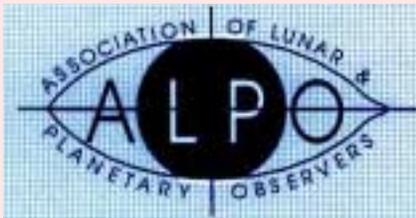


Journal of the Association of Lunar & Planetary Observers



The Strolling Astronomer

Volume 44, Number 1, Winter 2002

Now in Portable Document Format (PDF) for MacIntosh and
PC-Compatible Computers

Inside . . .

Doings on Jupiter . . .

In these remarkable CCD images taken by Antonio Cidadao (of Portugal), the amazing activity occurring in Jupiter's north equatorial belt (NEB) during 2002 January is easily apparent. At present, several bright rifts and a number of dark condensations can be seen, even visually, in the NEB at several locations around the planet.



In the 2002 January 17 image (at left), note the two dark condensations, or "barges," with a white oval between them, near the preceding limb (right side of the image) of the planet. Also, note the bright rift in the NEB near the central meridian (CM). These

barges are somewhat unusual in that they are usually seen on the northern edge of the NEB.

In the 2002 January 18 image (right), the two barges and the bright oval are in generally the same position relative to each other; however, the bright rift has overtaken them and expanded. In fact, the two barges have drifted 4



and 5 degrees in increasing longitude and, the white oval has drifted 3 degrees in increasing longitude. By contrast, the bright rift has expanded from a length of 22 degrees to 35 degrees, with its preceding edge drifting 20 degrees in decreasing longitude.

Also note the small, bright ovals on the northern edge of the NEB, reminiscent of the south south temperate belt (SSTB) ovals. Also note the dark veining within the NEB.

North is at the top in both images. See page 1 for info on the photos.

Also ..a report the ALPO Lunar Meteoritic Impact Search Program, more on the "Plato's Hook" controversy, the index to Volume 43 of the JALPO, a report on Saturn, a book review, computer software review, ALPO observing section reports and much, much more.

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

Volume 44, No. 1, Winter 2002

This issue published in February 2002 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.

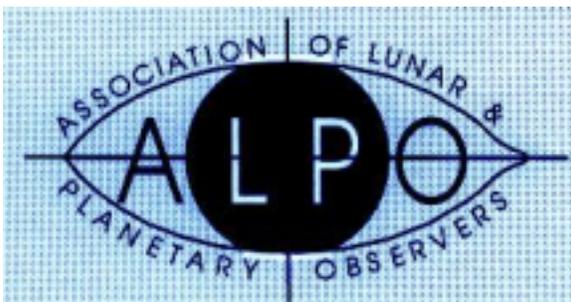
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In This Issue:

The ALPO Pages

Point of View: Julius Benton	1
Letters.....	2
Cover Photo Notes	2
Reminder: Address Changes	2
Call for Papers: ALCon 2002	2
Observing Section Reports:	
Solar Section	3
Lunar Section	
Lunar Topographical Studies.....	3
Lunar Transient Phenomena	4
Mars Section	6
Interest Section	
ALPO Website	6
DJALPO Website	6
Computing Section	7
Instruments Section.....	7
Staff Appointment.....	7

Features

A Program for Monitoring the Moon for	
Meteoritic Impacts: The First Year.....	11
Plato's Hook: Still an Open Problem.....	17
Jupiter Observing Alert	26
Observations of Saturn During the 1999-2000	
Apparition.....	27
Index to Volume 43 of the "Strolling Astronomer",	
Journal of the Assn. of Lunar & Planetary	
Observers.....	31
ALPO Book Review: <i>The Moon: A Biography</i>	
.....	44
ALPO Software Review: <i>Lunaview</i>	44

ALPO Resources

ALPO Board of Directors	45
Publications Staff	45
Lunar and Planetary Training Program	45
Observing and Interest Section Staff.....	45-47
ALPO Board/Staff E-mail Directory.....	47
ALPO Publications:	
The Monograph Series.....	47
ALPO Observing Section Publications	48
Other ALPO Publications	49
Membership in the ALPO.....	49

The ALPO Pages: Member, section and activity news

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Point of View

Are Amateur Observations of the Moon Still Useful?

