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Journal of the Association of Lunar & Planetary Observers

The Strolling Astronomer

Founded in 1947

Volume 51, Number 1, Winter 2009

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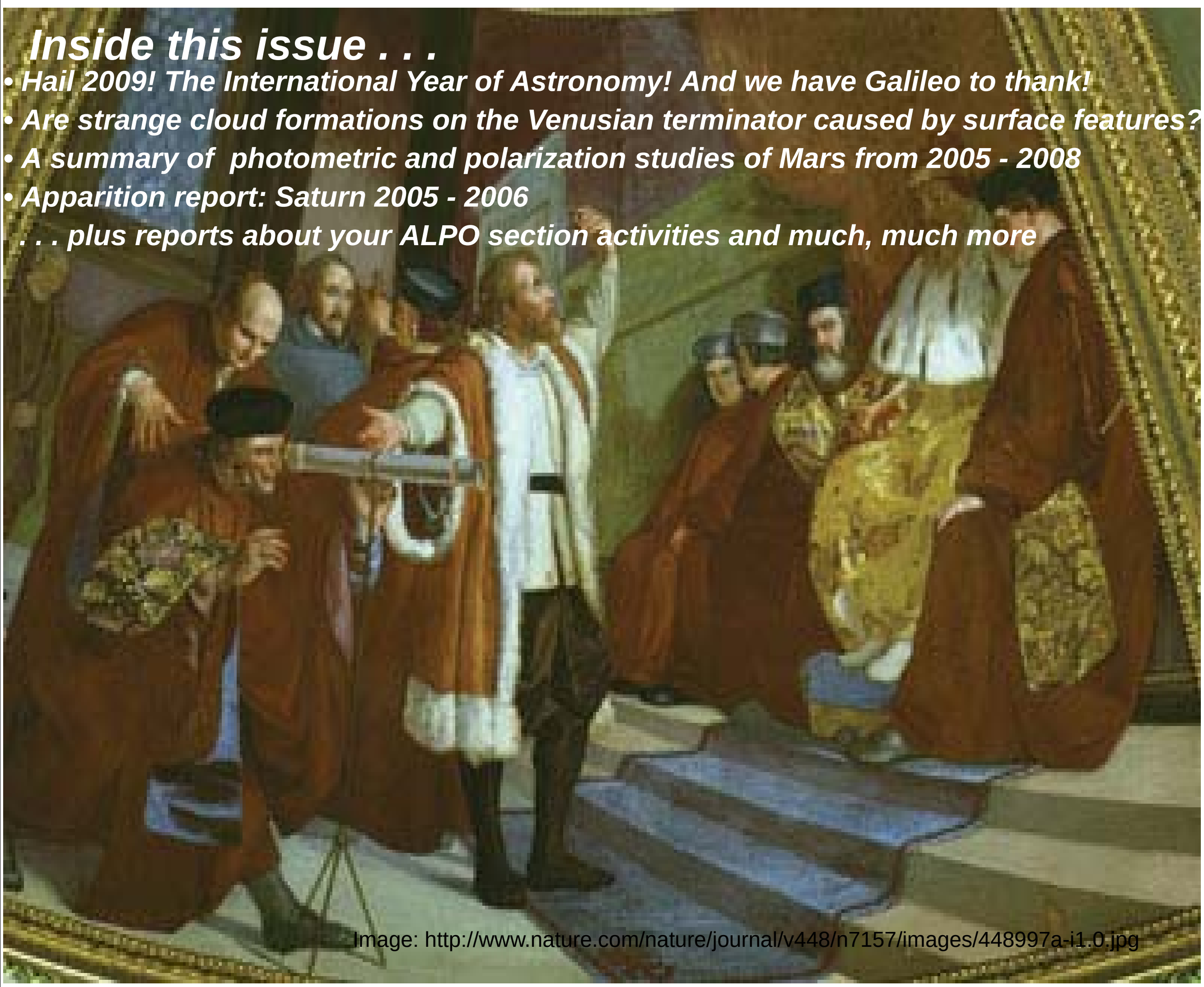

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Journal of the Association of Lunar & Planetary Observers

The Strolling Astronomer

Volume 51, No. 1, Winter 2009
This issue published in December 2008 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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ALPO Membership Secretary/Treasurer
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Springfield, Illinois 62791-3456

E-mail to: will008@attglobal.net

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Association of Lunar & Planetary Observers (ALPO)

Point of View
Making 2009 OUR Year!

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

Every so often, an event comes along that puts the spotlight on us, the astronomy community. In the past, milestone occurrences with NASA launches, spectacular landings and images by Mars probes, as well as sky events like Comet Shoemaker-Levy, highly active meteor showers, and eclipses served to spur friends and relatives to approach us with questions such as, "What's that all about?" Usually, the fuss and hubbub settled down after a week or two, but now we have coming an entire year dedicated to astronomy.

This year, 2009, has been designated "The International Year of Astronomy" (IYA2009) by the International Astronomical Union (IAU) as a one-year observance of the 400th anniversary of the first use of an astronomical telescope by Galileo Galilei. IYA2009 will include a global celebration of astronomy and its contributions to society and culture. The aim of IYA2009 is to stimulate worldwide interest, especially among young people, in astronomy and science under the central theme "The Universe, Yours to Discover". IYA2009 events and activities will promote a greater appreciation of the inspirational aspects of astronomy that embody an invaluable shared resource for all nations.

We in the ALPO should take special notice of this celebration and honoring of Galileo because his first observations were indeed the exact same things practiced today by ALPO observers, that is, solar system astronomy.

His observations and drawings of the Moon (with notations of the scarred surface and its shadows), his discovery that Venus shows periodic phases, his observations of Jupiter and its four largest moons and discussions of the true nature of our solar system may be things that we take for granted. But to those who have not yet discovered the wonder of such things, these are most beautiful and intriguing.

We, the ALPO, look forward to doing what we can as an organization dedicated to solar system astronomy to assist in this highly commendable effort by the IAU to share our enjoyment of this most beautiful activity..

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News of General Interest

Wanted: Assistant to the ALPO Secretary/Treasurer

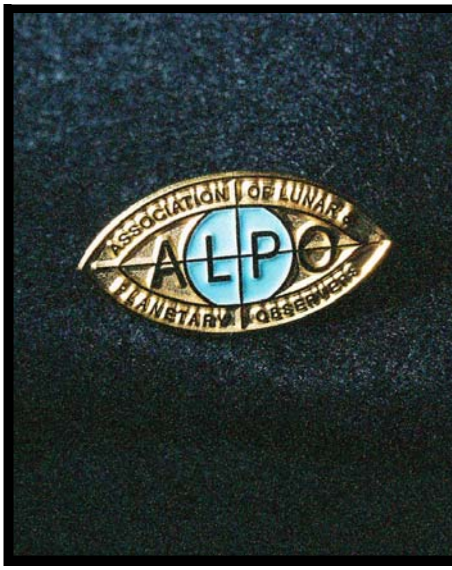
By Matthew Will, ALPO Secretary/Treasurer

The ALPO Secretary is now accepting inquiries concerning the appointment of a possible assistant to the Secretary.

The ALPO is composed of many observing sections and programs, and staffing requirements are generally commensurate with the activities in these sections and programs which may consist of program development, correspondence, observational analysis, research, and technical writing.

Conversely, the ALPO Secretary handles the unglamorous business end of the ALPO. This includes membership correspondence and accounting, along with meeting our legal obligations as a non-profit IRS Code 501(c)(3) organization. Buried in these main headings are many tasks that must be met with some regularity.

Also, the Secretary gets involved with special projects to help the ALPO run smoother and with other endeavors that expand the ALPO's exposure to the non-member astronomical community.



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Send orders to: ALPO, PO Box 13456, Springfield, IL 62791-3456. E-mail to: will008@attglobal.net

Addendum. In the previous issue of this Journal, we were unable to identify all members of the above photo, which were most of this year's ALPO contingent to the ALCon 2008 convention in Des Moines, Iowa USA last July. We are now indebted to ALPO member Robert Warren of South Bend, Indiana, USA, for informing us that the gentleman in the white teeshirt at the far right is Ron Whitehead, who is heavily associated with the Great Lakes Region of the Astronomical League. Thus, a more complete listing now states the lineup as, from left to right (front row, kneeling) Dan Joyce, Bob O'Connell, Jim Fox, Mike Mattei; (back row, standing) Frank Melillo, Richard Schmude, Walter Haas, Don Parker, (lady in yellow, not identified), Joan Post, Cecil Post, Sanjay Limaye, Don Jardine, Phil Plante, Matt Will, and Ron Whitehead.

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.

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With all of this going on, the ALPO Secretary tends to get bogged down from time to time with issues that merit higher priority while other issues are put on hold temporarily until they can be met. Ideally, having someone to handle some secondary issues that are still important and matter to the ALPO would help to meet all our business-like goals in a timely manner.

Therefore, this Secretary needs someone who can carry on some of these tasks and is willing to take the time to understand some of the issues involving our operation at the administrative level.

Please feel free to contact the Secretary if you feel you have the time, energy, and interest (or are just plain crazy!) to help the ALPO in these non astronomical but important endeavors. All inquiries will be given equal consideration. Send regular mail to Matthew Will, P.O. Box 13456, Springfield, IL 62791-3456; send e-mail to *will008@attglobal.net*

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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.

ALPO Interest Section Reports

Web Services

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

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

Computing Section

Report by Kim Hay, section coordinator,
kim@starlightcascade.ca

There are several talented computer programmers on the ALPOCS list who can help anyone with questions on their own computer programming or are looking for an astro-program.

We currently have over 250 members signed up to the list, and I invite any and all ALPO members to sign up to the ALPOCS e-mail list and help share your knowledge of computer programs – written or commercial – so all can benefit to know how programs work and which ones are your best and why!

In order for any section to work, it is a two-way communication action. We are here, but it's getting pretty lonely speaking to bits that go into the Internet wires and do not receive any reply back. If the section continues to be unused, it may disappear forever. So if you want the ALPOCS to thrive, it is up to you to say so — the choice is yours.

Important links:

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

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Orion® StarShoot™ Pro Deep Space CCD Color Imaging Camera

The StarShoot Pro brings cooled, multi-megapixel high-resolution color imaging performance into the realm of never-before-seen affordability.

This latest addition to the StarShoot line features a big 1.8" format (23.4mm x 15.6mm) Sony 6.1-megapixel color CCD chip with a 3032 x 2016 pixel array. That gives the Pro more than 6.5 times the light collecting area and over four times as many pixels as similarly priced astronomical CCD cameras. The Pro's 7.8µ x 7.8µ pixel size provides an excellent balance between high resolution and sensitivity.

Like all StarShoot cameras, the Pro is thermoelectrically cooled (TEC) to dramatically reduce thermal noise in your images. There's even a small fan on the rear housing to enhance cooling efficiency even more. The Pro renders full 16-bit dynamic range -- better than most DSLRs, which offer only 10- to 14-bit A/D conversion. Also unlike DSLRs, the Pro has no mechanical shutter or mirror to cause vibration problems and eventually wear out.

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(w): *www.oriontelescopes.com*

Lunar & Planetary Training Program

Report by 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, 2010 Hillgate Way #L, Simi Valley CA, 93065; e-mail to *cometman@cometman.net*

ALPO Observing Section Reports

Eclipse Section

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

Meteors Section

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

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

Meteorites Section

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

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

Solar Section

Report by Kim Hay, section coordinator,
kim@starlightcascade.ca

Three full Carrington rotations have passed since our last report (CR2074-CR2076), and we are currently in CR2077. On most days, the Sun still is fairly quiet, except we have had a few sunspots and prominences that have captivated the solar observers.

There was one sunspot in August (AR1001); September gave us (AR1002), with October producing the largest number of five sunspots (AR1003-AR1007). November has produced one sunspot to date (AR1008). Most of these spots are very small pore-like structures and some with no penumbra did not last long, some less than a day.

It is evident that we are in Solar Cycle 24 though off to a very slow start.

Here is an image showing a sunspot in white light and an H-alpha comparison of AR1002 taken on September 22-23 by David Tyler of Buckinghamshire, UK, and Howard Eskildsen of Ocala Florida, USA.

Many of the solar observers that contribute to the ALPO Solar Section are suffering through bad weather these days, with rain, snow and clouds; but with each opportunity taken to observe the Sun, the observers are out sketching, taking white light, H-alpha and Calcium images, and hoping that the Sun will produce a few more spots and activity.

The past three Carrington Rotations have been close to being spot-free, however, it appears that solar activity is on the rise, and we may have to wait until the next minimum to achieve that title.

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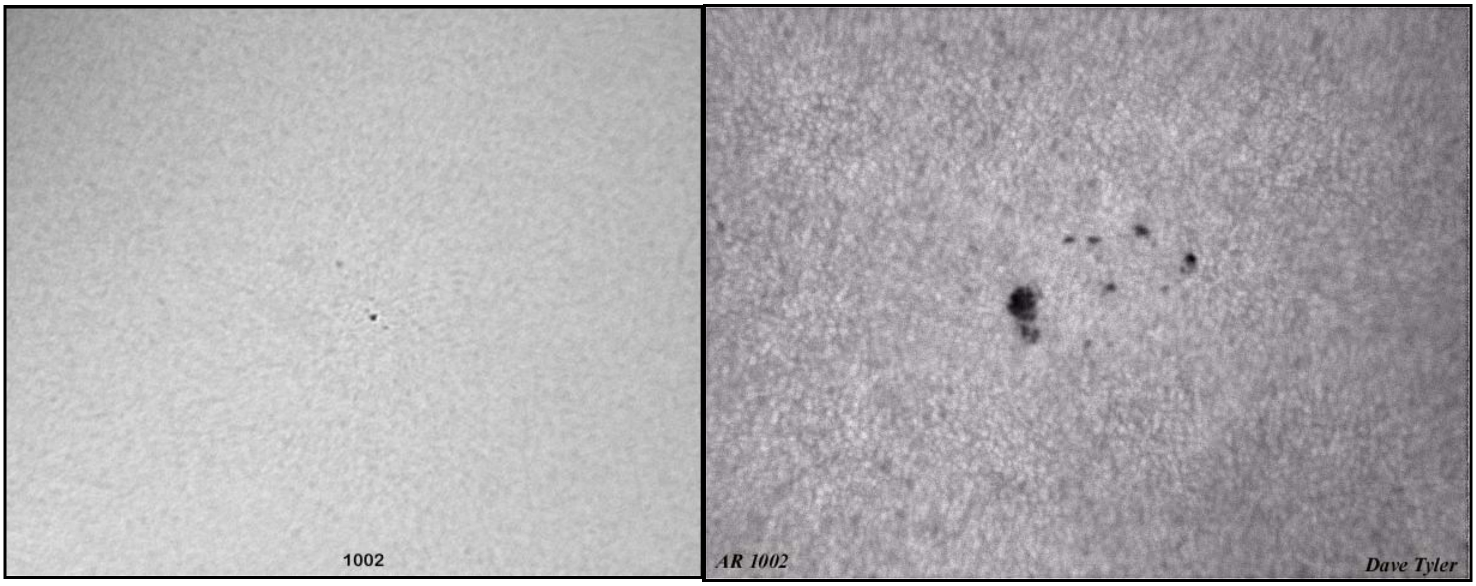

Two white light images of sunspot AR1002. At left, image taken by Howard Eskildsen of Ocala, FL, USA, on Sept 23, 2008, 12:32 UT. Carrington Roation No. 2074. Equipment details: Meade ETX125 Maksutov-Cassegrain (125 mm aperture, f/15, FL=1900), with AstroSolar Photofilm filter; fork-mounting with electric drive. Imaged with Orion Star Shoot II CCD and W15 yellow filter. At right, image of same area taken by Dave Tyler of Buckinghamshire, UK, on Sept 22, 2008, 10:31 UT . Equipment details: Intes Herschel Wedge, green filter, 6-inch, f/15 achromat in homemade telescope with a 2.5x Powermate f/30 and 180-inch effective focal length. Camera was Lumenera LU075M CCD.

The ALPO Solar Section currently has 10 active solar contributors, and over 289 members who are active on the ALPO Solar Yahoo group, which you can access at

http://tech.groups.yahoo.com/group/Solar-ALPO/

With Solar Activity on the rise, think about observing through the day, with proper filtration of course. We look forward to your observations.

For more 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

As I stated in the ALPO Mercury Section report in these pages in JALPO50-4, Octo-

ALPO Mercury Section Coordinator Frank J. Melilo with Dr. Ann Sprague of the Lunar and Planetary Laboratory (LPL) in front of Frank's Mercury poster board at the Division of Planetary Science (DPS) meeting last October.

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ber was expected to be an exciting month for Mercury. And indeed, it was!

The MESSENGER spacecraft successfully flew by Mercury on Oct. 6 and transmitted back to Earth new photos of the surface never been seen before. I will cover the second MESSENGER flyby in a future ALPO Journal.

The week after the flyby, I attended two of the five-day meeting event of the Division of Planetary Science (DPS) at Cornell University in Ithaca, NY. I made a postal presentation on Mercury and had a chance to meet some of the planetary scientists. I have included a photo of me and Mercury expert Dr. Ann Sprague of Lunar and Planetary Laboratory (LPL) standing with me in front of my poster board. Dr. Sprague and I talked about how great the ALPO Mercury Section is doing! Also, I will cover my experience with the DPS in a future ALPO issue.

John Boudreau did it again! After having taken Mercury images at high resolution showing dark features and ray craters that were seen by the second flyby of MESSENGER earlier in the month, John took advantage of the fine morning Mercury apparition in second half of October to acquire a sequence of images taken every three days showing Mercury's rotation. John has mastered the images of Mercury!

I finally got in touch with the Springer book publisher and they are interested in seeing a whole book on Mercury. They sent the book proposal forms to me for a possible authoring the book *Mercury and How to Observe It*.

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 east of the Sun during June 2008 and is now visible in the Western sky after sunset. During the current 2008-09 Eastern (Evening) Apparition, the planet will pass through its waning phases (a gradation from gibbous through crescentic phases). At the time of this report, the disk of Venus is about 16.0 arc-seconds across and roughly 71.0% illuminated. Venus reaches Greatest Elongation East on January 14, theoretical dichotomy (half phase) on January 17, and greatest brilliancy on February 18, 2009. During the 2008-09 Eastern (Evening) Apparition observer are seeing the leading hemisphere of Venus at the time of sunset on Earth. The following Geocentric Phenomena in Universal Time (UT) are presented for observational planning purposes.

Image of Venus' gibbous disk on November 23, 2008 at 21:30 UT by Frank Melillo of Holtzville, NY, using a 25.4cm (10.0 in.) SCT, Schott UG-1 UV and IR blocking filters, and a Starlight Xpress MX-5 digital imager. Bright regions and amorphous dusky features are quite apparent in this image. S = 5.5, Tr = daylight sky. Apparent diameter of Venus is 15.9", phase (k) 0.718 or 71.8% illuminated, and visual magnitude -4.1. Simply inverted image (south is at top).

The Venus Express (VEX) mission started systematically monitoring Venus at UV, visible (IL) and IR wavelengths back in late May 2006. As part of an organized Professional-Amateur (Pro-Am) effort, a few ALPO Venus observers submitted high quality digital images of the planet taken in the near-UV and near-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 2008-09 and a year or two afterwards. Since Venus has a high surface brightness it is potentially observable anytime it is far

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Geocentric Phenomena of the 2008-09 Eastern (Evening) Apparition of Venus in Universal Time (UT)

Superior Conjunction	2008	Jun 09^d (angular diameter = 9.6 arc-seconds)
Greatest Elongation East	2009	Jan 14 (47° east of the Sun)
Predicted Dichotomy	2009	Jan 17.02 (exactly half-phase)
Greatest Brilliancy	2009	Feb 18 (m_v = – 4.7)
Inferior Conjunction	2009	Mar 27 (angular diameter = 59.7 arc-seconds)

enough from the Sun to be safely observed.

Key observational endeavors include:

- 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.

Digital image of Gutenberg Dome taken by Michael Mattei of Littleton, MA, USA, on June 1, 2006, 00:39 UT, Colongitude 324.1°. Equipment: 14" SCT f/10, no filters, ToUcam 740K, 60 sec. run, 10/fps, processed with RegiStax 3. Transparency was 6 (out of 10, with 10 = best) and seeing was 4.

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.

Complete details can be found about all of our observing programs in the ALPO Venus Handbook.

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 William M. Dembowski, FRAS, program coordinator

bill.dembowski@alpo-astronomy.org

During the third quarter of 2008, the ALPO Lunar Topographical Studies Section (ALPO LTSS) received a total of 202 new observations from 22 observers in 10 countries and six of the United States. Emphasis during the period was on the study of the Aristarchus Plateau and the region near Aristoteles and Eudoxus. Reports on these projects were compiled and published in *The Lunar Observer* newsletter. As of this writing, a study of the area which includes Bullialdus and Kies is drawing to a close with 24 new observations having been received.

Since its inception 13 years ago, the ALPO LTSS has received over 5,000 observations from 145 different observers. Of those, over 600 were submitted on Banded Crater Observing Forms as part of that program. In addition, *The Lunar Observer* has grown from a two-page newsletter to one that now averages 20 pages per month.

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

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Lunar Calendar for First Quarter, 2009 (all times in UT)

Jan. 02	13:00	Moon 4.1 Degrees NNW of Uranus
Jan. 04	11:55	First Quarter
Jan. 10	10:53	Moon at Perigee (357,500 km - 222,140 miles)
Jan. 11	03:27	Full Moon
Jan. 15	07:00	Moon 5.7 Degrees SSW of Saturn
Jan. 18	02:46	Last Quarter
Jan. 23	00:12	Moon at Apogee (406,115 km -252,348 miles)
Jan. 25	02:00	Moon 0.71 Degrees S of Mars
Jan. 25	10:00	Moon 4.8 Degrees SSE of Mercury
Jan. 26	04:00	Moon 0.24 Degrees WSW of Jupiter
Jan. 26	07:55	New Moon (Start of Lunation 1065)
Jan. 27	17:00	Moon 1.6 Degrees NNW of Neptune
Jan. 29	21:00	Moon 4.2 Degrees NNW of Uranus
Jan. 30	09:00	Moon 2.5 Degrees NNW of Venus
Feb. 02	23:12	First Quarter
Feb. 07	20:09	Moon at Perigee (361,486 km - 224,617 miles)
Feb. 09	14:49	Full Moon (Penumbral Lunar Eclipse)
Feb. 11	15:00	Moon 5.7 Degrees SSW of Saturn
Feb. 16	21:38	Last Quarter
Feb. 19	17:01	Moon at Apogee (405,131 km - 251,737 miles)
Feb. 22	22:00	Moon 1.0 Degrees NNW of Mercury
Feb. 23	00:00	Moon 0.69 Degrees NNW of Jupiter
Feb. 23	06:00	Moon 1.5 Degrees NNW of Mars
Feb. 24	02:00	Moon 1.7 Degrees NNW of Neptune
Feb. 25	01:35	New Moon (Start of Lunation 1066)
Feb. 26	06:00	Moon 4.3 Degrees NNW of Uranus
Feb. 27	24:00	Moon 1.2 Degrees SSE of Venus
Mar. 04	07:45	First Quarter
Mar. 07	15:08	Moon at Perigee (367,019 km - 228,055 miles)
Mar. 10	22:00	Moon 5.5 Degrees SSW of Saturn
Mar. 11	02:37	Full Moon
Mar. 18	17:49	Last Quarter
Mar. 19	13:17	Moon at Apogee (404,301 km - 251,221 miles)
Mar. 22	21:00	Moon 1.4 Degrees NNW of Jupiter
Mar. 23	12:00	Moon 1.9 Degrees NNW of Neptune
Mar. 24	10:00	Moon 3.7 Degrees NNW of Mars
Mar. 25	16:00	Moon 4.4 Degrees NNW of Uranus
Mar. 26	06:00	Moon 5.7 Degrees NNW of Mercury
Mar. 26	16:07	New Moon (Start of Lunation 1067)
Mar. 26	20:00	Moon 3.8 Degrees SSE of Venus

(Table courtesy of William Dembowski)

- *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*

Lunar Domes Survey

Report by 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

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

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Mars Section

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

A report on photometric and polarization studies of Mars from 2005 thru 2008 appears later in this issue.

Regarding Richard Schmude's reports on the results of his photometric and polarimetric monitoring of Mars, those who observe Mars visually or by imaging may find his report to be tangential to their interest in the planet. However, there is a hidden bonus in the article for those who are interested in challenging the limits of their imaging skills.

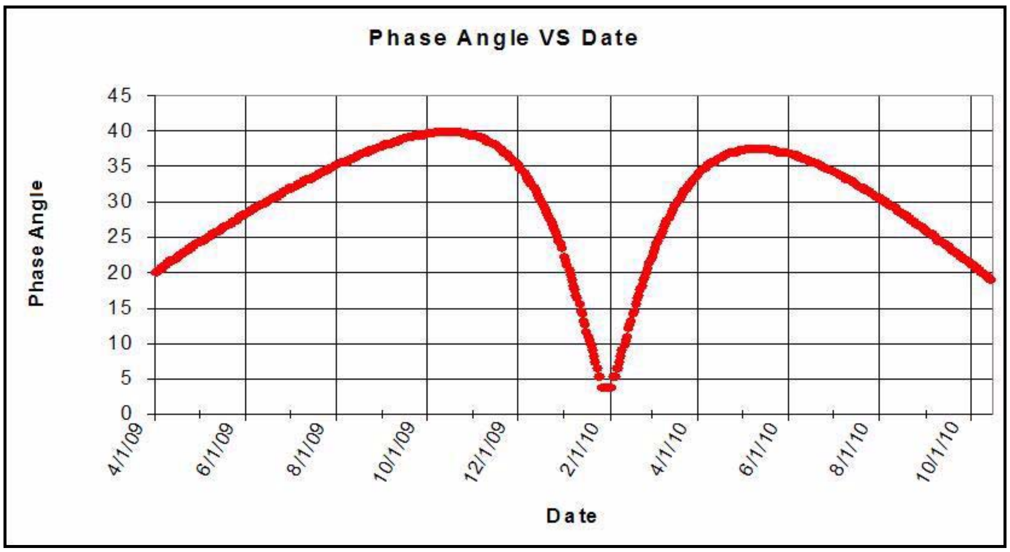
Imaging Mars in polarized blue light may help us to detect dust storms! The light reflected from Mars is partly linearly polarized, and as Richard demonstrates in his article, the extent of polarization is greatest in blue. Dust decreases the amount of polarization. Therefore, an image in polarized blue light may show a dusty area as a dark area. Note that this is completely different from our usual way of detecting dust storms we usually think of a dust storm as a moving obscuration that is bright in red light.

The orbiting spacecraft are detecting approximately 1000 dust storms per Martian year, mostly quite small and many confined to the edges of the polar caps. They may occur at any longitude of the Sun, not just in the "dust season" of Ls 241° to 360°. In view of the superb quality of amateur images nowadays, there is a prospect for detecting some of these small dust storms in polarized blue light. Earth-based images barely display dust storms over the northern plains of Mars, due to the low contrast in both color and brightness between the airborne dust and the ground. A new means of detecting the dust will be welcome.

The polarizer will have to have its polarizing orientation marked, and it will have to be mounted in such a way that it can be rotated. It should be stacked with the blue filter, with infrared excluded. The direction of polarization is perpendicular to the plane in which the Sun, Mars, and Earth lie. The idea is to subtract the image in polarized blue light from an image made with the polarizer rotated 90 degrees from this orientation.

The value "P" in Richard's article is in units of one-tenth of one percent polarization. Thus, a P value of 30 is 3% polarization. The smallness of this value is the reason to subtract the polarized image from the unpolarized one. The signal-to-noise ratio of your image can be enhanced by stacking a larger than usual number of images. Lest the small size of the P value discourage you from attempting this, let me point out that dust storms have already been detected in this way. You can see an image of one in the Ebisawa and Dollfus 1993 article, "Dust in the Martian atmosphere: polarimetric sensing," (*Astronomy and Astrophysics 272*:671-686.) This article is available online, but it cannot be linked to directly. You can find it by searching by authors and year in the NASA Astrophysical Data System search engine at *http://adsabs.harvard.edu/abstract_service.html* . I am confident that many Mars imagers have sufficient skill to demonstrate the presence of dust using this new technique. I think it likely that dust will be as readily detected in the northern plains with this technique as it is with traditional imaging. However, I am reluctant to guess whether the technique will prove to be useful to us in the long run.

Imagers will have to give attention to phase angle. As Richard's article shows, the polarization is greatest at the highest phase angles, which occur near quadrature, where the phase angle is about 40 degrees. Near a phase angle of 20 degrees, there is no net polarization and the technique should not work. When the phase angle is less than 10 degrees, near opposition, the opposite polarization



Phase angle is here graphed on the ordinate versus the date during the upcoming Mars apparition on the abscissa. Phase angle is the angle in the Martian sky between the Earth and the Sun. It is small early in the apparition when Mars appears to us to be close to the Sun, and it progressively increases to nearly 40° at quadrature in October 2009. It then decreases to about 4° around the time of opposition at the end of January 2010. After opposition, the phase angle increases until quadrature, and then decreases again. Good times to try imaging Mars in polarized blue light will occur when the phase angle is greater than 30° – approximately from June 15 to December 15, 2009, and from March 15 to August 1, 2010. The former period overlaps the traditional Martian dust season, which will be from April 5 to October 27, 2009.

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might be detected, with dust appearing brighter than the Martian atmospheric blue background. In this circumstance, the polarized view may be difficult to distinguish from clouds, which are also bright in blue light. The graph here can be used to guide imagers in selecting dates on which to try the technique, based on the phase angles in the coming apparition. It will be fascinating to see whether imagers can distinguish dust in this way.

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 Vol. 35, No. 4, contains lightcurves and rotation period determinations for 93 different asteroids. We congratulate the many contributing observers, most of them amateurs.

Some of these are the first ever published for the asteroid, including some for which the periods are secure and others with periods still uncertain; some are improvements from earlier determinations; some are at new aspects to aid in spin/shape modeling. Asteroids included are Nos. 161, 305, 316, 329, 411, 455, 578, 595, 608, 619, 651, 653, 655, 707, 710, 742, 788, 811, 1093, 1175, 1187, 1216, 1297, 1309, 1324, 3125, 1462, 1505, 1559, 1633, 1671, 1793, 1817, 1999, 2001, 2048, 2075, 2094, 2120, 2126, 2150, 2363, 2444, 2491, 2606, 2648, 3036, 3156, 3198, 3285, 3333, 3428, 3787, 3800, 4215, 4264, 4340, 4399, 4425, 4585, 5331, 5448, 5474, 5599, 5851, 6274, 6394, 6435, 7233, 7526, 7895, 8132, 8441, 11398, 12390, 12482, 13474, 14659, 15271, 16959, 17102, 18641, 23327, 24094, 26887, 27068, 27270, 28292, 31827, 46436, 74056, 74424, 2002 TD66.

Two independent data sets for 411 Xanthe both showed apparently low noise good fitting light curves with consistent amplitudes 0.12 magnitudes but periods in a 3:2 ratio of 7.56 and 11.344 hours, respectively. This dramatizes how easily even very careful observers can be fooled by aliases.

Spin/shape models are published for asteroids 54, 167, 409, 595, 1022.

Collaborating observers in Australia, Czech Republic, Slovakia, and the USA have utilized lightcurves at widely separated longitudes to determine properties of two binary asteroids. For 5474 Gingasen no eclipses/occultations were observed, but the lightcurves could be deconvolved into the addition of two separate lightcurves of the two binary members with respective periods and amplitudes of 3.6236h, 0.18mag and 3.1096, 0.06mag. Asteroid 7369 Gavrilin is a synchronous binary in which eclipse/occultation events were observed showing orbital period 49.12 hours. Maximum observed eclipse depth of 0.12 mag. indicates a lower limit of secondary to primary mean diameter ratio D2/D1 = 0.32.

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 will reach conjunction in early 2009 and will not be well placed for observations until about May 2009.

During 2008, I received over 1,000 files of Jupiter images; probably about 4,000 - 6,000 images of that planet. I have archived most of these into two large, three-ring binders. I am hoping to find someone who is willing to archive the images onto a CD or other digital medium. If you are interested, then let me know.

I am currently working on a comets book and will not be able to write the 2007 and 2008 Jupiter apparition reports until late 2009. I have submitted apparition reports through 2006.

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

Report by John Westfall, assistant 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; e-mail to address shown above to obtain an observer's kit, which includes Galilean satellite eclipse predictions for the 2009-10 apparition.

Saturn Section

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

Saturn reached conjunction with the Sun on September 4, 2008, but by the third week of September, observers were able to start viewing the planet low in the east-

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ern morning sky with a ring tilt of roughly -4.0°. As of late November, 23 observations and images have been submitted, and at least a couple of observers have imaged a small white spot in the SEBZ and have started observing phenomena of Saturn's brighter satellites that lie close to the ring plane.

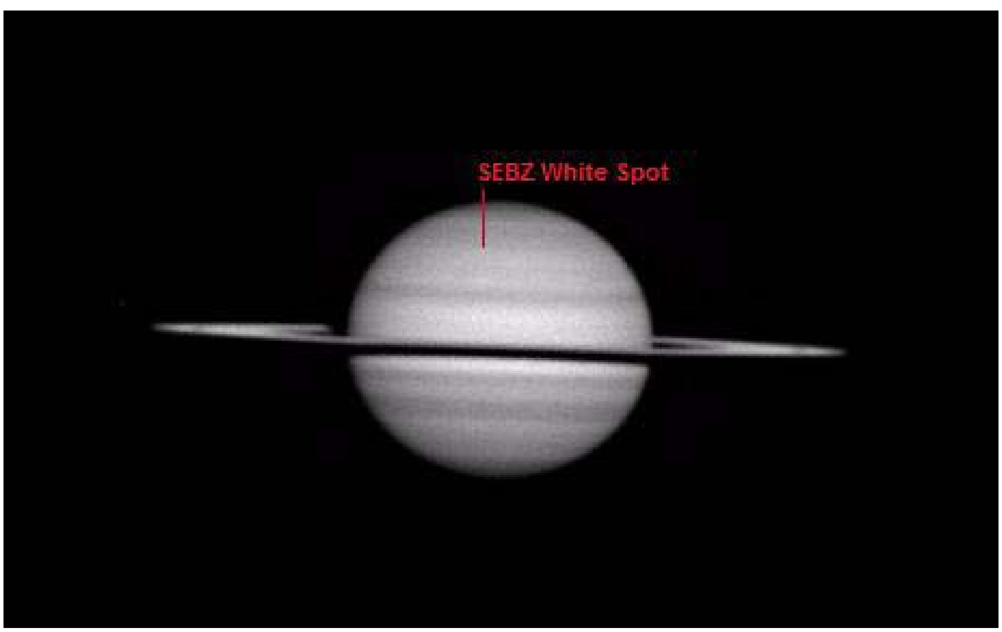
Geocentric phenomena for 2008-09 are presented in the accompanying table for the convenience of observers.

