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Journal of the Association of Lunar & Planetary Observers

Founded in 1947

The Strolling Astronomer

Volume 55, Number 3, Summer 2013

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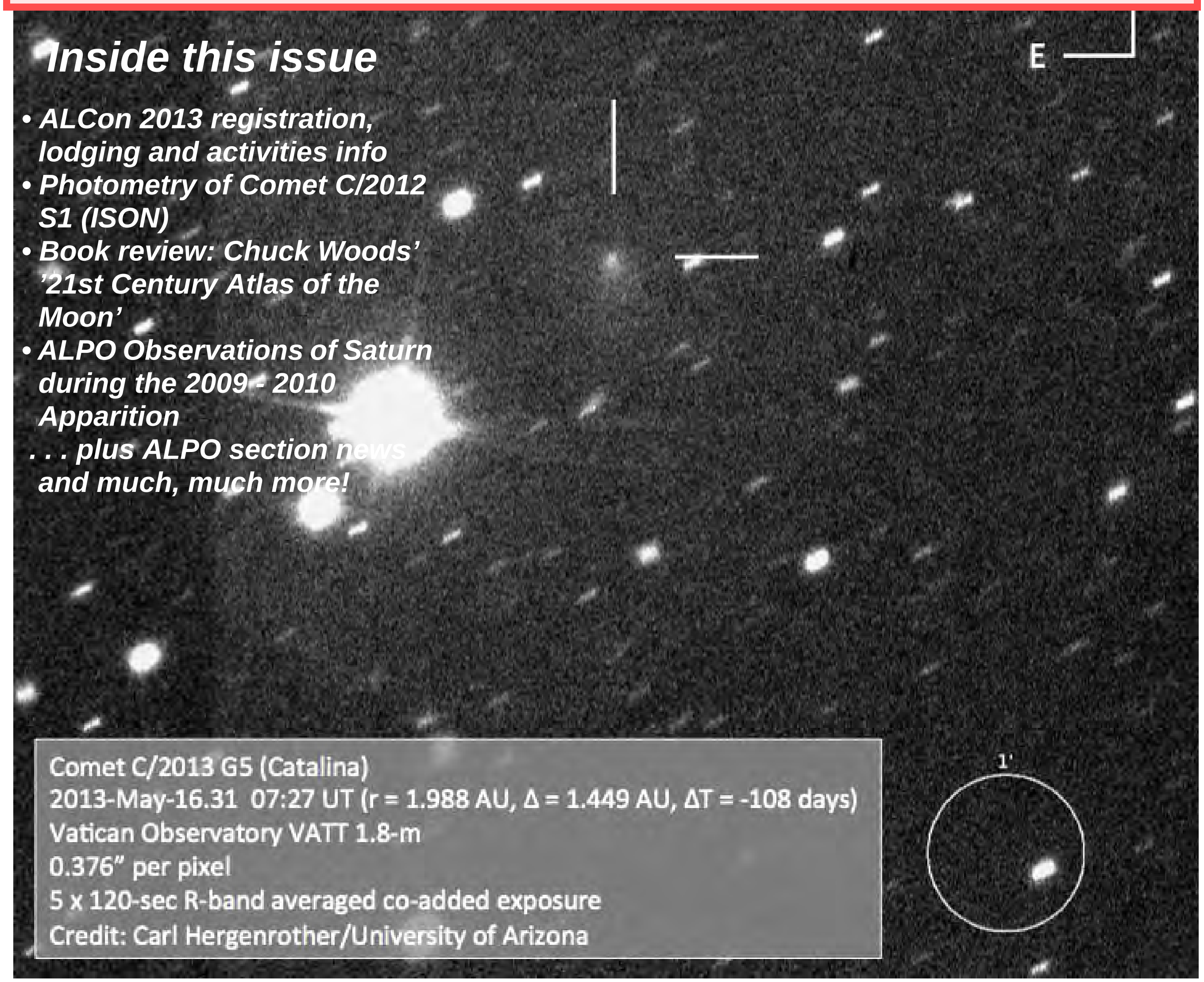

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- *ALCon 2013 registration, lodging and activities info*
- *Photometry of Comet C/2012 S1 (ISON)*
- *Book review: Chuck Woods' '21st Century Atlas of the Moon'*
- *ALPO Observations of Saturn during the 2009 - 2010 Apparition*

. . . plus ALPO section news and much, much more!

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Journal of the Association of Lunar & Planetary Observers

The Strolling Astronomer

Volume 55, No.3, Summer 2013
This issue published in June 2013 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.

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

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Point of View

Password? Who Needs a Password? We Do!

By Ken Poshedly, editor & publisher
The Strolling Astronomer

Once in awhile, questions are asked about why we password-protect the latest online (pdf) issues of this journal, *The Strolling Astronomer*. It happened again only a few months ago when someone wrote in and said that it was most annoying to him to have to deal with passwords. My respectful reply was basically the following.

Like it or not, there are two good reasons why we do this:

1. The ALPO Journal, with its observation reports and techniques specific to solar system astronomy, is the only tangible (hold-in-your-hands) benefit we can offer to our paying membership. It's the one common bond shared by our members.

2. If everything is free, why join? While there certainly are those who join organizations for the sheer satisfaction of being a member, I believe that number is miniscule. And in a world where every organization and every company is fighting tooth and nail for your dollar (or whatever currency you use), it behooves us to provide our members with something not available anywhere else so as to hopefully hold on to them and continue as best we can providing a quality product.

The ALPO is not a philanthropic organization that gives away its assets. Instead, it is a semiprofessional organization that provides to its members a direct benefit of their membership. What some folks call "inconvenient" is the only means we have of reassuring our members that they are getting something not available to anyone else.

If we dropped the password protection scheme, why in the world would you yourself rejoin when you could get for free what everybody else pays for?

The individual to whom I replied wrote back that he more fully understood how things work and was more sympathetic to our plight.

****

As for 2013, PLEASE consider attending this summer's ALCon 2013 event here in Atlanta. This time, all technical talks will be included as part of the main program. More about the event on the following pages.

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News of General Interest

ALCon 2013 News and Call for Papers

The ALPO will be well-represented at this year's ALCon 2013 event in Atlanta, Georgia, July 24 - 27.

Please see the reminder story describing this upcoming event later in this issue of *The Strolling Astronomer*.

All fees and other details are listed in the registration form that accompanies this issue of your JALPO.

Announcing, the ALPO Lapel Pin

Now you can display your affiliation with our fine organization proudly with the new, colorful ALPO Lapel Pin.

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ALPO Interest Section Reports

Web Services

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

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

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

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

Computing Section

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

Important links:

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

Lunar & Planetary Training Program

Tim Robertson, section coordinator
cometman@cometman.net

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

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

Send e-mail to:
cometman@cometman.net

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

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

ALPO Observing Section Reports

Mercury / Venus Transit Section

John Westfall, section coordinator
johnwestfall@comcast.net

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

Eclipse Section

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

Many thanks to Matt Will for his observations of the 25 May 2013 penumbral lunar eclipse.

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And we ask that all please forward your own observation reports of the following events:

- 2012 November 13 total solar eclipse
- 2013 May 10 annular solar eclipse
- 25 May 2013 penumbral lunar eclipse

We also welcome reports and observations from observers in the eastern hemisphere who observed the 25 April 2013 partial lunar eclipse.

Your observations can be qualitative, quantitative, photographic or a combination of observation types. Please also include descriptions of equipment and set-ups if possible.

Your eclipse report(s) can be as simple as noting that you actually did observe the eclipse, to a more-detailed eclipse observing and submission of an ALPO Eclipse Report form which can be downloaded from the ALPO Website (*http://alpo-astronomy.org/index.htm*) or by requesting the appropriate form from this ALPO Eclipse Section coordinator via e-mail (*m.d.reynolds@fscj.edu*).

You may e-mail your observations, including images taken, to Dr. Mike Reynolds at m.d.reynolds@fscj.edu.

Besides my e-mail address (stated above), materials can also be sent to me at my regular mail address:

Dr. Mike Reynolds
ALPO Eclipse Section
604 11th Avenue North
Jacksonville Beach FL 32250-4748
USA

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

Meteors Section

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

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

Meteorites Section

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

The Chelyabinsk meteorite(s) that fell in Russia on February 15, 2013 continues to present the biggest highlight for this period for both professional meteoriticists and amateur meteorite collectors.

This meteorite is undergoing intense study. So far, it reveals a "typical" shocked-type LL5 ordinary chondrite texture with numerous glassy veins from submillimeter to several millimeters wide that contain entrained fragments. Other recovered stones reveal extensive shock-melt on the parent asteroid. Yet others exhibit a dark lithology with interesting patches of sulfides and metal. There is a shiny, glossy "slickenside" material that appears as a coating on some broken fragments. The challenge is to ascertain which of these features were present in the 17-meter asteroid before it impacted Earth and what effects were due to explosive detonations during passage through the atmosphere.

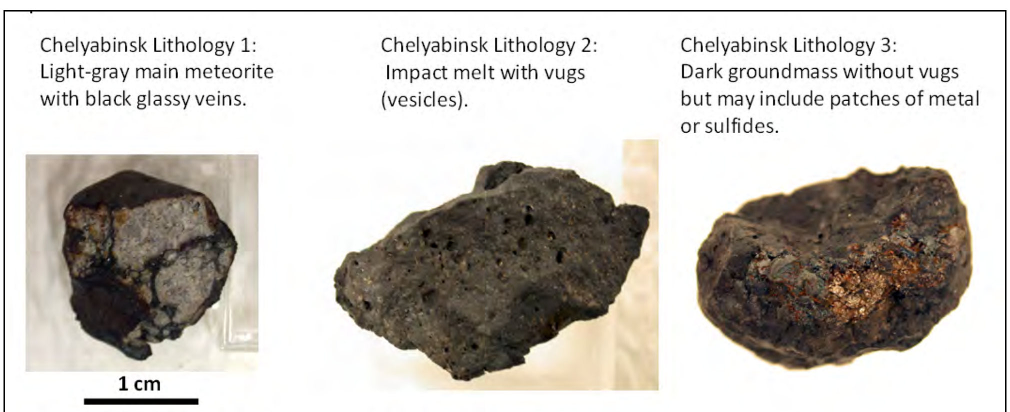
Chelyabinsk was not only an exciting meteor, it is also unusual in the variety of samples that were recovered.

If scientists could conduct cosmic ray exposure studies on all of the Chelyabinsk fragments, they might be able to "put the asteroid back together" – that is, determine the depth of each lithology on the asteroid that struck Earth and, perhaps, the relationship of the Chelyabinsk object to its parent asteroid in the Main Belt.

ALPO Meteorite Section Project

It would be very interesting to know the proportion and total mass of the three different lithologies illustrated here. If you have a specimen of Chelyabinsk, note the dimensions, mass, percentage of fusion crust that covers the specimen, and type (light meteorite with glassy veins; impact melt; or dark with metallic patches). A picture would be helpful, too.

Please e-mail all data to the address shown beneath my name at the head of this report with the subject line, "ALPO Chelyabinsk project". The sampling will understandably be incomplete, but it will



Photos by D. H. Hill of specimens undergoing examination at the University of Arizona.

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at least provide the first inventory of this nature.

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

Comets Section

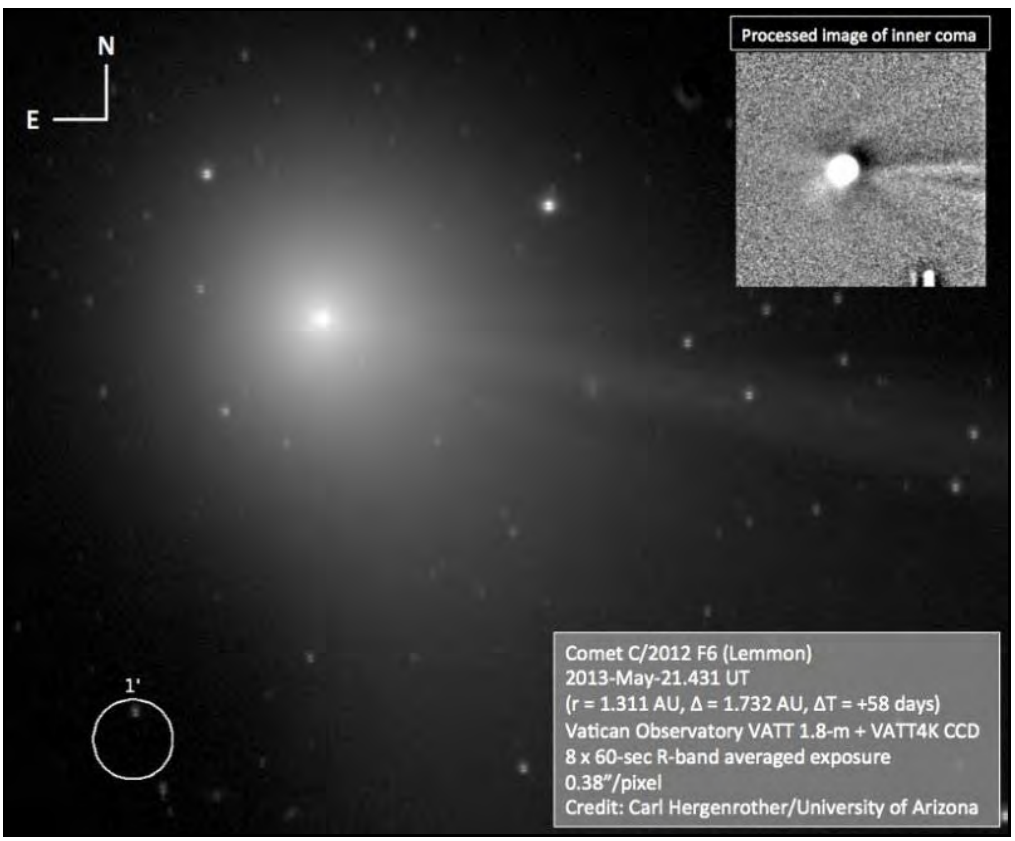
Report by Carl Hergenrother, acting assistant section coordinator
chergen@lpl.arizona.edu

The ALPO Comets Section would like to thank all the observers who have sent us their comet observations. Please keep the observations coming. For those of you who have been observing comets recently and have not submitted them to the ALPO Comet Section or to the ALPO Image Archive, please do so as soon as possible.

An ALPO Comets section image gallery has been established at http://www.alpo-astronomy.org/gallery/main.php?g2_itemId=4491 and is being populated with images.

At any time, there are usually one or more comets within reach of visual observers with small telescopes and a half dozen or more within reach of large telescopes. CCD observers can count on many tens of comets being visible to them.

Comets C/2011 L4 (PANSTARRS) and C/2012 F6 (Lemmon) were both naked-eye objects this spring. PANSTARRS peaked between 1st and 2nd magnitude in mid-March but has faded to around 9th magnitude by mid-June. Lemmon also reached perihelion in March and brightened to 5th magnitude. The comet has since faded to 7th magnitude (mid-June). Both comets should continue fading.



Sample image from the newly established ALPO Comet Section image archive.

Unfortunately no other comets are expected to be brighter than magnitude 10 this summer. Luckily at least two comets should become much brighter in the Fall. The so-called "comet of the century", C/2012 S1 (ISON), will reappear from behind the Sun in the morning sky by late August. Periodic comet 2P/Encke will become an easy small telescope object by October.

The ALPO Comet Section solicits any observations of these and all other comets, including images, drawings and magnitude estimates. Images of current and past comets are being archived in the ALPO Comet Section Image gallery.

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

Solar Section

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

Since our last report, we have been though three Carrington rotations, and are currently in Carrington Rotation CR2138, with CR2139 having started on June 12.

The Sun has been acting very strangely, not at all as predicted from the indication of a peak in Cycle 24. The Sun has had very low activity, with spurts of great activity. The new theory is that the Sun will double-peak later this year. (http://science.nasa.gov/science-news/science-at-nasa/2013/01mar_twinpeaks/)

Here is a summary of some solar data for the period March 1 thru May 31:

- No. of CME's (coronal mass ejections), 12

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- No. of auroras, 11
- Strongest solar flare (up to June 1), May 13 at 0217 UT

The ALPO Solar Section archives the increasing changing morphology of sunspot groups with images in any wavelength and sketches of the Sun. We currently have 7 observers sending in their data for archiving.

If you would like to include your images or sketches for archival purposes, please send tem to *kim.hay@alpo-astronomy.org*. Images/sketches should be no larger than 250 kb in size and include the CR number, date, UT and all other observing information available. If you would like to "talk" Solar and show your images online for all, join in on the Solar-ALPO Yahoo Group. There are currently 317 members.

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

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

Mercury Section

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

The ALPO Mercury section has been very slow, perhaps too slow for this year. Now most of the surface of Mercury is pretty much well known thanks to the MESSENGER spacecraft which continues image of the planet's surface.

However, we still need your observations to see whether any features imaged by MESSENGER can also be seen in the eyepiece of the telescope. While it can be difficult, today's technology enables highly skilled observers and CCD imagers to pull out major features such as the bright rayed craters and dark albedo regions. This has been proven when

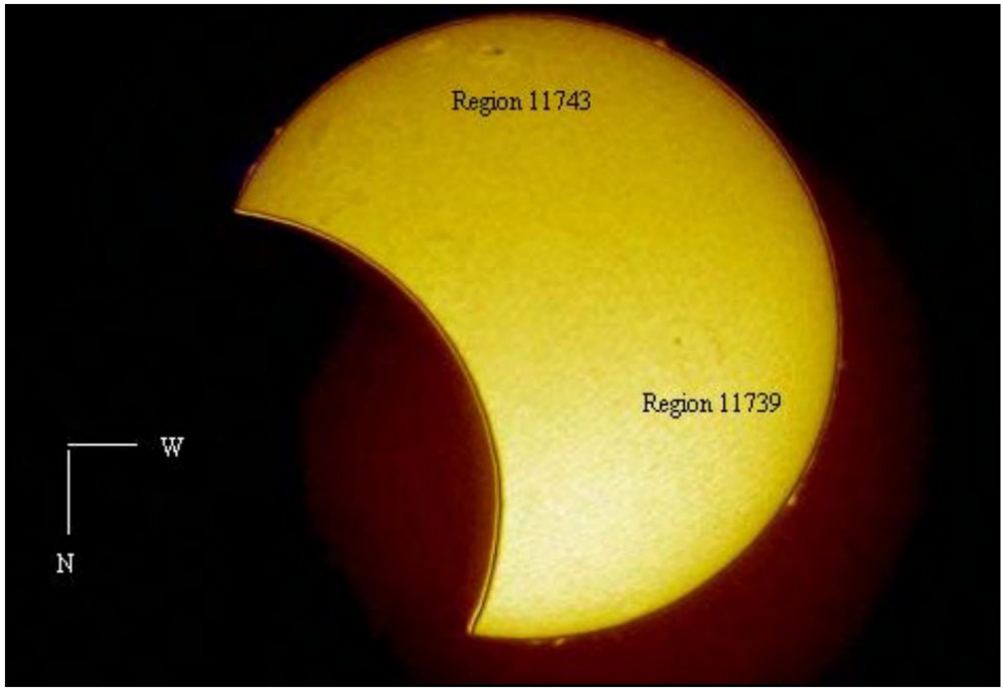

Image of the partial solar eclipse taken by Monty Leventhal of Australia (specific location not provided) on May 9, 2013, at 23:09 UT. "Conditions" = Fair (3); Equipment: Telescope, Solaris; camera, Canon 600D; ISO 400; shutter speed, 1/80 sec.; filter, H-alpha 6Å;

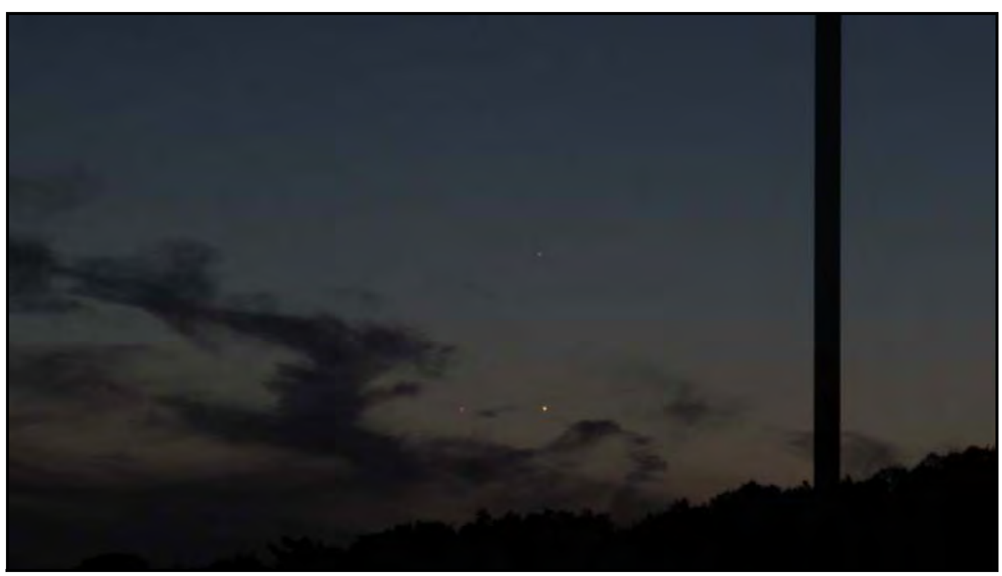

Image by Frank Melillo of Mercury, Venus and Jupiter. See text for details.

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comparing them with the MESSENGER's.

As of late May, I am hoping you are taking an advantage to observe Venus, Jupiter and yes, Mercury as they appear together right after sunset. This beautiful grouping is (was) easily visible with the naked-eye. It is funny that Mercury is always the first one below and closer to the Sun. But in this case, you see in the accompanying image that both Venus and Jupiter are below Mercury and closer to the Sun as seen from Earth! A rare sight indeed! In addition, Mercury is pretty much brighter than normal at -1 magnitude. So still, it matches well with the brightness of Jupiter (-2 magnitude) and Venus (-4 magnitude).

In this image that I took of the three planets right after sunset in late May at a nearby school yard, I used my daughter's Olympus camera on a tripod using a 1-second exposure. Mercury is at top, with Below, Jupiter is at left and Venus is at right.

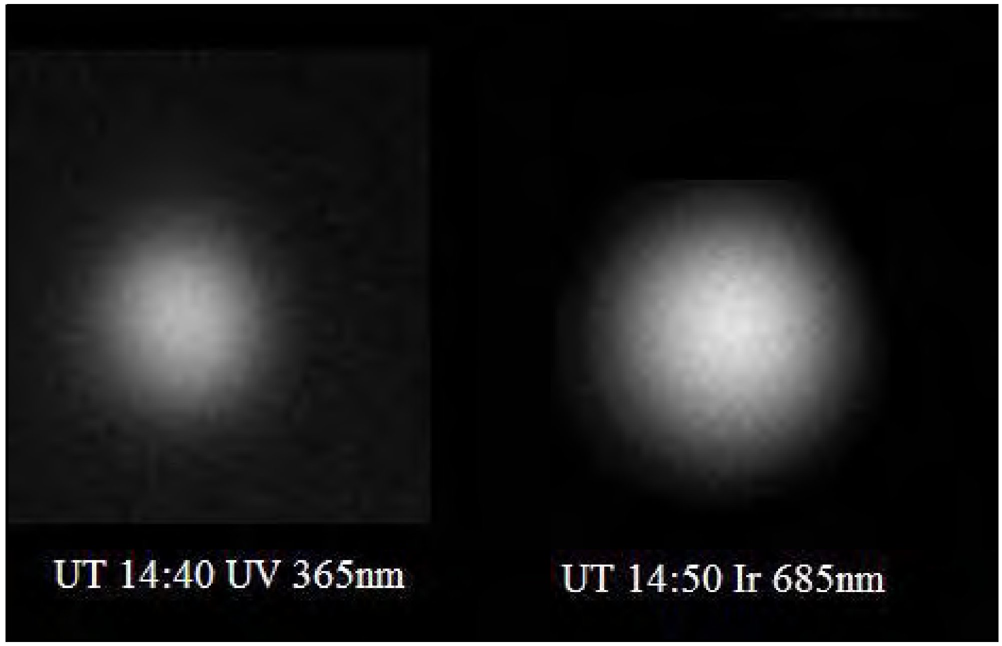
Visit the ALPO Mercury Section online at *www.alpo-astronomy.org/mercury*

Venus Section

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

Venus is now visible at dusk low in the western sky at the beginning of June at apparent visual magnitude -3.9, moving eastward relative to the Sun as the 2013-14 Eastern (Evening) Apparition progresses.

Venus is now passing through its waning phases (a progression from fully illuminated through crescentic phases) as observers witness the leading hemisphere of Venus at the time of sunset on Earth. Venus will reach theoretical dichotomy (half phase) on October 31 and attain



H. G. Lindberg of Skultuna, Sweden of these adjacent UV 365nm and IR 685nm images of Venus' nearly full disk on May 2013 between 14:40 and 14:50 UT using a 25.4 cm (10.0 in.) Schmidt-Newtonian in fair seeing. Limb darkening is obvious, but no marking are detectable in either the UV or IR images. Apparent diameter of Venus is 10.1", phase (k) 0.971 (97.1% illuminated), and visual magnitude -3.9. South is at top of image.

Greatest Elongation East of 47° on November 1, and reach Greatest Illuminated Extent (its greatest brilliancy) on December 6.

The accompanying table of Geocentric Phenomena in Universal Time (UT) is presented here for the convenience of observers for the 2013-14 Eastern (Evening) Apparition for planning purposes.

A number of observers have contributed images and drawings of Venus during the 2013-14 Eastern (Evening) apparition, and we assume many more will follow as the planet becomes more favorably placed for viewing this summer.

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

Geocentric Phenomena of the 2013-2014 Eastern (Evening) Apparition of Venus in Universal Time (UT)

Superior Conjunction	2013	Mar 28^d (angular diameter = 9.8 arc-seconds)
Predicted Dichotomy		Oct 31.14 (exactly half-phase predicted)
Greatest Elongation East		Nov 01 (Venus will be 47º east of the Sun)
Greatest Illuminated Extent		Dec 06 (m_v = –4.9)
Inferior Conjunction	2014	Jan 10 (angular diameter = 63.1″)

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Lunar Calendar for the Third Quarter, 2013 (All Times UT)

July 06	12:00	Moon 3.7 Degrees S of Mars
July 07	00:37	Moon at Apogee (406,491 km – 252,582 miles)
July 07	02:00	Moon 3.6 Degrees SSW of Jupiter
July 08	07:15	New Moon (Start of Lunation 1120)
July 08	12:00	Moon 0.14 Degrees NW of Mercury
July 10	19:00	Moon 6.7 Degrees SSW of Venus
July 16	03:19	First Quarter
July 16	24:00	Moon 3.2 Degrees SSW of Saturn
July 20	03:12	Extreme South Declination
July 21	09:00	Moon 1.2 Degrees NW of Pluto
July 21	20:28	Moon at Perigee (358,401 km – 222,700 miles)
July 22	18:15	Full Moon
July 25	02:00	Moon 5.4 Degrees NNW of Neptune
July 27	22:00	Moon 3.3 Degrees N of Uranus
July 29	17:44	Last Quarter
Aug. 03	08:54	Moon at Apogee (405,833 km – 252,173 miles)
Aug. 03	22:00	Moon 4.0 Degrees S of Jupiter
Aug. 04	09:00	Moon 5.2 Degrees SSW of Mars
Aug. 05	05:00	Moon 4.3 Degrees SSW of Mercury
Aug. 06	21:50	New Moon (Start of Lunation 1121)
Aug. 09	23:00	Moon 4.8 Degrees SSW of Venus
Aug. 13	05:00	Moon 3.0 Degrees SW of Saturn
Aug. 14	10:56	First Quarter
Aug. 16	12:12	Extreme South Declination
Aug. 17	20:00	Moon 1.6 Degrees NE of Pluto
Aug. 19	01:27	Moon at Perigee (362,264 km – 225,100 miles)
Aug. 21	01:44	Full Moon
Aug. 21	12:00	Moon 5.3 Degrees NNW of Neptune
Aug. 22	22:00	Moon 1.9 Degrees SE of asteroid 324-Bamberga
Aug. 24	03:00	Moon 3.2 Degrees NNW of Uranus
Aug. 28	09:35	Last Quarter
Aug. 29	17:06	Extreme North Declination
Aug. 30	23:47	Moon at Apogee (404,882 km – 251,582 miles)
Aug. 31	17:00	Moon 4.5 Degrees S of Jupiter
Sept. 02	05:00	Moon 6.1 Degrees SSW of Mars
Sept. 05	11:35	New Moon (Start of Lunation 1122)
Sept. 06	10:00	Moon 4.5 Degrees SSW of Mercury
Sept. 08	22:00	Moon 0.76 Degrees SE of Venus
Sept. 09	18:00	Moon 2.5 Degrees S of Saturn
Sept. 12	17:09	First Quarter
Sept. 12	18:30	Extreme South Declination
Sept. 14	01:00	Moon 1.5 Degrees NNW of Pluto
Sept. 15	16:35	Moon at Perigee (367,384 km – 228,284 miles)
Sept. 17	21:00	Moon 5.4 Degrees NNW of Neptune
Sept. 19	11:12	Full Moon
Sept. 20	13:00	Moon 3.1 Degrees NNW of Uranus
Sept. 26	01:06	Extreme North Declination
Sept. 27	03:55	Last Quarter
Sept. 27	18:18	Moon at Apogee (404,308 km – 251,225 miles)
Sept. 28	06:00	Moon 4.9 Degrees SSW of Jupiter

Table courtesy of William Dembowski

images to the ALPO Venus Section as well as to the VEX website at:

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

Regular Venus program activities (including drawings of Venus in Integrated Light and with color filters of known transmission) are also valuable throughout the period that VEX is observing the planet, which continues into 2013-14.

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

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

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

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magnifications and filters used, seeing and transparency conditions, etc.

The ALPO Venus Section urges interested readers worldwide to join us in our projects and challenges ahead.

Individuals interested in participating in the programs of the ALPO Venus Section are encouraged to visit the ALPO Venus Section online http://www.alpo-astronomy.org/venusblog/

Lunar Section

Lunar Topographical Studies / Selected Areas Program

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

The ALPO Lunar Topographical Studies Section (ALPO LTSS) received a total of 109 new observations from 13 observers during the January-March quarter. These included four ray observations and two sets of elevation measurements.

Three contributed articles were published in addition to numerous commentaries on images submitted.

The *Focus-On* series in this sections's newsletter *The Lunar Observer* continued with an article on Wrinkle Ridges & Rilles. Upcoming *Focus-On* subjects will include Mare Insularum and luna domes.

After many years of service as coordinator and then assistant coordinator of the LTSSA program, Bill Dembowski has asked to reduce his work load. Therefore, I'm looking for a volunteer to serve as assistant coordinator. If you're interested, please e-mail me at wayne.bailey@alpo-astronomy.org or by regular mail at the address given in the ALPO Resources section of this Journal.

Visit the following online web sites for more info:

- ALPO Lunar Topographical Studies Section moon.scopesandscapes.com/alpo-topo
- ALPO Lunar Selected Areas Program moon.scopesandscapes.com/alpo-sap.html
- The Lunar Observer (current issue) moon.scopesandscapes.com/tlo.pdf
- The Lunar Observer (back issues) moon.scopesandscapes.com/tlo_back.html

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- Banded Craters Program: moon.scopesandscapes.com/alpo-bcp.html
- The Lunar Discussion Group: tech.groups.yahoo.com/group/Moon-ALPO/
- The Moon-Wiki: the-moon.wikispaces.com/Introduction
- Chandrayaan-1 M3: pds-imaging.jpl.nasa.gov/portal/chandrayaan-1_mission.html
- LROC: lroc.sese.asu.edu/EPO/LROC/lroc.php
- GRAIL: http://www.nasa.gov/mission_pages/grail/main/
- GRAIL: solarsystem.nasa.gov/grail

Lunar Meteoritic Impacts

Brian Cudnik, program coordinator
cudnik@sbcglobal.net

On September 5, 2013, the Lunar Atmosphere and Dust Environment Explorer (LADEE) is scheduled to launch from Wallops Island, Virginia, for a 30-day voyage to the Moon. After another 30 days of scientific and systems checkout, the spacecraft will perform science operations for up to 120 days.

