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Journal of the Association of Lunar & Planetary Observers

The Strolling Astronomer

Volume 46, Number 1, Winter 2004

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

This month’s cover: Cassini Bright Spot, a digital image by Alexander Vandenbohede, Gent, Belgium, taken January 2, 2004, 22:00 UT, 20cm f/15 refractor. For info on the International Bright Lunar Rays Project, a joint venture between the ALPO, the American Lunar Society, the British Astronomical Assn, and the Society for Popular Astronomy in England, go to http://users.adelphia.net/~dembowski/rays.htm

Journal of the Association of Lunar & Planetary Observers, The Strolling Astronomer

Volume 46, No. 1, Winter 2004
This issue published in March 2004 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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http://www.lpl.arizona.edu/alpo

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Point of View

By Ken Poshedly

Look! Up in the sky! It's a bird! It's a plane! It's . . .

. . . our fellow Solar System buddies Venus, Mars, Jupiter and Saturn – all in the evening sky and well-placed for viewing and serious research! But alas – poor Pluto rises around 2 a.m. Eastern Time in the U.S., with Neptune rising around 6 a.m. and Mercury and Uranus following at about sunrise. Not the best of times for those of us with regular day-jobs.

So what's the big deal? Well, other than concerns about cloudy weather, that means there's little to keep us from getting out there these nights, jotting down our data, making our sketches, getting our images and getting all of this stuff to our intrepid observing coordinators.

A good read of this as well as some past issues will show how valuable you contributors of data really are. For instance, in Julius Benton's detailed writeup of the 2001-2002 Saturn apparition, he notes that this report is based on 166 visual, photographic, and CCD observations of Saturn from 27 contributors in the United Kingdom, France, Germany, Singapore, Spain, Japan, Mexico, Puerto Rico, and the United States.

Please contribute – you're bound to see your work here.

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To follow up on my column in the last issue, I'm still crawling out from under my self-imposed workload and have decided that Volume 45 of this Journal will consist of only 3 issues – No. 1 (Winter 2003), No. 2 (Spring 2003) and No. 3 (Summer 2003). This issue is Volume 46, No. 1.

All in all though, we're still doing much better than before.

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Member, section and activity news (continued)

ALPO Membership Online

The ALPO now accepts membership payment by credit card. However, in order to renew by this method you MUST have access to the World Wide Web. See the inside back cover for details.

Our Advertisers

As we all know by now, there is no free lunch. Everything costs money. This Journal and other various activities of the ALPO require funding. One way to help offset the costs of producing and mailing the hardcopy version of this publication is through advertising.

Please show your support of them as they show their support for us.

Observing Section Reports

Eclipse Section: Upcoming in 2004

By Dr. Mike Reynolds, coordinator

For eclipse chasers, there will be four eclipses visible in 2004 – two lunar and two solar. Both solar eclipses are partial, whereas both lunar eclipses are total. North American viewers will not see either solar eclipse, except that the October 14th partial solar eclipse will be visible from Alaska. However the October 28th total lunar eclipse will be visible from the 48 states, with the West Coast missing the penumbral ingress stage.

Observers should always use caution when observing a partial solar eclipse or the Sun itself. A number of safe observing techniques can be employed, including projection of the partially-eclipsed Sun.

The ALPO encourages reports on eclipse observations, including poor or cloudy weather reports. Please submit photos, images and data to the ALPO eclipse coordinator as noted at the end of this article.

19 April — Partial Solar Eclipse

This first eclipse will be visible from southern Africa and Antarctica. The maximum eclipse magnitude will be 0.7357, that is 73.57% of the Sun will be covered by the Moon. This partial solar eclipse is a member of Saros 119, that is, it will be the 65th event of this Saros. The last central eclipse of Saros 119, an annular, occurred 18 March 1950. Future eclipses of Saros 119 will be decreasing in magnitude, with the last eclipse occurring on 24 June 2112.

4 May — Total Lunar Eclipse

The first total lunar eclipse of 2004 will be best visible from the Eastern Hemisphere; Europe, Africa, Asia, and Australia. South American observers will be able to see the eclipse's last stages.

The Moon will pass through the Earth's southern penumbral/umbral shadow. Due to this, the Moon's southern hemisphere should be brighter than the northern hemisphere. At mid-totality, the eclipsed Moon is in the observer's zenith near northern Madagascar. Mid-eclipse occurs at 20:30:16 UT.

14 October — Partial Solar Eclipse

The final partial solar eclipse of 2004 will be visible from Northern Hemisphere locations over northeastern Asia, Alaska, and parts of the Pacific Ocean. Maximum eclipse magnitude will be 0.9270 for observers tantalizingly close to a central eclipse. This eclipse is part of Saros 124, the 54th event of this series. The last Saros 124 central eclipse was an annular eclipse on 3 October 1986. Saros 124 will continue to produce partial eclipses of decreasing magnitude until 11 May 2347.

28 October — Total Lunar Eclipse

The final eclipse during 2004 is a total lunar eclipse, visible from far Western Europe, North and South Americas. All of North America will enjoy the entire eclipse with the exception of the west, which will miss the penumbral shadow ingress.

The Moon will pass deeply through the northern part of the umbral shadow, with totality lasting 1 hour and 21 minutes. Since this is not a central passage, observers can expect to see a variation of brightness,

Reminder: Address changes

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

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

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

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much like the previous May total lunar eclipse, except that the Moon's Northern Hemisphere should be brighter one. Mid-eclipse occurs at 03:04:06 UT.

Looking Ahead to 2005…

- 8 April 2005 – Hybrid Solar Eclipse
- 24 April 2005 – Penumbral Lunar Eclipse
- 3 October 2005 – Annular Solar Eclipse
- 17 October 2005 – Partial Lunar Eclipse

Acknowledgement
A thank-you to Fred Espenak of NASA Goddard Space Flight Center who has prepared and distributed eclipse predictions, maps, and other useful information to professional and amateur astronomers for many years.

References

NASA/Goddard Space Flight Center Eclipse Home Page; http://sunearth.gsfc.nasa.gov/eclipse

Espenak, Fred, "Fifty Year Canon of Solar Eclipses: 1986-2035," Sky Publishing Corporation, Cambridge MA, 1988

Reynolds, Michael D. and Richard A. Sweetsir, "Observe Eclipses," The Astronomical League, Washington DC, 1995.

Note that "Observe Eclipses" is available through the Astronomical League or from the author at the address below for $15 postpaid.

Please send observations, questions, and orders for "Observe Eclipses" to this section coordinator (Dr. Mike Reynolds) at 2347 Foxhaven Drive West, Jacksonville FL 32224-2011; e-mail to astrogator90@aol.com

Visit the ALPO Eclipse Section on the World Wide Web at http://www.lpl.arizona.edu/~rhill/alpo/eclipse.html

Venus Section
By Julius Benton, coordinator

The 2003-2004 Eastern (Evening) Apparition of Venus is well underway, with the planet appearing as a brilliant object of visual magnitude -3.9 in the western sky right after sunset. Venus will reach Greatest Elongation East (-47°) on March 29, 2004, and observers should try to catch the planet during twilight before it is too near the horizon for useful observation.

Observations of the atmosphere of Venus are organized into the following routine programs:

1. Visual observation and categorization of atmospheric details in dark, twilight, and daylight skies.
2. Drawings of atmospheric phenomena.
3. Observation of cusps, cusp-caps, and cusp-bands, including defining the morphology and degree of extension of cusps.
4. Observation of dark hemisphere phenomena, including monitoring visibility of the Ashen Light.
5. Observation of terminator geometry (monitoring any irregularities).
6. Studies of Schröter's phase phenomenon.
7. Visual photometry and colorimetry of atmospheric features and phenomena.
8. Routine photography (including UV photography), CCD imaging, photoelectric photometry, and videography of Venus.
9. Observation of rare transits of Venus across the Sun, especially the one on June 8, 2004.
10. Simultaneous observations of Venus.

Complete details can be found about all of our observing programs in the ALPO Venus Handbook. Individuals interested in participating in the programs of the ALPO Venus Section are cordially invited to visit the ALPO Venus Section on the World Wide Web at http://www.lpl.arizona.edu/~rhill/alpo/venus.html

Lunar Section:
Lunar Domes
By Marvin W. Huddleston, coordinator, Lunar Dome Survey

The ALPO Board of Directors approved the revival of the Lunar Dome Survey during its annual board meeting in the summer of 2003. The initial LDS program was conceived by Harry Jamieson in the early

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1960's and was headed by him when the British Astronomical Assn. was invited to join the program, which they did. The joint effort between the ALPO and BAA lunar sections lasted for approximately 14 years, ending officially around 1976 due to a decline in interest. The program was again revived in 1987 under the direction of Jim Phillips and lasted until around the mid-1990's. All told, this program has been one of the longest running programs in the history of the Lunar Section of the ALPO.

The revived program will concentrate on cleaning up the existing catalog, classification and confirmation of the objects contained therein, and analysis of the database created in the process. It is hoped that much as in the past the newly revived Lunar Dome Survey will be an international effort.

Look for a full feature article on the revived Lunar Dome Survey program in the next Strolling Astronomer.

Persons interested in the revived survey are invited to join the Yahoo discussion group on Lunar Domes located at http://groups.yahoo.com/group/lunar-dome/

Visit the ALPO Lunar Dome Survey Section on the World Wide Web at http://www.lunar-dome.com

Lunar Topographic Studies
By Bill Dembowski, acting assistant coordinator

This acting assistant lunar coordinator encourages, collects, catalogs, and disseminates all lunar observations not covered by the established specialized lunar programs. One of our objectives is to build and maintain a library of lunar observations that can be of benefit to all students of the Moon.

Observations of all types are invited: written, sketched, photographic, and electronic. New observers are especially welcome since the Moon provides an ideal introduction to Solar System research, but observers at all levels of skill and experience are needed to continue the empirical study of Earth's only natural satellite. Examples of the Section's work can be found at <http://users.adelphia.net/~dembowski/alpolunar.htm>. The site can be found on the A.L.P.O. Lunar Section Page under "Recent Lunar Observations" and is updated monthly. Also, A.L.P.O. members should be aware that a Yahoo lunar discussion group has been established. Those wishing to join the group should send an email to <Moon-ALPO-subscribe@yahoogroups.com> to subscribe.

As part of its study of the lunar surface, the Lunar Topographical Section also heads a joint venture of a group of international astronomical organizations (Association of Lunar & Planetary Observers, American Lunar Society, British Astronomical Association, and Society for Popular Astronomy) in the study of bright lunar impact rays. A website and monthly newsletter for the project can be found at <http://users.adelphia.net/~dembowski/rays.htm> which is also linked to the Lunar Section Page of the A.L.P.O. website.

It will be a practice of the Lunar Topographical Section to publish semi-annual Lunation Reports in the JALPO to keep members abreast of its studies. Submissions are encouraged and welcomed, and should be sent to William Dembowski, 219 Old Bedford Pike, Windber PA 15963 – Email: dembowski@adelphia.net. All observations received will, of course, be acknowledged in the appropriate Lunation Report.

Lunar Meteoritic Impact Search
By Brian Cudnik, coordinator

The year 2003 was not been a particularly fruitful one for the Section, with the Moon being poorly placed for most of the significant annual showers. However, there were two total lunar eclipses that provided additional opportunity for the monitoring of meteoritic impacts. There were the usual isolated candidate reports that come in from time to time, but none of these were confirmed. No candidates were reported during the Orionid meteor shower. Six of the impact candidates, observed during the November total lunar eclipse, also await confirmation. Two individuals, elevating it to "probable" status, witnessed one of these; however, the individuals were observing from the same site. An updated catalog of unconfirmed and confirmed lunar impact observations made since the 1999 Leonid meteor storm will be made available early next year. The observations will be evaluated for quality, with the poorer, more suspect ones being dropped from the catalog.

Work has resumed on a manual for the observations of lunar meteoritic phenomena entitled "Observer's Guide to Lunar Meteoritic Phenomena". The book is summarized in the next several paragraphs:

The purpose of this publication is to collect in one place the most useful information regarding lunar

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meteoritic impact phenomena. The book will begin by outlining the overwhelming evidence for impact phenomena in the history of the solar system, and then brings the discussion closer to home by describing the Moon's impact history. From this general discussion, the work will move to a short discussion of Transient Lunar Phenomena (TLP) and its varying forms, briefly suggesting some possible physical causes of the TLP.

The manual is interested in TLP related to one physical cause — impacts of meteoroids. Impact physics is briefly discussed in a format comprehendible to the general public. From this discussion, several forms of TLP are considered which could be different manifestations of impact events. The most common impact-related TLP are the pinpoint flashes lasting less than a second. Other forms of TLP that may be impact-related include clouds of dust in very localized locations, "lunar lightning", and obscurations. A catalog of TLP manifestations most likely derived from meteoritic impacts is presented. The famous "lunar flare" of 1953 is discussed, along with a possible physical explanation (its duration appears to rule out meteoritic impact as a cause) this leads to a brief discussion of "quasi-impact TLP", events that may be impact in origin, but likely are not, due to duration of event, multiples of the event, etc.

Equipment and procedures useful for observation are presented, along with a guide, aimed for use by the amateur community (but with some guidelines to encourage professional astronomers to join in), on how to make scientifically valuable observations. Although visual observers are not left out (there will be a thorough discussion on visual lunar meteoritic watching), the emphasis is on videotaping lunar meteoritic events. This section of the book will draw upon the experiences of over four years of videotape astronomy, and will present information from a number of people who have had exposure to the universe of video astronomy. Data acquisition, preparation, use, and archiving procedures are presented.

The guide is intended to be a "one-stop" resource for lunar meteoritic observing, and will provide the information necessary to establish a successful program of observing this elusive phenomenon. The publication date is estimated to be late 2004.

Lunar Selected Areas
By Julius Benton, coordinator

Visit the ALPO Lunar Selected Areas Program on the World Wide Web at http://www.lpl.arizona.edu/~rhill/alpo/lunarstuff/selarea.html

Mars Section

By Dan Troiani, coordinator
Daniel P. Joyce, assistant coordinator

No longer the dominant sight it was five months ago, Mars nonetheless maintains a convenient evening aspect in its waning portion of the historic apparition. Its northward motion has also provided for more tranquil sky conditions for most observers and it continues to attract observers. Although significant dust activity occurred during the expected peak season, it has since subsided and the Martian disk is once again revealing surface features without much interference. There have been the usual limb clouds, now prevalent on the evening limb as the sunrise terminator encroaches onto the disk in the expected phase effect.

Much as Dr. Parker may try, he has not been able to detect the Spirit rover (nor even Gusev Crater). He and others, though, have kept vigilance on Isidis Planitia, where our now celebrated Columbia Memorial Station was established much to the relief of its investigative team and its many fans (get a load of the internet hits!). It has now been joined by sister ship Opportunity which has been described as a 305,000,000-mile hole-in-one. Congratulations to our good friend Jim Bell (Cornell U.) and the rest of the investigative team for giving us yet another OPPORTUNITY (!) to gaze upon such exotic shores, exactly where Mariner IV first robotically imaged the Martian surface.

As suggested by this Section before, Mars has once again roused the intrigue of visionaries who wish to explore its grandeur with manned missions. It is about time someone in government understood that in order to enter the 21st century, we need to think even beyond those missions carried out during the 20th century. Continued study on our part might well contribute to justification for further review of the comparative lethargy all of space science has fallen into since the glory days of the Apollo program.

Of recent interest in planetary observations has been the use of photometric and polarimetric measurements; and not just the technique, but the results. Our most esteemed leader has quantified with surprising precision the brightness fluctuations on Mars owing to atmospheric dust. Activity has been ebbing but apparently has not quite subsided.

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Dr. Parker has continued to be blessed by Florida skies (oh, and temperatures — many special thanks to those braving the recent Arctic Outbreak along the Eastern Seaboard and sending data in spite of). Very active also have been Damian Peach and members of the Oriental Astronomical Assn.(OAA) and the British Astronomical Assn. (BAA), plus our longtime mentor Walter Haas. It appears that there may be a doubling of the all-time record number of reports.

Jupiter Section

By Richard W. Schmude, Jr., coordinator

The Jupiter Section has been busy accumulating data, analyzing data and interacting with others. Richard Schmude, Jr. is finishing up the 1990-91 Jupiter report. John McAnally has interacted with Glenn Orton of the Jet Propulsion Laboratory; this interaction has centered on study of the small, dark South Tropical Zone spot. Craig MacDougal has published at least one Jupiter newsletter in the past two months. And both Clay Sherrod and Ed Grafton have been busy imaging Jupiter. In addition, Clay has analyzed recent Jupiter images in the hopes of being able to forecast future events and has made a few predictions already.

During February and March, Jupiter will be well placed for observation. The Great Red Spot has become a little darker. Both of the equatorial belts are still visible and the North Temperate belt is still very faint (or invisible). Please be sure to send your data to the coordinator at Schmude@gdn.edu. Also, those on the Jupiter Yahoo group would be interested in seeing your results.

Visit the ALPO Jupiter Section on the World Wide Web at http://www.lpl.arizona.edu/~rhill/alpo/jup.html

Saturn Section

By Julius Benton, coordinator

All ALPO Saturn observers are strongly encouraged to participate in a systematic observational patrol of Saturn as part of an Amateur-Professional Cassini Observing Patrol during 2004 (this means observations will begin during the current 2003-2004 apparition). Cassini's arrival at Saturn (orbit insertion) occurs on July 1, 2004, followed by the Titan Probe Entry and Orbiter flyby on November 27, 2004.

What will be most useful to the professional community will be digital images of Saturn at wavelengths ranging from 400 nm - 1 micron in good seeing using webcams, ccd's, digital cameras, and videocams. This effort will begin with great intensity during April of 2004 (to coincide with when Cassini starts observing Saturn at close range). Classical broadband filters (e.g., Johnson system: B, V, R and I) are recommended. For telescopes with large apertures (e.g., 30.0 cm. and greater), imaging through a 890-nm narrow band methane filter will also be extremely worthwhile.

The Cassini Team is hoping that ALPO Saturn observers will carefully and systematically patrol the planet every clear night to search for individual features, their motions and morphology, to serve as input to Cassini's imaging system, thereby indicating to Cassini scientists where interesting (large-scale) targets exist. Suspected changes in belt and zone reflectivity (i.e., intensity) and color will be also useful, so visual observers can also play a very useful role by making careful visual numerical relative intensity estimates. The Cassini team also would like to combine ALPO Saturn Section images with data from the Hubble Space Telescope and from other professional ground-based observatories (a number of proposals have been submitted).

Please contact the ALPO Saturn Section coordinator for more details on how to participate in this very important program.

Further information on ALPO Saturn programs, including observing forms and instructions, can be found on the World Wide Web at http://www.lpl.arizona.edu/~rhill/alpo/sat.html

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

Remote Planets Section

By Richard W. Schmude, Jr., coordinator

Both Uranus and Neptune will be at conjunction during the next few weeks and will not be visible. Please begin looking for Neptune at the end of March in the morning sky. Neptune will be in the eastern corner of Capricorn. Pluto is visible for most of the night. CCD photometric data of Pluto is needed. We have received Pluto data during the last three apparitions and any new data of Pluto are needed.

If you have observations of the remote planets from 2003, please be sure to send them to Richard Schmude, Jr., 109 Tyus St., Barnesville, GA 30204 or to Schmude@gdn.edu for inclusion in the 2003 report. Finder charts for Uranus, Neptune and Pluto during May will also be sent out in May.