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
Earth passes thru the Ring Plane S --> N	2009 Sep 04^d
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°

Since the last edge-on orientation of the rings back in 1995, the southern hemisphere and south face of the rings have been inclined toward Earth. That will change once the Sun and Earth pass through the ring plane headed northward in August and September 2009, respectively; therefore, 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 hemisphere are visible, separated by the ring plane.

Since the ring passages of the Earth and Sun through Saturn's ring plane occur so close to the time of the planet's conjunction with the Sun, observational conditions with be highly unfavorable. Even so, it is a normal practice at times of edgewise orientation of Saturn's rings to try to determine just how close to the theoretical edge-on positions the rings can actually be imaged or seen with a given telescope. The apparent disappearance of the ring system, which often occurs a number of times during a short interval, can be ascribed to one or more of the geometric circumstances as follows:

- 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



In this image taken on November 16, 2008 at 14:14UT by Ethan Allen of Sebastapol, CA, USA, using a 35.6cm (14-in.) SCT and a SKYnyx2-0M digital imager red wavelengths, notice the tiny white spot E of the CM in the SEBZ. Cassini's Division (A0 or B10) is visible at both ansae, and the shadow of the rings on the globe appears to the N of the ring plane. The shadow of the globe on the rings appears to the E of the globe. S = 4.0, Tr = 4.0, CMI=178.3° CMII=98.1° and CMIII=82.0° . The tilt of the rings is -1.5 . Simply inverted image (south is at top).

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the close proximity of Saturn to the Sun in 2009.

In 2008-09, when the inclination of the plane of the rings becomes minimal, the best opportunities also occur for observing transits, shadow transits, occultations, and eclipses of those satellites that lie near Saturn's equatorial plane. Small apertures are usually unable to produce optimum views of most phenomena of Saturn's satellites, except perhaps with the case of Titan. Larger telescopes generally make observations of events involving the satellites more worthwhile. It will be interesting to see what imaging with various instruments will reveal, since controversy persists 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 immediately dispatch such data to the ALPO Saturn Section. The belt or zone on the planet crossed by the shadow or satellite should be included in the reported data. Intensity estimates of the satellite, its shadow, and the belt or zone it is in front of can be very useful as well, and drawings of the immediate area at a given time during the event can be especially valuable.

For 2008-09, in addition to observing and imaging phenomena specific to the edge-on ring presentation, the following are important activities for ALPO Saturn observers:

- Visual numerical relative intensity estimates of belts, zones, and ring components.
- Full-disc drawings of the globe and rings using standard ALPO observing forms.
- 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 in plus studies of Casino'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 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.
- Regular digital imaging of Saturn and its satellites.

Observers are urged to carry out digital imaging of Saturn at the same time that others are imaging or visually watching Saturn (i.e., simultaneous observations).

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.

To continue to support our ongoing Pro-Am efforts in association with the Cassini imaging team, observers should employ classical broadband filters (Johnson UBVRI system) on telescopes with apertures of 31.8 cm (12.5 in. or larger) to image Saturn, including imaging using a 890nm narrow band methane (CH_4) filter. Our data are being used to alert the Cassini team of interesting large-scale targets, and suspected changes in belt and zone reflectivity (i.e., intensity) and color detected by visual methods are also useful. Be sure to include all supporting data such as time and date (UT), instrumentation used, observing conditions and location, etc., since without this fundamental information, observations are essentially useless.

The ALPO Saturn Section appreciates the work of so many dedicated observers who continue to submit observations and images, prompting more and more professional astronomers to request drawings, digital images, and supporting data from amateur observers around the globe.

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

Both Uranus and Neptune will be approaching the Sun as seen from Earth by January 15. You should still be able to see Uranus until about February 11 if you know where to look. Pluto will be well-placed in the morning sky for people in the southern United States. I am hoping that people will carry out CCD magnitude measurements of Pluto in 2009.

Jim Fox, Frank Melillo and this writer have made several brightness measurements of both Uranus and Neptune. Several people have also sent in high quality images and drawings of both planets. If you have made observations of Uranus, Neptune or Pluto, then I need them for the 2008-09 apparition report of these three objects; I hope to have this report ready in June 2009.

To repeat what was stated last month: 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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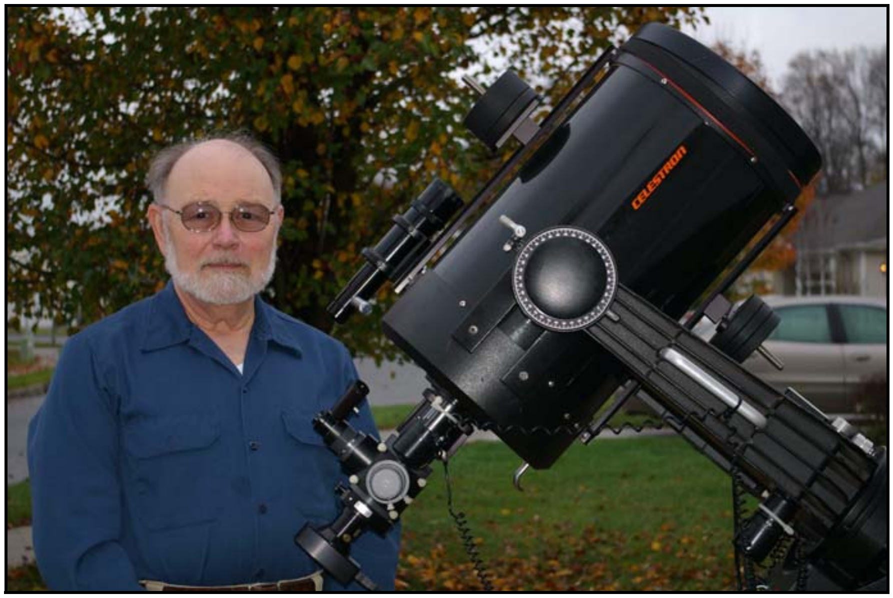
Meet the Member: Wayne Bailey



(Editor's Note: Our longtime friend and ALPO Lunar Topographical Studies Program Coordinator William Dembowski has decided to step down and become assistant coordinator. In his place will be Wayne Bailey, who was recommended by Bill himself. We look forward to many yeas of continued top-notch contributions from this winning team of Wayne and Bill.)

I'm a semi-retired, adjunct professor teaching astronomy (and occasionally physics or math) at our local community college in southern New Jersey. I was raised about 10 miles from my current home, where an elementary school science teacher gave me a magazine article on building a 6-inch Newtonian telescope. Although the resulting telescope was less than optically superb, I blame it — and the appearance of Comet Arend-Roland — for the path of the next 50 years of my life.

After obtaining a Ph.D. in Astronomy from the University of Arizona, I taught college and did research in the area of infrared stellar spectroscopy for five years before taking an aerospace industry job in Alabama. After 22 years supporting Spacelab science missions, the Shuttle Spacelab program ended, so I retired and went to work with a few of my colleagues for a small company developing gamma ray detectors for oil well drilling and coal mining (quite a change from IR astronomy to subterranean gamma rays). A few years later, when system development was being replaced by manufacturing, I retired again and moved back to NJ.

A homemade 8-inch reflector of somewhat better optical quality soon replaced my original 6-inch telescope. Eventually, it also was replaced by an 8-inch Meade Starfinder, a C-11 SCT, and a 5-inch Celestron Nexstar. The C-11 is now my main telescope while the 8-inch & 5-inch telescopes are used mainly for public star parties since they're more portable.
My interests initially leaned towards public star parties (the teacher instinct showing through) and visual observations of variable stars (since that was a field where I could make a useful contribution). Occasionally I would attempt film photography of the Moon or planets without much success. Webcams changed all that. Suddenly I could determine proper focus and exposure on the spot.

By this time I had moved back to NJ where the skies are bright, and discovered *The Lunar Observer* where the "Feature of the Month" provided a focus for my interests. That convinced me to join the ALPO, and I've been contributing lunar images ever since. My first ALPO meeting was the 2006 Atlanta meeting and I attended both subsequent meetings.

My usual equipment setup now is the C-11 with filters and a Skynyx monochrome camera. I use Johnson photometric filters since I also use them for variable star photometry. My first choice for lunar observing is an infrared filter because the seeing here seems to be better at long wavelengths and CCD sensitivity is still good.

Long-term monitoring and archiving observations is one area where amateurs can make a significant contribution to science. In addition to the traditional geometric observations, I believe photometric and possibly spectroscopic observations are an area where amateurs can contribute to lunar science. Observations intended to answer a specific question are immediately useful. Any observation may be useful in the future. But if nobody knows of its existence, it may as well not have been made.

Feature Story:

ALPO Observations of Mercury Compared to Images from the First MESSENGER Flyby

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

Abstract

The ALPO Mercury section has received a few observations of the part of Mercury's surface that the MESSENGER spacecraft imaged during its first flyby. Our observations are extremely high quality and they can be compared with the new MESSENGER images quite well. The purpose of this paper is to show that some of the features in the MESSENGER images can be seen in amateurs' images of Mercury.

Introduction

After the Mariner 10 flyby in 1975, no other spacecraft visited Mercury for 33 years. Finally, on January 14, 2008, MESSENGER made a close approach, skimming a mere 126 miles above the surface. It sent back more than a thousand images showing double-ringed craters, smooth plains, bright rayed craters and dark maria. Although Mercury is reminiscent of the Moon at first glance, close study of its surface reveals it to be a lot different. In this first flyby, MESSENGER imaged 1/3 of that half of the surface that had not been imaged by Mariner 10.

The flight plan calls for three flybys of Mercury, two of Venus and one of Earth, to reduce MESSENGER's speed in its solar orbit so that its speed matches that of Mercury. This slowing will allow MESSENGER to enter orbit around Mercury in 2011.

After its closest approach, MESSENGER continued past the planet in a direction toward Earth. Looking back at Mercury, it took more images during the outbound journey. From this vantage point its cameras eyed the planet with a view that nearly matched the view of simultaneous Earth-bound observers. Mercury was displaying a gibbous phase, with a CM of 230° longitude (Figure 1). The MESSENGER optics have better con-

Figure 1. A look-back image of MESSENGER just after the flyby, made on January 15, 2008, from a distance of 27,000 km (16,777 miles). The left image is the original, while the right image was taken after processing with a blurring routine to render the MESSENGER image similar to what might be expected to be seen from Earth under the best conditions. (Source: NASA)

All Readers

Your comments, questions, etc., about this report are appreciated. Please send them to: *poshedly@bellsouth.net* 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 Mercury when allowing for daylight and twilight

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

Directions, Please

In the images presented in this article, north is up and planetary east is to the right. CM means 'central meridian.' MESSENGER is an acronym for MErcury Surface, Space ENvironment, GEochemistry, and Ranging.

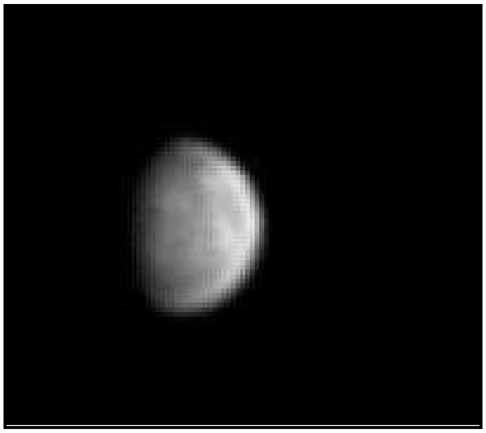


Figure 2. Mercury as imaged by Ed Lomeli on January 31, 2007, at 23:25 UT. CM = 235°. Schmidt-Cassegrain telescope of 235 mm (9.25 in.) aperture, DMK21AF04 camera, multiple brief images stacked. Though this image was made a year prior to MESSENGER's first encounter with the planet, the viewing angle and central meridian are very similar to those of a year later, and to those of MESSENGER in its look-back images. Notice its striking resemblance to the blurred image in Figure 1 that was made by the MESSENGER spacecraft.

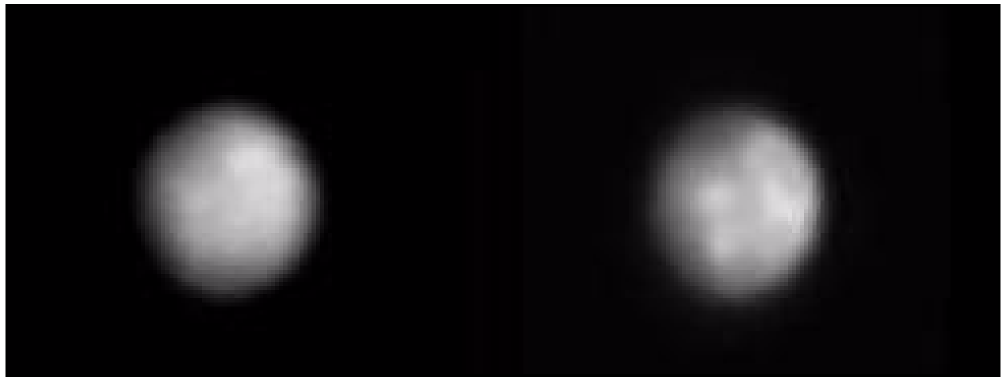


Figure 3. Two additional images of Mercury by Ed Lomeli; the first (at left) taken August 25, 2007, at 17:27 UT. CM = 224°, the second (at right) taken August 27, 2007, at 22:24 UT. CM = 234°. Schmidt-Cassegrain telescope of 235 mm (9.25 in.) aperture, DMK21AF04 camera, multiple brief images stacked.

trast and resolution than those of Mariner 10. We have been able to compare our images to the look-back images of MESSENGER to see whether we captured any details that are seen in the new MESSENGER images.

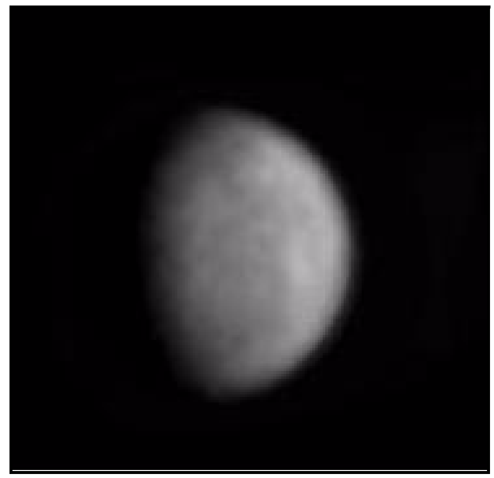


Figure 4. Image made by John Boudreau on January 16, 2008 at 19:24 UT. CM = 237º. Schmidt-Cassegrain telescope of 280 mm (11.0 in.) aperture, DMK21AF04.AS camera with 807-nm IR pass filter. This image also shows a striking resemblance to the blurred image in Figure 1 that was made by the MESSENGER spacecraft.

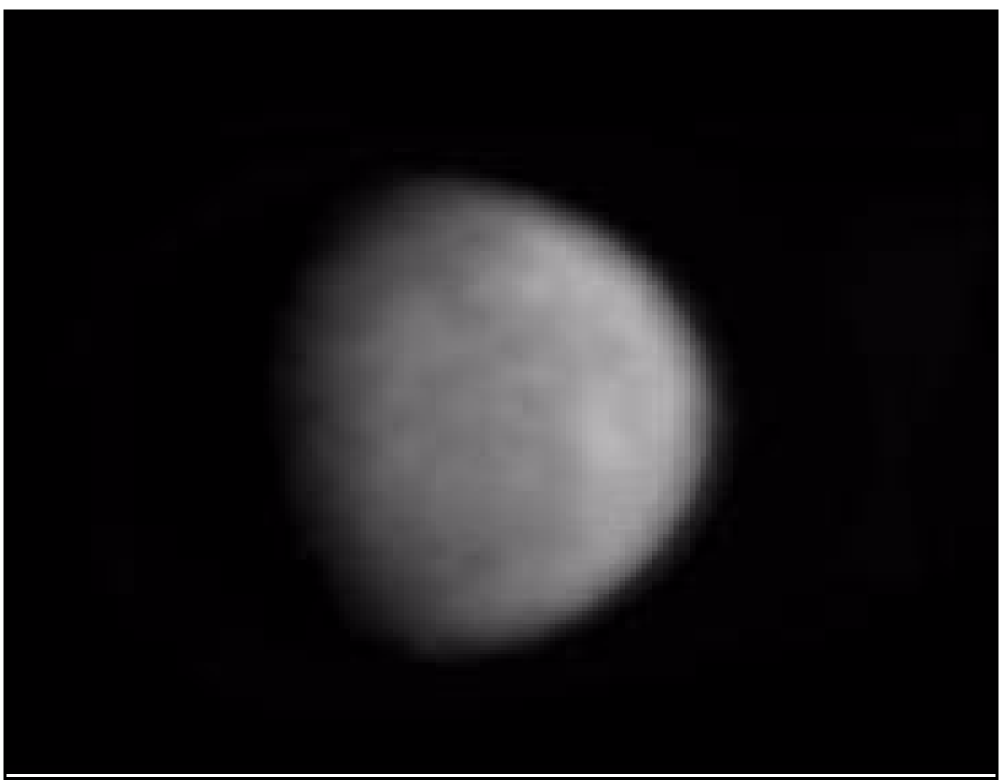


Figure 5. Sketch by Carl Roussell, using the MESSENGER look-back image as a guide. See text.

Observations

Members of the ALPO Mercury Section made some very high quality images in 2008. Features such as certain bright areas and impact ejecta blankets identified by MESSENGER are apparent in many of our observations.

Ed Lomeli of California is known for taking extraordinary planetary images, especially of Mercury. His image on January 31, 2007 shows Mercury with a gibbous phase during the evening apparition, with CM 236° W longitude (Figure 2.) There

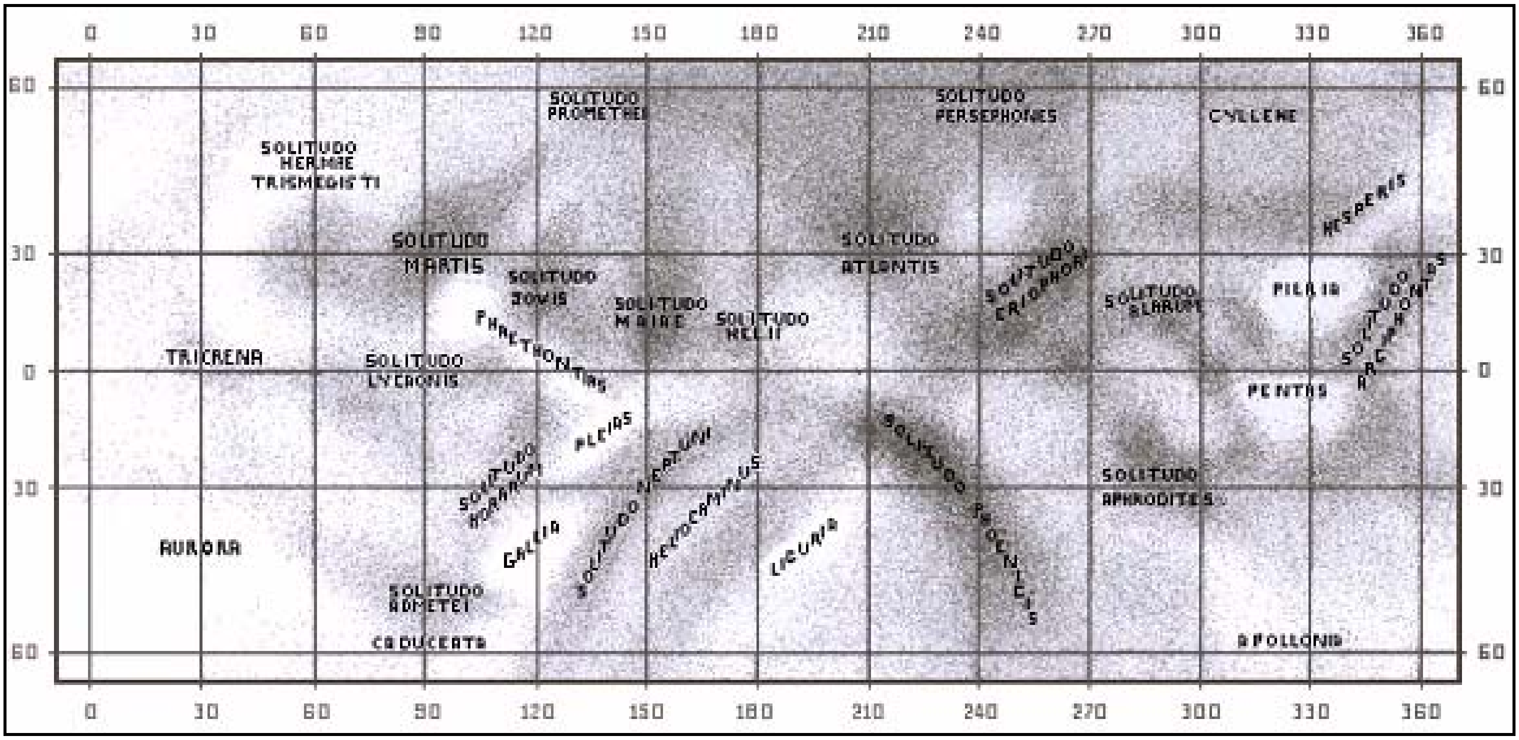


Figure 6. Albedo map of Mercury based on the chart produced by Dollfus and Murray, with named features adopted by the IAU. South is at the top, as in the telescopic view. (Source: *http://www.take27.co.uk/BAA_MV/MVMercury2.html*)

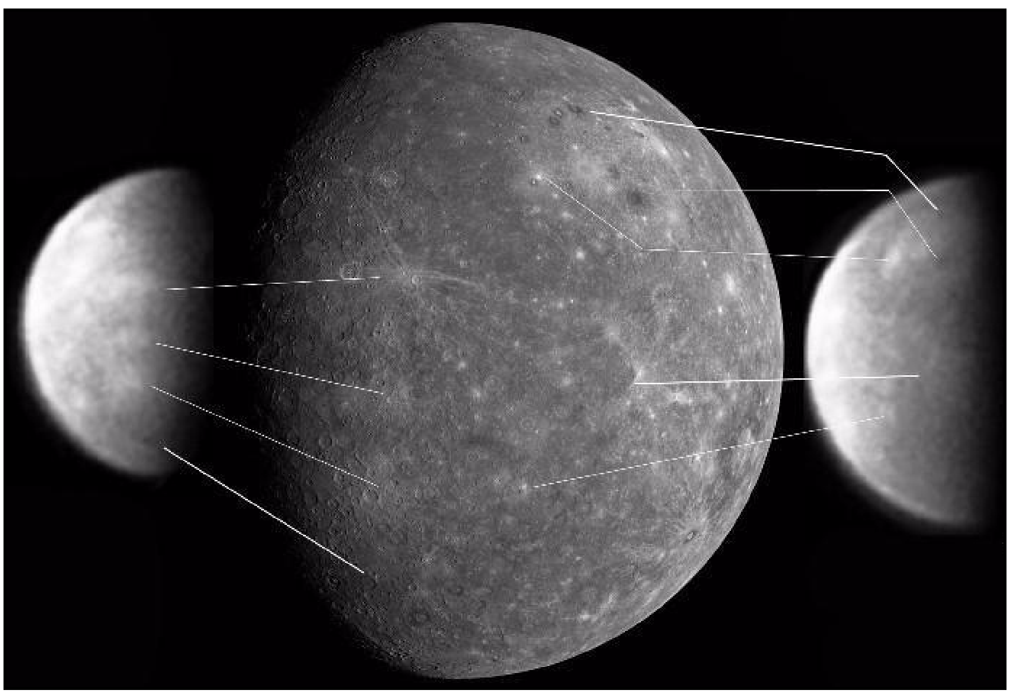


Figure 7. Comparison of MESSENGER image with two ground-based images. Ground-based images of Mercury by Dr. Gerald Cecil, professor of astronomy at the University of North Carolina at Chapel Hill, and UNC-CH senior Dmitry Rashkeev using the university's SOAR (SOuthern Astrophysical Research) telescope atop Cerro Pachón in the Chilean Andes mountains. Image at left taken April 1, 2007, CM = 200°; image at right taken March 23, 2007, CM = 173°. Results are result of the sharpest 30 images of 30,000 combined; image taken at 820 nm with a 1.3 m, off-axis aperture. MESSENGER image taken during first flyby. No additional image details available. (Image courtesy of Dr. Gerald Cecil, professor of astronomy at the University of North Carolina at Chapel Hill.)

are three bright regions near the terminator. Another bright area is in the NW (upper right) part of the disk. According to the map by Dollfus and Murray (Figure 6), Solitudo Criophori may be the dark albedo feature between the bright regions near the terminator. The bright region in the NW may be Liguria.

Lomeli took more images of nearly the same CM longitude on August 25, 27, and 28, 2007, at CM's of 224°, 234° (Figure 3) and 238°, respectively, which was also during an evening apparition. These images revealed bright regions near the terminator and in the NW that moved with the rotation of the planet. Lomeli's observations are all in agreement with the new MESSENGER images.

John Boudreau of Massachusetts made some impressive images of Mercury on January 16 and 18, 2008 (Figure 4), with CM's of 237° and 246°, respectively. This was also an evening apparition, and was just after the MESSENGER flyby. Boudreau's images look much like the blurred MESSENGER images, all of them matching quite nicely.

ALPO MERCURY SECTION

NAME______________________________

ADDRESS___________________________

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APPARITION:
Morning_____
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ELONGATION:
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For Coordinator Only:

Sketch

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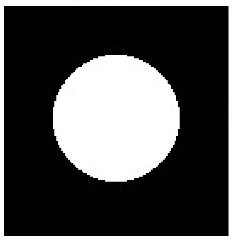

WEST

Central Meridian Longitude______°

DATE__________________
TIME (UT)______________
Telescope__________________________
Magnification_______________________
Filter(s)___________________________
Seeing (10-best/1-worst)______________
Visual Description:

Photo or CCD

DATE:_____________
TIME (UT):__________

Image 1

Central Meridian Longitude______°

Telescope:____________________
Camera Type:__________________
Exposure:_____________________
f/ratio:_______________________
Filter:________________________

Comments:

Date:________________
TIME (UT):_____________

Image 2

Central Meridian Longitude______°

Telescope____________________
Camera Type__________________
Exposure_____________________
f/ratio_______________________
Filter________________________

Comments:

Send all observations to: Frank J Melillo
ALPO Mercury Coordinator
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Carl Roussell of Ontario, Canada, placed a MESSENGER image at a distance from himself and made a sketch of it (Figure 5). His idea was to see whether any albedo features could be perceived in this way. Indeed, we think that it is easier to see the albedo markings from such a distance than it is when the detailed MESSENGER images are scrutinized up close. His sketch may show dark Solitudo Criophori between the bright areas just south of the equator along the terminator.

Also Solitudo Atlantis can be seen just below center as a dark area. Solitudo Phoenicus may be seen as a dark area extending from the northern part of the terminator southward and eastward, south of Liguria. Liguria appears to be a part of the Caloris Basin. Toward the south is a dark region that perhaps is Solitudo Persephones. In comparing Roussell's drawing with the 1971 official albedo map by Dollfus and Murray, there is considerable agreement.

Though the spacecraft's line of sight was similar to that of Earth-bound observers in January, there was a latitude difference. We looked at the planet with its north pole tilted 6° away from us, while MESSENGER saw it with its north pole tilted away only 1°. Mercury's orbit has a high inclination (7°), so our viewing angle shifts to the north or south periodically. This may affect the extent to which our images match those of MESSENGER in the future.

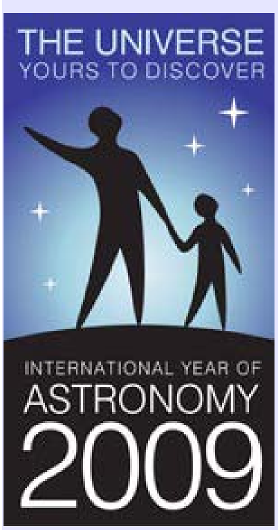
Conclusions

Amateurs have revolutionized the quality of their planetary observations, including those of Mercury. We are now seeing more than just the phase of this elusive planet, and our images are the best ever made by amateurs. The images from MESSENGER's first flyby have given us a chance to compare our images to the definitive images by that spacecraft. We are excited that we have now confirmed the reality of the subtle albedo features that we have been identifying. We may also be able to compare the MESSENGER images to historical observations, such as those by Schiaparelli. MESSENGER has not yet imaged the entire unknown side of the planet, so amateurs can still further our understanding of the planet. We look forward to the next two flybys, to make further comparisons of the perceptions of Earth-bound observers to definitive spacecraft images.

2009 – The International Year of Astronomy

In celebration of the 400th year since Galileo Galilei first turned his primitive telescope (shown at right) to the skies and began the science of telescopic observational astronomy, the International Astronomical Union and UNESCO have teamed together to initiate a global effort to help the citizens of the world rediscover their place in the Universe through the day- and night-time sky, and thereby engage a personal sense of wonder and discovery.

Called "The International Year of Astronomy", IYA2009 will be a global celebration of astronomy and its contributions to society and culture, highlighted by the 400th anniversary of the first use of an astronomical telescope by Galileo. The aim of the Year is to stimulate worldwide interest, especially among young people, in astronomy and science under the central theme "The Universe, Yours to Discover". IYA2009 events and activities will promote a greater appreciation of the inspirational aspects of astronomy that embody an invaluable shared resource for all nations.



The IYA2009 activities will take place at the global and regional levels and especially at the national and local levels. National Nodes in each country have been formed to prepare activities for 2009. These Nodes establish collaborations between professional and amateur astronomers, science centers, educators, and science communicators. Already now, 135 countries are involved and well over 140 are expected to participate eventually.

Vision

Everyone should realize the impact of astronomy and other fundamental sciences on our daily lives, and understand how scientific knowledge can contribute to a more equitable and peaceful society.

To help coordinate this huge global programme and to provide an important resource for the participating countries, the IAU has established a central Secretariat and an IYA2009 website (*www.astronomy2009.org*) as the principal IYA2009 resource for public, professionals and media alike.

The ALPO fully supports this effort and hopes to participate actively in the coming year.

Feature Story: Venus

Strange Cloud Formations on the Terminator of Venus

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

Abstract

Strange formations of clouds have been observed at the terminator on Venus that project over to the dark side of the planet. Bright white circular areas have been observed on the sunlit side. Might these observations predict the possibility of volcanic eruptions on the planet surface below? We can now compare these observations to spacecraft radar images of the surface of Venus.

Introduction

A tiny number of observations in the last 20 or so years have shown bulges along the terminator of Venus, presumably from the upper cloud layer projecting over the terminator onto the dark side. There seems to be no explanation other than that the winds may be mixing the clouds in the upper layer causing them to project over the terminator.

Another phenomenon is the occurrence of very bright white clouds on the sunlit side of the terminator, which have not been explained. These clouds may resemble cumulonimbus-type bulges in the upper cloud layer. However, there are no indications that there are strong storm formations that could cause this effect.

With the advent of spacecraft and radar knowledge of Venus's surface, we now know that there are no oceans and no strong weather forces created by oceans. We also know that there are volcanoes on the surface and there are many of them. Radar observations show what look like past lava flows that have issued from some of these volcanoes (Reference 1). We now have a clear map of the surface that can reveal where the volcanoes are at the time of these observations. Such plots might indicate that active volcanoes may be causing the bulges and projections in the upper cloud layer at and near the terminator.

Volcanoes on Earth

The Earth has a large number of volcanoes on its surface and some below the surface of the oceans. There are two types of volcano that we are interested in here, shield and strato-volcanoes, since these two types are similar to the shapes of volcanoes on Venus.

A well-known shield volcano on Earth is Mauna Loa of Hawaii, a huge structure that (measured from the ocean floor) is the largest volcano on Earth.

Among strato-volcanoes on Earth are Mount Fuji in Japan and Mount St. Helens in the state of Oregon in the USA. When Mount St. Helens erupted in 1980, the top portion of the mountain was blown off. This eruption caused some beautiful atmospheric displays because of the ash that was thrown into the upper atmosphere.

But there was another strato-volcano that we are most interested in here, Krakatoa. Krakatoa (or what's left of it) is located in the Sunda Straits between Sumatra and Java, 105° 25' E, and 6° 07' S. What remains now is Anak Krakatoa (son of Krakatoa), which appeared above the

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Online Features

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

Observing Scales

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

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

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

IAU directions are used in all instances.

Terminology: Western vs Eastern

"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.

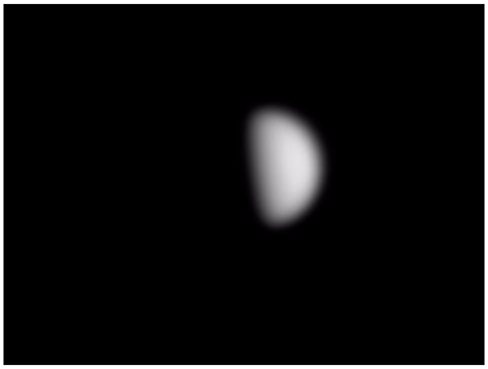

Figure 1. Venus as imaged by Mike Mattei on 28 May 2007, 20:41 UT, using a 14" SCT, f/20. North is up, east is at left.

waters about 50 years ago (Reference 2). On August 27, 1883, Krakatoa erupted and, for a couple of days, it spewed material like a roaring jet engine into the air to a height estimated to be 120,000 to 160,000 feet or about 30 miles (50 km). Then it went off with a bang literally heard about 3,000 miles away (Reference 3). Krakatoa was approximately 10 miles in diameter and 6,000 feet high. This blast, estimated to have a force of 21,000 megatons, removed the mountain and lifted it into the atmosphere to a height of 52 miles (84 km). It is estimated that 5 cubic miles (20 cubic km) of earth was moved into the air. There are many reports of what happened after the eruption that affected the whole world. Here we are interested in this explosion, its power, and the amount of material that was moved to great heights in the atmosphere.

And now we turn to Venus; might volcanoes there affect the upper atmosphere as they sometimes do on Earth?

The View of Venus

A first look at Venus shows a rather bland white crescent or gibbous phase without noticeable features. Viewing Venus with filters begins to show some different structure in its clouds, though still not very promising to the observer. Only in Ultraviolet (UV) light does Venus show structure in the clouds in detail. An observer will notice that in about four Earth-days, the clouds will show some rotation, which has been confirmed by ground-based and spacecraft observations. Figure 1 shows a typical view of Venus.

There are rare times when a bulge structure in the clouds becomes visible to the observer, presumably from the upper clouds that extend beyond the terminator and show extension into the dark side of the planet. An example is shown in Figure 2.

It is quite obvious that the terminator in the second image is not the same as the one in the first image. Since these are such rare events, it will likely be a long time before another occurs. With luck, one will occur while a nearby spacecraft images one of these events. We can now try to estimate where on the planet this bulge occurs and what lies below, perhaps a volcano.