Ground-based lunar meteor observations are requested in support of this mission, with the objective of monitoring the Moon for meteoroid impact flashes to relate these events with changes in the dust environment in low lunar orbit.

Along with the NASA-MSFC Meteoroid Environment Office, the ALPO-Lunar Meteoritic Impact Search Program will coordinate the observation of the Moon by interested members of the general public, both nationally and internationally. We will be working to enhance this coordination starting this summer and continue into next year and even beyond.

Check the ALPO LMIS website beginning in mid-late June for updates and action items concerning support for this mission. This is where we will provide guidelines and assistance to enable any interested observer to get involved.

For lunar meteor monitoring efforts, we welcome observations from: interested individuals; local astronomy clubs; schools, colleges, and universities; professional observatories; and pro-am groups like the ALPO, the British Astronomical Association, the Astronomical Society of the Pacific, and others.

We will, with support of the LMIS, provide ground-based "ground truth" to support this important scientific mission and give interested people the opportunity to play a key role in the science. Data provided by the public will assist impact modelers in their study of the physics of hypervelocity collisions.

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

Lunar Transient Phenomena

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

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

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

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

Mars Section

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

Mars passed through its conjunction with the Sun on April 18, thereby beginning the 2013-2015 apparition. However, it will not be observable until late summer. Watch for the apparition preview article that will appear in the next issue of this journal (JALPO55-4, Autumn 2013).

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

Alternatively, if you prefer that your observation not be posted for all to see, send it directly to me at the e-mail address given above.

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

Minor Planets Section

Frederick Pilcher, section coordinator
fpilcher35@gmail.com

Here are the most important results published in *Minor Planet Bulletin* Volume 40, No. 2, 2013 April - June.

It is now generally accepted that most asteroids smaller than 10 kilometers with short rotation periods less than about 3.5 hours have satellites derived from YORP effect rotational spin-up to the centrifugal limit at which a piece detaches to become a satellite.

This explains the perhaps surprising anomaly that more small than large asteroids have satellites.

Brian Warner describes the method to extract multiple periods from a set of lightcurves and provides parameters for six of these binary systems. The rotation period of the primary (Prot,) orbital period of the secondary (Porb), both expressed in hours, lower limit of size ratio of the

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secondary to the primary (Ds/Dp), and whether the result is secure or tentative and requires confirmation, are provided as shown below:

- 2047 Smetana: Prot=2.4970, Porb=22.43, Ds/Dp=0.21, secure
- 5646 1990 RG: Prot=3.1999, Prob=19.47, Ds/Dp=0.18, tentative
- 26471 2000 AS152: Prot=2.6869, Porb=39.61, Ds/Dp=n.a., secure
- 51356 2000 RY76: Prot=2.5572, Porb=62.05, Ds/Dp=0.21, secure
- 52316 1992 BD: Prot=2.7629, Porb=13.435, Ds/Dp=0.16, secure
- 1994 XD: Prot=2.7365, Porb=17.975, Ds/Dp=n.a., secure

Lightcurves with derived rotation periods are published for 107 other asteroids, 24, 95, 110, 159, 185, 191, 217, 226, 231, 273, 366, 433, 495, 538, 562, 592, 612, 774, 782, 1060, 1115, 1365, 1474, 1542, 1554, 1560, 1578, 1604, 1616, 1680, 1694, 1761, 1928, 2001, 2420, 2432, 2454, 2717, 2763, 2786, 2855, 2890, 2933, 3086, 3161, 3382, 3478, 3635, 3842, 3948, 4300, 4808, 5096, 5128, 5153, 5275, 5369, 5542, 5806, 6122, 6223, 6310, 6447, 6720, 6744, 7086, 7560, 7750, 8325, 9069, 11149, 11709, 11941, 13245, 13573, 14395, 15337, 15434, 15499, 17252, 17657, 17722, 19979, 22013, 26916, 27776, 30878, 30981, 31179, 31831, 32626, 47035, 51371, 55844, 55854, 63440, 66832, 70927, 72675, 86388, 90988, 123937, 136017, 152858, 192683, 330825, 2102 TC4.

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

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

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

Jupiter Section

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

Jupiter will reach conjunction with the Sun in July and will be visible in the early morning before sunrise starting in late August.

Manos Kardasis has submitted two recent images of Jupiter. The South Equatorial belt appears to be a bit wider than the North Equatorial Belt. I hope that others are able to continue observing Jupiter up to conjunction.

Once the 2011-2012 Jupiter apparition report is published, I will start working on the 2012-2013 report.

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

Galilean Satellite Eclipse Timing Program

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

By the time you read this, Jupiter will have passed behind the Sun (in point of fact, it gets occulted by the Sun; 2013 June 19), beginning the planet's 2013-2014 Apparition. For those who observe the events of Jupiter's Galilean satellites, the new apparition has three interesting aspects:

- At opposition on 2014 January 5, Jupiter will be at declination +22° 40' – farther north than at any opposition between 2002 and 2048, so that the planet will be high in the sky for our northern-hemisphere observers.
- The outermost Galilean satellite, Callisto, will begin a three-year series of eclipses on 2013 July 28.
- At opposition date, the Earth will actually transit the Sun as seen from Jupiter. By a fairly rare coincidence, the innermost Galilean satellite, Io, will be simultaneously occulted and eclipsed by Jupiter during the Earth transit (2013 Jan 06 00:32-02:48 UT). As the Sun will then be directly behind us when we view Io, the satellite's disk will be centered upon its shadow on the planet, an unusual sight for those readers who then have the planet above their horizon.

As usual, a schedule of Galilean satellite eclipses for the new apparition is available on the Jupiter page of the ALPO website (*http://alpo-astronomy.org*). We welcome observers to send us their timings of these events, using the observing form also available on the webpage.

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

Saturn Section

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

Saturn is now well-placed for viewing and imaging most of the night following opposition to the Sun back on April 28th.

The planet's northern hemisphere and north face of the rings are visible to greater advantage during the 2012-13 observing season since the ring tilt toward Earth is continuing to increase over the next several

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years, with global regions south of the rings becoming less favorable for viewing.

The accompanying table of geocentric phenomena for the 2012-13 apparition is presented for the convenience of readers who wish to plan their Saturn observing activities.

Observers have so far contributed over about 400 images and drawings of Saturn during the 2012-13 apparition.

As of late May, although the great white storm of 2010-11 imaged in the North Tropical Zone (NTrZ) has faded, observers are still imaging considerable structure in its aftermath. Observers have been still been noticing multiple compact bright spots in the region of the NTrZ storm as well as a bright spot in NTeZ. At least one recurring dark condensation just below the NTeZ has been imaged near the north edge of the NTeB.

There have been multiple small bright areas within the EZn (Equatorial Zone, northern half) since mid-February, particularly obvious at IR wavelengths. Of great interest have been amateur images of the remarkable hexagonal feature at Saturn's North pole at different wavelengths. Views of the major ring components, including Cassini's and Encke's divisions, are much improved this apparition due to the favorable ring tilt toward Earth of about 18°.

Observers are alerted to keep watch Saturn carefully throughout the rest of the apparition for continuing atmospheric activity in the northern hemisphere of the planet.

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

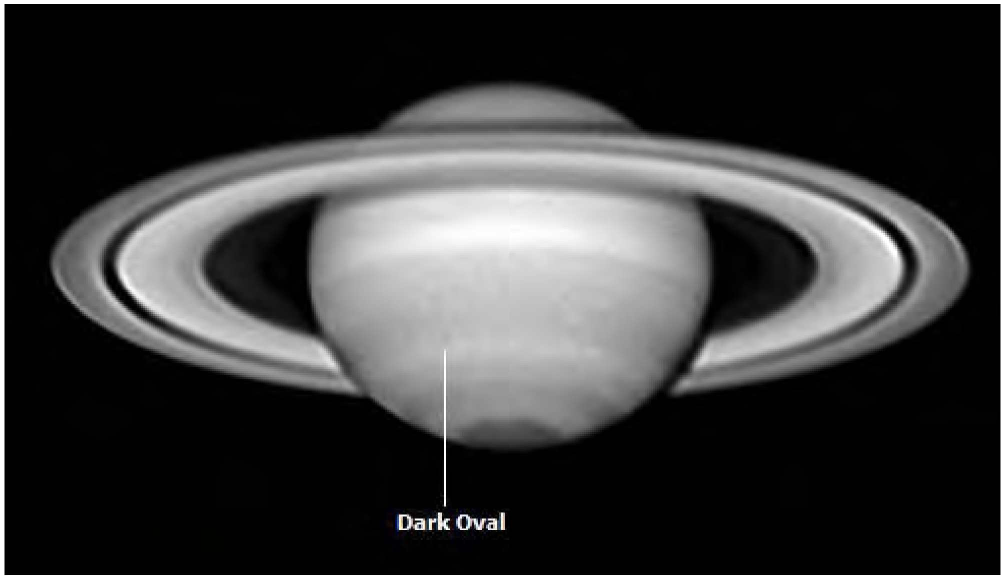

Image taken on May 28, 2013 at 11:48 UT by Anthony Wesley observing from Australia using a 36.8 cm (14.5 in.) Newtonian at red wavelengths. Notice the recurring dark oval pointed out in the image as well as a strong of white spots along the same latitude. Apparent diameter of Saturn's globe is 18.6" with a ring tilt of +17.6º. CMI = 171.3°, CMII = 208.4°, CMIII = 7.2°. S is at the top of the image.

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

The ALPO Saturn Section appreciates the dedicated work by so many observers who regularly submit their reports and images.

Geocentric Phenomena for the 2012-13 Apparition of Saturn in Universal Time (UT)	
Conjunction	2012 Oct 25^d
Opposition	2013 Apr 28^d
Conjunction	2013 Nov 06^d
Opposition Data:	
Equatorial Diameter Globe	18.7 arc-seconds
Polar Diameter Globe	16.7 arc-seconds
Major Axis of Rings	42.5 arc-seconds
Minor Axis of Rings	13.3 arc-seconds
Visual Magnitude (m_v)	0.1 m_v (in Libra)
B =	+18.2º

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Cassini mission scientists, as well as other professional specialists, are continuing to request drawings, digital images, and supporting data from amateur observers around the globe in an active Pro-Am cooperative effort.

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

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

Remote Planets Section

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

Several people submitted images and observations of the remote planets. Jim Fox submitted over three dozen brightness measurements. Uranus and Neptune were close to their brightness in late 2012 as they were in late 2011. This coordinator is grateful to Jim for his dedication over the last several years.

The 2011-2012 remote planets apparition report was finalized recently and it is now scheduled for publication in JALPO54-4 (Autumn 2013). Work will commence on the 2012-2013 remote planets in July.

Over the past 22 years, ALPO members have submitted over 1,000 brightness measurements of Uranus and several hundred images of Neptune between 1991 and the present. One of my goals is to combine the ALPO measurements with those made in the 1950s through the 1970s. This will give us a better understanding of any seasonal brightness changes that take place on these two planets.

I urge all to please try to attend the 2013 conference of the Astronomical League being held in Atlanta, Georgia, July 24 thru 27. At that conference, this coordinator will present a talk summarizing remote planets work.

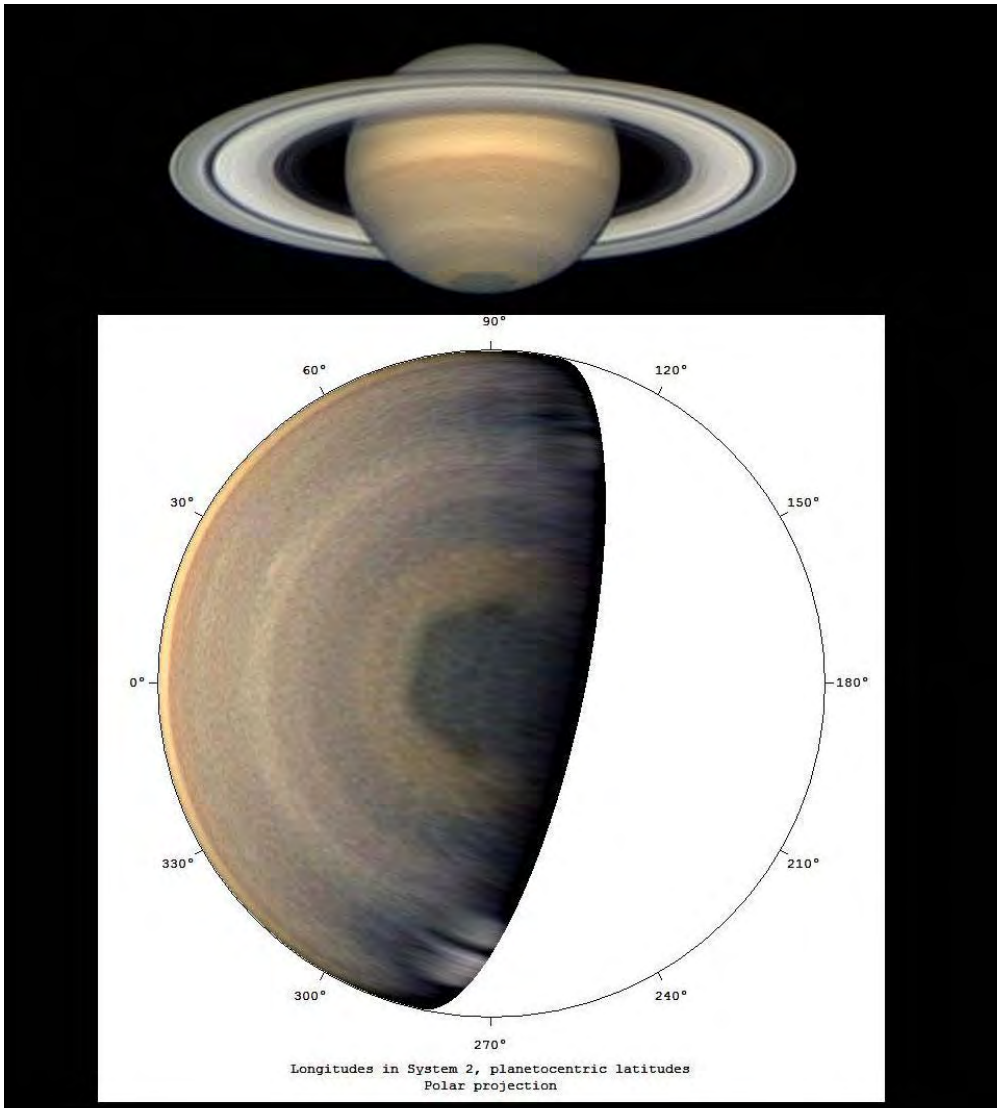


Image of Saturn by Tomio Akutsu of Cebu City, Philippines, May 5, 2013 at 14:52 UT using a 35.6 cm (14.0 in.) SCT in visible light (RGB) and good seeing, accompanied by an excellent polar projection clearly showing the north polar hexagonal feature. Apparent diameter of Saturn's globe is 18.7" with a ring tilt of +18.0º. CMI = 214.0º, CMII = 11.4º, CMIII = 188.2º. S is at the top of the image.

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

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

Book Review:

21st Century Atlas of the Moon

Review by Howard Eskildsen
howardeskildsen@msn.com

21st Century Atlas of the Moon by Charles A. Wood and Maurice J. S. Collins Lunar Publishing, UAIA Inc, Wheeling, WV, Copyright 2012, 101 pages + detailed index, $29.95, ISBN 978-0-9886430-0-0

Another lunar atlas has joined the competition for lunar enthusiasts who are looking for an easy-reading atlas for use on the table or by the telescope. The *21st Century Atlas of the Moon* stands out with its crisp, state of the art images from the Lunar Reconnaissance Orbiter (LRO) illuminated at a 25° Sun angle and never-before-seen computer-generated illustrations created from spacecraft data showing details of the Moon as seen from directly overhead. It is wire coil-bound with cover and pages printed on moisture-resistant 8.5x11 in. stock, and it opens to lie completely flat on any page without details drifting into the binding or pages that want to flip over on their own.

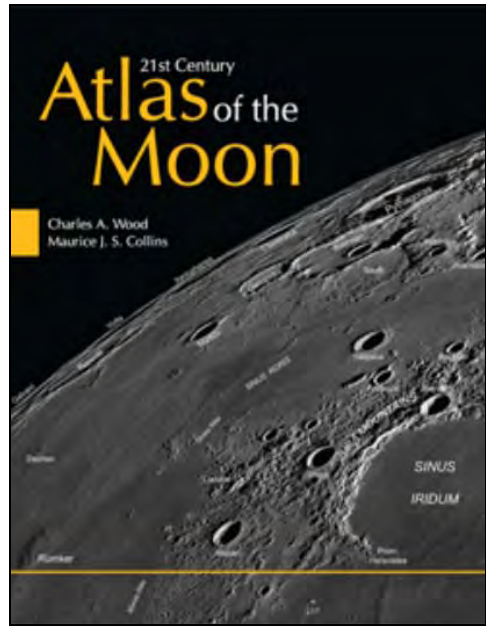
The cover photo features chart #20 of the northwestern lunar limb, revealing details that extend to the limit of the eye's resolution, and heralds the image quality that follows throughout the book. The back cover shows an overhead view of Mare Imbrium that has greatly changed my impression of the basin. The book begins with a very readable introduction on the geology of the Moon that drew me in as did my favorite science books when I was in junior high school, and carries both discussion and humor at levels that adolescents and adults with an interest in the Moon can readily comprehend.

Next, the book covers the face of the Moon observable from Earth with 28 regular charts and eight limb (libration zone) charts, followed by four full-Moon quadrant maps taken from the *Consolidated Lunar Atlas*. These images reflect the technological limits of their time (1960s) and were startling by their limited resolution and clarity compared with the LRO images. With current digital technology, Earth-based imagers can get better resolution from 80mm scopes, and it serves as a reminder of just how far technology has progressed. After the full Moon images, computer-generated overhead views of the lunar basins and mare ridges add perspective, followed by the Apollo and other selected probe landing sites. Finally quadrants and a concise discussion of the lunar far side are presented. An index lists the labeled features, their chart locations and diameters where applicable.

Each atlas chart is on two pages that remain open on any flat surface, thanks to the wire binding, with the labeled region on the right page and four overhead views of major features and a brief regional summary on the left page. An atlas chart locator is pictured on the bottom of the right page below the labeled chart with the current chart highlighted. There is also a listing of any of Chuck Wood's "Lunar 100" features on that particular chart. Nearly all of the named major lunar features are labeled, along with landing sites of lunar probes, but most of the lettered craters are not (with the exceptions of notable craters such as Petavius B with its distinctive rays and some of the concentric craters).

The atlas does not use the Latinized names for mountains, valleys, rilles, crater chains, etc, that were introduced in the 20th century, but does use the Latinized names of the earlier map makers, including terms such as mare, lacus, sinus, and oceanus.

The chart numbering had me confused at first, since it starts at the northeast margin and goes from north to south, down the eastern column of charts, and then upward from south to north for the next column and so on, so that charts travel page-by-page up and down the terminator as it progresses across the Moon. It is an unconventional, but very functional feature that adds to its value as an observing reference, because the terminator is the first draw as one looks at the Moon.



Every book I have read about the Moon has some typos, and this atlas is no exception; I have discovered a couple that are minor and have shared them with Chuck Wood. At http://lpod.wikispaces.com/Atlas+Corrections there is a growing list of corrections that have been discovered and revised. Since this is published on demand by the authors, corrections are made as they are discovered and future issues will have fewer and fewer errors.

I generally have not used an atlas while at the telescope observing the Moon, but the *21st Century Atlas of the Moon* is likely to change that, due to its ease of use, weather-resistance and overall quality and readability. I can recommend this book without reservation to lunar neophytes as well as experienced lunar observers who are looking for a quality lunar observing guide. I also believe that it will appeal to kid scientists who are just discovering their interest in the Moon, and can be an excellent outreach tool. The *21st Century Atlas of the Moon* is available only on line at: http://lpod.wikispaces.com/21st+Century+Atlas+of+the+Moon

Feature Story:

ALCon 2013 Atlanta Arrangements Nearly Complete

This is a slightly abbreviated version of what appeared in the spring issue of this Journal (JALPO55-2).

For the first time since 1975, the Astronomical League's annual convention of astronomy paper presentations, visitations to local sites of astronomy interest and awards for various observing milestones will be held once more in Atlanta Wednesday through Saturday, July 24 - 27, 2013.

More popularly known as “ALCon," the event spans most of the week and includes the annual meeting of the Astronomical League's National Council, the annual meeting of the South East Region of the Astronomical League (SERAL) and presentations of various technical and general interest papers on astronomy and related topics.

And while in the past, technical papers by ALPO members were presented separately from other papers, such will not be the case this year. Instead, all papers will be presented at the same venue

Primary Venue

The location for this year's event will the Fernbank Science Center, which is owned and operated by the DeKalb County (Georgia) School System. The facility features an observatory open to the public at no charge on clear Thursday and Friday evenings, plus one of the largest planetariums in the southeastern United States.

The 500-seat Jim Cherry Memorial Planetarium, where all papers and presentations will be given, is equipped with a 70-foot dome, a Mark V Zeiss star projector and includes over 100 strategically placed special effects projectors so all audience members can view data and other slides shown on the planetarium dome.

After each day's presentations are completed, the planetarium will be open to all for its usual series of nightly shows.

The planetarium theater will also be the location of the Friday morning Astronomical League Southeast Region meeting, then the organization's business meeting, and finally presentation of the League's youth awards, which include the National Young Astronomer Award and the Jack Horkheimer Service Award.

The ALPO's annual board meeting will be held in a specially reserved room also on Friday morning at the Fernbank Science Center.

The Dr. Ralph L. Buice, Jr. Observatory, houses a 0.9 meter (36-inch) Cassegrain reflector beneath a 10 meter (30 ft.) dome. This is the largest telescope in the southeastern United States and one of the largest instruments ever dedicated to education and public viewing.

The observatory is free and open to the public every Thursday and Friday evening from 9 p.m. (or dark) until 10:30 pm (weather permitting). A staff astronomer is available to position the telescope and answer questions.

In addition to these attractions, vendors will be available to discuss their exhibits, wares and services in a special room only a few steps away from the planetarium theater.

Finally, another room is being set aside for the ALPO board meeting to be held on Friday morning separate from the AL meetings and presentations. As usual, the meeting is open to any and all ALPO members.

Shuttle bus transportation to and from this site will be available for those without their own transportation.

The Fernbank Science Center's Jim Cherry Planetarium in use.

Lodging

Located only five minutes or so away from the Fernbank Science Center, the Emory Conference Center Hotel offers luxurious accommodations for ALCon 2013 attendees at a lodging rate considerably less than its standard rate.

Plus, the Hotel management has graciously extended the very discounted room rate for ALCon 2013 attendees from Sunday, July 21, through the following Sunday evening, July 28.

This full-service hotel is located on the Emory University Campus — only 15 miles from Atlanta's Hartsfield-Jackson International Airport, 6 miles from downtown Atlanta, and close to major shopping and attractions.

Besides serving as the lodging site for our out-of-town guests, the Emory Conference Center Hotel will also be the location of the Astronomical League's pre-ALCon council meeting on Tuesday, July 23, as well as where the awards banquet will be held on Saturday evening, July 27.

See the ALCon 2013 registration form for hotel contact and reservation information.

Side Trip One: Thursday Evening at the Deerlick

The Emory Conference Center Hotel

Astronomy Village

On Thursday evening of ALCon 2013, attendees are invited to tour this nationally known site approximately 90 miles or so east of Atlanta.

The 96-acre Deerlick Astronomy Village (or "DAV") is a unique, planned observing field and residential community catering to the specific needs of amateur and professional astronomers, and also serves as the home to one of two dark sky observing sites owned by the Atlanta Astronomy Club.

The facility is split between an open field on one half and the other half where residential lots with front yard observatories of various types are located.

And yes, lighting and related covenants are in effect to protect and maintain the dark sky environment.

This side trip will be available to all who either have their own transportation or can arrange for carpooling and requires approximately an hour or more travel time each way. There are restroom facilities at the site.

Side Trip Two: Star BQ at the Agnes Scott College Bradley Observatory

On Friday evening of ALCon 2013, attendees are invited to tour and have dinner at this beautiful facility only minutes away from both the Emory Conference Center Hotel and the Fernbank Science Center.

This facility is an astronomical teaching and research facility located on the campus of Agnes Scott College in Decatur, and is where your local hosting club, the Atlanta Astronomy Club, was founded in 1947.

The observatory building contains the 70-seat Delafield Planetarium, a 100-seat capacity lecture hall, a library/seminar room, three faculty offices, a darkroom, a student computer lab and an observing plaza for astronomical viewing.

The large dome atop the observatory building houses the 30-inch Lewis H. Beck

The Bradley Observatory at Agnes Scott College.

telescope. The Beck Telescope is a 30-inch reflector, a 1930 vintage Cassegrain with a Warner & Swasey mounting and optical elements by J.W. Fecker. It was completely refurbished and modified for its installation in 1950 by the Perkin-Elmer Corporation.

Shuttle bus transportation to and from this site will be available for those without their own transportation.

Side Trip Three: Saturday Afternoon at the AAC-Walter F. Barber Observatory

At mid-day Saturday of ALCon 2013, attendees are invited to tour the Atlanta Astronomy Club's observatory site near Villa Rica.

Located on the site are:

- A full-size, roll-off roof observatory building houses both 20-inch and 10-inch reflectors on motorized German Equatorial mounts.
- A smaller "mini-observatory" which houses its own scope
- A full-size warm-up building with chairs, electric heater, coffee supplies, etc., for presentations and as a warm up shed.

This side trip will be available to all who either have their own transportation or can arrange for carpooling and requires approximately an hour of travel time each way.

Feature Story:

Photometry of Comet C/2012 S1 (ISON)

M. A. Galiazzo, Department of Astrophysics at the University of Vienna)
mattia.galiazzo@univie.ac.at

W. W. Zeilinger, Department of Astrophysics at the University of Vienna

Biographical Information

MSc M. A. Galiazzo

Titles:

• MSc at the University of Padova, Italy

• PHd student at the Department of Astrophysics at the University of Vienna, Austria: *"Planetology: From Asteroids to Impact Craters (NEO asteroids and Impact Crater Studies)"*

Collaborations with: Dr. Carraro (ESO – Chile), photometry of minor bodies (Centaurs and KBOs) and Prof. J. Souchay (Observatoire de Paris – France), dynamics of asteroids.

Research areas: asteroids and minor bodies of the Solar System (photometry and celestial mechanics)

Prof. W. W. Zeilinger:

Titles:

• Ph.D. at the University of Vienna, Austria

• Fellowships at University of Padua, Italy and ESO

• Associate professor at the Department of Astrophysics at the University of Vienna

Research areas: structure and evolution of galaxies, dark matter in galaxies, stellar populations, astronomical instrumentation, astronomical software development

Introduction

(Editor's Note: Comet ISON was discovered on September 21, 2012, by two amateur astronomers in Russia, using a reflecting telescope at an observatory of the International Scientific Optical Network. Source: *http://www.voanews.com/content/astronomers-await-comet-ison-year-end-spectacular/1663642.html)*

Comet C/2012 S1 (ISON) presently shows unusually strong activity despite being far from the sun. The comet was observed with 1.5m RC telescope of the Leopold Figl – Observatorium für Astrophysik on April 10, 2013 UT when it was at geocentric distance of 4.1389 AU and heliocentric distance of 5.7844 AU. We report the result of Bessel VRI imaging photometry.

Methods

Images in the Bessel VRI photometric bands were obtained using a f/6.3 focal reducer and a peltier-cooled CCD camera yielding a field of view 5.6x4.8 $arcmin^2$ with a scale of 0.307 arcsec $pixel^{-1}$.

The comet was observed under photometric sky conditions with an average seeing of about 2.0 arcsec FWHM. The data were calibrated using standard IRAF procedures for bias and flat field correction.

The photometric calibration was performed with Landolt photometric standard stars (airmass 1.43) observed on April 10, 2013 UT. The photometric analysis, including corrections for airmass and extinction, was carried out using IRAF and Daophot II software. PSF-photometry was performed with an aperture radius of 32.12 arcsec and a fitting radius of 42.83 arcsec (equal for all photometric bands), selecting the best stars for fitting.

(Continued on page 19)

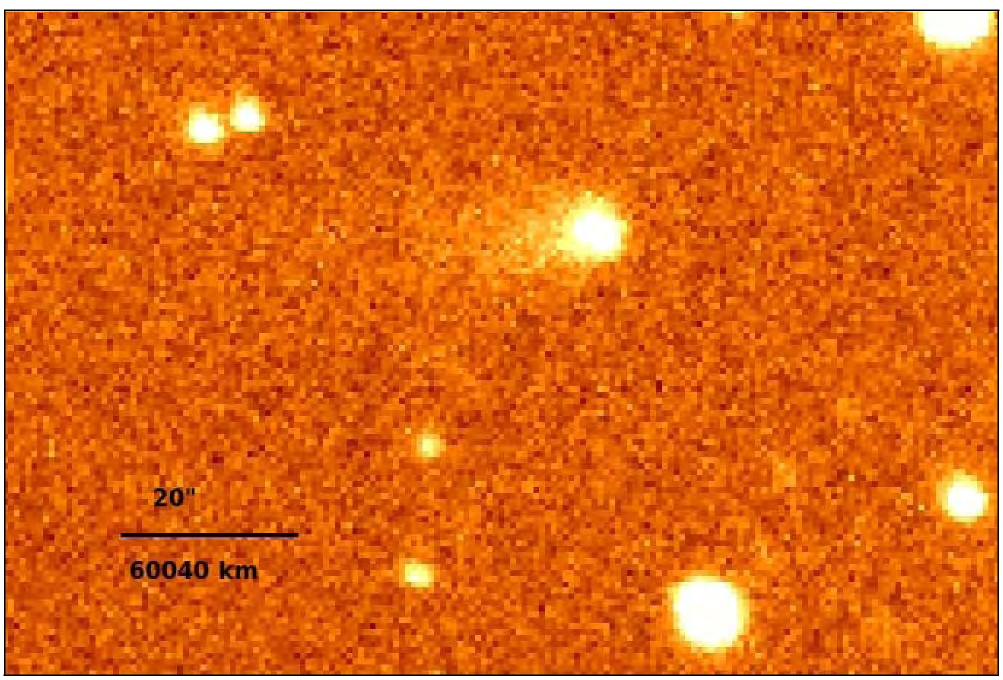


Figure 1. False color image of C/2012 S1 (ISON). The image was obtained by stacking all R band images (total exposure time: 1260s).