Visit the ALPO Remote Planets Section on the World Wide Web at http://www.lpl.arizona.edu/~rhill/alpo/remplan.html

ALPO Feature:
An Important Resource for the History of Astronomy

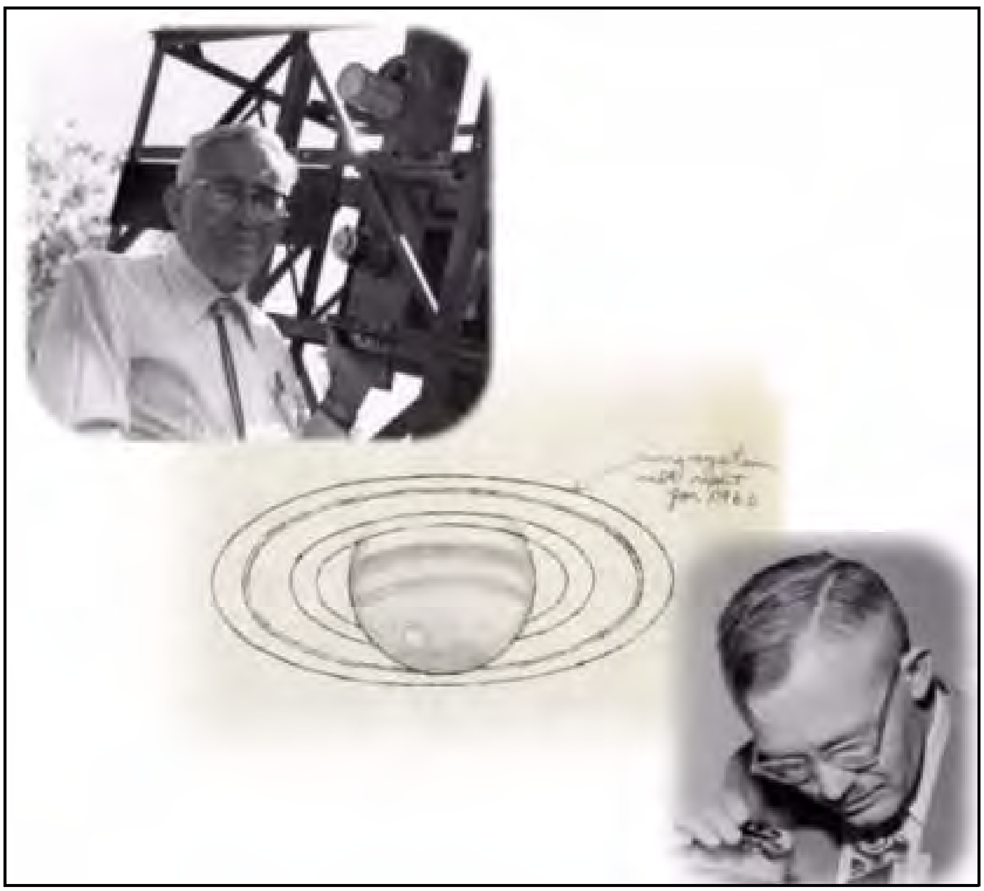
By: Walter H. Haas, ALPO director emeritus
e-mail to: haasw@zianet.com

The Rio Grande Historical Collections (RGHC) of the Department of Archives and Special Collections at the New Mexico State University Library, Las Cruces, NM, has acquired, and continues to acquire, a large and valuable collection of papers from important 20th century astronomers, both professional and amateur. A major part of this collection is the papers of **Dr. Clyde W. Tombaugh**, best known as the discoverer of the planet Pluto. An important planetary astronomer, Dr. Tombaugh was one of the first to apply geology to planetary research. His papers at the RGHC include extensive correspondence, scientific articles, photographs, observations, and personal memoranda.

The RGHC astronomy collections also include the papers of **Walter H. Haas**, who founded the international Association of Lunar and Planetary Observers in 1947 and was its director for many years. The association's primary goals were the collection, analysis, and publication of observations of solar system bodies — the Sun, the Moon, the bright planets, the minor planets, comets, meteors, and meteorites. The expanding RGHC astronomy collections also encompass the correspondence of **Dr. Hugh M. Johnson**, a pioneer in X-Ray astronomy; excellent visual lunar and planetary observations by **Elmer J. Reese**; the papers of **Latimer J. Wilson**, an outstanding visual observer and pioneer lunar and planetary photographer; and useful data on the Sun's activities from, **Philip R. Glaser,** an amateur astronomer and businessman. Efforts are underway to acquire the extensive papers of another famous planetary observer.

The astronomy collection at the RGHC is a unique historic, scientific, and cultural resource for all with an interest in the development of the study of the solar system.

Please contact Stephen Hussman, the Director of the Department of Archives and Special Collections at the New Mexico State University Library, at shussman@lib.nmsu.edu or telephone (505) 646-4756 if you wish to make use of the astronomy collection, if you have ideas about additional materials that can be added to the collection, or if you wish to lend financial support to the ongoing expansion of the collection. We hope you will become part of this historic project.



Montage from the New Mexico State University Archives and Special Collections Clyde W. Tombaugh frontpage. Source: http://archives.nmsu.edu/exhibits/tombaugh_website/index.htm

ALPO Feature: Transits

Black Drops and Gray Drops — Multi-Color CCD Observations of the 1999 Mercury Transit and Application to the 2004 Venus Event

By Brian M. Cudnik,
coordinator, ALPO Lunar Section,
Lunar Meteoritic Impact Search program
e-mail to: cudnik@sbcglobal.net

Abstract

I present observations of the 1999 November 15 Mercury transit of the Sun made in the light of hydrogen-alpha from the Prairie View Solar Observatory (PVSO). In addition, I downloaded a number of images made by the TRACE (Transient Region And Coronal Explorer) satellite in the white light, ultraviolet, and far-ultraviolet parts of the spectrum to compare the visibility of Mercury and the historic black-drop effect in multiple wavelengths, Earth- and space-based. Although the observations were made with professional equipment in a professional setting, today's amateurs are fully capable of duplicating these observations, and are strongly encouraged to make detailed, multi-wavelength observations of the upcoming Venus transits.

Introduction and Background

With the notable transit of Venus set to occur in June 2004, after two Mercury transits (1999 and 2003), it is of benefit to bring this matter to the attention of the Association of Lunar & Planetary Observers. The purpose of this note is to outline some of the results obtained from a CCD study of the November 1999 Mercury transit and to encourage similar observations of the upcoming Venus transit and future Mercury transits. The 1999 transit was one of the first to occur since the CCD camera became widely available to the amateur. Thus, the event provided a first opportunity to obtain electronic images of the transit event. Not only were observations obtained with CCD cameras, but they were obtained in more than two wavelengths and widely separated from each other geographically. The following text will go into more detail about this.

Observations and Analysis

Observations of the 15 November 1999 transit of Mercury were made at the PVSO. This event was very unusual in that it was a grazing transit, with only 5.77 arc-seconds separating the limbs of Mercury and the Sun at mid-transit. Farther south and west of North America, the separation between limbs decreased to 0, with observers in most of Australia never seeing the planet completely within the solar limb. These circumstances enabled an extended observation of the "Black Drop" phenomenon, allowing one to study it carefully and look for occurrences of anomalies such as deformation of the solar limb just after second contact and just before third. The weather was clear, but the seeing was fair-to-poor (ranging from 4 to 6 on the standard 10-point scale) for the event. The weather at the PVSO was clear, but the Sun was at a low elevation ranging from 24° at first contact to 14° at fourth contact. Since still images were obtained only once every 20 to 70 seconds, no accurate timings were possible for this event; however, the optical effects of the transit could be studied throughout the event.

About 70 CCD images were taken with the 35-cm vacuum Gregorian-type solar telescope at the PVSO from 21:11 to 22:10UT. A Santa Barbara Instrument Group ST-7 CCD camera was used for the imaging, along with a 10% transmitting neutral density filter to reduce the intensity of the light incident on the CCD chip, preventing image saturation. The filter was a DayStar 0.4 Å bandwidth H-alpha filter tuned to line center. The images acquired were full (765x512 pixels) and half (382x255 pixels), each with full resolution (1x1 binning) or 0.46 arc-seconds per pixel (seeing rendered the effective resolution about an order of magnitude larger). The images were roughly centered on Mercury's disk and blurred by atmospheric seeing and a damaged collimating lens (which was later replaced).

After evaluation for quality, the 32 best images were selected for further analysis. These images were flat field-corrected and corrected for dark current. The

Reminder!!!!

For more information about the upcoming transit of Venus, please see John Westfall's excellent article, "A Decade of Mercury//Venus Transits" in this journal, *The Strolling Astronomer,* Vol. 45, No. 1, Winter 2003, pp 16-25.

flat field images, obtained from an average of a set of three images taken at the center of the solar disk, were normalized to the maximum pixel value. Each program image was divided by the normalized flat to remove artificial pixel-to-pixel variations, such as "donuts" caused by dust particles. For convenience, each image was rotated so that a line connecting the center of Mercury's disk and the point on the limb of the Sun closest to the planet's disk center coincided with the y-axis of an overlaid coordinate system.

Multiwavelength Observations of Mercury and the "Black Drop" Effect

The TRACE satellite also obtained images of the Sun during the Mercury transit in several channels, or bandwidths centered on several wavelengths. These images were downloaded from the Internet and corrected for pixel bias by subtracting a value of 100 from each image. TRACE images were made during at least the first half of the event (but not the entire event) in three wavelengths: 171Å (171 Angstroms, far ultraviolet), 1,600Å (ultraviolet), and 5,000Å (white light). Combined with the PVSO, four wavelengths were available for study; to compare the appearance of Mercury and the Sun in each of these wavelengths, an image near mid-transit from each is presented in Figure 1. The TRACE white light (WL) images, centered at 5,000Å and unhindered by the turbulence of the Earth's atmosphere, show a grazing transit, where the planet, as seen from the vantage point of the satellite, did not penetrate deeper than about 1.0 arc-second, limb-to-limb. The estimated times of observed contacts for each filter are given in Table 1 and show how the times of contacts change with wavelength due to the varying heights of the solar atmosphere sampled in each filter. With shorter wavelength for these three channels only, the height of the solar limb increases, resulting in earlier ingress contact times and the planet's remaining on the solar disk longer.

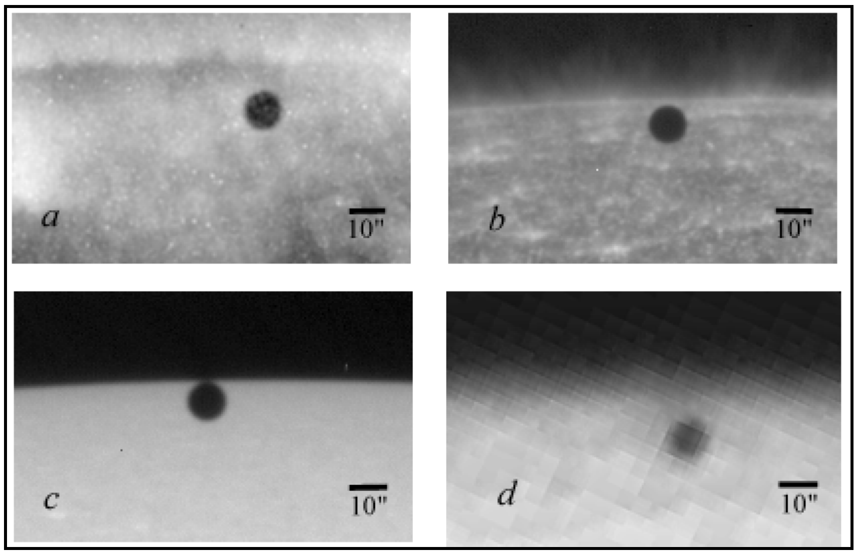


Figure 1. Mercury near mid-transit as imaged through the four wavelengths used in this paper. The PVSO H-alpha image was rotated to match the others, hence the striations. Each image was obtained at the following UT on 15 November 1999: (a) 171Å Far UV, 21:45:55, (b.) 1,600Å UV, 21:40:59, (c.) 5,000Å White Light, 21:41:38, (d.) 6,563Å Hydrogen-alpha (PVSO), 21:44.

Table 1: Approximate Times of Contacts I and II, as Inferred from TRACE Images

Wavelength	Contact I	Contact II	Contact III	Contact IV
6563 Å*	21:11:21	21:22:45	21:58:28	22:09:52
5000 Å	21:19:10	21:41:40	21:52:30	—
1600 Å	21:17:05	21:36:50	—	—
171 Å †	21:09:35	21:24:55	—	—

* Predicted contact times for Houston, Texas. (The predicted times of contacts I and II for PVSO are included for comparison and with the estimated times for TRACE.)

† Contact I was observed through significant noise from the Van Allen Radiation Belts.

As seen in hydrogen-alpha, the Sun has a double-limbed appearance, with the outer "limb" being considerably fainter than the inner limb. This is quite different from the single, sharp limb of the white-light Sun. Because of this difference, the Black Drop Effect did not appear obvious near contacts II and III when it was expected. This was also observed in H-alpha observations made at the George Observatory, located some 80 miles southeast of PVSO (Wilson, 2002, private communication). What was seen instead was a light gray band which appeared to extend from the disk of Mercury to the edge of the spicules throughout most of the event, as observed at PVSO. A closer look at the TRACE WL images also showed this effect throughout the

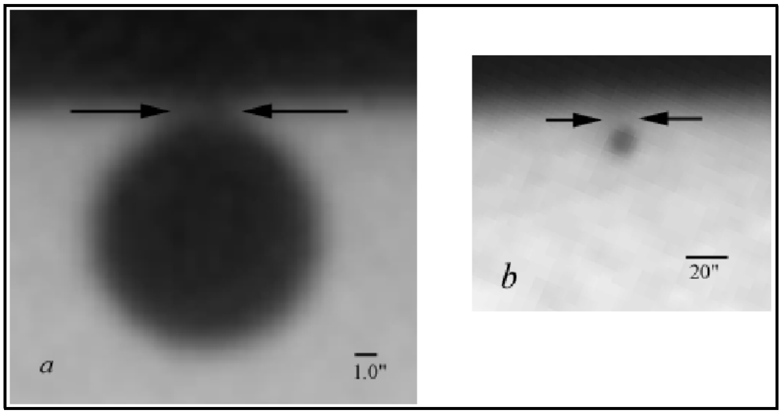


Figure 2: Images highlighting the Gray Drop effect as seen in H--alpha and WL. Arrows in each of the enlarged images draw attention to the shading of the effect. The scale of each image was optimized for maximum visual contrast of the gray drop.

transit. Other than the ghostly gray component of the black drop, little else was visible in the TRACE images. Due to the "double limbed" appearance, and/or lack of a sharp limb of the Sun as observed in three of the four wavelengths of this paper, the Black Drop phenomenon seemed to be much less obvious, even absent, as compared with broadband white-light imagery.

The "Gray Drop" Effect

Detailed study of Contact II showed that this occurred near the moment the classic Black Drop "faded" into what I call the "Gray Drop", due to its ghostly resemblance to its more prominent and well-known cousin. Figure 2 highlights the appearance of this phenomenon in two wavelengths, white light and hydrogen alpha. Just prior to this moment, the minimum intensity of the umbilicus (the "drop region") was dark enough to be perceived subjectively as a "black drop", with its non-zero measured value resulting primarily from stray light. After Contact II, stray light (known to be a key player in the visibility of the black drop effect) continued to play a role in maintaining the visibility of the gray drop phenomena. The limbs of the planet and Sun remained close enough together throughout the transit to allow the effects of scattered light (such as diffraction and light scatter caused by the instrument) to depress the intensity of the solar disk between the limbs enough to maintain the appearance of the gray drop. Between contacts III and IV, the events replay those which occurred between contacts I and II, but in reverse order. When the limbs are close enough to provide sufficient stray light interference, the intensity drops to near that of Mercury's disk, producing the apparent Black Drop.

During much of the transit, the Gray Drop phenomena appeared in the PVSO images as subtle shading joining the limbs of the Sun and Mercury, which were distinctly separated otherwise. In this particular case, the effect was found to be caused by a defect in one of the collimating lenses of the telescope. Thus, the instrumental component of stray light was a significant contributor to the total blurring, producing the PVSO Gray Drop with a rather directional effect. In summary, light scatter from several sources is the responsible physical agent for the production of both black and gray drops, with both being two components of one and the same effect. The "grayness" of the black and gray drop was measured to vary continuously throughout the transit due to the grazing incidence of the planet and the close proximity of the limbs.

In contrast with the TRACE white light images, no sign of the black and gray drop effects was seen with the TRACE 171 Å and the 1600 Å images. The TRACE channels at shorter wavelengths sample the higher regions of the solar atmosphere, resulting in the limb of the Sun appearing "higher" in the 1,600 Å and 171 Å images. The end result of the "higher" limb is the fact that Mercury appears to move deeper inside the apparent solar disk, for a longer period of time, thereby increasing the mid-transit limb-to-limb separation. Also, the limb of the Sun does not appear sharp against the black backdrop of space in these images, but rather as a margin bordering an illuminated background. It seems that without a sharp edge bordering black (or near-black), the visibility of the black- and gray-drop effects is greatly reduced or eliminated.

Conclusions and Discussions

The Black and Gray Drops have the same physical origin, and just as the terms (umbra and penumbra) describing both components of the shadow of an extended object depict two parts of the same physical phenomena, so it is with the Black Drop. The latter is used to distinguish the subtler component of the umbilicus from the more obvious component. The Gray Drop is observable immediately after the disappearance of the Black Drop, and the 1999 grazing transit of Mercury provided favorable conditions to observe this subtle effect, due to the slow ingress and egress of the planet. It is also shown that the end of the Black Drop, traditionally known as second contact, by definition, is actually a smooth transition from "black" to "gray", thus making the determination of the times of contacts II and III rather subjective. Brahde (1972) and Maltby (1971) argue that stray light is the sole cause of the black and gray drop; this was certainly the case with the Prairie View Solar Observatory images and also for the TRACE white light images. The PVSO observations included a significant contribution of stray light by the high-airmass atmosphere and instrumental scattering arising from a damaged collimator lens. Atmospheric effects did not plague the TRACE observations; the (much less significant) stray light contribution resulted from a combination of instrumental scattering and blurring from diffraction effects.

With these results in mind, we turn to future planetary transit events. An item of interest is the June 2004 transit of Venus. Unlike Mercury, which is virtually airless, Venus has a thick atmosphere that extends several hundred kilometers into space. Does the presence of the atmosphere increase the visibility of the black- and gray-drops? Most scientists do not think so, but it may be possible that with the assistance of certain absorbing filters, the atmosphere of Venus may increase the Black Drop's visibility as viewed from space. Certain broadband filters as well as narrowband filters centered on spectral lines corresponding to primary constituents of the upper atmosphere of Venus may absorb enough sunlight to increase the visibility of the gray and black drops. From Earth-based observatories, however, scattering of light by atmospheric seeing is the dominant mechanism of producing the Black Drop, which would likely drown out any effects that may be provided by Venus itself-even with the above-mentioned filters. However, it may be interesting to try to observe the black and gray drops through various filters, seeing if there are any changes in visibility with changes of filters.

Other interesting transit-related effects that may be observed by both ground- and space-based observatories include the refraction of sunlight by the atmosphere of Venus around the disk of the ingressing or egressing planet to form a ring (again, multiwavelength observations are encouraged here). A close watch of this should provide some interesting results with regards to the optical effects of planetary transits under different circumstances, and for an airless planet (Mercury, previous and future transits) versus one with a thick atmosphere.

One can also use a transiting planet as a knife-edge to measure very fine solar features, on the order of 10 km, with high-sped equipment (Hyder 1969). Other solar features such as prominence threads and spicules, and favorably placed photospheric and chromospheric fine structures, observed in multiple wavelengths near the first and fourth contact, are attainable. Measurements of both ingress and egress are useful to gauge any possible short-term changes in the sizes of the structures measured. The disadvantage of using Mercury is that the probability of the planet's crossing a desired feature is low. Hyder's suggestions can be easily done within the amateur community, and they provide a stimulus to promote professional-amateur collaboration. Tables 2 and 3 list the upcoming transits of Mercury and Venus for reference.

