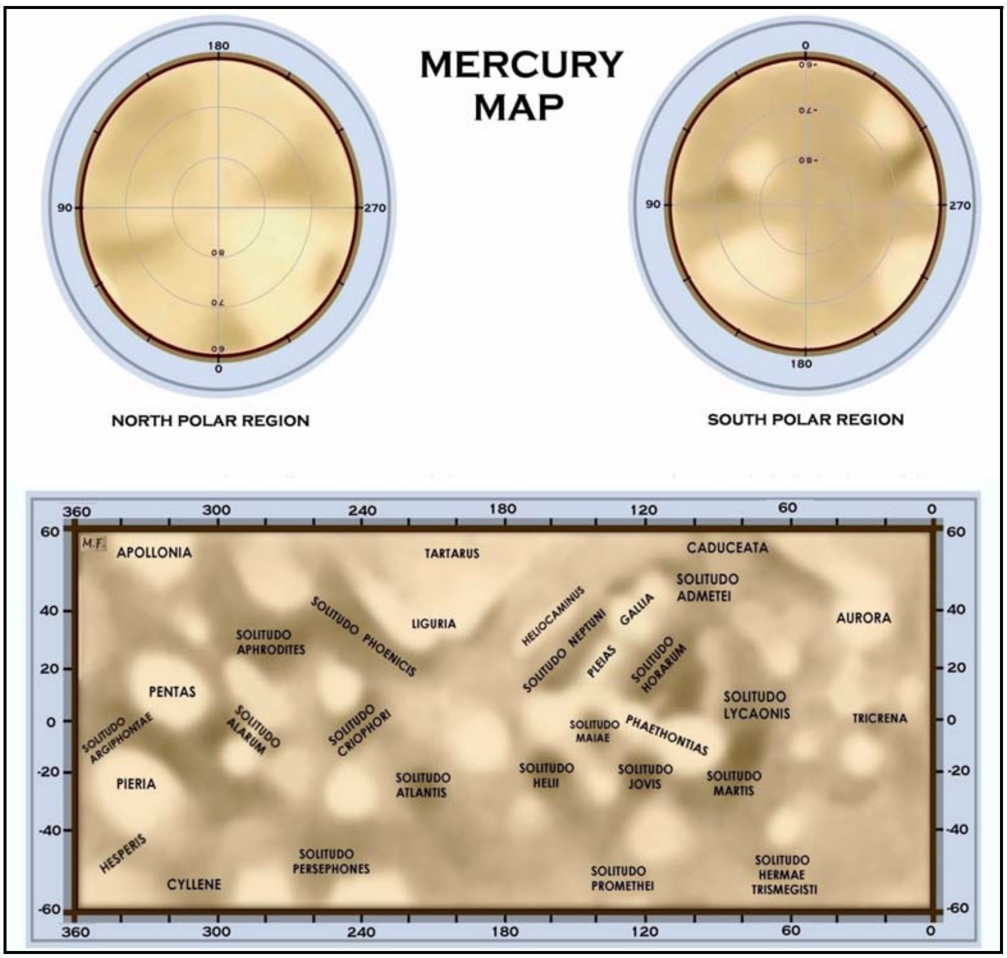

Figure 1. Map of the regolith albedo of Mercury based on 144 visual studies by Mario Frassati at Crescentino (VC), Piedmont, Italy, between January 1997 and January 2006 with a 203mm catadioptric telescope, 250x -400x. North is at the top to match the images later in this paper. (Annotated with IAU nomenclature and used with permission of M. Frassati.)

Apparition 1: Evening, January 6 - February 23

After the superior conjunction with the Sun on January 6, Mercury entered the evening sky. Though its declination was slightly south of the celestial equator, the angle the ecliptic makes with the western horizon after sunset at this time of year caused the planet to be better seen by northern than by southern observers. On the day of greatest elongation (Table 2), it was about 11° above the horizon at the end of civil twilight for an observer at latitude 40° north. A number of northern observers braved the cold weather to study Mercury during this apparition.

Ed Lomeli made the first two images on January 22 and 23. At central meridians (CMs) of 194° and 199° longitude, respectively, there is a bright area in the north (Figure 3, image A). This is probably Caloris, which is known to be a large basin with high reflectivity. On January 31 at CM = 230°, a better image by Lomeli showed Caloris rotated toward the northeast of the disk (Figure 3, image B.) In that image, notice the three bright regions arranged in a vertical row along the terminator. This shot is similar to what MESSENGER saw in its first flyby during the outbound journey (Melillo, 2009.) Carl Roussell made a drawing on February 5 (CM = 258°) showing perhaps Solitudo Atlantis in the south and Solitudo Phoenicis in the north (Figure 3, image C). On February 6 and 7, two British observers, Robert Katz and David Arditti, made observations. On February 6, at CM = 262°, Robert Katz drew Mercury with shading near the terminator, while David Arditti's webcam image also showed some shading along the terminator. At greatest elongation on February 7, at CM = 268°, Katz and Roussell again made drawings showing some shadings along the terminator. On Feb 23, Mercury went through inferior conjunction with the Sun.

Apparition 2: Morning, February 23 - May 3

This was a long morning apparition, lasting more than 2 months. Mercury was at aphelion on March 25 and was thus traveling at its slowest. Greatest elongation occurred on March 22, so this aphelion was optimally placed to bring about a long apparition. Maximum elongation was unusually great at about 28°. However, the angle that the ecliptic makes with the eastern horizon before sunrise at this time of year caused the planet to be only 6° above the horizon at the start of civil twilight, as seen from 40° north latitude. Southern hemisphere observers were strongly favored, as Mercury at greatest elongation was 21° above the morning horizon at the start of civil twilight, as seen from 40° south latitude.

Ed Lomeli made an image on March 19 at CM = 158° (Figure 4). Mercury was showing a half phase and a possible white area near the limb. Despite the very favorable circumstances of the apparition for southern observers, no other observations were received. Mercury went through the superior conjunction with the Sun on May 3.

Apparition 3: Evening, May 3 - June 28

With summer approaching in the northern hemisphere, Mercury was visible pretty late into the evening. Due to Mercury's position near the northernmost point of the ecliptic, its positive ecliptic latitude, and its approaching aphelion, its evening elongation of June 2 brought it 14° above the horizon at the end of civil twilight, as seen from 40° north latitude. Northern observers were favored.

Carl Roussell made his first drawings on May 7 and May 11 at CMs of 19° and 35°, soon after the superior conjunction of May 3. He depicted a white area near the center of the disc that appeared prominent under the high Sun (Figure 5, image A). This appears to be the bright Kuiper ray crater. Ed Lomeli captured the same bright area in his webcam image of May 15 (CM = 48°), rotated somewhat toward the limb (Figure 5, image B). Mario Frassati made drawings on May 15 and 17 at CMs of 51° and 60°. He drew a bright area exactly where Kuiper is located, matching Lomeli's image of May 15 (Figure 5, image C).

During the second half of May, Frassati, Roussell, John Boudreau, Michael Amato and this author made observations of Mercury, all of which showed somewhat scattered markings on the disk. Mercury

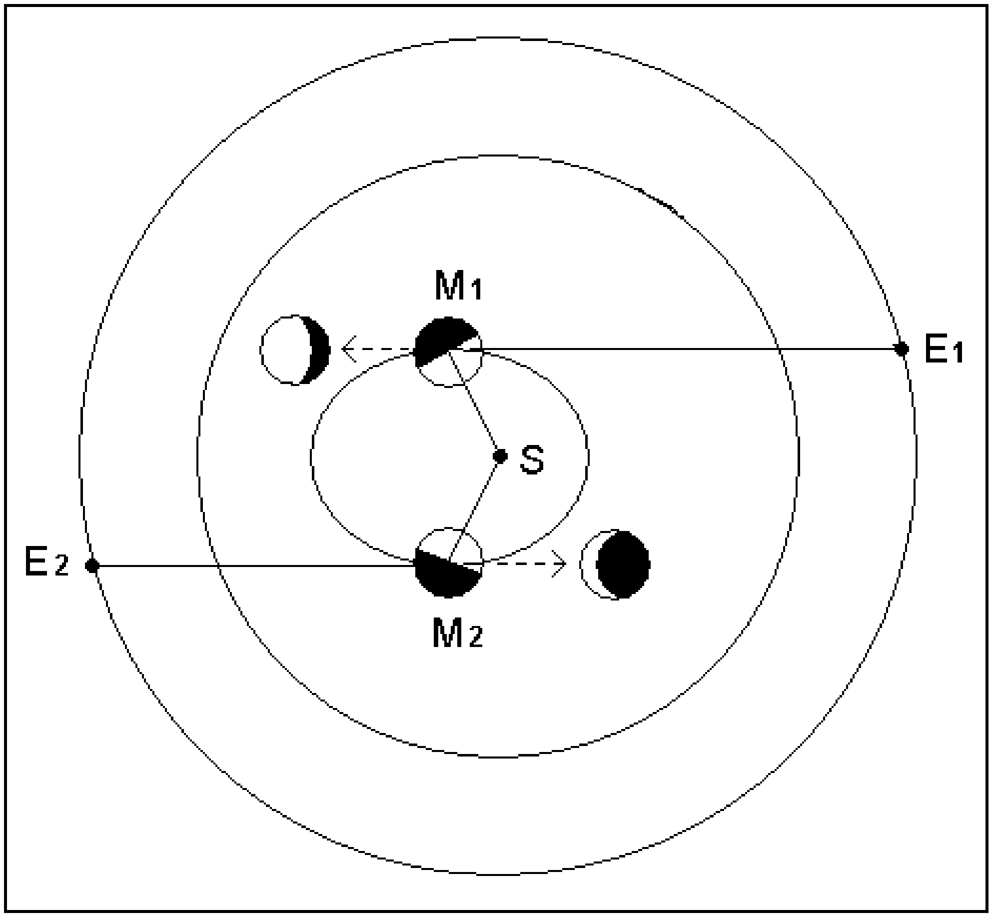

Figure 2. Posible variations in the phases of Mercury at its greatest elongations from the Sun. In the diagram, S is the Sun, E1 and E2 are two positions of Earth, and M1 and M2 are two positions of Mercury corresponding to E1 and E2. Greatest elongation occurs when the line of sight from Earth to Mercury is tangent to the orbit of Mercury. These greatest elongation lines of sight are drawn in the diagram; E1-to-M1 indicates greatest eastern elongation, and E2-to-M2 indicates greatest western elongation as seen from Earth. The elliptical orbit of Mercury causes its appearance at greatest elongation to vary greatly, because the S - E - M angle varies greatly. S - E1 - M1 is less than 90°, so that Mercury is seen as gibbous, while S - M2 - E2 is greater than 90° so that Mercury is seen as a crescent. The phase of Mercury at elongation can be anywhere from about 35% to 65% illuminated.

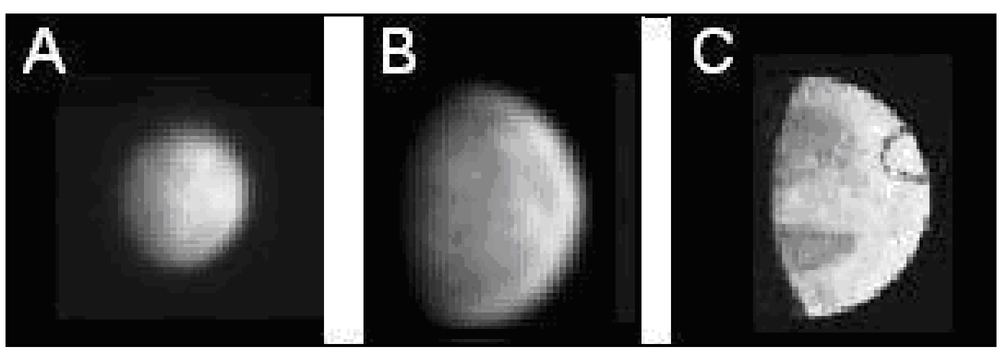

Figure 3. Images from Apparition 1 (see text). In this and all other figures in this article, north is up and planetary east is to the right.
A. Image by Ed Lomeli, 22 Jan 2007 at 21:06 UT, CM = 194°
B. Image by Ed Lomeli, 31 Jan 2007 at 23:45 UT, CM = 230°
C. Drawing by Carl Roussell, 05 Feb 2007 at 22:56 UT, CM = 258°

went through inferior conjunction on June 28.

Apparition 4: Morning, June 28 - August 15

This was a relatively difficult apparition for both northern and southern observers, because greatest elongation on July 20 was so close to perihelion on August 4. At greatest elongation, Mercury stood only 9° above the eastern horizon at the start of civil twilight, for observers at 40° north latitude. For observers at 40° south latitude, it was only 8° up. Nevertheless, a number of good observations were submitted.

Ed Lomeli imaged Mercury on July 20 (CM = 67°) and demonstrated a nice crescent phase (Figure 6, image A). John Boudreau and Lomeli imaged Mercury on July 26 (CM = 97°) and July 28 (CM = 106°) respectively, and they both showed markings on the disk that are not known to be associated with particular surface features (Figure 6, image B). Carl Roussell did a drawing on July 30 (CM = 115°) showing what appear to be Solitudos Martis and Jovis in the south and Solutido Lycaonis in the north. Boudreau made some fine images on Aug 2 and 3 at CMs of 128° and 132°, respectively (Figure 6, images C and D). Both images show bright patches just north of the equator near the center. When these two images are seen in a two-image animation, it is clear that the bright patches move in a way corresponding to actual rotational motion of the planet. This area of the surface was imaged by the Mariner 10 spacecraft, demonstrating a bright ray crater, now named Mena, at 0.5° north latitude and 125° west longitude. However, at present we cannot be sure whether Mena's rays are the bright area seen in Boudreau's images.

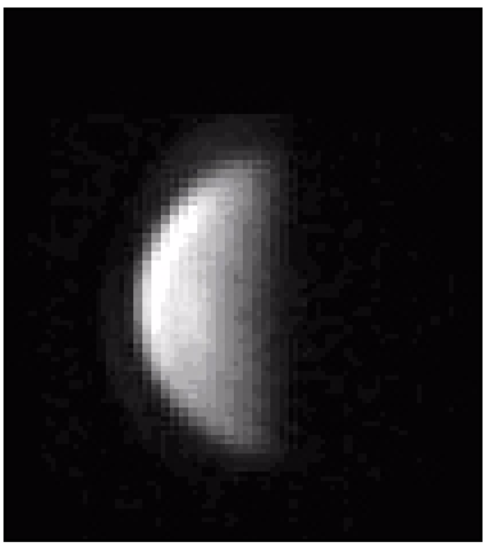

Figure 4. Image by Ed Lomeli from Apparition 2; 19 Mar 2007 at 16:47 UT, CM = 158°

Mercury went through superior conjunction with the Sun on Aug 15.

Apparition 5; Evening, August 15 - October 23

This was a long evening apparition, with an excellent maximum elongation of 26° from the Sun on September 29. Mercury reached aphelion on September 17, so we were watching it as it swung relatively slowly through the aphelic part of its orbit. However, the angle the ecliptic makes with the western horizon shortly after sundown at this time of year caused this to be a poor apparition for northern observers. At 40° north latitude, at the end of civil twilight, Mercury was only 3° above the western horizon. At 40° south latitude, it was 19° up. In spite of this, Ed Lomeli produced some excellent images.

When Ed Lomeli imaged the tiny planet on August 25 (CM = 224°), Mercury was still showing a nearly full phase. His image shows bright ray craters near the terminator and bright Caloris in the north (Figure 7, image A). On August 27 and 28 (CMs = 234° and 238°), he imaged Mercury again and these images were strikingly similar to what MESSENGER saw during its first flyby (Figure 7, image B), Carl Roussell made a drawing on August 31 (CM = 251°) and it shows two recognizable dark features; one in the north that is sometimes called Skinakas Basin, near 280° longitude, and one in the south known as Solitudo Criophori (Figure 7, image C). The Skinakas Basin feature may not be a basin, but as a dark albedo feature it has been well-documented by amateur observers. It was discussed by this author in a previous report (Melillo, 2008). Lomeli continued to image Mercury throughout the month of September (Figure 7, image D). By late September it was difficult to see Mercury due to its very low altitude, and the late images show less detail. Mercury ended the evening apparition with inferior conjunction on October 23.

Apparition 6: Morning, October 23 - December 17

In this final apparition of 2007, Mercury displayed a fine appearance in the morning sky, peaking at 12° above the horizon at the beginning of civil twilight for observers at 40° north latitude. We received many excellent drawings and images, and these are especially valuable because they show the part of the surface that was not imaged by the Mariner 10 spacecraft. However, this area was partially imaged in 2008 by MESSENGER during its second flyby. In addition, we received a number of simultaneous observations.