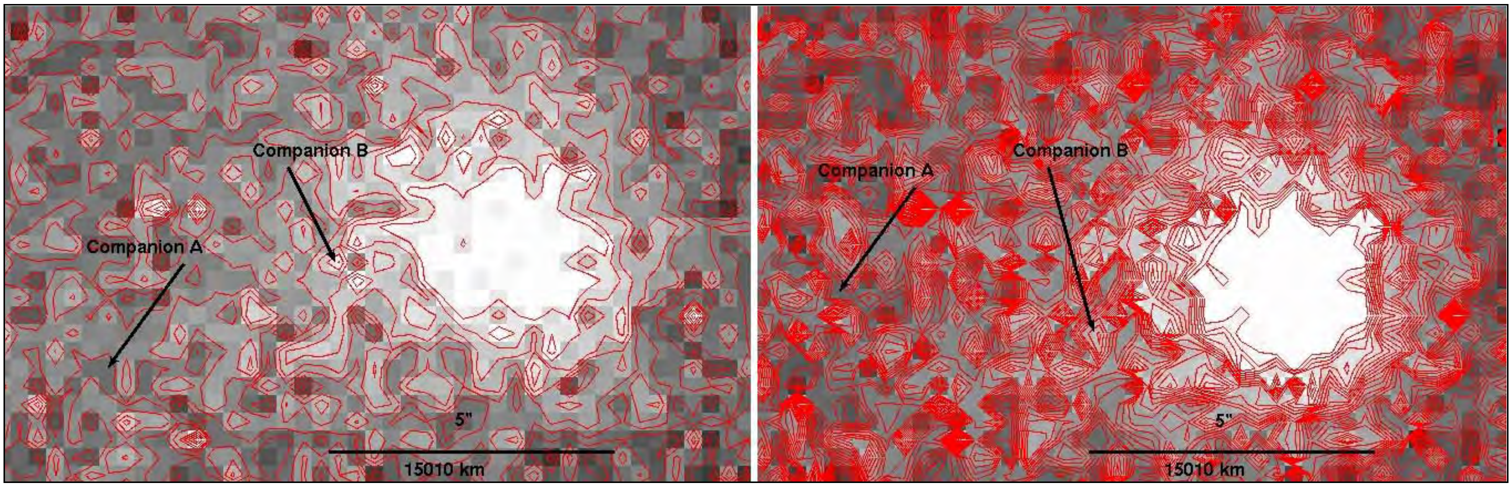


Figure 2. False color R band images of C/2012 S1 (ISON) obtained at 20:43:54 UT (left) and 20:49:45 UT (right). The positions of the candidate sources A and B are indicated.
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Table 1. Photometric Results of Comet C/2013 S1 (ISON) from the Individual Images

Body	UT	Coordinates	F	Exp	A.M.	Ph.A.	Mag.
Comet	20:23:56	06:37:12.081 +30:12:51.14	R	120	1.54	8.0710	16.62±0.04
Comet	20:33:13	06:37:12.082 +30:12:49.81	R	120	1.59	8.0710	16.86±0.04
Comet	20:43:54	06:37:12.082 +30:12:48:65	R	300	1.65	8.0710	16.76±0.03
Comet	20:49:45	06:37:12.082 +30:12:47.94	R	360	1.69	8.0710	16.81±0.03
Comet	20:57:00	06:37:11:983 +30:12:47:44	R	360	1.74	8.0709	17.04±0.05
Comet	20:27:38	06:37:12.029 +30:12:49.60	V	120	1.57	8.0710	17.03±0.04
Comet	20:37:03	06:37:12.039 +30:12:49.60	V	120	1.62	8.0710	17.15±0.05
Comet	21:26:04	06:37:11.964 +30:12:44.20	I	300	2.01	8.0709	15.12±0.04

NOTE: Column UT indicates the respective universal time. Columns F, Exp, A.M., Ph.A. and Mag. contain the filter, airmass, phase angle and derived apparent magnitude respectively.

Table 2. Photometric Results of the Candidate Sources A and B in the Neighborhood of Comet C/2013 S1 (ISON)

Body	UT	Coordinates	F	Exp	A.M.	Ph.A.	Mag.
B	20:23:56	06:37:12.313 +30:12:49.21	R	120	1.54	8.0710	17.88±0.08
A	20:33:13	06:37:13.032 +30:12:49.58	R	120	1.59	8.0710	18.95±0.24
B	20:33:13	06:37:12.267 +30:12:50.07	R	120	1.59	8.0710	17.55±0.07
A	20:43:54	06:37:12.645 +30:12:47.00	R	300	1.65	8.0710	18.26±0.09
B	20:43:54	06:37:12.327 +30:12:48.36	R	300	1.65	8.0710	17.57±0.05
A	20:49:45	06:37:12.681 +30:12:48.34	R	360	1.69	8.0710	18.71±0.11
B	20:49:45	06:37:12.352 +30:12:47.51	R	360	1.69	8.0710	18.02±0.07
A	20:57:00	06:37:12.696 +30:12:46.43	R	360	1.74	8.0709	18.45±0.09
B	20:57:00	06:37:12.375 +30:12:47.94	R	360	1.74	8.0709	18.15±0.07
A	20:37:03	06:37:13.150 +30:12:47.99	V	120	1.62	8.0710	19.33±0.37
B	20:37:03	06:37:12.334 +30:12:48.57	V	120	1.62	8.0710	18.88±0.16
A	21:26:04	06:37:13.234 +30:12:39.60	I	300	2.01	8.0709	18.06±0.33
B	21:26:04	06:37:12.039 +30:12:43.67	I	300	2.01	8.0709	16.23±0.09

NOTE: The columns are the same as described in Table 1.

(Continued from page 17)

Results

During this run of observations, the brightness decreased with an amplitude of 0.32 R magnitudes, ranging between apparent magnitude: 16.62 (R mag) and 17.04 (R mag), see Table 1. The computed color indices are V-R = +0.42 ± 0.07 mag and V-I ≈ +2.69 ± 0.08 mag; the individual measurements have a maximum error of 0.05 mag.

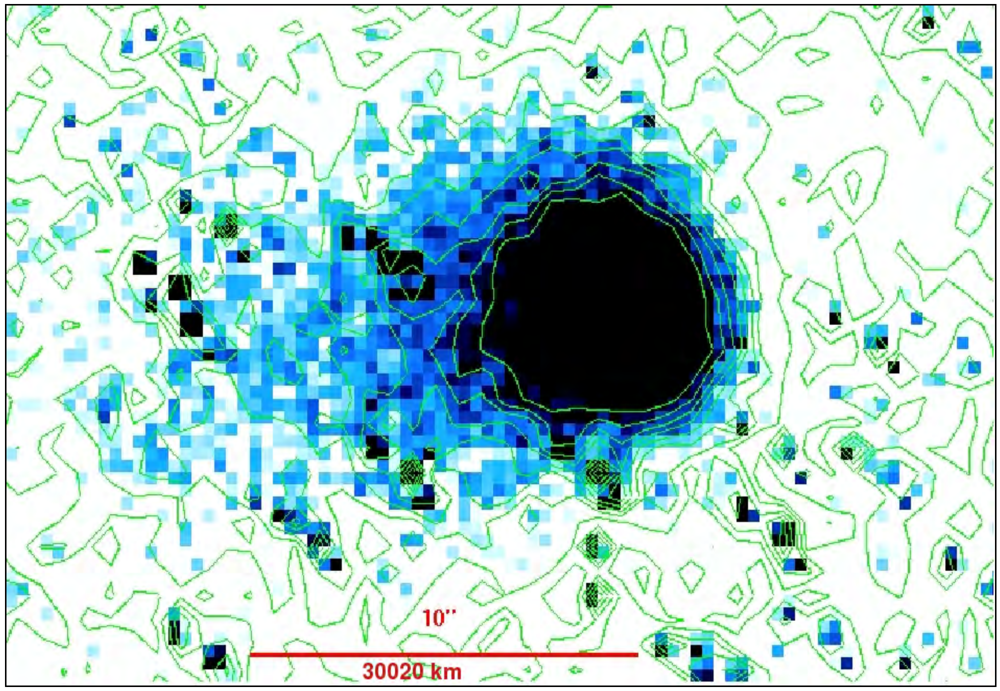

Figure 3. Coma and tail of C/2012 S1 (ISON). The image is a contrast enhancement of the stacked R band image of Figure1.

Signatures of possible comet fragments and/or companions were detected in the images (see Table 2 and Figure 2) within about 10 arc seconds of the comet by applying PSF-photometry which uses the fitted profiles of reference stars to detect sources even at sub-seeing resolutions.

The photometric signatures of two sources are consistently present in all frames. The photometric results are presented in Table 2. We derive V-R color-indices of +0.88 ± 0.52 and +0.43 ± 0.40 mag for sources A and B respectively. Further deep observations are needed to confirm these detections.

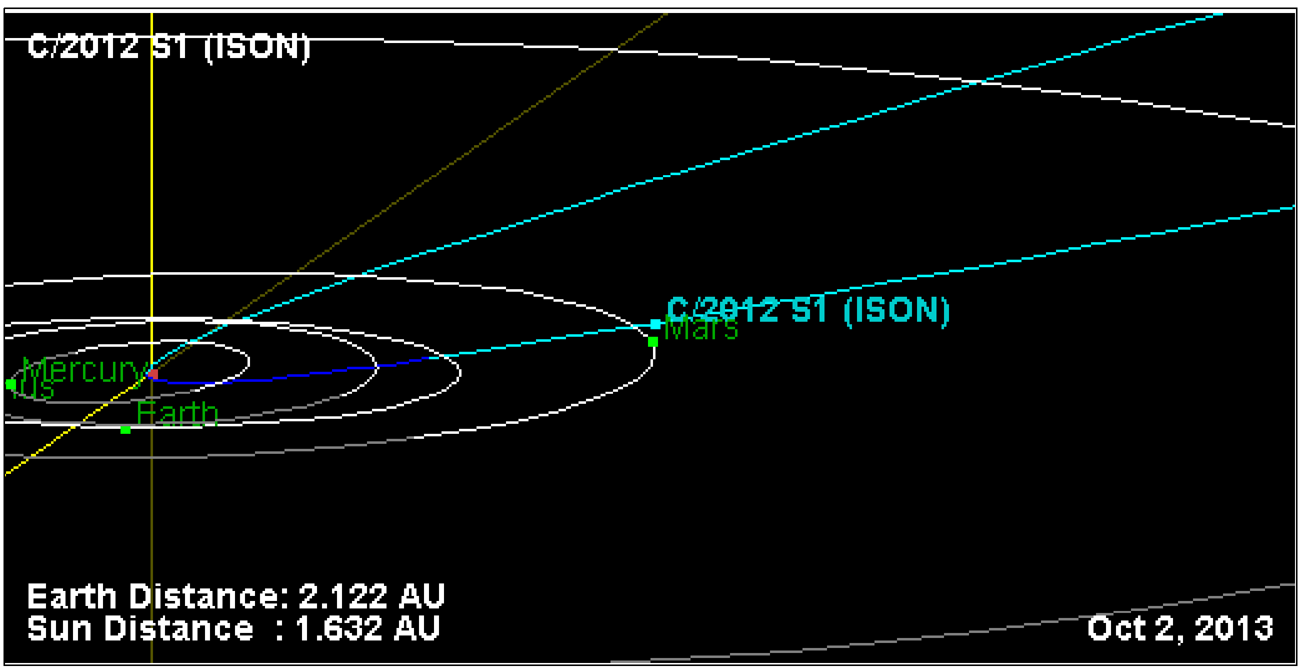

Figure 4. Orbit and position of Comet Ison at October 2, 2013 at the Periareion (Image made via JPL-horizon orbit diagram).

The size of the projection of the tail (SPT) from the center of the coma and the approximate diameter of the coma (ARC) is computed from the stacked R band image (see Fig. 3): SPT $\simeq$ 9.21" (corresponding to 60,700 km) and 2.5 arcsec (7,740 km) < ARC < 5.5 arcsec (9,960 km).

The real length of the tail can be much larger than the projection observing the direction of the comet (cyan vector) and the point where the Sun is (indicated by the yellow vector).

The comet was observed when it was pretty well over the ecliptic. Important closest approaches are expected with some bodies of the inner Solar System and they are in order: October 2, 2013, with Mars (0.0729 AU, see Figure 4); November 28, 2013 with the Sun (0.013 AU), and if the comet survives, December 28, 2013 with the Earth, but relatively far away (0.427 AU).

Feature Story: ALPO Observations of Saturn During the 2009 - 2010 Apparition

By Julius L. Benton, Jr., Coordinator, ALPO Saturn Section
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This paper includes a gallery of Saturn images submitted by a number of observers.

Please note that when a visual observer records or suspects a specific feature on Saturn, it is important to secure future observations quickly if we wish to obtain the period of rotation. For this purpose we encourage observers to use these facts: In System I (EZ plus NEB or SEB), 7 rotations are accomplished in close to 3 Earth-days, while in System II (rest of planet), 9 rotations require close to 4 such days.

A complete set of Saturn Observing Forms are available for downloading at *http://www.alpo-astronomy.org/publications/ALPO Section Publications/SaturnReportForms - All.pdf*

See the ALPO Resources Section, ALPO Observing Section Publications of this Journal for hardcopy availability.

Abstract

The ALPO Saturn Section received 404 visual observations and digital images during the 2009-10 apparition (from October 10, 2009 through July 18, 2010) which were contributed by 41 observers in Canada, China, France, Germany, Greece, Australia, Japan, The Netherlands, Philippines, Puerto Rico, Italy, United States, and United Kingdom. Instruments utilized to perform the observations ranged from 15.2 cm (6.0 in.) up to 50.8 cm (20.0 in.) in aperture. Sporadic, ill-defined dusky features were occasionally suspected in the South Equatorial Belt (SEB) and North Equatorial Belt (NEB) by visual observers during the apparition. Observers imaged recurring small white spots in the South Tropical Zone (STrZ) from early March through early July, as well as, short-lived white spots in the South Equatorial Belt Zone (SEBZ) during the second half of April, Equatorial Zone (EZ) from mid-April to early May, and a suspected white feature in the North Equatorial Belt Zone (NEBZ) in early June. A few recurring central meridian (CM) transit timings were submitted for at least some of these features. The inclination of Saturn's ring system toward Earth, **B,** attained a maximum value of +4.9° on

Table 1: Geocentric Phenomena in Universal Time (UT) for Saturn During the 2009-2010 Apparition

Conjunction		2009	Sep	17d
Opposition		2010	Mar	22d
Conjunction		2010	Oct	01d
Opposition Data				
Visual Magnitude		+0.6		
Constellation		Virgo		
B		-3.2°		
B'		-3.4°		
Globe	Equatorial Diameter	19.5"		
	Polar Diameter	17.6"		
Rings	Major Axis	44.4"		
	Minor Axis	2.4"		

All Readers

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

Online Features

Left-click your mouse on:

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

Observing Scales

Standard ALPO Scale of Intensity:
0.0 = Completely black
10.0 = Very brightest features
Intermediate values are assigned along the scale to account for observed intensity of features
Ring B has been adopted (for most apparitions) as the standard on the numerical sequence. The outer third is the brightest part of Ring B, and it has been assigned a constant 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).

Table 2: 2009-10 Apparition of Saturn, Contributing Observers

	Observer	Location	No. of Observations	Telescopes Used
1.	Abel, Paul G.	Leichester, UK	20 1	20.3 cm (8.0 in.) NEW 38.0 cm (15.0 in.) NEW
2.	Akutsu, Tomio	Cebu City, Philippines	14	35.6 cm (14.0 in.) SCT
3.	Arditti, David	Middlesex, UK	2	35.6 cm (14.0 in.) SCT
4.	Barry, Trevor	Broken Hill, Australia	16	40.6 cm (16.0 in.) NEW
5.	Benton, Julius L.	Wilmington Island, GA	55	15.2 cm (6.0 in.) REF
6.	Chang, Daniel	Hong Kong, China	3	23.5 cm (9.25 in.) SCT
7.	Chavez, Rolando	Powder Springs, GA	1	31.8 cm (12.5 in.) NEW
8.	Chester, Geoff	Alexandria, VA	1 1	20.3 cm (8.0 in.) SCT 30.5 cm (12.0 in.) REF
9.	Combs, Brian	Buena Vista, GA	11	35.6 cm (14.0 in.) SCT
10.	Delcroix, Marc	Tournefeuille, France	9	25.4 cm (10.0 in.) SCT
11.	Edwards, Peter	West Sussex, UK	3	28.0 cm (11.0 in.) SCT
12.	Go, Christopher	Cebu City, Philippines	23	28.0 cm (11.0 in.) SCT
13.	Grego, Peter	Cornwall, UK	4 1	20.3 cm (8.0 in.) SCT 30.5 cm (12.0 in.) REF
14.	Haberman, Bob	San Francisco, CA	1	25.4 cm (10.0 in.) SCT
15.	Hansen, Torsten	Berlin, Germany	3	20.3 cm (8.0 in.) NEW
16.	Hernandez, Carlos	Miami, FL	2	22.9 cm (9.0 in.) MAK
17.	Hill, Rik	Tucson, AZ	14	35.6 cm (14.0 in.) SCT
18.	Ikemura, Toshihiko	Osaka, Japan	18	38.0 cm (15.0 in.) NEW
19.	Jaeschke, Wayne	West Chester, PA	4	35.6 cm (14.0 in.) SCT
20.	Jakiel, Richard	Douglasville, GA	2	30.5 cm (12.0 in.) SCT
21.	Kardasis, Manos	Athens, Greece	1	25.4 cm (10.0 in.) SCT
22.	Kraaikamp, Emil	Ruinerwold, Netherlands	4	25.4 cm (10.0 in.) SCT
23.	Lazzarotti, Paolo	Massa, Italy	1	40.6 cm (16.0 in.) CAS
24.	Lewis, Martin	Hertfordshire, UK	5	22.2 cm (8.7 in.) NEW
25.	Llewellyn, Dan	Decatur, GA	1	35.6 cm (14.0 in.) SCT
26.	Maxson, Paul	Phoenix, AZ	72	25.4 cm (10.0 in.) DAL
27.	Melillo, Frank J.	Holtsville, NY	14	25.4 cm (10.0 in.) SCT
28.	Melka, Jim	St. Louis, MO	5	30.5 cm (12.0 in.) NEW
29.	Niechoy, Detlev	Göttingen, Germany	11	20.3 cm (8.0 in.) SCT
30.	Owens, Larry	Alpharetta, GA	3	40.6 cm (16.0 in.) NEW
31.	Peach, Damian	Norfolk, UK	5	35.6 cm (14.0 in.) SCT
32.	Pellier, Christophe	Bruz, FR	1	25.4 cm (10.0 in.) CAS
33.	Phillips, Jim	Charleston, SC	10	25.4 cm (10.0 in.) REF
34.	Phillips, Michael A.	Swift Creek, NC	3	20.3 cm (8.0 in.) SCT
35.	Prost, Jean-Pierre	Plateau de Calern, France	2	25.4 cm (10.0 in.) DAL
36.	Ramakers, Theo	Social Circle, GA	2	23.5 cm (9.25 in.) SCT
37.	Roussell, Carl	Hamilton, ON, Canada	5	15.2 cm (6.0 in.) REF
38.	Sabia, John D.	La Plume, PA	6	50.8 cm (20.0 in.) R-C
39.	Santacana, Guido	San Juan, Puerto Rico	3	15.2 cm (6.0 in.) REF
40.	Sweetman, Michael E.	Tucson, AZ	18	15.2 cm (6.0 in.) MAK
41.	Wesley, Anthony	Murrumbateman, Australia	23	36.8 cm (14.5 in.) NEW
	TOTAL OBSERVATIONS		404	
	TOTAL OBSERVERS		41	

Instrumentation Abbreviations:
NEW = Newtonian, CAS = Cassegrain, SCT = Schmidt-Cassegrain, MAK= Maksutov-Cassegrain, REF = Refractor, DAL = Dall-Kirkham, R-C = Ritchey-Chretien

January 8, 2010. Because of the small ring tilt in 2009-10, observers were able to see and image many of Saturn's traditional global feature in both hemispheres. In subsequent apparitions, until the next edgewise orientation in March 2025, it is the Northern Hemisphere of the planet and North face of the rings that will be increasingly inclined toward Earth for visual observations and imaging. A summary of visual observations and digital images of Saturn contributed during the apparition are discussed, including the results of continuing efforts to image the bi-colored aspect and azimuthal brightness asymmetries of the rings. Accompanying the report are references, drawings, photographs, digital images, graphs, and tables.

Introduction

This report is based on an analysis of 404 visual observations, descriptive notes, and digital images contributed to the ALPO Saturn Section by 41 observers from October 10, 2009 through July 18, 2010, referred to hereinafter as the 2009-10 "observing season" or apparition of Saturn.

Examples of submitted drawings and images are included with this summary, integrated as much as practicable with topics discussed in the text, with times and dates all given in Universal Time (UT).

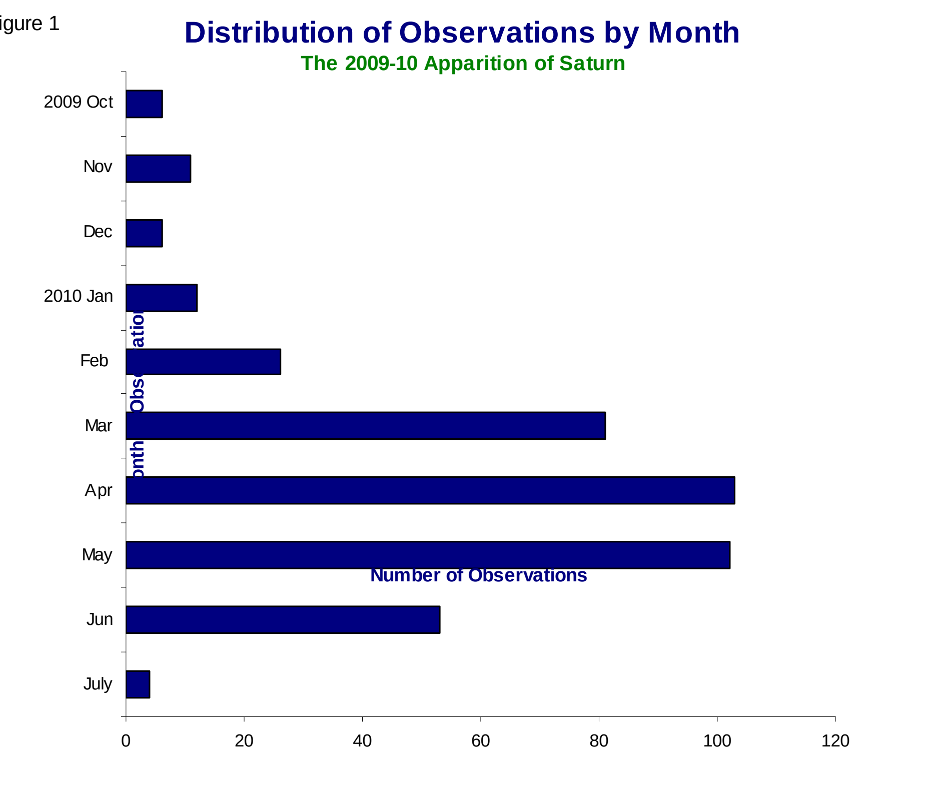
Table 1 provides geocentric data in Universal Time (UT) for the 2009-10 apparition. The numerical value of **B**, or the Saturnicentric latitude of the Earth referred to the ring plane (+ when north), ranged between the extremes of +4.9° (January 8, 2010) and +1.7° (May 28, 2010). The value of **B**', the saturnicentric latitude of the Sun, varied from +0.9° (October 10, 2009) to +5.1° (July 18, 2010).

Table 2 lists the 41 individuals who all together submitted 404 reports to the ALPO Saturn Section this apparition, along with their observing sites, number of observations, telescope aperture, and type of instrument. *Figure 1* is a histogram showing the distribution of observations by month, where it can be seen that 26.5% were made prior to opposition, 2.5% at opposition (March 22, 2010), and 71.0% thereafter. Although there usually is a tendency for observers to view Saturn more frequently around the date of opposition when the planet is well-placed high in the evening sky, coverage favored the period just before and following opposition during the 2009-10 apparition (90.3% of all observations took place from February through June 2010). For optimizing coverage, observers are urged to begin drawing and imaging Saturn as soon as the planet becomes visible in the eastern sky before sunrise right after conjunction. Our goal is to carry out regular observational surveillance of the planet for as much of its mean synodic period of 378^d as possible (this period refers to the elapsed time from one conjunction of Saturn with the Sun to the next, which is slightly longer than a terrestrial year).

Figure 2 and *Figure 3* show the ALPO Saturn Section observer base and the international distribution of all observations submitted during the apparition. The United States accounted for 46.3% of the participating observers and 55.9% of the submitted observations. With 54.5% of all observers residing in Canada, China, France, Germany, Greece, Australia, Japan, The Netherlands, Philippines, Puerto Rico, Italy, and United Kingdom, whose total contributions represented 44.1% of the observations, international cooperation continued to be strong this observing season.

Figure 4 graphs the number of observations this apparition by instrument type. Roughly two-fifths (42.3%) of all observations were made with telescopes of classical design (refractors, Newtonians, and Cassegrains). Classical designs with superb optics and precise collimation frequently produce high-resolution images with excellent contrast, a likely reason why they have often been the instruments of choice for visual studies of the Moon and planets. In recent apparitions, however, since a variety of adapters are readily available to attach digital imagers to them, the utilization of

Figure 1



comparatively compact and portable Schmidt-Cassegrains and Maksutov-Cassegrains has been growing. It has been repeatedly established that such instruments outfitted with quality well-collimated optics produce very fine images of Saturn.

Telescopes with apertures of 15.2 cm (6.0 in.) or larger accounted all of the observations contributed this apparition. Readers are reminded that numerous historical instances exist where considerably smaller instruments of good quality ranging from 10.2 cm (4.0 in.) to 12.7 cm (5.0 in.) have been very useful for quite a few of our Saturn observing programs.

The ALPO Saturn Section sincerely appreciates all of the descriptive reports, digital images, visual drawings, and supporting data submitted by all of the observers listed in *Table 2* for the 2009-10 apparition, without which this report would have been impossible. Those wishing to participate in the observing programs for Saturn using visual methods (i.e., drawings, intensity and latitude estimates, CM transit timings) and digital imaging are highly encouraged to do so in upcoming observing seasons as we continue our focus on maintaining international cooperative studies of Saturn. All methods of recording observations 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 digital imaging. It should be noted that, in recent years, too few experienced observers are making routine visual numerical relative intensity estimates, which are badly needed for a continued comparative analysis of belt, zone, and ring component brightness fluctuations over many apparitions. The Saturn Section, therefore, appeals to observers to set aside a few enough time while at the telescope to record intensity estimates (visual photometry) in integrated light and with standard color filters. The ALPO Saturn Section is always pleased to receive observations from novices, and the author is always delighted to offer assistance as one becomes acquainted with our programs.

The Globe of Saturn

The 404 observations submitted to the ALPO Saturn Section during 2009-10 were utilized in preparing this summary of this apparition's activities. Drawings, digital images, tables, and graphs are included so readers can refer to them as they study the content of this report. For drawings or images utilized as examples of the more notable features or phenomena occurring within Saturn's belts and zones, contributors are identified in the text along with dates and times of those specific observations for easy reference back to the relevant tables that list instrumentation employed, seeing, transparency, CM data, and so forth. In addition, captions associated with illustrations provide useful information.

Features on the globe of Saturn are described in the traditional south-to-north order and can be identified by referring to the nomenclature diagram shown in *Figure 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 2009-10 apparition. It has been customary in past Saturn apparition reports to compare the brightness and morphology of atmospheric features between observing seasons, and this practice continues with this report so readers are aware of very subtle, but nonetheless recognizable, variations that may be occurring seasonally on the planet.

Small fluctuations in intensity of Saturn's atmospheric features (see *Table 3*) may be due simply to the varying inclination of the planet's rotational axis relative to the Earth and Sun, although photometric work in past years has shown that tiny oscillations of roughly 0.10 in the visual magnitude of Saturn likely occur nearly over the span of a decade or so. Transient and longer-lasting atmospheric

Figure 2

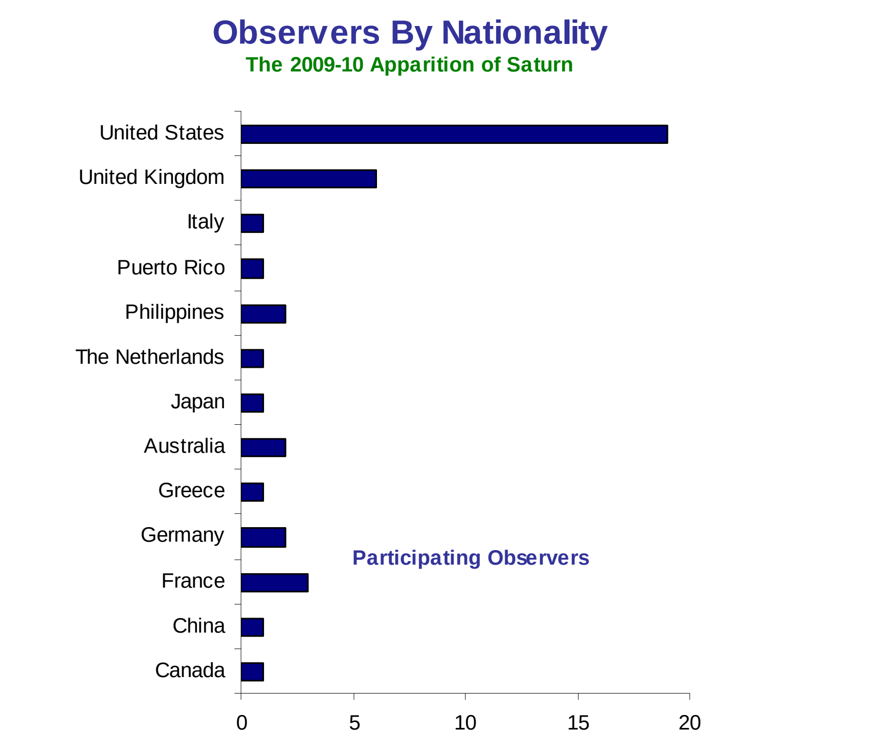


Table 3: Visual Numerical Relative Intensity Estimates and Colors for the 2009-10 Apparition of Saturn

Globe/Ring Feature	# Estimates	2009-10 Mean Intensity & Standard Error	Intensity Variance Since 2008-09	Mean Derived Color
Zones				
SPR	24	4.40 ± 0.07	+0.80	Dark Gray
STeZ	15	5.56 ± 0.18	+0.40	Yellowish-White
STrZ	16	6.66 ± 0.20	+0.40	Bright Yellowish-White
SEBZ	7	5.29 ± 0.14	+0.60	Dull Yellowish-Gray
EZs	32	7.53 ± 0.09	0.00	Bright Yellowish-White
NEBZ	9	4.69 ± 0.27	-----	Dull Yellowish-Gray
EZn	33	7.73 ± 0.10	+0.50	Bright Yellowish-White
NTrZ	15	5.87 ± 0.18	+0.50	Yellowish-White
NTeZ	11	5.73 ± 0.30	-----	Yellowish-White
NPR	29	4.25 ± 0.09	-----	Dull Gray
Belts				
Globe S of Rings	18	6.11 ± 0.08	-----	Yellowish-Gray
SSTeB	3	5.33 ± 0.14	-----	Light Gray
STeB	9	4.76 ± 0.15	-----	Light Grayish-Brown
SEB (whole)	22	4.59 ± 0.11	+1.00	Grayish-Brown
SEBs	10	4.23 ± 0.09	+0.50	Grayish-Brown
SEBn	13	3.78 ± 0.14	-0.20	Dark Grayish-Brown
EB	2	4.70 ± 0.57	-----	Light Grayish-Brown
NEB (whole)	21	3.88 ± 0.10	-0.05	Dark Grayish-Brown
NEBs	11	3.15 ± 0.17	-----	Dark Gray
NEBn	11	3.47 ± 0.18	-----	Dark Grayish-Brown
NTeB	8	4.70 ± 0.20	-----	Light Grayish-Brown
NNNTeB	1	5.00 ± 0.00	-----	Light Gray
Globe N of Rings	18	5.91 ± 0.10	-----	Yellowish-Gray
Rings				
A (whole)	8	6.20 ± 0.18	-1.10	Dull Yellowish-White
A0 or B10	4	0.25 ± 0.22	-0.40	Grayish-Black
B (outer 1/3)	5	8.00 ± 0.00 STD	0.00	Brilliant White
B (inner 2/3)	5	6.80 ± 0.18	-0.20	Bright Yellowish-White
Sh G or R	4	0.00 ± 0.00	-0.20	Black shadow
Sh R of G	4	0.00 ± 0.00	-0.40	Black shadow

Notes:
For nomenclature see text and Figure 5. 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 2008-09" is in the same sense of the 2008-09 value subtracted from the 2009-10 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.*

features seen or imaged in various belts and zones on the globe may also play a role in what appear to be subtle brightness variations. Regular photoelectric photometry of Saturn, in conjunction with carefully-executed visual numerical relative intensity estimates, is encouraged.