There are planetarium software programs available that can provide information on any event or location of any object in the sky. One of these programs used by the author is *Guide 8* from Project Pluto (Reference 4). With this software, the known surface of Venus can be viewed at a determined Central Meridian (CM). The time is important and the observation should list time as Universal Time (UT). A map of the surface is displayed showing the CM at the given time. Right-clicking on the image displays the information box that gives all of the data information of the object. Figure 3 is the map of the surface of Venus at the same time as the observation of the terminator bulge in Figure 2. For both Figure 2 and Figure 3 the CM is 175°.86 for the date and time given.

Looking at the image of Venus's surface in Figure 3, we can see that there are three volcanoes on or near the terminator, Maat Mons, Ozza Mons, and Sapas Mons. Could

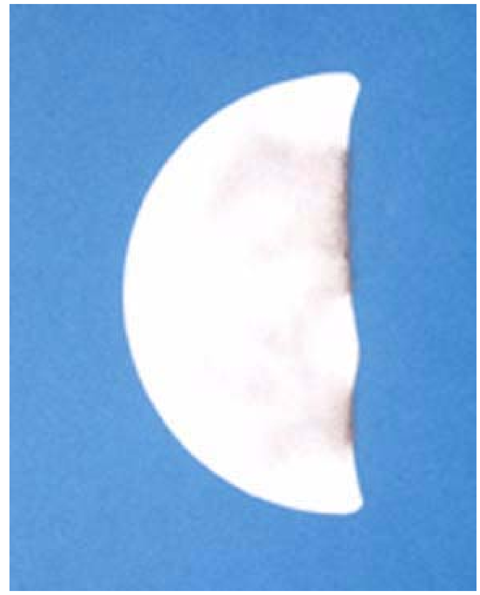

Figure 2. Venus showing a bulge at the terminator. 23 March 1988. 17:45 UT. Image courtesy of David Graham/Galaxy Picture Library. No other details available.

one or more of these three volcanoes have been in eruption when the image in Figure 2 was taken? According to Reference 1, "There is some speculation that Maat Mons might be an active volcano" (Reference 1). This speculation comes from the size, shape, and features of the volcano and the unusual radiothermal emissivity and radar reflectivity of its surface, along with variations in upper-atmosphere sulfur dioxide. (references 5, 6). One can see that the bulge in Figure 2 is directly over these volcanoes mapped in Figure 3. Can we determine that the volca-

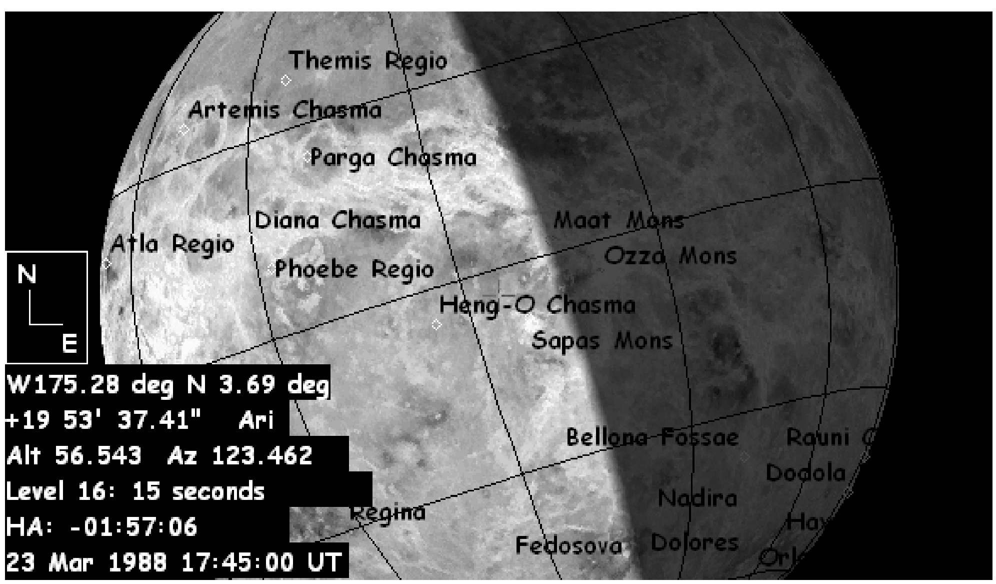

Figure 3. Map of the surface of Venus using *Guide 8* software.

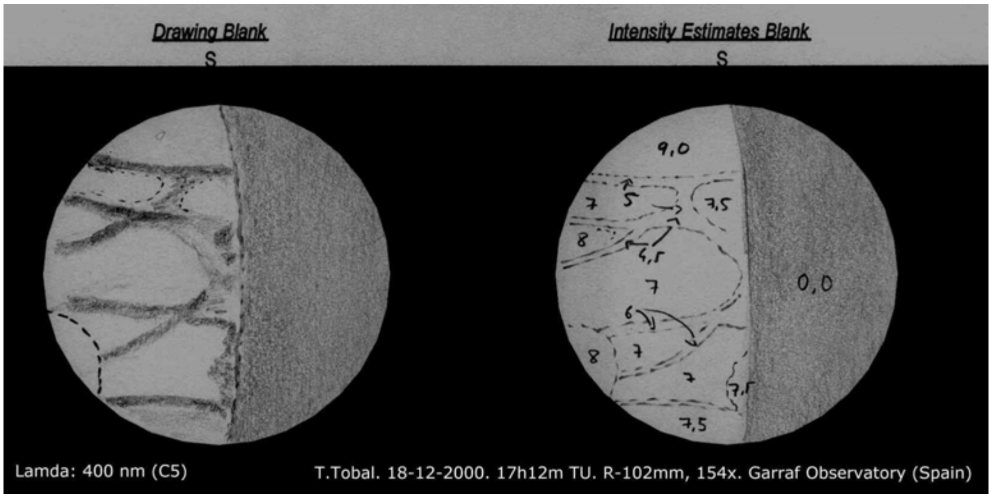

Figure 4. Drawing of Venus from the ALPO Venus archives; 18-Dec-2000, 17:24 UT, CM = 131.51°; north is at top. See image text for additional details.

noes are the possible cause of the bulge in the clouds above?

The author has searched archives for unusual drawings and digital images of Venus. In the United States ALPO (Reference 7) and Japan ALPO (Reference 8) archives, 21 observations have been found so far. Using planetarium software to find the map of Venus's surface at the same time as the images and drawings, it was found that the same three volcanoes were at the location of image features in all 21 cases.

Besides bulges at the terminator, many of the images and drawings show brighter patches in the sunlit clouds that are near the location of the three volcanoes. Some of the images show a bright white area near the limb of the planet which also matches the location of the volcanoes on the surface. An example of bright clouds is seen in Figure 4 on the sunlit side of Venus. If these clouds are of the cumulonimbus type, can they be traced to volcanoes also?

In the drawing of Figure 4, it is clear that there are some bright clouds near the terminator marked with intensity scale numbers where 0 = black and 10 = white. They are 37° from the volcanoes, which are to the left (bright side) in this image. Although Venus shows clouds that are elongated by the winds which pull them around the planet, these clouds are not being pulled by winds. They have a circular form and are brighter than the surrounding clouds. They are clumped together somewhat like cumulonimbus clouds.

If a volcano is erupting below and pushing up from the bottom of the clouds, such that the cloud is bulging above the normal level of the top of the clouds, this may explain the extension beyond the terminator and the circular bright white clouds on the sunlit side of the planet.

More Observations Needed

Below is a list of times to observe Venus when the volcanoes Maat Mons, Ozza Mons, and Sapas Mons are visible to Earth observers.

NOTE: These volcanoes are located at central meridian 169°.5 and close to the equator. The table was made using *Guide 8* planetarium software; you can make your own table using this method.

Eastern Elongation

- 7 December 2008. Volcanoes are 75° from terminator to limb, most important time to see bright circular clouds near limb.
- 15 December 2008. Volcanoes are 45° midway from terminator to limb. Look for bright circular clouds.
- 30 December 2008. Volcanoes are on terminator, most important time to see terminator projections of clouds.
- 6 January 2009. Volcanoes are 10° beyond terminator dark side, most important time to see terminator projection of clouds.

Inferior Conjunction

- 28 Mar 2009

Western Elongation

- 22 June 2009. Volcanoes 10° on dark side before terminator, most important time to observe terminator projection of clouds.
- 25 June 2009. Volcanoes are on terminator, most important time to observe terminator projection clouds.
- 9 July 2009. Volcanoes are 45° midway from terminator to limb. Look for bright circular clouds.
- 16 July 2009. Volcanoes are 75° from terminator to limb, most important time to see bright circular clouds near limb.

Conclusion

By making careful observations of the brightness (intensity measure) of the clouds and CCD imaging of any projections beyond the terminator we can determine if volcanoes are erupting on Venus.

Acknowledgments

My thanks go to:

- Dr. Julius L. Benton, Jr., ALPO Venus Section coordinator, for the Venus archive files.
- Dr. David Klick, MIT Lincoln Laboratory, for his help with this paper.

References

1) Web site with radar images of volcanoes. *http://www.geology.smu.edu/~dpa-www/venus.html*

2) Winchester, Simon (2004). "*Krakatoa: The Day the World Exploded: August 27, 1883*" Harper Collins Publisher Inc., 10 East 53rd Street, New York, NY 10022, p. 347

3) Winchester, Simon (2004). "*Krakatoa: The Day the World Exploded: August 27, 1883*" p.283

4) Project Pluto, *Guide 8.0*. 168 Ridge Road Bowdoinham, ME 04008. *http://www.projectpluto.com*

5) Robinson, CA, et al, Journal of Geophysical Research, 100 (E6), 11,755-11,763 (1995).

6) Head, J.W., AAPG Annual Meeting, Calgary, Alberta, Canada 76(13) 54 (1992).

7) Association of Lunar and Planetary Observers *http://alpo-astronomy.org*

8) Japan ALPO *http://alpo-j.asahikawa-med.ac.jp/Latest/index.html*

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

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

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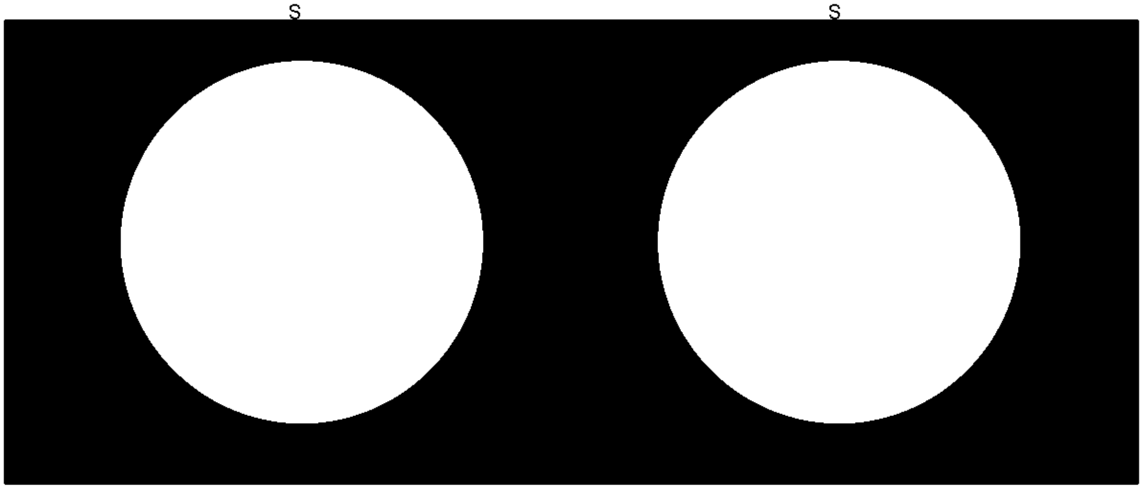

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N (*all coordinates are IAU*) N

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: Mars

Photometric and Polarization Studies in 2005-2008

By Richard Schmude, Jr., assistant coordinator, ALPO Mars Section (photometry & polarimetry)
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Abstract

The writer made 123 Johnson V filter brightness measurements of Mars between February 26, 2007 (L_S = 191°) and June 25, 2008 (L_S = 90°). In addition to this, he made 59 whole-disc polarization measurements of that planet between 2005 and 2008 in light with a wavelength between 0.42 and 0.86 μm. This report summarizes these measurements. The findings of this study are: Mars' brightness was close to what Mallama's model predicted; the average observed minus predicted magnitude between December 1, 2007 and March 31, 2008 was 0.009 ± 0.002 magnitudes. Secondly, dust deposited by the planet-encircling dust storm in the summer of 2007 caused little or no change in Mars' brightness. Thirdly, Mars reflected about the same amount of polarized light (at λ = 0.54 μm) in nearly dust-free conditions during the 2003, 2005 and 2007 apparitions. Fourthly, the amount of polarized light dropped with increased wavelength roughly in proportion to λ^{-4} in nearly dust-free conditions, and finally, the October 2005 dust clouds had different polarization characteristics than those in September 2001.

Introduction

Photometry refers to the measurement of brightness and polarization measurements refer to quantifying the amount of polarized light from an object. Several questions that a long-term photometric and polarization study of Mars can answer are:

1. Is Mars getting more or less cloudy over a 10 to 100 year time span?
2. What is the effect of deposited dust on Mars' brightness and polarization values?
3. How do changing sub-Earth and sub-solar latitudes affect the brightness and color of Mars?
4. How long does it take for dust clouds to dissipate and what role does the relative humidity play in this dissipation?
5. What is the wavelength dependence of polarized light under different meteorological conditions on Mars?

Mallama (2007) published a photometric model of Mars that predicts the Johnson U, B, V, R and I magnitudes of Mars for different solar phase angles, central meridian longitudes and areocentric longitudes - L_s or seasons of Mars. This model, for example, incorporates brightness changes caused by the size and orientation of the polar caps, the seasonal changes in cloud cover on Mars, and the different bright and dark surface features that rotate into view.

The objectives of the current study are:

1. Measure Mars' V filter magnitude in 2007-2008 and compare to Mallama's model;
2. Measure Mars' polarization values at different solar phase angles and determine if the polarization values, in nearly dust-free conditions, are consistent in different apparitions;
3. Measure polarization values at different wavelengths for both a dusty and a nearly dust-free Martian atmosphere; and
4. Measure the effect of deposited dust on Mars' Johnson V filter brightness.

Method and Materials

An SSP-3 solid-state photometer along with a filter that was transformed to the Johnson V system was used for all brightness measurements. A 0.09 meter (3.5 inch) Maksutov telescope was also used in collecting brightness measurements. More information about the equipment can be found elsewhere (Schmude, 1992), (Optec, 1997). The following comparison stars, with dates in parentheses, were used: ζ^2-Sagittarii (Feb. 26, 2007), θ-Capricorni (Mar. 18, 2007), γ-Capricorni (April 17, 2007), α-Arietis (June 28, 2007), ι-Geminorum (Nov. 21-Dec. 12, Dec, 15, 18, Jan. 2, Mar. 5, 13, Apr. 17 and May 5-13), ε-Tauri (Dec. 13, 17, 18, 25-31, Jan. 1, Jan. 2.098, Jan. 3-Mar. 5.051, Mar. 7, 9, and 27) and μ-Leonis (June 1 & 25, 2008). Magnitudes for all of the comparison stars were taken from Iriarte et al. (1965). Table 1 shows the brightness measurements of Mars. In all cases, these values were corrected for both atmospheric extinction and color transformation. The two-star method was used in evaluating color transformation corrections (Hall and Genet, 1988). Figure 1A shows the V filter brightness measurements made between March 18, 2007 and June 1, 2008. In all cases, the uncertainties are smaller than the symbols in the figure.

An SSP-3 solid-state photometer along with a filter close to the Johnson V system, a polarizer and a 0.03 m (1.2 inch) telescope were used in making all polarization measurements except where noted. The same technique and method of analysis used in 2001-2002 (Schmude, 2002, 106) was used in the current study. All polarization measurements made in 2005-

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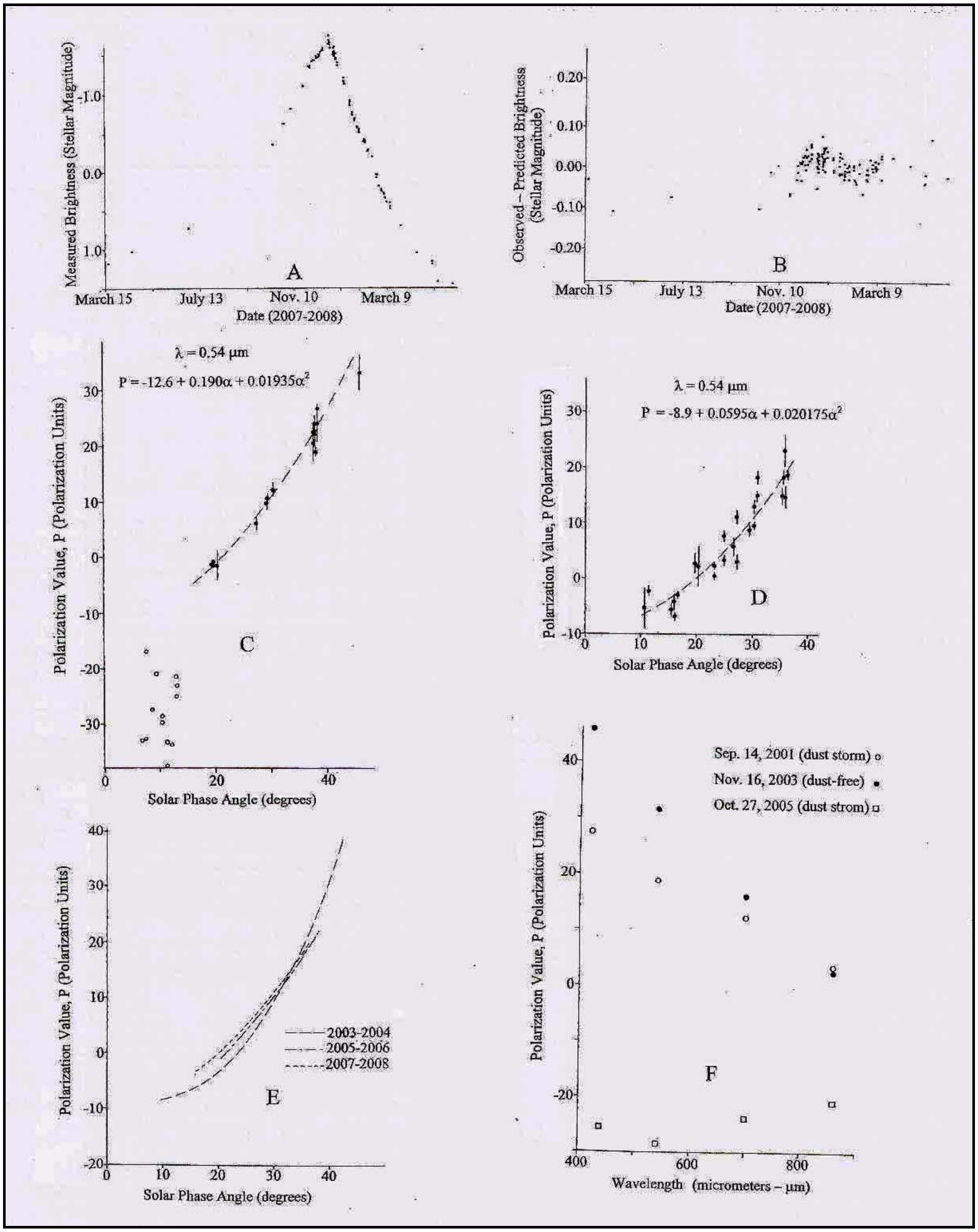


Figure 1A: A graph of the measured Johnson V magnitude of Mars versus the date. In all cases, the uncertainties are smaller than the filled circles.

Figure 1B: A graph of the observed minus predicted brightness value versus the date. In all cases, the predicted magnitude is from Mallama (2007). The uncertainties are roughly twice the size of the filled circles.

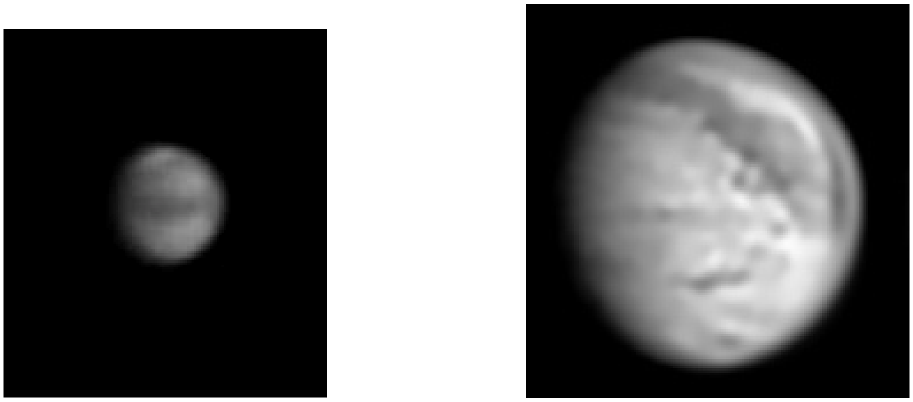
Figure 1C: A graph of the measured polarization value of Mars versus the solar phase angle for 2005-2006. Filled circles are values measured when Mars had nearly dust-free skies and open circles are values measured when dust particles were present.

Figure 1D: A graph of the polarization value versus the solar phase angle for 2007-2008. All data were collected when Mars' atmosphere was nearly free of dust.

Figure 1E: A graph of polarization curves for three different apparitions under nearly dust-free conditions. The curves are all close to each other. This agreement is consistent with Mars having almost the same trend of polarization for different apparitions.

Figure 1F: A graph of the polarization value versus the wavelength on three different dates. Under nearly dust-free conditions, the polarization value drops rapidly with increasing wavelength whereas this is not always the case under dusty conditions.

NOTE: A telescope-detector-filter system close to the Johnson V passband was used in figures 1C, 1D and 1E.



A B

Figure 2. Image A: Mars taken on April 17, 2007 (8:58 UT) by Fabio Carvalho with a 0.25 m (10 inch) Newtonian; the longitude of the central meridian was 239º W. Image B: Mars taken on October 14, 2007 (3:49 UT) by Lorenzo Comolli with a 0.25 m (10 inch) Newtonian; the longitude of the central meridian was 208º W.

2006 and 2007-2008 are summarized in tables 2 and 3 respectively.

Results: Photometry (2007-2008)

Mallama's model (Mallama, 2007) was used along with Mars' positional data in the Astronomical Almanac (2005, 2006) to compute predicted brightness values of Mars. Values of observed minus (-) predicted magnitudes were then computed for each value in Table 1. These values are plotted in Figure 1B. The uncertainties are roughly twice the size of the symbols in the figure.

Mars' brightness was close to what Mallama's model predicted. The overall average observed - predicted values (in stellar magnitudes) for different months were: December 2007 (0.019 ± 0.004), January 2008 (0.011 ± 0.004), February (-0.011 ± 0.005) and March (0.006 ± 0.004). The average observed minus predicted value for the time interval between Dec. 1, 2007 and March 31, 2008 was 0.009 ± 0.002 stellar magnitude. The uncertainty values equal the standard deviation divided by the square root of the number of data points. This is consistent with Mars being about 0.8 percent dimmer than expected. The monthly and overall differences are small and therefore, Mallama's model predicted Mars' brightness well in spite of Mars' different solar phase angles, central meridian longitudes and areocentric longitudes.

Five brightness measurements were made between February 26 and October 14, 2007. Three of these measurements (April 17, June 28 and October 14, 2007) were 0.110, 0.076 and 0.104 magnitudes brighter than expected. The writer has shown that dust storms cause Mars to be up to 0.25 magnitudes brighter than expected (Schmude, 2002, 2004). A large dust or condensate cloud is apparently the reason why Mars was brighter than expected on April 17 and dust is why Mars was brighter than expected on June 28 and October 14, 2007 (Minami et al. 2007a-f). Figure 2A shows a bright cloud in Ausonia and Hellas on April 17, 2007. Figure 2B shows a dust cloud in Eridania on October 14, 2007. A polarization measurement made on October 14, 2007 is also consistent with dust since it was lower than expected and dust lowers polarization values.

During the summer of 2007, a planet encircling dust storm covered much of Mars (Minami et al. 2007a-f). After the dust had settled, astronomers noted several albedo features had a different appearance than before the storm. Photometric measurements, however, indicated little or no change in Mars' Johnson V magnitude as a result of settled dust.

Minami et al (2007g) report that several people imaged a small dust storm in late January of 2008 at 250° W, 50° S. Brightness measurements made on January 28 at 0:04 Universal Time (UT) and 0:32 UT near central meridian longitudes of 278° and 285° W respectively were ~0.03 magnitude brighter than expected, which is consistent with dust.

Results: Polarization (2005-2006 and 2007-2008)

The 2005-2006 polarization measurements are plotted in Figure 1C. Filled circles correspond to a nearly dust-free Martian atmosphere. Open circles correspond to a dusty atmosphere. The lines running through the filled circles are error bars. The effective wavelength for the measurements in Figures 1C - 1E is 0.54 μm with a full-width-at-half-maximum of ~0.09 μm. The data collected under nearly dust-free conditions (all filled circles in Figure 1C) were fitted to a quadratic equation of the form:

$$P = a + b\alpha + c\alpha^2 \qquad (1)$$

where P is the polarization value in polarization units, α is the solar phase angle of Mars in degrees and a, b and c are constants to be determined. The result of this fit is:

$$P = -12.6 + 0.190\alpha + 0.01935\alpha^2 \quad [19.5^\circ < \alpha < 38.5^\circ] \qquad (2)$$

Since the data had α values of between 19.5° and 38.5°, the range of α is stated in brackets. Equation 2 is not valid for α values outside of this range.

The open circles in Figure 1C are about 10 to 30 polarization units lower than expected. This is discussed later in the report.

All 2007-2008 polarization measurements except for the one on October 14, 2007 are plotted in Figure 1D. All of the data in the figure were measured under nearly dust-free conditions. A least squares routine was used in fitting the data in Figure 1D. The result is:

$$P = -8.9 + 0.0595\alpha + 0.020175\alpha^2 \quad [10.4^\circ < \alpha < 36.1^\circ] \qquad (3)$$

Mars reflected about the same amount of polarized light at $\lambda = 0.54$ µm, in nearly dust-free conditions during the 2003, 2005 and 2007 apparitions. Polarization curves from nearly dust-free conditions during these apparitions are shown in Figure 1E. The close agreement points to a consistency from 2003 to 2008 in the polarization behavior of Mars at different α values under a nearly dust-free atmosphere. It will be interesting to see if this consistency continues in the 2010, 2012 and 2014 apparitions when Mars is expected to be much cloudier.

Figure 1F shows polarization values at different wavelengths of light for three different dates. The first set of measurements was taken on Sep. 14, 2001 when Mars had dust clouds and was at $\alpha = 45.3°$. The second set of measurements was made under nearly dust-free conditions on Nov. 16, 2003 and at $\alpha = 40.7°$. The last set of measurements was again made when Mars had a dusty atmosphere on Oct. 27, 2005 at $\alpha = 10.3°$ (Minami et al. 2005). The average error bar was 1.3 polarization units for all data, which is roughly twice the size of the symbols. One reason why the last set of measurements is

Table 1: Photometric Brightness Measurements of Mars Made in 2007-08

Date	Vmag	Date	Vmag	Date	Vmag	Date	Vmag
Feb. 26.468[a]	1.19	Dec. 18.190	-1.58	Jan. 7.006	-1.39	Feb. 14.025	-0.30
Mar. 18.448	1.14	Dec. 25.035	-1.76	Jan. 7.026	-1.42	Feb. 14.044	-0.27
Apr. 17.416	1.02	Dec. 25.083	-1.70	Jan. 13.106	-1.18	Feb. 19.127	-0.20
June 28.372	0.72	Dec. 25.158	-1.66	Jan. 13.179	-1.23	Feb. 24.022	0.03
Oct. 14.370	-0.36	Dec. 25. 176	-1.64	Jan. 14.033	-1.16	Feb. 24.039	0.03
Oct. 28.401	-0.64	Dec. 25.274	-1.66	Jan. 14.047	-1.15	Feb. 25.104	0.03
Nov. 6.456	-0.83	Dec. 26.051	-1.69	Jan. 21.024	-0.88	Feb. 25.145	0.07
Nov. 21.250	-1.11	Dec. 26.067	-1.67	Jan. 21.042	-0.92	Feb. 25.185	0.04
Nov. 21.267	-1.10	Dec. 26.139	-1.67	Jan. 21.084	-0.87	Feb. 28.053	0.17
Nov. 30.197	-1.37	Dec. 27.088	-1.67	Jan. 21.101	-0.91	Feb. 28.124	0.17
Dec. 1.165	-1.38	Dec. 27.107	-1.67	Jan. 21.167	-0.91	Mar. 2.028	0.21
Dec. 1.210	-1.36	Dec. 27.167	-1.66	Jan. 21.186	-0.94	Mar. 2.163	0.23
Dec. 4.162	-1.43	Dec. 27.259	-1.64	Jan. 25.009	-0.76	Mar. 3.036	0.25
Dec. 5.434	-1.44	Dec. 27.319	-1.60	Jan. 25.033	-0.79	Mar. 5.031	0.28
Dec. 5.479	-1.46	Dec. 31.107	-1.54	Jan. 28.003	-0.70	Mar. 5.051	0.29
Dec. 6.153	-1.46	Dec. 31.124	-1.57	Jan. 28.022	-0.69	Mar. 5.142	0.29
Dec. 6.170	-1.46	Dec. 31.230	-1.52	Jan. 28.088	-0.70	Mar. 5.185	0.28
Dec. 7.149	-1.44	Dec. 31.995	-1.60	Jan. 28.103	-0.69	Mar. 7.034	0.34
Dec. 10.133	-1.47	Jan. 1.014, 2008	-1.61	Jan. 28.163	-0.69	Mar. 7.055	0.33
Dec. 10.150	-1.50	Jan. 1.090	-1.57	Jan. 31.006	-0.61	Mar. 9.049	0.39
Dec. 11.150	-1.47	Jan. 1.106	-1.56	Jan. 31.174	-0.59	Mar. 13.041	0.40
Dec. 11.167	-1.53	Jan. 1.258	-1.51	Feb. 2.033	-0.56	Mar. 13.088	0.45
Dec. 12.149	-1.51	Jan. 1.273	-1.50	Feb. 2.051	-0.57	Mar. 13.103	0.47
Dec. 13.102	-1.53	Jan. 1.301	-1.52	Feb. 2.144	-0.52	Mar. 27.038	0.69
Dec. 13.118	-1.50	Jan. 2.013	-1.55	Feb. 2.178	-0.52	Apr. 17.083	1.06
Dec. 15.200	-1.56	Jan. 2.098	-1.52	Feb. 8.031	-0.43	May 5.063	1.16
Dec. 17.130	-1.57	Jan. 3.008	-1.52	Feb. 8.048	-0.43	May 6.099	1.19
Dec. 17.142	-1.57	Jan. 3.165	-1.49	Feb. 8.118	-0.41	May 13.092	1.42
Dec. 18.066	-1.60	Jan. 4.026	-1.53	Feb. 9.039	-0.43	June 1.089	1.44
Dec. 18.081	-1.58	Jan. 4.100	-1.46	Feb. 10.015	-0.41	June 25.085	1.58[a]
Dec. 18.167	-1.58	Jan. 5.004	-1.48	Feb. 11.019	-0.39		

[a]Measurements made on February 26, 2007 and June 25, 2008 have larger uncertainties than the other values and are not plotted in Figures 1A and 1B.

Table 2: Polarization Measurements of Mars in 2005-2006 (All measurements done with an SSP-3 photometer and a filter close to the Johnson V standard except where noted in parentheses.)

Date	Polarization Value [a]	Date	Polarization Value [a,b]	Date	Polarization Value [a]
June 15.364, 2005	33.1	Oct. 24.154	-21.8	Oct. 30.153	-16.9
Sep. 30.244	12.1	Oct. 25.187	-33.8	Oct. 30.264	-32.2
Oct. 2.184	10.7	Oct. 26.115	-33.3	Oct. 31.130	-33.0
Oct. 2.208	9.7	Oct. 26.165	-35.6	Jan. 31.191, 2006	22.1
Oct. 5.256	6.1	Oct. 27.094	-29.8	Feb. 1.163	19.8
Oct. 15.193	-1.6	Oct. 27.149	-28.6	Feb. 8.167	24.1
Oct. 16.238	-0.8	Oct. 27.168	-25.4 (B)	Feb. 14.114	26.9
Oct. 16.269	-1.5	Oct. 27.189	-20.8 (I)	Feb. 27.054	24.0
Oct. 16.326	-1.5	Oct. 27.208	-23.9 (R)	Feb. 27.096	22.8
Oct. 24.106	-23.1	Oct. 28.201	-20.9	Mar. 3.083	20.6
Oct. 24.130	-24.9	Oct. 29.158	-27.4	Mar. 4.092	22.4

[a]Measured in polarization units

[b](B) = Johnson B filter; (I) = Johnson I filter and (R) = Johnson R filter

so low is because it was made at a much smaller solar phase angle than the other two data sets. The low values are also due to the presence of dust clouds.

The inversion angle is the solar phase angle at which the polarization value changes from negative to positive. This angle depends on Mars' cloud conditions. Dust clouds will yield a high value of the inversion angle whereas condensate clouds yield a low value of this quantity (Dollfus, 1961). The measured inversion angles under nearly dust-free conditions (λ = 0.54 μm) for the 2003, 2005 and 2007 apparitions were 23.1° ± 1.0°, 21.1° ± 1.0° and 19.6° ± 2.0° respectively. The uncertainties are estimated values based on the number of data points and the error bars associated with the data. The inversion angle changes with different wavelengths of light (Ebisawa and Dollfus, 1993); furthermore, it undoubtedly depends on whether Mars' whole disc is being measured or if just part of it is being measured (Dollfus, 1961). It is for these reasons that it is difficult to compare the 2003-2007 inversion angles with previous studies (Dollfus, 1961); (Ebisawa and Dollfus, 1993).

Ebisawa and Dollfus (1993) reported a new Martian atmospheric feature based

Table 3: Polarization Measurements of Mars in 2007-2008 (All measurements done with an SSP-3 photometer and a filter close to the Johnson V standard except where noted in parentheses.)