Carl Roussell made his first drawing on November 2 (CM = 245°). Mercury displayed a crescent phase and there was a circular dark area, sometimes called Skinakas basin, located in Mercury's northern hemisphere at longitude 280° (Figure 8, image

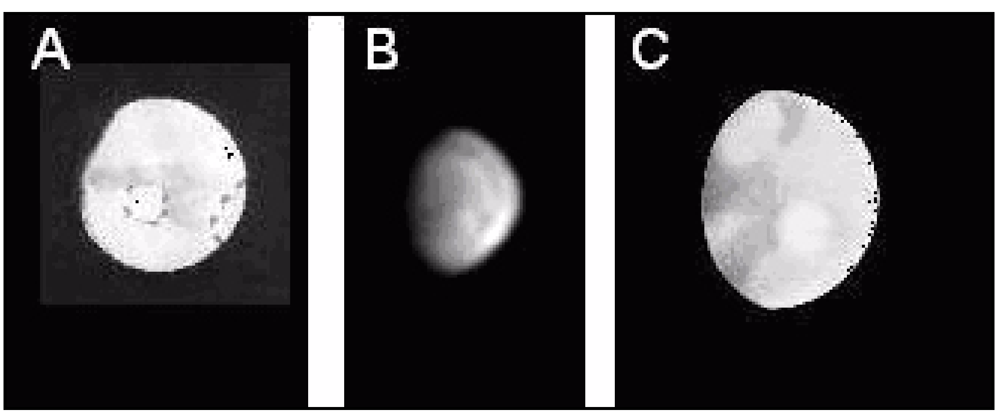

Figure 5. Images from Apparition 3 (see text).
A. Drawing by Carl Roussell, 11 May 2007 at 22:00 UT, CM = 35°
B. Image by Ed Lomeli, 15 May 2007 at 1:50 UT, CM = 48°
C. Drawing Mario Frassati, 15 May 2007 at 18:56 UT, CM= 51°

A). This author and John Boudreau imaged Mercury simultaneously on November 4 (CM = 257°). Both images show a dark area at the exact same location (Figure 8, image B). The next day (CM = 262°/263°) there were nearly simultaneous observations by Roussell and Boudreau. Roussell drew a dark patch on the terminator while Boudreau imaged three hours later showing some shading along the terminator. Another set of simultaneous observations was made on November 7 (CM = 274°) by Lomeli and Boudreau. These images show scattered markings on the disk (Figure 8, image C). On November 8 (CM = 279°) this author and Boudreau imaged Mercury simultaneously. Both images show good detail, with a number of surface features (Figure 8, images D and E). Elias Chasiotis made a drawing on November 9 (CM = 282°) and Brian Cudnik made one on November 11 (CM = 294°). Both showed dark markings near the terminator. Also, this author made a simultaneous observation with Cudnik on November 11. Again, we both detected a dark marking at 280° longitude.

From November 13 through November 25 (CMs = 301° to 359°), Frassati, Roussell, Boudreau, Lomeli and this author made a number of drawings and images showing white spots, believed to be bright ray craters, that came into view late in this apparition (Figure 8, images F, G, H, and I). There are approximately 4 bright ray craters within this region including Kuiper Crater and the 'radar' crater imaged by the Arecibo radio telescope (Harmon and Campbell, 2002). This author plans a special report about these bright ray craters in a future issue of this journal.

On December 17, Mercury completed its final apparition of 2007 at superior conjunction with the Sun.

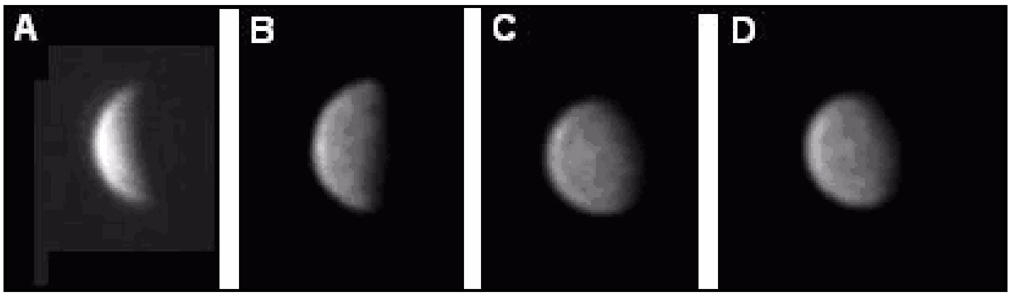

Figure 6. Images from Apparition 4 (see text).
A. Image by Ed Lomeli, 20 Jul 2007 at 13:02 UT, CM = 67°
B. Image by John Boudreau, 26 Jul 2007 at 13:58 UT, CM= 97°
C. Image by John Boudreau, 2 Aug 2007 at 12:23 UT, CM = 128°

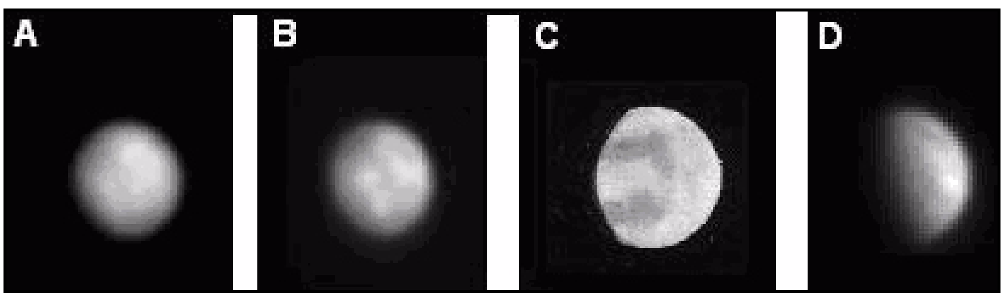

Figure 7. Images from Apparition 5 (see text).
A. Image by Ed Lomeli, 25 Aug 2007 at 17:27 UT, CM = 224°
B. Image by Ed Lomeli, 27 Aug 2007 at 22:24 UT, CM = 234°
C. Drawing by Carl Roussell, 31 Aug 2007 at 21:10 UT, CM = 251°
D. Image by Ed Lomeli, 26 Sept 2007 at 21:55 UT, CM = 14°

References

Harmon JK and Campbell DB (2002). "*Mercury Radar Imaging at Arecibo in 2001*." 33rd Annual Lunar and Planetary Science Conference, abstract 1858. Lunar and Planetary Institute, Houston, Texas.

Melillo FJ (2008). *Observations of Mercury's 280 Degrees Longitude Region*. *Journal of the Assn of Lunar & Planetary Observers* 50(3):27-29.

Melillo FJ (2009). *ALPO Observations of Mercury Compared to Images from the First Messenger Flyby*. *Journal of the Assn of Lunar & Planetary Observers* 51(1):16-20.

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

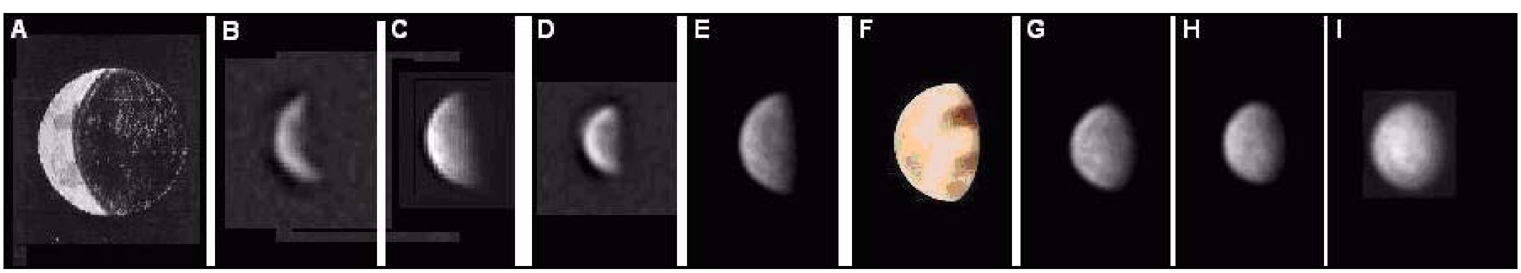

Figure 8. Images from Apparition 6 (see text).

A. Drawing by Carl Roussell, 2 Nov 2007 at 15:44 UT, CM = 245°
B. Image by Frank J. Melillo, 4 Nov 2007 at 15:05 UT, CM = 257°
C. Image by John Boudreau, 7 Nov 2007 at 15:35 UT, CM = 274°
D. Image by Frank J. Melillo, 8 Nov 2007 at 14:37 UT, CM = 279°
E. Image by John Boudreau, 8 Nov 2007 at 14:58 UT, CM = 279°
F. Drawing by Mario Frassati, 13 Nov 2007 at 6:20 UT, CM = 302°
G. Image by John Boudreau, 14 Nov 2007 at 14:34 UT, CM = 308°
H. Image by John Boudreau, 17 Nov 2007 at 14:39 UT, CM = 322°
I. Image by Ed Lomeli, 21 Nov 2007 at 20:55 UT, CM = 342°

Feature Story: Venus

ALPO Observations of Venus During the 2005 - 2006 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

Twelve observers from Canada, France, Germany, Japan, United Kingdom, and the United States submitted images and visual observations (drawings and detailed descriptive reports) to the ALPO Venus Section during the 2005-06 Eastern (Evening) Apparition. This report summarizes the results of the 181 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 181 observations for the 2005-06 Eastern (Evening) Apparition, comprised of visual drawings, descriptive reports, and digital images from 12 observers residing in Canada, France, Germany, Japan, United Kingdom, and United States. 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 employed.

Observational coverage of Venus throughout this apparition was not nearly as thorough as in the immediately preceding apparition. Several observers started monitoring Venus about two weeks after Superior Conjunction, which occurred on March 31, 2005, while others joined in the observational effort by mid-August. The majority of observers continued their observational studies well into December, and a few individuals followed Venus up to within a day of Inferior Conjunction on January 14, 2006. Every serious observer should try to make it a goal to carry out systematic observations of Venus when seeing conditions permit from conjunction to conjunction, and the ALPO Venus Section is indeed fortunate to have a growing team of persistent, dedicated observers who have tried to do that in recent years. The "observing season," or apparition, ranged from April 3, 2005 to January 13, 2006, with 77.3% of the observations occurring during the period of August through December 2005. For this observing season Venus passed through maximum elongation from the Sun (47.0°), dichotomy, and greatest brilliancy (–4.6mv).

All Readers

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

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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

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

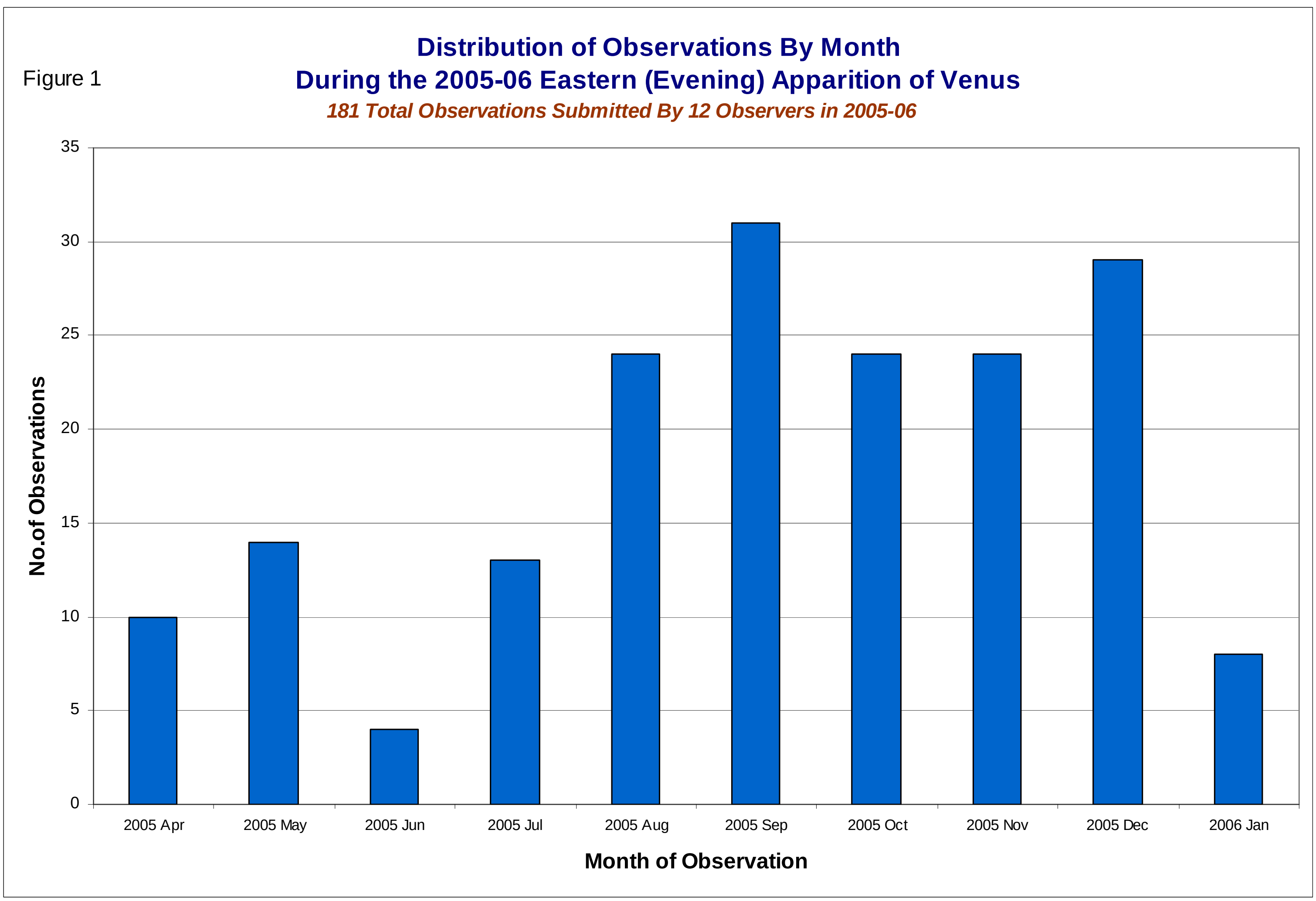
"Western" apparitions are those when an "inferior" planet (Mercury or Venus, whose orbits lie inside the Earth's orbit around the Sun) is **west of the Sun**, as seen in our morning sky before sunrise.

Table 1: Geocentric Phenomena in Universal Time (UT) for the 2005-06 Eastern (Evening) Apparition of Venus

Superior Conjunction	2005 Mar 21^{d} 03^{h} UT
Initial Observation	Apr 03 11.03
Dichotomy (predicted)	Nov 02 16.56
Greatest Elongation East	Nov 03 19.00 (46.0°)
Greatest Illuminated Event	Dec 09 06 (m_v = –4.6)
Final Observation	2006 Jan 13 13.32
Inferior Conjunction	Jan 14 00
Apparent Diameter (observed range): 9”.8 (2005 Apr 03) ↔ 63”.1 (2006 Jan 13)	
Phase Coefficient, ***k*** (observed range): 0.999 (2005 Apr 03) ↔ 0.004 (2006 Jan 13)	

Figure 2 shows the distribution of observers and contributed observations by nation of origin for this apparition, where it can be seen that half of the participants in our programs were located in the United States. They accounted for only 29.8% 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**. Slightly more than four-fifths (81.8%) of all observations were made with telescopes of at least 15.2 cm (6.0 in.) in aperture. During the 2005-06 Eastern (Evening) Apparition of Venus, the frequency of use of classical designs (refractors and Newtonians) was only 22.1%, while utilization of catadioptrics (Schmidt-Cassegrains and Maksutovs) was 77.9%, a continuing trend the last several apparitions. This could be a result of readily available adapters and filter housings for attaching digital imagers to Schmidt-Cassegrains and Maksutovs, as well as the overall compactness and portability aperture-for-aperture of catadioptrics for transport to remote sites. All 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 reduces the excessive glare associated with the planet. Also, viewing or imaging Venus when it is higher in the sky substan-



tially cuts down on the detrimental effects of atmospheric dispersion and image distortion prevalent near the horizon.

The author would like to thank the 12 observers who made this report possible by submitting their drawings, descriptive reports, and digital images of Venus in 2005-06. Readers who wish to follow Venus in coming apparitions are urged to join the ALPO and start participating in our observational studies. The 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 ALPO Venus Section programs requires only minimal aperture, ranging from 7.5 cm (3.0 in.) for refractors to 15.2 cm (6.0 in.) for reflectors.

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 a library of earlier issues of this Journal may also find it useful to consult previous apparition reports for a good historical account of ALPO studies of Venus.