There have been discussions over the last several apparitions that suspected slight increases or decreases in atmospheric activity on Saturn's globe could be a consequence of the planet's seasonal insolation cycle, but measurements in the past suggest only a slow thermal response to solar heating at Saturn's perihelion distance of ~9.0 AU from the Sun. So, as time elapses with succeeding apparitions following Saturn's perihelion passage back in 2003, observers should remain alert and maintain a watchful eye for atmospheric phenomena, since a lag in the planet's atmospheric thermal response could roughly mimic what we experience on Earth; that is, the warmest days do not arrive on the first day of summer but occur several weeks later. Any similar effect on Saturn would be extremely subtle, however, and probably not noticed for quite a number of years.

The intensity scale routinely employed by Saturn observers is the standard *ALPO Standard Numerical Relative Intensity Scale*, such that 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 2008-09 intensity from its 2009-10 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 probably not important.

It is always worthwhile to evaluate digital images of Saturn contributed by ALPO observers using different apertures and filter techniques. The goal is to understand the level of detail seen and how it compares with visual impressions

Figure 3

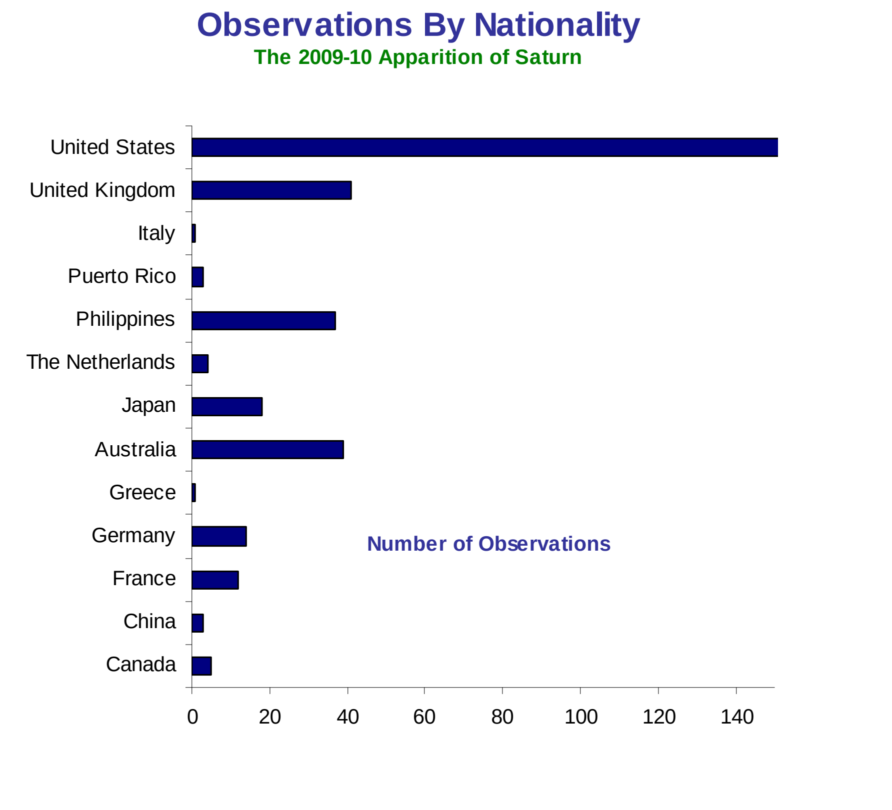


Figure 4

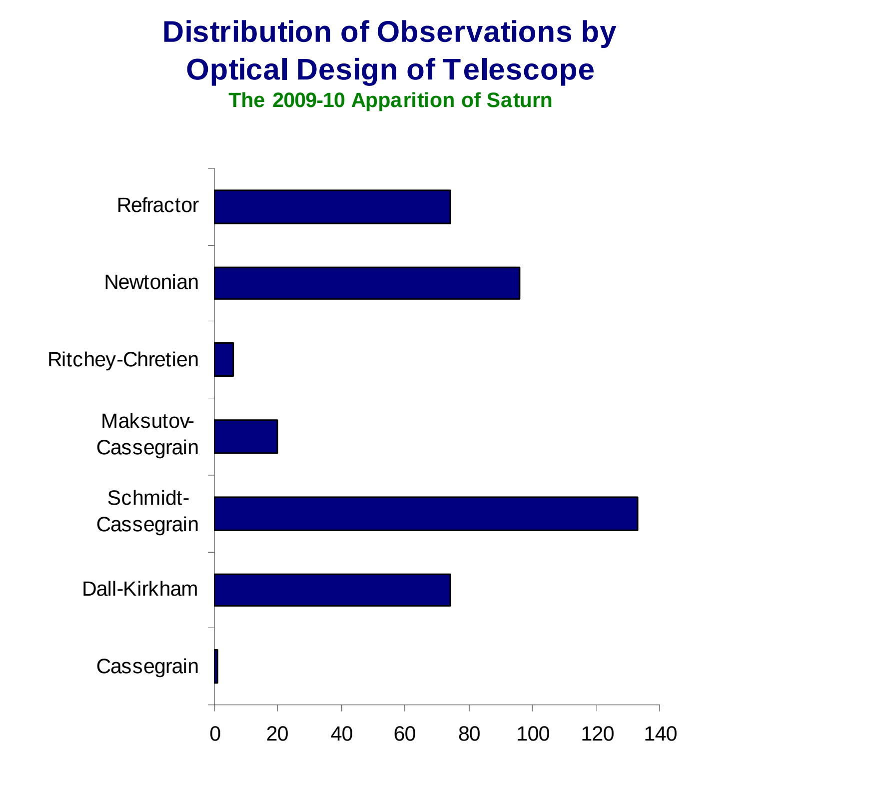


Table 4: White Spots in the STrZ during the 2009-10 Apparition of Saturn

Date (UT)	UT Start	UT End	CM Start			CM End							
yyyy mm dd	hh:mm	hh:mm	I (°)	II (°)	III (°)	I (°)	II (°)	III (°)	Obs	Obs Stn	Instr (cm)	Inst Type	NOTES
2010 03 06	14:26	15:34	182.6	239.4	10.4	222.5	277.8	48.7	Akutsu	PHIL	35.6	SCT	STrZ White Spot; particularly obvious in Red wavelengths
2010 03 09	15:31	15:46	233.9	192.3	319.6	242.7	200.8	328.1	Go	PHIL	28.0	SCT	STrZ White Spot near CM
2010 03 10	13:52	14:48	300.2	228.6	354.8	333.1	260.2	26.3	Akutsu	PHIL	35.6	SCT	STrZ White Spot; most obvious in Red light
2010 03 12	08:22		355.5	226.7	350.7				Maxson	USA	25.4	DALL	STrZ White Spot near CM
2010 03 13	15:58	16:48	27.2	215.9	338.4	56.6	244.1	6.5	Go	PHIL	28.0	SCT	STrZ White Spot near CM
2010 03 13	16:57	17:15	61.8	249.2	11.6	72.4	259.3	21.7	Akutsu	PHIL	35.6	SCT	STrZ White spot near CM
2010 03 14	13:17	14:24	57.2	217.2	338.6	96.5	255.0	16.3	Akutsu	PHIL	35.6	SCT	STrZ White Spot; most obvious in Red light
2010 03 14	13:51	14:22	77.2	236.4	357.7	95.3	253.8	15.2	Ikemura	JAP	38.0	NEW	STrZ White Spot near CM
2010 03 15	00:34		94.2	239.0	359.8				Abel	UK	20.3	NEW	STrZ White Spot near CM
2010 03 17	15:45	16:39	157.1	216.9	334.5	188.8	247.3	4.9	Akutsu	PHIL	35.6	SCT	STrZ White Spot; most obvious in Red light
2010 03 18	13:23		198.2	228.9	345.4				Wesley	AUS	36.8	NEW	STrZ White Spot is slightly elongated and prominent in Red and Green light
2010 03 18	13:37	14:23	206.5	236.8	353.3	233.4	262.7	19.2	Akutsu	PHIL	35.6	SCT	STrZ White Spot; elongated; most obvious in Red light
2010 03 18	13:57	16:48	218.2	248.0	4.6	318.4	344.5	100.9	Go	PHIL	28.0	SCT	Elongated STrZ White Spot
2010 03 19	22:06	22:22	269.3	255.9	10.8	278.7	264.9	19.8	Kardasis	GR	25.4	SCT	STrZ White Spot elongated
2010 03 21	05:39	05:57	299.3	243.4	356.7	309.8	253.6	6.9	Melillo	USA	25.4	SCT	STrZ White Spot on CM
2010 03 22	13:23	14:26	335.7	237.1	348.9	12.7	272.7	24.4	Go	PHIL	28.0	SCT	Elongated STrZ White Spot near CM
2010 03 22	13:34	14:25	342.2	243.4	355.1	12.1	272.1	23.8	Akutsu	PHIL	35.6	SCT	STrZ White Spot; elongated; most obvious in Red light
2010 03 22	13:51		352.1	252.9	4.7				Wesley	AUS	36.8	NEW	STrZ White Spot elongated in Green light
2010 03 25	13:38	16:25	357.6	161.8	269.9	95.5	256.0	3.9	Wesley	AUS	36.8	NEW	Elongated STrZ White Spot
2010 04 02	06:02		5.1	281.1	20.0				Melillo	USA	25.4	SCT	STrZ White Spot is diffuse near CM
2010 04 08	00:09								Hansen	GER	20.3	SCT	STrZ White Spot near CM
2010 04 08	21:11	21:24	204.1	266.0	356.8	211.8	273.3	4.1	Edwards	UK	28.0	SCT	STrZ White Spot
2010 04 08	21:18	21:28	208.3	269.9	0.8	214.1	275.6	6.4	Peach	UK	35.6	SCT	STrZ White Spot elongated near CM in Red light

Table 4: White Spots in the STrZ during the 2009-10 Apparition of Saturn (Continued)

Date (UT)	UT Start	UT End	CM Start			CM End							
yyyy mm dd	hh:mm	hh:mm	I (°)	II (°)	III (°)	I (°)	II (°)	III (°)	Obs	Obs Stn	Instr (cm)	Inst Type	NOTES
2010 04 11	03:09		302.7	291.9	20.1				Owens	USA	40.6	NEW	STrZ Wh Spot elongated
2010 04 11	03:47		325.0	313.4	41.5				Combs	USA	35.6	SCT	STrZ White Spot elongated
2010 04 13	19:53		60.1	322.2	47.0				Delcroix	FRA	25.4	SCT	STrZ White Spot near limb
2010 04 14	05:11	05:45	27.3	276.8	1.2	47.2	296.0	20.4	Melillo	USA	25.4	SCT	STrZ White Spot; more diffuse
2010 04 15	03:01		75.4	295.5	18.9				Melillo	USA	25.4	SCT	STrZ White Spot; diffuse
2010 04 16	11:30		138.1	314.6	36.3				Wesley	AUS	36.8	NEW	STrZ White Spot more prominent in Red light
2010 04 16	20:58	23:29	111.2	274.9	356.1	211.4	11.3	92.4	Kraaikamp	NETH	25.4	SCT	STrZ White spot
2010 04 16	21:30	21:46	129.9	292.9	14.1	139.3	302.0	23.1	Delcroix	FRA	25.4	SCT	STrZ White spot near CM
2010 04 17	21:19	23:56	339.8	107.3	187.1				Kraaikamp	NETH	25.4	SCT	STrZ White spot
2010 04 19	13:06	14:05	207.4	284.8	2.8	242.0	318.1	36.0	Go	PHIL	28.0	SCT	Elongated STrZ White spot
2010 04 20	10:39		245.5	293.9	10.8				Wesley	AUS	36.8	NEW	STrZ White spot elongated
2010 04 23	13:23	13:54	354.6	302.4	15.6	12.7	319.9	33.0	Go	PHIL	28.0	SCT	STrZ Wh Spot elongated and more diffuse
2010 04 24	20:56	22:23	24.5	289.9	75.5	338.9	50.4		Delcroix	FRA	25.4	SCT	STrZ White spot spreading in longitude and more diffuse
2010 04 27	11:20	12:37	59.7	241.1	309.5	104.8	284.5	352.8	Barry	AUS	40.6	NEW	STrZ White spot elongated and more diffuse
2010 04 28	09:40	11:24	125.3	276.7	344.0	186.3	335.3	42.5	Barry	AUS	40.6	NEW	STrZ White spot elongated and more diffuse
2010 04 30	05:14		217.9	310.7	15.8				Melillo	USA	25.4	SCT	STrZ White Spot is spreading and more diffuse
2010 05 01	03:13		271.3	334.4	38.4				Melillo	USA	25.4	SCT	STrZ White Spot is spreading and more diffuse
2010 05 02	11:40	11:45	332.8	352.3	54.7	335.8	355.1	57.5	Wesley	AUS	36.8	NEW	STrZ White spot considerably elongated diffuse
2010 05 05	13:15	13:53	41.4	321.8	20.5	63.7	343.3	41.9	Go	PHIL	28.0	SCT	STrZ White Spot spreading longitudinally
2010 05 09	03:48		206.0	10.0	64.4				Maxson	USA	25.4	DALL	STrZ White Spot is spreading and more diffuse
2010 05 10	11:21	11:37	235.9	357.4	50.2	245.3	6.4	59.2	Wesley	AUS	36.8	NEW	STrZ White spot is elongated and most obvious in Red light
2010 05 13	03:29		332.0	7.2	56.7				Maxson	USA	25.4	DALL	Elongated and diffuse STrZ White spot
2010 05 14	11:06		4.2	356.8	44.8				Go	PHIL	28.0	SCT	STrZ White spot elongated and more diffuse

Table 4: White Spots in the STrZ during the 2009-10 Apparition of Saturn (Continued)

Date (UT)	UT Start	UT End	CM Start			CM End							
yyyy mm dd	hh:mm	hh:mm	I (°)	II (°)	III (°)	I (°)	II (°)	III (°)	Obs	Obs Stn	Instr (cm)	Inst Type	NOTES
2010 05 16	04:39		25.8	322.5	8.4				Melillo	USA	25.4	SCT	STrZ White spot is diffuse
2010 05 21	02:21	03:18	206.1	344.5	24.4	239.5	16.6	56.5	Phillips	USA	20.3	SCT	STrZ White Spot is elongated in Red and Green light
2010 05 22	21:09	21:44	271.7	352.4	30.2	292.2	12.2	49.9	Kraaikamp	NETH	25.4	SCT	More diffuse and elongated STrZ White spot in red light
2010 05 22	21:11		272.9	353.6	31.3				Peach	UK	35.6	SCT	STrZ white spot is elongated and possibly split
2010 05 22	21:20	21:37	278.1	358.6	36.4	288.1	8.2	46.0	Delcroix	FRA	25.4	SCT	STrZ white spot is elongated and showing fragmentation trend
2010 05 22	21:28	21:41	282.8	3.2	40.9	290.4	10.5	48.2	Edwards	UK	28.0	SCT	STrZ white spot is elongated and showing fragmentation trend
2010 05 26	01:08	01:32	64.5	43.0	77.0	78.6	56.6	90.5	Jaeschke	USA	35.6	SCT	STrZ White spot is more elongated
2010 06 02	01:43		234.6	346.3	11.8				Jaeschke	USA	35.6	SCT	STrZ White spot is more elongated
2010 06 03	09:28	11:13	271.4	340.4	4.3	333.0	39.6	63.4	Barry	AUS	40.6	NEW	STrZ White spot is more diffuse with some subcomponents and elongated
2010 06 03	10:41		314.2	21.5	45.4				Wesley	AUS	36.8	NEW	STrZ White spot is more diffuse showing more fragmentation and elongation
2010 06 03	21:03	21:57	318.9	12.2	35.5	350.6	42.7	65.9	Pellier	FRA	25.4	SCT	STrZ White spot is elongated and split into several components
2010 06 03	21:03		318.9	12.2	35.5				Lewis	UK	22.2	NEW	STrZ White spot is elongated and split into several components
2010 06 06	01:52		16.8	359.0	19.7				Melka	USA	30.5	NEW	STrZ White spot is elongated and split into several components
2010 06 11	21:20	22:16	242.5	37.1	50.8	275.4	68.7	82.3	Delcroix	FRA	25.4	SCT	STrZ White spot is elongated and showing multiple components
2010 Jul 02	08:38		243.8	97.2	86.2				Barry	AUS	40.6	NEW	STrZ White spot is vague and faint with several components

of the globe and rings, including any correlation with spacecraft imaging and results from professional observatories. So, in addition to routine visual studies, such as drawings and visual numerical relative intensity estimates, Saturn observers should systematically image the planet every possible clear night to try to document individual features on the globe and in the rings, their motion and morphology (including changes in intensity and hue), to serve as input for grouping with images taken by professional ground-based observatories and spacecraft monitoring Saturn at close range. Furthermore, comparing images taken over several apparitions for a given hemisphere of Saturn's globe provides information on long-term seasonal changes suspected by observers employing visual numerical relative intensity estimates. Images and systematic visual observations by amateurs are being relied upon for providing initial alerts of interesting large-scale features on Saturn that professionals may not already know about but can subsequently examine further with considerably larger specialized instrumentation.

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 very dark, so imaging the planet with a series of color filters may 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 320nm are effectively blocked by the Earth's stratospheric ozone (O_3), while CO_2 and H_2O-vapor molecules absorb in the IR region beyond 727nm. The human eye is insensitive to UV light short of 320nm and can detect only about 1.0% at 690nm and 0.01% at 750nm in the IR (beyond 750nm visual sensitivity is essentially zero). 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 imaging Saturn in these near-IR and near-UV bands has provided some remarkable results in the past. The effects of absorption and scattering of light by the planet's atmospheric gases and clouds at various heights and with different thicknesses are often evident. Indeed, such images sometimes show differential light absorption by particles with dissimilar hues intermixed with Saturn's white NH_3 clouds.

Latitude Estimates of Features on the Globe

Observers should try to utilize the easy visual method developed by Haas over 60 years ago to perform estimates of Saturnian global latitudes every apparition. The process is to estimate as accurately as possible 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 calculated 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 virtually non-existent, and if available they tend to be very expensive, not to mention sometimes tedious to use.

Estimates of Saturnian latitudes during 2009-10 were generally lacking, and it is hopeful that more observers will employ Haas' simple and convenient method in future apparitions. A detailed description of the technique can be found in the author's book entitled *Saturn and How To Observe It*, published by Springer and available from booksellers worldwide.

Southern Regions of the Globe

During the 2009-10 apparition **B** attained a maximum value of only +4.9°, and although observers could view regions of the southern hemisphere of Saturn to good advantage, visibility of areas near the extreme South limb (e.g., SPR) are increasing tilted away from line of sight now that more of the northern hemisphere are progressively seen to advantage.

Sporadic, ill-defined dusky features were occasionally suspected in the South Equatorial Belt (SEB) by visual observers during the apparition. Observers imaged recurring small white spots in the South Tropical Zone (STrZ) that evolved

Table 5: White Spots in the SEBZ during the 2009-10 Apparition of Saturn

Date (UT)	UT Start	UT End	CM Start			CM End							
yyyy mm dd	hh:mm	hh:mm	I (°)	II (°)	III (°)	I (°)	II (°)	III (°)	Obs	Obs Stn	Instr (cm)	Inst Type	NOTES
2010 04 16	11:30		138.1	314.6	36.3				Wesley	AUS	36.8	NEW	SEBZ White Spot
2010 04 16	20:58	23:29	111.2	274.9	356.1	211.4	11.3	92.4	Kraaikamp	NETH	25.4	SCT	SEBZ White Spot
2010 04 17	21:19	23:56	339.8	107.3	187.1	339.8	107.3	187.1	Kraaikamp	NETH	25.4	SCT	SEBZ White Spot
2010 04 19	13:06	14:05	207.4	284.8	2.8	242.0	318.1	36.0	Go	PHIL	28.0	SCT	SEBZ White Spot
2010 04 20	10:39		245.5	293.9	10.8				Wesley	AUS	36.8	NEW	SEBZ White Spot
2010 04 27	11:20	12:37	59.7	241.1	309.5	104.8	284.5	352.8	Barry	AUS	40.6	NEW	SEBZ White Spot
2010 04 28	09:40	11:24	125.3	276.7	344.0	186.3	335.3	42.5	Barry	AUS	40.6	NEW	SEBZ White Spot

morphologically from early March through early July. Other less conspicuous and rather short-lived white spots were noted in the South Equatorial Belt Zone (SEBZ) during the second half of April, as well as the Equatorial Zone (EZ) from mid-April to early May. These phenomena are discussed in the forthcoming paragraphs dealing separately with each region of Saturn's southern hemisphere.

White spots, usually caused by upward convection of NH_4 (ammonia) in Saturn's atmosphere, showed subtle but recognizable morphological changes over time, particularly the STrZ white spot reported in 2009-10. The structure of zonal wind profiles in the STrZ, SEBZ, and EZ seem to contribute to the emergence and behavior of such discrete features. High-resolution imaging documented several white spots in these regions for a few rotations of Saturn, but with the exception of the STrZ white spot, re-identification and subsequent tracking of the more transient features proved difficult. So, with the exception of the recurring STrZ white spot, CM transit timings were unsuccessful, that would have facilitated derivation of drift rates of the short-lived spots in the SEBZ.

South Polar Region (SPR)

Based on visual numerical relative intensity estimates submitted during the 2009-10 apparition, the dark gray SPR may have been a little lighter in overall appearance than in 2008-09 (by a subtle difference in mean visual intensity of only +0.8). No drawings by visual observers or digital images of the SPR revealed discrete activity in this region during the apparition. The South Polar Cap (SPC) was not reported by observers making visual numerical relative intensity estimates in 2009-10, nor was it obvious on digital images, mainly because this region in the extreme South was tilted away from our line of sight. A dark gray South Polar Belt (SPB) often encircling the SPR was not reported by visual observers during the apparition nor was it apparent in digital images received.

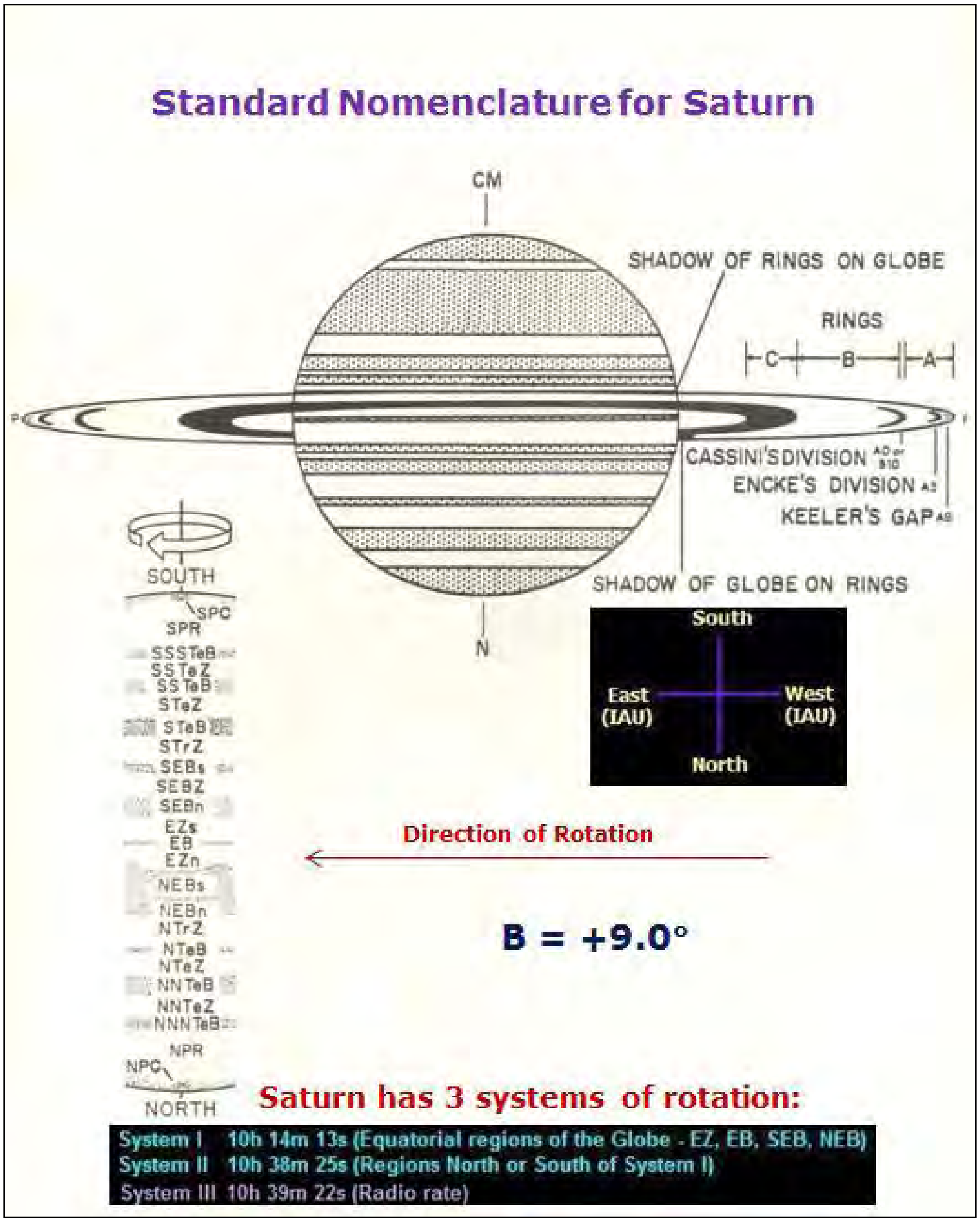


Figure 5. Saturn nomenclature, where A = Ring A, B = Band or Ring B or saturnicentric latitude of Earth, C = Ring C or Cap, E = Equatorial, f = following (celestial east), G = Globe, n = north component, N = North, p = preceding (celestial west), P = Polar, R = Ring(s) or Region, s = south component, S = South, Te = Temperate, Tr = Tropical, Z = Zone. The ring Ansae (not labeled) are the easternmost and westernmost protrusions of the Ring System. Note that "Gap" is also called "Division" or "Complex." South is at the top in this inverted view, similar to the orientation seen through an inverting telescope in Earth's Northern Hemisphere.

South South Temperate Zone (SSTeZ)

The SSTeZ was not reported by visual observers during this observing season, with no visual numerical relative intensity estimates being contributed, and it was not clearly apparent on digital images submitted in 2009-10.

South South Temperate Belt (SSTeB)

The light gray SSTeB was rarely sighted by contributing observers during 2009-10, and perhaps just barely perceptible on several high-resolution digital images.

South Temperate Zone (STeZ)

The yellowish-white STeZ was detected fairly frequently by visual observers in 2009-10, as well as being apparent on most digital images submitted. Compared with the previous observing season, the STeZ may have been slightly brighter in overall intensity this apparition (mean factor of +0.40). The STeZ was uniform in intensity across the globe of Saturn, showing no white spot activity [refer to Illustration No. 001].

South Temperate Belt (STeB)

The light grayish-brown STeB was observed intermittently with larger apertures in 2009-10 in good seeing, and although intensity estimates were submitted, there were no intensity estimates made during the immediately preceding apparition to facilitate comparison between observing seasons. High-resolution digital images showed this dusky feature during the apparition as devoid of discrete activity [refer to Illustration No. 002].

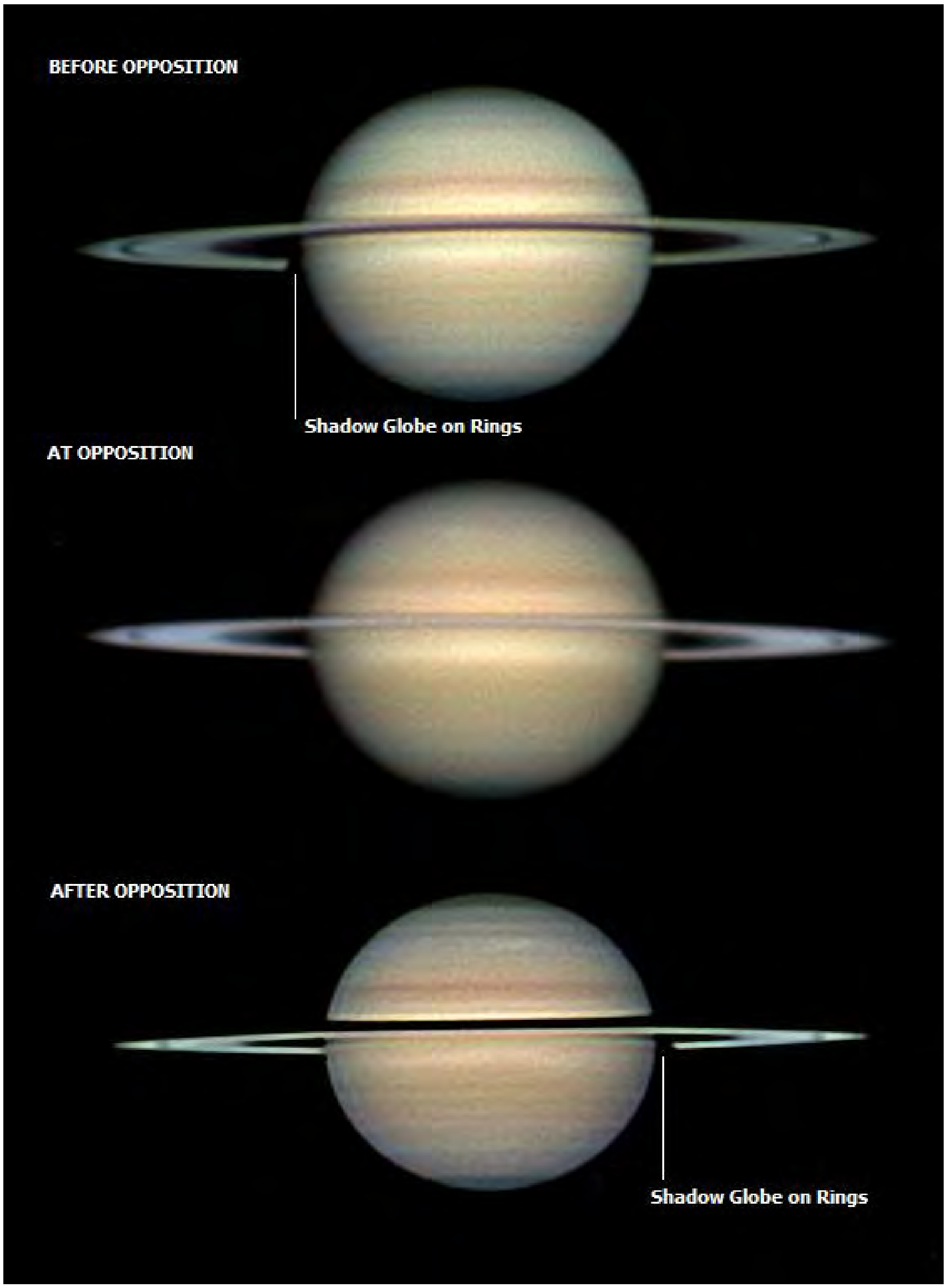


Figure 6. Three images digital images furnished by Christopher Go showing the position of the shadow of the globe on Saturn's rings on February 27, 2010 at 16:19UT (before opposition), March 22, 2010 at 14:26UT (at opposition) and May 5, 2010 at 13:53UT (after opposition).