Date	Polarization Value [a]	Date	Polarization Value [a]	Date	Polarization Value [a]
Oct. 14.407, 2007	16.0	Jan. 25.061	2.3	Feb. 10.065	9.7
Nov. 30.177	2.2	Jan. 25.130	0.7	Feb. 11.055	15.0
Dec. 1.186	2.8	Jan. 28.050	3.5	Feb. 11.189	18.3
Dec. 6.193	-6.9	Jan. 28.128	7.9	Mar. 3.065	15.3
Dec. 7.169	-5.7	Jan. 31.147	5.9	Mar. 5.084	18.3
Dec. 13.143	-5.2	Feb. 2.083	11.3	Mar. 6.043	23.3
Jan. 7.059, 2008	-2.2	Feb. 2.170	3.1	Mar. 7.105	14.6
Jan. 13.152	-4.2	Feb. 8.084	8.9	Mar. 9.084	18.9
Jan. 14.072	-2.9	Feb. 10.038	13.1		

[a]Measured in polarization units

on their polarization data. They describe this feature as being either transparent to visible light or having a yellowish color, and forming over the Hellas, Thaumasia, Tempe or Arcadia regions. It is also apparent that this feature has a much lower polarization value than expected; furthermore, polarization values of this feature have a large scatter. In all cases, this new feature was associated with either a dust storm or residual dust from a previous storm (McKim, 1999). The writer detected a similar feature in late October, 2005, which had the following characteristics: First, its polarization value was 10 to 30 polarization units lower than expected (see open circles in Figure 1C), and second, its polarization values were scattered much more than values measured in nearly dust-free conditions. In addition to this, the polarization value of this irregularity did not drop with increasing wavelength. See Figure 1F.

The amount of polarized light dropped with increased wavelength roughly in proportion to λ^{-4} when Mars' atmosphere was nearly dust-free on November 16, 2003. The polarization values measured during the large 2001 dust storm fell off with increasing wavelength but not as rapidly as for the nearly dust-free atmosphere. The polarization values measured on Oct. 27, 2005 did not decrease with increasing wavelength; this is different than for the dusty conditions on Sep. 14, 2001. Essentially the dust clouds on these two dates had different polarization characteristics. The dust storm on Oct. 27, 2005 appears to be similar to the February 1978 event summarized by Ebisawa and Dollfus (1993). Therefore, because of the different trend of polarization value with increasing wavelength, it is concluded that the dust clouds in September of 2001 and October of 2005 were different but the nature of this difference is not well known. Perhaps the particle size distribution was different or more water ice condensed on the dust particles in one of the dust storms.

Dust apparently has little or no effect on the I filter polarization value. In fact, dust may cause a small increase in the polarization values taken with that filter. More data in future apparitions are needed to measure the effect of Martian dust on the I filter polarization value.

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References

Astronomical Almanac for the Year 2007, Washington DC: US Govt. Printing Office, 2005.

Astronomical Almanac for the Year 2008, Washington DC: US Govt. Printing Office, 2006.

Dollfus, A. "Polarization Studies of Planets" in "Planets and Satellites" (G. P. Kuiper and B. M. Middlehurst - editors) Chicago: The University of Chicago Press, pp. 343-399, 1961.

Ebisawa, S and Dollfus, A. "*Dust in the Martian atmosphere: polarimetric sensing*" *Astronomy and Astrophysics,* Vol. 272, pp. 671-686, 1993.

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

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

Mallama, A. "*The magnitude and albedo of Mars*" *Icarus*, Vol. 192, pp. 404-416, 2007.

McKim, R. J. "Telescopic Martian Dust Storms: A Narrative and Catalogue" *Memoirs of the British Astronomical Association*, Vol. 44, pp. 1-165, 1999.

Minami, M., Murakami, M., Nakajima, T., Nishita, A. and Tsunemachi, H. "*Communications in Mars Observations, No. 312*" Published by the OAA Mars Section, 2005.

Minami, M., Murakami, M., Nakajima, T., Nishita, A. and Tsunemachi, H. "*Communications in Mars Observations, No. 333*" Published by the OAA Mars Section, 2007a.

Minami, M., Murakami, M., Nakajima, T., Nishita, A. and Tsunemachi, H. "*Communications in Mars Observations, No. 334*" Published by the OAA Mars Section, 2007b.

Minami, M., Murakami, M., Nakajima, T., Nishita, A. and Tsunemachi, H. "*Communications in Mars Observations, No. 335*" Published by the OAA Mars Section, 2007c.

Minami, M., Murakami, M., Nakajima, T., Nishita, A. and Tsunemachi, H. "*Communications in Mars Observations, No. 336*" Published by the OAA Mars Section, 2007d.

Minami, M., Murakami, M., Nakajima, T., Nishita, A. and Tsunemachi, H. "*Communications in Mars Observations, No. 344*" Published by the OAA Mars Section, 2007e.

Minami, M., Murakami, M., Nakajima, T., Nishita, A. and Tsunemachi, H. "*Communications in Mars Observations, No. 347*" Published by the OAA Mars Section, 2007f.

Minami, M., Murakami, M., Nakajima, T., Nishita, A. and Tsunemachi, H. "*Communications in Mars Observations, No. 343*" Published by the OAA Mars Section, 2007g.

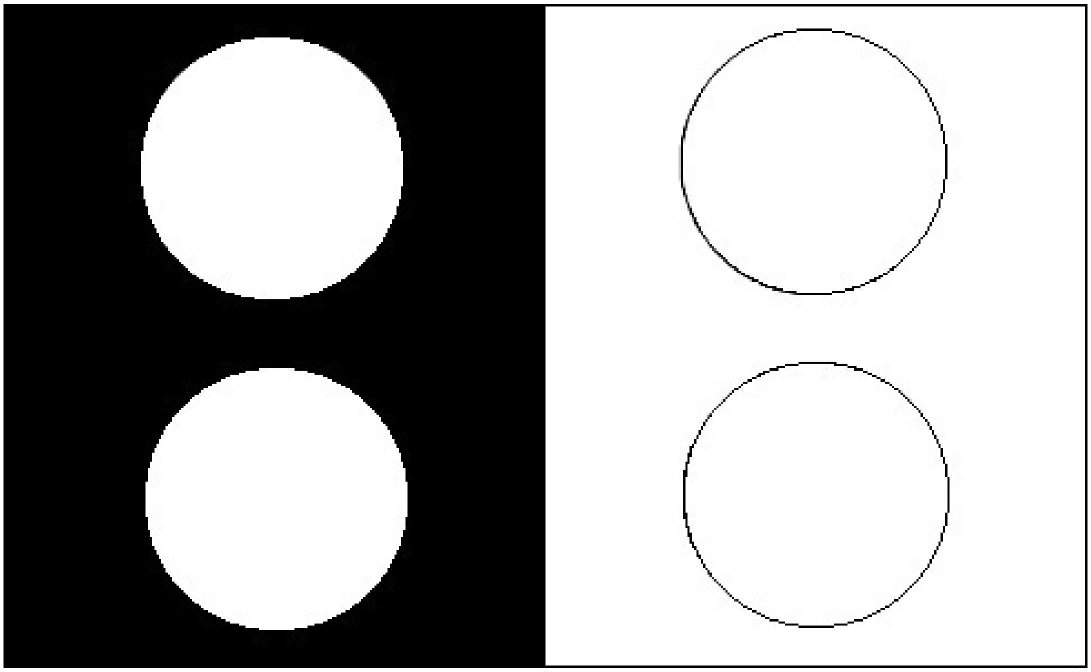
Optec Inc. "Model SSP-3 Solid-State Stellar Photometer Technical Manual for Theory of Operation and Operating Procedures, Revision 3, Lowell MI: Optec Inc., 1997.

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

Schmude, R. W. Jr. "*Photometric and Polarimetric Observations of Mars in 2000-2002*" *Journal of the Royal Astronomical Society of Canada*, Vol. 96, pp. 105-110, 2002.

Schmude, R. Jr. et al. "*ALPO Observations of the 2003 Apparition of Mars*" *Journal of the Assn. of Lunar and Planetary Observers*, Vol. 46, No. 4, pp. 28-45, 2004.

A.L.P.O. Mars Section Observation



Top: Time (UT):______________________ Bottom: Time (UT):______________________
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Telescope:______ f/_____ (in. / cm. ; RL . RR . SC)
Magnification:________x ________x ________x
Filters:________________________ (W / S)
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Transparency (1-6):______(Clear / Haze / Int. Clouds)
Blue (Violet) Clearing (0-3):__________

Observer:__________________________
Address:__________________________

Observing Station:__________________________
E-mail (optional):__________________________

Notes

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Feature Story:

ALPO Observations of Saturn During the 2005 - 2006 Apparition

By: Julius L. Benton, Jr.,
Coordinator, ALPO Saturn Section
E-mail: jlbaina@msn.com & jlbaina@gmail.com

This paper includes a gallery of Saturn images submitted by a number of observers.

A complete set of Saturn Observing Forms for use with the current (2008-2009 Saturn apparition) are available for downloading at *http://www.alpo-astronomy.org/publications/ALPO Section Publications/SaturnReportForms - All.pdf*

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Abstract

For the 2005-06 apparition (from August 23, 2005 through June 12, 2006) the ALPO Saturn Section received 414 visual observations and digital images submitted by 50 observers in the United States, Germany, Romania, Japan, France, Canada, Philippines, Italy, United Kingdom, Spain, and The Netherlands. Apertures used to perform observations ranged from 12.5 cm (4.9 in.) up to 76.2 cm (30.0 in.). Saturn observers occasionally reported discrete, short-lived dark features in the South Equatorial Belt (SEB) during the observing season, as well as small enduring white spots in the South Polar Region (SPR), the South Equatorial Belt Zone (SEBZ) and South Tropical Zone (STrZ). The SEBZ and STrZ white spots, first detected in November and December 2005, exhibited notable changes in morphology as the apparition progressed. A few recurring central meridian (CM) transit timings were submitted for some of these features. The inclination of Saturn's ring system toward Earth, **B**, attained a maximum value of –20.21° on April 4. 2006, so observers could view and image considerable portions of Saturn's Southern Hemisphere and the South face of the rings throughout the observing season. With the diminishing ring tilt, regions of the Northern Hemisphere, such as the North Polar Cap (NPC) and North Polar Region (NPR), were becoming accessible to our Earth-based telescopes. A summary of visual observations and digital images of Saturn contributed during the apparition are discussed, including the results of continuing efforts to image

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

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
- Ring B has been adopted (for most apparitions when Ring B can be seen) as the standard on the numerical sequence. The outer third is the brightest part of Ring B, and it has a stable intensity of 8.0 in integrated light (no filter). All other features on the globe and in the rings are estimated using this standard of reference.

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

Scale of Transparency Conditions:
- Magnitude of the faintest star visible near Saturn when allowing for daylight and twilight

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

Instrument Abbreviations

- REF = Refractor
- NEW = Newtonian reflector
- CAS = Cassegrain
- SCT = Schmidt-Cassegrain
- MAK = Maksutov
- DAL = Dall-Kirkham
- TRI = Trischiefspiegler

Table 1: Geocentric Phenomena in Universal Time (UT) for Saturn During the 2005-2006 Apparition

Conjunction		2005	Jul	23^{d}	17^{h} UT
Opposition		2006	Jan	27^{d}	23^{h}
Conjunction		2006	Aug	07^{d}	12^{h}
Opposition Data					
Visual Magnitude		–0.20			
Constellation		Cancer			
B		–18.85°			
B'		–18.83°			
Globe	Equatorial Diameter	20.45"			
	Polar Diameter	18.65"			
Rings	Major Axis	46.41"			
	Minor Axis	15.00″			

Table 2: 2005-06 Apparition of Saturn: Contributing Observers

	Observer	Location	No. of Observations	Telescopes Used
1.	Acquarone, Fabio	Genova, Italy	1 2	23.5 cm (9.25 in.) SCT 31.8 cm (12.5 in.) TRI
2.	Adelaar, Jan	Arnhem, The Netherlands	5	23.5 cm (9.25 in.) SCT
3.	Allen, Ethan	Sebastopol, CA	2	30.5 cm (12.0 in.) NEW
4.	Arditti, David	Middlesex, UK	9	25.4 cm (10.0 in.) DAL
5.	Baldoni, Paolo	Forca Canapine, Italy	1	26.1 cm (10.3 in.) NEW
6.	Bee, Ron	San Diego, CA	3	12.7 cm (5.0 in.) REF
7.	Benton, Julius L.	Wilmington Island, GA	50	15.2 cm (6.0 in.) REF
8.	Boisclair, Norman J.	S. Glens Falls, NY	4 2	50.8 cm (20.0 in.) NEW 76.2 cm (30.0 in.) NEW
9.	Bosman, Richard	Enschede, The Netherlands	96	28.0 cm (11.0 in.) SCT
10.	Casquinha, Paolo	Palmela, Portugal	4	25.4 cm (10.0 in.) NEW
11.	Chavez, Rolando	Powder Springs, GA	1	31.8 cm (12.5 in.) NEW
12.	Chester, Geoff	Alexandria, VA	4 2	20.3 cm (8.0 in.) SCT 66.0 cm (26.0 in.) REF
13.	Cudnik, Brian	Houston, TX	5 5	20.3 cm (8.0 in.) SCT 35.6 cm (14.0 in.) SCT
14.	Delcroix, Marc	Tournefeuille, France	4	25.4 cm (10.0 in.) SCT
15.	Dickinson, Bill	Glen Allen, VA	2	20.3 cm (8.0 in.) SCT
16.	Fattinnanzi, Cristian	Macerata, Italy	6	25.4 cm (10.0 in.) NEW
17.	Fisher, Jim	Austin, TX	2	25.4 cm (10.0 in.) NEW
18.	Friedman, Alan	Buffalo, NY	1	25.4 cm (10.0 in.) NEW
19.	Go, Christopher	Cebu City, Phillipines	9	28.0 cm (11.0 in.) SCT
20.	Grafton, Ed	Houston, TX	1	35.6 cm (14.0 in.) SCT
21.	Grage, Terry	Kissimmee, FL	1	20.3 cm (8.0 in.) SCT
22.	Heard, Kieron	Suffolk, UK	4	20.3 cm (8.0 in.) SCT
23.	Ikemura, Toshihiko	Osaka, Japan	10	31.0 cm (12.2 in.) NEW
24.	Jefferson, James	Middlesex, UK	16	12.5 cm (4.9 in.) SCT
25.	Kingsley, Bruce	Berkshire, UK	1	28.0 cm (11.0 in.) SCT
26.	Lawrence, Pete	Selsey, UK	1	25.4 cm (10.0 in.) NEW
27.	Lazzarotti, Paolo	Massa, Italy	4	25.4 cm (10.0 in.) DAL
28.	Lepine, Thierry	Saint Etienne, France	1	35.6 cm (14.0 in.) SCT
29.	Lomeli, Ed	Sacramento, CA	9	23.5 cm (9.25 in.) SCT
30.	Maxson, Paul	Phoenix, AZ	38	25.4 cm (10.0 in.) CAS
31.	Mazzotti, Cristina	Ravenna, Italy	1	30.5 cm (12.0 in.) SCT
32.	Melillo, Frank J.	Holtsville, NY	5	20.3 cm (8.0 in.) SCT
33.	Melka, Jim	St. Louis, MO	2	30.5 cm (12.0 in.) SCT
34.	Mobberley, Martin	Suffolk, UK	3	25.4 cm (10.0 in.) NEW
35.	Niechoy, Detlev	Göttingen, Germany	8	20.3 cm (8.0 in.) SCT
36.	Owens, Larry	Alpharetta, GA	3	35.6 cm (14.0 in.) SCT
37.	Parker, Donald C.	Coral Gables, FL	3	40.6 cm (16.0 in.) NEW
38.	Peach, Damian	Norfolk, UK	40	35.6 cm (14.0 in.) SCT
39.	Pellier, Christophe	Bruz, France	12	21.0 cm (8.3 in.) CAS
40.	Phillips, Jim	Charleston, SC	9	20.3 cm (8.0 in.) REF
41.	Plante, Phil	Braceville, OH	1 2	15.2 cm (6.0 in.) NEW 63.5 cm (25.0 in.) NEW
42.	Robbins, Sol	Fair Lawn, NJ	3 3	15.2 cm (6.0 in.) REF 24.8 cm (9.75 in.) NEW
43.	Roussell, Carl	Hamilton, ON, Canada	18	15.2 cm (6.0 in.) REF
44.	Sanchez, Jesus	Cordoba, Spain	6	28.0 cm (11.0 in.) SCT
45.	Sharp, Ian	West Sussex, UK	11	28.0 cm (11.0 in.) SCT
46.	Tasselli, Andrea	Florence, Italy	3 18	20.3 cm (8.0 in.) SCT 24.5 cm (9.6 in.) NEW
47.	Teodorescu, Maxmillian	Bucharest, Hungary	1	23.5 cm (9.25 in.) SCT
48.	Tyler, David	High Wycombe, Bucks, UK	21	35.6 cm (14.0 in.) SCT

Table 2: 2005-06 Apparition of Saturn: Contributing Observers (cont'd)

	Observer	Location	No. of Observations	Telescopes Used
49.	Vandebergh, Ralf	Maastricht, Netherlands	20	24.5 cm (9.6 in.) NEW
50.	Venable, Roger	Wrens, GA	2	28.0 cm (11.0 in.) SCT
	TOTAL NO. OBSERVATIONS		414	
	TOTAL NO. OBSERVERS		50	

Instrumentation Abbreviations:
REF = Refractor, NEW = Newtonian, CAS = Cassegrain, SCT = Schmidt-Cassegrain, MAK= Maksutov, DAL = Dall-Kirkham, TRI = Trischiefspiegler

the bicolored aspect and azimuthal brightness asymmetries of the rings. Accompanying the report are references, drawings, photographs, digital images, graphs, and tables.

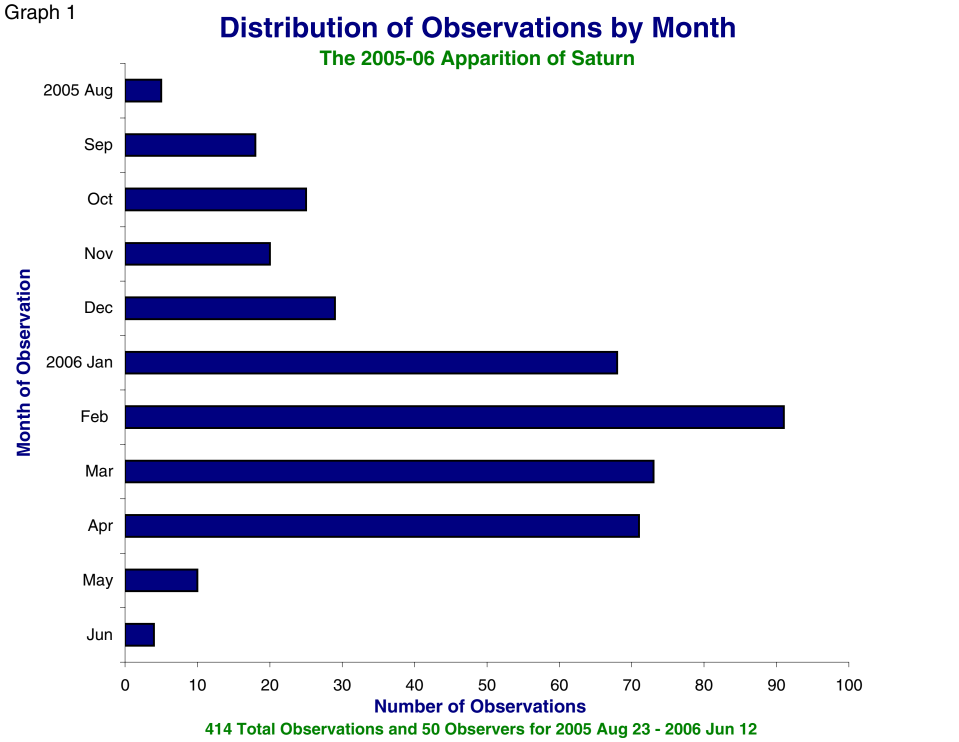
Introduction

This report is derived from an analysis of 414 visual observations and digital images that were contributed to the ALPO Saturn Section by 50 observers from August 23, 2005 through June 12, 2006, herein referred to as the 2005-06 "observing season" or apparition of Saturn. A selection of drawings and images accompany this report and are integrated as much as possible with topics discussed in the text. All times and dates mentioned in this observational summary are in Universal Time (UT).

Table 1 gives geocentric data in Universal Time (UT) for the 2005-06 apparition of Saturn. During this observing season, the numerical value of **B**, or the Saturnicentric latitude of the Earth referred to the ring plane (+ when north), ranged between the extremes of -17.43° (November 18, 2005) and -20.21° (April 4, 2006). The value of **B′**, the saturnicentric latitude of the Sun, varied from -20.64° (August 23, 2005) to -17.12° (June 12, 2006).

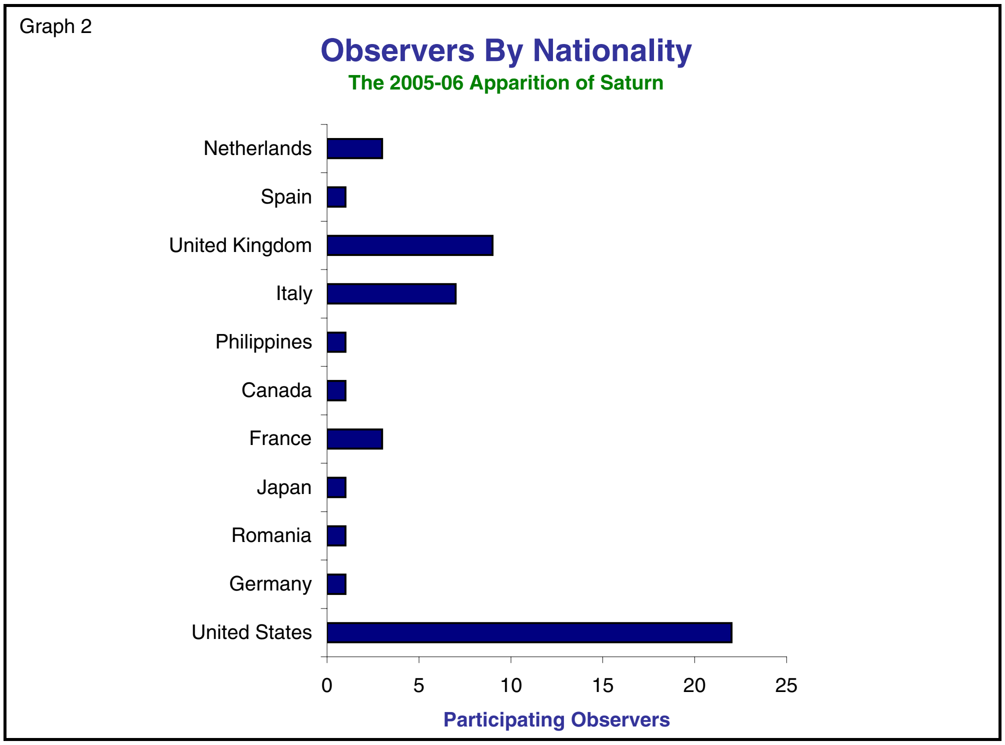
Table 2 lists the 50 individuals who together submitted 414 reports to the ALPO Saturn Section this apparition, along with their observing sites, number of observations, telescope apertures, and types of instrument. Graph 1 is a histogram illustrating the distribution of observations by month, where it is can be seen that 35.27% were made prior to opposition, 0.97% at opposition (January 27, 2006), and 63.77% thereafter. There is a continuing natural tendency for people to view Saturn around the date of opposition when the planet is well-placed high in the evening sky (73.19% of all observations occurred from January through April 2006); but to provide better coverage, observers are strongly urged to start viewing, drawing, and imaging Saturn as soon as it appears in the eastern sky before sunrise right after conjunction. Our objective is to conduct regular observational work for as much of the planet's mean synodic period of 378^d as possible (this period is the time elapsed between one conjunction of Saturn with the Sun to the next, which is slightly longer than one terrestrial year).

Graph 1



Graph 2 and Graph 3 show the ALPO Saturn Section observing base and the international distribution of all observations contributed during the apparition. The United States accounted for somewhat less than half of the participating observers (44.0%) and slightly more than a third of the submitted observations (39.86%). With 56.0% of all observers residing in Germany, Romania, Japan, France, Canada, Philippines, Italy, United Kingdom, Spain, and The Netherlands, whose total contributions represented 60.14% of the observations, international cooperation remained strong this observing season.

Graph 4 graphs the number of observations this apparition by instrument type. As in the immediately preceding observing season, about half (52.90%) of all observations were made with telescopes of classical design (refractors, Newtonian reflectors, and Cassegrains). Classical designs with superb optics and good collimation often produce high-resolution images with excellent contrast, undoubt-



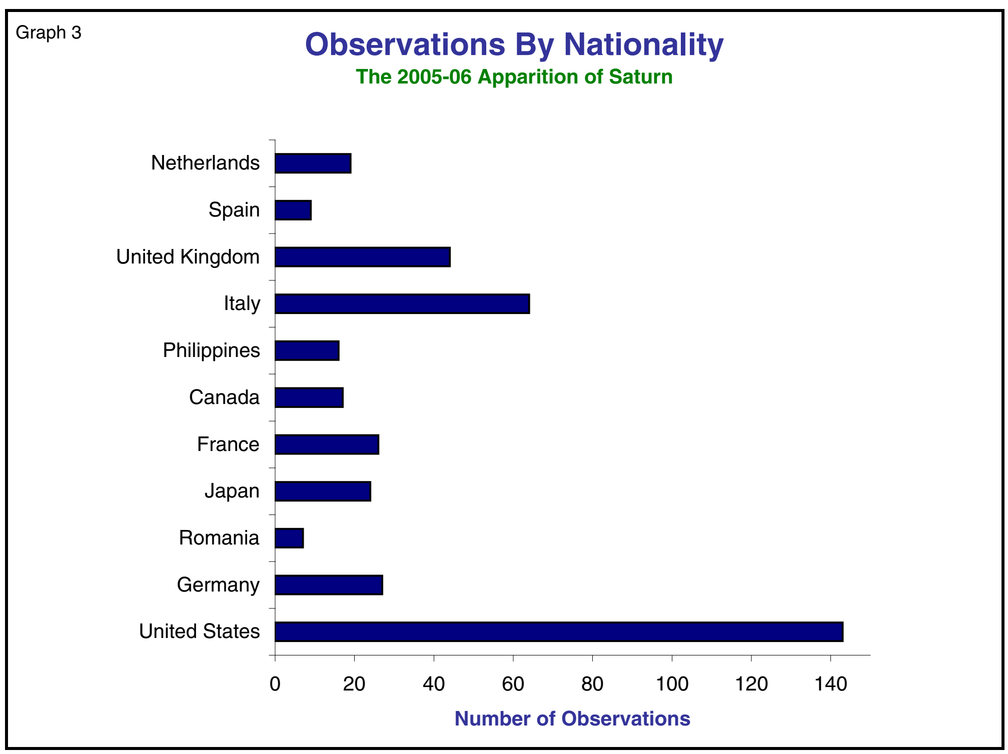
edly the reason they have traditionally been the instruments of choice for visual studies of the Moon and planets. In recent apparitions, however, since a wide variety of adapters are readily available to couple digital imagers to them, the usage of comparatively compact and portable Schmidt-Cassegrains and Maksutov-Cassegrains has been growing. It has been demonstrated that such instruments equipped with high-quality, well-collimated optics produce really fine images of Saturn.

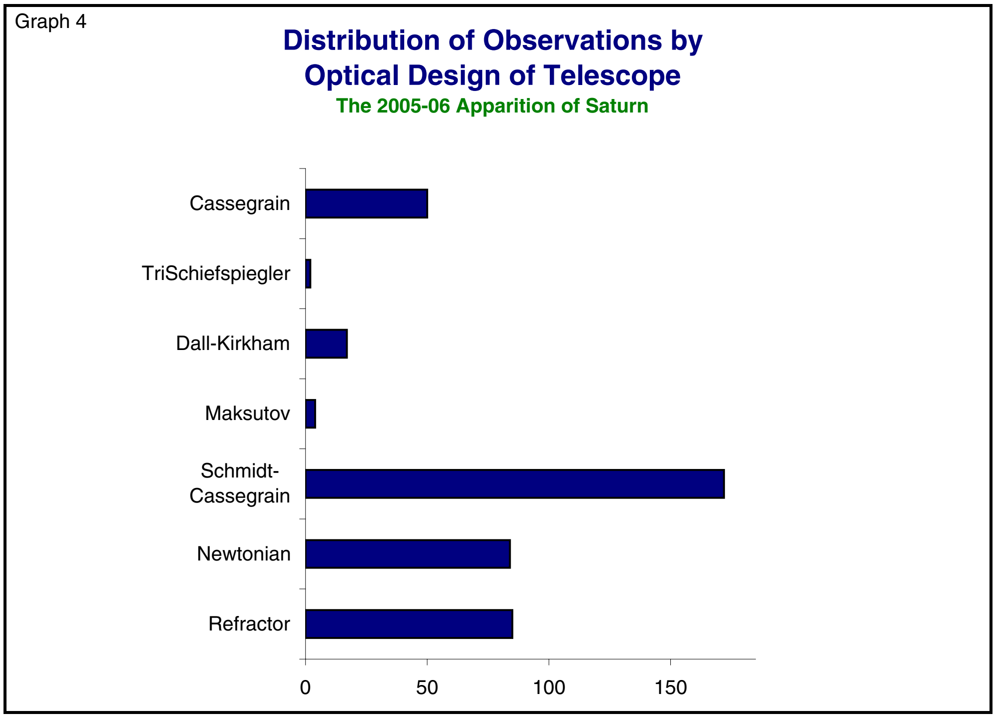
Telescopes with apertures of 15.2 cm (6.0 in.) or larger accounted for 95.41% of the observations contributed this apparition. That being the case, there are many historical instances where much smaller instruments of excellent quality ranging from 10.2 cm (4.0 in.) to 12.7 cm (5.0 in.) have been useful for many aspects of our Saturn observing programs.

The ALPO Saturn Section truly appreciates the diligent efforts of all contributors listed in Table 2 for their submitted data, digital images, descriptive reports, and excellent drawings during the 2005-06 apparition. Those who wish to participate in regular observational studies of Saturn employing visual methods (i.e., drawings, intensity and latitude estimates, and CM transit timings), regular photography, or more contemporary digital imaging techniques are invited to do so in upcoming apparitions as we seek to maintain international cooperative studies of the planet. All methods of recording observations, such as those cited above, are considered crucial to the success of our programs, whether there is a preference for sketching Saturn at the eyepiece or simply writing descriptive reports, making visual numerical relative intensity or latitude estimates, or pursuing film photography or digital imaging. The ALPO Saturn Section is always happy to receive contributions from beginning observers, and the author will be delighted to provide assistance as they become acquainted with our programs.

The Globe of Saturn

The excellent collection of 414 observations submitted to the ALPO Saturn Section in 2005-06 were used in preparing this summary of the observing season. Except in captions accompanying figures or in those instances where the identity of individuals is relevant to the discussion, names have been omitted for the sake of brevity. Drawings, digital images, tables, and graphs are included herewith so that readers may refer to them as they study the text. Features on the globe of Saturn are described in south-to-north order and can be identified by referring to the nomenclature diagram shown in Graph 5. If no reference is made to a global feature in our south-to-north discussion, the area was not reported by observers during the 2005-06 apparition. It has been customary in Saturn apparition reports to compare data for global atmospheric features between consecutive observing seasons,





and this process continues in this report to help make readers aware of very subtle, but nonetheless recognizable, variations that may be occurring seasonally on the planet.

Small intensity fluctuations of Saturn's atmospheric features (Table 3) may simply be a consequence of the varying inclination of the planet's rotational axis relative to the Earth and Sun, and photometric studies have also shown that tiny oscillations of as much as 0.10 in the visual magnitude of Saturn over nearly a decade occur. Transient and longer-lasting atmospheric features seen or imaged in various belts and zones on the globe also probably play a role in apparent brightness fluctuations. Regular photoelectric photometry of Saturn, in conjunction with carefully-executed visual numerical relative intensity estimates, is encouraged.

The intensity scale routinely employed by Saturn observers is the "ALPO Standard Numerical Relative Intensity Scale," where 0.0 denotes a total black condition (e.g., complete shadow) and 10.0 is the maximum brightness of a feature or phenomenon (e.g., an unusually bright EZ or dazzling white spot). This numerical scale is normalized by setting the outer third of Ring B at a "standard" intensity of 8.0. The arithmetic sign of an intensity change is determined by subtracting a feature's 2004-05 intensity from its 2005-06 value. Suspected variances of 0.10 mean intensity points are usually considered insignificant, while reported changes in intensity that do not equal or exceed roughly three times the standard error are seldom considered noteworthy.

It is always worthwhile to compare images of Saturn made by amateurs using different apertures, digital imagers, and filter techniques to try to understand the level of detail seen, including any correlation with spacecraft imaging and results from professional observatories, and lastly, how they relate to visual impressions of the globe and rings. Thus, in addition to routine visual studies, Saturn observers should carefully and systematically image the planet every possible clear night to try to capture individual features on the globe and in the rings, their motion and morphology (including changes in intensity and hue), to serve as input for combination with images taken by professional ground-based observatories and spacecraft monitoring Saturn at close range. Furthermore, comparing images captured over several apparitions for a given hemisphere of Saturn's globe provides information on seasonal changes long suspected by observers making visual numerical relative intensity estimates. It is important to point out that images (and systematic visual observations) by amateurs often serve as initial alerts of interesting large-scale features on Saturn that professionals may not already know about but can subsequently examine further with larger specialized instrumentation.

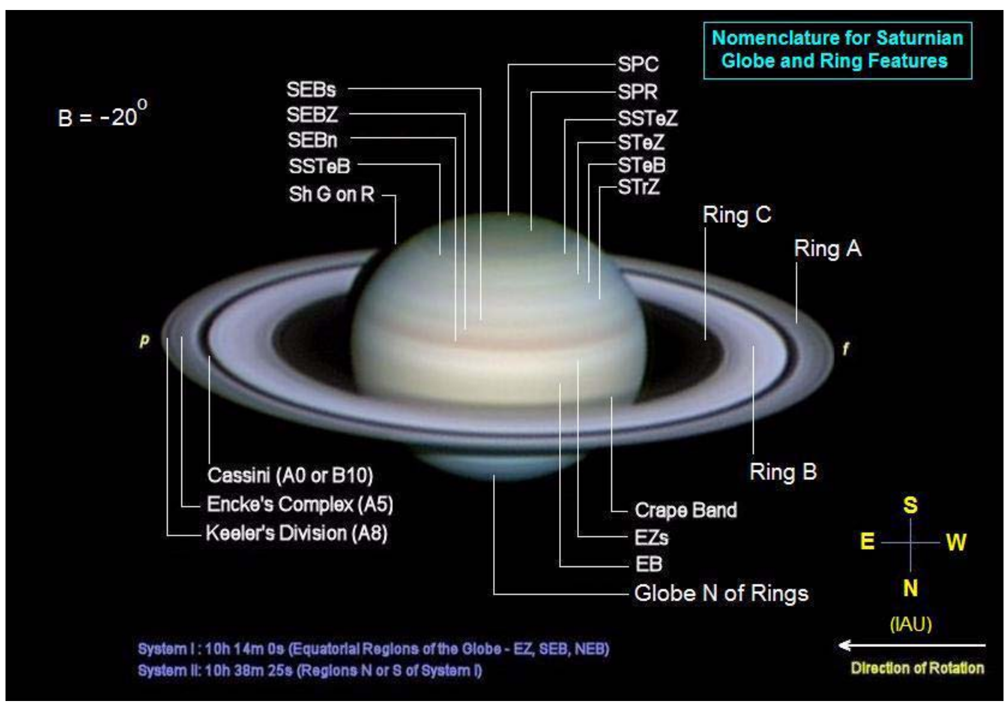


Figure 1. Nomenclature for Saturnian globe and ring features.