In summary, many observing projects dealing with planetary transits are worth pursuing, not limited to the few introduced above. Although the observations described in this paper were obtained from a professional observatory, the equipment and techniques are well within the capabilities of much of the amateur astronomical community. Further study of the black and gray drop effects for transits is strongly encouraged, especially in multiple wavelengths. High-resolution studies, both spatially and temporally, of contacts II and III are strongly recommended as well. Videotapes at the highest resolution attainable for a given site with a properly filtered scope are encouraged. I am especially interested in the evolution of the black / gray drop effect and how this varies from Calcium-K to Hydrogen-Alpha, to white light to near-infrared (such as a W87C filter would provide). I have argued that the Gray Drop and the Black Drop are two manifestations of the same phenomena, with the terms "black" and "gray" being somewhat relative given the continuous variation of the intensity of the umbilicus during and just after contact II and just before and during contact III. Further, more detailed studies of these effects may reveal more insight into their visibility in the past and provide a greater understanding into the factors that determine their appearances.

Table 2: Transits of Mercury: 1970-2050

Date	UT	Separation*
1970 May 09	08:16	114"
1973 Nov. 10	10:32	26"
1986 Nov. 13	04:07	471"
1993 Nov. 06	03:57	927"
1999 Nov. 15	21:41	963"
2003 May 07	07:52	708"
2006 Nov. 08	21:41	423"
2016 May 09	14:57	319"
2019 Nov. 11	15:20	76"
2032 Nov. 13	08:54	572"
2039 Nov. 07	08:46	822"
2049 May 07	14:24	512"

* "Separation" is the distance between the centers of the Sun and Mercury

Table 3: Transits of Venus: 1639-2012

Date	UT of mid-transit
1639 Dec. 4	18h
1761 June 6	5h
1769 June 3-4	22h
1874 Dec. 9	4h
1882 Dec. 6	17h
2004 June 8	8h19m (min. sep. of centers 625")
2012 June 5-6	1h35m (min. sep. of centers 552")

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ALPO Feature:
Classifications of Meteorites

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Introduction

Research and collecting of meteorites is a field that has grown tremendously, especially private collecting. *U.S. News & World Report* noted in its February 1, 1999 issue ("Forget Beanie Babies, these rocks are hot!", p. 50) that meteorites have become the next collectable. Meteorites — especially those that are known to have come from the Moon and Mars — continue to bring in record proceeds. The article also notes that "the craze to own space rocks and resulting price inflation aren't likely to end soon."

Those of us involved in solar system observing will often own at least a meteorite or two. The general public is fascinated by meteorites and enjoys the opportunity to see and even hold one. This is another way to get people excited about what we do as observers.

Types of Meteorites

Meteorites are classified into three basic categories: **irons**, **stones**, and **stony irons**. One important fact to keep in mind is that the vast majority of all meteorites are **magnetic**. Those who work in the field searching for meteorites keep a magnet handy. This is always the first test; if the suspect is not magnetic, it is nearly always a **meteorwrong**! Researchers and collectors learn quickly how to identify meteorwrongs since the purchase of what may be represented as a very rare stone meteorite at $200 a gram could turn out to be an expensive piece of junk.

Over the years, the classic meteorwrong is a specimen known as a Cumberlandite. For years, Cumberlandites have been found in Rhode Island, originating from an outcrop in Cumberland, Iron Mine Hill. Cumberlandites are igneous rocks and are still being offered for sale as meteorites.

There are four major visual clues in recognizing a meteorite:

1. It attracts a magnet due to the fact that the meteorite contains metallic iron.

2. It has an usually dark, thin, melted surface layer called a **fusion crust**, due to the melting of minerals on the meteorite's surface during the plunge through the earth's atmosphere.

3. It exhibits an aerodynamic shape acquired during the high speed flight.

4. Its surface is covered with thumbprint–shaped indentations called **regmaglypts**, made during the entry through the atmosphere.

It is possible to have a meteorite that does not exhibit some of the major traits. For example, a stone meteorite that has been severely weathered might not show a fusion crust, regmaglypts, or aerodynamic shaping.

Figure 1: Gibeon meteorite, machined into an 882-gram sphere and etched, showing the Widmannstatten pattern. Note the magnet-a tool most meteorite collectors keep nearby. (Photo taken by David Sisson)

Figure 2: The author with the Goose Lake Meteorite, an iron medium octahedrite (IAB), Smithsonian Institution's National Museum of Natural History. Earle Lindsley, Director of Chabot Observatory, recovered the meteorite in 1937. (Photo taken by Jose Olivarez)

Table 1: Types of Octahedrites

Octahedrite Type	Width of Band	Availability
Coarsest	greater than 3.3 mm	rare
Coarse	1.3 to 3.3 mm	common
Medium	0.5 to 1.3 mm	most common
Fine	0.2 to 0.5 mm	common
Finest	less than 0.2 mm	rare

Iron meteorites are the easiest class to identify because of their density and metallic nature. The most durable of all meteorites, it is also the most likely to be collected first. Many collectors started as children when a small iron meteorite chip was purchased from a museum gift shop. However, iron meteorites make up only about 10% of all meteorite falls.

Iron Meteorites

Iron meteorites, or "irons" as they are commonly known, are actually a combination of iron, nickel, and cobalt. Iron is the predominant metal, with 5% up to 50% nickel (as an alloy with iron in most iron meteorites), and a trace of cobalt. Iron meteorites are divided into three basic groups. These groups depend on the iron-nickel ratio and the rate at which their parent body originally cooled: Hexahedrites, Octahedrites, and Ataxites.

Figure 4: A 138-gram slice of the famous Stony-Iron pallasite (PAL) Imilac meteorite from the Atacoma Desert, Chile. (Photo taken by Dr. Mike Reynolds)

Hexahedrites

The word "hexahedrite" comes from the type of crystalline form, a hexahedron or six-sided crystal. Hexahedrites contain large, hexahedron crystals of kamacite. Kamacite is an iron-nickel crystal containing iron and up to 7.5% nickel. Other elements also often found in minute quantities include carbon, chromium, cobalt, phosphorous, silicon, and sulfur.

Octahedrites

Octahedrite, like hexahedrite, comes from the fact that they contain octahedron, or eight-sided crystals. In addition to the iron and nickel matrix. Octahedrites also can contain chromite, cohenite, diamond, and schreibersite, along with nodules of graphite and troilite, which are often surrounded by kamacite. Kamacite is an iron-nickel metal alloy up to 7.5% nickel.

Octahedrites are divided into several groups, depending on the iron-to-nickel ratio. These groups are Finest, Fine, Medium, Coarse, and Coarsest.

People will often ask how one knows for certain that a particular magnetic rock is a meteorite. Octahedrites produce a crystalline pattern of lines after being cut, polished and etched with a weak solution of

Figure 3: Mars Rocks-on Earth! Left: a 3.6-g Zagami from Nigeria. Right: a 2.128-g Dar al Gani from Libya. These two specimens, both stony achondrite Shergottites (SNC), together are valued at well over $2,000. (Photo taken by David Sisson)

Figure 5: Some of the stones from the Juanchenge, China fall in 1997. Juanchenge is an ordinary stone chondrite (H5). (Photo taken by Dr. Mike Reynolds)

nitric acid. These patterns are called the **Widmannstatten Pattern,** after its discoverer, Count Alois von Widmannstatten, a porcelain manufacturer from Vienna, Austria. Widmannstatten described the pattern in 1808. The Widmannstatten Pattern is unique to iron meteorites and is due to the broad kamacite bands sandwiched between narrow taenite bands. These bands are parallel to the octahedron's pairs of faces.

During the acid etching procedure, the kamacite bands, which are nickel-poor, are more altered by the acid than the nickel-rich taenite bands. This produces a look that is somewhat relief-like — an almost 3-dimensional effect — in structure. The Widmannstatten Pattern is not found in any Earth rocks, nor can it be replicated in laboratories on Earth, making it a major clue in confirming a specimen as an Octahedrite.

Figure 6: The Brenham pallasite was found in Brenham, Kiowa County, Kansas, USA, in 1882. This photograph shows a 3kg+ Brenham endpiece. (Photo source:http://www.meteorlab.com/METEORLAB2001dev/brenham.htm

Widmannstatten band width depends on the meteorite's asteroidal source. Big asteroids cooled more slowly than smaller asteroids. The slower the cooling, the thicker the crystals.

Hexahedrites also can produce a series of lines or bands, called **Neumann Lines**, named for its discoverer, Johann Neumann, who detailed them in 1848. These are a very fine series of lines, sometimes crossing each other. Neumann Lines, much like the Widmannstatten Pattern, are seen when the sample is cut, polished and acid-etched. However, the reason for Neumann Lines is that the sample experienced higher pressures and temperatures than Octahedrites.

The grouping of Octahedrites, from Finest to Coarsest, is determined by the width of the band or line in the Octahedrite's Widmannstatten Pattern.

It is interesting to note that Coarsest Octahedrites, even though rare, relatively speaking, are considered "rusters". Researchers and collectors can see these specimens literally fall apart into a pile of rust while sitting in their collection. This unfortunate event can occur even in low-humidity environments. Therefore, proper specimen selection and purchase, preparation, and storage are paramount.

Ataxites

Ataxites are also called Silicated Irons. This class of irons contains significant amounts of nickel, forming a unique nickel–iron alloy. Also Ataxites do not exhibit Neumann Lines or Widmannstatten Pattern when cut, polished and etched with nitric acid.

Stone Meteorites

Stone meteorites, also called "stony meteorites" or "Stones," make up over 94% of observed falls. They are mostly believed to be material from the crust and mantle of asteroids. A few stony meteorites are thought to be from comets. Stone meteorites contain approximately 75% to 90% silicate materials, such as olivine and pyroxene. Olivine and pyroxene are types of silicate minerals, which contain silicon, oxygen, and one or more metals. The majority of Stones also

Figure 7: Two samples of Millbillillie, an Australian stone achondrite (EUC). Note the lines on the right-hand sample, indicating the ground level where the meteorite was buried. (Photo taken by Dr. Mike Reynolds)

contain an iron-nickel alloy. There are two major groups of Stones: Chondrites and Achondrites.

Chondrites

Chondrites are so named due to the fact that they contain small spherical crystals of minerals such as olivine and pyroxene imbedded in the stony material, called **chondrules**. Edward Howard and Jacques–Louis Comte de Bournon first described chondrules in 1802. The term "chondrules" comes from the Greek "chondros," meaning a grain of seed. Chondrules are (approximately) millimeter-sized spheroids.

Chondrites can be as porous as sandstone and can be easy to break or crush. There are several subgroups of chondrites.

- Amphoteries or LL Chondrites — Contain very little iron ("LL" stands for low iron and low metal); these tend to be composed of fragmented rock.

- Carbonaceous or C Chondrites — Contain organic compounds. Carbonaceous Chondrites are very rare, contain little metal, exhibit well-defined chondrules, and tend to have a black to gray matrix. There are four subclasses of Carbonaceous Chondrites (C1 through C4) depending on their composition and state of alteration.

- Enstatite or E Chondrites — Contain the silicate enstatite, an iron-free pyroxene. Two subclasses (H and L) of Enstatite Chondrites are dependent on iron content. Enstatite Chondrites are very rare.

- Olivine-Bronzite or H Chondrites — The most abundant class of meteorites, contains a high degree of iron (thus the "H" Chondrite) both in metal flakes and mineral form.

- Olivine-Hypersthene or L Chondrites — Contain less iron ("L" Chondrite) than Olivine-Bronzite Chondrites.

Some additional classes of Chondrites have been suggested, including B Chondrites (more that 50% iron-nickel alloy) and R Chondrites (highly oxidized, olivine-rich, and little iron-nickel alloy).

Achondrites

Achondrite meteorites are so named due to the lack of chondrules or metal flakes, but are rich in silicates. Achondrites are very rare, relatively speaking. Achondrites are believed to have undergone advanced geological processing on their parent bodies, such as lava or magma flows and impact breccias. There are also a number of Achondrite subgroups.

Figure 8: Sikhote-Alin, iron coarsest octahedrite (IIAB) meteorite that impacted in Russia in 1947. (Photo taken by David Sisson)

- Eucrites — The most abundant of the achondrites, these are calcium-rich basaltic meteorites, meaning they are like volcanic rocks. Eucrites are nevertheless chemically different from terrestrial basalt and appear to be from the asteroid Vesta.

- Diogenites —(Calcium-poor basaltic meteorites) are related to the Eucrites. They also appear to be from the asteroid Vesta.

- Aubrites — Calcium- and iron-poor meteorites consisting mostly of enstatite (Aubrites might be related to the Enstatite Chondrites).

- Ureilites — Calcium-poor meteorites, consisting mainly of olivine, pyroxene, and carbon in the form of either graphite, diamond, or lonsdaleite (a rare pure carbon mineral like diamond, but with a different crystal structure), as well as a significant amount of iron and nickel. Their parent source is highly debated today.

- Lunar meteorites — A small number of lunar meteorites have been recovered. Lunar meteorites are impact breccias, rocks formed by the re-welding of loose fragments that were shattered during impact events. Lunar meteorites may be identified by a fusion crust with slightly green hues and by a gray interior with angular inclusions of often-brighter materials. Lunar meteorites are believed to have been blasted off the Moon as ejecta from high-velocity impact events.

- SNC or Martian meteorites — A small number of meteorites are apparently from Mars. Martian meteorites are commonly referred to as the SNC meteorites after Shergotty, Nakhla, and Chassigny (the first three subgroups known). These Martian meteorite subgroups are distinguished on the basis of mineralogy, but all share characteristics which together point to a Martian origin.

There are a number of Achondrites that do not fit into any of the preceding groups or subgroups. Some are the only meteorite known of its kind.

Stony–Iron Meteorites

Stony-iron meteorites, or stony-irons, are mixtures of silicates and iron-nickel in roughly equal proportions. Only about 1% of all falls have been stony-irons. There are three main stony–iron groups: Pallasites, Mesosiderites, and Lodranites.

Pallasites

Pallasites, the most common stony-iron, consist of olivine crystals embedded in an iron-nickel alloy matrix. The olivine crystals can be as large as 10 millimeters across. Many consider pallasite sections as simply the most beautiful form of meteorite representation when they are cut and polished. Pallasites are believed to have been formed at their parent body's core-mantle boundary. The iron-nickel, octahedrite in nature, would have come from the core and the olivine from the mantle's base.

Mesosiderites

Exhibiting characteristics of multiple impacts, Mesosiderites, or "Mesos" as they are often called, are often referred to as the "wastebasket" form of meteorites. The iron–nickel alloy of Mesosiderites does not form a network as in the Pallasites, but instead forms grains and nodules of the alloy. Like Pallasites, the iron-nickel alloy exhibits the same properties as Octahedrites.

Lodranites

A very rare meteorite type, Lodranites, consists of roughly equal amounts of olivine, pyroxene, and iron-nickel alloy. Lodranites are coarse and easily broken.

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(Copies of Mike Reynolds' book on meteorites, Falling Stars, can be purchased at many local bookstores and museums. Or copies can be ordered directly from Mike for $12 plus $3 s/h; Mike will even autograph copies if desired! Payment can be made via check or through PayPal (astrogator90@aol.com); mail checks to 2347 Foxhaven Drive West, Jacksonville, FL 32224-2011.)

ALPO Feature:
The Spring Comets of 2004

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Observers are being presented with a great opportunity this spring, with not just one, but two bright naked-eye comets gracing our skies. In fact, observers in the Southern Hemisphere will have the very rare chance to see the comets simultaneously in the morning sky of late April and in the evening sky of late May. Such an opportunity has not occurred since the comets C/1618 V1 and C/1618 W1 were visible in the morning sky of late November of 1618.

Comet C/2001 Q4 (NEAT)

S. H. Pravdo, E. F. Helin, and K. J. Lawrence (Jet Propulsion Laboratory) announced that the 1.2-m Schmidt telescope at Palomar Observatory (California, USA) had found a comet on 2001 August 24.40 in the course of the Near Earth Asteroid Tracking (NEAT) program. The comet was found on CCD images and the astronomers were able to confirm the discovery on August 26 and 27. The comet was described as a round nebulosity measuring about 8 arc seconds across. The total magnitude was given as 20.0. Confirmations also came from other observatories on August 27 and these indicated a brighter total magnitude of 17.3 to 17.8.

This comet was first announced on IAU *Circular* No. 7695 (2001 August 28), when Daniel W. E. Green gave the discovery details, as well as a “very uncertain” orbit by Brian G. Marsden. The orbit indicated the comet might pass perihelion on 2005 August 25, with the closest distance to the Sun being just over 4 AU. The reason for the orbit's uncertainty was that the comet was moving very slowly due to its rather great distance from the Sun. Marsden's orbit indicated the comet was probably over 11 AU from the Sun when discovered. Kazuo Kinoshita published an orbit for this comet on his website on September 5. This orbit used 25 positions spanning the period of August 24 to 31 and indicated a perihelion date of 2004 May 23 and a perihelion distance of 0.99 AU. Such an orbit indicated a potentially bright apparition for this comet, but little excitement was generated as more observations were needed to firmly establish an orbit. Confirmation of Kinoshita's

Table 1: Ephemerides for Comet C/2001 Q4 (NEAT)

Date (UT)	R.A. (2000)	Decl.	Delta	r	Elong.	m1
2004 03 01	23 38.0	-66 05	1.85	1.59	59.1	6.9
2004 03 06	23 46.1	-65 48	1.75	1.53	60.5	6.6
2004 03 11	23 55.4	-65 36	1.64	1.47	62.1	6.3
2004 03 16	00 06.1	-65 30	1.53	1.41	63.9	6.0
2004 03 21	00 18.8	-65 31	1.41	1.35	65.8	5.6
2004 03 26	00 34.1	-65 36	1.28	1.30	67.9	5.3
2004 03 31	00 53.0	-65 47	1.16	1.24	70.0	4.9
2004 04 05	01 17.2	-65 58	1.02	1.19	72.2	4.4
2004 04 10	01 49.2	-66 03	0.89	1.15	74.3	3.9
2004 04 15	02 32.6	-65 39	0.75	1.10	76.2	3.4
2004 04 20	03 30.9	-63 57	0.62	1.06	77.8	2.7
2004 04 25	04 43.4	-59 07	0.49	1.03	78.6	2.2
2004 04 30	05 59.7	-47 50	0.39	1.00	78.1	1.5
2004 05 05	07 05.8	-27 05	0.33	0.98	75.8	1.1
2004 05 10	07 55.9	-01 30	0.34	0.97	73.2	1.0
2004 05 15	08 32.0	+18 22	0.42	0.96	71.3	1.4
2004 05 20	08 58.3	+30 40	0.53	0.96	69.6	2.0
2004 05 25	09 17.9	+38 13	0.66	0.97	67.6	2.5
2004 05 30	09 32.9	+43 08	0.79	0.99	65.4	3.0
2004 06 04	09 45.0	+46 32	0.93	1.02	63.1	3.4
2004 06 09	09 55.1	+49 02	1.06	1.05	60.8	3.8
2004 06 14	10 04.0	+50 57	1.18	1.09	58.7	4.2
2004 06 19	10 12.0	+52 28	1.30	1.13	56.6	4.6
2004 06 24	10 19.6	+53 43	1.42	1.17	54.8	5.0
2004 06 29	10 27.0	+54 46	1.52	1.22	53.2	5.3

NOTE: In the table headers:
Date (UT) = Year, Month, and Day for 0 hours Universal Time
RA & Decl = Right Ascension and Declination for epoch 2000.0
Delta & r = the comet-Earth and comet-Sun distances, respectively in astronomical units (au)
Elong. = the angular distance from the Sun as seen from Earth
m1 = the predicted magnitude or brightness of the comet

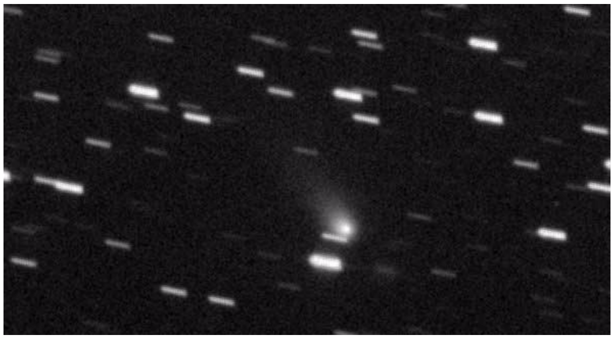

Figure 1: Closeup of C/2001 Q4 on August 26.77 UT, 2003 at 1.8 arc sec per pixel using a Tak E160. Image is 35 minutes exposure, with DDP processing and a slight median filter applied to clean up noise. Estimated magnitude was mag 11.9 (CCD USNO R mag) with west at top and south to right. The tail can be traced 7 arc minutes in PA 310×. Copyright © 2003 by Terry Lovejoy (Australia) Source: http://cometography.com/lcomets/2001q4.html

calculations came on September 10, when IAU *Circular* No. 7711 included new positions, as well as an orbit by Green which was based on 38 positions from the period of August 24 to September 10. This orbit indicated a perihelion date of 2004 May 26 and a perihelion distance of 1.00 AU. Green wrote that the perihelion date "is still uncertain by several weeks, but it appears that this comet may become an easy binocular (and possibly naked-eye) object in May-June 2004." The orbit ultimately proved to be hyperbolic with a perihelion date of May 15.95, which indicated the comet was discovered when 10.1 AU from the Sun.