By Julius L. Benton, Jr., coordinator, Lunar
Selected Areas Program, Assn. of Lunar &
Planetary Observers



The missions of Apollo transformed our nearest celestial neighbor from a virtually unknown and inaccessible object into a relatively familiar world. Including the unprecedented historical events of the first manned lunar landing on July 20, 1969, twelve astronauts from Earth have set foot upon the Moon's surface, col-

lecting and returning to Earth some 380 kg. of rocks and debris from six Apollo ventures. Of course, in mentioning any lunar explorations from Earth, one cannot omit the small but no less important 130 gm. of rocks gathered during the unmanned Russian Luna-16 and Luna-20 missions.

Apart from the vast collection of photographs supplementing previous data from missions such as Surveyor and Orbiter, the Apollo program enabled equipment to be set up on the lunar surface to monitor moonquakes, meteoritic impacts, thermal characteristics of the lunar surface material, and alleged magnetic phenomena. Adding to the wealth of accumulated data that now exists has been the massive collection of photographs of the entire lunar surface made in unprecedented detail in 1994 by the orbiting Clementine spacecraft, as well as significant data from remote sensing by Lunar Prospector in 1998-99. It will be many years, no doubt, before all of this information will be thoroughly assimilated and carefully refined into a realistic account of the Moon and its cosmic history.

For the amateur astronomer, the Moon has always been a favorite subject for his telescopes, and until the first really energetic space efforts, he mostly dominated the field of selenography. Now, with the impact of a great multitude of photographs taken at close-hand, with precise measurements of the Moon's complex chemical composition, radioactiv-

Continued on page 6

Letters: Lunar Dome

Dear Sirs,

In Vol. 43, 4, page 27 of the ALPO Journal, the article by Lena et al.: "A Previously Unreported and Unclassified Dome Near Archimedes". I must bring to your attention that the dome described in this article is neither "unreported" nor "unclassified", as it is included in the dome list published by Head and Gifford ("Lunar Mare Domes: Classification and Modes of Origin", *The Moon and the Planets* 22 (1980) 235-258) under the entry "Eratosthenes 3" and assigned to the class V with a diameter of about 8 km.

The dome can also be recognized on the *Consolidated Lunar Atlas* plate C10 and on chart 22 of the R ukl lunar atlas, even if it is not labeled as such (but the same is true for the larger dome named -073+375). I would add that on the chart, it appear clearly to be a dome, and not merely an "indistinct structure".

To state that the dome "eluded most observers to date" is surely incorrect. I am wondering what meaning the authors have attributed to the term "unreported", considering that the dome can be identified on at least four different sources. Even if the terms "unreported" and "unclassified" refer to the lack of the abovementioned dome in the ALPO Lunar Dome Survey, again I would say this is not sufficient to call the dome in such a way because the ALPO list is - unfortunately - an unofficial one.

One can easily concede that Lena et al. have refined both the position and the diameter of the dome with respect to Head & Gifford's list (the latter gives only approximate values for longitude and latitude) thus the article really does say something new about the dome itself.

Nevertheless, both the article's title and introduction are misleading and I think that a clarification is needed to ensure the correctness of the information given on the Journal.

My best regards,

Raffaello Braga, Milan - Italy

Cover Photos

In both, north is at the top. The images were obtained with a 10-inch (D=254 mm) f/10 Meade LX200 SCT working at an effective focal length of 10,300 mm. An "AO-2" tip-tilt adaptive optics device from Stellar Products was used to stabilize the images during the integrations. A SBIG's ST-5C CCD camera was used to grab the images, and filters (RGB Schuler Astro Imaging) were positioned on a FLI CFW-2 color filter wheel. For each channel, 5 to 10 raws were averaged. Integration times for each raw were 3.5 sec (R), 4.5 sec (G) and 10 sec (B). No seeing or transparency data available.