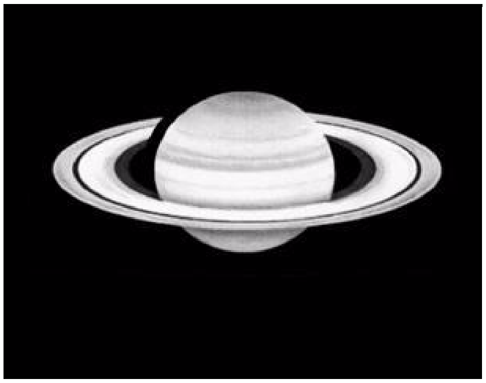


Figure 2. 2005 Dec 14 07:22 UT. Sol Robbins. 15.2 cm (6.0 in.) REF. Drawing at 350-400X, IL. S = 7.0, Tr not specified. CMI = 67.1°, CMII = 292.36°, CMIII = 124.6° B = –17.7°, B´ = –19.3°. Dark SPC is surrounded by a lighter SPR. S is at top and E at left (IAU).

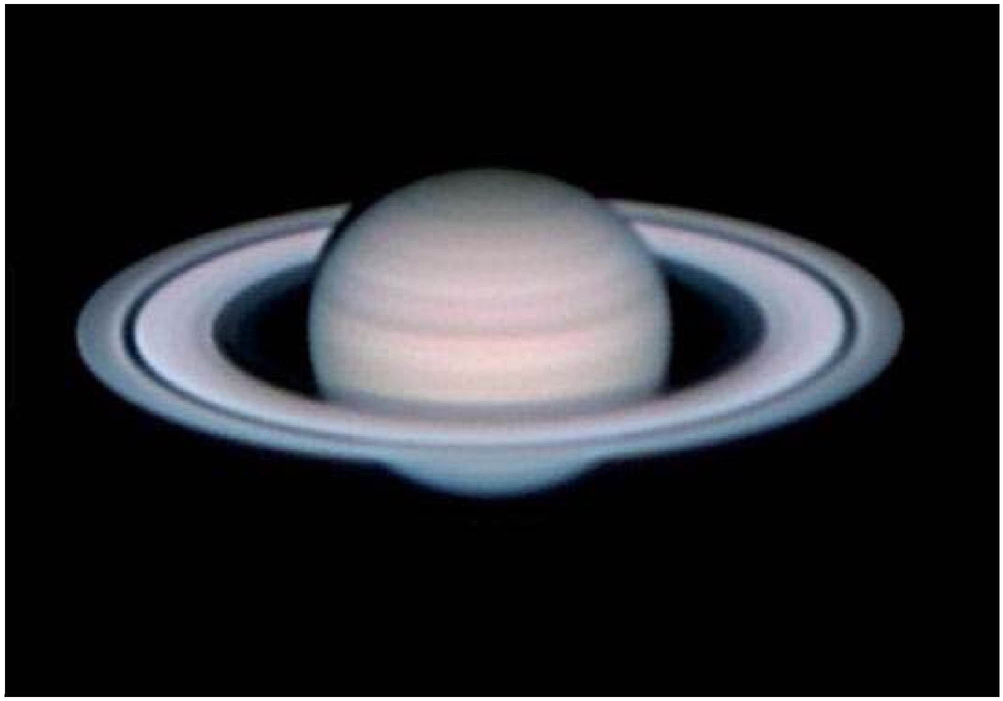


Figure 4. 2006 Feb 12 22:34 UT. Fabio Acquarone. 31.8 cm (12.5 in.) TRI, with a Lumenera 075M digital imager, IL + IR Blocking filter. S = 6.0, Tr = 5.0. CMI = 145.2°, CMII = 211.9°, CMIII = 331.1° B = –19.4°, B´= –18.6°. Note the slightly darker SPC surrounded by the SPR. S is at top and E at left (IAU).

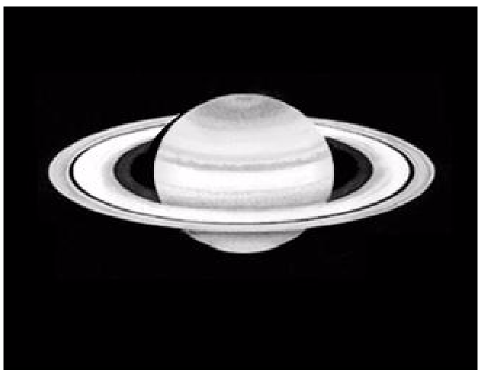


Figure 3. 2006 Jan 13 05:26 UT. Sol Robbins. 24.8 cm (9.75 in.) NEW. Drawing at 353-397X, IL. S = 7.0, Tr not specified. CMI = 131.1°, CMII = 109.9°, CMIII = 266.1° B = –18.4°, B´ = –19.0°. The small, dull gray SPC appears darker than the surrounding SPR in this drawing. S is at top and E at left (IAU).

Particles in Saturn's atmosphere reflect different wavelengths of light in very distinct ways, which causes some belts and zones to appear especially prominent, while others look extremely dark, and imaging the planet using a series of color filters can help shed light on the dynamics, structure, and composition of its atmosphere. In the UV and IR regions of the electromagnetic spectrum, it is possible to determine additional properties as well as the sizes of aerosols present in different atmospheric layers not otherwise accessible at visual wavelengths, as well as useful data about the cloud-covered satellite Titan. UV wavelengths shorter than 320 nm are effectively blocked by the Earth's stratospheric ozone (O_3), while H_2O-vapor and CO_2 molecules absorb in the IR region beyond 727 nm, and the human eye is insensitive to UV light short of 320 nm and can detect only about 1.0% at 690 nm and 0.01% at 750 nm in the IR (beyond 750 nm visual sensitivity is essentially nil). Although most of the reflected light from Saturn reaching terrestrial observers is in the form of visible light, some UV and IR wavelengths that lie on either side and in close proximity to the visual region penetrate to the Earth's surface, and capturing images of Saturn in these near-IR and near-UV bands frequently produces very interesting results. The effects of absorption and scattering of light by the planet's atmospheric gases and clouds of various heights and thicknesses are usually noticeably apparent, and such images sometimes show differential light absorption by particles with dissimilar hues intermixed with Saturn's white NH_3 clouds.

Estimates of Latitude of Global Features. During any given apparition of Saturn, observers are always encouraged to employ the handy visual method developed by Haas over 60 years ago to perform estimates of Saturnian global latitudes. Observers simply need only to estimate the fraction of the polar semidiameter of Saturn's globe subtended on the central meridian (CM) between the limb and the feature whose latitude is desired. As a control on the accuracy of this method, observers should include in their estimates the position on the CM of the projected ring edges and the shadow of the rings. The actual latitudes can then be computed from the known values of **B** and **B′** and the dimensions of the rings, but this test cannot be effectively applied when **B** and **B′** are near their maximum attained numerical values. Experienced observers have used this visual technique for many years with very reliable results, especially since filar micrometers are hard to find and tend to be very expensive. Unfortunately, for the first time in recent years, no observers submitted estimates of Saturnian latitudes during 2005-06.

In the future, all observers are encouraged to employ this easy method, for which a detailed description can be found in the author's book entitled *Saturn and How To Observe It*, published by Springer and available from booksellers worldwide.

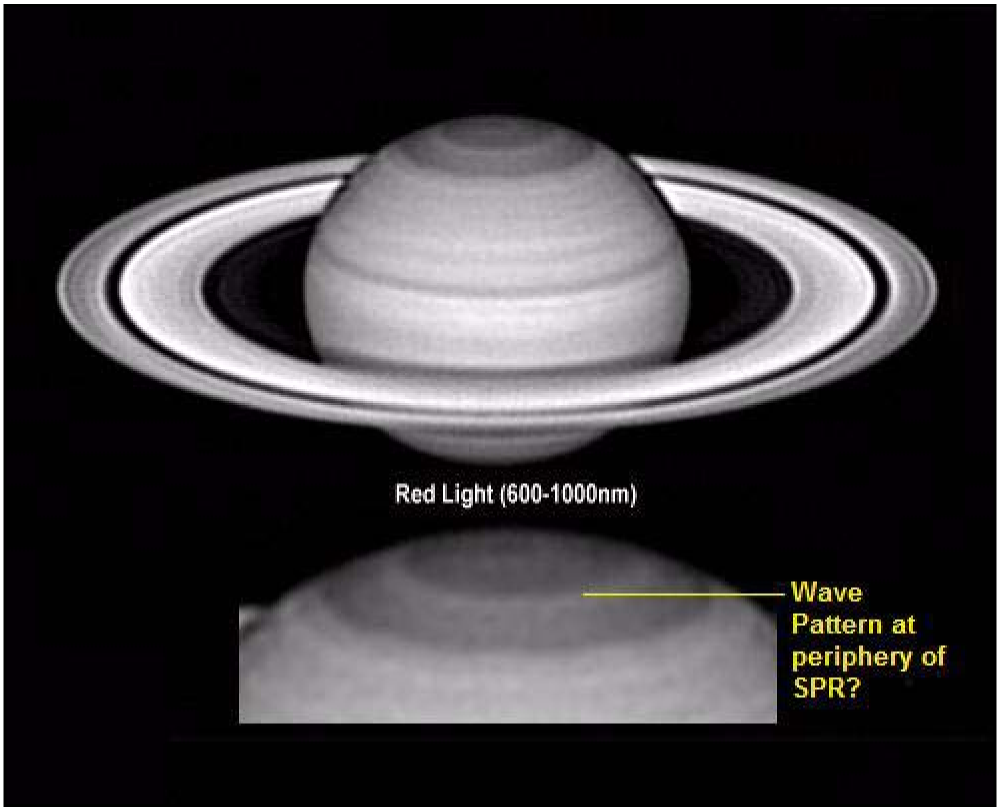


Figure 5. 2006 Jan 23 23:59 UT. Damian Peach. 35.6 cm (14.0 in.) SCT, with ATK -1HS, IL + red filter. S and Tr not specified. CMI = 227.3°, CMII = 218.6°, CMIII = 1.3° B = –18.7°, B´ = –18.9°. Wavy pattern at edge of SPR in red light?. S is at top and E at left (IAU).

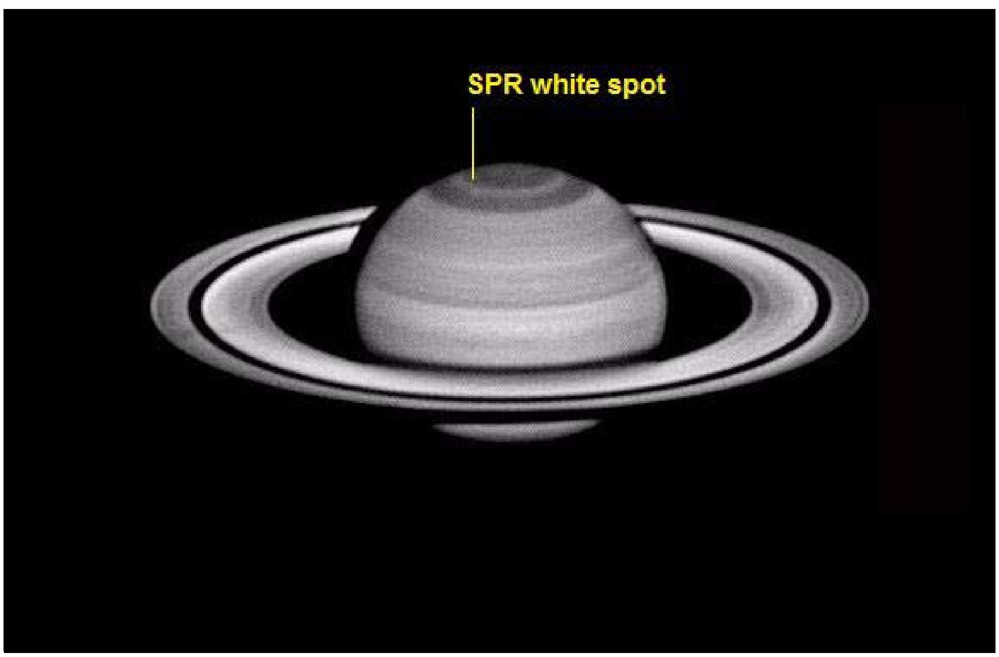


Figure 6. 2005 Nov 30 03:02 UT. David Tyler. 35.6 cm (14.0 in.) SCT, with Lumenera, digital imager IL. S and Tr not specified. CMI = 332.8°, CMII = 296.6°, CMIII = 145.5° B = –17.5°, B´ = –19.5. 1st report of a small SPR white spot approaching E limb. S is at top and E at left (IAU).

Southern Regions of the Globe. During the 2005-06, apparition **B** attained a maximum numeric value of -20.21°, so observers were able to study Saturn's Southern Hemisphere to good advantage, but most of the Northern Hemisphere was still obscured by the rings as they crossed in front of the planet's globe. From a reduction of visual numerical relative intensity estimates received this apparition, the mean brightness of the Southern Hemisphere features of Saturn showed negligible change since 2004-05. Nevertheless, some visual observers strongly suspected that several belts and zones in the Southern Hemisphere displayed a delicate, progressive decline in overall brightness over the last four observing seasons. It will be interesting to see if this suspected tendency continues over the next few apparitions as Saturn's tilt toward our line of sight gets smaller with the approaching edgewise ring presentation in 2009.

From September 18, 2005 through April 19, 2006, quite a number of observers either made drawings of or imaged small white spots in the SPR, STrZ, and SEBZ that will be discussed in the forthcoming paragraphs dealing separately with each region of Saturn's globe. These white spots, which typically result from the upward convection of NH_3 (ammonia) in Saturn's atmosphere, exhibited morphological changes with time. The structure of zonal wind profiles in these regions appears to contribute to the emergence and behavior of these features. Diffuse transient dusky festoons were also reported associated with the SEB on September 18-19, 2005. High-resolution imaging allowed observers to monitor the white spots for several rotations of Saturn, facilitating a few number of CM transit timings and very tentative drift rates.

Saturn reached perihelion back on July 26, 2003, which occurs every 29.5y (one Saturnian year). It has been proposed that any perceived small increase in atmospheric activity on Saturn could be a consequence of the planet's seasonal insolation cycle, yet past measurements reveal only a slow thermal reaction to solar heating at Saturn's perihelion distance from the Sun of ~9.0 AU. Observers are urged to keep the Southern Hemisphere under close surveillance over the next few apparitions now that Saturn has passed perihelion, since a lag in the planet's atmospheric thermal response may possibly mimic what we experience on Earth, where the warmest days do not arrive on the first day of summer, but occur several weeks later. On Saturn, however, any similar effect would be extremely subtle and may not be noticed for quite a number of years.

South Polar Region (SPR). Based on visual numerical relative intensity estimates submitted during the 2005-06 apparition, the gray SPR seemed slightly darker than in 2004-05 (by a rather unimpressive mean visual intensity value of 0.42). With the exception of a few reports of a possible brightening of this region in 2004-05, the extremely subtle darkening trend that seemed to be underway every apparition since the 2001-02 observing season possibly continued in 2005-06.

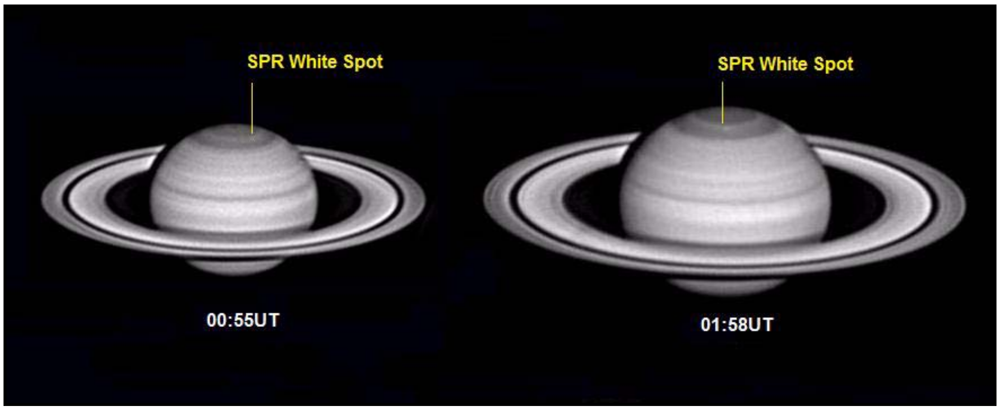


Figure 7. Two near-simultaneous images of the small SPR white spot (approximately an hour apart). S is at top and E at left (IAU) in both images. (Left image) 2005 Dec 20 00:55 UT. Ian Sharp. 28.0 cm (11.0 in.) SCT, with ATK -1HS, IL + RGB filters. S and Tr not specified. CMI = 226.2°, CMII = 266.8°, CMIII = 91.7° B = –17.8°, B´ = –19.3°. (Right image) 2005 Dec 20 01:58 UT. Damian Peach. 35.6 cm (14.0 in.) SCT with ATK -1HS, IL + RGB filters. S and Tr not specified. CMI = 263.5°, CMII = 302.5°, CMIII = 127.5° B = –17.8°, B´ = –19.3°.

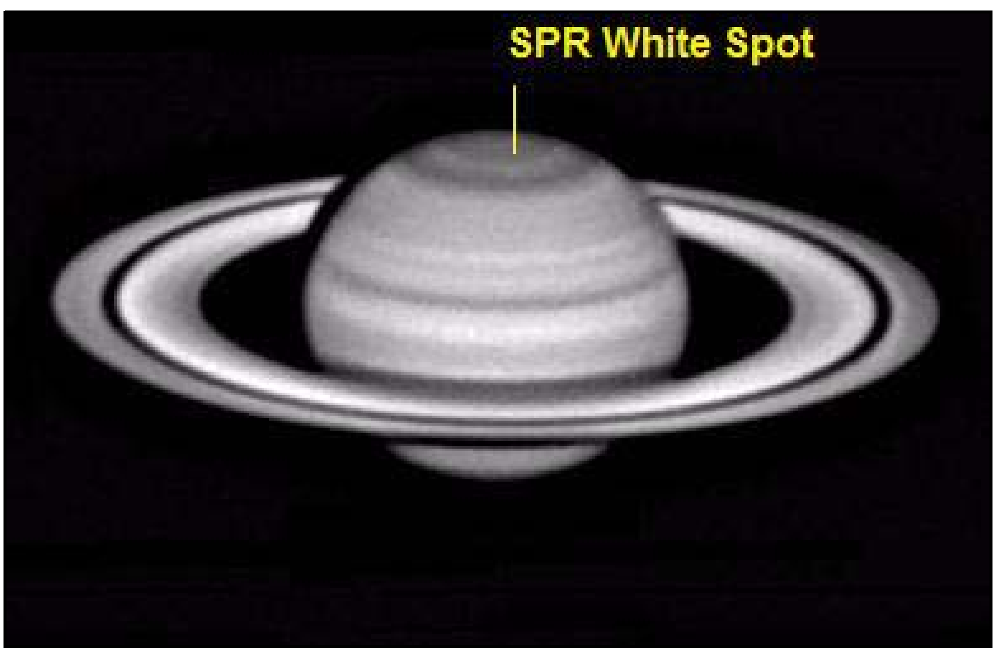


Figure 8. 2005 Dec 24 02:27 UT. Paolo Lazzarotti. 31.5 cm (12.4 in.) DAL, with Lumenera digital imager, IL + Red filter. S and Tr not specified. CMI = 58.1°, CMII = 326.9°, CMIII = 147.5° B = –17.9°, B´ –19.2°. Small SPR white spot imaged in red filter.

The small, dull gray South Polar Cap (SPC) seemed slightly brighter (by a mean intensity value of +0.83) in integrated light than in the immediately preceding apparition, but was duskier than the surrounding SPR by a hardly significant 0.27 mean visual intensity points. Two drawings by Sol Robbins, observing from New Jersey with a 15.2 cm (6.0 in.) REF at 350-400X on December 14, 2005 at 07:40 UT, and again on January 13, 2006 using a 24.8 cm (9.75 in.) NEW at 353-297X, exemplify this difference in visual appearance of the SPR and SPC during the apparition [figures 2 and 3]. There were several more experienced visual observers who made comparable sketches showing the same appearance of the SPC and SPR during the 2005-06 apparition. The darker SPC and a dusky gray SPR were also readily apparent on a fair number of digital images captured at visual wavelengths this apparition, confirming overall visual impressions. For example, notice the subtle difference between the SPR and slightly darker SPC in an image captured by Fabio Acquarone observing from Genova, Italy using a 31.8 cm (12.5 in.) TRI on February 12, 2006 at 22:34 UT [Figure 4].

With regard to activity in the SPR during 2005-06, a wavy pattern was suspected along the edge of the SPR on in late January and early February 2006 in poor seeing [Figure 5], and the ALPO Saturn Section received several images of one or more very small white spots, especially obvious in images taken with red filters, associated with the SPR from late November 2005 through late January 2006, as well as in early April 2006 [figures 6 through 9]. Table 4 lists the very small SPR white spots imaged by ALPO observers during the 2005-06 apparition, as well as suspected wavy patterns along the SPR, with supporting data and brief descriptive notes.

The South Polar Belt (SPB) that encircles the SPR was not reported by visual observers during the 2005-06 apparition, although this feature was apparent in at least a few of the best digital images submitted.

South South Temperate Zone (SSTeZ). The yellowish-white SSTeZ was reported only twice by visual observers during this observing season, and based on those two accounts, it was lighter by only an intensity factor of +0.31 since 2004-05 and was second only to the EZs in brightness based on visual numerical relative intensity data. Most digital images contributed in 2005-06 showed a narrow SSTeZ without any recognizable activity.

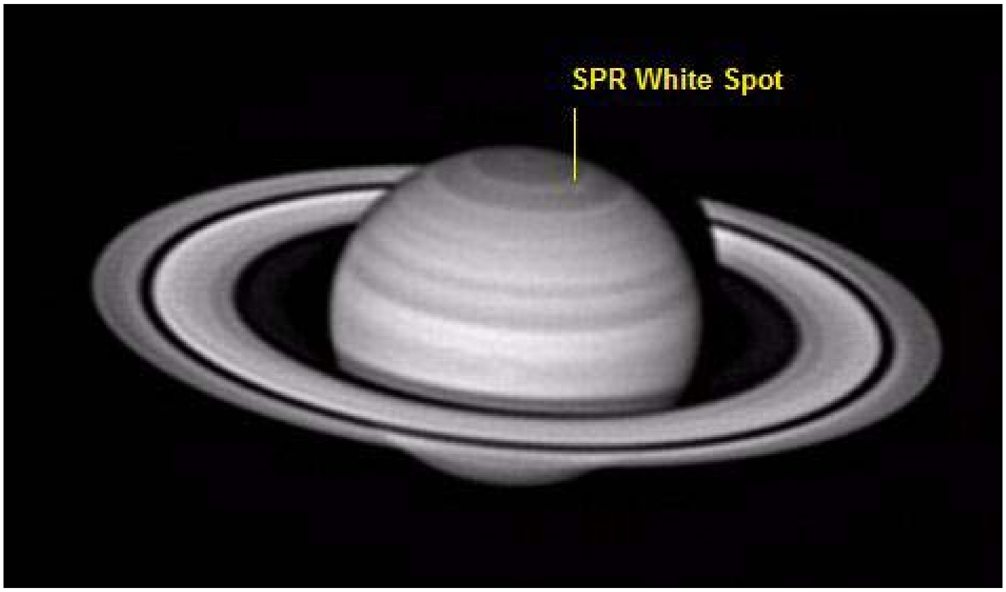


Figure 9. 2006 Apr 11 01:18 UT. Damian Peach. 35.6 cm (14.0 in.) SCT, with ATK -1HS, IL + red filter. S and Tr not specified. CMI = 125.0°, CMII = 147.5°, CMIII = 197.3° B = –20.2°, B´ = –17.9°. Small SPR white spot imaged in red filter. S is at top and E at left (IAU).

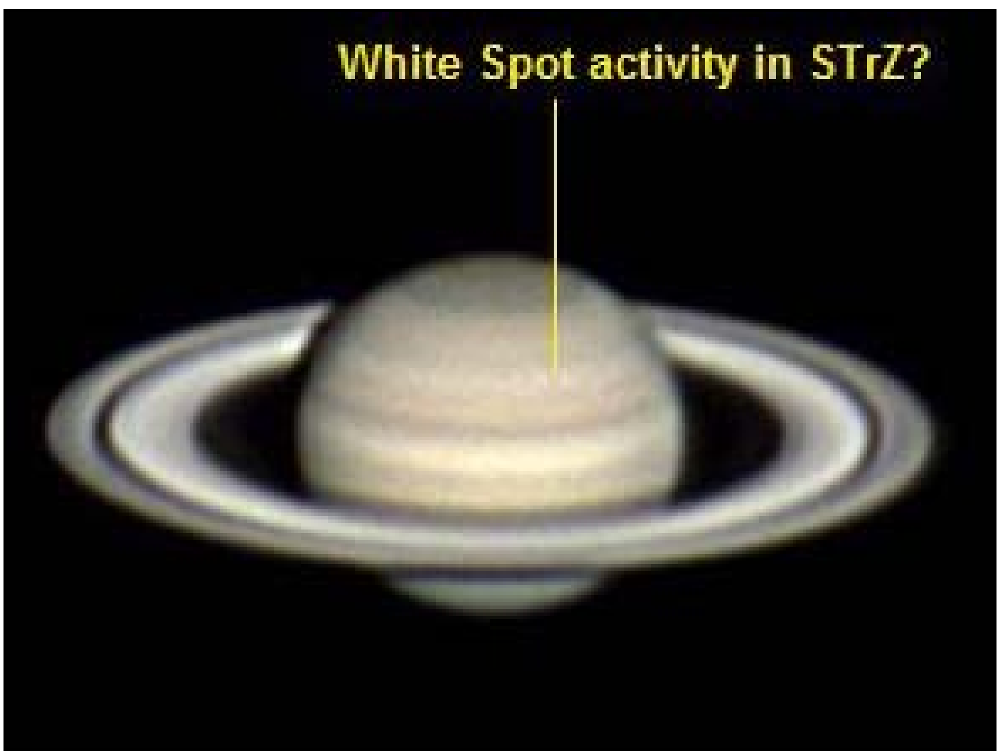


Figure 10. 2005 Dec 21 01:42 UT. Marc Delcroix. 25.4 cm (10.0 in.) SCT, with Philips ToUcam digital imager, IL + IR blocking filter. S = 4.0 Tr = 4.0. CMI = 18.2°, CMII = 25.4°, CMIII = 209.0° B = –17.8°, B´ –19.3°. STrZ white spot? S is at top and E at left (IAU).

South South Temperate Belt (SSTeB). Only one visual observation of the SSTeB was received during this apparition, but this narrow light grayish-brown belt was fairly obvious on many of the best digital images. It was not possible to compare the SSTeB between 2005-06 and 2004-05 because this feature was not reported during the last observing season.

South Temperate Zone (STeZ). The dull yellowish-white STeZ was seen frequently by visual observers in 2005-06 and was regularly apparent in most digital images of Saturn. When compared with the immediately preceding observing season, the STeZ may have been a bit dimmer in overall intensity (factor of –0.43) this apparition, and was third behind the SSTeZ and EZs in brightness in 2005-06. The STeZ appeared uniform in intensity during most of the observing season as it crossed the globe of Saturn. No activity in the STeZ was reported by visual observers, nor were discrete phenomena imaged, during the 2005-06 apparition.

South Temperate Belt (STeB). The light grayish-brown STeB was glimpsed only two times by visual observers during this apparition, but high-resolution digital images easily revealed this dusky feature during 2005-06. When visual observers saw this belt, as well as when it was imaged, there was no apparent activity within this feature as it ran uninterrupted across the globe of Saturn. Based on mean intensity data, the STeB was the lightest belt in the Southern Hemisphere of Saturn and exhibited no substantial change in brightness (mean difference of +0.25) since 2005-06.

South Tropical Zone (STrZ). Visual observers saw the dull yellowish-white STrZ several times during the 2005-06 apparition. Based on mean visual numerical relative intensity estimates that were contributed to the ALPO Saturn Section, the STrZ exhibited essentially the same mean intensity as in 2004-05 (negligible variance of -0.20), and it ranked fourth in order of brightness behind the EZs, SSTeZ, and STeZ. When comparing visual impressions with some of the best digital images at visual wavelengths, the gross morphology of this feature appeared similar.

On December 21, 2005 Marc Delcroix of France, using a 25.4 cm (10.0 in.) SCT in fair seeing, submitted an image of a small white spot within the STrZ (Figure 10). Then from late January through mid-April 2006 a host of other ALPO observers began imaging a tiny white spot near Saturnigraphic latitude 36° in the STrZ riding along the N edge of the STeB [figures 11 through 14]. Over time, the STrZ white spot, which was often noticeably more prominent on images captured in green and red wavelengths, evolved from a rather compact feature into a more diffuse, somewhat elongated region [figures 16 and 17], then ultimately split into two discrete white spots by mid–March into early-April 2006 [figures 18 and 19], then was last reported by ALPO observers on April 19, 2006 [Figure 25]. Although quite tentative, a few CM transits seemed to point to a rotational rate in this latitude of $10^h40^m38^s$. Only one confirming visual sighting of this discrete white feature in the STrZ was received, perhaps because it was chiefly below the threshold of vision and of poor contrast in most telescopes employed for visual work. Remember that the smallest features appearing in digital images are more obvious because of image processing that helps bring out very subtle detail.

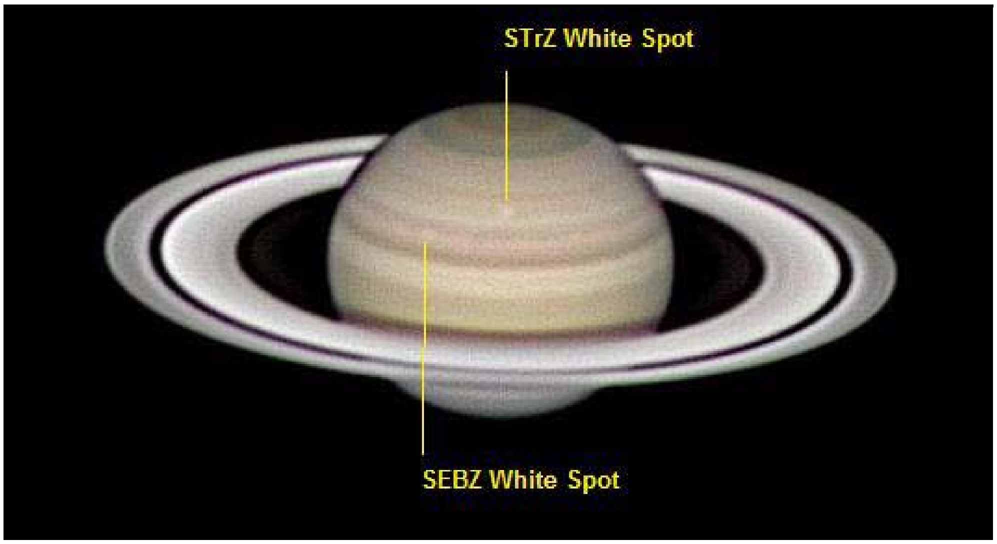


Figure 11. 2006 Jan 24 04:53 UT. Donald C. Parker. 40.6 cm (16.0 in.) NEW, with Lumenera digital imager, IL + RGB filters. S and Tr not specified. CMI = 40.1°, CMII = 24.3°, CMIII = 167.3° B = –18.8°, B´ = –18.8. STrZ white spot near CM; SEBZ white spot E of CM. S is at top and E at left (IAU).

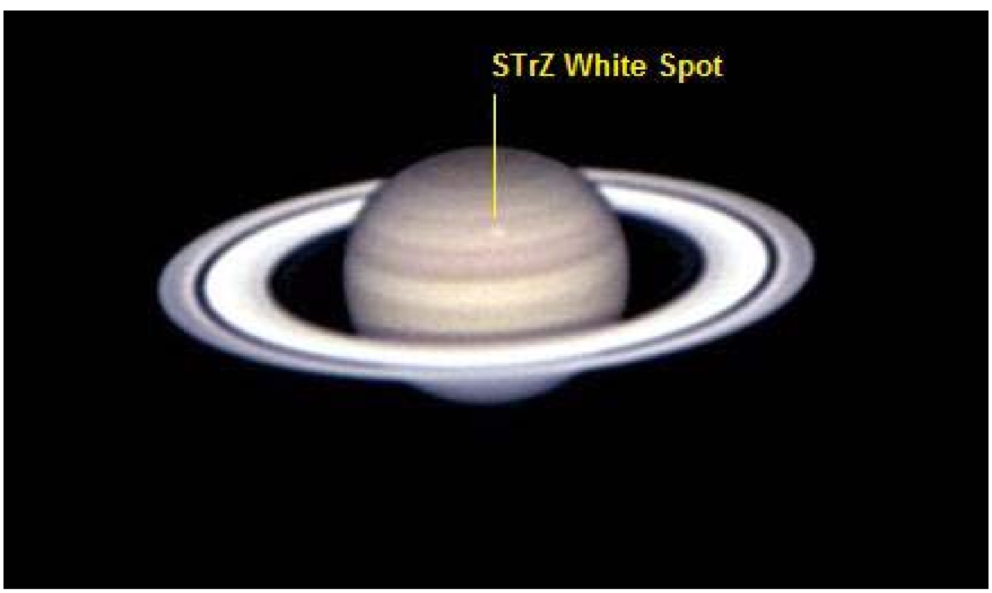


Figure 12. 2006 Jan 28 05:22 UT. Jim Phillips. 20.3 cm (8.0 in.) REF, with Lumenera digital imager, IL + RGB filters. S and Tr not specified. CMI = 194.3°, CMII = 49.1°, CMIII = 186.7° B = –18.9°, B´ = –18.8. STrZ white spot near CM. S is at top and E at left (IAU).

As a shining example of continued Professional-Amateur cooperation involving the ALPO Saturn Section, Michael Kaiser, one of the Radio and Plasma Wave Science (RPWS) team members at NASA's Goddard Space Flight Center in Greenbelt, Maryland, e-mailed this author in late January 2006, requesting observations of any new bright clouds in Saturn's Southern Hemisphere that observers might be reporting or imaging. That was because on January 23, 2006, Cassini had started detecting cracks and hisses like those familiar to AM radio listeners during a terrestrial thunderstorm, this radio noise emanating from high-voltage lightning discharges on Saturn far more powerful than any seen on Earth. It turned out that images of a small STrZ white spot had already been pouring into the ALPO Saturn Section, and they were made available to the Cassini team. The ALPO observations were especially important because, while terrestrial telescopes could image the STrZ white spot as it rotated across Saturn's sunlit side, Cassini was not able to do so since it was situated behind the planet and could only image the night side. Table 5 gives a comprehensive listing of the very small STrZ white spots along the N edge of the STeB that were imaged by ALPO Saturn observers during the 2005-06 apparition, together with brief notes and other pertinent data.