The comet slowly brightened during the remainder of 2001 and throughout 2002. As 2003 began, the comet was still fainter than magnitude 15, but it steadily brightened as the year progressed, reaching mag. 14 near the end of May, mag. 13 early in July, and mag. 12 around mid-September. September of 2003 also marked the time that amateur astronomers in the Southern Hemisphere began supplying regular visual observations of this comet. The coma diameter was typically given as 0.6 to 1.2 arc minutes during September. CCD images by amateurs first revealed a short fan-shaped tail pointing northward in July. By late September, this tail extended about 0.8 arc minutes toward the northwest. As 2003 came to an end, the comet had become slightly brighter than magnitude 10, with a coma diameter of about 2 arc minutes. A faint, fan-shaped tail extended about 4 arc minutes toward the east.

The comet should be at its brightest during the first half of May. The Central Bureau for Astronomical Telegrams, which is the official clearing house for comet information, predicts a maximum magnitude of 0.9, although their brightness parameters have not been updated in many months. Several experienced amateur astronomers are keeping close tabs on this comet. Andreas Kammerer (Germany) looked at all available observations obtained up to the end of November 2003, and suggests the comet's total magnitude may reach 2. Seiichi Yoshida (Japan) indicated during the last days of 2003 that the maximum brightness might reach 2; however, he noted that observations during December showed the comet

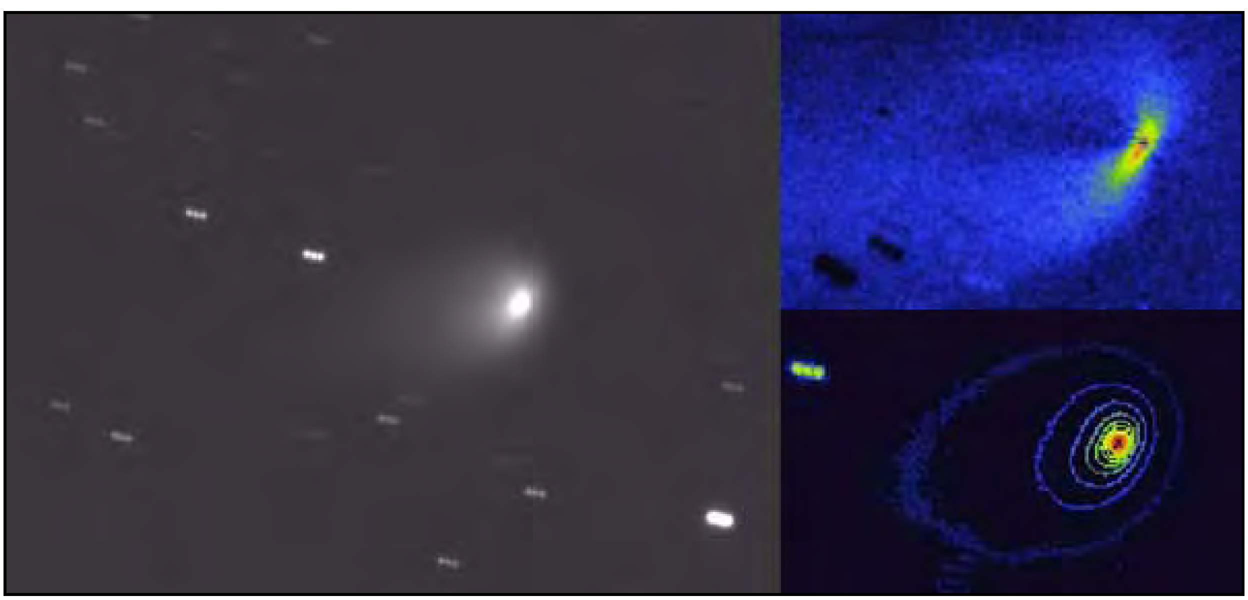

Figure 2: Image by G. Masi and F. Mallia using a 0.81-m, f/7 telescope and a CCD camera on 2003 November 29.25. It is a combination of three 1-minute exposures. The B&W image was log scaled; on the right: the upper image shows the application of the Larson-Sekanina gradient to better investigate the activity in the inner coma, while the bottom panel shows isophotes, calculated on the log-scaled image.Copyright © 2003 by Gianluca Masi and Franco Mallia (Campo Catino Astronomical Observatory, Italy) Source: http://cometography.com/lcomets/2002t7.html

Table 2: Ephemerides for Comet C/2002 T7 (LINEAR)

Date (UT)	R.A. (2000)	Decl.	Delta	r	Elong.	m1
2004 03 01	00 07.3	+12 37	2.02	1.23	28.1	6.6
2004 03 06	00 05.6	+12 02	2.00	1.16	22.8	6.3
2004 03 11	00 04.0	+11 28	1.98	1.08	17.9	6.0
2004 03 16	00 02.3	+10 53	1.94	1.00	13.4	5.7
2004 03 21	00 00.6	+10 17	1.89	0.93	10.0	5.3
2004 03 26	23 58.8	+09 38	1.83	0.86	9.2	4.8
2004 03 31	23 56.9	+08 54	1.74	0.79	11.4	4.4
2004 04 05	23 54.9	+08 04	1.64	0.73	15.5	3.9
2004 04 10	23 53.3	+07 07	1.52	0.68	20.4	3.4
2004 04 15	23 52.2	+05 59	1.38	0.64	25.4	3.0
2004 04 20	23 52.6	+04 39	1.22	0.62	30.4	2.5
2004 04 25	23 55.7	+03 04	1.04	0.62	35.0	2.2
2004 04 30	00 03.6	+01 05	0.85	0.63	38.7	1.9
2004 05 05	00 20.5	-01 34	0.66	0.67	40.8	1.5
2004 05 10	00 55.9	-05 40	0.48	0.72	40.2	1.1
2004 05 15	02 16.6	-12 43	0.32	0.77	36.2	0.6
2004 05 20	05 02.5	-19 57	0.27	0.84	43.9	0.6
2004 05 25	07 33.5	-17 44	0.35	0.91	63.4	1.5
2004 05 30	08 44.1	-13 50	0.52	0.98	72.0	2.7
2004 06 04	09 18.5	-11 22	0.70	1.06	74.1	3.7
2004 06 09	09 38.5	-09 49	0.88	1.14	73.4	4.5
2004 06 14	09 51.8	-08 50	1.07	1.22	71.4	5.2
2004 06 19	10 01.6	-08 10	1.25	1.29	68.8	5.8
2004 06 24	10 09.4	-07 44	1.43	1.37	65.8	6.3
2004 06 29	10 15.9	-07 28	1.60	1.45	62.5	6.9

NOTE: In the table headers:
Date (UT) = Year, Month, and Day for 0 hours Universal Time
RA & Decl = Right Ascension and Declination for epoch 2000.0
Delta & r = the comet-Earth and comet-Sun distances, respectively in astronomical units (au)
Elong. = the angular distance from the Sun as seen from Earth
m1 = the predicted magnitude or brightness of the comet

already brighter than predicted and suggested a maximum brightness of 1 during the early days of May 2004.

Comet C/2002 T7 (LINEAR)

The Lincoln Near-Earth Asteroid Research (LINEAR) survey announced the discovery of an asteroidal object on images obtained on 2002 October 14.42. The magnitude was given as 17.5. Several observatories obtained follow-up observations as October progressed. Interestingly, P. Birtwhistle (Great Shefford, U.K.) noted that CCD images obtained with a 0.3-m Schmidt-Cassegrain on October 28.0 revealed that the actual comet appeared "softer" than nearby stars of similar brightness. T. B. Spahr (Whipple Observatory, Mt. Hopkins) obtained CCD images with a 1.2-m reflector on October 29.4 and noted the object appeared "very slightly diffuse" with a total magnitude of 17. IAU Circular No. 8003 (2002 October 29) announced that this object was really a comet. Prediscovery observations were found on LINEAR images obtained on October 12.

The first published orbit came on IAU *Circular* No. 8003 (2002 October 29). B. G. Marsden (Central Bureau for Astronomical Telegrams) took 88 positions spanning the period of October 12 to 29, and calculated a parabolic orbit with a perihelion date of 2004 April 23.69. Ultimately, the comet proved to be moving in a hyperbolic orbit, with a perihelion date of April 23.06.

The comet slowly brightened during 2003, although the pace quickened during the last couple of months of the year. Magnitude estimates were near 14 during February and March, and finally reached 13 at the end of August. More and more observers began following the comet starting in October, when the comet surpassed magnitude 12. As the year came to a close the brightness had nearly reached magnitude 8, while the coma was typically estimated as between 4 and 6 arc minutes.

As 2003 came to a close, several predictions were offered as to how bright the comet would become during May of 2004. The Central Bureau for Astronomical Telegrams listed the brightest magnitude as 0.3 during May 17-19, although this has not been updated in some time. Yoshida indicates the maximum brightness would reach magnitude 1, although his own charts show that the comet has been running a little brighter than the predictions since October. Kammerer noted the apparent brightening of the comet beginning around mid-October and says the new trend indicated the comet could become brighter than magnitude 0 during May of 2004, although he points out that this brightening could be temporary.

As with previous comets, please send observations or photographs to the ALPO Comets Coordinator for analysis. If possible, please e-mail the images to me at the address kronk@amsmeteors.org. I am in the process of scanning ALPO comet photos submitted since the late 1970s, so they can be distributed on a CD-ROM.

ALPO Feature: The Moon
The Valentine Dome

By Eric Douglass, JALPO staff writer
e-mail to: ejdftd@mindspring.com

Introduction

The Valentine dome (Figure 1) is just to the east of the Caucasus Mountains, and west of crater Linné B. The dome is 30 km in its longest axis, and a variety of massifs are visualized on its surface. A number of authors have suggested the possibility of a rille on the surface of this dome. The purpose of this study is twofold: (1) to determine if a rille does cut across this dome, and (2) to define this dome's geology.

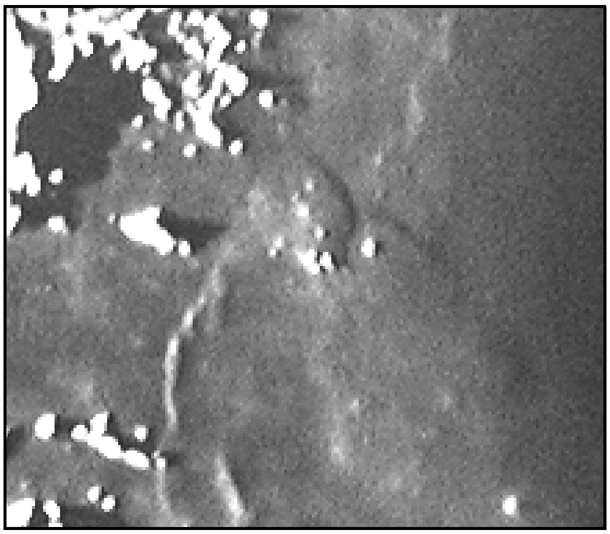

Figure 1: Consolidated Lunar Atlas, C11, Kuiper, G. (Lunar north at top, lunar east at right.)

Rilles

Straight rilles on the Moon are produced by stresses within the crust. One kind of 'rille-producing stress' is the near surface expression of a volcanic dike or sill (1). Here a volcanic melt tracks up a subsurface fault and stretches the overlying surface materials. If this stress is great enough, or fast enough, it will produce failure of the overlying layer, so creating a rille. One good example of this is the place where the northern end of Rima Birt bisects a volcanic dome. Because lunar domes are also produced by volcanic forces, it is not surprising that they two occasionally occur together.

A number of authors, using Earth-based observations, have drawn a rille running across the Valentine dome (Figure 2; Figure 3). However, these place the rille in different locations. Examination of Earth-based photography from many sources under different lightings didn't reveal the presence of these rilles (Table 1). This suggests that if a rille is present, it is a very difficult feature to observe. Next, examination of the Apollo imagery did not reveal the presence of a rille (Figure 4; note that the short "line" in the eastern section is further elucidated at the bottom right of the image, and this suggests a series of massifs, perhaps mixed wth small craters; however, one reviewer noted the similarity to endogenically produced craters). However, the Clementine imagery did reveal a rille that extends from a small unnamed crater (to the east of the dome itself) to both the east and west (Figure 5; for orientation: 'A' marks the three massifs at the southern edge of the dome, and 'B' the massif to the east of the dome; 'C' marks the crater mentioned in the text). This rille does correspond to the rille identified in the geologic map of this quadrant (Figure 3).

The illusion of other rilles is likely produced by the following mechanisms: (A) the prominences on the surface of the dome may create line shadows at very low sun angles; (B) the prominences on the surface appear to line up as a rille; and (C) the mare ridges from the southeast and the southwest may trick the eye to seeing their shadows as going onto the dome itself.

My conclusion is that a rille does cross the Valentine dome, but that it is very difficult to observe from Earth, and that the local geology often creates impressions of non-existent rilles.

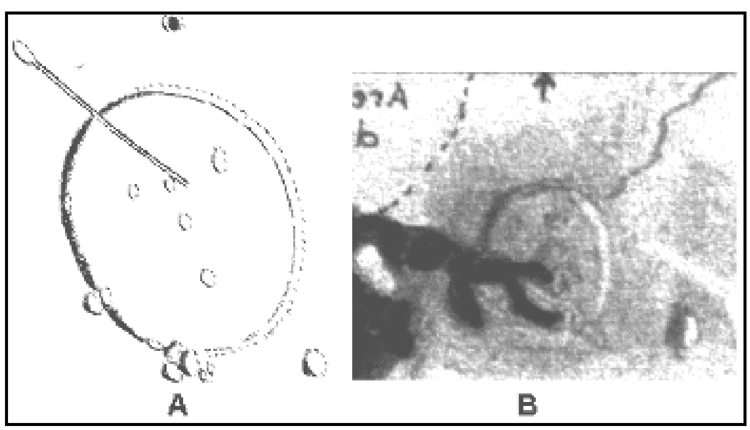

Figure 2A: Drawing by D. Arthur; *The Journal of the Biritsh Astronomical Association*, Vol 70, No. 7, Sept 1960, p. 301 (Copyright BAA; used with permission). No date/colongitude provided. (Lunar north at top, lunar east at right.) Figure 2B: Drawing by Daniel del Valle; December 2, 2000 at 22:49 UT. Used by permission.

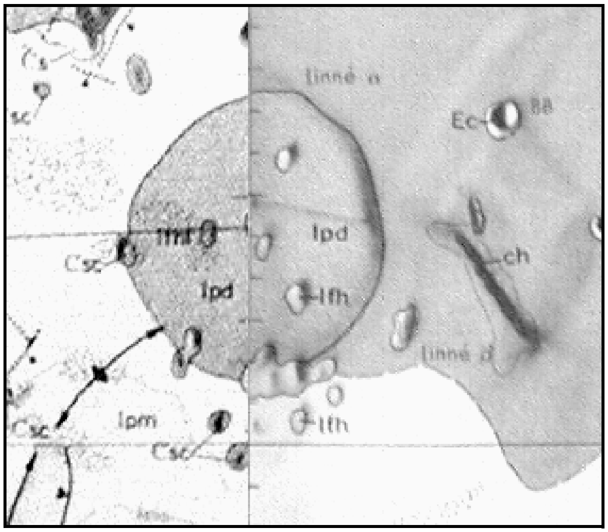

Figure 3: Left side: Hackman, R. Geologic Map of the Montes Apenninus Region of the Moon; *United States Geological Survey*, 1966. Right side: Carr, M. Geologic Map of the Mare Serenitatis Region of the Moon; *United States Geological Survey*, 1966. (Lunar north at top, lunar east at right.)

Rille Geology

In the Clementine imagery (Figure 5), a rille crosses the dome. This rille begins in an oblong crater, with the western aspect of the rille being straight to curvilinear, and the eastern aspect of the rille being sinuous. The Moon has numerous rilles that begin in oblong depressions (ref. 2; e.g., Hadley Rille), these being especially of the sinuous type. Here the interpretation is that the depression is the source vent, and the sinuous rille is the lava channel for that magma. However more nearly linear rilles occasionally originate in depressions (e.g., rilles in Alphonsus, Rima Birt). Here the interpretation is that a dike remained subsurface, stressing the surface layers to form the rille (1), but gaining surface access at the depression. In the current feature, the depression connects both kinds of rilles, and the exact relationship between the two is more complex. Given the geology of the present area, I would suggest that a dike arose in one of the faults caused by the Imbrium impact (it is radial to that basin). As this neared the surface, it produced sufficient stress to cause failure of the overlying rock (western portion of the rille). Under pressure, the magma did reach the surface at a point of weakness, forming both the depression and the subsequent lava channel (eastern portion).

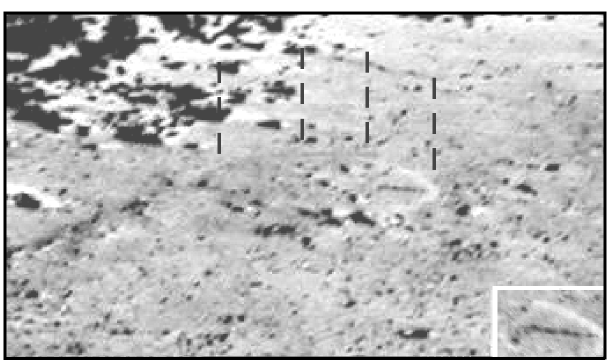

Figure 4: Masursky, H., Colton, G., and El-Baz, F. Apollo Over the Moon: A View From Orbit. NASA Sp 362. Washington: U.S. Government Printing Office, 1978; p. 41. Inset: Apollo image: AS17-0954. (Lunar north at top, lunar east at right.)

Dome Geology

The origin of lunar domes is clearly volcanic, though the exact mechanism of formation is debated. In the Moon's mantle, radioactive elements decayed, producing enough heat to melt the minerals olivine and pyroxene (3). As these were lower in density than the surrounding rocks, these magmas ascended as diapirs (defined as a magma unit that pierces rock layers as it ascends). As the magmas approached the surface, they took a variety of courses. The more massive magmas erupted from fissures to flood the basin floors. However, magmas under less pressure could

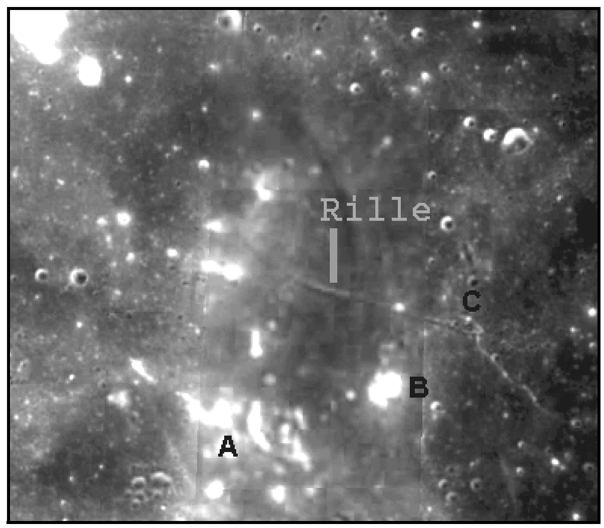

Figure 5: Clementine Imagery; Digital Image Model, UVVIS 750-nm basemap; NASA. (Lunar north at top, lunar east at right.)

either erupt at a slower rate or remain as an intrusion in the crust. The former circumstance produced domes, as the slower eruption rate allowed lava to cool on time-scales for low shield volcanoes to form. Domes with endogenic summit craters formed in this way, and the summit crater is a result of collapse within the central vent after the supporting magma withdrew. The latter circumstance, that of a subsurface volcanic intrusion, may also have produced domes. Here the intrusion produced pressure on surface layers, arching them up into domes (4). In this scenario, domes are laccoliths that didn't cause failure of the surface layers. Domes of this type do not have summit craters. Note, however, that domes without summit craters may form by either scenario, as the

Figure 6: *Consolidated Lunar Atlas*; Kuiper, G. (Lunar north at top, lunar east at right.)

lava of many extrusive domes solidified in the vent as a lava plug. Thus, for many domes, it is impossible to identity the exact mechanism involved in their formation.