Most of the drawings and some of digital images used for this analytical report were made at visual wavelengths, but more observers are now regularly imaging Venus in infrared (IR) and ultraviolet (UV) light than ever before. A few examples of submitted observations in the form of drawings and images supplement 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

Table 2: ALPO Observing Participants, 2005-06 Eastern (Evening) Apparition

Observer and Observing Site	No. Obs.	Telescope(s) Used*
Arditti, David Middlesex, UK	13	25.4 cm (10.0 in) DALL
Bell, Charles Vicksburg, MS	2	30.5 cm (12.0 in) SCT
Benton, Julius L. Wilmington Island, GA	26	12.7 cm (5.0 in) MAK
Boisclair, Norman J. South Glens Falls, NY	4 6	9.0 cm (3.5 in) MAK 50.8 cm (20.0 in) NEW
Cudnik, Brian Weimar, TX	4 1 1	25.4 cm (10.0 in) NEW 31.8 cm (12.5 in) NEW 35.6 cm (14.0 in) NEW
Ikemura, Toshihiko Osaka, Japan	8	31.0 cm (12.2 in) NEW
Jefferson, James Middlesex, UK	2	12.5 cm (5.0 in) SCT
Mancilla, Joseph Elancourt, France	1	8.0 cm (3.1 in) REF
Melillo, Frank J. Holtsville, NY	9	20.3 cm (8.0 in) SCT
Niechoy, Detlev Göttingen, Germany	84	20.3 cm (8.0 in) SCT
Pellier, Christophe Bruz, France	1	21.0 cm (8.3 in) DALL
Roussell, Carl Hamilton, Ontario, Canada	19	15.2 cm (6.0 in) REF
Total No. of Observers	**12**	
Total No. of Observations	**181**	

*REF = Refractor, SCT = Schmidt-Cassegrain, NEW = Newtonian, MAK = Maksutov, DALL = Dall-Kirkham

Table 3: Dark Hemisphere Infrared Images, 2005-06 Eastern (Evening) Apparition of Venus

UT Date and Time	k	Observer	Location	Instrument
2005 Dec 18 16:54	0.183	Pellier, Christophe	France	21.0 cm (8.3 in) DALL
2005 Dec 23 22:05	0.136	Melillo, Frank J.	USA	20.3cm (8.0 in) SCT
2005 Dec 25 08:29	0.118	Ikemura, Toshihiko	Japan	31.0 cm (12.2 in) NEW
2005 Dec 29 08:27	0.082	Ikemura, Toshihiko	Japan	31.0 cm (12.2 in) NEW
2005 Dec 30 21:55	0.074	Melillo, Frank J.	USA	20.3cm (8.0 in) SCT
2006 Jan 01 08:42	0.058	Ikemura, Toshihiko	Japan	31.0 cm (12.2 in) NEW
2006 Jan 02 08:30	0.050	Ikemura, Toshihiko	Japan	31.0 cm (12.2 in) NEW

Figure 2

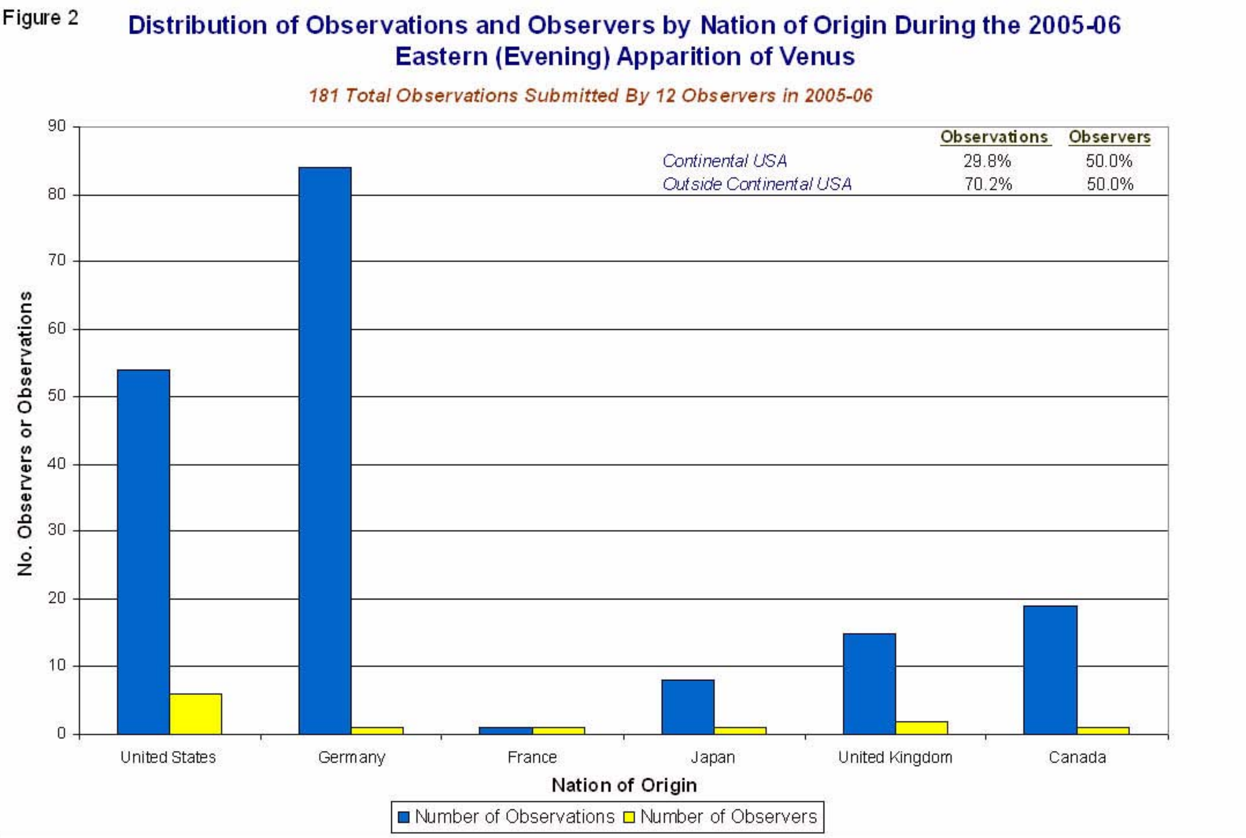
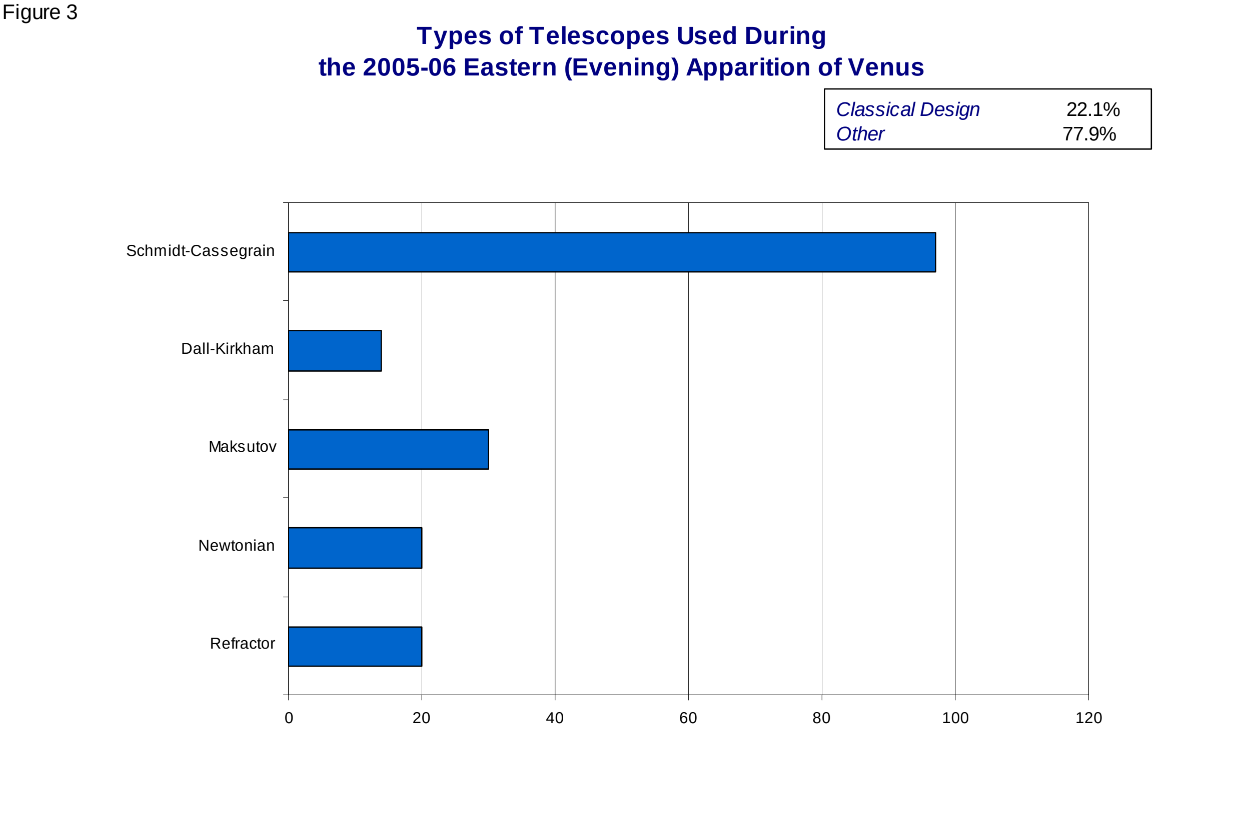


Figure 3



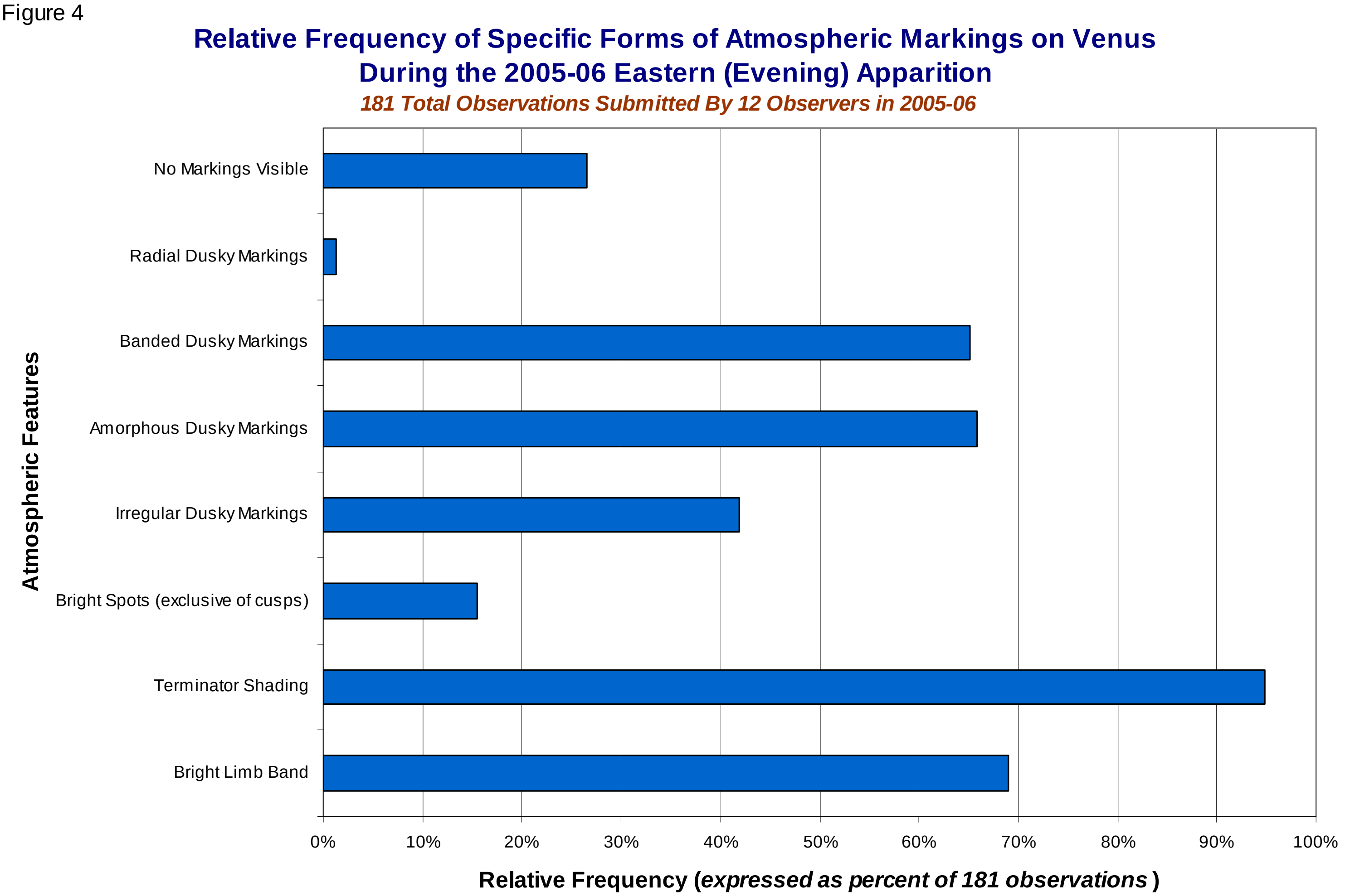
long-established categories of dusky and bright markings in the atmosphere of Venus, including a small fraction of radial dusky features, described in the literature cited earlier in this report. **Figure 4** illustrates the frequency of identifiable forms of markings seen or suspected on Venus. Most observations referenced more than one category of marking or feature, so totals exceeding 100% are not at all unusual. There is no question that some subjectivity is inevitable when visual observers try to describe, or accurately represent on drawings, the variety of highly elusive atmospheric features on Venus, and this natural bias likely affected some of the data in **Figure 4**. It is believed, however, that conclusions discussed in this report are at the very least reasonable.

The dusky markings of Venus' atmosphere are always very troublesome to perceive by normal visual observing methods, and this well-known characteristic of the planet is largely independent of the experience of the observer. Yet, when color and variable-density polarizing filters are routinely employed, views of cloud phenomena on Venus at visual wavelengths are often measurably improved. In conjunction with routine visual work, the ALPO Venus Section encourages observers to try digital imaging of Venus at UV and IR wavelengths, and with every apparition that passes, it is clear that more and more individuals are getting into such work. Indeed, 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). Yet, similarities do occasionally occur between images taken at UV wavelengths and drawings made with blue and violet filters, and the more of these received during an observing season, the more interesting are the comparisons of what can or cannot be detected visually versus what is captured in digital images at various wavelengths.

Figure 4 illustrates that in 26.5% of the observations submitted this apparition, the dazzlingly bright disc of Venus was thought to be totally devoid of atmospheric features. When dusky features were seen or suspected on the brilliant disc of Venus, the highest percentage was "Amorphous Dusky Markings" (65.8%), followed by "Banded Dusky Markings" (65.2%), and "Irregular Dusky Markings" (41.9%). Although many more UV images were submitted this observing season, the incidence of "Radial Dusky Markings" was very small (1.3%). (See images 1 through 3.)

Terminator shading was reported in 94.8% of the observations, as shown in **Figure 4**. Terminator shading normally

Figure 4



extended from one cusp of Venus to the other, and the dusky shading was progressively lighter in tone (higher intensity) from the region of the terminator toward the bright planetary limb. Many observers described this upward gradation in brightness as ending in the Bright Limb Band. Several images at visual wavelengths showed terminator shading, but it was most obvious on many UV images. (See images 5, 8 and 9.)

The mean numerical relative intensity for all of the dusky features on Venus this apparition ranged from 8.6 to 8.9. The ALPO Scale of Conspicuousness (a numerical sequence from 0.0 for "definitely not seen" up to 10.0 for "definitely seen") was used regularly, and the dusky markings in **Figure 4** had a mean conspicuousness of ~3.5 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 15.5% of the submitted observations. It is standard practice for observers to denote such bright areas on drawings by using dotted lines to surround them. (See Image 6.)

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.

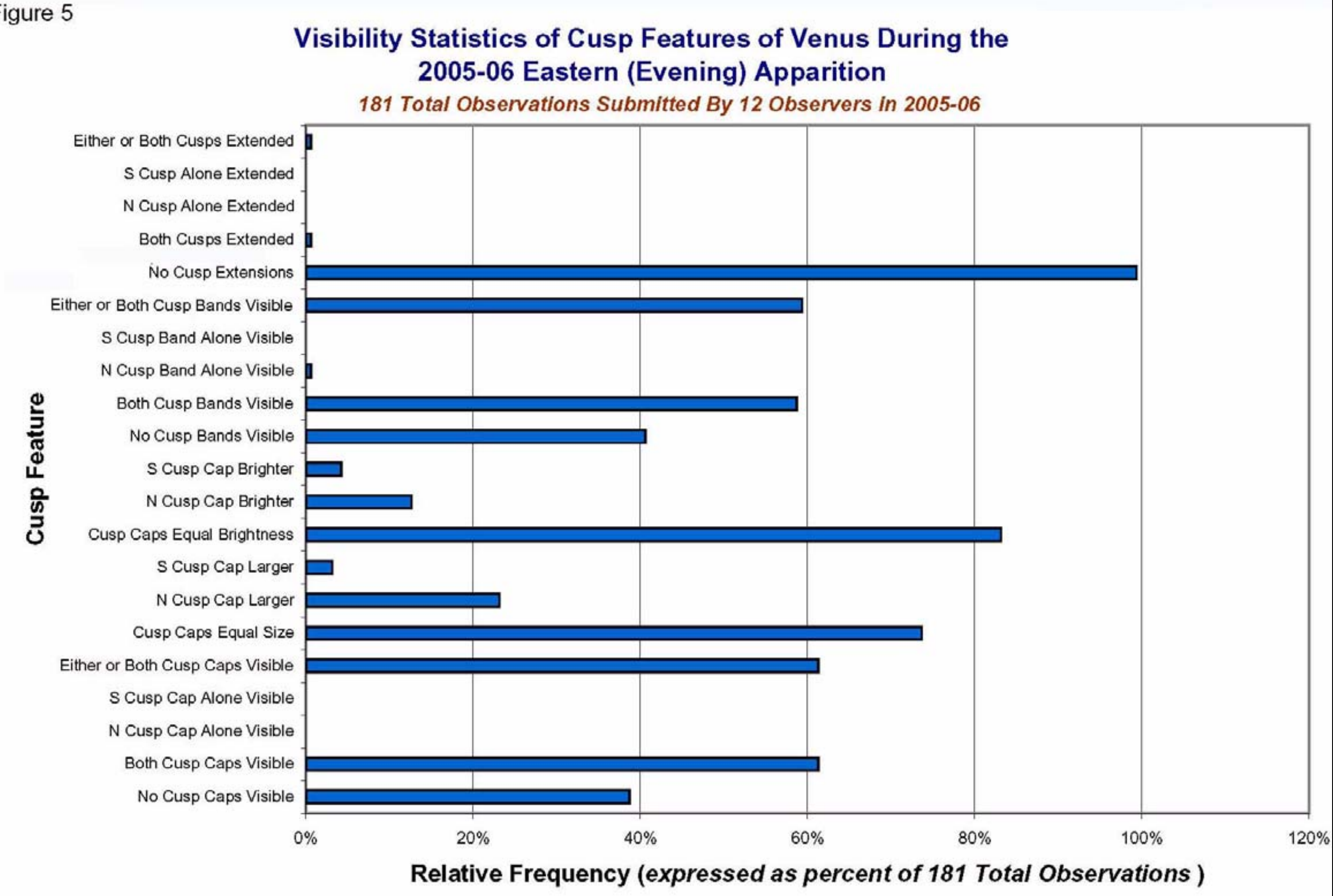
The Bright Limb Band

Figure 4 illustrates that less than half of the submitted observations (44.5%) 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 47.1% of the time, and interrupted or only marginally visible along the limb of Venus in 52.9% 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.