South Tropical Zone (STrZ)

Visual observers usually reported the bright yellowish-white STrZ during the 2009-10 apparition. It was considered to be perhaps a shade brighter in mean intensity this observing season when compared with 2008-09 (slight variation of +0.4), and other than the EZs and EZn, it was easily the brightest zone on Saturn. Visual observers and those using digital imagers called attention to a recurring small white spot in the South Tropical Zone (STrZ) that evolved progressively from early March through early July. At 15:07UT on March 6th Tomio Akutsu was the first ALPO Saturn observer to image a small white spot in the STrZ that was particularly noticeable at red wavelengths [refer to Illustration No. 003]. There were a considerable number of images submitted in the days and weeks to follow (see *Table 4*). For example, consider the image contributed by Christopher Go at 16:48UT on March 13th when the STrZ was crossing the CM [refer to Illustration No. 004], as well as nearly simultaneous image by Tomio Akutsu on the same date at 16:57UT [refer to Illustration No. 005]. The first visual observation (drawing) of the STrZ white spot located near the CM was received from P.G. Abel on 00:34UT on March 15th [refer to Illustration No. 006]. Anthony Wesley's image of the STrZ white spot in green light on March 18th at 13:23UT suggested that the feature was starting to fade slightly, showing what appeared to be internal differentiation and some elongation longitudinally [refer to Illustration No. 007]. Near simultaneous images on March 18th by Tomio Akutsu at 13:49UT [refer to Illustration No. 008] and Christopher Go at 13:57UT [refer to Illustration No. 009] seemed to confirm Wesley's impression that the STrZ white spot was undergoing changes in morphology and a slight fading trend. Another image by Anthony Wesley in green light on March 22nd at 13:51UT showed the STrZ white spot with an apparent dual structure [refer to Illustration No. 010]. Nearly a month later, on April 20th at 10:39UT, an image of the STrZ white spot by Wesley showed much of the same internal fragmentation as before [refer to Illustration No. 011]. By May 22nd it was quite obvious in several virtually simultaneous image by Emil Kraaikamp at 21:09UT in red light [refer to Illustration No. 012], Damian Peach at 21:11UT [refer to Illustration No. 013], Marc Delcroix at 21:32UT in green light [refer to Illustration No. 014], and Peter Edwards at 21:28UT [refer to Illustration No. 015] that the STrZ white spot had elongated considerably and split into what appeared to be three components longitudinally within the zone. Although other observers' images started to show the multiplicity of the STrZ white spot, perhaps the best examples of its evolution into a triplicate feature were the images on June 3rd by Anthony Wesley's image at 10:41UT [refer to Illustration No. 016], those of Christophe Pellier's captured at 21:19UT at red wavelengths [refer to Illustration No. 017], and a simultaneous RGB image by Martin Lewis at 21:03UT [refer to Illustration No. 018], the results of all three observers depicting three components lined along the STrZ. As the month of June progressed, observers remarked that the STrZ white spots might have brightened ever so slightly. A subsequent image showing the triple STrZ white spots was submitted by Jim

General Caption Note for Illustrations 1-45*. B = saturnicentric latitude of the Earth; B' = saturnicentric latitude of the Sun; CMI, CMII and CMIII = central meridians in longitude Systems I, II and III; IL = integrated light; S = Seeing on the Standard ALPO Scale (from 0 = worst to 10 = perfect); Tr = Transparency (the limiting naked-eye stellar magnitude). Telescope types as in Table 2; feature abbreviations are as in Figure 5. In all figures, south is at the top and IAU east is to the left.*

Illustration 001. 2009 May 23 12:02UTUT. Digital image by Christopher Go using a 28.0 cm (11.0 in.) SCT, with RGB + IR blocking filter. S = 7.5 Tr = 4.0. CMI = 77.0°, CMII = 47.2°, CMIII = 164.5°, B = –4.3°, B´ = –1.5°. South Polar Belt (SPB) is visible encircling the SPR in this image.

Table 6: White Spots in the EZn during the 2009-10 Apparition of Saturn

Date (UT)	UT Start	UT End	CM Start			CM End							
yyyy mm dd	hh:mm	hh: mm	I (°)	II (°)	III (°)	I (°)	II (°)	III (°)	Obs	Obs Stn	Instr (cm)	Inst Type	NOTES
2010 04 17	21:19	23:56	339.8	107.3	187.1	339.8	107.3	187.1	Kraaikamp	NETH	25.4	SCT	Elongated EZn White Spot most obvious in red and green light
2010 04 20	10:39		245.5	293.9	10.8				Wesley	AUS	36.8	NEW	Elongated EZn White Spot
2010 05 05	13:15	13:53	41.4	321.8	20.5	63.7	343.3	41.9	Go	PHIL	28.0	SCT	Elongated EZn White Spot

Melka at 01:52UT on June 6th [refer to Illustration No. 019], and over three weeks later, Trevor Barry captured the final image sent to the ALPO Saturn Section for the 2009-10 apparition on July 2nd at 08:38UT, in which he described the STrZ spots as very faint and significantly elongated [refer to Illustration No. 020].

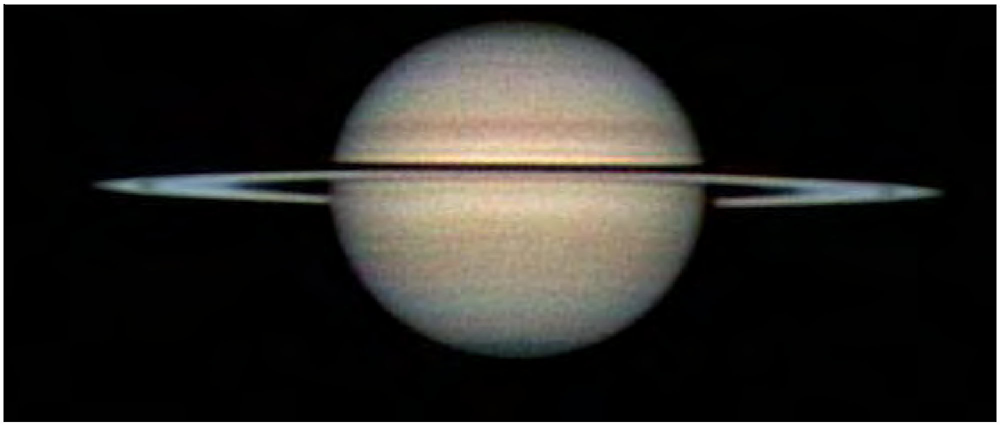


Illustration 002. 2009 Apr 20 20:24UT. Digital image by Damian Peach employing a 35.6 cm (14.0 in.) SCT with RGB filters + IR blocker. S and Tr not specified. CMI = 231.2°, CMII = 176.0°, CMIII = 332.7°, B = –4.1°, B´ = –2.0°. SSTeB is apparent in this excellent image.

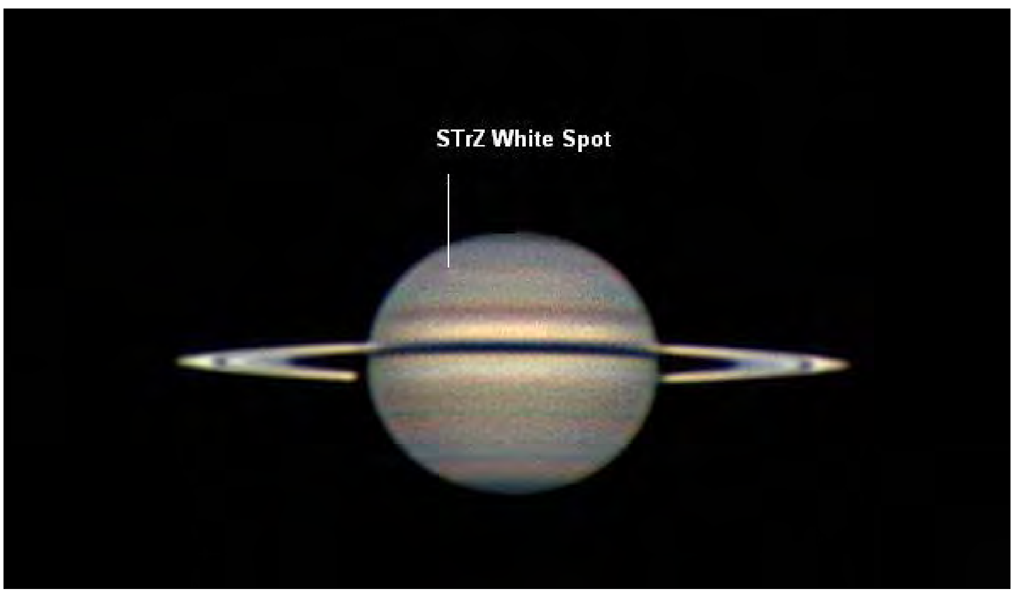


Illustration 003. 2010 Mar 06 15:07UT. Digital image by Tomio Akutsu using a 35.6 cm (14.0 in.) SCT with RGB filters5 S = 7.0, Tr = 4.0. CMI = 206.79°, CMII = 262.6°, CMIII = 33.5°, B = +3.6°, B´ = +3.0°. First image submitted in 2009-10 of the STrZ white spot in fair seeing conditions.

South Equatorial Belt (SEB)

The dark grayish-brown SEB was routinely reported by visual observers in 2009-10, subdivided into dark grayish-brown 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 of Saturn's southern hemisphere, appearing to visual observers as a bit lighter in 2009-10 than in 2008-09 (by +1.0 mean intensity points), and lighter by +0.71 mean intensity points compared with its counterpart in the northern hemisphere, the NEBw. The SEBn was usually the darker of the two components visually by a visual numerical intensity factor of -0.45, and it was apparent in most images submitted. Visual observers who made relative numerical intensity estimates considered the SEBn only suspiciously duskier than in 2008-09 by a factor of -0.2, and the SEBs perhaps a little brighter by +0.5 mean intensity. Most digital images of Saturn submitted during 2009-10 showed the SEB as a very prominent belt, occasionally as a singular feature, but most often subdivided into SEBs and SEBn components with the lighter SEBZ lying in between [refer to Illustration No. 021]. The SEBn appeared slightly wider and darker than the SEBs in most of the contributed images, consistent with the majority of visual impressions. The dull yellowish-gray South Equatorial Belt Zone (SEBZ) seemed slightly lighter in overall intensity since 2008-09 (+0.5 mean intensity increase between apparitions).

Table 7: White Spot in the NEBZ during the 2009-10 Apparition of Saturn

Date (UT)	UT Start	UT End	CM Start			CM End							
yyyy mm dd	hh:mm	hh: mm	I (°)	II (°)	III (°)	I (°)	II (°)	III (°)	Obs	Obs Stn	Instr (cm)	Inst Type	NOTES
2010 06 06	01:52		16.8	359.0	19.7				Melka	USA	30.5	NEW	Suspected White Spot near limb in NEBZ

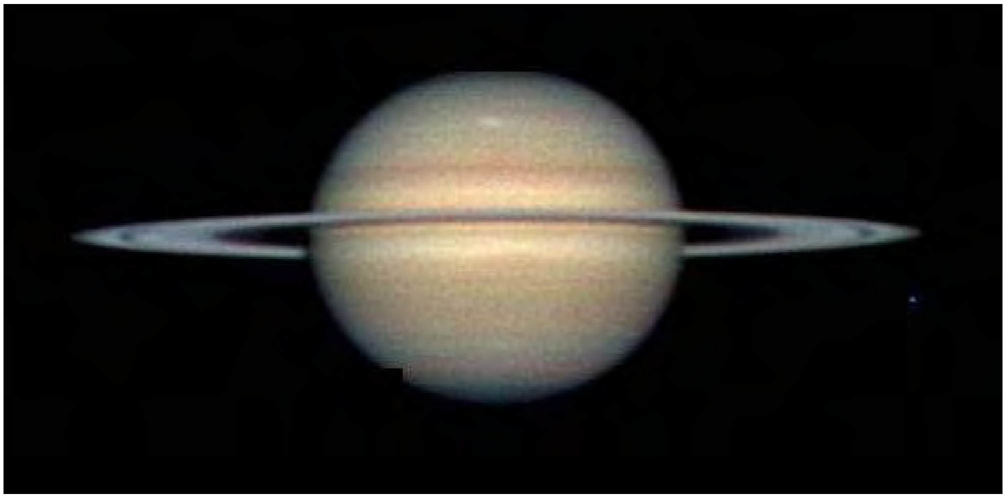


Illustration 004. 2010 Mar 13 16:48UT. Digital image by Christopher Go using a 28.0 cm (11.0 in.) SCT with RGB + IR blocking filter. S = 7.5, Tr = 4.0. CMI = 56.6°, CMII = 244.1°, CMIII = 6.5°, B = +3.3°, B´ = +3.1°. The STrZ white spot is crossing the CM.

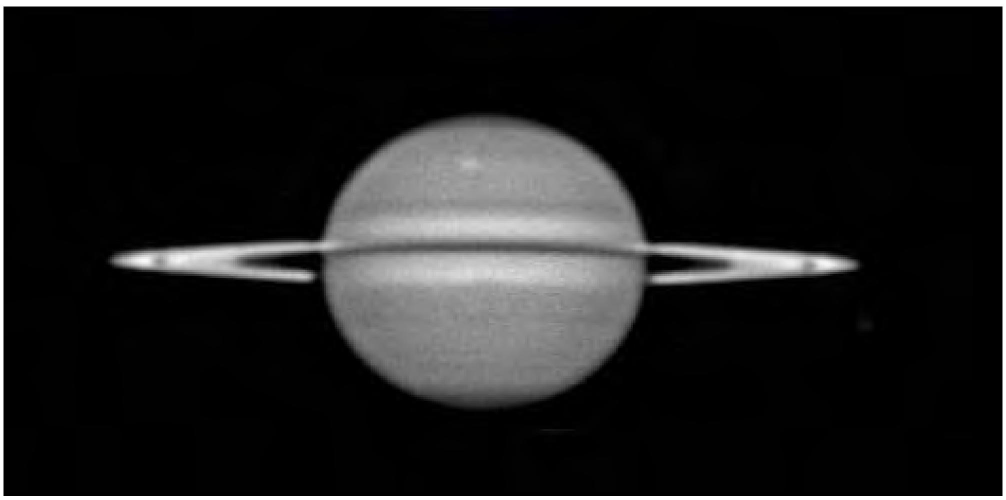


Illustration 005. 2010 Mar 13 16:57UT. Digital image by Tomio Akutsu using a 35.6 cm (14.0 in.) SCT with red filter. S = 6.0, Tr = 4.0. CMI = 61.8°, CMII = 249.2°, CMIII = 11.6°, B = +3.3°, B´ = +3.1°. The STrZ white spot, imaged in red wavelengths, has just passed the CM.

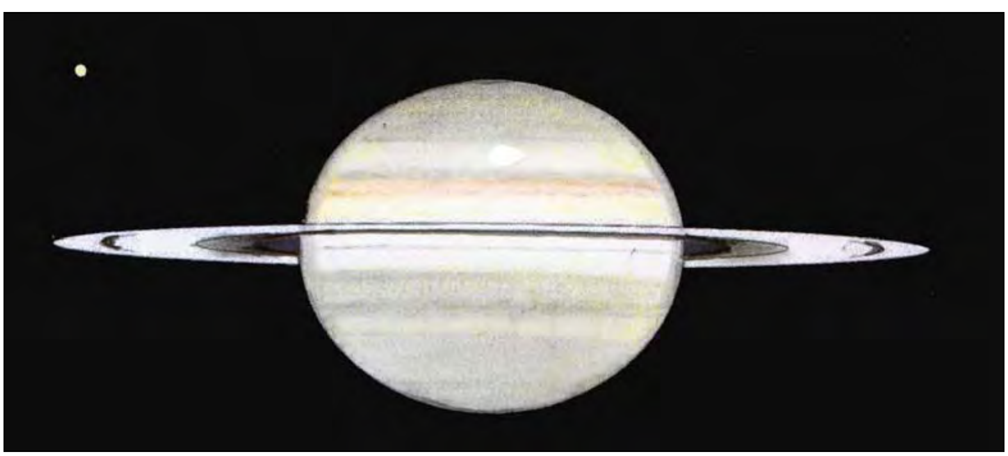


Illustration 006. 2010 Mar 15 00:34UT. Superb drawing by Paul G. Abel using a 20.3 cm (8.0 in.) NEW at 312X in IL (no filter). S = 4.0 (interpolated), Tr not specified. CMI = 74.3°, CMII = 219.8°, CMIII = 340.6°. B = +3.3°, B´ = +3.1°. The STrZ white spot is at CM.

From April 16th through 28th, observers imaged a small, somewhat diffuse white spot within the SEBZ that seemed to spread out somewhat with time, but the overall appearance and brightness of this feature did not change significantly during this period. Anthony Wesley was the first to submit an image of the SEBZ white spot on April 16, 2010 at 11:30UT [refer to Illustration No. 022], followed by an image on the same date at 20:58UT Emil Kraaikamp [refer to Illustration No. 023]. On April 19th Christopher Go imaged the SEBZ white spot at 14:05UT [refer to Illustration No. 024], and the feature is quite noticeable halfway between the planet's limb and CM in Anthony Wesley's image on April 20th at 10:39UT [refer to Illustration No. 025]. Trevor Barry submitted an image on April 27th at 12:00UT [refer to Illustration No. 026] and on April 28th at 09:40UT showing the diffuse SEBZ white spot to end the reports of the feature in 2009-10 [refer to Illustration No. 027]. *Table 5* gives a complete listing, with supporting data and short comments, of the small white spot images in the SEBZ during 2009-10. No visual observers reported any white spot activity in the SEBZ during the observing season.

Recurring visual accounts of suspected dusky markings within the SEB and its sub-components were received sporadically during the 2009-10 observing season, but they all seemed to be transient, ill-defined features.

Equatorial Zone (EZ)

With the rings of Saturn at relatively small inclinations to our line of sight during 2009-10, the southern and northern portions of the Equatorial Zone (i.e., the EZs and EZn, respectively), could still be seen and imaged to reasonable advantage. Based on intensity estimates and digital imaging this observing season, the northern half of the bright yellowish-white Equatorial Zone (EZn) was suspected to be slightly lighter than the bright yellowish-white EZs by mean factor of +0.20, and the EZn was the brightest zone on Saturn's

Table 8: Satellite Phenomena during the 2009-10 Apparition of Saturn

Date (UT)	UT Start	UT End	CM Start			CM End							
yyyy mm dd	hh:mm	hh:mm	I (°)	II (°)	III (°)	I (°)	II (°)	III (°)	Obs	Obs Stn	Instr (cm)	Inst Type	NOTES
2010 02 19	15:47	15:54	163.1	342.6	131.6	168.3	347.7	136.7	Wesley	AUS	36.8	NEW	Rhea and shadow in transit
2010 02 21	00:06	00:40	221.2	357.3	144.6	241.2	16.4	163.8	Abel	UK	20.3	NEW	Dione and shadow transiting disk
2010 02 21	00:40	00:50	241.2	16.4	163.8	247.0	22.1	169.4	Lewis	UK	22.2	NEW	Dione and shadow transiting disk in region of SEB (red light)
2010 02 21	00:52		248.2	23.2	170.5				Peach	UK	35.6	SCT	Dione and shadow transiting disk in region of SEB (red light)
2010 02 27	16:19		98.1	18.5	157.9				Go	PHIL	28.0	SCT	Dione off globe in image
2010 03 06	15:32	16:39	221.3	276.6	47.6	260.6	314.4	85.3	Go	PHIL	28.0	SCT	Titan
2010 03 09	15:31	15:46	233.9	192.3	319.6	242.7	200.8	328.1	Go	PHIL	28.0	SCT	Rhea, Dione
2010 03 30	13:40		260.6	263.2	5.3				Go	PHIL	28.0	SCT	Titan and Tethys
2010 04 15	05:08		149.8	7.2	90.4				Maxson	USA	25.4	DALL	Titan
2010 04 24	20:56	22:23	24.5	289.9	75.5	338.9	50.4		Delcroix	FRA	25.4	SCT	Dual satellite transit of Tethys and Dione
2010 05 01	09:04	11:00	117.1	172.4	236.1	185.1	237.8	301.4	Wesley	AUS	36.8	NEW	Titan transit sequence
2010 05 01	11:00	13:05	185.1	237.8	301.4	258.4	308.3	11.8	Go	PHIL	28.0	SCT	Titan transit sequence
2010 05 02	11:40	11:45	332.8	352.3	54.7	335.8	355.1	57.5	Wesley	AUS	36.8	NEW	Titan Transit
2010 05 08	03:44	03:51	79.3	275.8	331.3	83.5	279.7	335.3	Maxson	USA	25.4	DALL	Tethys shadow
2010 05 08	11:34	12:57	355.0	180.8	236.0	43.7	227.6	282.7	Wesley	AUS	36.8	NEW	Dione
2010 05 09	11:05	11:22	102.3	256.4	310.4	112.2	266.0	320.0	Wesley	AUS	36.8	NEW	Rhea 742nm near IR
2010 05 09	13:25	14:04	184.3	335.4	29.2	207.2	357.4	51.2	Go	PHIL	28.0	SCT	Titan and Rhea
2010 05 10	11:21	11:37	235.9	357.4	50.2	245.3	6.4	59.2	Wesley	AUS	36.8	NEW	Enceladus transit
2010 05 14	02:26	02:46	59.3	63.6	112.0	71.0	74.9	123.2	Combs	USA	35.6	SCT	Shadow of Dione
2010 05 14	03:27		95.1	98.0	146.3				Maxson	USA	25.4	DALL	Shadow of Dione
2010 05 23	02:49		111.0	184.2	221.6				Melka	USA	30.5	NEW	Rhea and Tethys
2010 05 25	03:38		28.2	35.7	70.7				Maxson	USA	25.4	DALL	Tethys Shadow
2010 06 02	04:46	05:58	341.9	89.4	114.8	24.1	130.0	155.3	Maxson	USA	25.4	DALL	Titan on globe
2010 06 10	03:56		226.3	76.6	92.3				Maxson	USA	25.4	DALL	Titan and Rhea

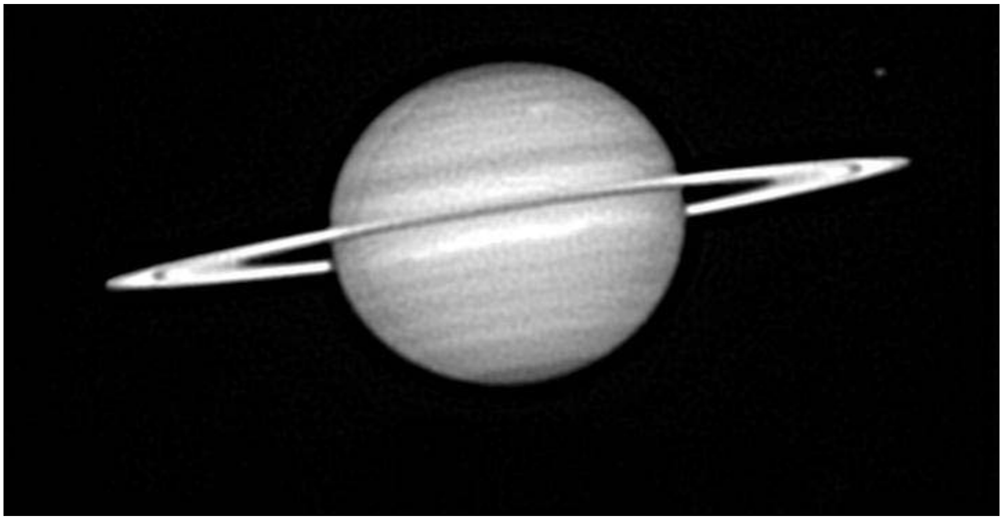
globe during 2009-10. Visual numerical relative intensity data revealed that the EZs remained unchanged since 2008-09 and the EZn was slightly lighter than in 2008-09 by +0.5 mean intensity points.

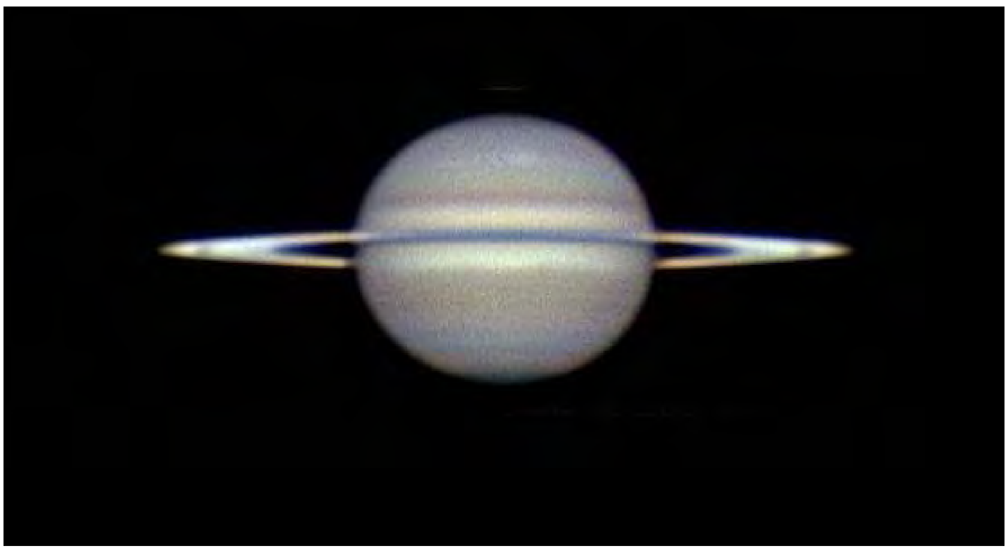
On three dates 2009-10 white spot activity was imaged in the EZn (see *Table 6*). The first instance was an image contributed by Emil Kraaikamp depicting a rather elongated EZn white feature near the CM on April 17th at 21:19UT, especially noticeable in red wavelengths [refer to Illustration No. 028]. Another image of the same feature was furnished by Anthony Wesley on April 20th at 10:39UT [refer to Illustration No. 025], and a final one by Christopher Go on May 5th at 13:53UT [refer to Illustration No. 029]. There were no further reports of white spot activity in the EZn, although as mentioned previously in this report, observers making intensity estimates believed the EZn had brightened slightly since 2008-09, perhaps attributable to white spot activity in the region? Some observers suspected festoons in the EZn, but confirming reports were lacking.

The light grayish-brown Equatorial Band (EB) was reported on only two occasions by visual observers during the apparition, but it was captured occasionally on digital images during the observing season. For example, it is quite apparent in the excellent image contributed by Brian Combs on January 28, 2010 at 08:38UT [refer to Illustration No. 030].

Northern Portions of the Globe

Now that the northern hemisphere of Saturn is increasingly tipped toward our view since the edgewise orientation in late 2009, regions of the planet's northern hemisphere such as the NEB, NTrZ and NPR were more favorably exposed to observers who made drawings and captured images. Now that the Earth is situated north of the rings, and will be for more than a decade,





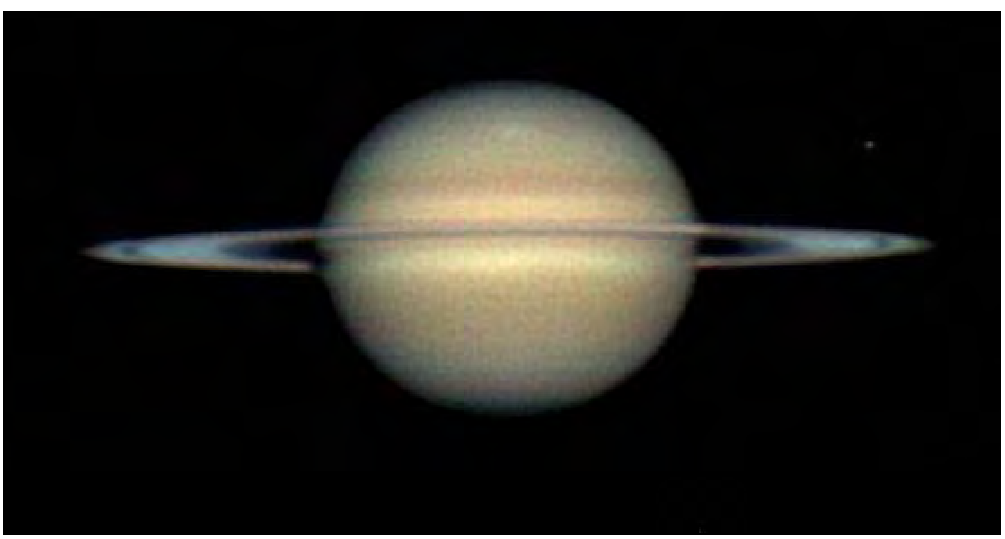


Illustration 007. 2010 Mar 18 13:23UT. Digital image by Anthony Wesley using a 36.8 cm (14.5 in.) NEW and green filter. S and Tr not specified. CMI = 198.2°, CMII = 228.9°, CMIII = 345.4°, B = +3.2°, B´ = +3.2°. The STrZ white spot is near CM, showing some internal differentiation and elongation.

Illustration 008. 2010 Mar 18 13:49UT. Digital image by Tomio Akutsu using a 35.6 cm (14.0 in.) SCT with red filter. S = 5.0, Tr = 4.0. CMI = 213.5°, CMII = 243.5°, CMIII = 0.1°, B = +3.2°, B´ = +3.2°. The STrZ white spot appears a little diffuse near the CM with some longitudinal extension.

Illustration 009. 2010 Mar 18 13:57UT. Digital image by Christopher Go using a 28.0 cm (11.0 in.) SCT with RGB + IR blocking filter. S = 6.0, Tr = 5.0. CMI = 218.2°, CMII = 248.0°, CMIII = 4.6°, B = +3.2°, B´ = +3.2°. The STrZ white spot is crossing the CM, looking somewhat diffuse and somewhat spread out longitudinally.

studies of Saturn's northern hemisphere become more advantageous as regions of the southern hemisphere progressively are hidden from view by the rings. The small inclination of the rings during 2009-10, however, still permitted comparisons of analogous features in Saturn's northern and southern hemispheres. In terms of activity, a very elusive white feature in the North Equatorial Belt Zone (NEBZ) was imaged during early June 2010, and very poorly-defined dusky features were sometimes suspected in the North Equatorial Belt (NEB) by visual observers during the apparition. These will be discussed in the upcoming sections dealing separately with each region of Saturn's northern hemisphere.