Top photo taken 2002 Jan 16, 22:58 UT, CM1=240°, CM2= 281° and CM3=2°

Bottom photo taken 2002 Jan 18, 23:51 UT, CM1=228°, CM2= 254° and CM3=335°

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 has 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.

Speaking of address changes, ALPO Meteors Section Coordinator Robert D. Lunsford has changed e-mail addresses. The new one is:

lunro.imo.usa@cox.net

Call for Papers

ALCon 2002, this year's National Convention of the Astronomical League, will be held Wednesday through Saturday, July 31 - August 3, at the University of Utah in Salt Lake City, NV.

The Assn. of Lunar & Planetary Observers traditionally plays an important and active role in this event. At ALCon, ALPO members present their own research papers on lunar and planetary studies, plus this is the place where the ALPO board holds its annual meeting.

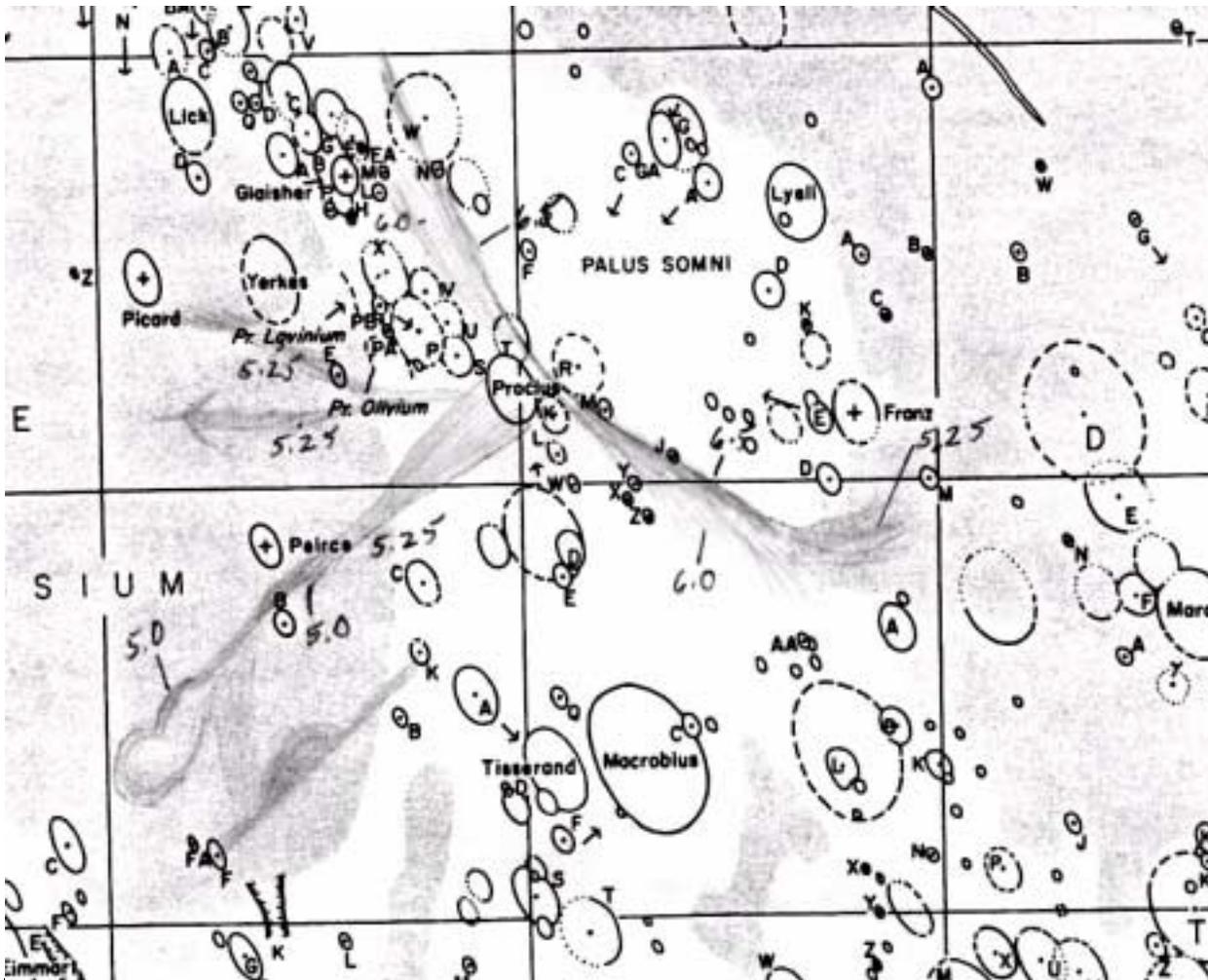
ALPO members who are currently completing research involving a Solar System topic are urged to present their results at this event. ALCon is well-covered by the astronomical press, with important announcements from the amateur astronomy community getting maximum exposure.