Terminator Irregularities

The terminator is the geometric curve that separates the brilliant sunlit and dark

Figure 5



hemispheres of Venus. A deformed or asymmetric terminator was reported in 45.8% of the observations. Amorphous, banded, and irregular dusky atmospheric markings often seemed to merge with the terminator shading, possibly contributing to some of the reported incidences of irregularities. Filter techniques usually improved the visibility of terminator asymmetries and associated dusky atmospheric features. Bright features adjacent to the terminator can occasionally take the form of bulges, while darker markings may appear as wispy hollows. (See Image 7.)

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 (73.7%) of the time and in brightness in 83.2% of the observations. Also, there were several instances when the southern and northern cusp-caps were larger and brighter than each other. Neither cusp-cap was visible in 38.7% of the observational reports. The mean relative intensity of the cusp-caps was about 9.8 during the observing season. No dusky cusp-bands were detected flanking the bright cusp-caps in 40.6% of the observations when cusp-caps were visible. When seen, the cusp-bands displayed a mean relative intensity of about 7.6 (**Figure 5**). [See Image 4.)

Cusp Extensions

In 99.4% 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 (**Figure 5**). As Venus entered crescent phases as it approached inferior conjunction on January 14, 2006, a few observers recorded cusp extensions occasionally, ranging from 2× to 20×, represented on a few drawings that were submitted. The only image submitted to the ALPO Venus Section that seemed to show cusp extensions was made by Frank Melillo, observing from New York in moderate seeing conditions at 21:30 UT on January 7, 2006, using a Starlight Xpress MX-5 camera with a W25 red filter attached to a 20.3 cm (8.0 in.) SCT. Experience has shown that cusp extensions, more often than not, are extremely difficult to image because the sunlit regions of Venus are overwhelmingly brighter than faint cusp extensions. Even so, observers are strongly encouraged to try to record these features using digital imaging equipment in future apparitions. [See Image 12).

Image 1. 2005 Apr22 11:48 UT, Detlev Niechoy, Göttingen, Germany, 20.3 cm (8.0 in.) SCT, Drawing @ 225x Integrated Light, Seeing 5.0 (interpolated), Phase (k) = 0.995.

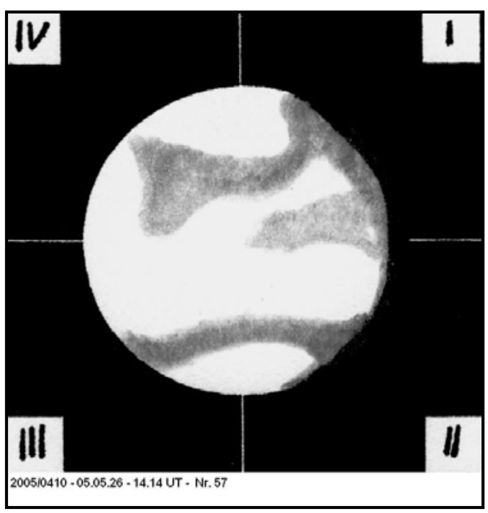


Image 2. 2005 May 26 14:14 UT, Detlev Niechoy, Göttingen, Germany, 20.3 cm (8.0 in.) SCT, Drawing @ 225x W57 (green) filter, Seeing 4.0 (interpolated), Phase (k) = 0.967.

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

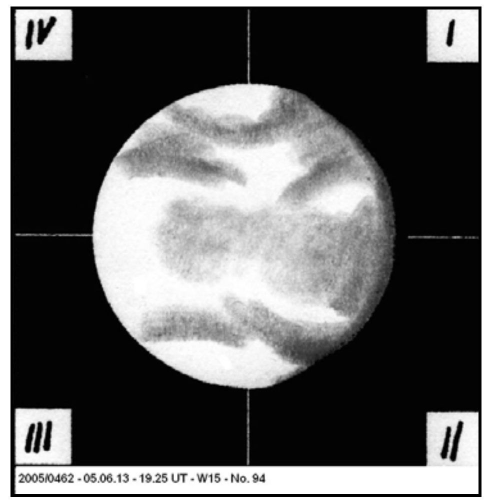


Image 3. 2005 Jun 13 19:25 UT, Detlev Niechoy, Göttingen, Germany, 20.3 cm (8.0 in.) SCT, Drawing @ 225x W15 (yellow) filter, Seeing 4.0 (interpolated), Phase (k) = 0.940.

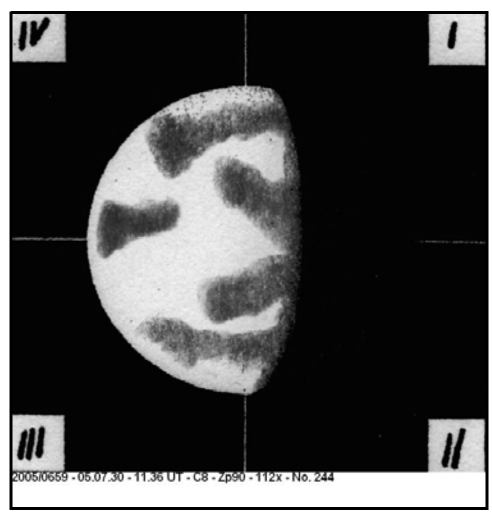


Image 4. 2005 Jul 30 11:36 UT, Detlev Niechoy, Göttingen, Germany, 20.3 cm (8.0 in.) SCT, Drawing @ 112x Integrated Light, Seeing 5.0 (interpolated), Phase (k) = 0.838.

angle, i, between the Sun and the Earth as seen from Venus equals 90×. Although theoretical dichotomy occurred on November 2, 2005 at 16.56h UT, visual dichotomy estimates were not submitted during this apparition.

Dark Hemisphere Phenomena and Ashen Light Observations

The Ashen Light, reported the first time by G. Riccioli in 1643, is an extremely elusive, faint illumination of Venus' dark hemisphere. Although the origin is not the same, the Ashen Light is described by some observers to resemble Earthshine on the dark portion of the Moon. Many experienced observers are of the opinion that Venus must be viewed against a totally dark sky for the Ashen Light to be detected, but these 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 complicates matters as well. Even so, the ALPO Venus Section continues to receive reports from seasoned observers, looking at the planet in twilight, who are positive they have seen the Ashen Light, and so the controversy persists. Venus observers are urged 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. During this apparition, only Detlev Niechoy of Germany suspected seeing the Ashen Light on Venus on December 16, 2005 at 15:28 UT (at 225x with a W47 violet filter) and again on January 3, 2006 at 14:30 UT (integrated light at 112x) using a 20.3cm (8.0 in.) SCT on both occasions in poor seeing. [See images 10 and 11.)

Readers of this Journal will recall the historically unprecedented amateur images by Christophe Pellier of Bruz, France, of the illuminated dark hemisphere of Venus in 2004 on May 12th, 16th, and 21st using a 35.6 cm (14.0 in.) SCT, an ATK-1HS CCD camera, and a 1000nm (1m) IR filter. The ALPO Venus Section has continued to encourage observers to attempt systematic imaging of the planet Venus at near infrared wavelengths, and three observers responded during the 2005-06 Eastern (Evening) Apparition, submitting digital IR images listed in **Table 3**. (See images 13 through 19.)

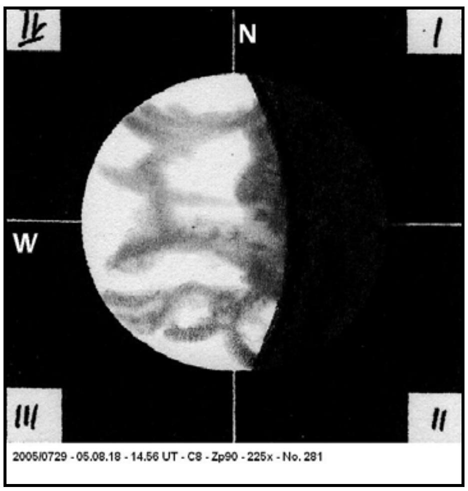


Image 5. 2005 Aug 18 14:58 UT, Detlev Niechoy, Göttingen, Germany, 20.3 cm (8.0 in.) SCT, Drawing @ 225x Integrated Light, Seeing 5.0 (interpolated), Phase (k) = 0.785.

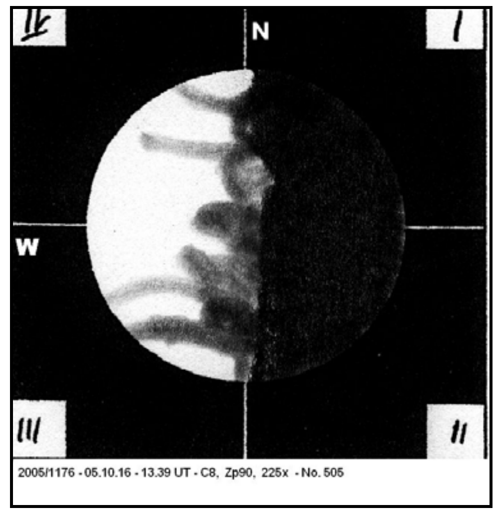


Image 7. 2005 Oct 16 13:39 UT, Detlev Niechoy, Göttingen, Germany, 20.3 cm (8.0 in.) SCT, Drawing @ 225x Integrated Light, Seeing 4.5 (interpolated), Phase (k) = 0.579.

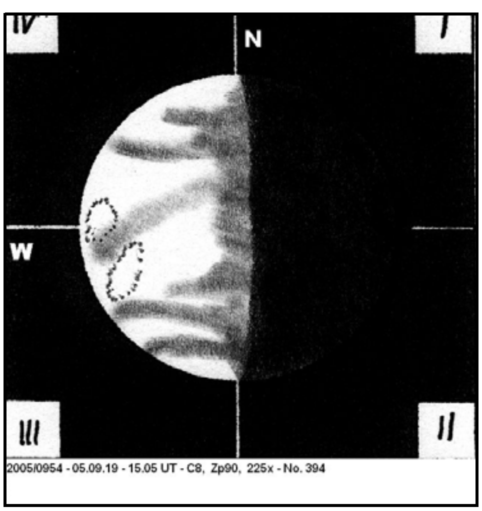


Image 6. 2005 Sep 19 15:05 UT, Detlev Niechoy, Göttingen, Germany, 20.3 cm (8.0 in.) SCT, Drawing @ 225x W15 Filter, Seeing 3.0 (interpolated), Phase (k) = 0.683.

Image 8. 2005 Nov 20 08:50 UT, Toshihiko Ikemura, Osaka, Japan, 31.0 cm (12.2 in.), NEW, ATK-2HS camera, U340 UV filter, Seeing not specified, Phase (k) = 0.400.

Just like those of Pellier during 2004, these images show the hot surface of Venus in the near-IR, the light penetrating the dense clouds of the planet. The few mottlings that show up in the January 2006 images by Ikemura are not Venusian atmospheric features but perhaps represent cooler dark higher-elevation terrain and warmer bright lower surface areas in the IR and look similar to those taken in 2004 by Pellier. Since the instrumentation and methods are not very complicated, more Venus observers are urged to continue IR imaging of the planet in future apparitions.

Image 9. 2005 Nov 20 20:55 UT, Frank J. Melillo, Holtsville, NY, 20.3 cm (8.0 in.) SCT, Starlight Xpress MX-5, Schott UG-1 UV filter, Seeing 7.0, Phase (k) = 0.400.

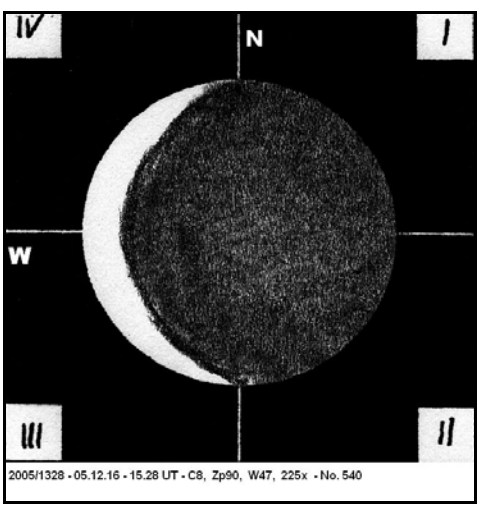


Image 10. 2005 Dec 16 15:28 UT, Detlev Niechoy, Göttingen, Germany, 20.3 cm (8.0 in.) SCT, Drawing @ 225x W47 (violet) filter, Seeing 3.0 (interpolated), Phase (k) = 0.195.

There were no 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.

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 2005-06 Eastern (Evening) Apparition indicated that vague shadings on the disc of the planet were occasionally apparent to visual observers who utilized suitable filter techniques to emphasize very elusive atmospheric features. It is often very difficult, however, to decide between what is real and what is merely illusory at visual wavelengths in the atmosphere of Venus, but increased confidence in visual results are improving as the incidence of simultaneous observations increases. Readers should realize, therefore, that well-executed drawings of Venus

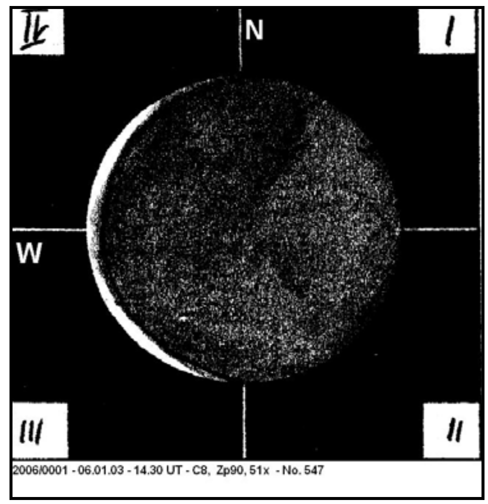


Image 11. 2006 Jan 03 14:30 UT, Detlev Niechoy, Göttingen, Germany, 20.3 cm (8.0 in.) SCT, Drawing @ 112x Integrated Light, Seeing 4.0 (interpolated), Phase (k) = 0.039.

Image 12. 2006 Jan 07 21:30 UT, Frank J. Melillo, Holtsville, NY, 20.3 cm (8.0 in.) SCT, Starlight Xpress MX-5, W25 (red) filter, Seeing 5.0, Phase (k) = 0.016.

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 more and more Venus observers are contributing digital images of image Venus at visual, near-UV, and near-IR wavelengths. It is also meaningful when several observers working independently, some using visual methods at the same time that others are doing digital imaging, produce comparable results. For example, atmospheric banded features and radial ("spoke") patterns depicted on drawings often look strikingly similar to those in digital images received for 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 remains our main objective, and the ALPO Venus Section encourages interested readers to join us in our many projects and challenges in the coming years.

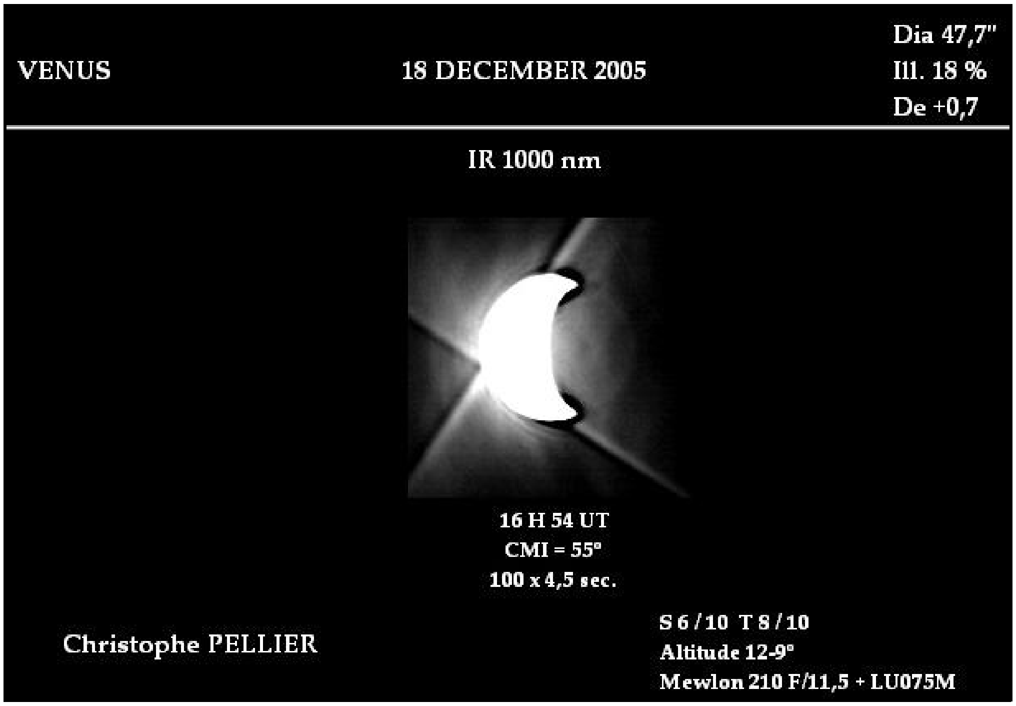


Image 13. 2005 Dec18 16:54 UT, Christophe Pellier, Bruz, France, 21.0 cm (8.3 in.) DALL, LU075M camera, IR1000nm, Seeing 6.0, Transparency 8.0, Phase (k) = 0.176.