The Valentine dome lacks a summit crater, placing it in this ambiguous category. However, the images offer another clue. While most lunar domes have angles of inclination around 2-4 degrees (ref. 5; see example of inclined dome in Figure 6), the top of this Valentine dome in nearly flat (none of the images collected showed a clear angle of inclination across the top of this dome; also see Figure 4). This suggests that the rising lava did not build up the dome through a series of flows, as this would have produced a gradual inclination at the vent. Rather this dome more likely formed by the rising lava collecting in a subsurface pocket. Here it spread laterally, stressing the surface layers into the present form. Thus, this dome is more likely a 'laccolith' with even lateral spread and relaxation of uplift in the central region.

A final interesting feature of this dome is the many small areas of positive relief on its surface. These appear to have wide bases that decrease in diameter to the summit. Given their genetic association with a lava structure, these most likely represent places where magma gained access to the surface, producing either tumuli or cinder cones (6).

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6. Mursky (Mursky, G. *Introduction to Planetary Volcanism*. Upper Saddle River: Prentice Hall, 1996; p. 165) and the Basaltic Volcanism project members (Basaltic Project Members. Basaltic Volcanism on the Terrestrial Planets; New York: Pergamon Press, 1981; p. 757) state that cinder cones may be up to 3 km in diameter.

Table 1: Source Atlas Details

Source Atlas	Author	Identifying Number	Colongitude
Photographic Atlas	Kuiper	C2D	159.1
Photographic Atlas	Kuiper	C3B	159.3
Photographic Atlas	Kuiper	C3D	159.7
Photographic Atlas	Kuiper	C3E	167.8
Consolidated Lunar Atlas	Kuiper	C11	167.3
Consolidated Lunar Atlas	Kuiper	C9	7.2
Consolidated Lunar Atlas	Kuiper	C8	155.6
Consolidated Lunar Atlas	Kuiper	B11	167.3
Consolidated Lunar Atlas	Kuiper	B9	3.0
Lunar Atlas	Alter	52A	160
New Photographic Atlas of the Moon	Kopal	Plate 16	166
Catalina Telescope	--	1403	351
Catalina Telescope	--	1512	3
Catalina Telescope	--	1821	357
Atlas of the Lunar Terminator (image from author)	Westfall	167^0-N	166.8
Images from J. Westfall	Westfall	--	353.8
Images from J. Westfall	Westfall	--	351.7
Images from J. Westfall	Westfall	--	351.2

ALPO Feature: Saturn

ALPO Observations During the 2001-2002 Apparition

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Peer Review by Dr. Richard K. Ulrich

Abstract

A very fine collection of 166 visual, photographic, and CCD observations of Saturn were submitted to the ALPO Saturn Section during the 2001-2002 apparition by 27 contributors residing in the United Kingdom, France, Germany, Singapore, Spain, Japan, Mexico, Puerto Rico, and the United States. The observations covered the period from 2001 July 21 through 2002 April 22, and the instruments used to record these data ranged in aperture from 9.0 cm. (3.5 in.) up to 50.8 cm. (20.0 in.). Of considerable interest during 2001-2002 were several occultations of Saturn by the Moon that occurred from 2001 September 10 through 2002 February 21, for which a few observations and images were submitted to the ALPO Saturn Section. Saturn observers reported sporadic dusky festoons and other transient dark spots among the belts and zones of Saturn's Southern Hemisphere during the apparition, as well as a few very diffuse, short-lived white areas in the Southern Equatorial Zone (EZs). Recurring central meridian (CM) transit timings were not reported, however, owing to the short duration of these discrete phenomena. The inclination of the ring system to Earth, **B**, reached a maximum value of –26°.459 on 2002 April 22, and consequently, observers enjoyed optimum views of Saturn's Southern Hemisphere and the South face of the rings during the apparition. Visual observations and alleged images of the curious bicolored aspect of the rings and azimuthal brightness asymmetries are discussed. Accompanying the report are references, drawings, photographs, CCD images, graphs, and tables.

Table 1: Geocentric Phenomena in Universal Time (UT)for Saturn During the 2001-2002 Apparition

Conjunction	2001	May	25d	13h
Stationary		Sep	27	03
Opposition		Dec	03	14
Stationary	2002	Feb	08	10
Conjunction		Jun	09	11

Opposition Data:	
Visual Magnitude	-0.40 (in constellation of Taurus)
B	-25°.904
B'	-26°.102
Globe	
Equatorial Diameter	20".57
Polar Diameter	18".94
Rings	
Major Axis	46".68
Minor Axis	20".39

Introduction

The following analysis was derived from 166 visual observations, photographs, and CCD images contributed by ALPO observers from 2001 July 21 through 2002 April 22, hereinafter referred to as the 2001-2002 apparition of Saturn or "observing season." Accompanying this discussion are several representative drawings, photographs, and CCD images. Note that all times and dates mentioned in this report are in Universal Time (UT).

Table 1 presents geocentric data in Universal Time (UT) for the 2001-2002 apparition of Saturn. During the observing season, the numerical value of **B**, or the saturnicentric latitude of the Earth referred to the ring plane (+ when north), ranged between the extremes of -25°.765 (2002 Jan 18) and -26°.459 (2002 April 22). The value of **B'**, the saturnicentric latitude of the Sun, ranged from -25×.469° (2001 July 21) and -26×.536° (2002 April 22).

Table 2 lists the 27 individuals who provided a total of 166 observations to the ALPO Saturn Section for the 2001-2002 apparition, along with their observing sites, number of observations, and telescope type and aperture.

Figure 1 is a histogram that shows the distribution of observations by month during the 2002-2002 observing season, and as in most apparitions, there was a greater tendancy for observers to study Saturn during the months inclusive of and immediately surrounding the date of opposition. To improve consistency of observational coverage, contributors are encouraged to keep Saturn under close surveillance from near the time it first emerges in the eastern sky before sunrise until it approaches conjunction with the Sun. Of the submitted observations, 43.98% were made before opposition, none on the precise date of opposition (2001 December 03), and 56.02% thereafter.

Table 2: 2001-2002 Apparition of Saturn: Contributing Observers

	Observer Location	No. of Observervations	Instrument
1.	Bates, Donald R. Houston, TX	2	25.4 cm. (10.0 in.) NEW
2.	Benton, Julius L. Wilmington Island, GA	37	15.2 cm. (6.0 in.) REF
3.	Berry, Peter Panama City, FL	1	15.2 cm. (6.0 in.) MAK
4.	Boisclair, Norman J. South Glens Falls, NY	6	9.0 cm. (3.5 in.) MAK 50.8 cm. (20.0 in.) NEW
5.	Crandall, Ed Winston-Salem, NC	5	25.4 cm. (10.0 in.) NEW
6.	Cudnik, Brian Houston, TX	2 2 2	25.4 cm. (10.0 in.) NEW 31.8 cm. (12.5 in.) NEW 35.6 cm.(14.0 in.) CAS
7.	del Valle, Daniel San Juan, Puerto Rico	18	20.3 cm. (8.0 in.) SCT
8.	Di Sciullo, Maruizio Coconut Creek, FL	1	25.4 cm. (10.0 in.) NEW
9.	Fink, Richard Brick, NJ	1	9.0 cm. (3.5 in.) MAK
10.	Gossett, Richard Roseville, NJ	2	20.3 cm. (8.0 in.) SCT
11.	Grafton, Ed Houston, TX	5	35.6 cm. (14.0 in.) SCT
12.	Haas, Walter H. Las Cruces, NM	1	15.2 cm. (6.0 in.) NEW 20.3 cm. (8.0 in.) NEW 31.8 cm. (12.5 in.) NEW
13.	Ikemura, Toshihiko Osaka, Japan	14	30.5 cm. (12.0 in.) NEW
14.	Kiss, Gabor Erkner, Germany	2	25.4 cm. (10.0 in.) NEW
15.	Leong, Tan Wei Singapore	2	28.0 cm. (11.0 in.) SCT
16.	Melillo, Frank J. Holtsville, NY	5	20.3 cm. (8.0 in.) SCT
17.	Miller, Dave Barberton, OH	1	25.4 cm. (10.0 in.) SCT
18.	Niechoy, Detlev Göttingen, West Germany	16	20.3 cm. (8.0 in.) SCT
19.	Parker, Donald C. Coral Gables, FL	3	40.6 cm. (16.0 in.) NEW
20.	Peach, Damian Norfolk, UK	2	30.5 cm. (12.0 in.) SCT
21.	Plante, Phil Braceville, OH	3	20.3 cm. (8.0 in.) SCT
22.	Roel, Eric Valle de Bravo, Mexico	2	25.4 cm. (10.0 in.) MAK
23.	Schmidt, Mark Racine, WI	1	35.6 cm. (14.0 in.) SCT
24.	Sherrod, Clay Little Rock, AR	4	30.5 cm. (12.0 in.) SCT
25.	Slauson, Doug Swisher, IA	1	23.5 cm. (9.0 in.) SCT
26.	Tobal, Tofol Barcelona, Spain	1	10.2 cm. (4.0 in.) REF
27.	Viladrich, Christian Paris, France	2	20.3 cm. (8.0 in.) MAK

Total No. Observations 166

Total No. Observers 27

REF = Refractor NEW = Newtonian SCT = Schmidt-Cassegrain
MAK= Maksutov CAS = Cassegrain

Figure 2 shows the ALPO Saturn Section observer base (total of 27) for 2001-2002, including the international distribution of the 166 observations that were contributed. During the apparition, the United States accounted for two-thirds (66.67%) of participating observers and nearly two-thirds (64.46%) of the contributed observations. With 33.33% of ALPO Saturn observers residing in the United Kingdom, France, Germany, Singapore, Spain, Japan, Mexico, and Puerto Rico, whose total contributions accounted for 35.54% of all the observations, it is evident that international cooperation in our programs continued satisfactorily during the 2001-2002 observing season.

Figure 3 is a pie chart depicting the number of observations by instrument type, where it can be seen that slightly more than half (56.63%) of the 166 total observations in 2001-2002 were made with telescopes of classical design (refractors, Cassegrains, and Newtonians). Such instruments, when properly collimated, often produce superior resolution and image contrast, and they are frequently the telescopes of choice for detailed studies of the Moon and planets. Telescopes with apertures $\geq$15.2 cm. (6.0 in.) accounted for 95.18% of the observations submitted during the 2001-2002 apparition. Readers are reminded, however, that smaller apertures of good quality in the range of 7.5 cm. (3.0 in.) to 12.8 cm. (5.0 in.) are still extremely useful for observing the planet Saturn.

The writer wishes to thank all of the dedicated individuals mentioned in *Table 2* who sent their observational reports to the ALPO Saturn Section in 2001-2002. Observers everywhere who want to become involved in systematic studies of Saturn using visual methods (drawings and intensity estimates), photography, and more sophisticated techniques employing CCD's and video cameras, are warmly encouraged to join us in the future as we attempt to maintain an international, comprehensive surveillance of the planet. Readers should note that the ALPO Saturn Section considers all methods of recording observations mentioned above as vital to the success of our programs, regardless of whether one's preference might be sketching Saturn at the eyepiece or simply writing descriptive reports, making visual numerical relative intensity estimates, doing photography, or pursuing CCD imaging and videography. Novice observers are also urged to contribute their work, and both the ALPO Training Program and the Saturn Section will always be delighted provide assistance in getting started.

The Globe of Saturn

The 166 observations submitted to the ALPO Saturn Section during 2001-2002 by the 27 observers listed in Table 2 were used in preparation of this summary. Except when the identity of an individual is consid-

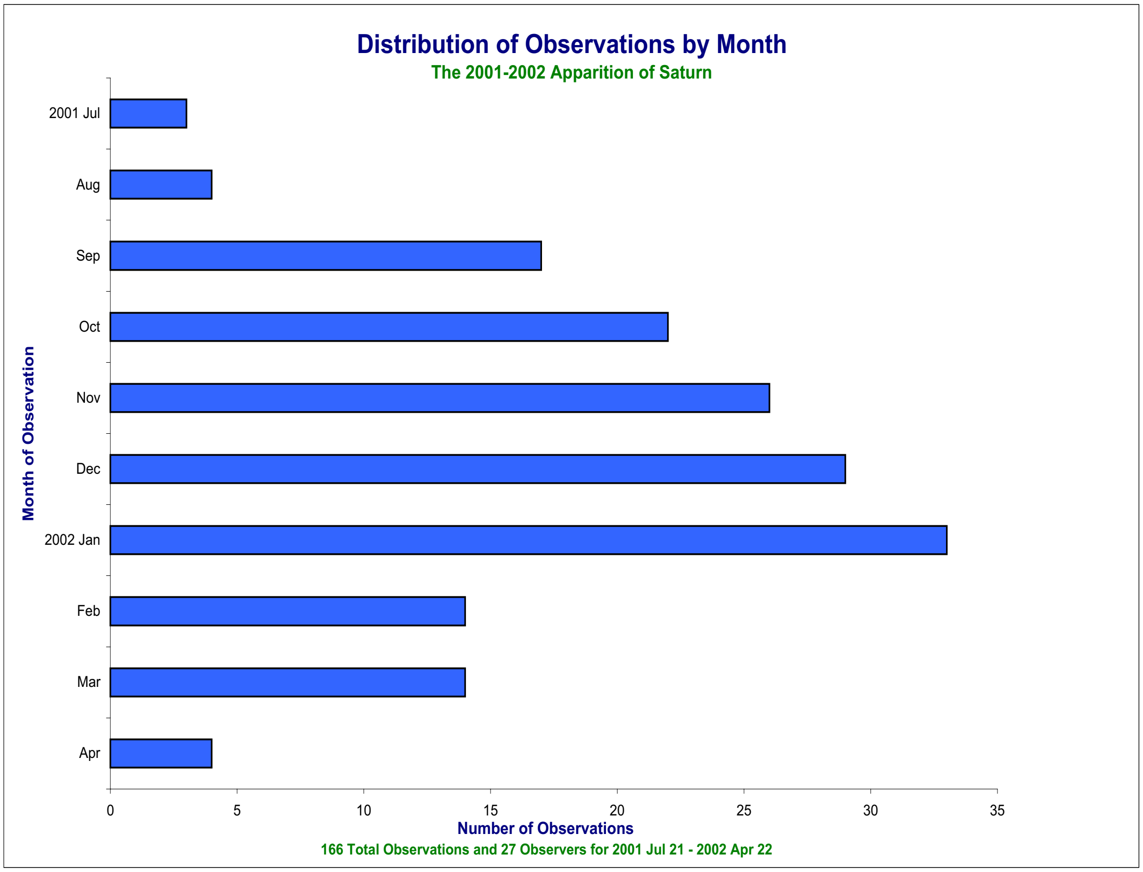

Figure 1

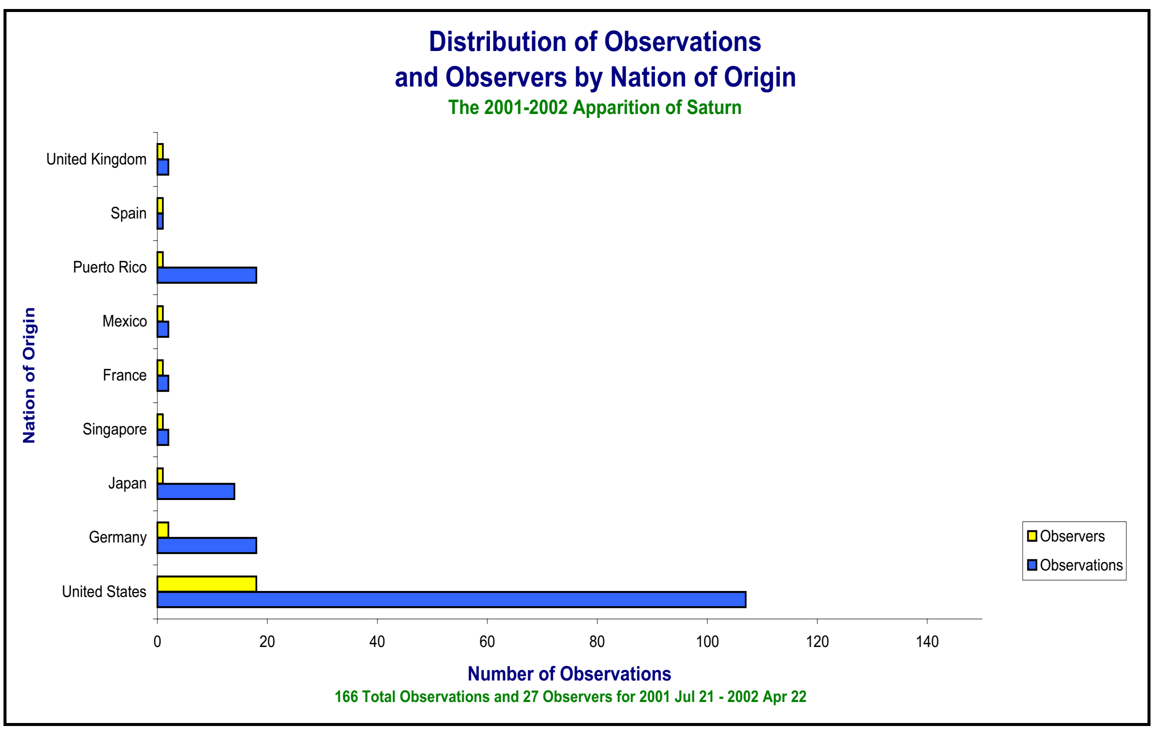

Figure 2

ered meaningful to the discussion, names have been omitted in the interest of brevity, however contributors are mentioned in selected illustrations accompanying this report. Drawings, photographs, CCD images, tables, and graphs are included with this summary so that readers can refer to them as they study the text. Readers should be aware that features on the globe of Saturn are described in south-to-north order and can be identified by looking at the nomenclature diagram shown in *Figure 4*. If no reference is made to a global feature in our south-to-north discussion, the area was not reported by observers during the 2001-2002 apparition.

It has been customary in preparing apparition reports for the ALPO Saturn Section to compare data for global atmospheric features between observing seasons. This practice is maintained with this report to aid the reader in understanding the significance of very subtle, but nonetheless recognizable, variations that may occur seasonally on Saturn.

Observational data suggest that some of the intensity variations noted in Saturnian belts and zones (see *Table 3*) may be merely a consequence of the continually changing inclination of the planet's rotational axis relative to the Earth and Sun. Using photoelectric photometry, observers have also recorded delicate oscillations of about ±0.10 in the visual magnitude of Saturn in recent observing seasons. There is no question, however, that transient and long-enduring atmospheric features occurring in Saturn's belts and zones also play a role in perceived brightness fluctuations. Regular photoelectric photometry of Saturn, in conjunction with carefully-executed visual numerical relative intensity estimates, remains a very important project for observers.

The intensity scale employed is the *ALPO Standard Numerical Relative Intensity Scale*, where 0.0 denotes a total black condition (e.g., shadows) and 10.0 represents maximum brightness of a feature or phenomenon (e.g., an unusually bright EZ or exceptionally brilliant 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 found by subtracting a feature's 2000-2001 intensity from its 2001-2002 value. A change of ±0.10 mean intensity points is not considered significant, and a perceived intensity fluctuation is not truly noteworthy unless it is more than about three times its standard error.