Presentations may be in the form of hardcopy reports, slide or overhead transparency presentations, or computer display presentations.

For more information on ALPO presentations, contact ALPO Executive Director Julius Benton, c/o Associates in Astronomy, 305 Surrey Road, Savannah, GA 31410; or e-mail jlbaina@msn.com

For more information about ALCon 2002 itself, either write to: ALCon 2002 P.O. Box 9574, Salt Lake City, UT 84109-9574, or visit the website at:

< <http://www.alcon2002.org/index1.html> >



Ray map of Proclus area sketched by Robin Gray on 2000 Nov 4 from 2:57 to 3:22 UT. Telescope used was a 15 cm (6 in.) f/9 refractor at 114X, no filter, and the seeing was 4/10 (with "0" worst and "10" best).

Observing Section Reports

Solar Section

By Rik Hill

Solar activity is noticeably declining. This fact is reflected in reduced observations and traffic on Sol-Net, the official ALPO Solar Section list at <sol-net@yahoo.com>

There have been a number of changes on Solar Section webpages (accessed from <<http://www.lpl.arizona.edu/~rhill/alpo/solar.html>>) A new auroral page has been set up for the times when we do get such images, the 2002 Ephemerides set up thanks to Brad Timerson, and report forms and instructions have been modified for easier download.

Rick Gossett is proceeding with the archiving of our solar data. At this time he is past the halfway point from our start to the present.

Lunar Section:

Lunar Topographical Studies

By William Dembowski

The Lunar Topographical Studies Section continues to receive a steady stream of observations; many of which are associated with the International Bright Lunar Rays Project. This is a joint venture by the ALPO, the American Lunar Society (ALS), the British Astronomical Assn. (BAA) and several other astronomical organizations and independent observers. The purpose of the project is to map, catalog, and otherwise study the bright lunar ray patterns seen on the lunar surface under a high sun angle. Observations consist of photographs, CCD images, video stills, and ray maps such as the one of Proclus submitted by Robin Gray of Winnemucca, Nevada, shown on this page.

Lunar Transient Phenomena

By David O. Darling

This section is still alive and well and research is continuing on the many hundreds of observations that have been sent to me over the years. I have been presently working on getting the interest in Lunar Transient Phenomena (LTP) rekindled. The climate for observers to participate has been chilled with a recent article published in *Sky & Telescope* magazine. The authors of this article implied that LTP could not be seen from Earth and if observers were reporting phenomena, their ability as credible observers should be questioned.

The second blow that has had a great impact on the observing program is the report by Dr. Bonnie Buretti of confirmed changes found on Aristarchus with two Clementine photographs. This was in conjunction with the LTP report submitted by an observer during that time for Aristarchus. After this announcement, much excitement followed. But it was soon followed with a retraction saying that no change had been found after careful evaluation of the images.

It is this kind of environment that presently prevails in the scientific community and LTP research has fallen out of favor. This is not new in the 20 years that I have been doing this research; the attitude toward these phenomena has increased and declined, depending on the latest authorities who have published their opinions on the topic.

What I have tried to do to counter this is to establish my own page on the World Wide Web that will address the LTP phenomena, their history and the statistical evaluation of the phenomena. Also, the web page has an observing manual available for observers to access with information on the steps to follow to be effective in their search for these phenomena. I have also established an LTP report form that can be completed and submitted by the observer covering all aspects of the LTP event.