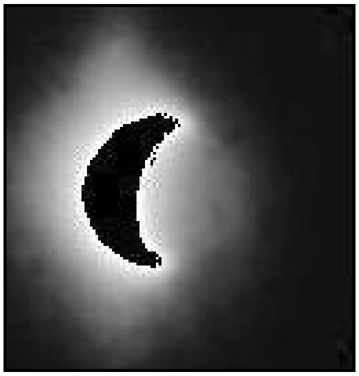


Image 14. 2005 Dec 23 22:05 UT, Frank J. Melillo, Holtsville, NY, 20.3 cm (8.0 in.), SCT, Starlight Xpress MX-5, 1000nm IR filter, Seeing 7.0, Phase (k) = 0.128.

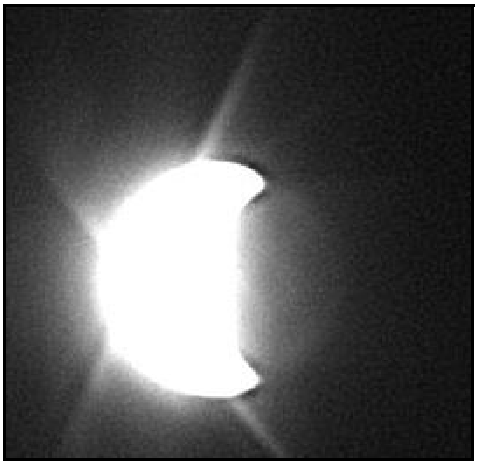


Image 15. 2005 Dec 25 08:29 UT, Toshihiko Ikemura, Osaka, Japan, 31.0 cm (12.2 in.) NEW, ATK-2HS camera, 990-1000nm IR filter, Phase (k) = 0.115.

References

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

———, (2004), *"ALPO Observations of Venus During the 2000-2001 Eastern (Evening) Apparition." Journal of the Assn. of Lunar & Planetary Observers, 46,* No. 4 (Autumn), 13-24.

———, (2005), *"ALPO Observations of Venus During the 2001-2002 Western (Morning) Apparition." Journal of the Assn. of Lunar & Planetary Observers, 47,* No. 4 (Autumn), 26-35.

———, (2006a), *"ALPO Observations of Venus During the 2002 Eastern (Evening) Apparition." Journal of the Assn. of Lunar & Planetary Observers, 48,* No. 3 (Summer), 15-27.

———, (2006b), *"ALPO Observations of Venus During the 2002-2003 Western (Morning) Apparition." Journal of the Assn. of Lunar & Planetary Observers, 48,* No. 4 (Autumn), 17-26.

________ (2007), *"ALPO Observations of Venus During the 2003-2004 Eastern (Evening) Apparition." Journal of the Assn of Lunar & Planetary Observers, 49* (4), 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.

Bougher, S.W. et al., eds. (1997). *Venus II: Geology, Geophysics, Atmosphere, and Solar Wind Environment*. Tucson: University of Arizona Press.

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 2005 and 2006 editions, published in 2004 and 2005 respectively, were used for this report.)

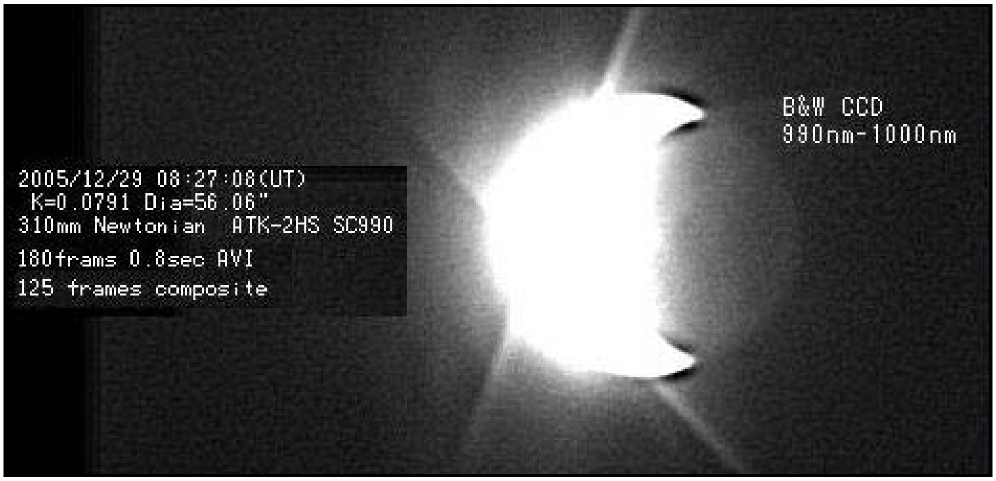


Image 16. 2005 Dec 29 08:27 UT, Toshihiko Ikemura, Osaka, Japan, 31.0 cm (12.2 in.) NEW, ATK-2HS camera, 990-1,000nm IR filter, Phase (k) = 0.077.

Image 17. 2005 Dec 30 21:55 UT, Frank J. Melillo, Holtsville, NY, 20.3 cm (8.0 in.) SCT, Starlight Xpress MX-5, 1,000nm IR filter, Seeing 7.5, Phase (k) = 0.066.

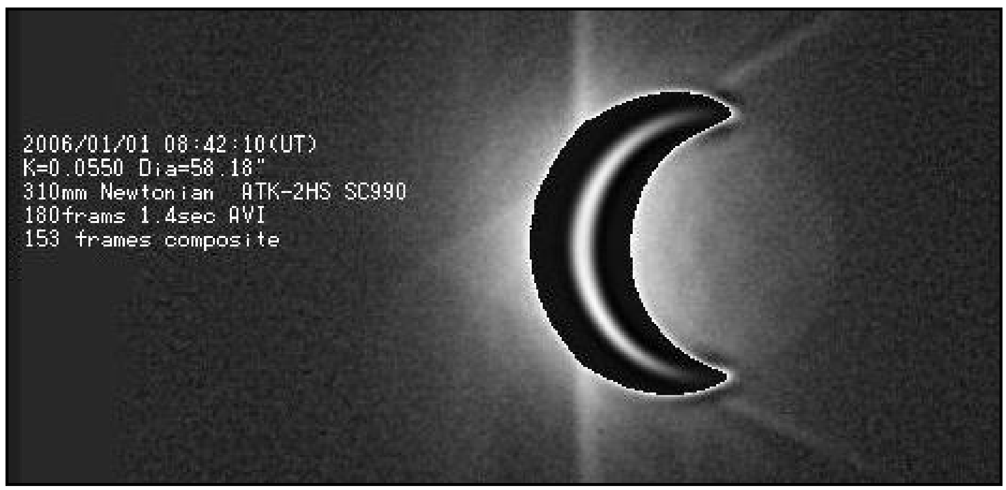


Image 18. 2006 Jan 01 08:42 UT, Toshihiko Ikemura, Osaka, Japan, 31.0 cm (12.2 in) NEW, ATK-2HS camera, 990-1,000nm IR filter, Phase (k) = 0.055.

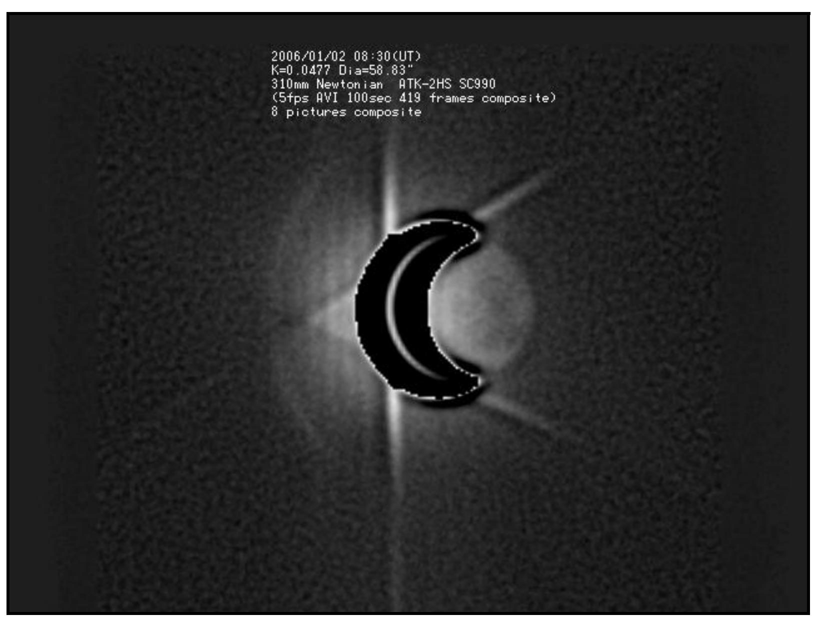


Image 19. 2006 Jan 02 08:30 UT, Toshihiko Ikemura, Osaka, Japan, 31.0 cm (12.2 in.) NEW, ATK-2HS camera, 990-1,000nm IR filter, Phase (k) = 0.047.

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

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

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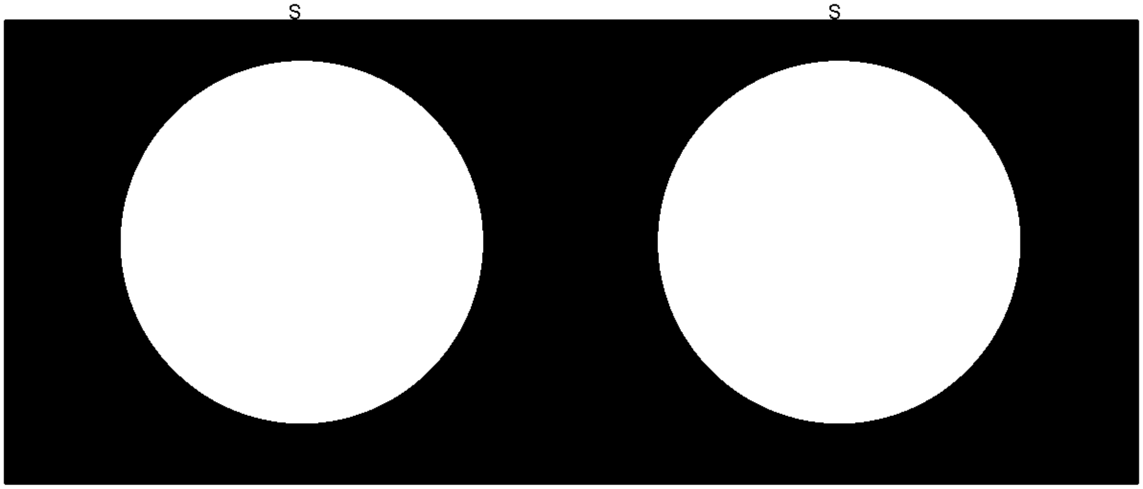

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N (*all coordinates are IAU*) N

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:

Galilean Satellite Eclipse Timings During the 1998/99 Apparition

By: John E. Westfall, assistant coordinator, ALPO Jupiter Section
johnwestfall@comcast.net

Abstract

The Galilean Satellite Eclipse Timing Program of the ALPO Jupiter Section received 417 visual timings of eclipses of Io, Europa, Ganymede and Callisto from 31 observers for the 1998/99 Apparition. For each satellite, eclipse visual disappearance and reappearance timings were adjusted for telescope aperture and were then compared with the Jet Propulsion Laboratory's "E-2" Ephemeris. Of the four satellites, two differed significantly in position from the E-2 Ephemeris; Europa was 26.5 ± 3.2 seconds (364 km) behind (late), and Ganymede 13.0 ± 7.2 seconds ahead (early).

Introduction

The 1998/99 Apparition of Jupiter was the 21st analyzed by the ALPO Jupiter Section's Galilean Satellite Eclipse Timing Program. The satellites timed were Io (1), Europa (2), Ganymede (3) and Callisto (4). Visual observers timed the "first speck" visible when the satellite emerged from Jupiter's shadow (reappearance), or the "last speck" seen when the satellite entered the shadow (disappearance). Reports for previous apparitions are listed under "References" (page 48). [Westfall 1983-84, 1986a, 1986b, 1987, 1988, 1989, 1991, 1992, 1994, 1996, 1998, 1999, 2000, 2005 and 2008]

Table 1 lists some important dates for the 1998/99 Jupiter Apparition. All dates and times in this report are in Universal Time (UT). Note that an *apparition* is the period between successive solar conjunctions, while an *observing season* is the period of actual observation. Thus the 1998/99 observing season began a full 52 days after solar conjunction, with Jupiter 40° west of the Sun, but ended just 27 days before the next conjunction, at solar elongation 21° east.

At its closest approach to us, Jupiter's distance from Earth was 3.963 AU (astroomical units), giving a relatively large apparent equatorial diameter of 49".70. At opposition in 1998, Jupiter had a visual magnitude of -2.9 and a geocentric declination of -4°.2, the latter roughly equally favorable for observers on both sides of the the Earth's equator.

Observations

The 417 timings received for 1998/99 bring our 21-apparition total to 9,871 visual timings (this includes older observations received since our last report), but represent a slight decrease from the 430 for the 1997/98 Apparition. A total of 31 persons made observations and are listed in **Table 2** along with their nationalities, telescope apertures and numbers of timings. The timings themselves are given in **Table 9**, with the observers and their telescope apertures identified by the numbers given in the left-hand column of **Table 2**.

Timings for the 1998/99 Apparition were made by observers in 11 countries in five continents, and the number of observers and timings received from each nation are given in **Table 3**. The geographic spread of our observers is gratifying, but there continue to be longitude gaps in our coverage, including Africa, Asia outside China, and much of the Pacific Basin.

Table 1: 1998/99 Jupiter Apparition Data

Conjunction with the Sun	1998 Feb 23, 09h	Jupiter 0°.9 south of the Sun
First Eclipse Timing	1998 Apr 16, 19h	Solar Elongation = 39°.9 west
1st Maximum Phase Angle	1998 Jun 18, 15h	i = 11°.7682
Opposition to the Sun	1998 Sep 15, 17h	Declination = 4°.2 south
Closest Approach to Earth	1998 Sep 16, 03h	3.9629 AU, D(Eq.) = 49".70
2nd Maximum Phase Angle	1998 Dec 11, 10h	i = 11°.4528
Last Eclipse Timing	1999 Mar 05, 00h	Solar Elongation = 20°.6 east
Conjunction with the Sun	1999 Apr 01, 06h	Jupiter 1°.0 south of the Sun
(Sources: Meeus 1995; *Astronomical Almanac 1998 and 1999* issues; JPL HORIZONS website. Dates and times are UT. AU = astronomical units [1 AU =149,597,871 km], D(Eq.) = apparent equatorial diameter.)		

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

IAU directions are used in all instances (so that Jupiter rotates from west to east).

Table 2: Participating Observers and Instruments, Galilean Satellite Eclipse Timings, 1998/99 Apparition (417 observations total)

Observer			Instrument(s)		Observer's Timings Total
Identification Number	Name	Nationality	Aperture (cm)	No. Timings	
1a	Abrahams, W.	Australia	6	1	2
1b			20	1	
2	Bacon, I.	Australia	25	6	6
3a	Bembrick, C.	Australia	6	1	29
3b			7	16	
3c			25	12	
4	Blanksby, J.	Australia	15	37	37
5a	Bock, P.	USA (VA)	8.0	4	13
5b			8.9	9	
6	Bulder, H.	Netherlands	30	4	4
7	Büttner, D.	Germany	6	7	7
8	Chen, D.-H.	P.R. China	20.0	19	19
9	Ferenchak, R.	USA (OH)	20.3	13	13
10	Foglia, S.	Italy	11.4	3	3
11	Girling, D.	Australia	20	19	19
12	Gonçalves, R.	Portugal	20	1	1
13	Grunnet, C.	Denmark	15	3	3
14a	Haas, W.	USA (NM)	20.3	6	24
14b			31.75	18	
15a	Hays, R.	USA (IL)	13	3	18
15b			15	15	
16	Head, M.	New Zealand	15	3	3
17	Horenz, M.	Germany	6	4	4
18a	Kerr, S.	Australia	5	23	36
18b			20	13	
19	Kruijshoop, A.	Australia	20	10	10
20	Larkin, P.	Australia	20	44	44
21	Laskowski, S.	USA (WI)	25.4	2	2
22a	Loader, B.	New Zealand	10	7	40
22b			20	33	
23a	MacDonald, M.	New Zealand	15	1	19
23b			25	18	
24	MacDougal, C.	USA (FL)	15	10	10
25	Parl, M.	Germany	6	2	2
26	Rosa Campos, A.	Brazil	18	17	17
27a	Samolyk, G.	USA (WI)	32	2	3
27b			65	1	
28	Skilton, P.	Australia	15	3	3
29	Smith, C.	Australia	25	10	10
30	Sullivan, M.	Canada (BC)	11.43	9	9
31	Westfall, J.	USA (CA)	28	7	7

Also, it is disappointing that only about one-quarter of the observers were from the United States and that they averaged relatively few timings per observer.