North Equatorial Belt (NEB)

The dark grayish-brown NEB was reported by visual observers much of the apparition, occasionally differentiated into North and South components. Visual numerical relative intensity estimates of the NEB as a whole (NEBw) in 2009-10 suggested that it was essentially unchanged since 2008-09 (difference between apparitions of -0.05 is negligible). It appeared perhaps a little darker than the overall SEB by -0.71 mean intensity points by visual accounts, however, most images typically showed just the opposite situation in visual wavelengths. Observers with larger apertures reported the split into a narrower dark gray NEBs and a wider dark greyish brown NEBn, with a fairly broad dull yellowish grey Northern Equatorial Belt Zone (NEBZ) situated in between. Visual numerical intensity estimates revealed that the NEBs may have been slightly darker by -0.32 points than the NEBn. Comparing the NEBs with the SEBs, the former was darker by -1.08 in mean intensity, while the NEBn was -0.31 mean intensity points darker than the SEBn. Imaging often revealed the NEBs and NEBn during the observing season separated by the NEBZ, and on June 6, 2010 at 01:52UT Jim Melka imaged what appeared to be a possible NEBZ white spot just barely perceptible at Saturn's west (IAU) limb (see Table 7), although there were no other corroborating reports received [refer to Illustration No. 031].

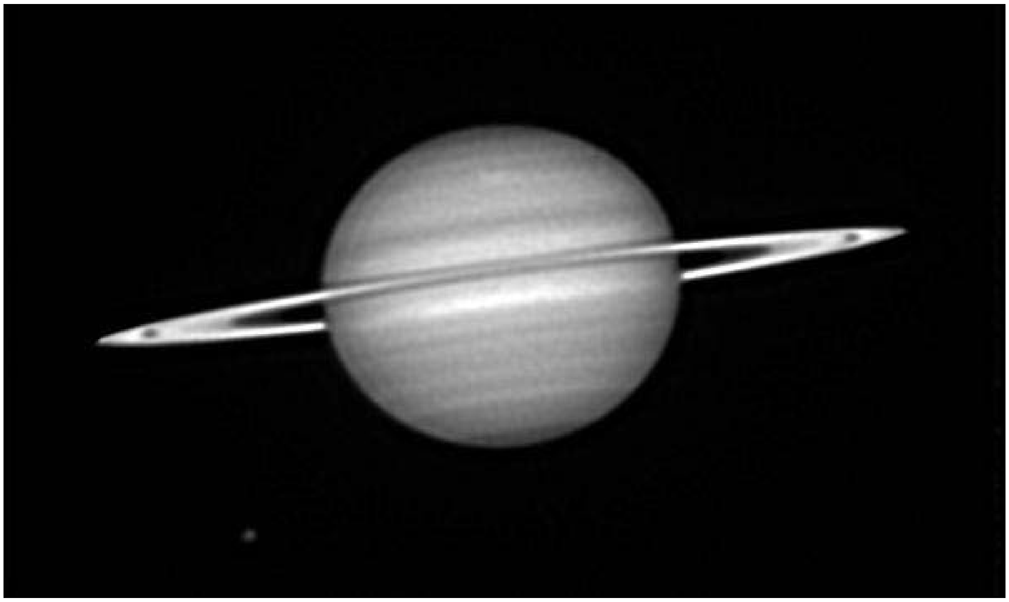


Illustration 010. 2010 Mar 22 13:51UT. Digital image by Anthony Wesley using a 36.8 cm (14.5 in.) NEW and green filter. S and Tr not specified. CMI = 352.1°, CMII = 252.9°, CMIII = 4.7°, B = +3.0°, B´ = +3.2°. The STrZ white spot is near CM, and quite obvious in green light, apparently beginning to split into two components.

Illustration 011. 2010 Apr 20 10:39UT. Digital image by Anthony Wesley using a 36.8 cm (14.5 in.) NEW and RGB filters. S and Tr not specified. CMI = 245.5°, CMII = 293.9°, CMIII = 10.8°, B = +2.1°, B´ = +3.7°. The STrZ white spot is near CM showing longitudinal fragmentation into at least two lobes or components.

North Tropical Zone (NTrZ)

Visual observers described a yellowish white NTrZ that was a little brighter by a factor of +0.5 in mean intensity, and it was quite apparent on images captured in good seeing conditions, such as the one submitted by Wayne Jaeschke May 26, 2010 at 01:32UT [refer to Illustration No. 032]. There was no activity reported in the NTrZ during 2009-10.

North Temperate Belt (NTeB)

The light grayish-brown NTeB was reported only occasionally by visual observers during 2009-10 without any noticeable activity. In visual numerical intensity, it was roughly comparable to the STeB. The NTeB was captured on many digital images contributed during the observing season, but there were no discrete phenomena detected in this belt on images submitted this apparition [refer to Illustration No. 032].

North Temperate Zone (NTeZ)

This yellowish-white zone was periodically reported by visual observers throughout 2009-10, perhaps slightly lighter in mean intensity than its counterpart, the STeZ. Digital images showed this zone generally devoid of discrete phenomena during the apparition such as the excellent image by Anthony Wesley captured on March 25, 2010 at 13:38UT [refer to Illustration No. 033].

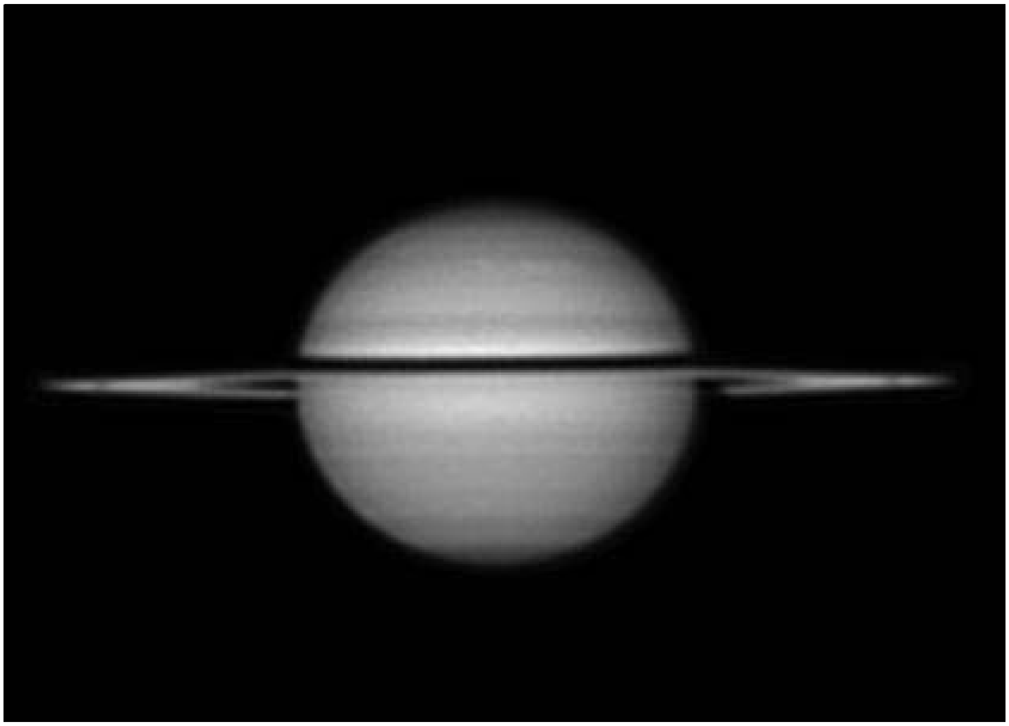


Illustration 012. 2010 May 22 21:09UT. Digital image by Emil Kraaikamp using a 25.4 cm (10.0 in.) SCT and red filter. S and Tr not specified. CMI = 271.7°, CMII = 352.4°, CMIII = 30.2°, B = +1.6°, B´ = +4.2°. The STrZ white spot appears elongated considerably, split into perhaps three components longitudinally within the zone.

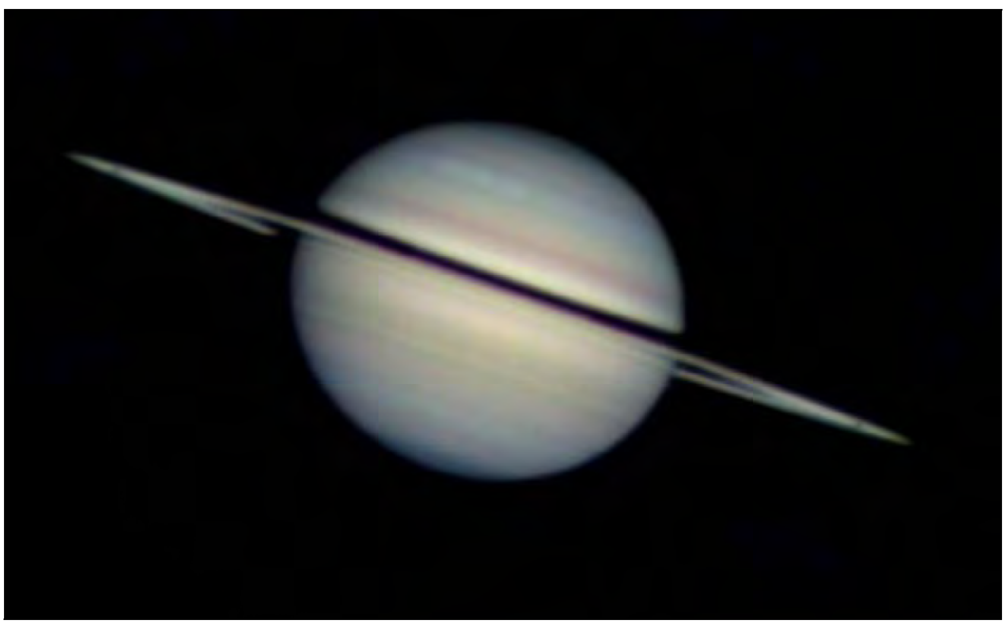


Illustration 013. 2010 May 22 21:11UT. Digital image by Damian Peach with a 35.6 cm (14.0-in.) SCT using RGB filters. S and Tr not specified. CMI = 272.9°, CMII = 353.6°, CMIII = 31.3°, B = +1.6°, B´ = +4.2°. The STrZ white spot is elongated and split into perhaps three components longitudinally within the zone.

North North Temperate Belt (NNTeB)

The dull gray NNTeB was hard to detect on even the best images taken in good seeing conditions in 2009-10, and visual observers did not report it.

North North Temperate Zone (NNTeZ)

During 2009-10 the dull yellowish-gray NNTeZ was not reported visually but was barely perceptible on the best images taken with larger apertures during the observing season, for example, the fine image provided by Brian Combs on April 16, 2010 at 05:04UT [refer to Illustration No. 034].

North North North Temperate Belt (NNNTeB)

A light gray NNNTeB was reported visually only once in 2009-10 by Michael Sweetman in fair seeing on May 26, 2012 at 06:25UT. The feature was sometimes detectable on the best images contributed during the apparition.

North Polar Region (NPR)

The dull gray NPR was frequently reported by visual observers during the 2009-10 apparition, perhaps only slightly darker than the SPR and devoid of any discernable activity. Digital images routinely showed what appeared to be the dusky NPR, but detail was seldom seen within it. [refer to Illustration No. 034].

Shadow of the Globe on the Rings (Sh G on R)

The Sh G on R was visible to observers as a geometrically regular black shadow on either side of opposition during 2009-10. Any presumed variation of this shadow from a totally black intensity (0.0) during a given observing season is merely a consequence of bad seeing conditions or the presence of extraneous light. Digital images revealed this feature as completely black. Readers are reminded 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 precisely at opposition (no shadow) as illustrated in *Figure 6* showing digital images furnished by

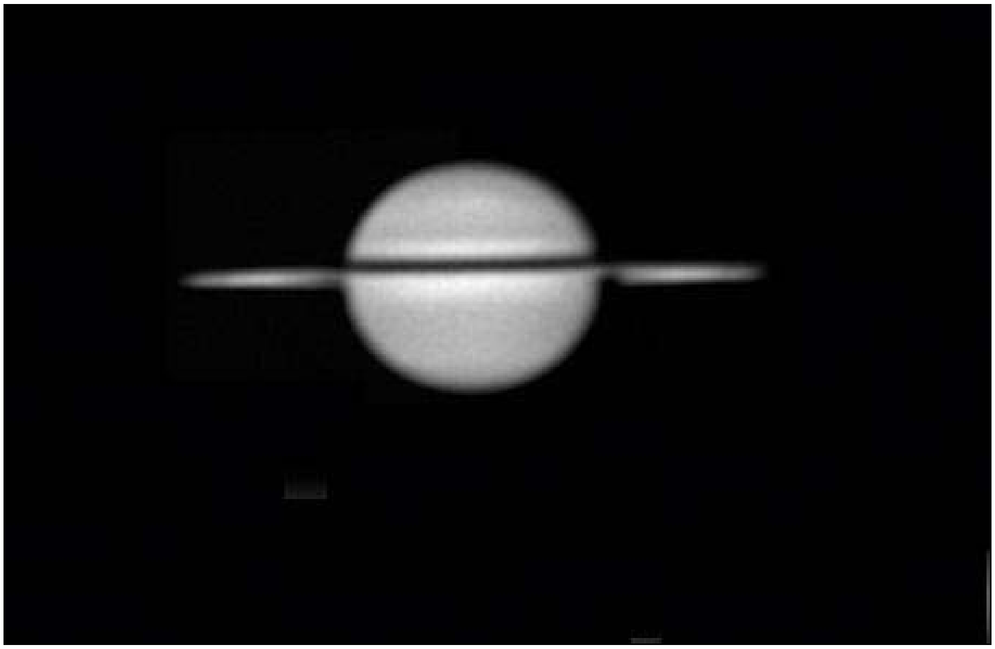


Illustration 014. 2010 May 22 21:32UT. Digital image by Mark Delcroix using a 25.4 cm (10.0-in.) SCT with R + IR filters. S and Tr not specified. CMI = 285.2°, CMII = 5.4°, CMIII = 43.2°, B = +1.6°, B´ = +4.2°. The STrZ white spot is split into three components lined up longitudinally within the zone.

Illustration 015. 2010 May 22 21:28UT. Digital image by Peter Edwards using a 28.0 cm (11.0-in.) SCT with RGB filters. S and Tr not specified. CMI = 282.8°, CMII = 3.2°, CMIII = 40.9°, B = +1.6°, B´ = +4.2°. The STrZ white spot is split into three components lined up near the CM across the zone.

Christopher Go on February 27, 2010 at 16:19UT (before opposition), March 22, 2010 at 14:26UT (at opposition), and May 5, 2010 at 13:53UT (after opposition).

Saturn's Ring System

The discussion in this section is based on visual studies of Saturn's ring system with the customary comparison of mean intensity data between apparitions, and impressions from digital images of the rings are included below as well. Readers will recall that near the end of the immediately preceding apparition of 2008-09, the rings were oriented edge-on to Earth, so the ring tilt to our line of sight in 2009-10 remained quite small (**B**=+3.2° at opposition) making it somewhat troublesome to view major ring components to advantage as their tilt toward our line of sight began increasing. It was also difficult to trace divisions and intensity minima around the circumference of the rings. Henceforth for about 10 years or so from 2009-10, however, more and more of the northern hemisphere of Saturn's globe, as well as the north face of the rings, will be seen to greater advantage.

Ring A

The majority of visual observers agreed that the dull yellowish-white Ring A, taken as a whole, was perhaps a bit darker in 2009-10 than in 2008-09 based on visual numerical relative intensity estimates (difference of -1.10 mean intensity points). Visual observers usually described Ring A as one overall component, not being differentiated into inner and outer halves. Most digital images of Saturn in 2009-10, however, depicted inner and outer halves of Ring A, with the inner half slightly brighter than the outer half, especially at red wavelengths. Visual observers occasionally reported the very dark gray Encke's division (A5) in 2009-10 when the rings were near their maximum tilt but offered no visual numerical relative intensity estimates, while a few of the best images occasionally revealed A5 near the ansae [refer to Illustration No. 030]. There were hints of Keeler's gap

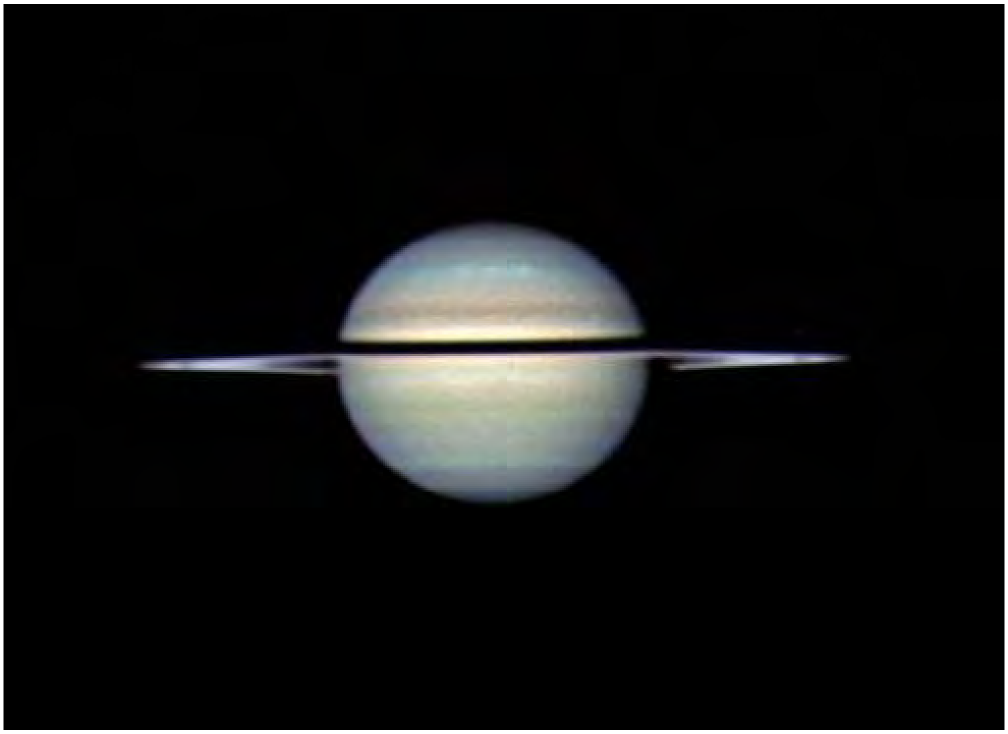


Illustration 016. 2010 Jun 03 10:41UT. Digital image by Anthony Wesley using a 36.8 cm (14.5 in.) NEW and RGB filters. S and Tr not specified. CMI = 314.2°, CMII = 21.5°, CMIII = 45.4°, B = +1.6°, B´ = +4.3°. The STrZ white spot is near the CM and this RGB image is among the best examples of its evolution into three components.

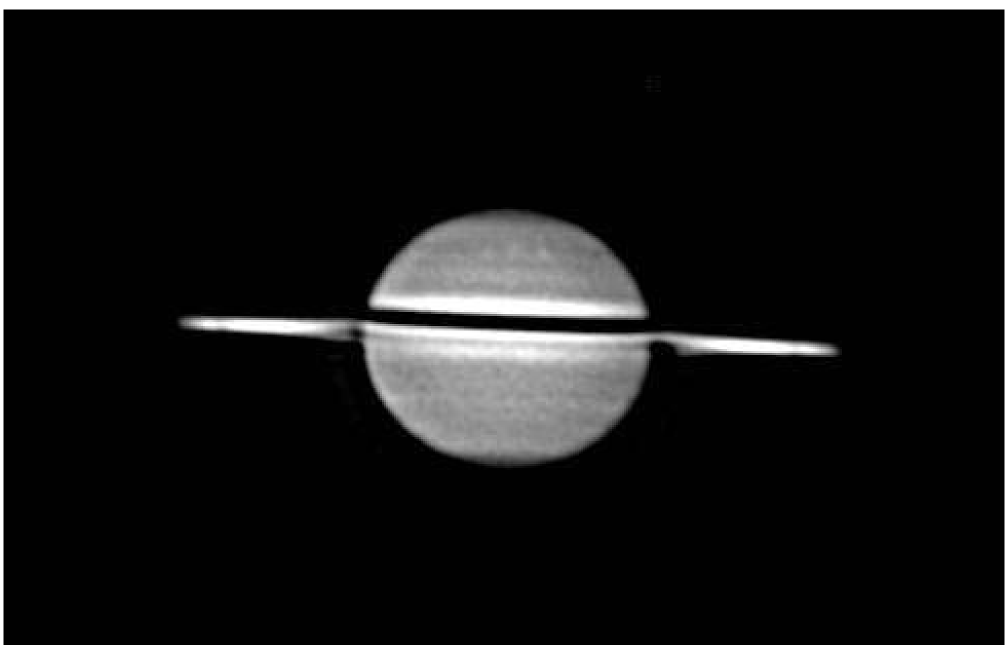


Illustration 017. 2010 Jun 03 21:19UT. Digital image by Christophe Pellier using a 25.4-cm (10.0-in.) CAS with R + IR filters. S and Tr not specified. CMI = 328.3°, CMII = 21.3°, CMIII = 44.6°, B = +1.6°, B´ = +4.3°. The STrZ white spot is near the CM, and with a red filter, its triplicate nature is clearly visible.

(A8) on some images in rare instances. The latter was not reported by visual observers.

Ring B

The outer third of Ring B is the established standard of reference for the ALPO Saturn Visual Numerical Relative Intensity Scale, with an assigned value of 8.0. Under circumstances of greater ring tilt during the apparition, visual observers reported that the outer third of Ring B appeared brilliant white with no variation in intensity, and compared with other ring components and atmospheric phenomena of Saturn's globe, it was always the brightest intrinsic feature. The inner two-thirds of Ring B during this apparition, which was described as bright yellowish-white and uniform in intensity, displayed essentially the same mean intensity as in the immediately preceding observing season. Digital images confirmed most visual impressions during 2009-10 [refer to Illustration No. 035].

Cassini's Division (A0 or B10)

Despite the relatively small inclination of the rings much of 2009-10, Cassini's division (A0 or B10) was frequently reported by visual observers, described as grayish-black gap at both ansae but not quite traceable all the way around Saturn's ring system by visual observers due to the small numerical value of **B** this apparition, also the situation even with high-resolution images. For instance, see the superb image by Brian Combs on January 28, 2010 taken at 08:38UT [refer to Illustration No. 030]. While a black Cassini's division was usually apparent on many of the digital images received during the 2009-10 observing season, a deviation from a totally black intensity for Cassini's Division was a consequence of bad seeing, scattered light, or insufficient aperture. The general visibility of major ring divisions and other intensity minima across the breadth of the northern face of the rings was not favorable this apparition with the small ring tilt.

Illustration 018. 2010 Jun 03 21:03UT. Digital image by Martin Lewis using a 22.2 cm (8.7 in.) NEW and RGB filters. S and Tr not specified. CMI = 318.9°, CMII = 12.2°, CMIII = 35.5°, B = +1.6°, B´ = +4.3°. The STrZ white spot is near the CM and yet another image showing the three components. The ring shadow on the globe is cast to their south starting about March 18, 2010 and henceforth for the rest of the observing season.

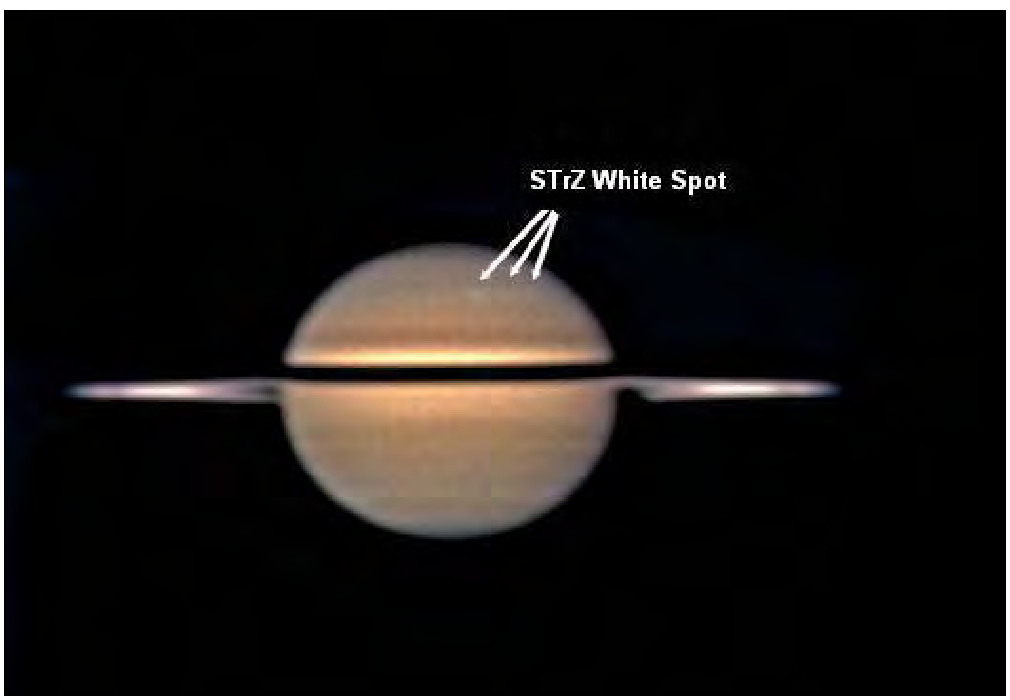


Illustration 019. 2010 Jun 06 01:52UT. Digital image by Jim Melka using a 30.5 cm (12.0 in.) NEW and RGB filters. S = 4.0, Tr = 6.0. CMI = 16.8°, CMII = 359.0°, CMIII = 19.7°, B = +1.6°, B´ = +4.4°. The STrZ white spot is approaching the CM showing the three components as they continue to evolve.

Ring C

The very dark gray Ring C was often visible at the ansae in 2009-10 and apparent on most digital images, particularly those submitted when the rings were sufficiently inclined toward our view during the apparition. Visual observers did not submit visual numerical relative intensity estimates. The Crape Band (merely Ring C in front of the globe of Saturn) appeared very dark gray in color and uniform in intensity, and was generally visible on digital images such as the one furnished by David Arditti at 01:53UT on February 21, 2010 [refer to Illustration No. 036]. Although mentioned in several visual reports, and noticeable in a number of digital images, observers did not offer intensity estimates of the Crape Band during the 2009-10 observing season.

Opposition Effect

During 2009-10, despite the small tilt of the rings of +3.2° toward Earth at opposition, the Seeliger "opposition effect" was reported by several observers. This phenomenon refers to a perceptible brightening of Saturn's ring system during a very short interval on either side of opposition, typically when the phase angle between Sun, Saturn, and the Earth is less than about 0.3°. This ring brightening is due to coherent back-scattering of sunlight by their constituent m-sized icy particles, which do so far more effectively than the particles of Saturn's atmosphere. Christopher Go was the only observer to actually call attention to this brightening of the rings during 2009-10, exemplified in his image on March 23rd at 13:35UT [refer to Illustration No. 037].

Shadow of the Rings on the Globe (Sh R on G)

This shadow in 2009-10 was almost always described as a completely black feature where the rings crossed Saturn's globe. Reported departures from an overall black (0.0) intensity occurs for the same reason as previously noted in our discussion regarding the Sh G on R. When **B** and **B'** are both positive, and the value of **B** is greater than that of **B'**,

Illustration 020. 2010 Jul 02 08:38UT. Digital image by Trevor Barry using a 40.6 cm (16.0 in.) NEW and RGB filters. S = 4.0, Tr not specified. CMI = 243.8°, CMII = 97.2°, CMIII = 86.2°, B = +2.1°, B´ = +4.8°. Final submitted image in 2009-10 of the triple STrZ white spot, with the feature now becoming rather faint and more diffuse longitudinally.

Illustration 021. 2009 Dec 14 21:13UT. Digital image by Tomio Akutsu using a 35.6 cm (14.0 in.) SCT with RGB filters. S = 5.0, Tr = 4.0. CMI = 302.4°, CMII = 118.9°, CMIII = 348.4°, B = +4.5°, B´ = +1.7°. The SEB is quite prominent in this image.

the ring shadow is to the north of the projected rings, which happened prior to March 18, 2010 [refer to Illustration No. 031]. When **B** and **B’** are both positive, and the value of **B** is less than of **B’**, the shadow of the rings on the globe is cast to their south, circumstances that occurred starting about March 18, 2010 through July 18, 2010 (the final observation received for the apparition) [refer to Illustration No. 018], and the Crape Band then is seen south of the projected Rings A and B. At times when the shadows of Ring A, Ring B, and Ring C projection are superimposed, it is often very challenging to distinguish between them in ordinary apertures and seeing conditions, and the shadow of Ring C is a further complication.

Terby White Spot (TWS)

The TWS is an apparent brightening of the rings immediately adjacent to the Sh G on R. There were only a few instances when this feature was reported by visual observers during 2009-10. It is purely an artificial contrast effect, not a real feature of Saturn's rings, but it is useful to try to find any correlation that might exist between the visual numerical relative intensity of the TWS and the varying tilt of the rings, including its brightness and visibility using variable-density polarizers, color filters, photographs, and digital images.

Bicolored Aspect of the Rings and Azimuthal Brightness Asymmetries

The bicolored aspect of the rings is an observed difference 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). There were no reports of this phenomenon in 2009-10, although in recent years observers have been systematically attempting to document the presence of the bicolored aspect of the rings using digital imagers. In the past, there have been rare instances when the phenomenon was allegedly photographed, and of particular importance would be images of the bicolored aspect at the same time it is sighted visually, especially when it occurs independent of similar effects on the globe of Saturn (which would be expected if atmospheric dispersion was a contributing factor). Such simultaneous visual observations cannot be stressed enough so that more objective confirmation of the bicolored aspect of the rings can occur. Unfortunately, during 2009-10 there were no images submitted with suggesting evidence of this phenomenon, nor were there reported visual impressions of the bicolored aspect.

Professional astronomers are well-acquainted with Earth-based sightings of azimuthal variations in the rings (initially confirmed by *Voyager* spacecraft), which is probably a result of light-scattering by denser-than-average clumps of particles orbiting in Ring A. ALPO Saturn observers are encouraged to try to image any azimuthal brightness asymmetries in Ring A, preferably at the same date that visual observers report it.

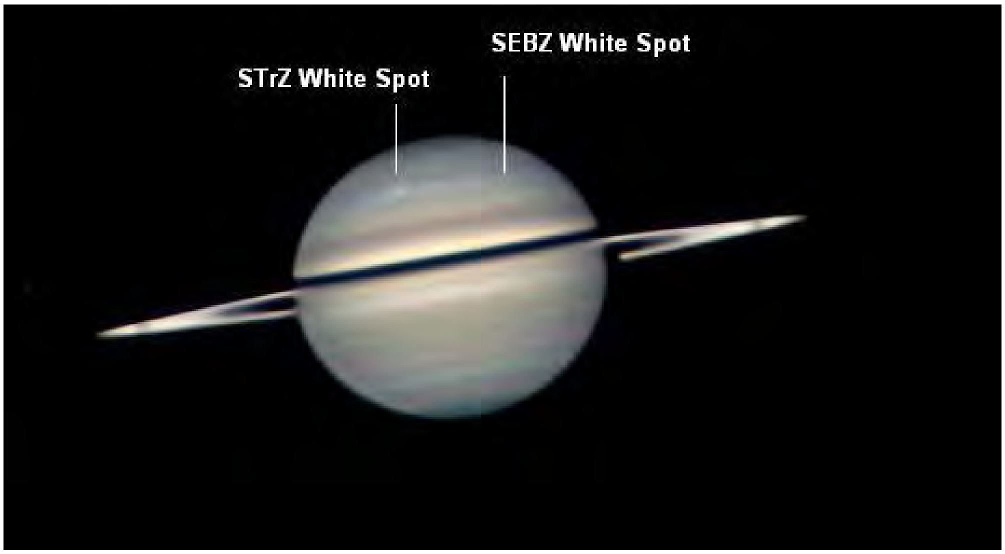


Illustration 022. 2010 Apr 16 11:30UT. Digital image by Anthony Wesley using a 36.8 cm (14.5 in.) NEW and RGB filters. S and Tr not specified. CMI = 138.1°, CMII = 314.6°, CMIII = 36.3°, B = +2.2°, B´ = +3.6°. First submitted image of an SEBZ white spot in 2009-10 (STrZ white spot is also visible in this image).