South Equatorial Belt (SEB). The grayish-brown SEB was reported by visual observers throughout the 2005-06 apparition, sometimes subdivided into SEBn and SEBs components (where “n” refers to the North Component and “s” to the South Component), with the SEBZ lying in between them during good seeing conditions and with larger apertures. Taken as a whole, the SEB was the darkest belt on Saturn’s globe during this apparition, but it seemed to visual observers to be slightly lighter in 2005-06 as

Table 3: Visual Numerical Relative Intensity Estimates and Colors for the 2005-06 Apparition of Saturn

Globe/Ring Feature	# Estimates	2005-06 Mean Intensity & Standard Error	Intensity Variance Since 2004-05	Mean Derived Color
Zones:				
SPC	8	4.13 ± 0.26	+0.83	Dull Gray
SPR	26	4.40 ± 0.14	-0.42	Gray
SSTeZ	2	6.25 ± 0.53	+0.31	Yellowish-White
STeZ	19	6.05 ± 0.20	−0.43	Dull Yellowish-White
STrZ SEBZ	10 13	5.90 ± 0.09 5.00 ± ---	−0.20 −0.04	Dull Yellowish-White Dull Yellowish-Gray
EZs	30	7.48 ± 0.10	-0.06	Bright Yellowish-White
NPR	22	4.43 ± 0.09	-----	Gray
Belts:				
SSTeB	1	5.00 ± 0.00	-----	Light Grayish-Brown
STeB	2	5.25 ± 0.18	+0.25	Light Grayish-Brown
SEB (whole)	23	4.57 ± 0.08	+0.58	Grayish-Brown
SEBs	13	4.41 ± 0.07	+0.74	Dull Grayish-Brown
SEBn	13	3.96 ± 0.09	+0.29	Dark Grayish-Brown
Rings:				
A (whole)	36	6.85 ± 0.06	+0.09	Yellowish-White
A5	10	1.10 ± 0.25	-----	Very Dark Gray
A0 or B10	21	0.05 ± 0.05	−0.24	Grayish-Black
B (outer 1/3)	36	8.00 ± 0.00 **STD**	0.00	Brilliant White
B (inner 2/3)	34	7.02 ± 0.04	-0.18	Bright Yellowish-White
B3	1	6.00 ± 0.00	-----	Light Gray
B5	1	6.00 ± 0.00	-----	Light Gray
C (ansae)	23	1.07 ± 0.13	-0.31	Very Dark Gray
Crape Band	30	3.00 ± 0.20	+0.92	Dark Gray
Sh G or R	24	0.00 ± 0.00	-0.33	Black shadow
Sh R of G	16	0.41 ± 0.15	-0.12	Dark Grayish-Black

Notes:

For nomenclature see text and Figure 1. A letter with a digit (e.g. A0 or B10) refers to a location in the ring specified in terms of units of tenths of the distance from the inner edge to the outer edge. Visual numerical relative intensity estimates (visual surface photometry) are based upon the ALPO Intensity Scale, where 0.0 denotes complete black (shadow) and 10.0 refers to the most brilliant condition (very brightest Solar System objects). The adopted scale for Saturn uses a reference standard of 8.0 for the outer third of Ring B, which appears to remain stable in intensity for most ring inclinations. All other features on the Globe or in the rings are compared systematically using this scale, described in the Saturn Handbook, which is issued by the ALPO Saturn Section. The "Intensity Variance Since 2004-05"is in the same sense of the 2004-05 value subtracted from the 2005-06 value, "+" denoting an increase (brightening) and "–" indicating a decrease (darkening). When the apparent change is less than about 3 times the standard error, it is probably not statistically significant.

opposed to 2004-05 by a visual mean intensity factor of +0.58. When the SEBn and SEBs were both visible, the dark grayish-brown SEBn was always darker than the dull grayish-brown SEBs by +0.45 visual mean intensity points.

Although the SEBn was the darkest belt of all on Saturn this observing season, the SEBn was ever so slightly brighter in 2005-06 than in 2004-05 by a visual mean intensity factor of +0.29, while the SEBs was brighter by +0.74 when comparing visual numerical relative intensities between the two apparitions. The dull yellowish-gray South Equatorial Belt Zone (SEBZ) showed perhaps a subtle darkening since 2004-05.

Most digital images of Saturn submitted during 2005-06 generally supported visual impressions of the SEB as a whole, as well as depicting the SEB as a very prominent belt and virtually always subdivided into a darker SEBn and lighter SEBs with a brighter SEBZ in between [Figure 21]. The SEBn appeared considerably wider than the SEBs as well.

From late November 2005 through a little past mid-April 2006 observers imaged one or more small, diffuse white spots in the SEBZ at about Saturnigraphic latitude -25° [figures 22 through 24]. In some of the images provided by Saturn observers starting in January 2006 and onward, the SEBZ white spots could be seen on images showing also the small white spot in the STrZ to the south [Figure 25]. After

Table 4: White Spot Activity in the SPR During the 2005-06 Apparition of Saturn

Date (UT)	CM Start I (°)	CM Start II (°)	CM Start III (°)	CM End I (°)	CM End II (°)	CM End III (°)	Obs	Obs Stn	Inst (cm)	Inst Type	S	Tr	NOTES
11/30/2005 03:02-04:13 UT	332.8	296.6	145.5	14.4	336.6	185.4	Tyler	UK	35.6	SCT			Small wh spot in SPR at E limb
11/30/2005 03:44-04:10 UT	357.4	320.3	169.1	12.7	334.9	183.7	Peach	UK	35.6	SCT			Small wh spot in SPR at E limb
12/11/2005 02:34-02:50 UT	245.0	213.6	49.8	254.4	222.6	58.8	Vandebergh	NET	25.4	NEW			Tiny SPR wh spot not imaged (see images by Tyler same date)
12/11/2005 04:20-05:10 UT	306.8	273.6	109.1	336.2	301.8	137.2	Tyler	UK	35.6	SCT			Small SPR wh spot in R filter, but not in G or B
12/20/2005 00:55-01:50 UT	226.2	266.8	91.7	258.5	297.8	122.6	Sharp	UK	28.0	SCT			Small wh spot in SPR is obvious; other wh features near W limb also?
12/20/2005 00:52-02:10 UT	224.8	264.9	90.4	270.5	308.9	134.3	Peach	UK	35.6	SCT			Small wh spot in SPR near CM
12/24/2005 01:48-02:36 UT	34.9	305.1	125.1	63.1	332.2	152.1	Lazzarotti	ITL	31.5	DALL			Small SPR wh spot in R filter (spot is R in hue)
12/24/2005 02:10 UT	47.8	317.5	137.5				Tyler	UK	35.6	SCT			Small SPR wh spot in R filter (spot is R in hue)
1/22/2006 00:00-02:54 UT	339.5	34.8	180.5	81.5	133.0	278.5	Tasselli	ITL	25.4	NEW	8.5	5.0	SPR wh spots are visible E of CM
1/23/2006 23:59 UT	227.3	218.6	1.3				Peach	UK	35.6	SCT			Wavy pattern at edge of SPR in R light?
2/1/2006 23:12-23:17 UT	239.2	300.8	72.7	242.1	303.6	75.5	Vandebergh	NET	25.4	NEW			Wavy structure at SPR edge?
4/8/2006 00:08 UT	71.3	192.3	245.7				Tyler	UK	35.6	SCT			Tiny wh spot is still visible near SPR on CM in R light
4/11/2006 01:18 UT	125.0	147.5	197.3				Peach	UK	35.6	SCT			Tiny wh spot is still visible near SPR W of CM in R light

April 19, 2006, the SEBZ white spots were not reported or imaged again by observers.

Table 5 provides a complete listing, with supporting data and short comments, of the small transient white spots imaged in the SEBZ during 2005-06, along with one instance when small white mottlings were suspected visually in the SEBZ. It is not clear whether the SEBZ white spots originated from a single feature that evolved and split apart, or whether dual white features in the SEBZ existed from the beginning of the observing season.

A few, rather poorly-defined dusky features or elongated dark spots were reported occasionally along both the SEBn and SEBs [Figure 26]. Occasional reports were also received from visual observers of suspected festoon activity along the northern edge of the SEBn extending partially into the EZs in fair seeing.

Equatorial Zone (EZ). The southern half of the bright yellowish-white Equatorial Zone (EZs) was the region of the EZ visible (or imaged) between where the rings cross the globe of Saturn and the SEBn in 2005-06 (the EZn was not clearly visible during the apparition). The EZs during the 2005-06 apparition according to visual observers was unquestionably the brightest zone on Saturn's globe, showing no perceptible change in brightness since 2004-05. Visual observers, as well as those performing digital imaging, reported no white spot activity in the EZs during the 2005-06 observing season. The typically narrow light gray Equatorial Band (EB) was not reported by visual observers during the apparition, but this feature was frequently captured in digital images [Figure 27].

Northern Portions of the Globe. With Saturn tipped at -18.85° to our line of sight (at opposition) during 2005-06, regions of the extreme Northern Hemisphere of the planet could be viewed or imaged during the apparition, namely the NPR. Studies of Saturn's Northern Hemisphere will become more favorable in forthcoming apparitions when geometric circumstances for observing these regions afford better views.

North Polar Region (NPR). Visual numerical relative intensity estimates received during the 2005-06 apparition suggested that the gray NPR appeared essentially identical to the SPR in brightness. Digital images also showed what appeared to be a dusky NPR beyond the outer edge of Saturn's rings.

Shadow of the Globe on the Rings (Sh G on R). The Sh G on R was visible to observers as a geometrically regular dark grayish-black feature on either side of opposition during 2005-06. Any presumed departure from a complete black intensity (0.0) was a consequence of poor seeing conditions or the presence of extraneous light. Most digital images revealed this feature as completely black. Readers should be aware that the globe of Saturn casts a shadow on the ring system to the left (or IAU East) prior to opposition, to the right (or IAU West) after opposition, and on neither side exactly at opposition (no shadow) as illustrated in Figure 15.

Shadow of the Rings on the Globe (Sh R on G). This shadow in 2005-06 was described as a dark grayish-black feature north of the rings where they crossed Saturn's globe. Any reported variations from an intrinsic black (0.0) condition were due to the same reasons cited above for the Sh G on R.

Figure 13. 2006 Jan 28 15:37 UT. Toshihiko Ikemura. 31.0 cm (12.2 in.) NEW, with ATK 2C digital imager, IL + RGB filters. S and Tr not specified. CMI = 195.2°, CMII = 35.8°, CMIII = 173.4° B = –18.9°, B´ = –18.8. STrZ white spot just E of CM. S is at top and E at left (IAU).

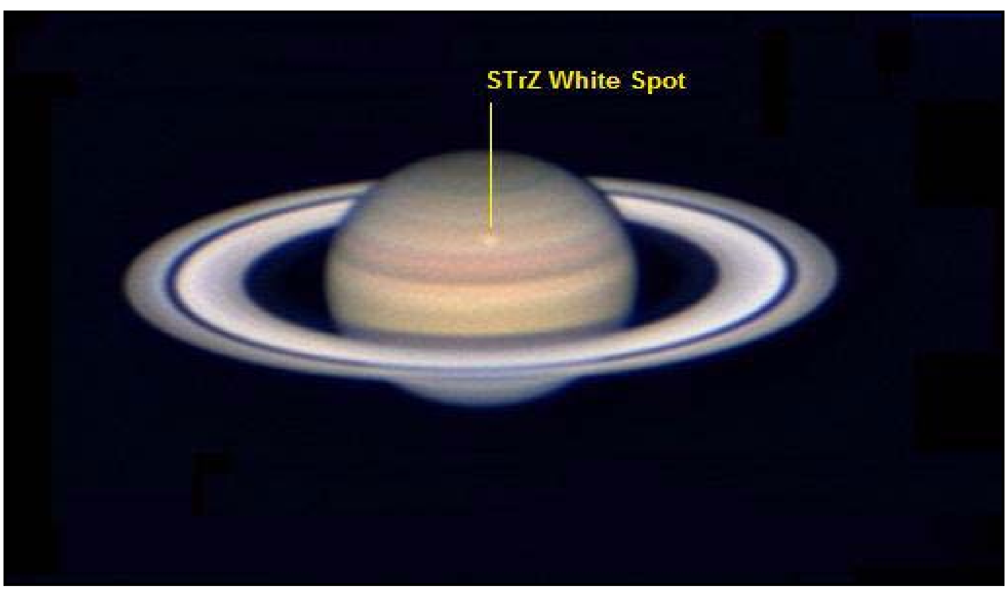


Figure 14. 2006 Feb 02 02:07 UT. Jesus R. Sanchez. 28.0 cm (11.0 in.) SCT, using Philips ToUcam digital imager, IL. S and Tr not specified. CMI = 342.1°, CMII = 39.3°, CMIII = 171.6°, B = –19.0°, B´ –18.7°. STrZ white spot near CM. S is at top and E at left (IAU).

Saturn's Ring System

The discussion in this section pertains to visual studies of Saturn's ring system with the traditional comparison of mean intensity data between apparitions, and impressions based on digital images of the rings are also included below. The southern face of the rings was readily apparent during 2005-06 as the inclination of the rings (value of **B**) toward observers on Earth reached as much as -20.2°.

Ring A. Most visual observers were in agreement that the yellowish-white Ring A, when considered as a whole, had basically the same intensity in 2005-06 as in 2004-05. Although most digital images of Saturn taken during the 2005-06 apparition clearly showed inner and outer halves of Ring A, with much of the inner half of Ring A frequently showing up slightly brighter in the images than the outer half. Visual observers who made visual numerical relative intensity estimates of Saturn simply referred to the brightness of Ring A as a whole rather than suggesting the ring component was differentiated into inner and outer halves. The very dark gray Encke's division (A5), sometimes described as an intensity minima "complex" halfway out in Ring A at the ansae, exhibited a mean visual numerical relative intensity similar to that of Ring C during this apparition and was imaged often during 2005-06 apparition. Several digital images captured in better-than-average seeing showed Keeler's Division (A8), but it was not described by visual observers this observing season [Figure 28].

Ring B. The outer third of Ring B is the conventional standard of reference for the ALPO Saturn Visual Numerical Relative Intensity Scale, with an assigned value of 8.0. To visual observers during 2005-06 the outer third of Ring B appeared brilliant white with no fluctuation in intensity,

Table 5: White Spot Activity in the STrZ During the 2005-06 Apparition of Saturn

	CM Start			CM End									
Date (UT)	I (°)	II (°)	III (°)	I (°)	II (°)	III (°)	Obs	Obs Stn	Inst (cm)	Inst Type	S	Tr	NOTES
12/21/2005 01:42 UT	18.2	25.4	209.0				Delcroix	FRA	25.4	SCT	4.0	4.0	STrZ white spot?
1/24/2006 03:59-05:12 UT	8.1	354.0	136.4	50.9	35.1	177.6	Parker	USA	40.6	NEW			Small wh spot at N edge STeB into STrZ
1/24/2006 06:04 UT	81.4	64.5	206.8				Fisher	USA	25.4	NEW			Small wh spot at N edge STeB into STrZ
1/25/2006 02:13-02:43 UT	70.3	26.3	167.6	87.9	43.2	184.5	Phillips	USA	20.3	REF	7.0		Small wh spot at N edge STeB into STrZ
1/25/2006 14:24-14:33 UT	138.9	78.5	219.3	144.2	83.6	224.3	Lepine	FRA	35.6	SCT			Small wh spot at N edge STeB into STrZ
1/28/2006 03:13-05:22 UT	118.6	336.4	114.0	194.3	49.1	186.7	Phillips	USA	20.3	REF	8.0		Small wh spot at N edge STeB into STrZ
1/28/2006 05:05-05:40 UT	184.3	39.5	177.1	204.8	59.3	196.8	Melillo	USA	20.3	SCT	8.0		STrZ wh spot vague on image?
1/28/2006 15:04-16:12 UT	175.9	17.2	154.8	215.7	55.5	193.1	Ikemura	JAP	31.0	NEW			STrZ wh spot near CM
1/29/2006 23:07-23:25 UT	223.1	21.8	157.3	233.7	31.9	167.4	Vandebergh	NET	25.4	NEW			Small wh spot at N edge STeB into STrZ
1/29/2006 23:13 UT	226.6	25.2	160.6				Sharp	UK	28.0	SCT			Small wh spot at N edge STeB into STrZ
1/31/2006 06:19-06:38 UT	240.8	357.5	131.4	252.0	8.2	142.1	Parker	USA	40.6	NEW			Small wh spot at N edge STeB into STrZ
1/31/2006 07:23 UT	278.3	33.6	167.4				Fisher	USA	25.4	NEW	6.0	4.0	Small wh spot at N edge STeB into STrZ
2/1/2006 03:53-05:23 UT	279.6	7.2	140.1	332.3	58.0	190.7	Phillips	USA	20.3	REF	8.0		Small wh spot at N edge STeB into STrZ in transit across CM
2/2/2006 00:12-01:02 UT	264.4	334.7	106.5	303.7	2.9	134.6	Vandebergh	NET	25.4	NEW			Small wh spot at N edge STeB into STrZ
2/2/2006 00:35 UT	287.8	347.6	119.4				Lazzarotti	ITL	31.5	DAL	6.5	4.0	Small STeB-STrZ wh spot at W limb in RGB image?
2/2/2006 01:53-02:14 UT	333.6	31.6	163.3	345.9	43.5	175.2	Sanchez	SPA	28.0	SCT			Small wh spot at N edge STeB into STrZ in transit across CM
2/2/2006 23:07 UT	0.6	30.1	160.7				Delcroix	FRA	25.4	SCT	4.0	3.0	Small STeB-STrZ wh spot prominent in R light?
2/5/2006 05:00-05:06 UT	96.3	53.3	181.2	99.9	56.7	184.6	Phillips	USA	20.3	REF	8.0		STeB-STrZ wh spot appears larger and more diffuse?
2/5/2006 05:57-06:02 UT	129.8	85.4	213.3	132.7	88.3	216.1	Lomeli	USA	23.5	SCT	3.0	5.0	STeB-STrZ wh spot E of CM nearing E limb; may be larger and more diffuse.
2/5/2006 13:58-14:00 UT	51.8	356.7	124.2	53.0	357.8	125.3	Go	PHIL	28.0	SCT	9.0	5.0	STeB-STrZ wh spot apparently showing “growth” N & S and becoming more dif-fuse
2/6/2006 22:41-23:44 UT	122.8	23.7	149.5	159.8	59.2	185.0	Sanchez	SPA	28.0	SCT			STeB-STrZ wh spot in transit across CM; spot appears more diffuse and perhaps brighter?
2/6/2006 22:43-23:36 UT	124.0	24.8	150.7	155.1	54.7	180.5	Casquinha	ITL	25.4	NEW			STeB-STrZ wh spot in transit across CM; spot appears more diffuse and perhaps brighter?

Table 5: White Spot Activity in the STrZ During the 2005-06 Apparition of Saturn (cont'd)

Date (UT)	CM Start I (°)	CM Start II (°)	CM Start III (°)	CM End I (°)	CM End II (°)	CM End III (°)	Obs	Obs Stn	Inst (cm)	Inst Type	S	Tr	NOTES
2/8/2006 06:16-07:30 UT	154.0	12.3	136.6	197.4	54.1	178.3	Lomeli	USA	23.5	SCT	4.0	4.0	STeB-STrZ wh spot; spot is more diffuse and elongated
2/10/2006 03:14-03:20 UT	296.0	93.8	215.8	299.5	97.2	219.2	Phillips	USA	20.3	REF			STeB-STrZ wh spot; spot is more diffuse and elongated
2/10/2006 21:55-22:11 UT	233.3	6.0	127.0	242.7	15.0	136.1	Tyler	UK	35.6	SCT			STeB-STrZ wh spot; appears larger and more diffuse now
2/10/2006 23:20-23:50 UT	283.1	53.7	175.3	301.1	70.7	192.2	Sharp	UK	28.0	SCT			STeB-STrZ wh spot; appears larger and more diffuse; spot near CM.
2/11/2006 00:30-00:40 UT	324.2	93.4	214.3	330.0	99.0	220.0	Kingsley	UK	28.0	SCT			STeB-STrZ wh spot; spot is more diffuse and elongated; very noticeable in green filter
2/11/2006 21:09-21:12 UT	330.7	72.1	192.0	332.4	73.8	193.7	Acquarone	ITL	31.8	TRI	6.0	5.0	STeB-STrZ wh spot; appears larger and more diffuse now
2/14/2006 01:31-03:07 UT	13.0	43.9	161.2	69.3	98.1	215.3	Phillips	USA	20.3	REF			STeB-STrZ wh spot; appears larger and more diffuse now
2/14/2006 23:14-23:58 UT	57.0	58.7	174.8	82.8	83.5	199.7	Vandebergh	NET	25.4	NEW			STeB-STrZ wh spot; appears larger and more diffuse now
2/17/2006 05:33 UT	167.9	96.6	210.0				Grafton	USA	35.6	SCT			STeB-STrZ wh spot is W of CM
2/18/2006 00:23-01:19 UT	110.5	13.8	126.3	143.3	45.4	157.8	Tasselli	ITL	25.4	NEW			STeB-STrZ wh spot is W of CM
2/18/2006 22:08-23:54 UT	155.7	29.7	141.1	217.8	89.5	200.8	Tasselli	ITL	25.4	NEW			STeB-STrZ wh spot is W of CM
2/19/2006 00:01 UT	221.9	93.4	204.7				Bosman	NET	28.0	SCT			STeB-STrZ wh spot is W of CM
2/19/2006 00:26-00:47 UT	236.6	107.5	218.8	248.9	119.3	230.6	Tasselli	ITL	25.4	NEW			STeB-STrZ wh spot is W of CM
2/19/2006 04:38-04:56 UT	24.4	249.6	0.7	34.9	259.8	10.8	Melka	USA	30.5	NEW			STeB-STrZ wh spot is W of CM
2/21/2006 03:22 UT	228.5	30.8	139.6				Chester	USA	20.3	SCT	7.0	6.0	STeB-STrZ wh spot is W of CM
2/22/2006 22:48 UT	316.5	60.4	166.9				Casquinha	ITL	25.4	NEW			STeB-STrZ wh spot is W of CM
2/24/2006 05:27-06:28 UT	314.7	17.4	122.4	350.5	51.8	156.8	Lomeli	USA	23.5	SCT	6.5	3.0	STeB-STrZ wh spot is W of CM (vague); diffuse; observer could not see wh spot visually
2/24/2006 19:48-20:51 UT	99.6	142.9	247.2	136.5	178.5	282.7	Niechoy	GER	20.3	SCT			STeB-STrZ wh spot suspected visually
2/25/2006 03:28 UT	9.3	42.3	146.2				Maxson	USA	25.4	CAS			STeB-STrZ wh spot is W of CM (vague); diffuse and more elongated
2/26/2006 23:34-23:40 UT	120.7	94.4	196.1	124.2	97.8	199.5	Vandebergh	NET	25.4	NEW			STeB-STrZ wh spot is slightly E of CM; spot is slightly more elongated

Table 5: White Spot Activity in the STrZ During the 2005-06 Apparition of Saturn (cont'd)

Date (UT)	CM Start I (°)	CM Start II (°)	CM Start III (°)	CM End I (°)	CM End II (°)	CM End III (°)	Obs	Obs Stn	Inst (cm)	Inst Type	S	Tr	NOTES
2/28/2006 19:11 UT	215.2	130.1	229.6				Tyler	UK	35.6	SCT			STeB-STrZ wh spot is elongated and diffuse (fuzzy image)
3/1/2006 04:21 UT	177.6	80.3	179.3				Melka	USA	30.5	NEW			STeB-STrZ wh spot is slightly W of and near CM; spot is slightly more elongated
3/1/2006 23:32 UT	132.5	9.3	107.4				Vandebergh	NET	25.4	NEW			STeB-STrZ wh spot is on CM
3/1/2006 23:36 UT	134.8	11.6	109.7				Peach	UK	35.6	SCT			STeB-STrZ wh spot is suspected at CM but not obvious on this image
3/2/2006 19:00-22:11 UT	97.3	308.0	45.1	209.3	55.7	152.6	Tyler	UK	35.6	SCT			STeB-STrZ wh spot is diffuse and less well-defined
3/2/2006 21:10-23:06 UT	173.5	21.3	118.3	241.6	86.7	183.6	Tasselli	ITL	25.4	NEW	5.0	3.0	STeB-STrZ wh spot is diffuse and less well-defined
3/2/2006 22:10-22:28 UT	208.7	55.1	152.0	219.3	65.3	162.2	Peach	UK	35.6	SCT			STeB-STrZ wh spot is diffuse and less well-defined
3/2/2006 23:33 UT	257.4	101.9	198.8				Delcroix	FRA	25.4	SCT	4.0	3.0	STeB-STrZ wh spot is apparently on CM but is very diffuse and ill-defined in image
3/3/2006 00:02 UT	274.4	118.3	215.1				Tasselli	ITL	25.4	NEW	5.0	3.0	STeB-STrZ wh spot is diffuse and less well-defined; just E of CM
3/3/2006 19:33 UT	241.0	58.6	154.4				Peach	UK	35.6	SCT			STeB-STrZ wh spot is diffuse and less well-defined; W of CM in G light
3/3/2006 20:45 UT	283.2	99.2	195.0				Heard	UK	20.3	DAL	3.0	4.0	STeB-STrZ wh spot is diffuse and less well-defined; W of CM
3/4/2006 18:23-19:35 UT	324.2	111.1	205.8	6.5	151.7	246.4	Tyler	UK	35.6	SCT			STeB-STrZ wh spot is diffuse; image in G light and near CM at 18:23 UT
3/4/2006 22:57-23:01 UT	124.9	265.6	0.1	127.2	267.9	2.4	Vandebergh	NET	25.4	NEW			Diffuse and elongated STeB-STrZ wh spot is near CM
3/11/2006 21:23 UT	219.8	136.6	222.7				Vandebergh	NET	25.4	NEW			STeB-STrZ wh spot is diffuse and less well-defined; E of CM
3/15/2006 19:56-21:16 UT	305.9	95.5	176.8	352.8	140.6	221.9	Peach	UK	35.6	SCT			STeB-STrZ wh spot has now split into two features
3/15/2006 20:02-20:52 UT	309.5	98.8	180.2	338.8	127.0	208.3	Pellier	FRA	21.0	CAS	7.5	6.0	STeB-STrZ wh spot is pronounced in green light; appears elongated and possibly dual
3/15/2006 20:08-20:15 UT	313.0	102.2	183.6	317.1	106.2	187.5	Tyler	UK	35.6	SCT			STeB-STrZ wh spot is now looks multiple

Table 5: White Spot Activity in the STrZ During the 2005-06 Apparition of Saturn (cont'd)

Date (UT)	CM Start I (°)	CM Start II (°)	CM Start III (°)	CM End I (°)	CM End II (°)	CM End III (°)	Obs	Obs Stn	Inst (cm)	Inst Type	S	Tr	NOTES
3/15/2006 20:25-21:17 UT	322.9	111.8	193.1	353.4	141.1	222.4	Vandebergh	NET	25.4	NEW			Elongated, possibly dual STeB-STrZ wh spot is visible in images
3/19/2006 20:28-20:50 UT	102.1	121.2	198.2	115.0	133.6	210.7	Tyler	UK	35.6	SCT			STeB-STrZ wh spot is diffuse and has spread S up and over adjacent STeB?
3/19/2006 21:20 UT	132.3	150.7	227.2				Peach	UK	35.6	SCT			STeB-STrZ wh spot is diffuse and has spread S up and over adjacent STeB?
3/19/2006 21:10 UT	126.7	144.9	222.0				Vandebergh	NET	25.4	NEW			STeB-STrZ wh spot appears split into two regions
3/22/2006 22:55-23:25 UT	200.7	120.1	192.9	218.3	137.1	209.8	Vandebergh	NET	25.4	NEW			STeB-STrZ wh spot appears split into two regions
3/23/2006 21:04 UT	259.9	149.5	221.2				Vandebergh	NET	25.4	NEW			Wh spot in STrZ?
4/6/2006 20:05-22:00 UT	164.6	323.4	18.2	232.0	28.2	83.0	Pellier	FRA	21.0	CAS	8.0	6.0	Small wh mottlings in STrZ?
4/8/2006 00:28-01:16 UT	83.0	203.6	257.0	111.2	230.7	284.0	Peach	UK	35.6	SCT			Diffuse STeB-STrZ wh spot (split into two) is E of CM; has spread S up and over adjacent STeB
4/11/2006 23:44-23:56 UT	194.1	186.5	235.1	201.1	193.2	241.8	Peach	UK	35.6	SCT			Diffuse STeB-STrZ wh spot (split into two) is E of CM; has spread S up and over adjacent STeB
4/12/2006 00:02-00:27 UT	204.6	196.6	245.2	219.3	210.7	259.3	Peach	UK	35.6	SCT			Diffuse STeB-STrZ wh spot (split into two) is E of CM; has spread S up and over adjacent STeB
4/16/2006 00:10 UT	346.2	208.8	252.5				Peach	UK	35.6	SCT			Remnants of dual STeB-STrZ wh spot near CM
4/19/2006 23:31-23:48 UT	100.1	194.4	233.3	110.0	203.9	242.9	Peach	UK	35.6	SCT			Remnants of dual STeB-STrZ wh spot near CM.

and it was always the brightest feature on Saturn's globe or in the ring system. The inner two-thirds of Ring B during this apparition, which was described as bright yellowish-white and uniform in intensity, displayed almost the same mean intensity as in the immediately preceding observing season (a difference between the current and immediately preceding apparition of 0.15 is almost negligible).

Observations using digital imagers were in general agreement with the visual reports during 2005-06. Vague dusky spoke-like features were thought to be present within the inner portion of Ring B near the E or W ansae from early January through late February 2006 by Detlev Niechoy of Germany using a 20.3 cm (8.0 in.) SCT at 225X in fair seeing in integrated light [Figure 29]. No digital images, however, were received that showed radial spokes in Ring B during the 2005-06 apparition. Visual observers also reported the possible occurrence of dark grayish intensity minima at the B3 and B5 positions in Ring B during the observing season, but there were no conclusive observations and only one visual numerical relative intensity estimate made of each of these suspected narrow ripples in Ring B. Digital images captured some faint intensity minima B1, B2, B5 and perhaps B8 positions within in Ring B [Figure 30].

Cassini's Division (A0 or B10). Cassini's Division (A0 or B10) was detected almost routinely by visual observers during 2005-06 as a grayish-black gap at both ansae, and in good seeing with moderate to larger apertures this division could be traced around the circumference of the Saturn's ring system. It should be pointed out that any departure from a totally black intensity for Cassini's

Table 6: White Spot Activity in the SEBZ During the 2005-06 Apparition of Saturn

	CM Start			CM End									
Date (UT)	**I (°)**	**II (°)**	**III (°)**	**I (°)**	**II (°)**	**III (°)**	**Obs**	**Obs Stn**	**Inst (cm)**	**Inst Type**	**S**	**Tr**	**NOTES**
11/30/2005 03:02-04:13 UT	332.8	296.6	145.5	14.4	336.6	185.4	Tyler	UK	35.6	SCT			Small wh spot in SEBZ (difficult)
11/30/2005 03:44-04:10 UT	357.4	320.3	169.1	12.7	334.9	183.7	Peach	UK	35.6	SCT			Small wh spot in SEBZ (difficult)
1/21/2006 00:00-02:54 UT	214.8	302.9	89.2	316.8	41.1	187.2	Tasselli	ITL	25.4	NEW	8.5	5.0	SEBZ wh spot visible E of CM
1/24/2006 03:59-05:12 UT	8.1	354.0	136.4	50.9	35.1	177.6	Parker	USA	40.6	NEW			Small wh spot in SEBZ
1/29/2006 00:07 UT	133.9	323.5	100.2				Tasselli	ITL	25.4	NEW	6.5	3.0	SEBZ wh spot?
1/31/2006 06:19-06:38 UT	240.8	357.5	131.4	252.0	8.2	142.1	Parker	USA	40.6	NEW			SEBZ wh spot barely visible red light image
2/2/2006 20:32-20:48 UT	269.7	302.7	73.5	279.1	311.7	82.5	Mazzotti	ITL	30.5	SCT	5.0		Duality suspected of SEBZ wh spot, or perhaps becoming elongated?
2/4/2006 03:36 UT	282.7	273.9	43.1				Dickinson	USA	20.3	SCT	6.5	6.0	SEBZ possibly visible W of CM
2/4/2006 23:06-23:14 UT	248.8	213.7	341.9	253.5	218.2	346.4	Lawrence	UK	25.4	SCT	7.0		Duality suspected again of SEBZ wh spot; noise in image?
2/4/2006 23:39-23:54 UT	268.1	232.3	0.5	276.9	240.7	8.9	Tasselli	ITL	25.4	NEW			SEBZ wh spot visible in some images W of CM
2/5/2006 00:00-00:56 UT	280.4	244.1	12.3	313.3	275.7	43.8	Tasselli	ITL	25.4	NEW			SEBZ wh spot visible in some images W of CM
2/10/2006 07:23-08:05 UT	82.0	234.2	356.0	106.6	257.9	19.7	Lomeli	USA	23.5	SCT	7.0	3.0	SEBZ wh spot is apparent; perhaps whitish mottlings in SEBZ W of SEBZ wh spot?
2/28/2006 02:00-02:23 UT	330.6	268.8	9.1	344.1	281.7	22.1	Robbins	USA	15.2	REF	7.0		Whitish mottlings in SEBZ
3/15/2006 19:56-21:16 UT	305.9	95.5	176.8	352.8	140.6	221.9	Peach	UK	35.6	SCT			Small SEBZ wh spot may exist E of CM
3/18/2006 20:05-20:36 UT	324.0	16.4	94.2	342.2	33.9	111.6	Pellier	FRA	21.0	CAS	5.0	6.0	Small whitish mottlings in SEBZ near CM
3/22/2006 19:37 UT	84.6	8.5	81.4				Peach	UK	35.6	SCT			Pair of SEBZ wh spots near CM
3/22/2006 21:26 UT	148.5	70.0	142.8				Bosman	NET	28.0	SCT			Wh features in SEBZ are possibly present E of CM
3/23/2006 00:18-00:22 UT	249.4	166.9	239.6	251.7	169.2	241.9	Phillips	USA	20.3	REF			SEBZ wh mottlings near CM?
3/23/2006 03:10 UT	350.2	263.9	336.5				Maxson	USA	25.4	CAS			SEBZ wh feature may be W of CM
3/27/2006 05:32-06:26 UT	210.5	351.8	59.4	242.1	22.3	89.8	Allen	USA	30.5	NEW	4.5		Wh mottlings in SEBZ?
4/1/2006 12:07 UT	343.3	314.2	15.5				Go	PHIL	28.0	SCT	8.0	4.0	A pair of small wh spots in SEBZ are possibly present near the CM
4/6/2006 20:05-22:00 UT	164.6	323.4	18.2	232.0	28.2	83.0	Pellier	FRA	21.0	CAS	8.0	6.0	Small wh mottlings in SEBZ

Table 6: White Spot Activity in the SEBZ During the 2005-06 Apparition of Saturn (cont'd)

Date (UT)	CM Start I (°)	CM Start II (°)	CM Start III (°)	CM End I (°)	CM End II (°)	CM End III (°)	Obs	Obs Stn	Inst (cm)	Inst Type	S	Tr	NOTES
4/9/2006 23:26-23:52 UT	295.1	352.5	43.5	310.4	7.1	58.2	Peach	UK	35.6	SCT			Dual SEBZ wh spots are quite apparent; development from earlier suspected mottlings in SEBZ?
4/19/2006 23:31-23:48 UT	100.1	194.4	233.3	110.0	203.9	242.9	Peach	UK	35.6	SCT			Possible dual tiny wh spots in SEBZ?