The web page is located at:

<http://www.ltpresearch.org/>

I am presently working on putting all the data from the Clementine observations onto the web page for observers to be able to access. The observations from the Lunar Prospector mission will also be posted.

Another major project is the completion of an LTP database to be put on CD ROM consisting of all LTP events on file. Any supporting documentation such as drawings or images will also be incorporated into the database. This will give future researchers critical data that is presently not available. At present, there is no complete database of all LTP events available for the researcher.

Another major project is the scanning of all the original observations reports from the Clementine and Lunar Prospector missions and putting them on CD ROM for future researchers.

This is a long term project and it will take several years to complete the programs that I have mentioned.

Mars Section

By Dan Joyce, Coordinator

Reports are still coming in for the current apparition as Mars continues its rapid northward progression ahead of the Sun's glare despite the diminishing apparent diameter. Now falling below six arc-seconds, it becomes, technically speaking, too distant for high-resolution work, yet the favorable aspect of its emergence from steep southern declination has been providing a distinct advantage for most observers. Frequently, such southern declinations are accompanied by low altitude and the attendant inferior viewing conditions. In addition to the favorable altitude, many observers are using more sophisticated equipment that can extend the apparition's useful window.

Though Mars is currently in a season for substantial dust activity, it has quieted down considerably and surface features have returned to normal appearance with just a few exceptions. The south cap has been prominent, as expected, and reasonable review can be expected for anomalies resulting from the unexpected dust storm of last June.

The map for the 2000-2001-2002 apparition is being prepared, and the 1999 images (at last!) are being scanned for the archives.

Interest Section Reports

ALPO Website

By Rik Hill

The size of our website has doubled in the last year. Much of this is due to the revamped observations pages for Mars, Mercury and Jupiter matching the changes seen on the Solar Section observations page. This has allowed many more of the images to be posted at one time.

Our "Tons-O-Clubs" page of astronomy club websites continues to be a premiere site for astronomy club information with over a dozen new clubs added in the last two months. If your club is not on there then contact: rhill@lpl.arizona.edu

DJALPO Website

By Jon Slaton

Various problems have surfaced during the trial/implementation of the DJALPO website. No one per-

son solved the problems; it was a trial and error system that seemed to work best. In the end, it seems that password protecting the file itself was the easiest route. But we didn't know that until we tried various alternatives. I'm sure that new opportunities will creep up now and then, and we will be ready for them.

Computing Section

**By Michael (Mike) McClure
Coordinator**

The ALPO Computing Section is dedicated to providing comprehensive computational support to the Association of Lunar & Planetary Observers.

As of 2001 December 31, we have 90 registered members in our section's e-mail listserv.

The Computing Section maintains its own website at:

<http://www.m2c3.com/alpocs>

Our site has registered 2,114 hits in the one-year period ending 2001 December 31.

The four primary areas of the ALPO Computing Section website are:

- **Ephemeris** - The Ephemeris section is dedicated to providing ephemeris information for astronomical objects in the Solar System. Tables and links provide position and physical aspect data for the sun, moon, and planets. Planetary phenomena, meteor showers, eclipses, comets, and online ephemeris generator links are also included.
- **Reference** - The reference section is a guide to computer-related websites (astronomy software, operating systems, programming languages, etc).
- **Newsletter (*The Digital Lens*)** - The newsletter section (*The Digital Lens*) is an electronic newsletter dedicated to Solar System Astronomical Computing, and is published as a service of the ALPO Computing Section. Our newsletter serves as a forum for continuing education and information related to the activities of our section. Articles, book reviews, software reviews, tutorials, programs, or comments are welcome on any area of Computing directly or indirectly related to Solar System Astronomy.
- **Listservs** - The Computing Section is also active in creating and moderating listservs using a free listserv service called "Egroups." In 1999 July, the Computing Section established alpocs@egroups.com as a listserv serving members of our section. As of 2000 May 1, we've had 506 postings averaging 46 postings per month. In addition to our own section's listserv, the Computing Section created and moderates two

Egroup listservs for the ALPO. The alpoc-staff@egroups.com listserv was created in 1999 September to facilitate communication between ALPO coordinators and staff members. And, the alpoboard@egroups.com listserv was created in 1999 December to serve the communication needs of the ALPO board of directors.