Observers continued to employ the handy visual technique introduced by Haas nearly 40 years ago to carry out estimates at the eyepiece of Saturnian global latitudes during 2001-2002. This method involves simply estimating the fraction of the polar semidiameter of the planet's globe subtended on the central meridian (CM) between the limb and the feature whose latitude is desired. Data resulting from this exercise compare very favorably with latitudes measured from drawings, images, or was determined with a bi-filar micrometer. Quantitative reduction of latitudes of Saturn's global features during 2001-2002 appear in *Table 4*. While one is cautioned not to place undue confidence in data generated by only a couple of individuals, experienced observers have been using this visual technique for many years with reliable results. So, more observers are urged to routinely use this procedure, even if a bi-filar micrometer is available, since comparison of latitude data generated by more than one method is important. As a control on the accuracy of the visual method, observers should include in their estimates the positions on the CM of the projected ring edges and the shadow of the rings. The actual latitudes can then be computed from the known values of **B** and **B’** and the dimensions of the rings, but this test cannot be readily applied when **B** and **B’** are near their maximum attained numerical values. In describing each feature on Saturn's globe, gleanings from latitude data are incorporated into the text where appropriate. A detailed description of Haas' visual technique can be found in *The Saturn Handbook* available from the author in printed or pdf format.

Southern Regions of the Globe

During 2001-2002 apparition, the maximum value for **B** was -26.459°, thus observers were afforded near optimal views of Saturn’s Southern Hemisphere. Of course, most of the Northern Hemisphere of the globe was obscured by the rings as they crossed in front of the planet. From the observational data for 2001-2002, the Southern Hemisphere of Saturn displayed roughly the same mean numerical relative intensity as in 2000-2001. There were several instances during the 2001-2002 observing season when observers suspected dusky features in the Southern Hemisphere of Saturn (mainly associated with the SEB), but unfortunately these features were not of sufficient longevity to be recovered after one rotation of the planet. During 2001-2002, poorly-defined and rather diffuse white spots were occasionally suspected in early August 2001 within the Equatorial Zone (EZs), but no confirming reports were submitted. Just like the infrequently reported wispy festoons suspected in the SEB, the very subtle white ovals in the EZs were likely only transient events and thus afforded no good opportunities for timing of recurring CM transits.

South Polar Region (SPR)

The dark yellowish-grey SPR was generally uniform in texture throughout the 2001-2002 apparition, with no reported activity, and the SPR had maintained essentially the same mean intensity since 2000-2001. Some individuals detected a light greyish South Polar Cap (SPC) that appeared slightly brighter than the

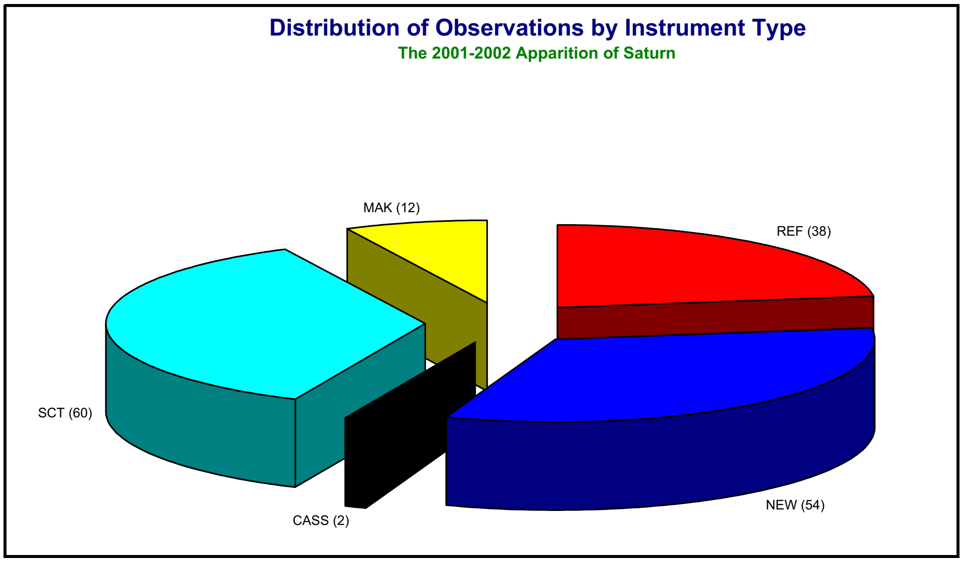

Figure 3

encompassing SPR, and it was thought by most visual observers to appear slightly darker than in the immediately preceding apparition (a mean intensity difference of -0.32 since 2000-2001 is hardly significant, however). Some of the best CCD images submitted during the 2001-2002 apparition generally confirmed the foregoing visual impressions, but precisely at the South Pole of Saturn, CCD images depicted a region that was darker than the immediate environs of the SPC and SPR. The dark greyish South Polar Belt (SPB) encircling the SPR, complete from limb to limb, was detected sporadically during the 2001-2002 observing season, but it was quite obvious in many of the better CCD images of the planet. A few observers considered the SPB as more diffuse and perhaps minimally lighter in intensity in 2001-2002 as opposed to 2000-2001 (mean intensity variance of +0.10).

South South Temperate Zone (SSTeZ)

The SSTeZ was reported only once by visual observers throughout the 2001-2002 apparition. The SSTeZ exhibited a pale yellowish-white hue, and if a single sighting of this zone really means anything, it was second only to the EZs in mean intensity. Most CCD images of Saturn captured the SSTeZ, but this zone displayed no discrete atmospheric phenomena during 2001-2002. Compared with 2000-2001, the SSTeZ may have been a little lighter in intensity in 2001-2002, but it was seen only once in each of the two apparitions in

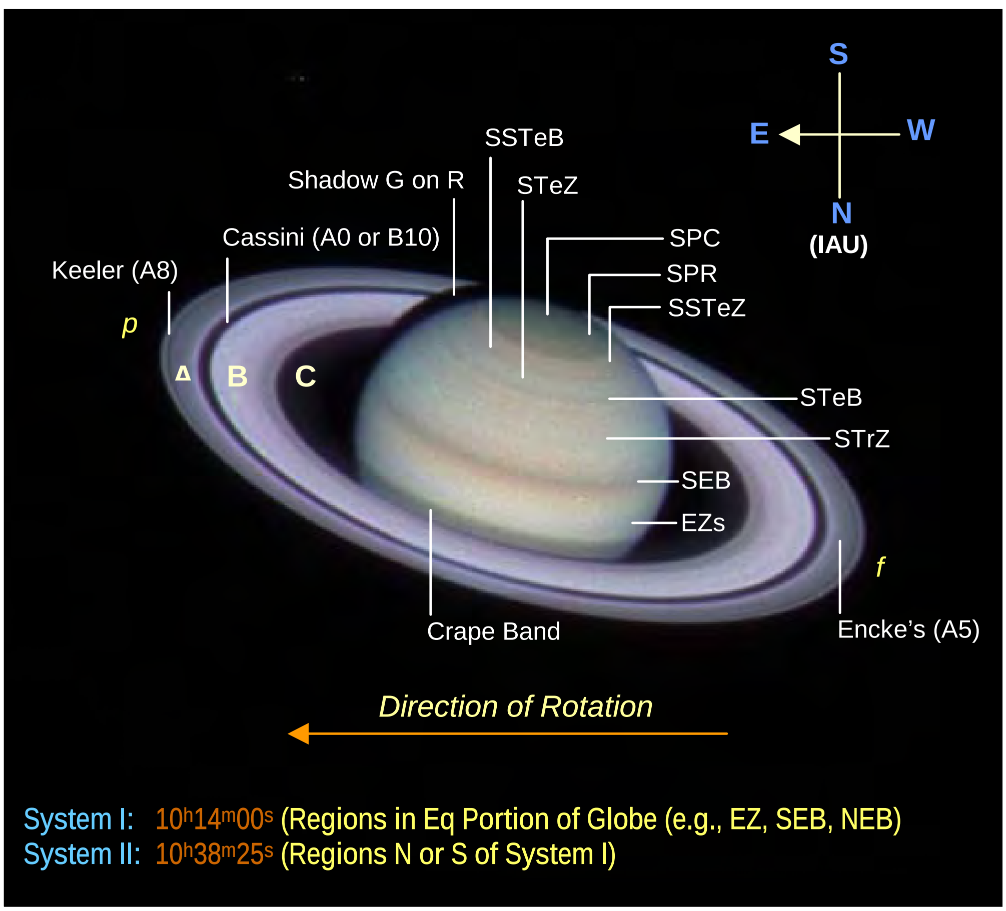

Figure 4

Table 3: Visual Numerical Relative Intensity Estimates and Colors for the 2001-2002 Apparition of Saturn

2001-2002 Numerical Relative Intensities				
Globe/Ring Feature	**No. of Estimates**	**Mean and Standard Error**	**Change Since 2000-2001**	**"Mean" Derived Color in 2001-2002**
Zones:				
SPC	9	5.03 ± 0.18	- 0.32	Light Grey
SPR	25	4.78 ± 0.11	- 0.13	Dark Yellowish-Grey
SSTeZ	1	7.00 ± 0.00	+ 0.25	Pale Yellowish-White
STeZ	21	5.77 ± 0.16	+ 0.02	Yellowish-White
STrZ	18	5.76 ± 0.16	- 0.08	Yellowish-White
SEBZ	2	5.25 ± 0.18	+ 0.09	Dull Yellowish-Grey
EZs	37	7.70 ± 0.19	- 0.09	Bright Yellowish-White
Globe S of Rings	16	4.97 ± 0.02	+ 0.07	Dull Yellowish-Grey
Belts:				
SPB	14	3.83 ± 0.04	+ 0.10	Dark Grey
STeB	5	5.40 ± 0.09	+ 0.37	Light Yellowish-Grey
SEB (whole)	21	4.13 ± 0.09	+ 0.17	Greyish-Brown
SEBs	17	3.46 ± 0.07	0.00	Dark Grey
SEBn	17	2.96 ± 0.10	+ 0.02	Very Dark Grey
EB	15	4.52 ± 0.15	- 0.31	Light Grey
Rings:				
A (whole)	45	6.70 ± 0.07	- 0.22	Pale Yellowish-White
Ring A (outer ½)	6	6.80 ± 0.02	- 0.03	Pale Yellowish-White
Ring A (inner ½)	6	6.58 ± 0.02	+ 0.02	Pale Yellowish-White
A5	27	2.16 ± 0.30	+ 0.36	Very Dark Grey
A0 or B10	44	0.78 ± 0.10	- 0.37	Greyish-Black
B (outer 1/3)	STANDARD	8.00 ± 0.00	---	Brilliant White
B (inner 2/3)	32	7.22 ± 0.05	- 0.04	Bright Yellowish-White
B1	6	3.63 ± 0.07	+ 0.11	Dark Grey
B2	1	4.00 ± 0.00	+ 0.17	Dark Grey
C (ansae)	43	1.60 ± 0.16	- 0.16	Greyish-Black
Crape Band	20	2.06 ± 0.10	- 0.11	Very Dark Grey
Sh G on R	40	0.32 ± 0.04	- 0.15	Dark Greyish-Black
TWS	12	7.97 ± 0.13	- 0.21	Brilliant White

NOTES: For nomenclature see text and Figure 4. 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 A.L.P.O. 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 A.L.P.O. Saturn Section. The "Change Since 2000-2001" is in the same sense of the 2000-2001 value subtracted from the 2001-2002 value, "+" denoting an increase in brightness and "-" indicating a decrease (darkening). When the apparent change is less than about 3 times the standard error, it is probably not statistically significant.

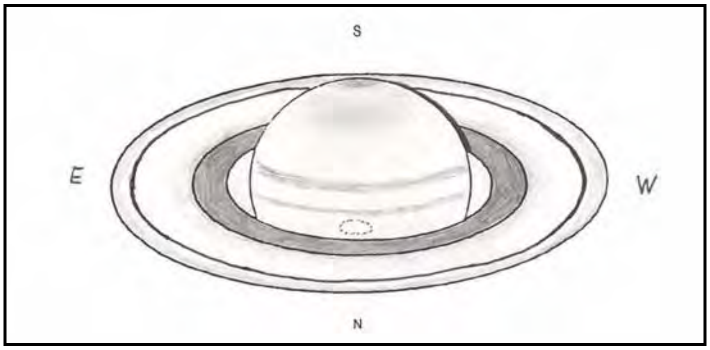

Plate 1: 2001 Aug 12 09:48-10:19UT Brian Cudnik. 35.6cm. (14.0in.) CAS, Drawing. 326-489X, IL + W25, W80A color filters. S = 7.0, Tr = 5.0. White oval in EZs. CMI = 114.0°, CMII = 51.9° - CMI = 132.2°, CMII = 69.3° B = -26.152°, B´ = -25.586°.

question by visual observers who estimated its intensity; thus, no real confidence should be placed in such a small observational sample.

South South Temperate Belt (SSTeB)

Visual observers did not report the SSTeB during the 2001-2002 apparition, but many processed CCD images depicted this linear feature extending across the globe of Saturn from limb to limb.

South Temperate Zone (STeZ)

The yellowish-white STeZ was detected fairly often by visual observers in 2001-2002, and when compared with 2000-2001, the STeZ exhibited no real variance in mean intensity. In overall intensity, the STeZ ranked third behind the EZs and SSTeZ during 2001-2002 as the brightest zone in the Southern Hemisphere of Saturn, and it had basically the same mean intensity as the STrZ during the observing season. The STeZ maintained uniformity in appearance and brightness during 2001-2002, with no discrete phenomena reported by observers. The STeZ was readily apparent in most CCD and digital camera images of Saturn, confirming visual impressions of the relative prominence of this feature.

South Temperate Belt (STeB)

The light yellowish-grey STeB was rarely seen by visual observers during the 2001-2002 apparition, but it was present in the best images submitted during the observing season. When visual observers caught a glimpse of this belt, it displayed no activity as it extended uninterrupted across Saturn's globe. STeB was a little brighter by +0.37 mean inrtensity points since 2000-2001.

South Tropical Zone (STrZ)

Plate 2: 2001 Sep 15 11:14UT. Ed Grafton. 35.6cm. (14.0in.) SCT, CCD Image, IL + IR rejection filter. S = 8.0 Tr = 3.0. CMI= 71.3°, CMII = 349.0° B = -26.171°, B´ = -25.756°.

The yellowish-white STrZ was reported periodically during the 2001-2002 observing season, and based on submitted data, the STrZ was fundamentally equal to the STeZ in mean intensity, as well as essentially

Table 4: Saturnian Belt Latitudes in the 2001-2002 Apparition

		Form of Latitude:		
Saturnian Belt	**# Esimates**	**Eccentric (Mean)**	**Planetocentric**	**Planetographic**
N edge SPB	16	-85.98° ± 0.43 (-0.48°)	-85.51° ± 0.48 (-0.54°)	-86.41° ± 0.38 (-0.43°)
N edge SEB	24	-29.42° ± 0.17 (-1.58°)	-26.72° ± 0.16 (-1.47°)	-32.27° ± 0.18 (-2.26°)
S edge SEB	24	-33.92° ± 0.19 (-0.27°)	-30.98° ± 0.18 (-0.26°)	-36.98° ± 0.20 (-0.28°)
Center EB	14	-09.54° ± 0.46 (+6.01°)	-08.54° ± 0.41 (+5.44°)	-10.66° ± 0.51 (+6.60°)

NOTES: For nomenclature, see Figure 4. Latitudes are calculated using the appropriate geocentric tilt, **B**, for each date of observation, with the standard error also shown. Planetocentric latitude is the angle between the equator and the feature as seen from the center of the planet. Planetographic latitude is the angle between the surface normal and the equatorial plane. Eccentric, or "Mean," latitude is the arc-tangent of the geometric mean of the tangents of the other two latitudes. The change shown in parentheses is the result of subtracting the 2000-2001 latitude value from the 2001-2002 latitude value.

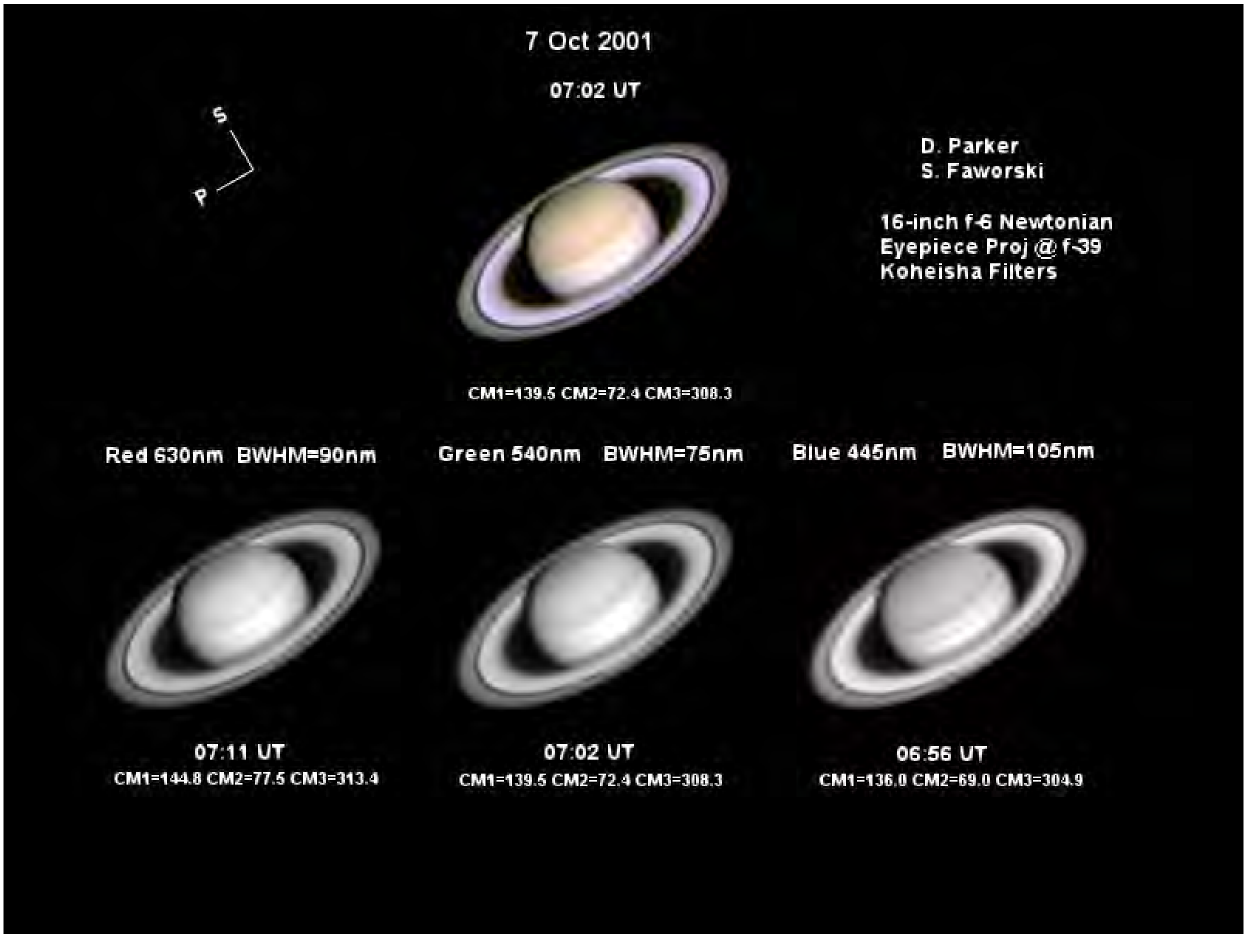

Plate 3: 2001 Oct 07 07:02UT. Donald C. Parker. 40.6 cm. (16.0 in.) NEW, CCD Image, IL + RGB filters. S = 8.0, Tr = 5.0 CMI =139.7°, CMII = 72.5° B = -26.128°, B´ = -25.860°.

unchanged in brightness since 2000-2001. CCD images generally substantiated most visual impressions. Since the STeZ and STrZ were basically the same intensity during 2001-2002, both were third in order of brightness compared with the EZs and SSTeZ. The STrZ remained uniform in intensity and devoid of activity during the 2001-2002 observing season.