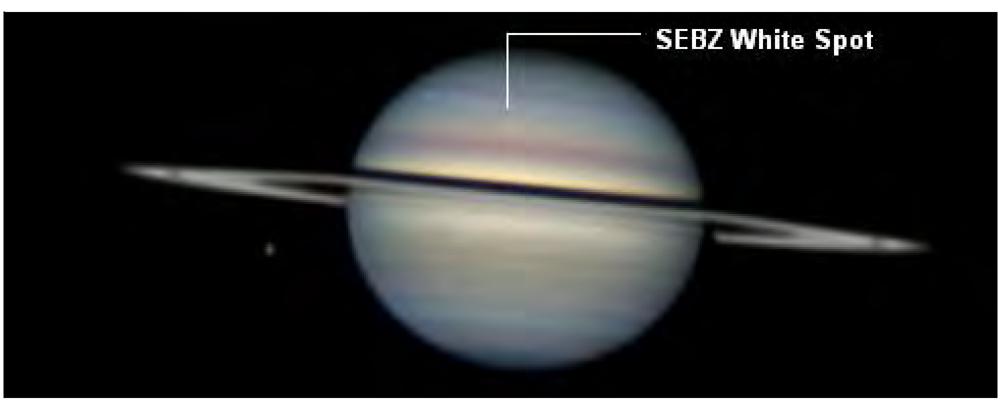


Illustration 023. 2010 May 16 20:58UT. Digital image by Emil Kraaikamp using a 25.4 cm (10.0 in.) SCT and RGB filters. S and Tr not specified. CMI = 111.2°, CMII = 274.9°, CMIII = 356.1°, B = +2.2°, B´ = +3.6°. Diffuse SEBZ white spot just past the CM.

The Satellites of Saturn

During the 2009-10 apparition the rings were still tilted at rather small angles to our line of sight from Earth, whereby much of the glare from Saturn's rings was reduced, it was easier to detect visually and image faint objects like satellites close to the planet. Many of the planet's satellites show tiny fluctuations in visual magnitude as a result of their varying orbital positions relative to the planet and due to asymmetries in distribution of surface markings on a few. Despite close proximity sensing by spacecraft, the true nature and extent of all of the observed satellite brightness variations is not completely understood and merits further investigation.

Visual Magnitude Estimates and Photometry

ALPO Saturn Section observers in 2009-10 submitted no systematic visual estimates of Saturn's satellites employing recommended techniques by the ALPO Saturn Section. Even though photometry has largely replaced visual magnitude estimates of Saturn's moons, visual observers should still try to establish the comparative brightness of a satellite relative to reference stars of calibrated brightness when the planet passes through a field of stars that have precisely known magnitudes. To do this, observers need to employ a good star atlas that goes faint enough and an accompanying star catalogue that lists reliable magnitude values. A number of excellent computer star atlases exist that facilitate precise plots of Saturn's path against background stars for comparative magnitude estimates.

The methodology of visually estimating satellite magnitudes is quite simple. It first begins with selection of at least two stars with well-established magnitudes and those 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 roughly 1.0 magnitude. This makes it easy to divide the brightness difference between the two comparison stars into equal magnitude steps of 0.1. 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, however, 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.

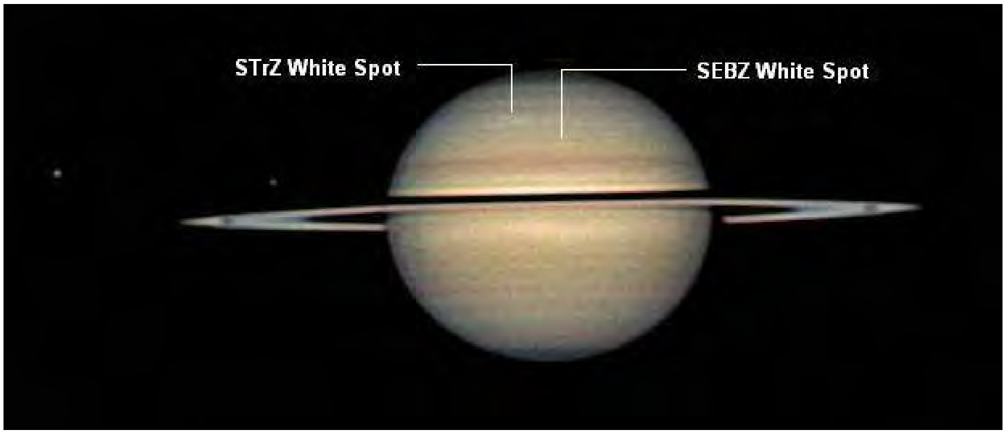


Illustration 024. 2010 Apr 19 14:05UT. Digital image by Christopher Go using a 28.0 cm (11.0 in.) SCT with RGB + IR blocking filter. S = 8.5, Tr = 5.0. CMI = 242.0°, CMII = 318.1°, CMIII = 36.0°, B = +2.1°, B´ = +3.6°. Tiny SEBZ white spot is on the CM (STrZ white spot is also visible in this image).

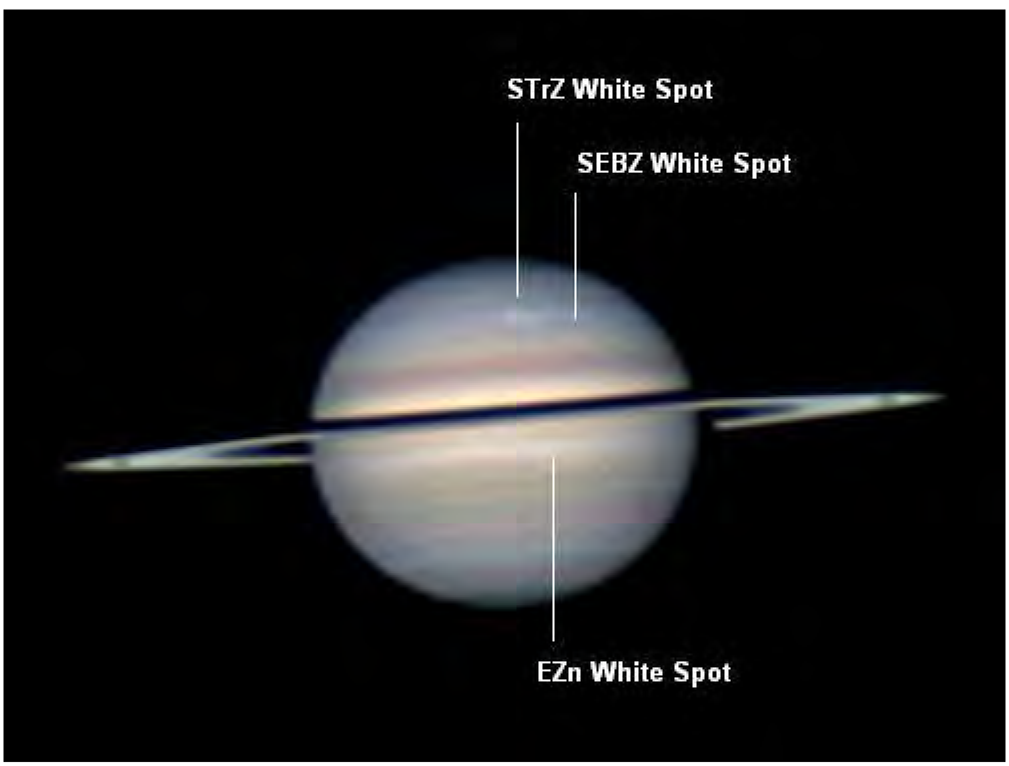


Illustration 025. 2010 Apr 20 10:39UT. Digital image by Anthony Wesley using a 36.8 cm (14.5 in.) NEW and RGB filters. S and Tr not specified. CMI = 245.5°, CMII = 293.9°, CMIII = 10.8°, B = +2.1°, B´ = +3.7°. The small SEBZ white spot is visible headed toward the CM (STrZ and EZn white spots are also visible in the image).

Some observers have begun using digital imagers with adequate sensitivity to capture the satellites of Saturn together with nearby comparison stars, thereby providing 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 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 be exactly the same as visual impressions because the peak wavelength response of the CCD chip is different than that of the eye. 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. Rather sophisticated techniques are required to correct for scattered light surrounding Saturn and its rings.

Spectroscopy of Titan

Since 1999 observers have been urged to attempt spectroscopy of Titan whenever possible as part of a cooperative professional-amateur project. Although Titan has been studied by the Hubble Space Telescope (HST), very large Earth-based instruments, and at close range the ongoing *Cassini-Huygens* mission, opportunities continue for amateurs to contribute systematic observations using appropriate instrumentation. Thanks to the *Cassini-Huygens* mission starting in 2004, we now know that Titan is a very dynamic world with transient and long-term variations. From wavelengths of 300nm to 600nm, Titan's hue is dominated by a reddish methane (CH_4) atmospheric haze, and beyond 600nm, deeper CH_4 absorption bands appear in its spectrum. Between these CH_4 wavelengths are "portals" to Titan's lower atmosphere and surface, so regular monitoring in these regions with photometers or spectrophotometers is a useful complement to professional work. Long-term studies of Titan's brightness from one apparition to the next is meaningful in helping shed light on Titan's known seasonal variations. Observers with suitable equipment are being asked to participate in these professional-amateur projects, and further details can be found on the Saturn page of the ALPO website at *http://www.alpo-astronomy.org/* as well as directly from the ALPO Saturn Section.

Illustration 026. 2010 Apr 27 12:00UT. Digital image by Trevor Barry using a 40.6 cm (16.0 in.) NEW and RGB filters. S = 6.0, Tr not specified. CMI = 83.1°, CMII = 263.6°, CMIII = 332.0°, B = +1.9°, B´ = +3.8°. Small SEBZ white spot is headed toward the CM.

Illustration 027. 2010 Apr 28 09:40UT. Digital image by Trevor Barry using a 40.6 cm (16.0 in.) NEW and RGB filters. S = 7.0, Tr not specified. CMI = 125.3°, CMII = 276.7°, CMIII = 344.0°, B = +1.9°, B´ = +3.8°. Rather diffuse and small SEBZ white spot is near the CM (final submitted image of this feature during 2009-10).

Transits of Saturnian Satellites and their Shadows

During the 2009-10 apparition smaller inclinations of Saturn's ring plane to our line of sight afforded observers continued opportunities to witness transits and shadow transits of satellites lying near the planet's equatorial plane. Apertures less than about 20.3 cm (8.0 in.) are insufficient to produce optimum views of these phenomena for satellites other than perhaps Titan, but observers with digital imagers in 2009-10 submitted some very interesting results as listed in *Table 8*.

Some examples of observations of Saturn's satellites during 2009-10 are worth mentioning. Anthony Wesley contributed an image of Rhea and it's shadow transiting the globe of Saturn on February 19, 2010 at 15:54UT, but Rhea itself is difficult to see in the image against the disk of the planet [refer to Illustration No. 038]. On February 21st at 00:52UT, Damian Peach imaged in red light the shadow of Dione crossing the globe of Saturn [refer to Illustration No. 039], while on March 9th at 15:46UT Christopher Go captured a nice image of Rhea and it's shadow in transit [refer to Illustration No. 040]. On April 24th Marc Delcroix caught a dual transit of the small shadows of Tethys and Dione at 22:11UT in red wavelengths [refer to Illustration No. 041], and on May 1st Christopher Go provided an outstanding sequence of images of Titan as it crossed the globe of Saturn between 11:00 and 13:05UT [refer to Illustration No. 042]. Anthony Wesley captured Enceladus in transit across Saturn at 11:37UT on May 10th, detectable with some difficulty in the image only because it was passing in front of the ring shadow on the planet. A transit of Enceladus in front of Saturn is quite rare because it is not generally visible against the illuminated cloud tops of the planet [refer to Illustration No. 043]. For a final example of satellite phenomena in 2009-10, consider the sharp image by Brian Combs on May 14th at 02:46UT clearly showing Dione's shadow in front of the globe near the CM [refer to Illustration No. 044].

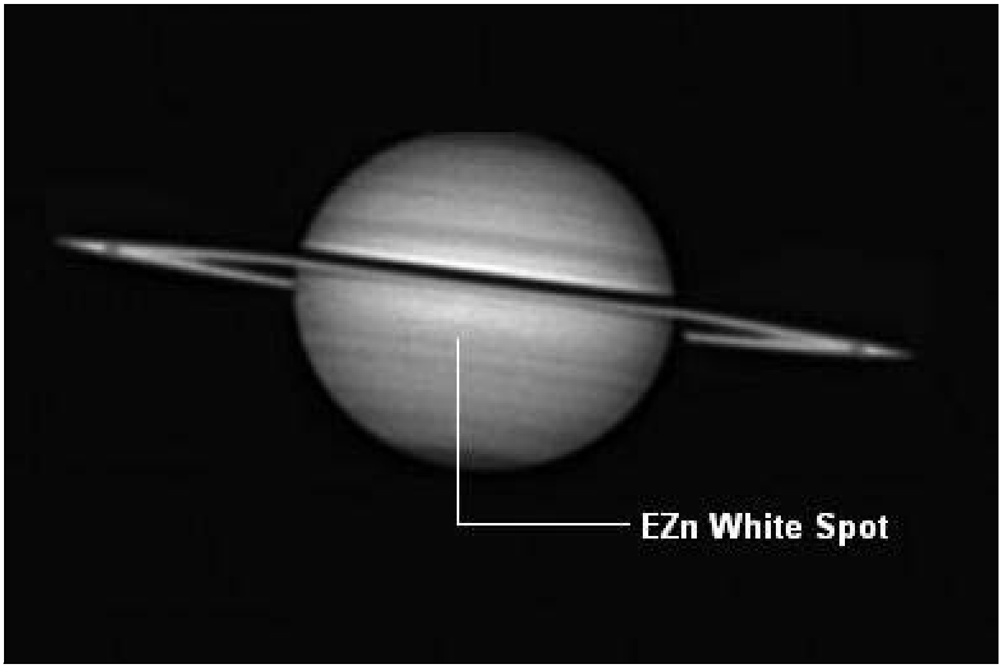


Illustration 028. 2010 Apr 17 21:19UT. Digital image by Emil Kraaikamp using a 25.4 cm (10.0 in.) SCT in red filter. S and Tr not specified. CMI = 247.8°, CMII = 18.8°, CMIII = 98.7°, B = +2.1°, B´ = +3.6°. Elongated EZn white feature appears near the CM.

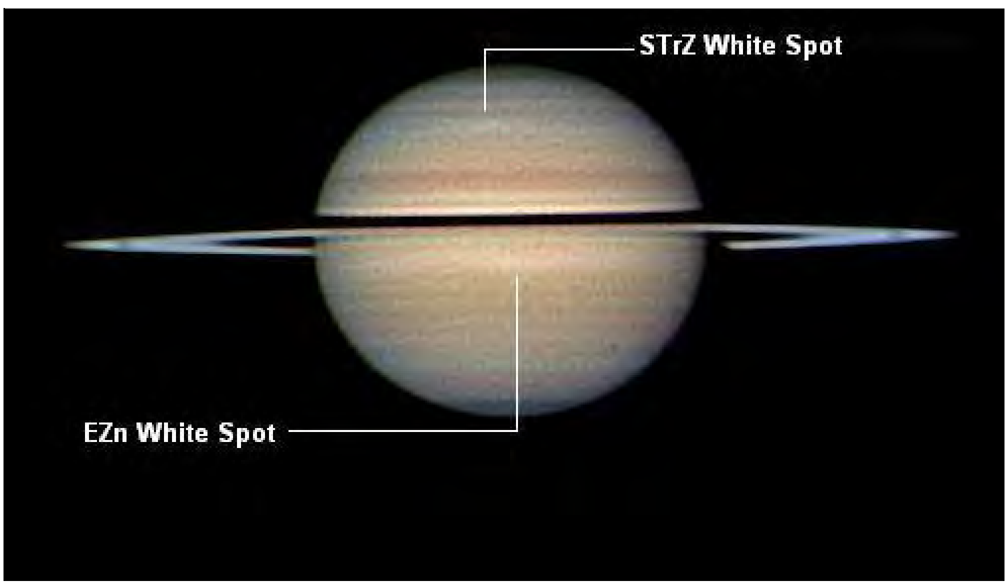


Illustration 029. 2010 May 05 13:53UT. Digital image by Christopher Go using a 28.0 cm (11.0 in.) SCT with RGB + IR blocking filter. S = 8.5, Tr = 5.0. CMI = 63.7°, CMII = 343.3°, CMIII = 41.9°, B = +1.7°, B´ = +3.9°. Small, diffuse SEBZ white spot is on the CM (STrZ white spot is also visible in this image).

Observations of satellite events at smaller ring inclinations remains a highly worthwhile and extremely interesting endeavor for individuals with adequate aperture. Simultaneous visual observations at the same time that imaging is occurring helps establish limits of visibility of such events using both methods. Precise timings should be made 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 ring orientations. Notes should also be made of the belt or zone on the planet crossed by the shadow or satellite, and visual numerical relative intensity estimates of the satellite, its shadow, and the belt or zone it is in front of is important, as well as drawings of the immediate area at a given time during the event.

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 unparalleled chances for firm verification of ill-defined or traditionally controversial phenomena. The ALPO Saturn Section has organized a simultaneous observing team so that several individuals in reasonable proximity to each another can maximize the opportunities for viewing and imaging Saturn at the same time using similar equipment and methodology. Joint efforts like this significantly reinforce the level of confidence in the data submitted for each apparition. Examples of such observations of Saturn this observing season were cited earlier in this report, and in forthcoming apparitions this valuable work is strongly encouraged.

Pro-Am Opportunities

Our cooperative involvement in professional-amateur (Pro-Am) projects continued this apparition. Readers of this Journal may recall the appeal that occurred a few apparitions ago from NASA's Radio and Plasma Wave Science (RPWS) team for amateur astronomers to monitor Saturn's Southern Hemisphere for bright clouds following a sudden occurrence of radio noise caused by a dynamic storm in the STrZ in January 2006. Amateur observers responded right away and contributed images of the small white spots, which apparently corresponded with the outburst of radio noise detected by the Cassini spacecraft. Careful systematic imaging by ALPO observers equivalent to the efforts in 2006 have been continuing, and our results are now routinely being shared with the professional community. It should be pointed out, however, that this

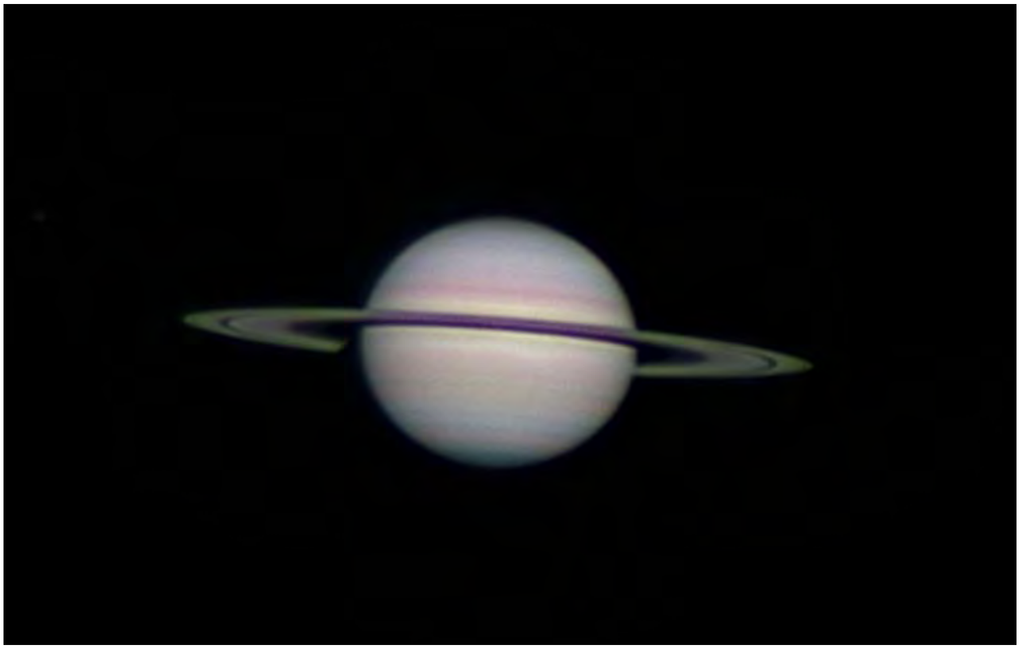


Illustration 030. 2010 Jan 28 08:38UT. Digital image by Brian Combs using a 35.6 cm (14.0 in.) SCT with RGB + IR blocking filter. S and Tr not specified. CMI = 56.0°, CMII = 235.8°, CMIII = 51.7°, B = +4.6°, B´ = +2.4°. The narrow EB is quite apparent in this excellent image. Encke's (A5) and Cassini's (A0 or B10) divisions are both apparent at the ansae.

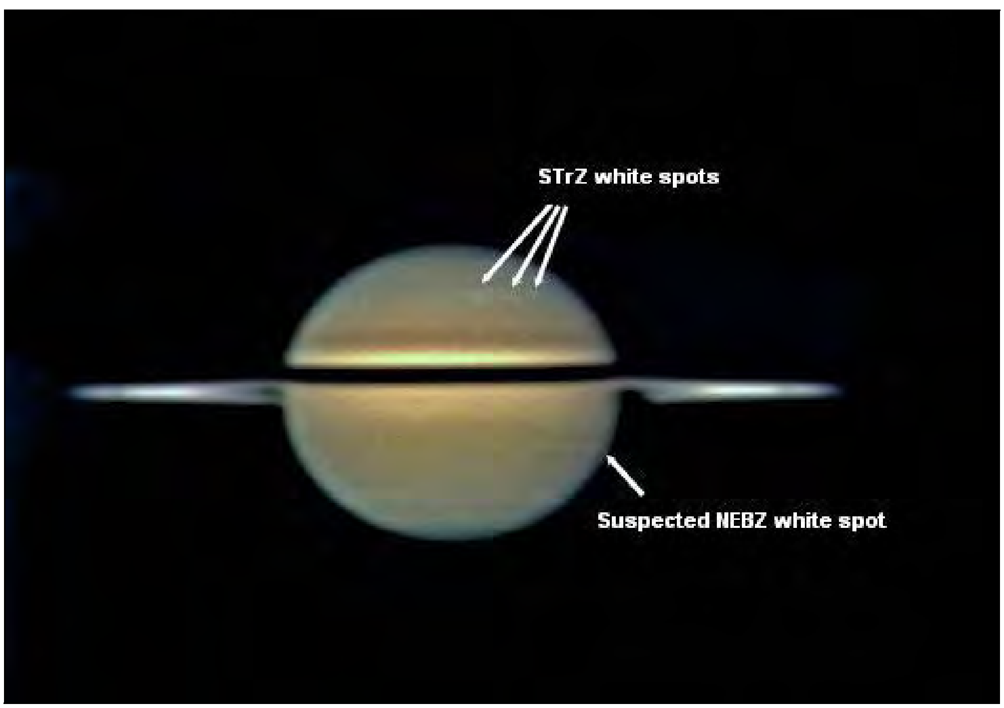


Illustration 031. 2010 Jun 06 01:52UT. Digital image by Jim Melka using a 30.5 cm (12.0 in.) NEW and RGB filters. S = 4.0, Tr = 6.0. CMI = 16.8°, CMII = 359.0°, CMIII = 19.7°, B = +1.6°, B´ = +4.4°. NEBZ white spot just barely detectable at the west (IAU) limb (STrZ white spots are also visible). The ring shadow is to the north of the projected rings, which happened this observing season prior to March 18, 2010.

was not the first concerted Pro-Am effort in recent observing seasons. Dating back to the time Cassini started observing Saturn at close range in April 2004, digital images at wavelengths ranging from 400nm - 1m under good seeing conditions were solicited by professionals from amateurs. To participate in this specific project, observers simply need to utilize classical broadband filters (e.g. Johnson system: B, V, R and I) with telescope apertures of 30.5 cm (12.0 in.) or larger, while also imaging through a 890-nm narrow band CH4 (methane) filter. The Cassini Team requests that observers systematically patrol the planet every clear night for individual features, watching their motions and morphology, and thereby furnish input of interesting large-scale targets for Cassini's imaging system to begin close-up surveillance. Visual observers with apertures ranging upwards from 10.2 cm (4.0 in.) can play a very meaningful role by making routine visual numerical relative intensity estimates and keep track of suspected variations in belt and zone reflectivities (i.e., intensity) and color.

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 requested to contact the ALPO Saturn Section with any questions they may have as to 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.

Conclusions

Based on mean visual numerical relative intensity estimates during 2009-10 and

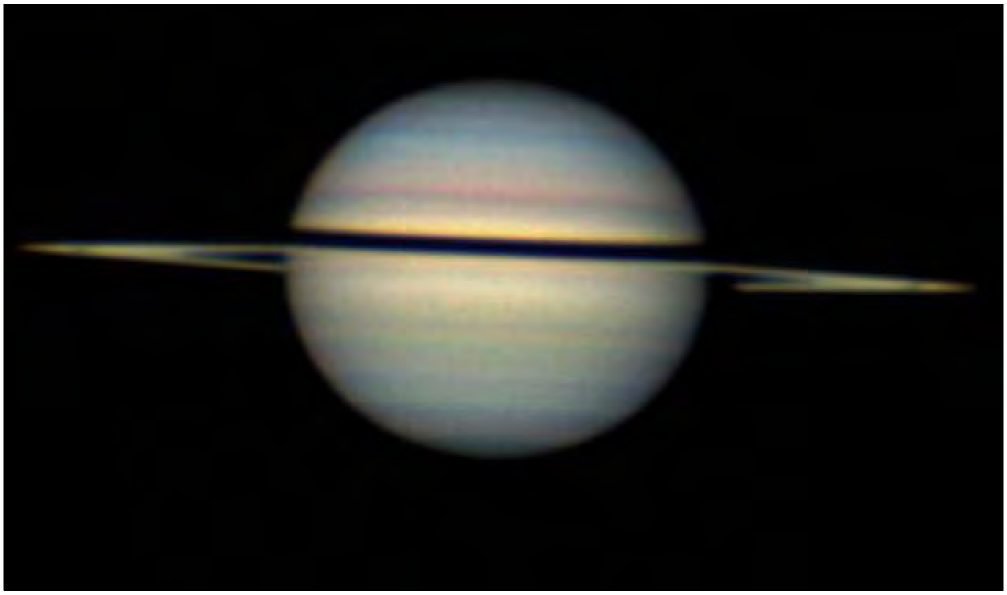


Illustration 032. 2010 May 26 01:32UT. Digital image by Wayne Jaeschke using a 35.6 cm (14.0 in.) SCT and RGB filters. S and Tr not specified. CMI = 78.6°, CMII = 56.6°, CMIII = 90.5°, B = +1.6°, B´ = +4.2°. The NTrZ and NTeB are both visible in this excellent, detailed image; STrZ white spots are also visible approaching Saturn's east limb (IAU).

Illustration 033. 2010 Mar 25 13:38UT. Digital image by Anthony Wesley using a 36.8 cm (14.5 in.) NEW and RGB filters. S and Tr not specified. CMI = 357.6°, CMII = 3.3°, CMIII = 161.8°, B = +2.9°, B´ = +3.3°. The NTeZ can be seen in this beautiful image along with considerable detail in both hemispheres of Saturn's globe.

comparing the results with the immediately preceding apparition, only minor variations in belt and zone intensities were suspected. It would be difficult to conclude that atmospheric activity on Saturn's globe increased or decreased substantially over the last several apparitions. Visual observers and those using digital imagers called attention to an enduring small white spot in the South Tropical Zone (STrZ) that evolved progressively from early March through early July. During those months it elongated considerably, because somewhat diffuse, showed a subtle fluctuation in brightness, then ended up splitting three components longitudinally within the zone. Other limited atmospheric activity in the form of small white spots was apparent in the South Equatorial Belt Zone (SEBZ), and Equatorial Zone (EZn), North Equatorial Belt Zone (NEBZ) during the apparition.

With respect to the Ring System, apart from routine visual observations and digital images showing Cassini's (A0 or B10), Encke's (A5), and possibly Keeler's (A8) divisions, several less conspicuous intensity minima at different locations within Ring B were recorded with digital imagers. Although observers used standard methodology is looking for the bi-colored aspect of the rings during the 2009-10 apparition, there were no reports of the phenomenon by visual observers or indications of its presence on digital images submitted.

Digital imaging, which now routinely accompanies visual studies of Saturn, often reveals discrete detail on the globe and in the rings typically below the normal visual threshold. The combination of both methods greatly improves the opportunities for detecting changes on Saturn during any given observing season. Because of their sensitivity, digital imagers help signal outbursts of activity that visual observers can ultimately attempt to study with their telescopes. This helps establish limits of visibility of such features in integrated light (no filter) and at various wavelengths. In addition, during the

2009-10 apparition, Saturn's small ring inclination still allowed observers to witness and image transits of satellites lying near the planet's equatorial plane and their shadows, such as Rhea, Dione, Tethys, Titan, and even Enceladus on one occasion.

Acknowledgements

The author is very thankful for all the continuing observation support by the individuals mentioned in this report who faithfully submitted drawings, digital images, descriptive reports, and visual numerical relative intensity estimates during the 2009-10 apparition. It was also quite pleasing to see that observers are striving to improve the incidence of simultaneous observation. Dedicated systematic observational work keeps our programs going strong and helps amateur and professional astronomers alike to obtain a keener understanding of Saturn and its dynamic ring system. Observers throughout the world are encouraged to get involved in our endeavors in future apparitions.

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________ (2012). *ALPO Observations of Saturn During the 2008-2009*

Illustration 034. 2010 Apr 16 05:04UT. Digital image by Brian Combs using a 35.6 cm (14.0 in.) SCT with RGB + IR blocking filter. S and Tr not specified. CMI = 271.8°, CMII = 96.9°, CMIII = 178.9°, B = +2.2°, B´ = +3.6°. In this superb detailed image, the narrow NNTeZ and dusky NPR are both apparent in Saturn's northern hemisphere.

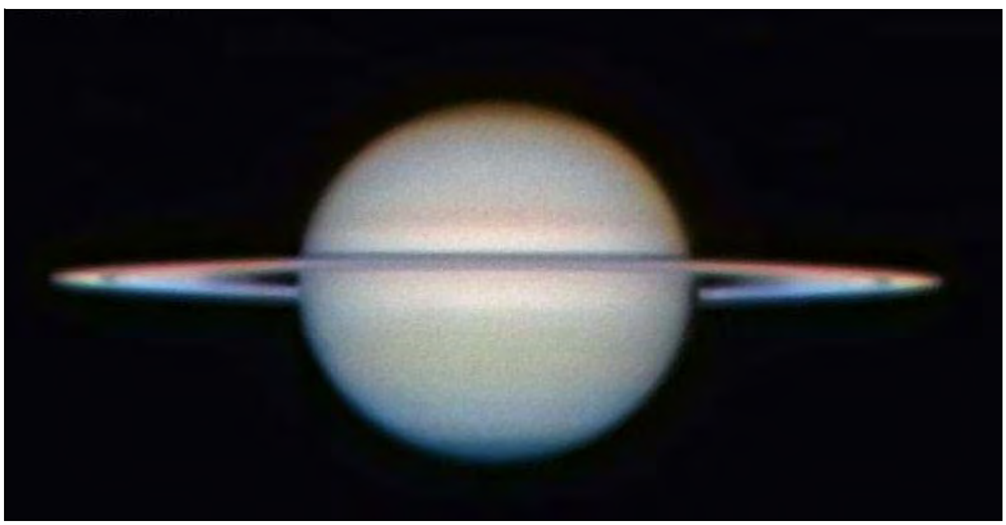

Illustration 035. 2010 Apr 05 03:34UT. Digital image by Dan Llewellyn using a 35.6 cm (14.0 in.) SCT and RGB filters. S and Tr not specified. CMI = 291.4°, CMII = 113.8°, CMIII = 209.1°, B = +2.5°, B´ = +3.4°. The duller inner and brighter outer components of Ring B are visible at the ansae this image, including Cassini's division (A0 or B10), as well as the inner dusky Ring C.