Contributing to this total were 258 timings (62 percent of the total) by 13 New Zealand and Australian observers coordinated by Brian Loader of the Royal Astronomical Society of New Zealand.

The 1998/99 observers averaged 13.5 timings per observer, thus up from 11.9 in 1997/98, with observers from New Zealand, Australia, China and Brazil notable for their number of observations. We here need to recognize those observers for the 1998/99 Apparition who had contributed observations for five or more apparitions. **Table 4** gives their names, number of apparitions and number of timings.

Telescope aperture definitely affects timing results. Note also that nine participants used two or even three instruments. The most popular aperture among the 41 different instruments continues to be 20 cm (10 instruments), which was also the median aperture. Fourteen small telescopes, of 5- to 7-cm aperture, were used. At the other extreme, there were four fairly large telescopes, of 30- to 65-cm aperture. The range of apertures continues to be large, showing that almost any size of telescope can be used in our program.

Table 5 gives the number of timings by satellite and type of event. It is the rule that eclipses of the satellites closer to Jupiter are timed more frequently; their orbital periods are less than those of satellites farther from the planet and their eclipses thus more frequent. As with all previous apparitions, somewhat more reappearances are observed than disappearances; for this apparition 53 percent were the former.

The outermost Galilean satellite, Callisto, is a special case because for roughly three years at a time, it passes north or south of Jupiter's shadow and experiences no eclipse. Callisto experienced its last predicted eclipse for this "season" on 1998 Nov 23, with the last one actually observed on 1998 Nov 06

The number of timings made each month is shown in **Table 6**. It is remarkable that the most active two months were both

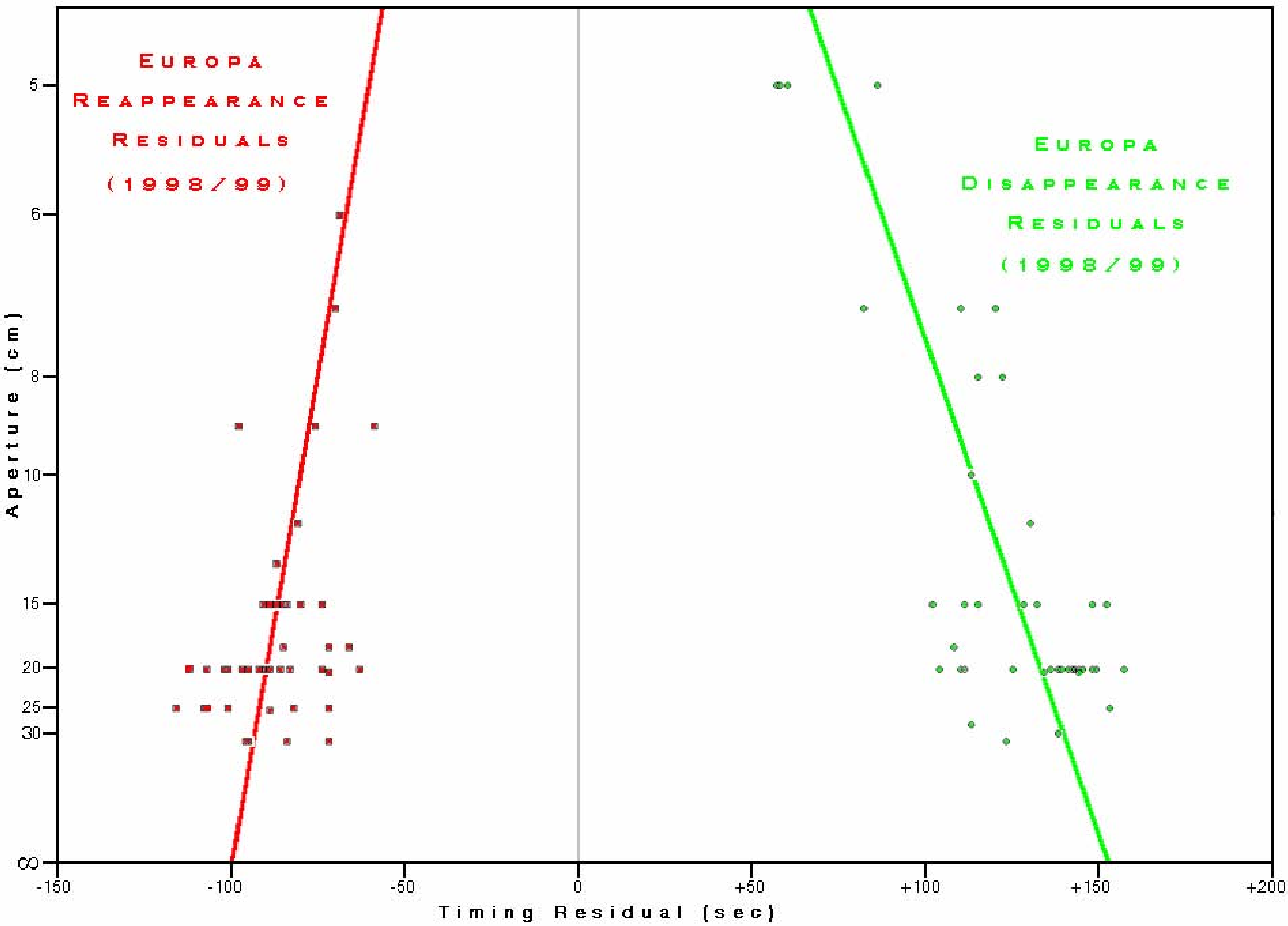


Figure 1. Plot of residuals (differences from the E-2 Ephemeris) of observed eclipses and reappearances for Europa (1998/99) Apparition). The vertical axis is scaled in terms of reciprocal of telescope aperture (cm; the aperture in cm is labeled on the axis). The diagonal lines represent the residual: aperture regression model discussed in the text. Note that for all apertures the disappearances were timed later than the reappearances were earlier, relative to the ephemeris.

before the mid-September opposition (August) and after opposition (November). There was a slight bias toward post-opposition timings, constituting 53 percent of the timings. We appreciate those observers who observed events after midnight, creating an almost-even balance in coverage.

Of course the pattern of the different eclipse phenomena for the different satellites affects the frequency of observations. Eclipse disappearances of Io are visible only before opposition, and its reappearances visible only after. Normally this is also true for Europa, but due to Jupiter being near its perihelion (1999 May 20), its phase angle became large enough that for short periods both disappearance and reappearance could be seen for the same eclipse of that satellite (in 1998 Jun/Jul and Dec; see the dates of maximum phase angle in **Table 1**). Disappearances and reappearances for the same eclipses of Ganymede and Callisto could be observed for most of the apparition except near opposition or conjunction.

Reduction

The reduction process was described in detail in our last previous report [Westfall 2008]. In brief, it began by grouping the timings by satellite and by whether they were of disappearances or reappearances. The reported times were compared with the predictions of the "E-2" Ephemeris developed by Jay H. Lieske of the Jet Propulsion Laboratory. [Lieske, 1981] The predicted time of each event was then subtracted from the observed time; these (O – C) differences are listed in **Table 9**. A positive observed-minus-computed difference meant that an event was "late"; a negative (O-C) difference, that it was "early." We expect disappearances to be early, and reappearances late, in relation to the predicted eclipse time because the latter predicts when, as seen from the center of the satellite's disk, the Sun is bisected by the limb of Jupiter.

The (O-C) differences were analyzed in relation to the aperture of the telescope

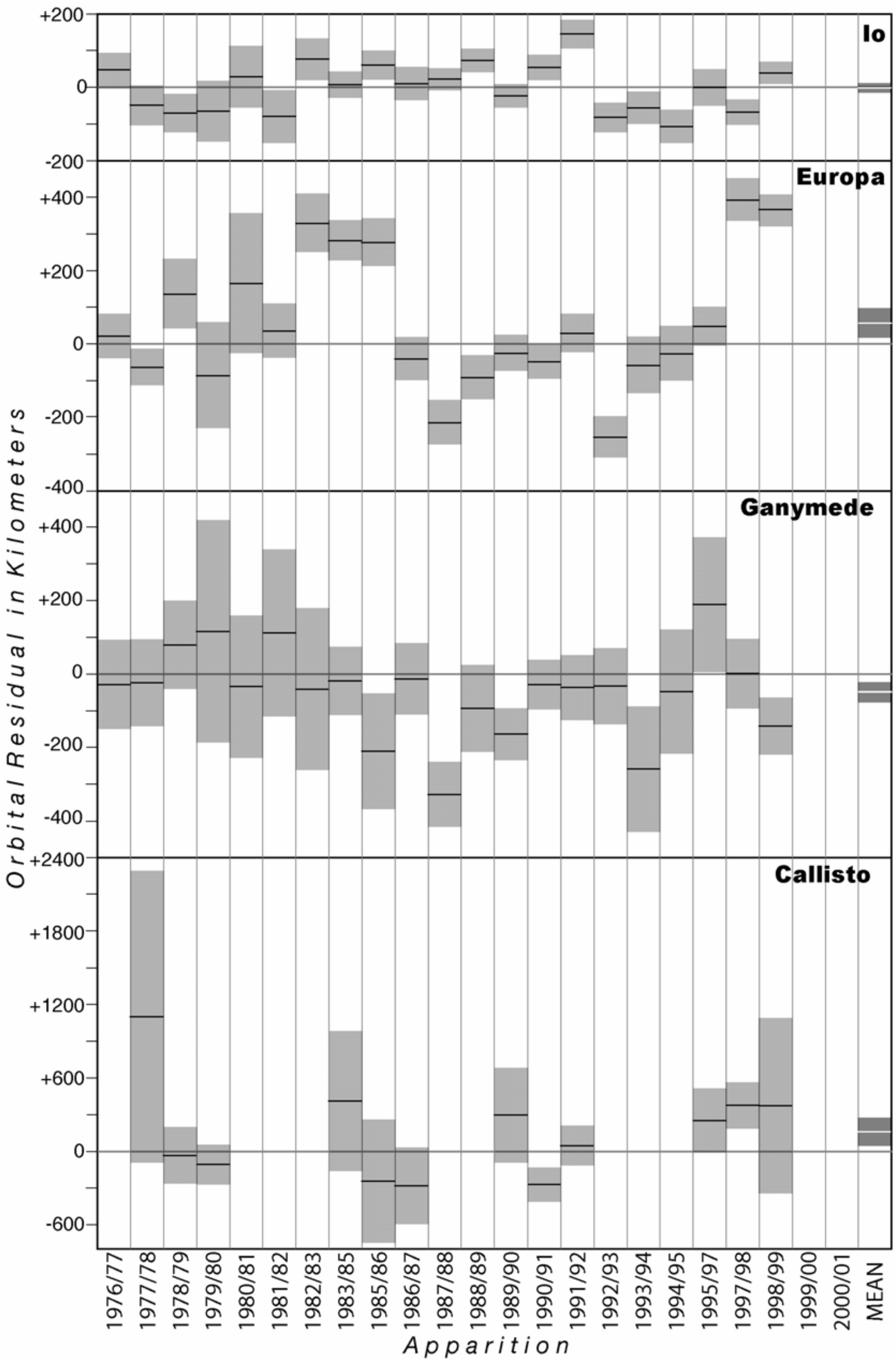


Figure 2. Deviations in kilometers of the Galilean satellites Io, Europa, Ganymede and Callisto from the JPL E-2 Ephemeris for the 1976/77 - 1998/99 Apparitions of Jupiter. The black line in the center of the grey bar for each apparition represents the estimated deviation of each satellite, while the bar itself shows the 1-sigma uncertainty range. The black rectangle on the right margin of the graph shows the 1-sigma range of the 21-apparition mean deviation; none of these four long-term means are significantly different from zero at the 5-percent significance level.

Table 3: Observers and Timings by Nationality, Galilean Satellite Eclipse Timings, 1998/99 Apparition

Nationality	Number of Observers	Number of Timings	Timings per Observer
Australia	10	196	19.6
Brazil	1	17	17.0
Canada	1	9	9.0
China (P.R.)	1	19	19.0
Denmark	1	3	3.0
Germany	3	13	4.3
Italy	1	3	3.0
Netherlands	1	4	4.0
New Zealand	3	62	20.7
Portugal	1	1	1.0
USA	8	90	11.2
Total	31	417	13.5

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

A total of 33 timings, or 8 percent, were not used because they differed from the regression model at the 5-percent significance level (i.e., this would occur by chance less than 5 percent of the time) as measured by the standard error (given in **Table 7**). For each satellite and type of event, this 5-percent significance criterion was applied twice in succession. The timings not used for the 1998/99 Apparition are shown by italicized residuals in **Table 9**. Rejected timings do not necessarily imply observer error, poor optics or unfavorable seeing or transparency. Timings near the beginning and end of the apparition are often unsatisfactory because the event has to be observed in twilight, near the horizon, or both. Another unfavorable situation occurs when eclipse events occur near the glare of Jupiter's limb.

Two statistics describe how well the model fits the observed residuals. One, the standard error (S.E.), is the root-mean-square difference between the model and the observations. The other statistic, the coefficient of variation or R^2, measures what proportion of the variance (squared differences among the residuals) is removed by the model.

1998/99 Results

Results for the 1998/99 Apparition are given in **Table 7**. This table gives results for each of the four satellites in a separate column. Each column is divided into three parts, "Disappearance," "Reappearance" and "Orbital Residual." For both disappearances and reappearances, the number of timings made is given first, followed in parentheses by the number finally used in the regression analysis after aberrant timings have been deleted. The next entry is the mean (O-C) difference for the timings that were retained, along with its 1-standard error uncertainty range; in **Table 7** all uncertainty ranges are preceded by the "±" symbol. The next row contains the coefficient of determination (R^2). If the latter is followed by "(ns)" the coefficient is not significantly different from zero and thus there is no significant aperture effect; if by "*" the chance of a false aperture effect being due to chance is 5 percent or less; if R^2 is followed by "**" the probability of a chance effect is under 1 percent. In the "A(sec)" and "B(sec-cm)" rows the two regression coefficients are given with their 1-standard error uncertainty ranges. Next is the standard error of estimate for the regression model. Following this are the predicted (O-C) differences for four commonly used telescope apertures.

The last three rows of **Table 7** give the orbital residual, which measures the amount the satellite is "behind" (positive) or "ahead of" (negative) its predicted position, in seconds, kilometers, and degrees of orbital arc, with the standard error and statistical significance of the time residual. In order to find a satellite's orbital residual it is necessary to have performed a regression analysis on observations of both its eclipse disappearance and reappearance. For this reason, and because a significant number of timings is needed, the orbital residuals listed in **Table 7** should be considered as averages for the entire observing season; they give no information on possible short-term (within-apparition) deviations of a satellite from its predicted position. That such weeks- or months-scale deviations occur is indicated by photometric CCD timings. [Mallama *et al*., 2000, 2003]

There are eight event types listed in **Table 7**; eclipse disappearances and reappearances for each of the four satellites. As

Table 4: Observers in 1998/99 Who Have Contributed for Five or More Apparitions, Galilean Satellite Eclipse Timing Program

Observer	Number of Apparitions	Number of Timings
William Abrahams	13	50
Colin Bembrick	12	199
J. L. Blanksby	11	327
Paul H. Bock	10	59
Henk Bulder	11	108
Dietmar Büttner	11	80
Chen Dong-Hua	8	143
Sergio Foglia	5	14
Rui Gonçalves	10	166
Carl Grunnet	5	43
Walter Haas	14	102
Robert Hays	12	143
Stephen Kerr	9	219
Alfred Kruijshoop	12	196
Patricia Larkin	9	292
Brian Loader	17	403
Malcolm MacDonald	11	191
Craig MacDougal	13	133
Gerry Samolyk	8	31
Peter Skilton	7	81
Charlie Smith	11	205
Michael Sullivan	6	70
John Westfall	21	368

Table 5: Number of Galilean Satellite Eclipse Timings by Event Type, 1998/99 Apparition

Satellite	(1) Io	(2) Europa	(3) Ganymede	(4) Callisto	Total
Disappearances	78	47	44	29	198
Reappearances	98	55	39	27	219
Total	*176*	*102*	*83*	*56*	*417*

Table 6: Number of Galilean Satellite Eclipse Timings by Month, 1998/99 Apparition

Month	Solar Elongation Range (observing season only)	Number of Timings
1998 APR	040-050°W	3
MAY	050-075°W	15
JUN	075-101°W	35
JUL	101-130°W	34
AUG	130-163°W	83
SEP	163W-164°E	55
OCT	164-131°E	49
NOV	131-101°E	81
DEC	101-074°E	38
1999 JAN	074-047°E	19
FEB	047-024°E	4
MAR	024-021°E	1
Before Opposition		198 (47%)
After Opposition		219 (53%)

shown by the R^2 values, in six of the eight cases, the aperture-regression model significantly reduced the variance among the timings. Nonetheless, in only three of the eight regressions was the majority of the variance among the timings accounted for in our simple residual-aperture model. Naturally, the uncertainties in our timings represent the combined effect of many variables that are not considered in our analysis, such as type of instrument, magnification, optical quality, atmospheric conditions, distance and phase angle of Jupiter, apparent distance of the satellite from Jupiter's limb, keenness of the observer's eye, or the use of an occulting bar (an opaque strip placed at the focus of a positive eyepiece to block out Jupiter itself). One observer found large differences in his timing of Callisto events resulted simply from whether he placed the disk of Jupiter inside or outside the field of view. There is also the effect of atmospheric variations on the shadow-caster, Jupiter, informally estimated as affecting eclipses times by as much as ten seconds. Clearly, only some of these variables are quantifiable, and for most we have no data at all. Nonetheless, with the almost 10,000 timings which have accumulated since 1975, a more complex statistical analysis is possible, which might reduce the amount of uncertainty.