South Equatorial Belt (SEB)

The SEB was commonly seen during 2001-2002 as an undifferentiated greyish-brown belt, often appearing differentiated into distinct SEBn and SEBs components (where **n** refers to the North Component and **s** to the South Component) by visual observers and CCD imagers. The SEB was considered to be slightly lighter in mean intensity (variance of +0.17) since 2000-2001, but when seen as distinct SEBn and SEBs components, the mean intensity was unchanged since the immediately preceding apparition. Although observers detected an intervening, dull yellowish-grey South Equatorial Belt Zone (SEBZ) during the 2001-2002 apparition, only two observers estimated its intensity and agreed that there was little change, if any, in prominence of the SEBZ since 2000-2001. Taken as a whole, the SEB was second only to the SPB in being the darkest belt on Saturn during the 2001-2002 apparition, but the very

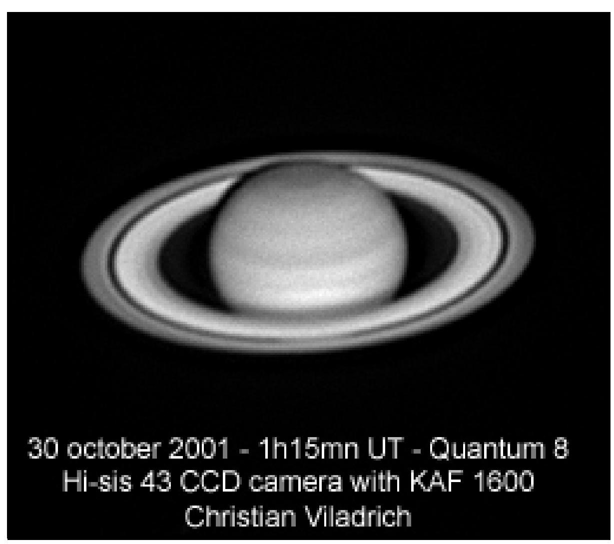

Plate 4: 2001 Oct 30 01:15UT. Christian Viladrich. 20.3 cm. (8.0 in.) MAK, CCD Image, IL + IR rejection filter. S = 5.0 Tr = 3.0 CMI = 277.3°, CMII = 195.1° B = -26.053°, B´ = -25.962°.

Table 5: Visual Observations of the Bicolored Aspect of Saturn's Rings During the 2001-2002 Apparition

	UT Date and Time		Telescope				Filter		
Observer	**(entire observing period)**		**Type and Aperture**	**x**	**S**	**Tr**	**Bl**	**IL**	**Rd**
Haas	2001 Oct 11	10:47-11:37	NEW 31.8 cm. (12.5 in.)	321	2.5	3.5	E	=	=
Benton	2001 Nov 16	01:36-02:05	REF 15.2 cm. (6.0 in.)	250	4.0	5.0	E	=	=
del Valle	2001 Dec 13	00:17-00:26	SCT 20.3 cm. (8.0 in.)	339	4.5	4.0	E	=	=
del Valle	2002 Jan 10	01:27-01:35	SCT 20.3 cm. (8.0 in.)	450	3.5	3.5	=	=	E
Haas	2002 Jan 23	03:10-03:43	NEW 31.8 cm. (12.5 in.)	321	2.5	3.5	=	=	E
Haas	2002 Apr 10	03:20-03:50	NEW 20.3 cm. (8.0 in.)	203	2.0	3.0	W	=	E
Haas	2002 Apr 22	02:23-02:51	NEW 20.3 cm. (8.0 in.)	203	2.5	2.5	E	=	=

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

dark grey SEBn (mean intensity of 2.96)and dark grey SEBs (mean intensity 3.46) were the darkest belts reported in the Southern Hemisphere of the planet. The SEBn was invariably described by observers as being considerably darker than the adjacent SEBs in 2001-2002. The best processed CCD images of Saturn frequently corroborated visual impressions of the SEB in the above discussion.

From 2001 October through 2002 mid-January there were scattered reports of diffuse, ill-defined dark spots in the SEB, the most obvious ones appearing as vague dusky projections arising from the northern edge of the SEBn extending minimally into the EZs environs. None of these features remained visible long enough to be seen in subsequent rotations for useful CM transit timings.

Equatorial Zone (EZ)

The southern half of the bright yellowish-white Equatorial Zone (EZs) was the region of the EZ visible between where the rings cross the globe of the planet and the SEBn in 2001-2002 (the EZn was not clearly visible during the apparition). The mean intensity of the EZs in 2001-2002 remained principally unchanged since the 2000-2001 apparition, appearing always as the brightest zone on Saturn during the observing season to both visual observers and to those using CCD imagers. The EZs was also a little brighter than the inner tw-thirds of Ring B in mean intensity.

Brian Cudnik, observing from Texas on 2001 August 12 and using a 35.6 cm. (14.0 in.) Cassegrain, made a sketch of Saturn (see Plate 1) depicting what he perceived to be a fairly obvious white oval in the EZs, the center of which was in transit across the CM at 10:10UT. No other observers reported similar white ovals in the EZs during 2001-2002 apparition, however, either visually or in CCD images.

During good seeing at various times during the 2001-2002 apparition, visual observers sighted a narrow, continuous light greyish Equatorial Band (EB) that extended across Saturn's globe. This feature was very obvious in the better CCD images of Saturn. Mean intensity data in 2001-2002 suggested that the EB was perhaps a bit darker than in 2000-2001 by -0.31 mean intensity points.

Northern Portions of the Globe

With Saturn tipped –26.5° to our line of sight in 2001-2002, very little of the Northern Hemisphere could be viewed to advantage. Examination of the Northern Hemisphere of the planet will have to wait until subsequent apparitions when geometric conditions for seeing these regions are more favorable.

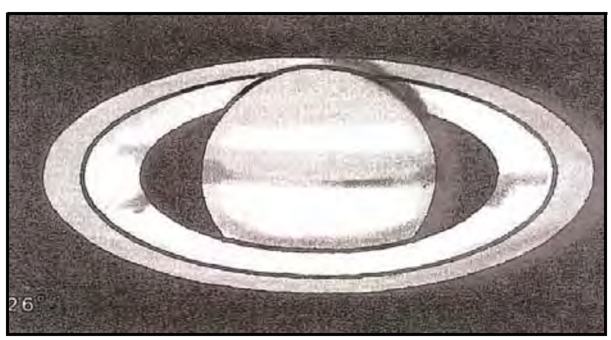

Plate 5: 2001 Oct 30 20:51UT. Detlev Niechoy. 20.3 cm. (8.0 in.) SCT, Drawing. 135X, IL. S = 2.5 Tr = 2.5. CMI = 247.2°, CMII = 138.3° B = -26.053°, B´ = -25.962°. Radial spokes were suspected in Ring B at both ansae.

Plate 6: 2001 Nov 03 20:45UT. Tofol Tobal. 10.2 cm. (4.0 in.) REF, Drawing. 100X, IL S = excellent (undefined scale). CMI = 21.3°, CMII = 143.3° B = -26.038°, B´ = -25.979°. Color drawing of first contact of Saturn being occulted by the Moon.

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

The Sh G on R was seen by observers as a geometrically regular dark greyish-black feature on either side of opposition during 2001-2002. Any perceived departure from a true black (0.0) intensity was a consequence of less-than-favorable seeing conditions or scattered light. Most CCD images showed this feature as completely black.

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

Observers in 2001-2002 reported this shadow as a dark greyish-black feature south of the rings where they passed in front of the globe. Reported variations from an intrinsic black (0.0) condition were due to the same causes noted with respect to the Sh G on R.

Saturn's Ring System

The following section of this apparition report generally concerns visual studies of Saturn's ring system, as well as a traditional comparative analysis of mean intensity data between apparitions, although impressions derived from CCD and digital camera images of the rings are also included. Observations of the southern face of the rings were almost optimal during 2001-2002 as the inclination of the rings (value of B) toward observers on Earth increased to as much as –26.5°.

Ring A

Ring A, taken as a whole, was pale yellowish-white during all of 2001-2002, but possibly dimmer (by -0.22 mean intensity points) than in 2000-2001. On just a few occasions during the apparition, observers described pale yellowish-white outer and inner halves of Ring A, and with the outer half of Ring A slightly the brighter of the two in mean intensity.Most CCD images of Saturn taken during the 2001-2002 showed inner and outer halves of Ring A that were basically equal in brightness, although there were a few processed images that confirmed the visual impressions by observers. The dark greyish Encke's Division (A5) was seen often at the ring ansae by visual observers and imaged regularly as a "complex" halfway out in Ring A. Several CCD images easily

Plate 7: 2001 Nov 06 07:30UT. Dave Miller. 25.4 cm. (10.0 in.) SCT, Sony TRV-310 Digital 8 Video camera in IL. S = 5.0 Tr = 5.0. CMI = 288.1°, CMII = 337.0° B = -26.025°, B´ = -25.992°.

revealed Keeler's Division (A8), although no visual observers estimated its intensity. No other intensity minima in Ring A were reported in 2001-2002 either visually or with CCD imagers.

Ring B

The outer third of Ring B is our established standard of reference for the *ALPO Saturn Visual Numerical Relative Intensity Scale*, with an assigned value of 8.0. To visual observers for the entire 2001-2002

Plate 8: 2001 Nov 07 07:49UT. Ed Grafton. 35.6 cm. (14.0 in.) SCT, CCD Image, IL + IR rejection filter. S = 7.0, Tr = 5.0. CMI = 63.7°, CMII = 74.3° B = -26.021°, B´ = -25.996°.

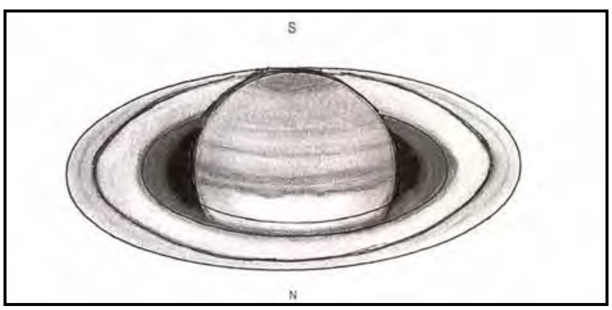

Plate 9: 2001 Nov 13 02:45 - 03:10UT. Phil Plante. 20.3 cm. (8.0 in.) SCT, Drawing. 250X, IL + W38A color filter. S = 6.5 Tr = 3.8. CMI = 271.8°, CMII = 95.5°, CMI = 286.5°, CMII = 109.5°, B = -25.858°, B´ = -26.140°. Dark undulations along N edge of SEBn.

Plate 10: 2001 Nov 19 06:39UT. Ed Grafton. 35.6 cm. (14.0 in.) SCT, CCD Image, IL + IR rejection filter. S = 6.0, Tr = 5.0. CMI = 75.6°, CMII = 60.1°, B = -25.995°, B´ = -26.021°.

apparition, the outer third of Ring B was brilliant white, maintained its apparent stable intensity, and was always the brightest feature on Saturn's globe or in the ring system, with the possible exception of the spurious Terby White Spot (TWS). The inner two-thirds of Ring B, which was described as bright yellowish-white in color and usually uniform in intensity, was generally the same mean intensity from 2000-2001 to 2001-2002. Observers using CCD imagers and digital cameras were in agreement with the visual results during the apparition.

As in 2000-2001, a few observers continued to report dusky spoke-like features near the ansae. For example, Detlev Niechoy, observing from Germany under fairly decent seeing conditions, made a drawing of Saturn depicting spokes at both ansae in Ring B on 2001 October 30 at 20:51UT using a 20.3 cm. (8.0 in.) SCT at 153X in Integrated Light. Niechoy also vaguely suspected similar radial features in Ring B during 2001 December. No other observers reported spokes in Ring B during 2001-2002, however, but all individuals are encouraged to try to image these elusive ring features when seen visually, or at least try to obtain simultaneous visual confirmation. No CCD images received by the ALPO Saturn Section showed any hint of radial spoke features at the ansae in Ring B.

Visual observers also suspected dark grey intensity minima at B1 and B2 during 2001-2002, and these features were quite obvious in the best processed CCD images of Saturn. Also imaged (but not reported visually) were intensity minima at B5 and B8 positions in Ring B. (See Plate 5.)

Cassini's Division (A0 or B10)

Cassini's division (A0 or B10) was routinely seen visually as a grayish-black gap at both ansae during 2001-2002, while in good seeing with moderate apertures, it could be traced all the way around the ring system. A black Cassini's division was always quite obvious in CCD images submitted during 2001-2002, encircling the ring system. In some of the best CCD images, the Northern Hemisphere of the globe of Saturn could be easily seen through Cassini's Division. Readers are reminded that any divergence from a totally black intensity for Cassini's Division is merely a consequence of scattered light, poor seeing, inadequate aperture, etc. It is worth noting also that the visibility of major ring divisions and other intensity minima was improved in 2001-2002 because the rings were near their maximum possible inclination to our line of sight, where the numerical value of **B** attained -26.5° during the apparition. Surely a consequence of the improved tilt of the rings toward Earth, the mean intensity of Cassini's Division was reportedly darker to visual observers in 2001-2002 when compared with the view in 2000-2001.

Ring C

Visual observers frequently reported the grayish-black Ring C at the ansae during 2001-2002, and it was thought to be a little darker in mean intensity compared with 2000-2001 data (mean intensity difference of -0.16). Where Ring C crossed Saturn's globe (the "Crape Band") it appeared very dark grayish in texture and uniform in intensity, virtually unchanged in brightness since 2000-2001. Processed CCD images showed Ring C encircling the globe of Saturn, confirming visual impressions of this ring component during 2001-2002.

When **B** and **B'** are both negative, and **B** > **B'**, the shadow of the rings on the globe is cast to their south, circumstances that occurred during 2001-2002 through 2001 November 10. The Crape Band is then also located south of the projected Rings A and B. If **B** < **B'**, the shadow is north of the projected rings, which occurred in the apparition from 2001 November 11 and after. When the shadows of Ring A, Ring B, and Ring C projection are superimposed, it is very difficult to distinguish them from one another in ordinary apertures and seeing conditions, and the shadow of Ring C is an additional complication.

Terby White Spot (TWS)

The TWS is a sometimes striking brightening of the rings immediately adjacent to the Sh G on R. On several occasions in 2001-2002 visual observers noticed a brilliant TWS (intensity of 7.97), but it is simply a false contrast phenomenon, not an intrinsic feature of Saturn's rings. It is still worthwhile, however, to try to ascertain what correlation could exist between the visual numerical relative intensity of the TWS and the fluctuating tilt of the rings, including its brightness and visibility in variable-density polarizers, color filters, photographs, and CCD or digital camera images. No CCD images submitted during 2001-2002 showed a Terby White Spot.

Bicolored Aspect of the Rings and Azimuthal Brightness Asymmetries

The bicolored aspect of the rings refers to a perceived difference in brightness between the East and West ansae (IAU system) when systematically compared with alternating W47 (Wratten 47), W38, or W80A (all blue filters) and W25 or W23A (red filters).

The circumstances of visual observations are listed in *Table 5* when a bicolored aspect of the ring ansae was thought to be present during 2001-2002, and it is worthwhile to note that the author and Daniel del Valle did not detect similar brightness variations on the corresponding limbs of the globe on the dates that the bicolored aspect was suspected. Readers should be aware that the directions in *Table 5* refer to Saturnian, or IAU (International Astronomical

Plate 11: 2001 Dec 18 17:24UT. Tan Wei Leong. 28.0 cm. (11.0 in.) SCT, CCD Image, IL + IR rejection filter. S = 5.0, Tr = 5.0. CMI = 101.1°, CMII = 214.4°, B = -25.837°, B´ = -26.159°.

Plate 12: 2001 Dec 23 16:04UT. Toshihiko Ikemura. 30.5 cm. (12.0 in.) NEW, CCD Image, IL + IR rejection filter. S = excellent (undefined scale). CMI = 316.0°, CMII = 269.5°,B = -25.818°, B´ = -26.178°.

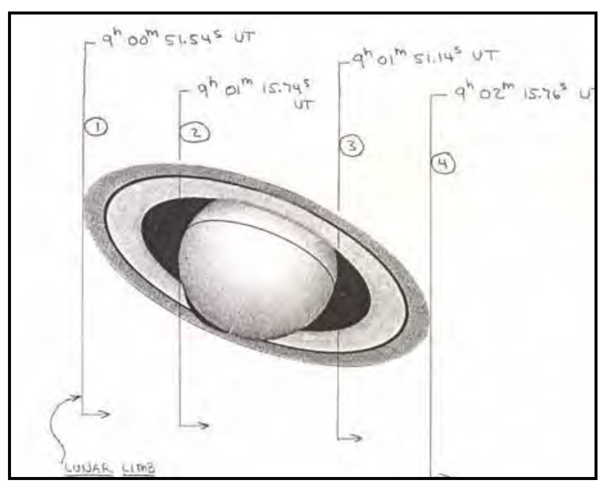

Plate 13: 2001 Dec 28 09:01 - 09:02UT. Richard Fink. 9.0 cm. (3.5 in.) MAK, Drawing. 86X, IL. S = 3.0, Tr = 5.0. CMI = 329.7°, CMII = 131.3° - CMI = 330.3°, CMII = 131.8°, B = -25.801°, B´ = -26.196°. Saturn disappears in occultation at lunar limb.

Plate 14: 2001 Dec 31 00:51UT. Ed Crandall. 25.4 cm. (10.0 in.) NEW, CCD Image, IL + IR rejection filter. S = 5.0, Tr = 4.0. CMI = 55.2°, CMII = 131.1°, B = -25.793°, B´ = -26.206°.

Union), directions, where west is to the right in a normally-inverted telescope image (observer located in the Northern Hemisphere of the Earth) which has south at the top.

Perhaps the first photograph of the bicolored aspect of the rings was made by the late C.F. Capen back on 1963 October 1 using a BG-12 (blue) filter with 40.6 cm. (16.0 in.) Cassegrain at Table Mountain Observatory in Wrightwood, CA (see Plate 20), but some critics argue that the effect in this image is spurious because the same differential brightness is noticed on the corresponding limb of Saturn's globe.

In recent years, however, a few observers have been systematically attempting to capture the bicolored aspect with CCD, video, and digital cameras. Results so far have been inconclusive, but as such efforts become commonplace, the greater will be the probability of success. For example, during 2001-2002 Frank Melillo submitted five images of Saturn taken with a CCD camera in Integrated Light (no filter) on 2002 January 2 between 04:12 and 04:30UT using a 20.3 cm. (8.0 in.) Schmidt-Cassegrain in good seeing (Plate 15). Although the brightness difference seen in Ring B at opposite ansae may be little more that an image processing artifact, the possibility remains that the bicolored aspect is apparent in Melillo's images (the effect is not visible on the globe).