Division is a result of poor seeing, scattered light, insufficient aperture, etc. A black Cassini's Division was generally quite apparent on all digital images received during the 2005-06 observing season [refer to Figure 30 again]. The overall visibility of major ring divisions and other intensity minima started becoming a little less favorable in 2005-06 because the numerical value of **B** had diminished to between -17.43° and -20.21° during the apparition, and the tilt will be even less in succeeding apparitions as the rings close up approaching the next edgewise orientation to observers on Earth in 2009.

Ring C. The grayish-black Ring C at the ansae was routinely visible in 2005-06 and considered by some visual observers to be slightly duskier when compared with 2004-05 (a mean intensity difference of -0.31). The Crape Band, or simply Ring C in front of the globe of Saturn, appeared dark gray in color and uniform in intensity, looking a little brighter than on the immediately preceding apparition (mean intensity variance of +0.92). Digital images showed Ring C encircling the globe of Saturn and confirming most of the visual impressions of this ring component during 2005-06 [Figure 30]. When B and **B′** are both negative, and the value of **B** exceeds that of **B′**, the shadow of the rings on the globe is cast to their south, circumstances that transpired beginning January 28, 2006 through June 12, 2006 (the last observation received for the apparition). The Crape Band then is seen south of the projected Rings A and B. If the value of **B** is less than that of **B′**, the ring shadow is to the north of the projected rings, which happened prior to January 28, 2006. When Sh R on G is cast to the south, it is superimposed on the Ring C projection on the globe, as is well shown in Figures 23 and 24. Observers may sometimes be confused. The Ring C projection, with or without an accompanying shadow of the rings, is often called the Crape Band.

Terby White Spot (TWS). The TWS is an apparent brightening of the rings immediately adjacent to the Sh G on R. This feature was not reported or imaged during 2005-06. When seen, this feature is merely an artificial contrast effect, not a genuine feature of Saturn's rings. It is useful, however, to try to ascertain any corre-

Table 7: Dark Spot Activity in the SEB During the 2005-06 Apparition of Saturn

Date (UT)	CM Start I (°)	CM Start II (°)	CM Start III (°)	CM End I (°)	CM End II (°)	CM End III (°)	Obs	Obs Stn	Inst (cm)	Inst Type	S	Tr	NOTES
9/18/2005 08:34-09:05 UT	91.6	246.1	182.7	109.8	263.5	200.2	Roussell	CAN	15.2	REF	7.0	3.0	Dark features seen along SEBs
9/19/2005 08:52-09:12 UT	226.4	348.2	283.6	238.2	359.5	294.8	Roussell	CAN	15.2	REF	7.5	3.0	Dark features seen along SEBs & SEBn
10/20/2005 07:15-07:27 UT	62.9	264.9	163.6	70.0	271.7	170.4	Roussell	CAN	15.2	REF	5.5	2.0	Dark features seen along SEBs & SEBn
02/12/06 23:35-23:55 UT	181.0	246.3	5.5	192.7	257.6	16.7	Roussell	CAN	15.2	REF	6.0	4.0	Dark features seen along SEBs & SEBn
02/24/2006 20:40 UT	130.4	172.1	276.9				Niechoy	GER	20.3	SCT	3.0	3.0	Dark festoons emanating from SEB into EZs?

Table 8: Visual Observations of the Bicolored Aspect of Saturn's Rings During the 2005-06 Apparition

Observer	UT Date and Time	Telescope Type & Aperture	X	S	Tr	Filter B	Filter IL	Filter R
Roussell	2005 Sep 19 08:52-09:12	REF 15.2 cm (6.0 in.)	400	7.5	3.0	E	=	=
Roussell	2005 Sep 27 08:48-09:03	REF 15.2 cm (6.0 in.)	400	6.0	2.0	E	=	=
Roussell	2005 Oct 17 09:10-09:25	REF 15.2 cm (6.0 in.)	300	4.5	3.0	E	=	=
Roussell	2005 Oct 20 07:15-07:27	REF 15.2 cm (6.0 in.)	300	5.5	2.0	E	=	=
Roussell	2006 Feb 09 03:40-03:56	REF 15.2 cm (6.0 in.)	300	6.0	3.0	E	=	=
Roussell	2006 Mar 05 04:05-04:23	REF 15.2 cm (6.0 in.)	300	5.0	4.0	E	=	=

Notes:
Telescope types are as in Table 2. Seeing is the 0-10 ALPO Scale, and Transparency is the limiting visual magnitude in the vicinity of Saturn. Under "Filter," **B** refers to the blue W47 or W80A filters, **IL** to integrated light (no filter), and **R** to the red W25 or W23A filters. **E** means the East ansa was brighter than the W, **W** that the West ansa was brighter, and **=** means that the two ansae were equally bright. East and West directions are as noted in the text.

lation that may exist between the visual numerical relative intensity of the TWS and the varying tilt of the rings, including its brightness and visibility in variable-density polarizers, color filters, photographs, and digital images.

Bicolored Aspect of the Rings and Azimuthal Brightness Asymmetries.
The bicolored aspect of the rings refers to an observed variance in coloration between the East and West ansae (IAU system) when systematically compared with alternating W47 (where "W" denotes the Wratten filter series), W38, or W80A (all blue filters) and W25 or W23A (red filters). The circumstances of visual observations are listed in Table 8 when the bicolored aspect of the ring ansae was thought to be present in 2005-06. As in the rest of this report, directions in Table 8 refer to Saturnian or IAU directions, where West is to the right in a normally-inverted telescope image (observer located in the Northern Hemisphere of the Earth) which has South at the top.

During this apparition and previous observing seasons, observers have been systematically attempting to capture the bicolored aspect of the rings using digital imagers, but results have so far been largely inconclusive. During 2005-06, there were no images submitted showing clear evidence of this phenomenon, but now that imaging of Saturn is occurring regularly by more and more observers, the chance of success significantly improves. Combining simultaneous visual observations of Saturn with imaging of the planet on any given night by a team of observers is extremely worthwhile in searching for and trying to confirm the bicolored aspect of the rings.

Likewise, observers are urged see if they can capture subtle azimuthal brightness asymmetries in Ring A as in the past and when they are simultaneously reported by visual observers. Documenting these phenomena, particularly when they occur independent of similar effects on the globe of Saturn (which would be expected if atmospheric dispersion was the cause),

Figure 16. Position of shadow of Saturn's globe on Rings (Sh G on R).

is of tremendous value. Professional astronomers are well-acquainted with Earth-based sightings of azimuthal variations in the rings (initially confirmed by Voyager spacecraft) that apparently occur when light is scattered by denser-than-average clumps of particles orbiting in Ring A, so any images obtained by ALPO Saturn observers are very useful.

Occultation of BY Cancri (SAO 98054) by Saturn and its Rings

During the 2005-06 apparition, observers in Europe, Asia, North Africa, portions of Japan and Australia, were able to witness a comparatively rare occultation on January 25, 2006 of the variable star BY Cancri (SAO 98054) of visual magnitude +7.9 at the time of obervation (located in the famous Beehive Cluster or M44) by Saturn and its ring system. Based on information provided by David Arditti, observing the event from the UK, the beginning of the occultation was to occur at roughly 18:50 UT, with the passage of the star first making contact with Ring A and moving behind the ring system during the initial phases of the occultation, then behind Saturn's globe, and ultimately emerging near planet's South Polar limb without involving the rings again at about 20:50 UT. He submitted a set of four reasonably good digital images [Figure 32] made using a 25.4 cm (10.0 in.) DAL from 20:50-21:51 UT in poor seeing at low altitude, for which the following is an excerpt from his observing notes:

> "The occultation of BY Cancri by Saturn and its rings was not an easy event to observe or image because of the large magnitude difference between the two, the low altitude of the beginning of the event from this latitude, and generally poor seeing on the night. Moreover, webcams cannot really cope with large brightness differences in one frame (as is easily seen when trying to image the Moon close to, and away from, the terminator). However, Spode, or Murphy's Law was violated, as it was cloudy before and after, but remained clear for the entire duration of the event from North London. Lucky, since, with all the advanced publicity, I had gone to considerable efforts to prune trees for the event and adjust the telescope for the west side of the mount, which is the opposite to that on which I usually work. Using my 10 in. Cassegrain, I could not detect the star 10 minutes before the predicted ingress behind the rings either visually or with the webcam: probably due to bad seeing just above house rooftops and absorbtion. There was clearly no chance of detecting it in the Cassini division. However, the end of the event was imaged. I detected the star visually at 20:52 UT, 1.5 minute after the predicted egress for London, and was then able to record it."

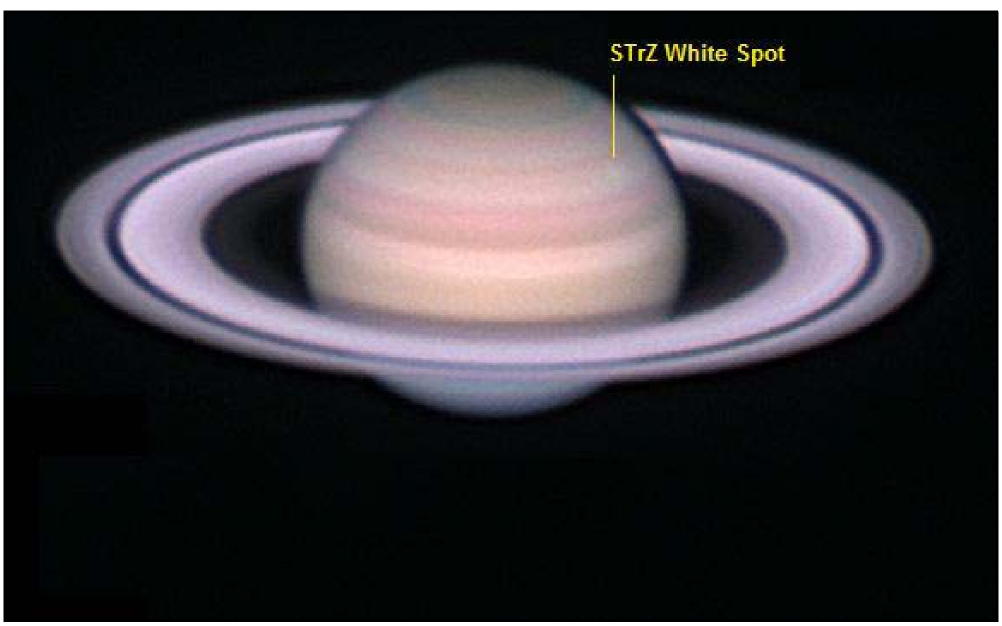


Figure 16. 2006 Feb 05 13:58 UT. Christopher Go. 28.0 cm (11.0 in.) SCT, using DMK digital imager, IL. S = 9.0, Tr = 5.0. CMI = 51.8°, CMII = 356.7°, CMIII = 124.2°, B = –19.1°, B´ –18.7°. STrZ white spot apparently showing longitudinal growth and becoming more diffuse. S is at top and E at left (IAU).

Additional images of the star's egress during the occultation were contributed by observers in the UK, namely Ian Sharp, who imaged Saturn from 20:51-20:55 UT using a 28.0 cm (11.0 in.) SCT [Figure 33], and David Tyler using a 35.6 cm (14.0 in.) SCT at 21:51 UT [Figure 34]. An occultation event like this involving a star of 7.9 visual magnitude, from the standpoint of visual observations, is best viewed with instruments well in excess of 20.3 cm (8.0 in.) aperture, but smaller instruments with digital imagers can capture phases of the occultation that might not otherwise be possible.

The Satellites of Saturn

In terms of visual magnitude, many of Saturn's satellites show tiny brightness fluctuations attributed to their varying orbital positions relative to the planet and due to asymmetries in distribution of surface markings on some. Despite close proximity sensing by spacecraft, the true nature and extent of all of the observed satellite brightness variations is not totally understood and merits further study.

ALPO Saturn Section observers in 2005-06 submitted no systematic visual estimates of Saturn's satellites employing recommended systematic techniques by the ALPO Saturn Section. For example, even though photometry has mostly replaced visual magnitude estimates of the Saturnian satellites, visual observers can still try to establish the comparative brightness of a satellite relative to reference stars of calibrated brightness when Saturn passes through a field of stars that have precisely known magnitudes. Observers can utilize a good star atlas that goes faint enough and an accompanying star catalogue listing reliable magnitude values for this kind of work. A number of excellent computer star atlases exist that facilitate precise plots of Saturn's path against background stars for comparative magnitude estimates.

Visual satellite photometry begins by first selecting at least two stars with well-established magnitudes; that is, stars that have about the same color and brightness as the satellite. One of the stars chosen should be slightly fainter and the other a little brighter than the satellite so that the difference in brightness between the stars is about 1.0 magnitude. This makes it easy to divide the brightness difference between the two comparison stars into equal magnitude steps of 0.1, and to estimate the visual magnitude of the satellite, simply place it along the scale between the fainter and brighter comparison stars.

In the absence of suitable reference stars, a last resort alternative is to use Saturn's brightest satellite, Titan, at visual magnitude 8.4. It is known to exhibit only subtle brightness fluctuations over time compared with the other bright satellites of Saturn that have measured amplitudes. Some observers are starting to use digital imagers with sufficient sensitivity to capture the satellites of Saturn, along with any nearby comparison stars, as a permanent record to accompany visual magnitude estimates as described above.

Images of the positions of satellites relative to Saturn on a given date and time are tremendously worthwhile for cross-checking against ephemeris predictions of their locations and identities. It is important to realize, however, that the brightness of satellites and comparison stars on digital images will not necessarily correspond to visual impressions because the peak wavelength response of the CCD chip is different from that of the eye.

Relative to capturing the satellites of Saturn with digital imagers, two observers submitted samples of the type of observations that could be extremely useful if suitable field stars are carefully identified for comparative magnitude estimates. The image, by Frank J. Melillo of Holtsville, NY, shows Saturn (globe and rings necessarily over-exposed) and several of its brighter moons (Titan, Hyperion, Rhea, Dione, Tethys, Mimas, and Enceladus) with unidentified background comparison stars on January 28, 2006 at 05:40 UT with a 20.3 cm (8.0 in.) SCT and Starlight XpressMX-5 camera in good seeing [Figure 33].

Likewise, Geoff Chester of Alexandria, VA used the Alvan Clark 66.0 cm (26.0 in.) REF of the U.S. Naval Observatory in Washington, DC and a digital camera (using eyepiece projection) on March 19, 2006 at 02:06 UT to produce a composite image of the moons Titan, Mimas, Rhea,

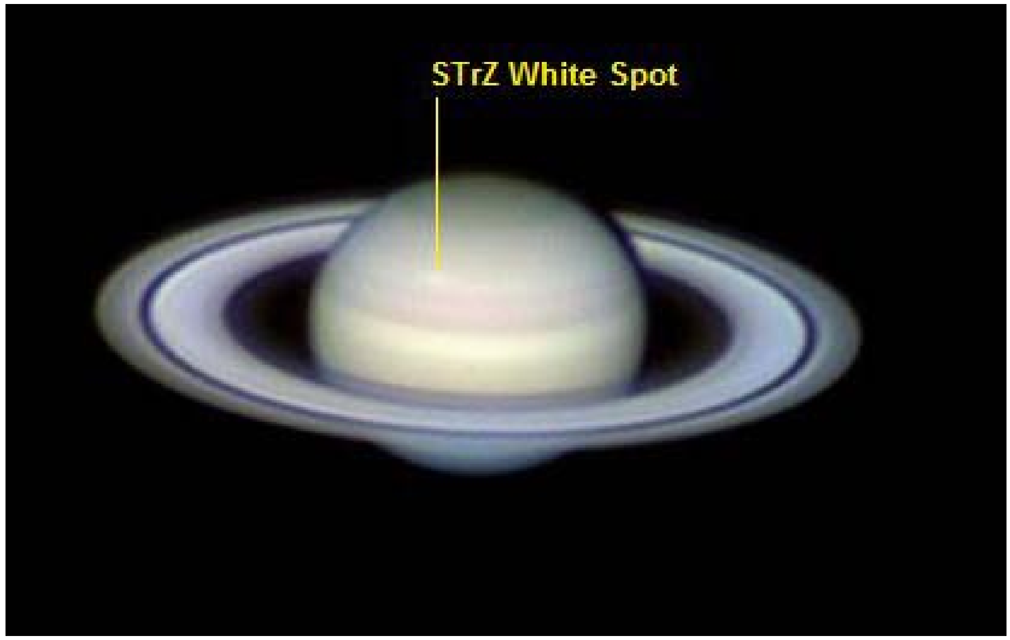


Figure 17. 2006 Feb 19 00:01 UT. Richard Bosman. 28.0 cm (11.0 in.) SCT, with ATK 2C digital imager, IL + RGB filters & IR blocker. S and Tr not specified. CMI = 221.9°, CMII = 93.4°, CMIII = 204.7° B = –19.5°, B´ = –18.5°. Elongated STrZ white spot E of CM. S is at top and E at left (IAU).

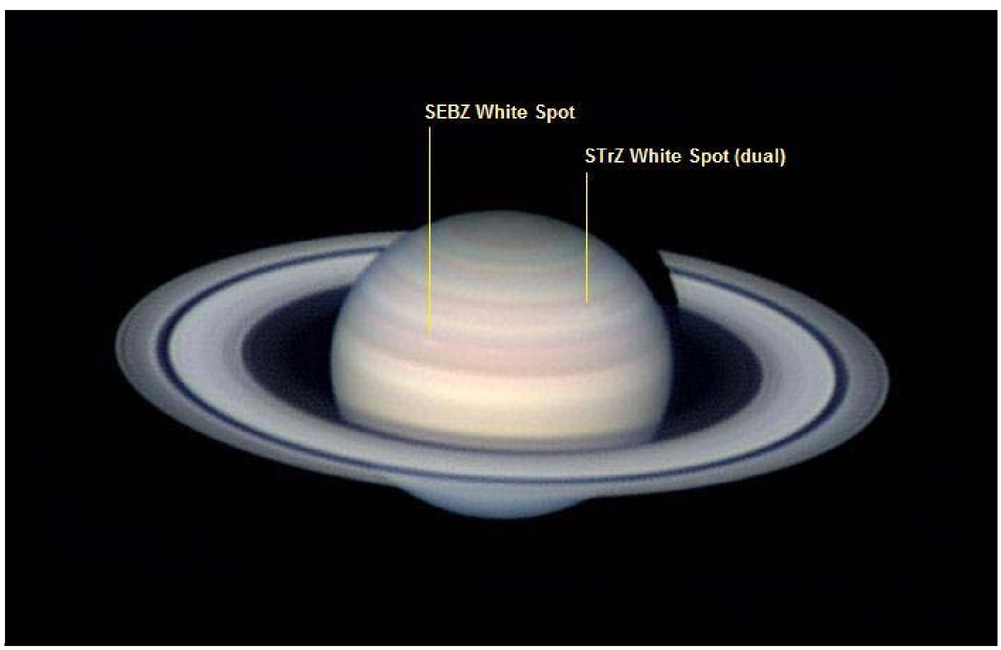


Figure 18. 2006 Mar 15 19:56 UT. Damian Peach. 35.6 cm (14.0 in.) SCT, with ATK -1HS, IL. S and Tr not specified. CMI = 305.9°, CMII = 95.5°, CMIII = 176.8° B = –20.0°, B´ = –18.2°. STrZ white spot W of CM has now split into two; a small SEBZ white spot is also visible in this image E of CM. S is at top and E at left (IAU).

Dione, Tethys, and Enceladus, all apparent in the field of view (Saturn is overexposed) and a background comparison star [Figure 36].

Observers who have photoelectric photometers may also contribute measurements of Saturn's satellites, but they are notoriously difficult to measure owing to their faintness compared with the planet itself. Sophisticated techniques are required to correct for scattered light surrounding Saturn and its rings.

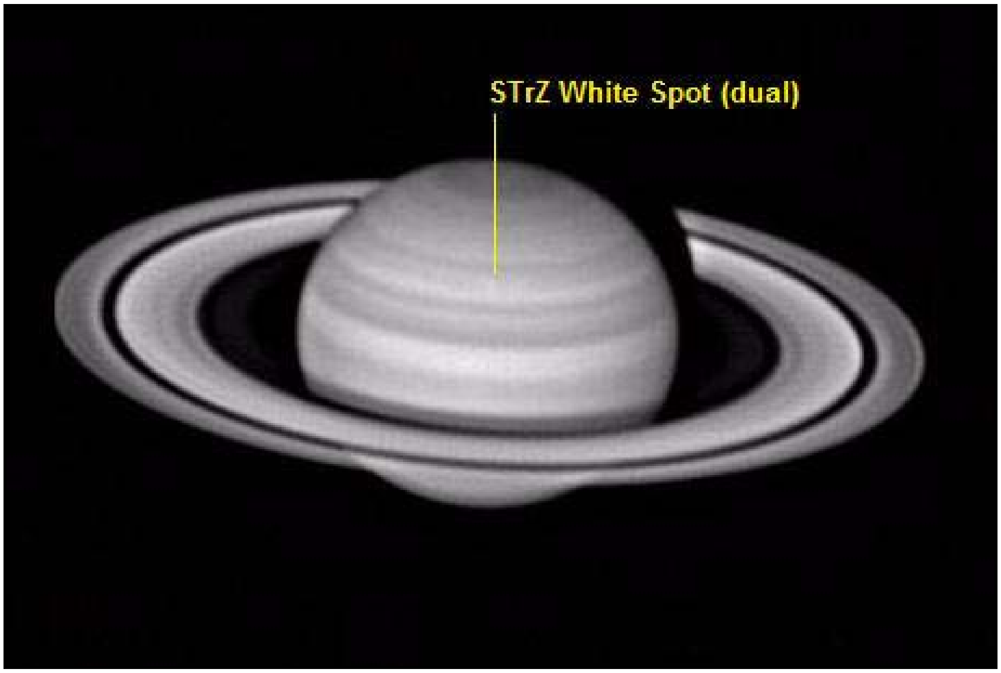


Figure 19. 2006 Apr 11 23:44 UT. Damian Peach. 35.6 cm (14.0 in.) SCT, with ATK -1HS, IL + red filter. S and Tr not specified. CMI = 194.1°, CMII = 186.5°, CMIII = 235.1° B = –20.2°, B´ = –17.9°. Dual STrZ white spot is near CM. S is at top and E at left (IAU).

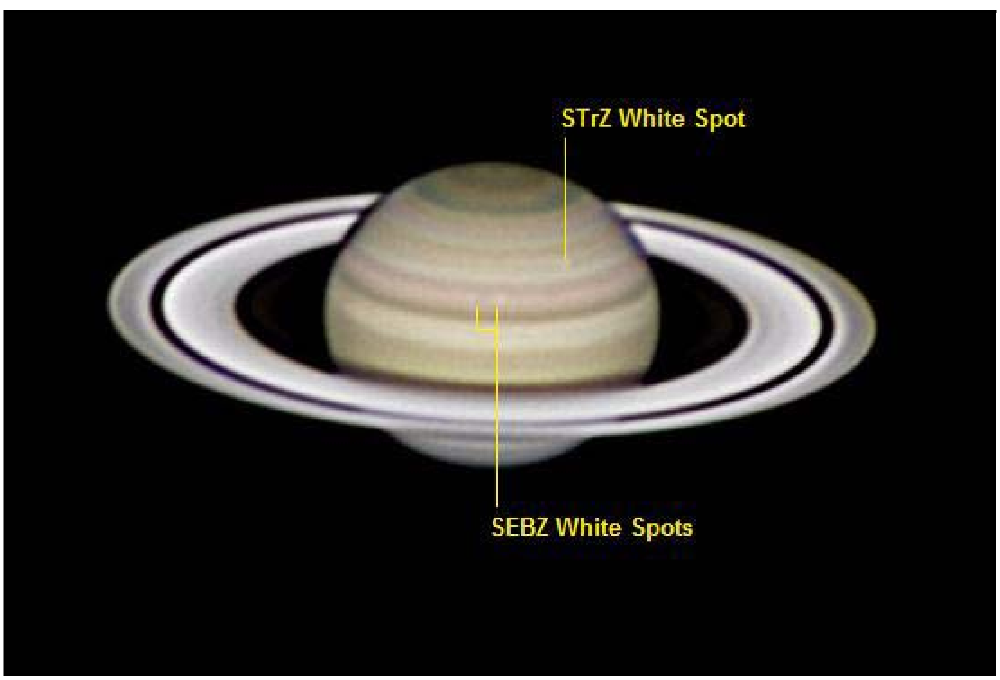


Figure 20. 2006 Jan 24 03:59 UT. Donald C. Parker. 40.6 cm (16.0 in.) NEW, with Lumenera digital imager, IL + RGB filters. S and Tr not specified. CMI = 8.1°, CMII = 354.0°, CMIII = 136.4° B = –18.8°, B´ = –18.8. SEBZ white spots near CM; STrZ white spot W of CM is also visible in image. S is at top and E at left (IAU).

Nearly half a decade ago in 1999-2000, observers were encouraged to try spectroscopy of Titan as part of a newly-introduced professional-amateur cooperative project. Despite the fact that Titan has been studied by the Hubble Space Telescope (HST), very large Earth-based instruments, and more recently by the highly successful Cassini-Huygens mission, opportunities still remain for systematic observations by amateurs with appropriate instrumentation. As the Cassini-Huygens mission in 2004-05 and henceforth has revealed, Titan is quite a dynamic world with transient as well as long-term variations.

As discussed in past apparition reports, from wavelengths of 300 nm to 600 nm, Titan's hue is dominated by a reddish methane (CH_4) atmospheric haze, and beyond 600 nm, deeper CH_4 absorption bands appear in its spectrum. Between these CH_4 bands exist "portals" to Titan's lower atmosphere and surface, so daily monitoring in these regions with photometers or spectrophotometers is worthwhile for cloud and surface studies to supplement professional work still underway in support of Cassini-Huygens. Furthermore, long-term studies of other areas from one apparition to the next is meaningful in helping shed light on Titan's known seasonal variations. Observers with suitable equipment are urged to participate in these interesting and immensely useful professional-amateur projects. Further details on these programs can be found on the Saturn page of the ALPO website at http://www.alpo-astronomy.org/saturn/ as well as directly from the ALPO Saturn Section.

Simultaneous Observations

Simultaneous observations, or studies of Saturn by individuals working independently of one another at the same time and on the same date, offer tremendous opportunities for verification of ill-defined or traditionally controversial Saturnian phenomena. The ALPO Saturn Section has organized a simultaneous observing team so that several individuals in reasonable proximity of one another can maximize the chances of viewing and imaging Saturn at the same time using similar equipment and methods. Cooperative efforts like this significantly reinforce the level of confidence in the data submitted for each apparition. Several simultaneous, or near-simultaneous, observations of Saturn were submitted during 2005-06, but as in previous observing seasons, such observations occur rather fortuitously. Experienced observers usually are the more common participants in such an endeavor, but newcomers to our programs are most welcome to get involved. Readers are urged to inquire about how to join our simultaneous observing team.

Figure 21. 2005 Sep 23 12:34 UT Paul Maxson. 25.4 cm (10.0 in.) CAS, with Philips ToUcam digital imager, IL. S = 3.0 (Tr not specified). CMI = 134.0°, CMII = 121.0°, CMIII = 52.0° B = –18.5°, B´ = –20.3. SEBn is considerably darker that the SEBs; SEBZ separates the two SEB components.

Figure 22. 2006 Feb 02 20:32 UT. Cristina Mazzotti. 30.5 cm (12.0 in.) SCT, with Lumenera digital imager, IL + IR blocker. S = 5.0, Tr not specified. CMI = 269.7°, CMII = 302.7°, CMIII = 73.5° B = –19.0°, B´ = –18.7. SEBZ white spots just E of CM. S is at top and E at left (IAU).

Conclusions

The globe of Saturn during 2005-06 exhibited a small amount of discrete activity, largely in the form of very small white spots in the SPR, STrZ, and SEBZ with a few dusky elongations and festoon-like features in the vicinity of the SEB during the apparition. It is difficult, however, to conclude that there atmospheric activity was on the increase since 2004-05. A relatively dull SPC surrounded by a bit lighter SPR was reported often this apparition, confirmed both visually and with digital imagers.

Apart from many visual observations and digital images showing Cassini's (A0 or B10), Encke's (A5), and Keeler's (A8) divisions, visual observers suspected and digital imagers recorded a few different intensity minima at different locations within Ring B. At least one visual observer suspected and sketched dusky ring spokes that were possibly evident at the inner edge of Ring B during 2005-06, but there were no digital images submitted this observing season that showed radial spokes in either Ring A or B. Only one observer submitted an account of the possibility of the bicolored aspect of the ring ansae during the apparition. Minor fluctuations in belt and zone intensities were possibly indicated from an analysis of visual numerical relative intensity estimates.

Digital imaging, which now regularly supplements careful detailed visual work, continues to reveal fine detail on the globe and in the rings below the normal visual threshold. The combination of both methods improves the chances of detecting changes on Saturn during any given apparition. Also, an initial recording of different regions of Saturn with digital imagers may signal outbursts of activity that visual observers may eventually be able to see and monitor with their telescopes, as well as define the limits of visibility of such features.

The author sincerely thanks all of the individuals mentioned in this report who contributed drawings, digital images, descriptive reports, and visual numerical relative intensity estimates during the 2005-06 apparition. Systematic observational work in support of our programs helps amateur and professional astronomers alike to obtain a better understanding of Saturn and its beautiful, dynamic rings. Observers the world over are invited to participate in our programs in future observing seasons.

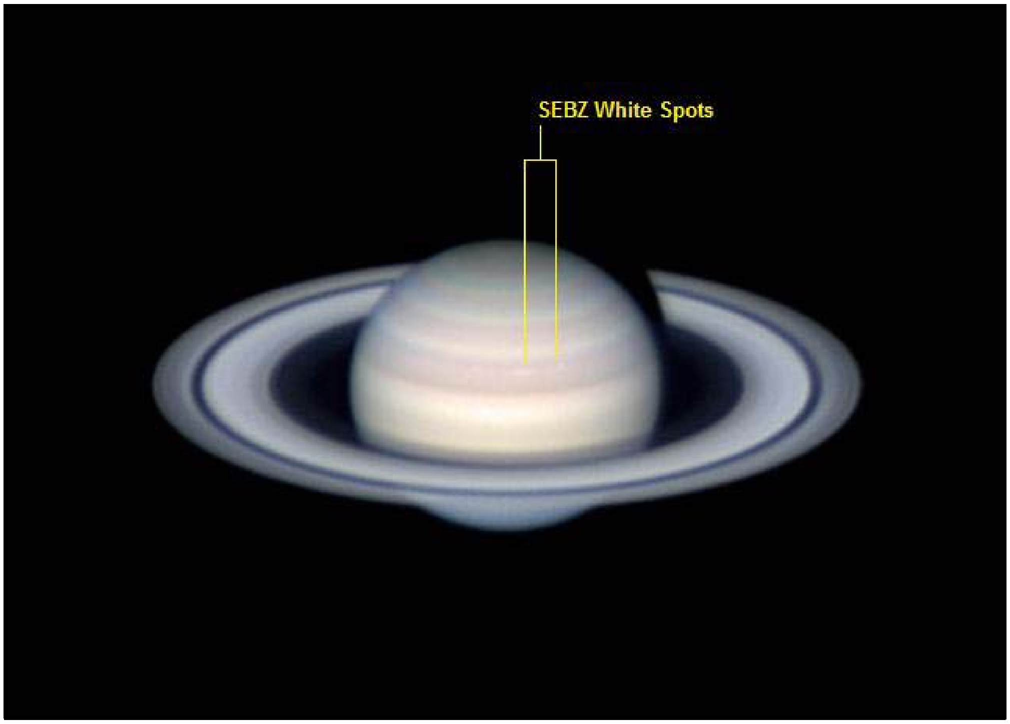


Figure 23. 2006 Mar 22 19:37 UT. Damian Peach. 35.6 cm (14.0 in.) SCT, with ATK -1HS digital imager, IL + RGB filters. S and Tr not specified. CMI = 84.6°, CMII = 8.5°, CMIII = 81.4° B = –20.1°, B´ = –18.1°. SEBZ white spots approaching CM; leading spot is more elongated than the trailing spot. S is at top and E at left (IAU).

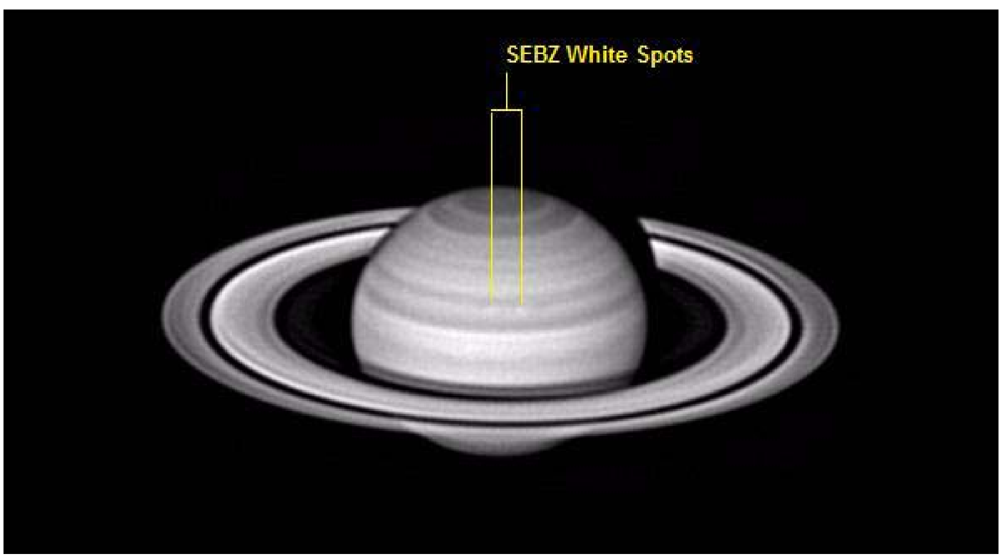


Figure 24. 2006 Apr 09 23:52 UT. Damian Peach. 35.6 cm (14.0 in.) SCT, with ATK –1HS digital imager, IL + RGB filters. S and Tr not specified. CMI = 310.4°, CMII = 7.1°, CMIII = 58.2° B = 20.2°, B´ = –17.9°. SEBZ white spots near CM. S is at top and E at left (IAU).