The standard error gives the uncertainty of the timings, which increased with distance from Jupiter as follows (standard errors are given as disappearance:reappearance): 9:12 seconds for Io; 17:12 seconds for Europa; 26:40 seconds for Ganymede. The standard errors were a remarkable 217:322 seconds for Callisto, but this is clearly due to the fourth satellite being near the end of its eclipse "season" so that its path intersected Jupiter's shadow cone at extremely oblique angles, resulting in very gradual and prolonged events (note the latitude values for Callisto in **Table 9**). This trend of uncertainties increasing with satellite distance from Jupiter is expected as the satellites move more slowly, and Jupiter's shadow penumbra becomes broader, with increasing distance from the planet.

The values of the **B**-coefficients indicate the effect of telescope aperture on the observed time of "first speck" or "last speck." With the exception of statement (iii) for the eclipse reappearances of Europa and Ganymede, the values follow the expected pattern:

(i) **A** is positive for disappearances and negative for reappearances; "last speck" occurs after, and "first speck" before, the predicted time.

(ii) **B** is negative for disappearances and positive for reappearances; the larger the aperture, the later a disappearance, or the earlier a reappearance, is judged to occur.

(iii) The absolute value of the **B**-coefficient increases with a satellite's distance from Jupiter; as the orbital semimajor axis increases a satellite's orbital velocity decreases and the width of the penumbral band of Jupiter's shadow increases.

The orbital residuals, expressed in seconds of time, are the simple means of the disappearance and reappearance **A**-coefficients of each satellite. The four satellites' time residuals have also been converted to degrees of orbital arc and to kilometers.

Note that the timing results differed significantly from the E-2 Ephemeris for Europa, which has often been true in past apparitions, and on average it experienced eclipses 26.5 ± 3.2 seconds later than predicted, equivalent to being "behind" by 384 km in its orbit. This discrepancy was statistically significant at the 1-percent level. **Figure 1** illustrates how disappearances differed more from the ephemeris than did reappearances, regardless of aperture.

Ganymede also differed significantly from its ephemeris, but only at the 5-percent level; it averaged 13.0 ± 7.2 seconds or 141 km "ahead" of its predicted position.

Comparison with CCD Timings

We encourage suitably-equipped observers to use CCD cameras to time the eclipses of Jupiter's four major satellites and to report their results to the program headed by Anthony Mallama. For information about the CCD timing program and how to participate in it, visit *http://www.amsmeteors.org/mallama/galilean/index.html*

Table 8 compares the 1998/99 CCD timings with the visual timings of our program. In comparing the two sets of residuals, it is important to remember that the CCD results are the means of sets of observations of individual eclipse events; consulting the latter may well show trends within apparitions. Except perhaps for Io, the CCD standard errors probably reflect more the actual variations in the satellites' positions and in Jupiter's atmosphere than they do observational error. On the other hand, the visual results merge all the individual timings to give a satellite position generalized over the entire apparition.

Given this caveat, there are no statistically significant differences between the CCD and the visual timings; even the apparently large difference for Callisto is swallowed up by its large uncertainty.

Long-Term Results

The apparent changes in satellite position between the 1997/98 and 1998/99 Apparitions were found by subtracting the former from the latter, giving:

Io +6.2 ± 2.6 s
Europa -2.1 ± 5.4 s
Ganymede -13.0 ± 7.2 s
Callisto -0.6 ± 90.6 s

None of the four apparent changes is statistically significant, even at the five-percent level.

Summarizing the entire history of our program, the orbital residuals for Io, Europa, Ganymede and Callisto for the 21 apparitions from 1976/77 through 1998/99 are graphed in **Figure 2** (there were insufficient observations for the 1975/76 Apparition to determine its orbital deviations). In the figure, the error bars represent a 1 standard-error range, and a deviation from the ephemeris significant at the 5-percent level would have to equal at least about 2 standard errors.

The diagram hints at cyclical variations for some of the satellites, particularly for Europa and Ganymede, perhaps in a 12 Earth-year cycle reflecting Jupiter's orbital period.

Table 7: Galilean Satellite Eclipse Timing Differences from E-2 Ephemeris, 1998/99 Apparition

	Satellite			
	(1) Io	(2) Europa	(3) Ganymede	(4) Callisto
Disappearance				
Number of Timings	78 (65)	47 (41)	44 (37)	29 (22)
Mean Difference (sec)	+84.1 ± 1.7	+121.7 ± 4.0	+253.7 ± 6.4	+578.8 ± 45.3
Regression Coefficients				
R^2	0.6152**	0.5892**	0.5844**	0.0306 (ns)
A (sec)	+100.7 ± 2.0	+152.7 ± 4.9	+294.8 ± 7.2	+658.9 ± 108.3
B (sec-cm)	-192 ± 19	-394 ± 53	-515 ± 73	-1125 ± 1382
Standard Error (sec)	± 8.7	± 16.6	± 25.5	± 217.2
Aperture Differences (sec)				
6 cm	+69 ± 2	+87 ± 5	+209 ± 8	+471 ± 140
10 cm	+82 ± 1	+113 ± 3	+243 ± 5	+546 ± 60
20 cm	+91 ± 1	+133 ± 3	+269 ± 5	+603 ± 54
40 cm	+96 ± 2	+143 ± 4	+282 ± 6	+631 ± 78
Reappearance				
Number of Timings	97 (83)	55 (46)	39 (34)	27 (22)
Mean Difference (sec)	-84.7 ± 1.5	-87.9 ± 1.9	-267.9 ± 9.0	-533.5 ± 67.1
Regression Coefficients				
R^2	0.2110**	0.1769**	0.4459**	0.0040 (ns)
A (sec)	-96.2 ± 2.8	-99.7 ± 4.2	-320.7 ± 12.4	-567.5 ± 137.7
B (sec-cm)	+183 ± 39	+196 ± 684	+787 ± 155	+464 ± 1630
Standard Error (sec)	± 12.5	± 12.1	± 39.5	± 321.8
Aperture Differences (sec)				
6 cm	-66 ± 4	-67 ± 7	-189 ± 17	-490 ± 167
10 cm	-78 ± 2	-80 ± 3	-242 ± 8	-521 ± 81
20 cm	-87 ± 1	-90 ± 2	-281 ± 7	-544 ± 78
40 cm	-92 ± 2	-95 ± 3	-301 ± 9	-556 ± 104
Orbital Residual				
Seconds	+2.3 ± 1.7 (ns)	+26.5 ± 3.2**	-13.0 ± 7.2*	+45.7 ± 87.6 (ns)
Orbital Arc (degrees)	+0.005 ± .004	+0.031 ± 0.004	-0.008 ± 0.004	+0.011 ± 0.022
Kilometers	+39 ± 30	+364 ± 44	-141 ± 78	+373 ± 716

Conclusion

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

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

We thank the many observers who participated in this ALPO project for the 1998/99 Apparition of Jupiter. Remember that your timings become more accurate as you accumulate experience, and also that, the more visual timings that are made, the more accurate and significant our results.

Table 8: Galilean Satellite CCD Eclipse Timing Results Compared with ALPO Visual Results, E-2 Ephemeris (Observed – Predicted) in Seconds, 1998/99 Apparition

Satellite	CCD Photometry (derived from Mallama *et al.* 2003)		ALPO Visual Results
	Number of Observations	Mean and Standard Error	Mean and Standard Error
Io	11	-2.2 ± 0.4	+2.3 ± 1.7
Europa	7	+29.2 ± 3.7	+26.5 ± 3.2
Ganymede	7	-10.1 ± 5.2	-13.0 ± 7.2
Callisto	2	-21 ± ----	+45.7 ± 87.6

Table 9: Galilean Satellite Eclipse Timings, 1998/99 Apparition

UT	LD	Lat	ObN	STB	Dif
Io Disappearances					
1998					
0416	0.7	+7	3a	000	+81
			20	000	+82
0502	0.9	+7	20	110	+84
0509	1.0	+8	11	000	*+48*
			18a	000	+56
			20	000	+93
0518	1.1	+8	22b	100	+91
0525	1.1	+8	18a	000	*+42*
			4	010	+71
			20	010	+78
			11	100	+89
0601	1.1	+8	18a	000	+65
			22b	101	+82
0608	1.2	+8	11	001	+84
0610	1.2	+8	18a	000	+45
0612	1.2	+8	14a	21-	+99
0617	1.2	+9	18a	000	+67
			4	001	+77
			19	101	+95
			11	000	+96
			20	001	+96
0624	1.2	+9	18a	010	+51
			3b	000	+85
0703	1.1	+9	22b	000	+100
0717	1.0	+9	4	000	+80
			20	000	+101
0719	1.0	+9	22b	020	+91
0721	1.0	+9	5a	000	+84
			15b	000	+95
0728	0.9	+10	23b	002	+74
			14b	21-	+96
0730	0.9	+10	24	211	+96
0802	0.9	+10	8	000	*+42*
			18a	000	+66
			3b	000	+80
			22b	000	+104
0804	0.8	+10	23b	000	+84
			20	000	+99
0808	0.8	+10	7	000	*+96*
0809	0.8	+10	18a	000	+65
			4	111	+72
			11	001	+79
			3b	000	+80
			20	000	+95
			8	000	+96
0811	0.7	+10	8	000	*+41*
			18a	000	+75
			18b	000	*+111*
0813	0.7	+10	30	101	+91
0816	0.6	+10	6	12	*+49*

UT	LD	Lat	ObN	STB	Dif
Io Disappearances (cont.)					
1998					
0818	0.6	+10	22a	000	+81
			20	000	+91
			4	000	+96
			22b	000	+98
0820	0.6	+10	23b	020	+87
0822	0.5	+10	15a	000	+98
0825	0.5	+10	18a	110	+63
			4	100	+81
			20	000	+85
0827	0.4	+10	3b	010	+54
			4	100	+88
			11	120	+91
			20	000	+95
			22b	000	+99
0829	0.4	+10	30	010	+87
			18b	000	+97
0903	0.3	+11	18a	010	+53
			20	010	+91
			8	000	+98
0905	0.2	+11	14b	21-	+100
0907	0.2	+11	5b	002	+72
			26	11-	+90
0912	0.1	+11	118a	200	*-53*
			23b	000	*+13*
			4	100	*+43*
			22b	010	*+61*
0914	0.0	+11	5b	010	*-11*
0915	0.0	+11	26	00-	*+40*
Io Reappearances					
1998					
0916	0.0	+11	26	22-	*+28*
0917	0.0	+11	13	200	*-35*
0921	0.1	+11	22b	100	*-76*
			23b	000	*-54*
			16	---	*+45*
0923	0.2	+11	30	200	*-3289**
0924	0.2	+11	26	00-	-64
0928	0.3	+11	22b	000	-90
			20	100	-86
			16	010	-84
			4	100	-72
			3b	000	-59
0930	0.3	+11	30	000	-68
			9	000	*+2*
1002	0.3	+11	9	111	-65
1005	0.4	+11	18b	000	-96
			23b	001	-70
			3c	010	*-40*
1007	0.5	+11	31	000	*-40*
1009	0.5	+11	27b	111	-106

UT	LD	Lat	ObN	STB	Dif
Io Reappearances (cont.)					
1998					
1009	0.5	+11	9	210	*-32*
1012	0.6	+12	8	000	-82
1014	0.6	+12	29	100	-99
			20	000	-98
			1a	100	-86
			3b	000	-73
1016	0.6	+12	24	211	-99
			9	000	-91
1021	0.7	+12	29	100	-98
			3c	000	-95
1023	0.7	+12	9	000	-86
			30	010	-81
1025	0.8	+12	15b	100	-101
			26	00-	-87
			9	101	-60
1026	0.8	+12	12	101	-94
1028	0.8	+12	20	010	-87
			4	020	-85
1101	0.9	+12	14b	--1	-92
			9	122	-80
1102	0.9	+12	13	101	-75
1104	0.9	+12	8	100	-80
1106	0.9	+12	19	000	-112
			29	100	-101
			20	000	-96
			11	20	-94
			4	000	-92
			18b	010	-62
1108	0.9	+12	14b	21-	*-148*
			26	11-	-72
1109	1.0	+12	5b	100	-76
1113	1.0	+12	22b	000	-111
			8	000	-104
			3b	010	-78
1115	1.0	+12	14b	22-	-65
1117	1.0	+12	15a	000	-92
			26	00-	-87
1120	1.0	+12	3c	000	-81
			4	000	-73
			20	020	-71
1124	1.1	+12	14b	21-	*-188*
			27a	211	-94
			21	200	-88
			9	100	*-52*
1127	1.1	+13	2	201	-88
1129	1.1	+13	20	011	-99
			4	002	-89
1201	1.1	+13	24	222	-77
			15b	200	-76
1206	1.1	+13	29	101	-100

Table 9: Key to column headings. UT = Universal Time, expressed as mmdd; LD = distance of satellite from Jupiter's limb in units of Jupiter's equatorial radius; Lat = latitude of satellite on Jupiter's shadow cone in degrees; ObN = observer number as in Table 2; STB = observing conditions, where S = seeing, T = transparency and B = field brightness, all expressed in terms of 0 = condition not perceptible, 1 = condition perceptible but does not affect accuracy and 2 = condition perceptible and does affect accuracy; and Dif = (observed – calculated) eclipse time in seconds.

Table 9: Galilean Satellite Eclipse Timings, 1998/99 Apparition (cont'd.)

UT	LD	Lat	ObN	STB	Dif
Io Reappearances (cont.)					
1998					
1206	1.1	+13	2	000	-97
			3b	000	-73
1211	1.1	+13	17	20-	-51
1215	1.1	+13	23b	000	*-33*
1217	1.1	+13	15b	000	-98
			14b	21-	-76
			31	200	-73
1222	1.1	+13	19	000	-102
			20	000	-101
			29	101	-99
			4	101	-93
			18b	000	-92
			3b	000	-52
1225	1.1	+13	26	10-	-81
1229	1.1	+13	2	001	-99
			4	001	-89
1999					
0102	1.0	+13	14a	21-	-88
0103	1.0	+13	10	222	*+123*
0109	1.0	+13	31	100	-67
0114	1.0	+14	20	000	-99
			4	101	-96
0119	0.9	+14	7	000	-68
			17	21-	-59
0121	0.9	+14	2	211	-93
0125	0.9	+14	14b	21-	-84
0209	0.7	+14	15b	000	-94
0211	0.7	+14	10	100	-120
0305	0.4	+15	9	022	*-61*
Europa Disappearances					
1998					
0424	1.3	+14	18a	000	+57
0519	1.7	+15	18a	100	+60
			22b	010	+111
0526	1.7	+16	18a	010	+58
			3b	000	+82
0606	1.8	+16	14a	11-	+144
0620	1.8	+17	22b	000	+142
0627	1.8	+17	20	000	+110
			4	100	+111
			19	000	+143
			11	000	+144
			22b	000	+148
0701	1.8	+17	15b	000	+152
0708	1.8	+17	30	011	+130
0715	1.7	+17	22b	010	+138
0722	1.8	+18	20	020	*+89*
			22b	000	+139
			11	000	+149
0726	1.5	+18	24	221	+132

UT	LD	Lat	ObN	STB	Dif
Europa Disappearances (cont.)					
1998					
0729	1.5	+18	18a	000	+86
			3b	000	+110
			22b	200	+125
0802	1.4	+18	5a	000	+122
0809	1.2	+18	14b	21-	+123
0816	1.0	+19	23b	010	*+64*
			20	010	*+101*
			22a	000	+113
			22b	000	+145
			11	110	+157
0820	0.9	+19	5a	000	+115
0823	0.8	+19	3b	000	+120
			4	000	+128
			8	000	+141
			11	000	*+169*
0827	0.7	+19	14a	11-	+134
			24	111	+148
0830	0.6	+19	22b	001	+136
0906	0.3	+19	6	122	+138
0910	0.2	+19	22a	000	+68
			20	010	+104
			22b	000	+104
			31	000	+113
			15b	001	+115
			23b	000	+153
0913	0.1	+20	26	00-	+108
1215	0.0	+22	18b	000	*+87*
1218	0.0	+23	24	202	+102
Europa Reappearances					
1998					
0917	0.1	+19	8	000	*-56*
0921	0.2	+19	5b	000	-98
			14b	21-	-72
0924	0.3	+19	20	000	-74
			4	000	*-42*
0928	0.4	+19	22b	100	-89
			16	---	-74
			9	110	*+27*
1005	0.7	+19	18b	100	-101
			23b	201	*-46*
1012	0.9	+20	1b	000	-112
			3b	000	-70
1016	1.0	+20	24	211	-87
			26	00-	-85
			15b	100	-84
			5b	000	-59
1019	1.1	+20	29	100	-108
			20	000	-97
			8	000	-86
1023	1.2	+20	30	010	-81

UT	LD	Lat	ObN	STB	Dif
Europa Reappearances (cont.)					
1998					
1023	1.2	+20	9	000	-72
1026	1.3	+20	17	011	*-26*
1102	1.4	+20	13	101	*-52*
1106	1.5	+20	19	000	-112
			29	100	-107
			11	000	-102
			20	000	-95
			18b	000	-92
			22b	110	-91
			4	000	-80
1109	1.6	+21	24	202	-89
			5b	100	-76
1113	1.6	+21	22b	002	-83
			8	000	-63
1117	1.7	+21	15a	000	-87
			26	12-	-72
1124	1.7	+21	14b	21-	-95
			15b	100	-91
			21	210	-89
1208	1.8	+21	23b	000	-116
			20	010	-95
			4	112	-89
			3c	100	-72
1211	1.8	+21	26	01-	-66
1215	1.8	+21	20	100	-90
			4	100	-85
1219	1.8	+22	14b	21-	-84
1229	1.7	+22	7	020	-69
1999					
0109	1.6	+22	18b	100	-107
			3c	000	-82
0112	1.6	+22	26	22-	*+59*
0116	1.5	+22	2	001	-101
0120	1.5	+22	14b	21-	-96
0130	1.3	+23	10	101	*-17*
0221	0.9	+23	14a	21-	*-51*
Ganymede Disappearances					
1998					
0505	2.4	+16	23b	110	+258
			20	010	*+321*
0603	2.9	+18	15b	100	+282
			24	011	+293
0617	3.0	+19	18a	000	+228
			20	001	+272
			11	000	+287
			19	101	+304
0723	2.5	+21	18a	000	+179
			20	000	+275
			3c	100	+283
			22b	000	+302

Table 9: Key to column headings. UT = Universal Time, expressed as mmdd; LD = distance of satellite from Jupiter's limb in units of Jupiter's equatorial radius; Lat = latitude of satellite on Jupiter's shadow cone in degrees; ObN = observer number as in Table 2; STB = observing conditions, where S = seeing, T = transparency and B = field brightness, all expressed in terms of 0 = condition not perceptible, 1 = condition perceptible but does not affect accuracy and 2 = condition perceptible and does affect accuracy; and Dif = (observed – calculated) eclipse time in seconds.