Another observer, Maurizio Di Sciullo, contributed a CCD image of Saturn taken on 2002 January 20 between 01:11 and 01:20UT using a 25.4 cm. (10.0 in.) Newtonian in excellent seeing (Saturn near the zenith; see Plate 16). Di Sciullo's image seems to reveal some very subtle azimuthal brightness variations in Ring A, as well as what could be a slight reddish enhancement at one ansa and a bluish one at the other (no similar effect was noted on Saturn's globe, which one would expect if atmospheric dispersion was at fault). Indeed, professional astronomers are well-acquainted with Earth-based observations of such azimuthal asymmetries (confirmed by the *Voyager* probe), which apparently arise when light is scattered by denser-than-average particle agglomerations orbiting in Ring A. Indeed, such images by ALPO Saturn observers are truly fascinating, and

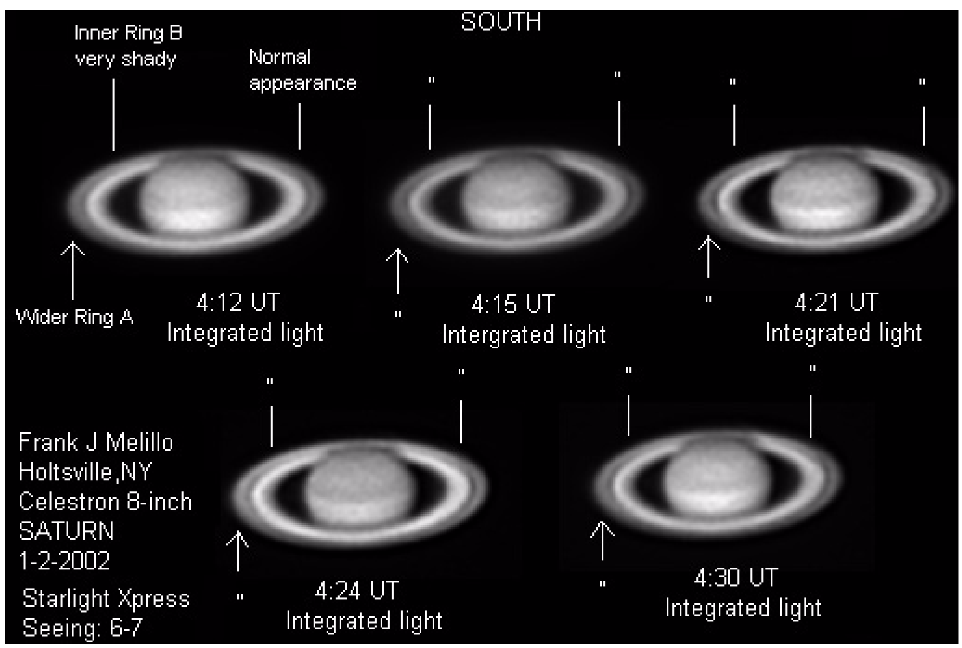

Plate 15: 2002 Jan 02 04:12 - 04:30UT. Frank Melillo. 20.3 cm. (8.0 in.) SCT, CCD Image, IL + IR rejection filter. S = 6.5, Tr = 5.0. CMI = 61.96°, CMII = 68.2° - CMI = 72.4°, CMII = 78.4°, B = -25.786°, B´ = -26.214°. Bicolored aspect?

Plate 16: 2002 Jan 20 01:11 - 01:20UT. Maurizio Di Sciullo. 25.4 cm. (10.0 in.) NEW, CCD Image, IL + IR rejection filter. S = 7.0, Tr = 5.0. CMI = 33.1°, CMII = 182.2° - CMI = 38.3°, CMII = 187.3°, B = -25.766°, B´ = -26.276°. Are subtle azimuthal brightness asymmetries apparent, along with indications of the bicolored aspect?

continued imaging to try to capture the bicolored aspect of the rings, as well as azimuthal brightness differences in the rings, is highly encouraged, especially when simultaneous visual observations indicate that these phenomena may be present.

The Satellites of Saturn

Observers in 2001-2002 did not submit systematic visual estimates of Saturn's satellites employing suggested methods described in *The Saturn Handbook*. Photoelectric photometry and systematic visual magnitude estimates of Saturn's satellites are strongly encouraged in future apparitions.

Dating back to the 1999-2000 apparition, the ALPO Saturn Section has been urging observers to attempt spectroscopy of Titan as part of a newly-introduced professional-amateur cooperative project. Even though Titan has been occasionally studied by the Hubble Space Telescope and very large Earth-based instruments, the opportunity still exists for systematic observations by amateurs with suitable instrumentation.

Titan is an extremely dynamic satellite exhibiting transient as well as long-term variations. From wavelengths of 3000Å to 6000Å, Titan's color is dominated by a reddish methane haze in its atmosphere, while longward of 6000Å, deeper methane absorption bands appear in its spectrum. Between these methane bands are "windows" to Titan's lower atmosphere and surface, and daily monitoring in these "windows" with photometers or spectrophotometers is worthwhile for cloud and surface studies. Also, long-term investigations of other areas from one apparition to the next can help shed light on Titan's seasonal variations. Suitably-equipped observers are, therefore, encouraged to participate in this interesting and valuable project. Details on this endeavor can be found on the Saturn page of the ALPO website at http://www.lpl.arizona.edu/alpo.

Occultations of Saturn by the Moon

Several occultations of Saturn by the Moon occurred during the 2001-2002 apparition, all of which presented some interesting observational and imaging opportunities for observers, depending on one's geographical location. The first of these occultations occurred on 2001 September 10, where the most favorable chances for viewing the entire sequence of

Plate 17: 2002 Feb 20 01:24 - 05:00UT. Donald C. Parker. 40.6 cm. (16.0 in.) NEW, CCD Image, IL + RGB filter. S = 7.0, Tr = 5.0. CMI = 291.8°, CMII = 159.7° - CMI = 58.6°, CMII = 281.5°, B = -25.876°, B´ = -26.375°

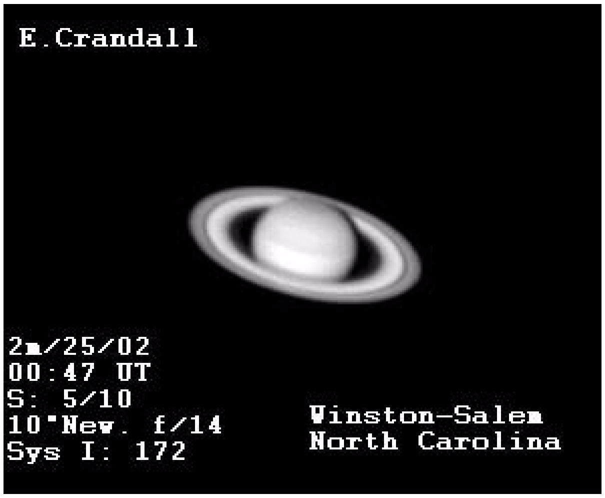

Plate 18: 2002 Feb 25 00:47UT. Ed Crandall. 25.4 cm. (10.0 in.) NEW, CCD Image, IL + IR rejection filter. S = 5.0, Tr = 4.0. CMI = 171.2°, CMII = 238.2°, B = -25.911°, B´ = -26.390°.

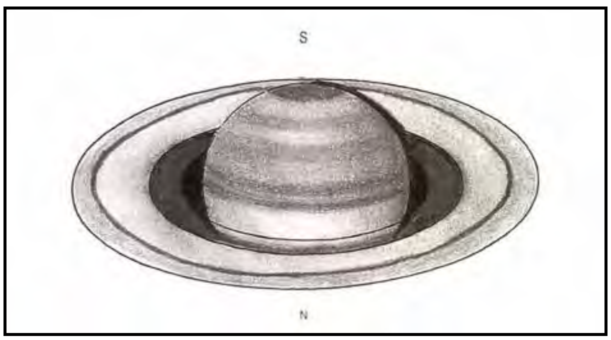

Plate 19: 2002 Apr 07 01:10 - 01:30UT. Phil Plante. 20.3 cm. (8.0 in.) SCT, Drawing. 333X, IL. S = 5.5 Tr = 3.5. CMI = 234.9°, CMII = 57.2° - CMI = 246.6°, CMII = 68.5°, B = -26.305°, B´ = -26.501°.

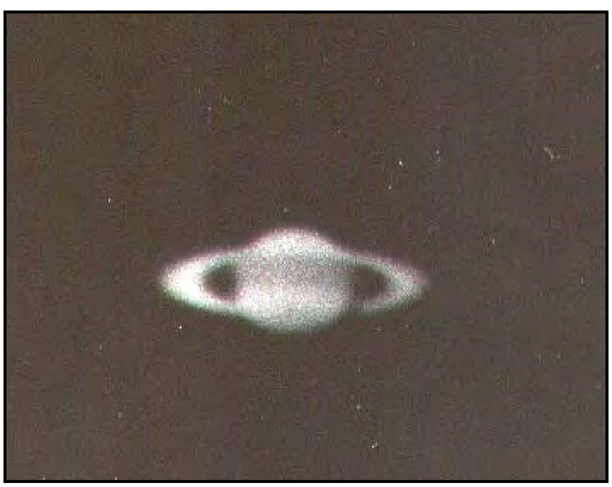

Plate 20: 1963 Oct 01 12-sec exposure by the late C.F. Capen of bicolored aspect of the rings (?) in BG-12 (blue) filter with 40.6 cm. (16.0 in.) Cassegrain at Table Mountain Observatory in Wrightwood, CA. Note the obvious brightness difference between the East (left) and West (right) ansae, but notice also the same effect on the globe of Saturn. South is toward top of image.

events under dark skies occurred in Hawaii. From Honolulu, Saturn's disappearance at the bright lunar limb occurred at 11:05UT, and reappearance occurred at the dark limb of the Moon at 11:49UT. For most of the Eastern United States, all of the occultation events for 2001 September 10 occurred during daylight, however, so the farther west one traveled, the better were one's chances of seeing Saturn at least disappear behind the Moon under dark skies. Unfortunately, no observations of this occultation were received from ALPO Saturn Observers.

Another quite spectacular lunar occultation of Saturn took place on 2001 November 3 for observers in Europe, including the United Kingdom, Northwest portions of Africa, Japan, and Russia. Tofol Tobal, in Spain, observed from 20:45UT to 21:48UT and was able to image, as well as make drawings of, the disappearance and reappearance of Saturn under dark skies (see Plate 6). Barely a month later, on 2001 December 01, the Full Moon occulted Saturn again during the 2001-2002 observing season, but in this case, observations of the disappearance and reappearance of Saturn's rings behind the Moon were hampered by the overwhelming brilliance of the lunar limb. Only one ALPO Saturn observer, Richard Fink, made timings of the 2001 December 1 occultation. Viewing the events from New Jersey using a 9.0 cm. (3.5 in.) Maksutov in good seeing, Fink recorded on video tape Saturn's disappearance (last contact of the rings with the lunar limb) at 09:02UT.

Yet another occultation of Saturn occurred on 2001 December 28, where disappearance and reappearance were predicted for 08:30UT and 09:40UT in the predawn sky, respectively, but no ALPO Saturn observers submitted observations for this occultation.

Finally, on 2002 February 20-21, a very favorable occultation of Saturn occurred for observers in the United States, particularly those located on the East Coast. Accordingly, Don Parker (Miami), using a 40.6 cm. (16.0 in.) Newtonian made outstanding sequential CCD images of the disappearance of Saturn behind the dark lunar limb from 01:24UT to 05:00UT (see Plate 17).

Simultaneous Observations

Simultaneous observations, or studies of Saturn by individuals working independently of one another at the same time and on the same date, afford good opportunities for verification of ill-defined or controversial Saturnian phenomena. The ALPO Saturn Section has organized a simultaneous observing team so that several individuals in reasonable proximity of one another can maximize the chances of viewing Saturn at the same time using similar equipment and methods. Joint efforts like this significantly reinforce the level of confidence in the data submitted for each apparition. Several simultaneous, or near-simultaneous, observations of Saturn were submitted during 2001-2002, but as in the 2000-2001 apparition, such observations was essentially fortuitous. More experienced observers generally participate in this endeavor, but newcomers to observing Saturn are heartily welcome to get involved. Readers are urged to inquire about how to join the simultaneous observing team in future observing seasons.

Conclusions

Based on the foregoing discussion, it may be concluded that that Saturn's atmosphere was relatively quiescent during the 2001-2002 apparition, consistent with impressions of the planet during the last few observing seasons. Generally, reported activity on Saturn in 2001-2002 was in the form of poorly-defined dusky spots or festoons in the SEB and an isolated sighting of a white oval in the EZs on 2001 August 12, none of which reappeared following later rotations of the planet to facilitate recurring CM transits. Aside from frequent visual observations and CCD images of Cassini (A0 or B10) and Encke (A5) divisions, several observers imaged Keeler's gap (A8). Visual observers spotted, and CCD imagers recorded, other intensity minima in Ring B. Several visual observers suspected, and made drawings of, dusky ring spokes that were possibly evident in Ring B during 2001-2002. Interesting visual observations, as well as possible images of the curious bicolored aspect and azimuthal brightness variations of the rings were submitted during the apparition.

The author extends his sincerest thanks to all of the observers mentioned in this report who submitted visual drawings, photographs, CCD and digital camera images, and descriptive reports during 2001-2002. Systematic observational work which supports our many programs helps amateur and professional astronomers alike obtain a better understanding of Saturn and its always intriguing ring system.

Observers everywhere are invited to join us in our studies of Saturn in the coming year. The ALPO Saturn Section Coordinator is always eager to offer guidance for new, as well as advanced, observers. A very meaningful resource for learning how to observe and record data on Saturn is our ALPO Training Program, and we urge participation in this valuable educational experience. Also, detailed descriptions of methods and techniques for observing Saturn are contained in *The Saturn Handbook*, available from the author as a printed manual or as a pdf file.

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- **Monograph Number *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. Price: $10 for the United States, Canada, and Mexico; $15 elsewhere.
- **Monograph Number *6.*** *Proceedings of the 47th Convention of the Association of Lunar and Planetary Observers, Tucson, Arizona, October 19-21, 1996.20* pages. Price $3 for the United States, Canada, and Mexico; $4 elsewhere.
- **Monograph Number 7.** *Proceedings of the 48th Convention of the Association of Lunar and Planetary Observers. Las Cruces, New Mexico, June 25-29, 1997.76* pages. Price: $12 for the United States, Canada, and Mexico; $16 elsewhere.
- **Monograph Number 8**. *Proceedings of the 49th Convention of the Association of Lunar and Planetary Observers. Atlanta, Georgia, July 9-11,1998.122* pages. Price: $17 for the United States, Canada, and Mexico; $26 elsewhere.
- **Monograph Number 9**. *Does Anything Ever Happen on the Moon?* By Walter H. Haas. Reprint of

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1942 article. 54 pages. Price: $6 for the United States, Canada, and Mexico; $8 elsewhere.

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

ALPO Observing Section Publications

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

- **Lunar and Planetary Training Program (Robertson):** *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. To order, send check or money order payable to "Timothy J. Robertson."
- **Lunar (Benton):** (1) *The ALPO Lunar Section's Selected Areas Program (*$17.50). Includes a full set of observing forms for the assigned or chosen lunar area or feature, together with a copy of the *Lunar Selected Areas Program Manual.* (2) *Observing Forms Packet,* $10. Includes observing forms to replace those provided in the observing kit described above. Specify *Lunar Form*s. (See note for Venus.)
- **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 h.jamieson@bresnan.net.
- **Venus (Benton):** (1) *The ALPO Venus Observing Kit,* $17.50. Includes introductory description of ALPO Venus observing programs for beginners, a full set of observing forms, and a copy of *The Venus Handbook.* (2) *Observing Forms Packet,* $10. Includes observing forms to replace those provided in the observing kit described above. Specify *Venus Forms.* To order either numbers (1) or (2), send a check or money order payable to "Julius L. Benton, Jr." All foreign orders should include $5 additional for postage and handling; p/h included in price for domestic orders. Shipment will be made in two to three weeks under normal circumstances. NOTE: Observers who wish to make copies of the observing forms may instead send a SASE for a copy of forms available for each program. Authorization to duplicate forms is given only for the purpose of recording and submitting observations to the ALPO Venus, Saturn, or lunar SAP sections. Observers should make copies using high-quality paper.
- **Mars (Troiani):** (1) *Martian Chronicle;* published approximately monthly during each apparition; send 8 to 10 SASE's; (2) *Observing Forms;* send SASE to obtain one form for you to copy; otherwise send $3.60 to obtain 25 copies (make checks payable to "Dan Troiani").
- **Mars:** *ALPO Mars Observers Handbook,* send check or money order for $10 per book (postage and handling included) to Astronomical League Book Service, c/o Paul Castle, 2535 45th St., Rock Island, IL 61201.
- **Jupiter:** (1) *Jupiter Observer's Startup Ki*t, $3 from the Jupiter Section Coordinator. (2) *Jupite*r, ALPO section newsletter, available online via the ALPO website or via snail-mail; send SASE to the Jupiter Section Coordinator; (3) To join the ALPO Jupiter Section e-mail network, *J-Ne*t, send an e-mail message to the Jupiter Section Coordinator. (4) *Timing the Eclipses of Jupiter's Galilean Satellites* observing kit and report form; send SASE to John Westfall.
- **Saturn (Benton):** (1) The *ALPO Saturn Observing Ki*t, $20; includes introductory description of Saturn observing programs for beginners, a full set of observing forms, and a copy of *The Saturn Handboo*k. (2) *Saturn Observing Forms Packe*t, $10; includes observing forms to replace those provided in the observing kit described above. Specify *Saturn Forms.* To order, see note for *Venus Forms*.
- **Meteors:** (1) Pamphlet, *The ALPO Guide to Watching Meteors,* send check or money order for $4 per book (postage and handling included) to Astronomical League Book Service, c/o Paul Castle, 2535 45th St., Rock Island, IL 61201. (2) *The ALPO Meteors Section Newslette*r, free (except postage), published quarterly (March, June, September, and December). Send check or money order for first class postage to cover desired number of issues to Robert D. Lunsford, 161 Vance St., Chula Vista, CA 91910.
- **Minor Planets (Derald D. Nye):** *The Minor Planets Bulleti*n, published quarterly $14 per year in the U.S., Mexico and Canada, $19 per year elsewhere (air mail only). Send check or money order payable

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to "Minor Planets Bulletin" to 10385 East Observatory Dr., Corona de Tucson, AZ 8564I-2309.

Other ALPO Publications

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

- ***An Introductory Bibliography for Solar System Observers.* Free** for a stamped, self-addressed envelope. A 4-page list of books and magazines about Solar System bodies and how to observe them. The current edition was updated in October, 1998. Order from: ALPO Membership Secretary.
- *ALPO **Membership Directory.*** $5 in North America; $6 elsewhere. Latest updated list of members on 3.5-in. MS-DOS diskette; either DBASE or ASCII format. Make payment to "ALPO" Also available via e-mail as portable document format (pdf) file to requester's e-mail address. Provided at the discretion of the Membership Secretary. Order from Matthew Will, ALPO membership secretary/treasurer.
- **Back issues** of *The **Strolling Astronomer (JALPO).*** Many of the back issues listed below are almost out of stock, and it is impossible to guarantee that they will remain available. Issues will be sold on a first-come, first-served basis. The price is $4 for each back issue; the current issue, the last one published, is $5. We are always glad to be able to furnish old issues to interested persons and can arrange discounts on orders of more than $30. Order directly from and make payment to "Walter H. Haas"(see address under "Board of Directors," on page 40):

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The ***Association of Lunar and Planetary Observers* (ALPO)** was founded by Walter H. Haas in 1947, and incorporated in 1990 as a medium for advancing and conducting astronomical work by both professional and amateur astronomers who share an interest in Solar System observations. We welcome and provide services for all levels of astronomers: For the novice, the **ALPO** is a place to learn and to enhance and practice techniques. For the advanced amateur, it is a place where one's work will count. For the professional, it is a resource where group studies or systematic observing patrols are necessary.

Our Association is an international group of students of 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.

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We have "sections" for the observation of all the types of bodies found in our Solar System. Section Coordinators collect and study submitted observations, correspond with observers, encourage beginners, and contribute reports to our Journal at appropriate intervals. Each Coordinator can supply observing forms and other instructional material to assist in your telescopic work. You are encouraged to correspond with the Coordinators in whose projects you are interested. Coordinators can be contacted through our web site via email or at their postal mail addresses listed in back of our Journal. Out web site is hosted by the Lunar and Planetary Laboratory of the University of Arizona which you are encouraged to visit at http://www.lpl.arizona.edu/alpo/. Our activities are on a volunteer basis, and each member can do as much or as little as he or she wishes. Of course, the ALPO gains in stature and in importance in proportion to how much and also how well each member contributes through his or her participation.

Our work is coordinated by means of our periodical, "The Strolling Astronomer", also called the Journal of the Assn. of Lunar & Planetary Observers. Membership dues include a subscription to the Journal. The ALPO offers a printed version of the Journal that is mailed out quarterly. An identical digital (Acrobat Reader) version is available over the internet at reduced cost. Subscription rates and terms are listed below.

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