Our cooperative involvement in professional-amateur (Pro-Am) projects continued this apparition following an e-mail request from the Radio and Plasma Wave Science (RPWS) team at NASA's Goddard Space Flight Center for ALPO Saturn observers to monitor the planet for any new Southern Hemisphere bright clouds. Cassini had discovered radio noise associated with a dynamic storm near 36° south on Saturn, and it turned out that on January 25, 2006 ALPO observers imaged a small white spot in the region of the STeB-STrZ. This white spot seemed to correspond with the outburst of radio noise detected by the Cassini spacecraft, and the storm was regularly imaged by ALPO observers, with the observations being made available to the professional community.

Readers may recall a similar Pro-Am opportunity in 2004-05 in association with the Amateur-Professional Cassini Observing Patrol, as Cassini arrived at Saturn on July 1, 2004, followed by the Titan Probe Entry and Orbiter flyby occurring on November 27, 2004. Digital images, at wavelengths ranging from 400 nm - 1m under good seeing conditions were solicited from amateurs starting in April 2004, coinciding with the time Cassini started observing Saturn at close range. This Pro-Am effort has continued ever since, and to participate, observers need to utilize classical broadband filters (e.g., Johnson system: B, V, R and I) with telescopes of 31.8 cm (12.5 in.) in aperture or greater, imaging through a 890 nm narrow band CH_4 (methane) filter as well.

The Cassini Team requests observers to systematically patrol the planet every clear night for individual features, watching their motions and morphology, to provide input of interesting large-scale targets for Cassini's imaging system to begin close-up surveillance. Accounts of suspected variations in belt and zone reflectivities (i.e., intensity) and color are also very useful, so visual observers can continue to play a very meaningful role by making routine visual numerical relative intensity estimates. The Cassini team combines ALPO Saturn Section images with data from the Hubble Space Telescope and from other professional ground-based observatories for immediate and future study. As a means of facilitating regular amateur-professional observational cooperation, readers are urged to contact the ALPO Saturn Section for instructions on how they can share their observational reports, drawings, and images of Saturn and its satellites with the professional community. The author is always delighted to offer guidance to novices, as well as more experienced observers. A very meaningful resource for learning how to observe and record data on Saturn is the ALPO Training Program, and it is recommended that beginners take advantage of this valuable educational resource.

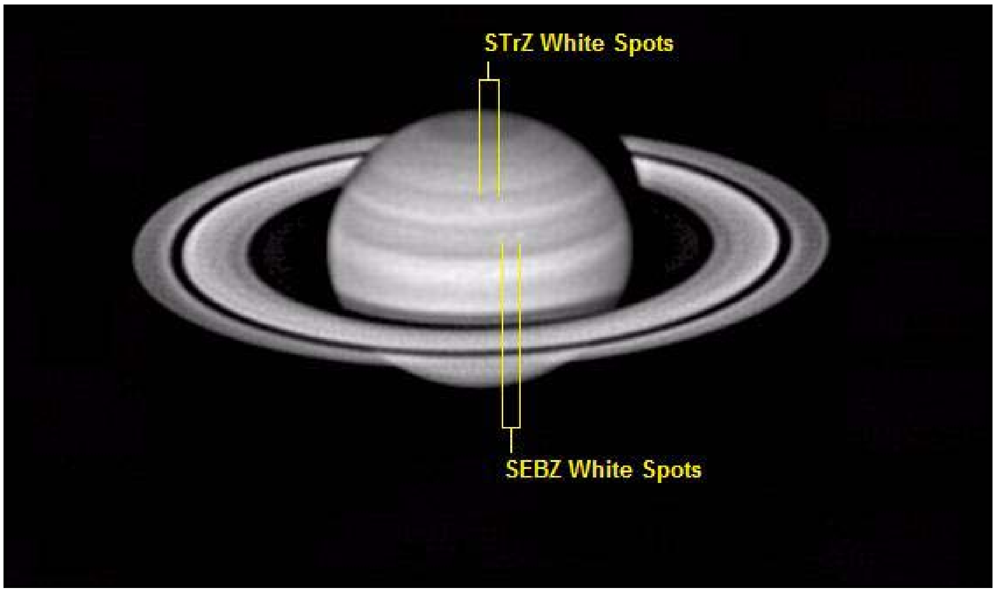


Figure 25. 2006 Apr 19 23:48 UT. Damian Peach. 35.6 cm (14.0 in.) SCT, with ATK –1HS digital imager, IL + RGB filters. S and Tr not specified. CMI = 110.0°, CMII = 203.9°, CMIII = 242.9° B = –20.1°, B´ = –17.8°. SEBZ white spots just W of CM; dual STrZ white spots are near CM. S is at top and E at left (IAU).

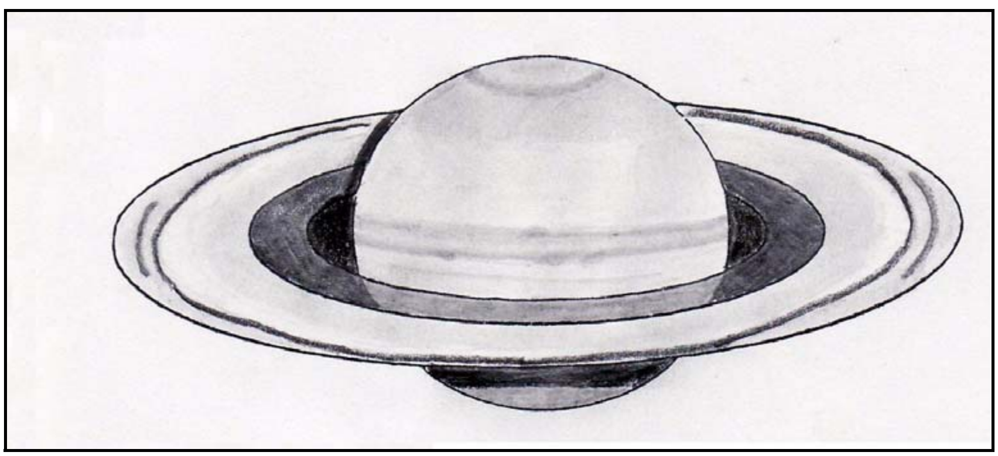


Figure 26. 2005 Oct 20 07:27 UT. Carl Roussell. 15.2 cm (6.0 in.) REF. Drawing at 300X with W80A (blue), W58 (green) and W23A (red) filters, and IL. S = 5.5, Tr = 2.0. CMI = 70.0°, CMII = 271.7°, CMIII = 170.4° B = –17.8°, B´ = –20.1°. Dark features seen along SEBs & SEBn. S is at top and E at left (IAU).

References

Alexander, A.F. O'D. *The Planet Saturn*. London: Faber and Faber, 1962.

Benton, J.L., Jr., *Saturn and How to Observe It*. London: Springer-Verlag, 2005.

----------------, *Visual Observations of the Planet Saturn: Theory and Methods (The Saturn Handbook)*. Savannah, GA: Review Publishing Company, 1996 (8th Revised Edition - now available also in pdf format).

---------------------, 1999 The 1995-96 Apparition of Saturn and Edgewise Presentation of the Rings: Visual and Other Observations, *Journal of the Assn of Lunar & Planetary Observers*, 41, 1: 1-23.

---------------------, 1999, *Observations of Saturn During the 1996-97 Apparition*, *Journal of the Assn of Lunar & Planetary Observers*, 42, 1: 28-40.

---------------------, 2000, Observations of Saturn During the 1997-98 Apparition, *Journal of the Assn of Lunar & Planetary Observers*, 42, 3: 106-117.

---------------------, 2001,"Observations of Saturn During the 1998-99 Apparition, *Journal of the Assn of Lunar & Planetary Observers*, 43, 4: 31-43.

---------------------, 2002,"*Observations of Saturn During the 1999-2000 Apparition*, *Journal of the Assn of Lunar & Planetary Observers*, 44, 1: 15-27.

---------------------, 2003, *ALPO Observations of Saturn During the 2000-2001 Apparition, Journal of the Assn of Lunar & Planetary Observers*, 45, 1: 64-76.

---------------------, 2004, *ALPO Observations of Saturn During the 2001-2002 Apparition*, *Journal of the Assn of Lunar & Planetary Observers*, 46, 1: 24-39.

----------------, 2006, *ALPO Observations of Saturn During the 2002-2003, Apparition*, *Journal of the Assn of Lunar & Planetary Observers, 48*, 2: 24-40.

----------------, 2007, *ALPO Observations of Saturn During the 2003-2004 Apparition*, *Journal of the Assn of Lunar & Planetary Observers, 49, 2: 32-55*.

----------------, 2008, *ALPO Observations of Saturn During the 2004-2005 Apparition*, *Journal of the Assn of Lunar & Planetary Observers, 50, 1: 30-54*.

Gehrels, T. and Matthews, M.S., *Saturn.* Tucson: University of Arizona Press, 1984.

Kozyrev, N.A., 1974, "*East-West Asymmetry of Saturn's Ring*," *Astrophysics and Space Science, 27*, 1: 111-116.

Lukkari, J. and Piironen, J.O., 1981, "*The East-West Asymmetry of Saturn's Rings: New Measurements?*," *The Moon and Planets, 25*, 133-136.

Morrison, D., *Voyages to Saturn (NASA SP-451)*. Washington: U.S. Government Printing Office, 1982.

Smith, B. A., et al, 1981, "*Encounter with Saturn: Voyager 1 Imaging Science Results*," *Science, 212*, 163-191.

Spilker, Linda J., Editor, *Passage to A Ringed World: The Cassini-Huygens Mission to Saturn and Titan* (NASA SP-533). Washington: U.S. Government Printing Office, 1997. United States Naval Observatory.

The Astronomical Almanac 2005, Washington: U.S. Government Printing Office.

The Astronomical Almanac 2006. Washington: U.S. Government Printing Office.

Figure 27. 2005 Nov 20 04:35 UT. Damian Peach. 35.6 cm (14.0 in.) SCT, with ATK –1HS digital imager, IL + RGB filters. S and Tr not specified. CMI = 223.9°, CMII = 148.1°, CMIII = 9.5° B = –17.4°, B´ = –19.6°. The narrow EB is easily visible within the EZ running across the globe of Saturn. S is at top and E at left (IAU).

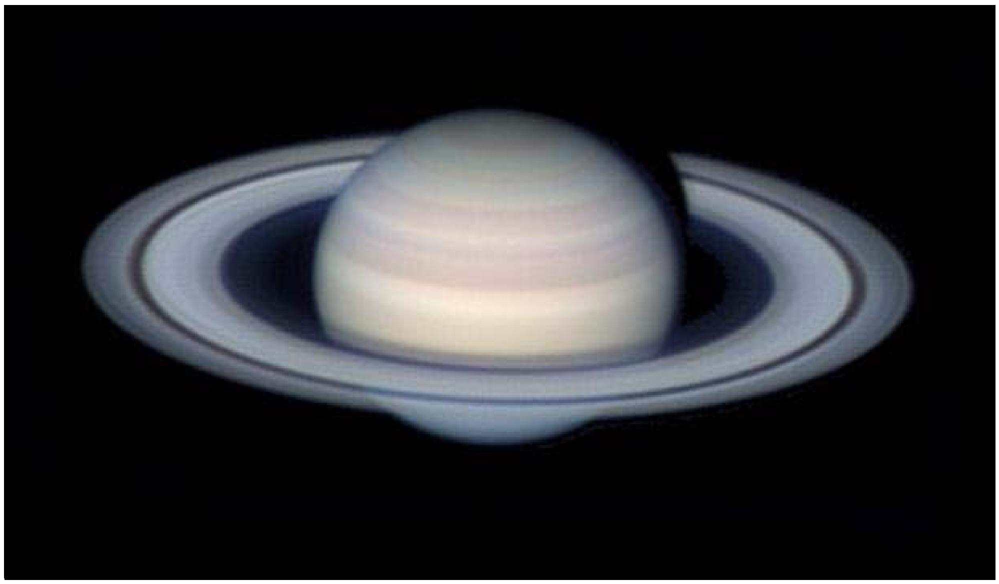


Figure 28. 2006 Apr 21 01:07 UT. Damian Peach. 35.6 cm (14.0 in.) SCT, with ATK –1HS digital imager, IL + RGB filters. S and Tr not specified. CMI = 280.9°, CMII = 340.2°, CMIII = 18.5° B = –20.1°, B´ = –17.8°. Encke' Complex (A5) and Keeler's Gap (A8) are visible in this image at both ansae in Ring A. S is at top and E at left (IAU).

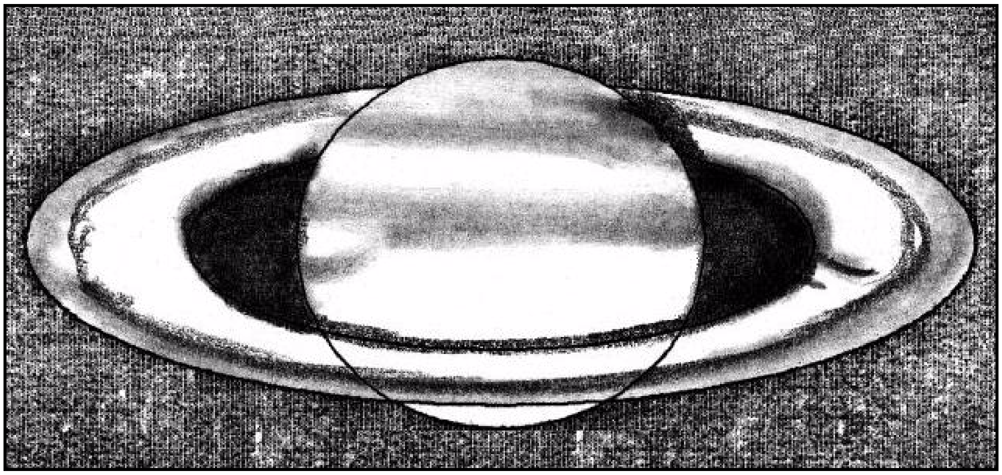


Figure 29. 2006 Feb 24 20:32 UT. Detlev Niechoy. 20.3 cm (8.0 in.) SCT. Drawing at 225X, IL. S = 5.5, Tr = 2.0. CMI = 125.7°, CMII = 167.6°, CMIII = 272.4° B = –19.7°, B´ –18.5°. Very ill-defined dusky features or spokes were suspected in poor seeing in Ring B at the W ansa. S is at top and E at left (IAU).

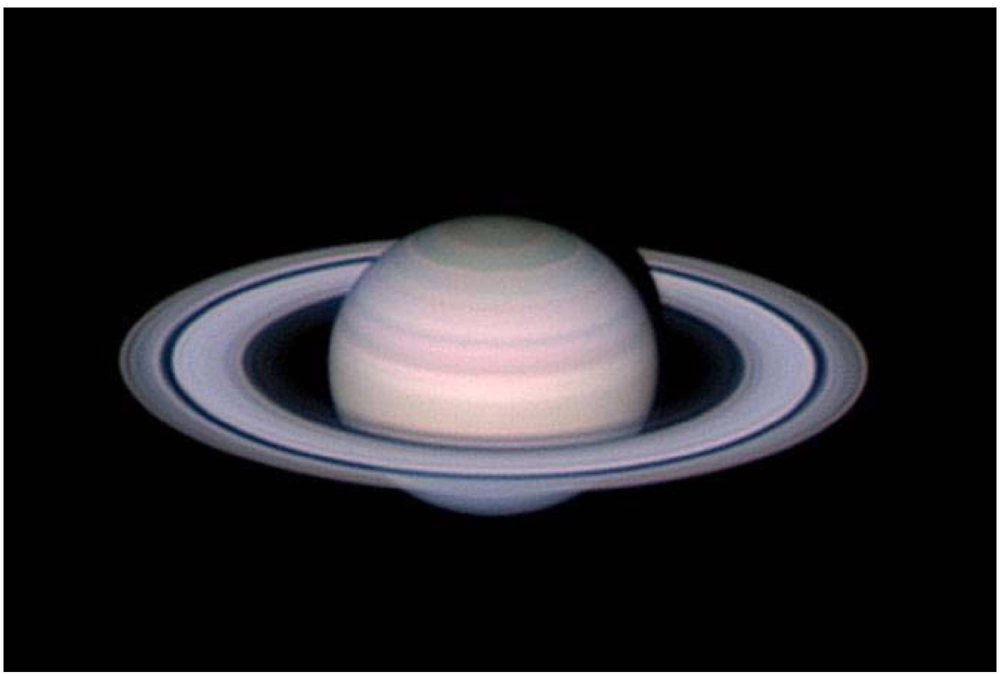


Figure 30. 2006 Mar 16 01:42 UT. Larry Owens. 35.6 cm (14.0 in.) SCT, with Lumenera Lu075 digital imager, RGB filters. S = 6.0 (Tr not specified). CMI = 149.1°, CMII = 290.4°, CMIII = 12.0° B = –20.0°, B´ –18.2°. Considerable detail is visible in Ring B including several intensity minima at various positions, and Cassini's Division (A0 or B10) is black and visible around the circumference of Ring B. S is at top and E at left (IAU).

Figure 31. 2006 Apr 21 20:18 UT. Cristian Fattinnanzi. 25.4 cm (10.0 in.) NEW, with Philips Vesta pro digital imager, IL + IR blocker. S = 6.5 (Tr not specified). CMI = 235.7°, CMII = 269.2°, CMIII = 306.5° B = –20.1°, B´ = –17.8°. Ring C is readily apparent at both ansae, and Crape Band is visible crossing the globe. S is at top and E at left (IAU).

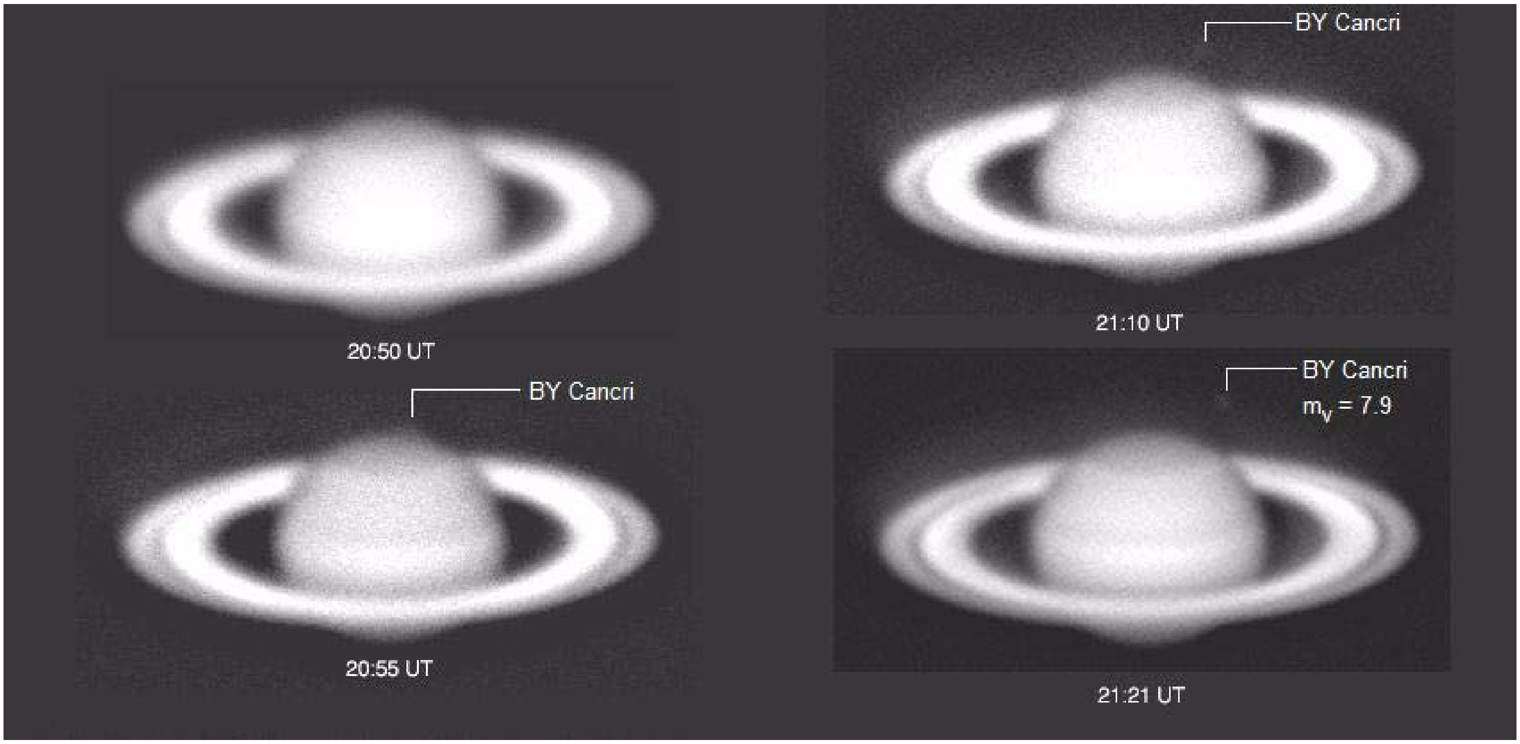


Figure 32. 2006 Jan 25 20:50-21:21 UT. David Arditti. 25.4 cm (10.0 in.) DAL, with Philips ToUcam digital imager + IR blocker. CMI = 5.6°-23.8 °, CMII = 296.0°-313.5°, CMIII = 77.0°-94.5° B = –18.8°, B´ = –18.8°. Progressive egress of occulted variable star BY Cancri (mv = 7.9) from behind Saturn's South polar limb. S is at top and E at left (IAU).

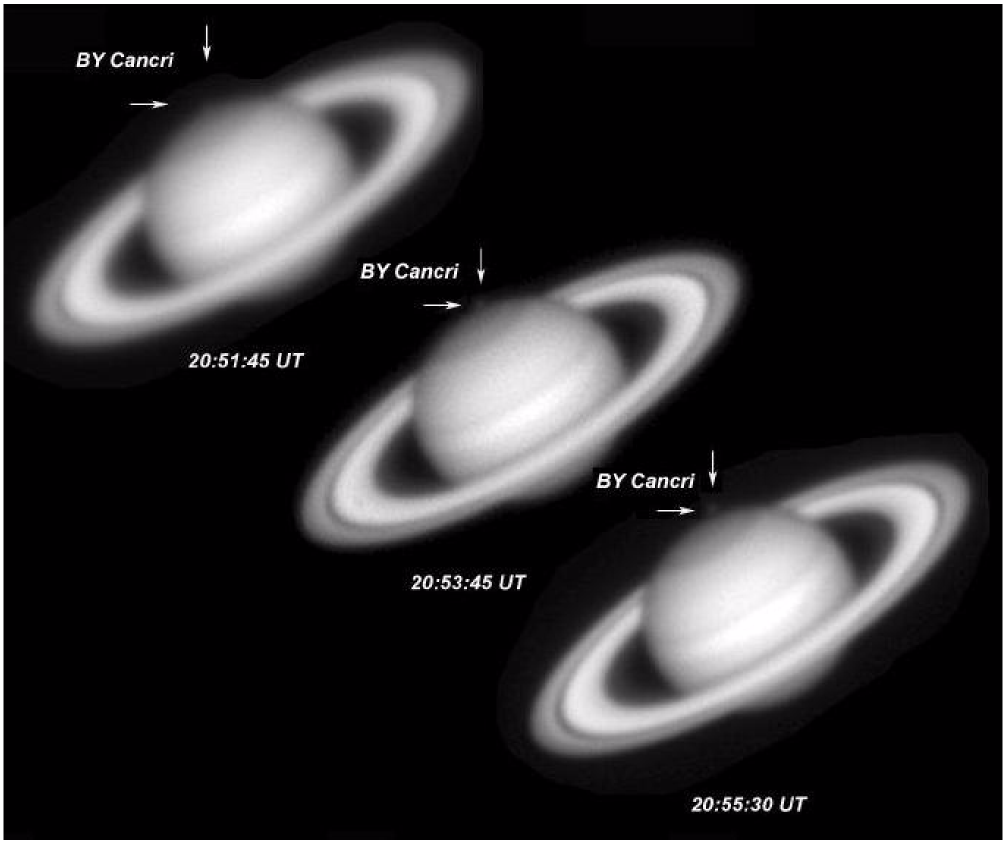


Figure 33. 2006 Jan 25 20:51-20:55 UT. Ian Sharp. 28.0 cm (11.0 in.) SCT, with ATK –1HS digital imager, IL + RGB filters. CMI = 8.5°, CMII = 298.9°, CMIII = 79.9° B = –18.8°, B´ = –18.8°. Egress of occulted variable star BY Cancri (mv = 7.9) from behind Saturn's South polar limb. S is at top and E at left (IAU).

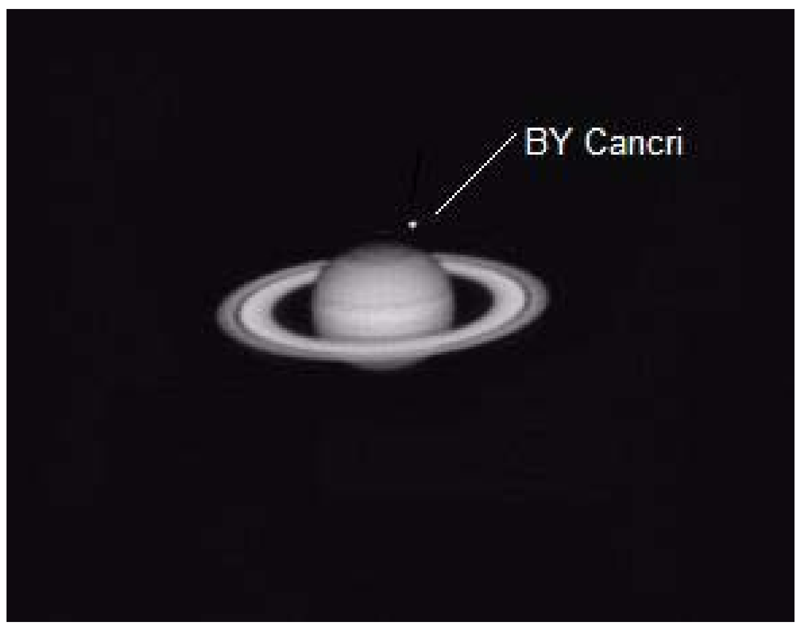


Figure 34. 2006 Jan 25 21:31 UT. David Tyler. 35.6 cm (14.0 in.) SCT, with ATK –1HS digital imager, IL + RGB filters. CMI = 29.7°, CMII = 319.2°, CMIII = 100.1° B = –18.8°, B´ = –18.8°. Egress of occulted variable star BY Cancri (mv = 7.9) from behind Saturn's South polar limb. S is at top and E at left (IAU).

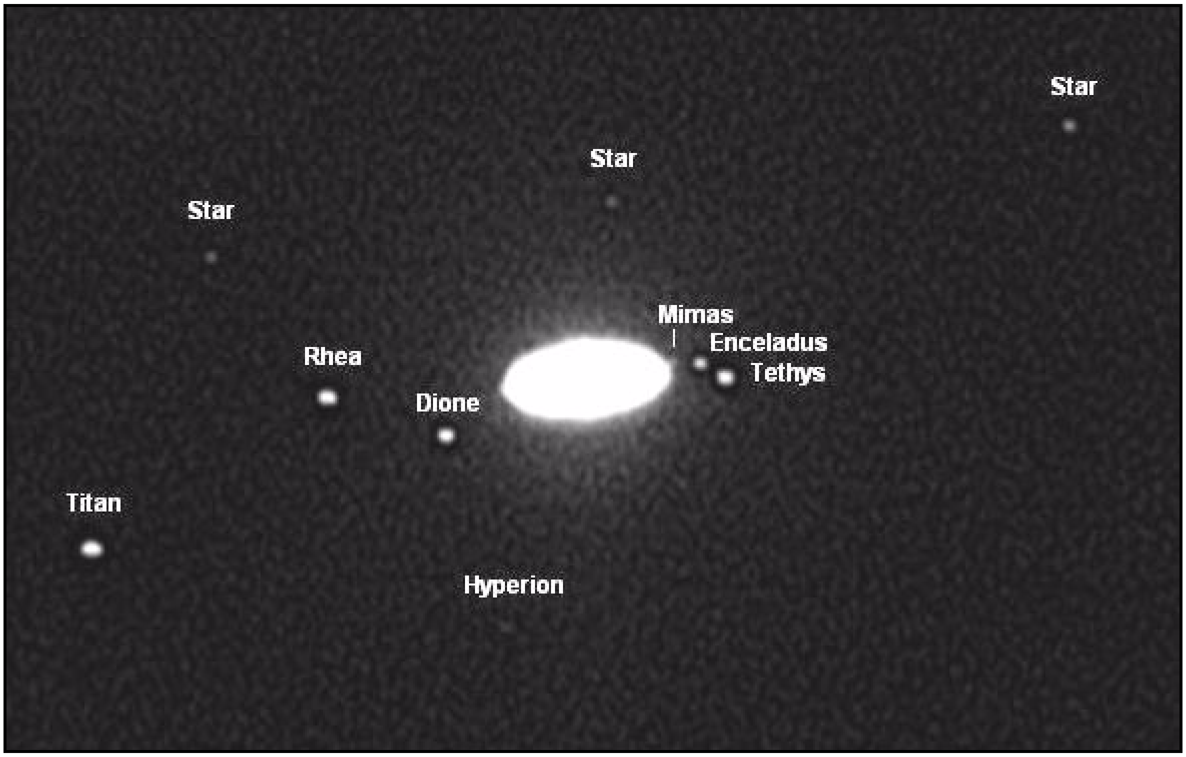


Figure 35. 2006 Jan 28 05:40 UT. Frank J. Melillo. 20.3 cm (8.0 in.) SCT, with Starlight Xpress MX-5 digital imager, IL. B = –18.9°, B´ = –18.8°. Image of seven satellites of Saturn with three stars in field. S is at top and E at left (IAU).

Figure 36. 2006 Mar 19 02:06 UT. Geoff Chester. Alvan Clark 66.0 cm (26.0 in.) REF of the U.S. Naval Observatory with Canon PowerShot A95 digital camera + eyepiece projection, IL. B = –20.0°, B´ = –18.2°. Image of six Saturnian satellites with comparison star in field of view. S is at top and E at left (IAU).

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Online Readers

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

ALPO Resources

People, publications, etc., to help our members

son, Arizona, October 19-21, 1996.20 pages. Hard copy $3 for the United States, Canada, and Mexico; $4 elsewhere.

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

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

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

- **Monograph Number 10.** *Observing and Understanding Uranus, Neptune and Pluto*. By Richard W. Schmude, Jr. 31 pages.Hard copy $4 for the United States, Canada, and Mexico; $5 elsewhere.

ALPO Observing Section Publications

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

- **Solar:** Totally revised *Guidelines for the Observation and Reporting of Solar Phenomena*, $10 USD; includes CD with 100 page-manual in pdf with up-to-date techniques, images, and links to many solar references. Produced by ALPO Solar Section Assistant Coordinator and Archivist Jamey Jenkins, this publication replaces *Observe and Understand the Sun* and its predecessor, *The Association of Lunar& Planetary Observer's Solar Section Handbook for the White Light Observation of Solar Phenomena*, both by the ALPO's own Rik Hill. To order, send check or US money order made payable to Jamey Jenkins, 308 West First Street, Homer, Illinois 61849; e-mail to jenkinsjl@yahoo.com

- **Lunar & Planetary Training Section:** *The Novice Observers Handbook* $15. An introductory text to the training program. Includes directions for recording lunar and planetary observations, useful exercises for determining observational parameters, and observing forms. Available as pdf file via e-mail or send check or money order payable to Timothy J. Robertson, 2010 Hillgate Way #L, Simi Valley, CA 93065; e-mail cometman@cometman.net.

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

- **Lunar**: *The Lunar Observer*, official newsletter of the ALPO Lunar Section, published monthly. Free at http://www.zone-vx.com/tlo.pdf or 70 cents per copy hard copy; send SASE with payment (check or money order) to: William Dembowski, Elton Moonshine Observatory, 219 Old Bedford Pike, Windber, PA 15963

- **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):** (1) *ALPO Venus Observing Kit,* $17.50; includes introductory description of ALPO Venus observing programs for beginners, a full set of observing forms, and a copy of *The Venus Handbook.* (2) *Observing Forms,* free at http://www.alpo-astronomy.org/venus, or $10 for a packet of forms by regular mail (specify *Venus Forms).* To order either numbers (1) or (2), send a check or money order payable to "Julius L. Benton, Jr." All foreign orders should include $5 additional for postage and handling; p/h included in price for domestic orders. Shipment will be made in two to three weeks under normal circumstances. NOTE: Observers who wish to make copies of the observing forms may instead send a SASE for a copy of forms available for each program. Authorization to duplicate forms is given only for the purpose of recording and submitting observations to the ALPO Venus section. Observers should make copies using high-quality paper.

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

ALPO Resources

People, publications, etc., to help our members

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):** (1) *ALPO Saturn Observing Kit*, $20; includes introductory description of Saturn observing programs for beginners, and a full set of observing forms, and a copy of *The Saturn Handbook*. Newly released book *Saturn and How to Observe It* (by J. Benton) replaced to *The Saturn Handbook* in early 2006. (2) *Saturn Observing Forms*, free at *http://www.alpo-astronomy.org/saturn*, or $10 by regular mail. Specify *Saturn Forms.* NOTE: Observers who wish to make copies of the observing forms may instead send a SASE for a copy of forms available for each program. Authorization to duplicate forms is given only for the purpose of recording and submitting observations to the ALPO 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).

- ***Back issues of The Strolling Astronomer (JALPO)***. 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).

Many of the hard copy back issues listed below are almost out of stock, and it is impossible to guarantee that they will remain available. Issues will be sold on a first-come, first-served basis. Back issues are $4 each, and $5 for the current issue. We can arrange discounts on orders of more than $30. Order directly from and make payment to “Walter H. Haas” (see address under “Board of Directors,”):

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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. 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 Journal at appropriate intervals. Each 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 through our web site via e-mail or at their postal mail addresses listed in back of 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*. Membership dues include a subscription to our Journal. Two versions of our ALPO are distributed on a quarterly basis, a hardcopy (paper) version and an online (digital) version in "portable document format" (pdf) at considerably reduced cost.

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