Table 9: Galilean Satellite Eclipse Timings, 1998/99 Apparition (cont'd.)

UT	LD	Lat	ObN	STB	Dif
Ganymede Disappearances (cont.)					
1998					
0730	2.3	+22	18a	000	+217
			11	000	+279
			22b	000	+292
			8	000	+298
0806	2.0	+22	25	101	+196
0821	1.4	+23	5a	000	*+298*
0828	1.0	+24	14b	11-	+289
0904	0.6	+24	18a	000	+198
			22a	000	+230
			23b	001	+232
			8	010	+238
			22b	000	+276
			18b	000	+318
			20	010	*+323*
1024	0.2	+28	7	200	+156
1108	0.7	+29	9	220	*+143*
			5b	100	+232
			26	11-	+240
1115	0.9	+29	14b	22-	+247
1122	1.0	+30	3c	000	*+216*
			4	002	+244
			18b	010	+262
			20	000	+295
1129	1.1	+30	2	211	+252
1221	1.2	+32	26	21-	*+206*
			31	100	+239
			14b	21-	+260
1999					
0104	1.0	+33	23a	102	*+205*
			3c	000	+269
0118	0.7	+34	17	10-	+177
			7	100	+221
0202	0.4	+35	31	101	+266

UT	LD	Lat	ObN	STB	Dif
Ganymede Reappearances					
1998					
0610	1.1	+18	18a	000	-174
0617	1.2	+19	19	000	-267
			11	001	-262
			20	001	-209
0723	0.7	+21	22b	000	-271
			11	210	-246
			4	000	-215
			3c	000	*-189*
			18a	000	-186
0730	0.5	+22	20	011	*-175*
0807	0.3	+22	6	111	-254

UT	LD	Lat	ObN	STB	Dif
Ganymede Reappearances (cont.)					
1998					
0807	0.3	+22	25	200	-126
0814	0.0	+23	24	211	-262
0919	0.2	+26	26	00-	*-185*
			5b	020	*-166*
0926	0.6	+26	15b	100	-282
1003	0.9	+27	23b	002	*-208*
1010	1.3	+27	20	000	-311
			28	010	-291
			4	000	-278
			3c	020	-277
1017	1.6	+28	20	010	-309
			8	000	-295
1101	2.2	+29	9	122	-246
1108	2.4	+29	14b	11-	-345
			26	12-	*-170*
1115	2.6	+30	18b	000	-337
			29	101	-330
			22b	000	-310
			3b	001	-259
1122	2.7	+30	20	000	-325
			4	000	-310
			3c	000	-304
			8	000	-304
1214	2.8	+32	15b	110	-289
			27a	212	-252
1221	2.8	+32	31	100	-294
1228	2.7	+33	22b	200	-315
			23b	021	-174

UT	LD	Lat	ObN	STB	Dif
Callisto Disappearances					
1998					
0625	5.0	+43	14a	21-	+400
			15b	100	+482
0814	2.8	+52	20	010	+454
			23a	000	+465
			4†	000	+546
			4¶	000	+626
			8	000	+663
			22b	000	+685
0831	1.3	+55	3b	000	+342
			4†	210	+440
			20	000	+462
			22a	000	+468
			11	210	+508
			23b	001	+520
			28	000	+585
			4¶	210	+611

UT	LD	Lat	ObN	STB	Dif
Callisto Disappearances (cont.)					
1998					
0831	1.3	+55	14b	11-	+636
			22b	000	+688
0917	0.0	+58	30	010	+281
			5b	020	+370
1020	2.0	+66	7	100	+819
1106	3.1	+71	23b	001	+1082
			4†	000	+1180
			8	000	*+1679*
			18b	010	*+1711*
			29	101	*+1844*
			4¶	000	*+1931*
			19	000	*+2049*
			20	000	*+2085*

UT	LD	Lat	ObN	STB	Dif
Callisto Reappearances					
1998					
0608	3.6	+40	19	000	-461
			3c	000	-418
			11	000	-344
			18a	000	-192
0712	3.4	+45	15b	000	-505
0814	1.6	+51	8	000	-592
			4¶	000	-580
			22b	001	-577
			4†	000	-494
			22a	001	-437
0831	0.4	+54	22b	020	-591
			28	000	-574
			4	100	-529
			20	000	-472
			3b	000	-367
			11	200	-201
			23b	000	-101
0917	0.1	+58	30	120	-133
1020	2.7	+66	7	000	-967
			6	110	-582
1106	3.7	+71	18b	000	*-2455*
			29	101	*-2084*
			19	000	*-2072*
			20	000	*-1990*
			4¶	001	*-1751*
			8	000	-1310
			4†	001	-1309

Notes:

* Possible misidentified satellite or event. See page 45, Io 09/23 reappearance.

† Jupiter placed *inside* field.

¶ Jupiter placed *outside* field.

Table 9: Key to column headings. UT = Universal Time, expressed as mmdd; LD = distance of satellite from Jupiter's limb in units of Jupiter's equatorial radius; Lat = latitude of satellite on Jupiter's shadow cone in degrees; ObN = observer number as in Table 2; STB = observing conditions, where S = seeing, T = transparency and B = field brightness, all expressed in terms of 0 = condition not perceptible, 1 = condition perceptible but does not affect accuracy and 2 = condition perceptible and does affect accuracy; and Dif = (observed – calculated) eclipse time in seconds.

References

Collins, Donald F.; Mallama, Anthony; Nelson, Peter and Park, James (1997). "Precision Time Measurements of Galilean Satellite Eclipses using Small Format CCD's." *Bulletin of the American Astronomical Society*, 29: 819.

Lieske, Jay B. (1981). "Catalog of Eclipses of Jupiter's Galilean Satellites, 1610-2000." *Astron. Astrophys. Supl. Ser.*, 44 (May): 209-216. [The full catalog is available on microfiche.]

Mallama, Anthony (1991). "Light Curve Model for the Galilean Satellites During Jovian Eclipse." *Icarus*, 92: 324-331.

Mallama, Anthony; Caprette, Douglas S.; Nelson, Peter; Park, James; Collins, Donald F. and Vojtisek-Lom, Michal (1994). "Precise Timings of Galilean Satellite Eclipses and Assessment of the E-3 Ephemeris." *Icarus*, 107: 212-214.

Mallama, Anthony; Collins, Donald F.; Nelson, Peter; Park, James and Krobusek, Bruce A. (2000). "Precise Timings of Galilean Satellite Eclipses and Assessment of the E5 Ephemeris." *Icarus*, 147: 348-352.

Mallama, Anthony; Krobusek, Bruce A.; Collins, Donald F.; Nelson, Peter and Park, James (2002). "CCD Photometry of Galilean Satellites." *Journal of the Assn of Lunar & Planetary Observers*, 44 (Spring): 15-21.

Mallama, Anthony; Nelson, Peter; Park, James; Collins, Donald F. and Krobusek, Bruce A. (2003). "Galilean Satellite Eclipse Timing Data", *http://www.amsmeteors.org/mallama/galilean/timings.html*.

Meeus, Jean (1995). *Astronomical Tables of the Sun, Moon and Planets*. Richmond, VA: Willmann-Bell.

United States Naval Observatory (1994). *The Astronomical Almanac for the Year 1995.* Washington: U.S. Government Printing Office.

________ (1997). *The Astronomical Almanac for the Year 1997*. Washington: U.S. Government Printing Office.

________ (1998). *The Astronomical Almanac for the Year 1998*. Washington: U.S. Government Printing Office.

________ (2007). *The Astronomical Almanac for the Year 2009*. Washington: U.S. Government Printing Office.

Westfall, John E. (1983-84). "Galilean Satellite Eclipse Timings: 1975-82 Report." *Journal of the Assn of Lunar & Planetary Observers*, 30 (3-4): 45-53, 30 (5-6): 105-115, and 30 (7-8): 145-154.

________ (1985). "Modest Suggestions for Galilean Satellite Eclipse Photoelectric Photometry." *Journal of the Assn of Lunar & Planetary Observers*, 31 (3-4): 45-47.

________ (1986a). "Galilean Satellite Eclipse Timings: 1982/83 Report." *Journal of the Assn of Lunar & Planetary Observers*, 31 (5-6):105-119.

________ (1986b). "Galilean Satellite Eclipse Timings: 1983/85 Report." *Journal of the Assn of Lunar & Planetary Observers*, 31 (9-10): 198-206 and 31 (11-12) 249-258.

________ (1987). "Galilean Satellite Eclipse Timings: 1985/86 Report." *Journal of the Assn of Lunar & Planetary Observers*, 32 (5-6): 114-128.

________ (1988). "Galilean Satellite Eclipse Timings: 1986/87 Report." *Journal of the Assn of Lunar & Planetary Observers*, 32 (11-12): 245-257.

________ (1989). "Galilean Satellite Eclipse Timings: 1987/88 Report." *Journal of the Assn of Lunar & Planetary Observers*, 33 (10-12): 157-167.

________ (1991). "Galilean Satellite Eclipse Timings: The 1988/89 Apparition." *Journal of the Assn of Lunar & Planetary Observers*, 35 (1): 14-24.

________ (1992). "Galilean Satellite Eclipse Timings: The 1989/90 Apparition." *Journal of the Assn of Lunar & Planetary Observers*, 36 (2): 63-74.

________ (1994). "Galilean Satellite Eclipse Timings: The 1990/91 Apparition." *Journal of the Assn of Lunar & Planetary Observers*, 37 (4): 154-164.

________ (1996). "Galilean Satellite Eclipse Timings: The 1991/92 Apparition." *Journal of the Assn of Lunar & Planetary Observers*, 39 (1): 16-27.

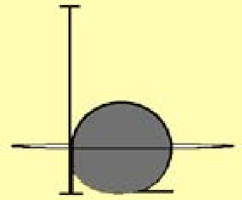
________ (1998). "Galilean Satellite Eclipse Timings: The 1992/93 Apparition." *Journal of the Assn of Lunar & Planetary Observers*, 40 (1): 14-25.

________ (1999). "Galilean Satellite Eclipse Timings: The 1993/94 Apparition." *Journal of the Assn of Lunar & Planetary Observers*, 41 (Jan.): 24-35.

________ (2000). "Galilean Satellite Eclipse Timings: The 1994/95 Apparition." *Journal of the Assn of Lunar & Planetary Observers,* 42 (2): 74-82.

________ (2005). "Galilean Satellite Eclipse Timings: The 1995/97 Apparition." *Journal of the Assn of Lunar & Planetary Observers*, 47 (4): 36-49.

________ (2008). "Galilean Satellite Eclipse Timings: The 1997/98 Apparition." *Journal of the Assn of Lunar & Planetary Observers*, 50 (4): 37-46.



Feature Story:

Eclipses of Saturn's Brighter Satellites June - December 2009

In 2009 will be Saturnian ring-plane passages of the Sun (Aug 10) and the Earth (Sep 04), resulting in a series of satellite events.

The following table lists the eclipses by Saturn's globe of the brighter satellites for the second half of 2009. These predictions are based on the French Multi-Sat website maintained by IMCCE (Institut deMéchanique Céleste et de Calcul des Éphémérides) using the INPOP planetary theory and the satellite theory developed by Vienne and Duriez.

Saturn's shadow is assumed cylindrical, with no penumbra; times given are for when the disk center of the satellite falls on the shadow margin. Times are UT and rounded to one minute. Satellites shown are Tethys (3), Dione (4), Rhea (5) and Titan (6), of approximate visual magnitudes 10.3,10.4, 9.7 and 8.4 respectively. The letter "D" indicates eclipse disappearance and "R" eclipse reappearance. Events occulted by Saturn's globe are not given. Distances from Saturn's limb are given in arc-seconds.

Date (MMdd)	UT (hhmm)	Event	Limb Distance	Date (MMdd)	UT (hhmm)	Event	Limb Distance
0607	0908	4R	6	0721	0428	4R4	
0608	0529	6D	6	0722	0946	3R	3
0608	1140	6R	20	0723	2210	4R	4
0608	2327	3R	4	0724	0705	3R	3
0609	0855	5R	8	0724	1338	5R	5
0610	0251	4R	6	0726	0424	3R	3
0610	2046	3R	4	0726	0937	6R	13
0612	1805	3R	4	0726	1552	4R	4
0612	2033	4R	6	0728	0143	3R	3
0613	2123	5R	8	0729	0206	5R	5
0614	1524	3R	4	0729	0935	4R	4
0615	1416	4R	6	0729	2302	3R	3
0616	1244	3R	4	0731	2021	3R	3
0618	0758	4R	5	0801	0317	4R	3
0618	0952	5R	8	0802	1434	5R	5
0618	1003	3R	4	0802	1740	3R	2
0620	0722	3R	4	0803	2059	4R	3
0621	0141	4R	5	0804	1459	3R	2
0622	0441	3R	4	0806	1218	3R	2
0622	2220	5R	8	0806	1442	4R	3
0623	1923	4R	5	0807	0303	5R	4
0624	0200	3R	4	0808	0937	3R	2
0624	0441	6D	4	0809	0824	4R	3
0624	1101	6R	19	0810	0656	3R	2
0625	2319	3R	4	0811	0853	6R	9
0626	1306	4R	5	0811	1531	5R	4
0627	1048	5R	7	0812	0206	4R	3
0627	2038	3R	4	0812	0415	3R	2

Date (MMdd)	UT (hhmm)	Event	Limb Distance	Date (MMdd)	UT (hhmm)	Event	Limb Distance
0629	0648	4R	5	0814	0134	3R	2
0629	1757	3R	4	0814	1948	4R	2
0701	1516	3R	4	0815	2253	3R	2
0701	2317	5R	7	0816	0358	5R	3
0702	0031	4R	5	0817	1331	4R	2
0703	1235	3R	4	0817	2012	3R	2
0704	1813	4R	5	0819	1731	3R	2
0705	0955	3R	4	0820	0713	4R	2
0706	1145	5R	7	0820	1627	5R	3
0707	0714	3R	4	0821	1450	3R	2
0707	1155	4R	5	0823	0055	4R	2
0709	0433	3R	3	0823	1209	3R	1
0710	0538	4R	5	0825	0454	5R	2
0710	0355	6D	2	0825	0928	3R	1
0710	1020	6R	16	0825	1837	4R	2
0711	0013	5R	6	0827	0647	3R	1
0711	0152	3R	3	0827	0806	6R	5
0712	2311	3R	3	0828	1219	4R	2
0712	2320	4R	4	0829	0406	3R	1
0714	2030	3R	3	0829	1722	5R	2
0715	1242	5R	6	0831	0125	3R	1
0715	1703	4R	4	0831	0602	4R	1
0716	1749	3R	3	0901	2244	3R	1
0718	1045	4R	4	0902	2344	4R	1
0718	1508	3R	3	0903	0550	5R	2
0719	0110	5R	6	0903	2003	3R	1
0720	1227	3R	3	0905	1722	3R	1

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- **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

ALPO Resources

People, publications, etc., to help our members

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").

- **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), and 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.

- **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.

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

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).

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- Download JALPO43-1 thru present issue in pdf from the ALPO website at *http://www.alpo-astronomy.org/djalpo* (no charge; most recent issues are password-protected, contact ALPO membership secretary Matt Will for password info).

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THE ASSOCIATION
OF LUNAR & PLANETARY OBSERVERS (ALPO)

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

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

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

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

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