Apparition, Journal of the Assn of Lunar & Planetary Observers, 54, 2: 29-70.

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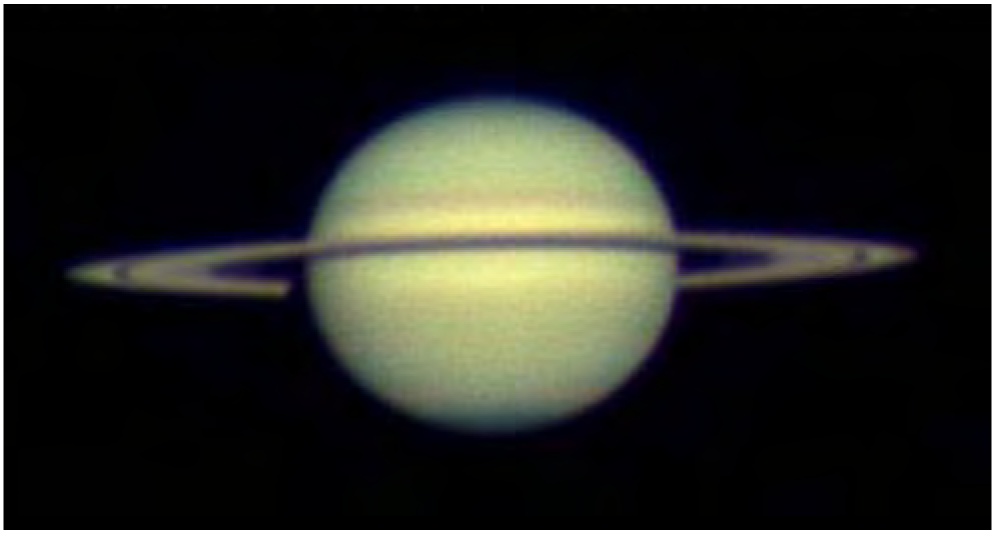


Illustration 036. 2010 Feb 21 01:53UT. Digital image by David Arditti using a 35.6 cm (14.0 in.) SCT and RGB filters. S and Tr not specified. CMI = 284.0°, CMII = 57.6°, CMIII = 204.9°, B = +4.0°, B´ = +2.8°. The dusky inner Ring C is easily visible at the ansae.

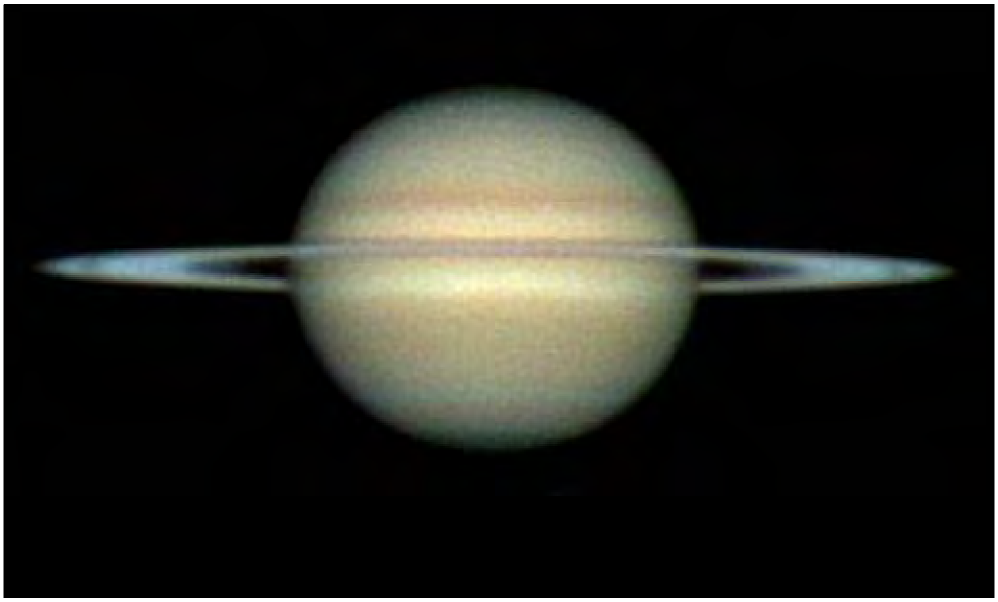
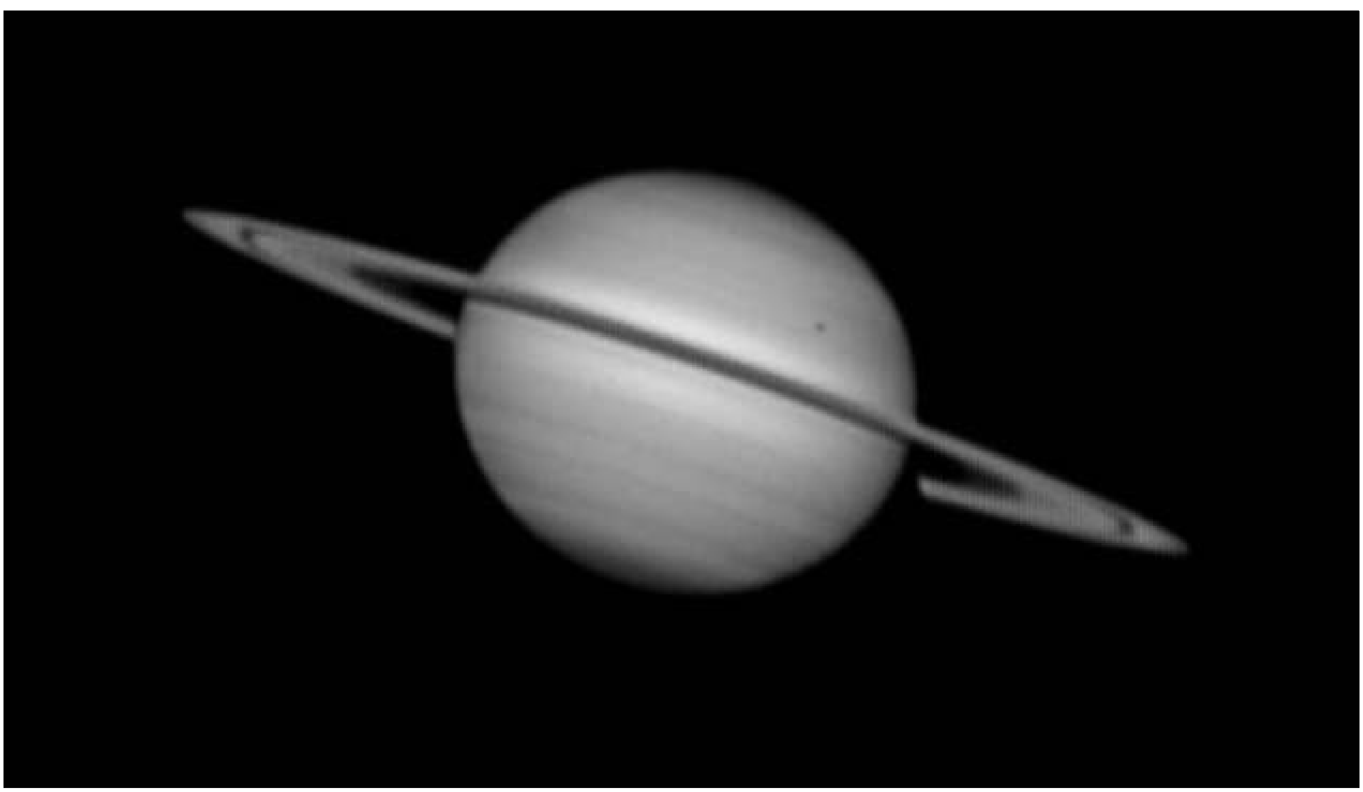


Illustration 037. 2010 Mar 23 13:55UT. Digital image by Christopher Go using a 28.0 cm (11.0 in.) SCT with RGB + IR blocking filter. S = 7.0, Tr = 3.0. CMI = 118.9°, CMII = 347.3°, CMIII = 97.8°, B = +3.0°, B´ = +3.2°. Image near opposition showing the Seeliger Effect, a brightening of Saturn's rings by coherent back-scattering of sunlight by their µ-sized icy particles.

Illustration 038 (left). 2010 Feb 19 15:54UT. Digital image by Anthony Wesley using a 36.8 cm (14.5 in.) NEW and RGB filters. S and Tr not specified. CMI = 168.3°, CMII = 347.7°, CMIII = 136.7°, B = +4.1°, B´ = +2.7°. Rhea and its shadow transiting the globe of Saturn.

Illustration 039 (below). 2010 Feb 21 00:52UT. Digital image by Damian Peach using a 35.6 cm (14.0-in.) SCT employing a red filter. S and Tr not specified. CMI = 247.0°, CMII = 22.1°, CMIII = 169.4°, B = +4.0°, B´ = +2.8°. Shadow of Dione crossing the globe of Saturn.



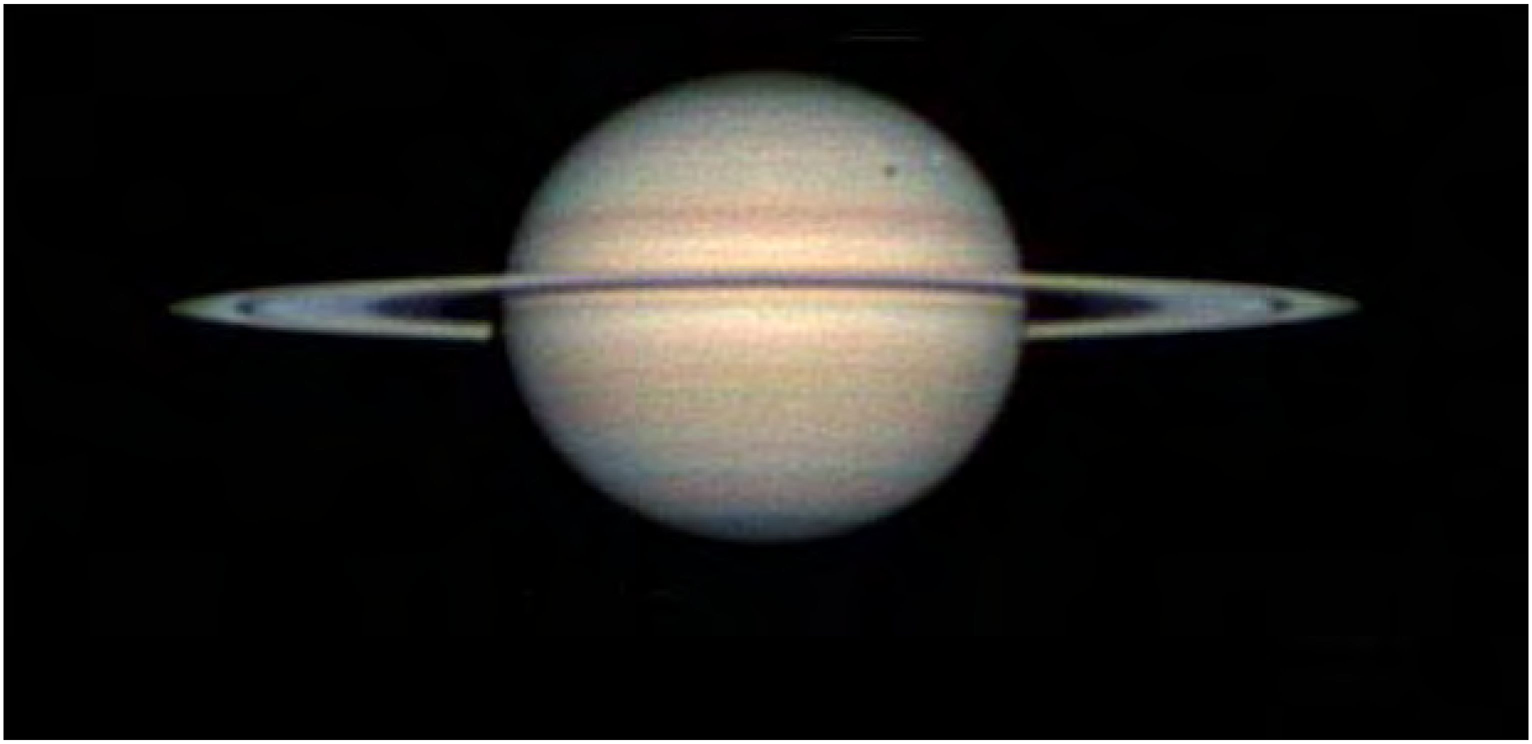


Illustration 040. 2010 Mar 09 15:46UT. Digital image by Christopher Go using a 28.0 cm (11.0 in.) SCT with RGB + IR blocking filter. S = 7.0, Tr = 5.0. CMI = 242.7°, CMII = 200.8°, CMIII = 328.1°, B = +3.5°, B´ = +3.0°. Nice image of Rhea and its shadow in transit.

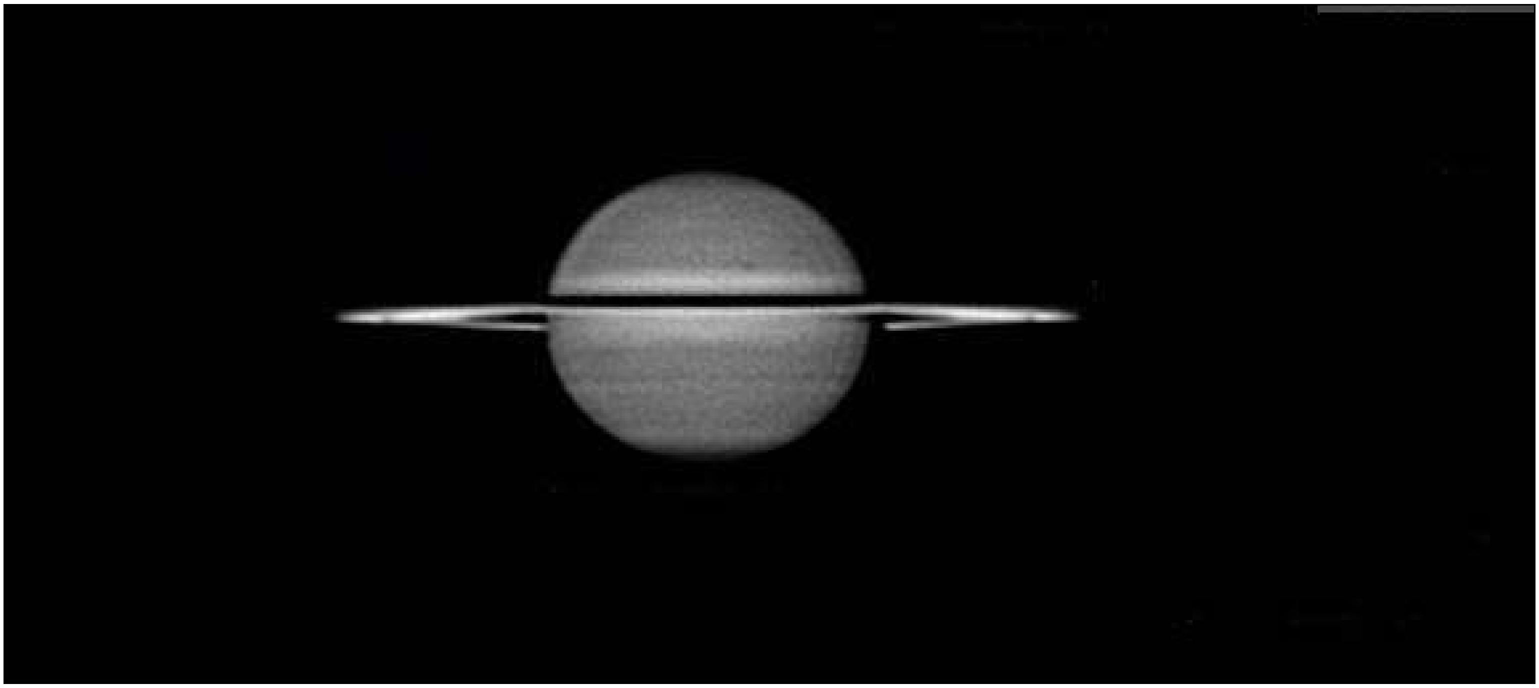


Illustration 041. 2010 Apr 24 22:11UT. Digital image by Mark Delcroix using a 25.4 cm (10.0-in.) SCT with R + IR filters. S = 8.0, Tr = 4.0. CMI = 68.4°, CMII = 332.2°, CMIII = 43.7°, B = +2.0°, B´ = +3.7°. Dual transit of the small shadows of Tethys and Dione in red light.

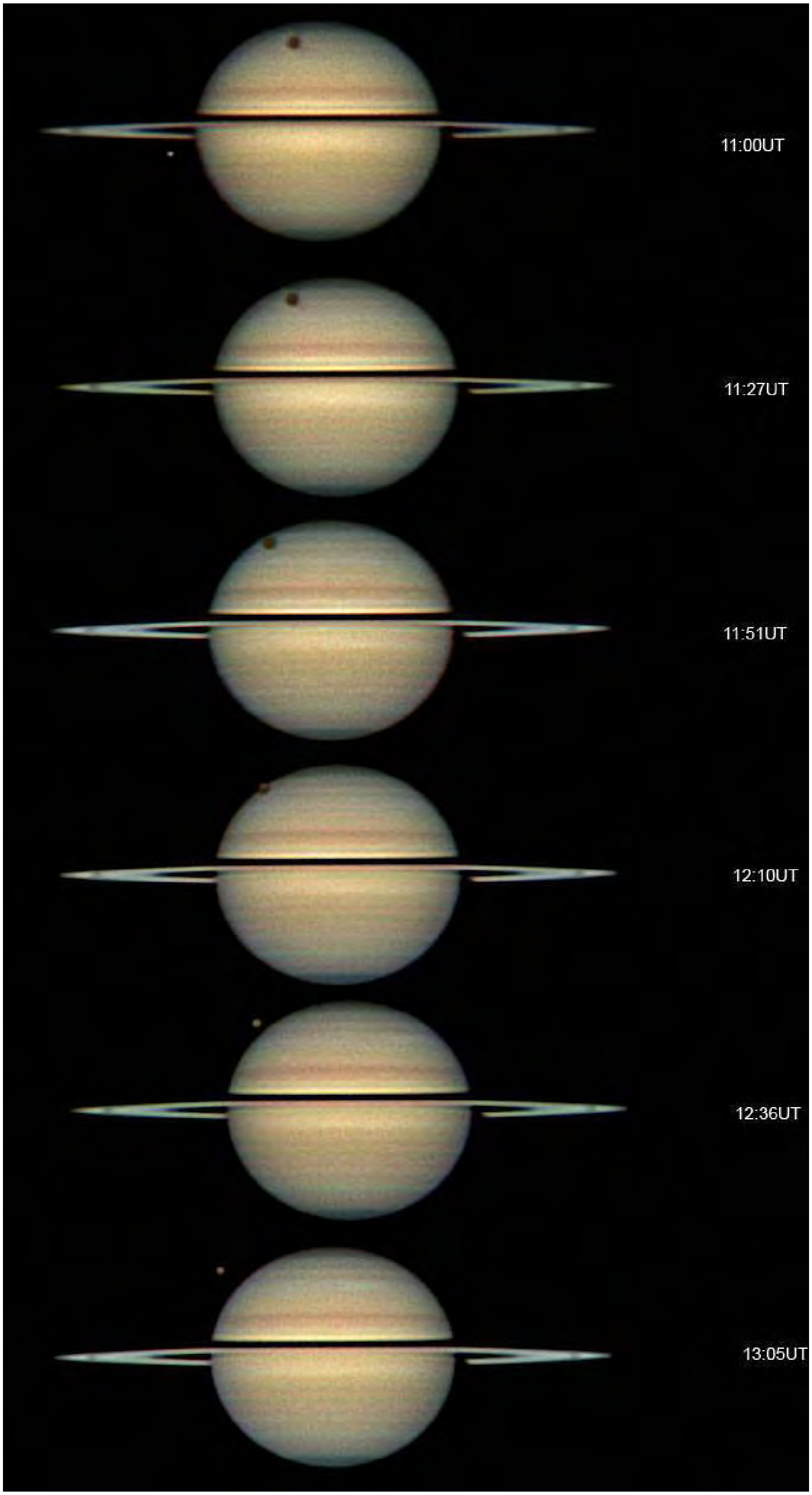


Illustration 042. 2010 May 01 11:00 – 13:05UT. Digital images by Christopher Go using a 28.0 cm (11.0 in.) SCT with RGB + IR blocking filter. S = 7.5, Tr = 5.0. CMI = 185.1°, CMII = 237.8°, CMIII = 301.4° thru CMI = 258.4°, CMII = 308.3°, CMIII = 11.8°, B = +1.8°, B´ = +3.8°. Outstanding sequence of images of Titan as it crossed the globe of Saturn.

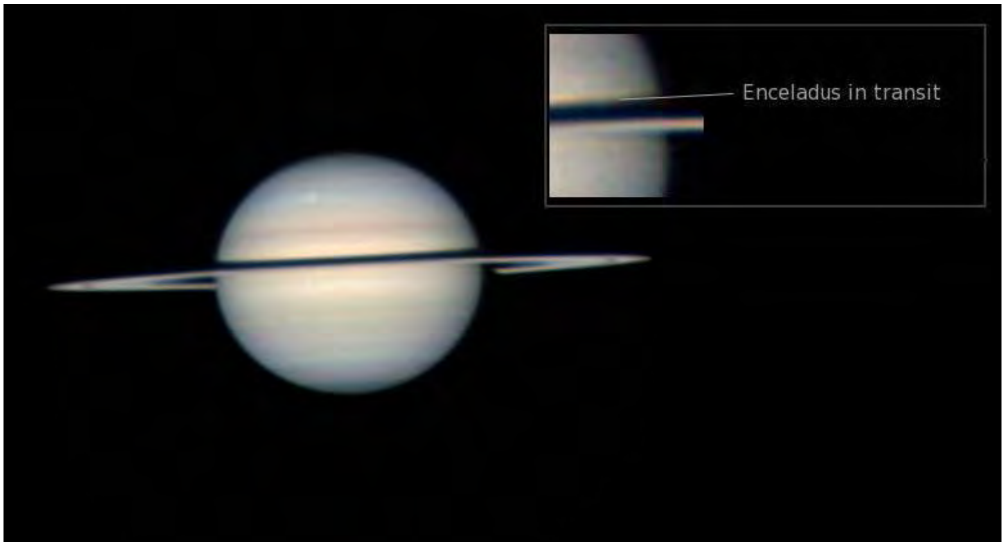


Illustration 043. 2010 May 10 11:37UT. Digital image by Anthony Wesley using a 36.8 cm (14.5 in.) NEW and RGB filters. S and Tr not specified. CMI = 245.3°, CMII = 6.4°, CMIII = 59.2°, B = +1.7°, B´ = +4.0°. Enceladus in transit across Saturn as it was passing in front of the ring shadow (see image insert).

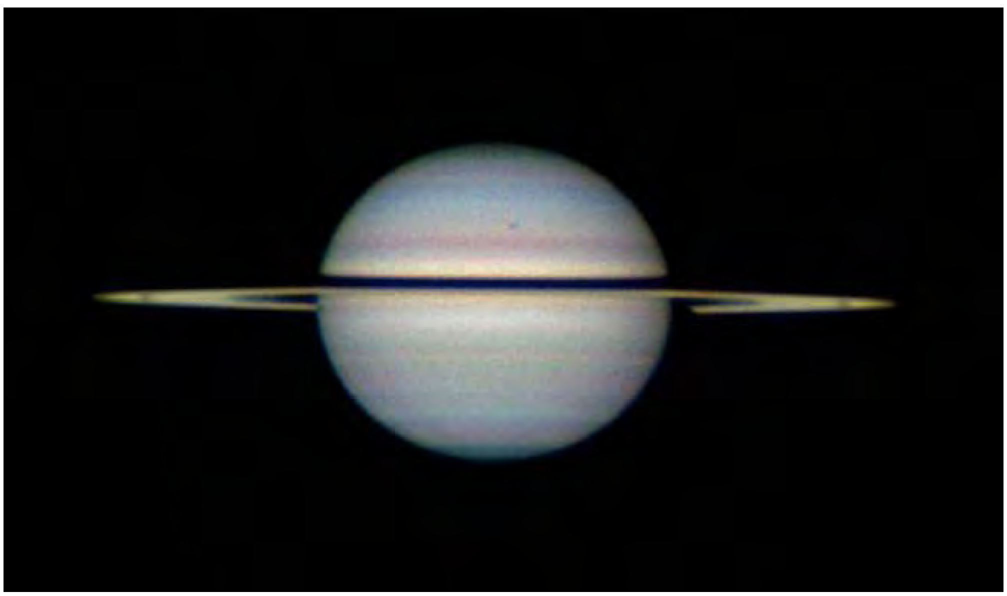


Illustration 044. 2010 May 14 02:46UT. Digital image by Brian Combs using a 35.6 cm (14.0 in.) SCT with RGB + IR blocking filter. S and Tr not specified. CMI = 71.0°, CMII = 74.9°, CMIII = 123.29°, B = +1.6°, B´ = +4.0°. Dione's shadow in front of the globe near the CM.

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

The Lunar Observer

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

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

Banded Craters Program

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

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

There is NO CHARGE for any of the ALPO monographs.

- **Monograph No. 1.** *Proceedings of the 43rd Convention of the Association of Lunar and Planetary Observers. Las Cruces, New Mexico, August 4-7, 1993. 77* pages. File size approx. 5.2 mb.
- **Monograph No. 2**. *Proceedings of the 44th Convention of the Association of Lunar and Planetary Observers. Greenville, South Carolina, June 15-18, 1994. 52* pages. File size approx. 6.0 mb.
- **Monograph No. 3**. *H.P. Wilkins 300-inch Moon Map.* 3rd Edition (1951). Available as one comprehensive file (approx. 48 megabytes) or five section files (Part 1, 11.6 megabytes; Part 2, 11.7 megabytes; Part 3, 10.2 megabytes; Part 4, 7.8 megabytes; Part 5, 6.5 mb)
- **Monograph No. 4.** *Proceedings of the 45th Convention of the Association of Lunar and Planetary Observers. Wichita, Kansas, August 1-5, 1995.127* pages. Hard copy $17 for the United States, Canada, and Mexico; $26 elsewhere. File size approx. 2.6 mb.
- **Monograph No. *5.*** *Astronomical and Physical Observations of the Axis of Rotation and the Topography of the Planet Mars. First Memoir; 1877-1878.* By Giovanni Virginio Schiaparelli, translated by William Sheehan. 59 pages. Hard copy $10 for the United States, Canada, and Mexico; $15 elsewhere. File size approx. 2.6 mb.
- **Monograph No. *6.*** *Proceedings of the 47th Convention of the Association of Lunar and Planetary Observers, Tucson, Arizona, October 19-21, 1996.20* pages. Hard copy $3 for the United States, Canada, and Mexico; $4 elsewhere.File size approx. 2.6 mb.
- **Monograph No. 7.** *Proceedings of the 48th Convention of the Association of Lunar and Planetary Observers. Las Cruces, New Mexico, June 25-29, 1997.76* pages. Hard copy $12 for the

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United States, Canada, and Mexico; $16 elsewhere.File size approx. 2.6 mb.

- **Monograph No. 8**. *Proceedings of the 49th Convention of the Association of Lunar and Planetary Observers. Atlanta, Georgia, July 9-11,1998.122* pages. Hard copy $17 for the United States, Canada, and Mexico; $26 elsewhere.File size approx. 2.6 mb.
- **Monograph Number 9**. *Does Anything Ever Happen on the Moon?* By Walter H. Haas. Reprint of 1942 article. 54 pages.Hard copy $6 for the United States, Canada, and Mexico; $8 elsewhere.File size approx. 2.6 mb.
- **Monograph Number 10.** *Observing and Understanding Uranus, Neptune and Pluto*. By Richard W. Schmude, Jr. 31 pages. File size approx. 2.6 mb.
- **Monograph No. 11**. *The Charte des Gebirge des Mondes* (Chart of the Mountains of the Moon) by J. F. Julius Schmidt, this monograph edited by John Westfall. Nine files including an accompanying guidebook in German. Note files sizes:
  Schmidt0001.pdf, approx. 20.1 mb;
  Schmidt0204.pdf, approx. 32.6 mb;
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  SchmidtGuide.pdf,approx. 10.2 mb

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

- **Solar:** *Guidelines for the Observation of White Light Solar Phenomena*, *Guidelines for the Observing Monochromatic Solar Phenomena* plus various drawing and report forms available for free as pdf file downloads at http://www.alpo-astronomy.org/solarblog.
- **Lunar & Planetary Training Section:** *The Novice Observers Handbook* $15. An introductory text to the training program. Includes directions for recording lunar and planetary observations, useful exercises for determining observational parameters, and observing forms. Available as pdf

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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To join or renew online, simply left-click on this Astronomical League web page:
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Interest Abbreviations
0 = Sun 1 = Mercury 2 = Venus 3 = Moon 4 = Mars 5 = Jupiter 6 = Saturn 7 = Uranus 8 = Neptune 9 = Pluto A = Asteroids C = Comets D = CCD Imaging E = Eclipses & Transits H = History I = Instruments M = Meteors & Meteorites P = Photography R = Radio Astronomy S = Computing & Astronomical Software T = Tutoring & Training Program (including Youth)

ALCON 2013 ATLANTA

July 24-27, 2013 • Atlanta, Georgia
Summer Skies, Southern Hospitality

Location: Fernbank Science Center

Host Organizations: Atlanta Astronomy Club, Astronomical League

Partnering Organization: Association of Lunar and Planetary Observers (ALPO) • This year, ALPO presentations will be mainstreamed with League talks

Accommodations...

Emory Conference Center Hotel

- Shuttle service between hotel and presentations at Fernbank Science Center, and Agnes Scott College Bradley Observatory for those without transportation
- Be sure to ask for the Astronomical League rate. 1-800-933-6679, emoryconferencecente-px.trvlclick.com
- Saturday night's Awards Banquet

Primary Venue: Fernbank Science Center

- Talks held in 70ft planetarium
- Evening shows with Zeiss Mark V projector coupled with various special effects projector
- 0.9 meter Cassegrain reflector in the Ralph Buice Memorial Observatory
- Vendor displays

Atlanta Attractions

World of Coca-Cola
Georgia Aquarium
Zoo Atlanta
Inside CNN
Atlanta Botanical Garden
Olympic Games venues

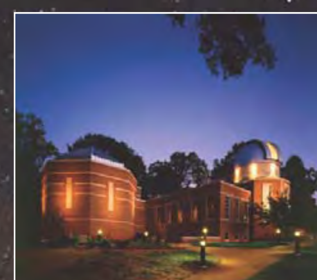
Excursions around Atlanta

Agnes Scott College Bradley Observatory

- Friday night's Star BQ
- Delafield Planetarium
- 30 inch Lewis H. Beck telescope

Atlanta Astronomy Club's Vila Rica Observatory

- Full size roll-off roof observatory
- 20 inch Newtonian reflector



Atlanta 1996

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