Request for computer support/information/help may be submitted to our group listserv at alpocs@yahoo.com.

Instruments Section

**By Dick Wessling
Assistant Coordinator**

I have been getting a few inquiries from members about particular telescope problems and some to do with mirror cost, refiguring and testing. However, from the ALPO membership, activity is extremely slow to non-existent.

My personal activities are keeping me quite busy with telescope testing and optical work. I am continuing to have excellent success with my newly finished 13.25-inch, f/12 Cassegrain, which uses a f/3.8 primary mirror. I made the optics several years ago and finished the scope this summer. This scope is a delight to use, and even with its high obstruction ratio of 32 percent, it gives excellent views of the Moon and planets.

I am also making a new secondary mirror for my 12.5-inch Buchroeder Tri-Schiefspiegler to replace the one that was damaged during coating several years ago. Soon I will write a paper about the advantages and disadvantages of interference testing using test plates versus interferometry. This has become interesting to me since I must interfere test the Schiefspiegler secondary against the test plate I made. I have made many Schiefspiegler optic sets so I am further refining the testing techniques.

I have also learned some interesting and bad things about some commercial telescopes that I will discuss at a later date.

Staff Appointment

After several conversations this month via e-mail and telephone between Tom Dobbins and myself, I have appointed him as Acting Assistant Coordinator of the ALPO History Section. Concurrently, Tom is renewing his membership in the ALPO, since this is a condition for serving on our staff. In a cooperative plan, he and Richard Baum will decide how to parcel out the many responsibilities within our History Section, including making progress on the writing of the History of the ALPO, a project that many of us hope will come to fruition in the near term, along with furnishing scholarly articles in historical astronomy for the DJALPO. Please join me in welcoming Tom back to our Staff.

(Julius Benton, Chairman of the Board)

Lunar Selected Areas, continued from page 1

ity and seismic profile, and following sophisticated petrographic investigations of lunar materials, one might quickly assume that the work of the amateur astronomer has been relegated to redundancy or insignificance from our fixed vantage point in space.

Too many people have gotten the mistaken impression that regular observations of the Moon are pointless and that little awe or mystery remains about our "Queen of the Night." The activities by Apollo astronauts on the Moon and close-range photographic surveys by lunar orbiting spacecraft are obviously out of the domain of the amateur astronomer. Yet, it must be emphasized that there are areas of lunar observation that still largely remain the forte of the amateur astronomer, fields that may be pursued without an imminent threat of obsolescence by an onslaught of imposing professional equipment. Unlike the professional specialist, the amateur typically has the freedom to scan at will a chosen lunar feature for extended periods of time in hopes of drawing or capturing photographic, video, or CCD images of low-sun shadows of minor relief features, varying tonal patterns exhibited in lunar environments exposed to a high sun, and other possible long-term or transient events.

Any observing program, for its results to be scientifically useful, requires of its participants a suitable blend of preparation, skill, patience, and tenacity. Because of the large image size and brightness of the Moon, lunar studies are especially suited for amateur astronomers using small to moderate apertures. More importantly, there have been numerous instances when professional astronomers, in trying to resolve some observational query by relying solely on existing spacecraft photographs, have enlisted the services of amateur astronomers. For example, by a fortuitous improper positioning of the spacecraft camera or as a result of unfavorable solar illumination, an optimum view was not afforded of the morphology of a particular lunar crater or other feature. Fortunately, amateur observers were able to provide indispensable assistance by monitoring the specific region of the Moon under the conditions sought by professional astronomers. In a few cases, relevant data already existed in amateur observational archives. Cooperative efforts such as these clearly demonstrate how meaningful amateur observations of the Moon can be and how a vital link to professional research is maintained.

There are many possible areas of lunar research where the imaginative amateur astronomer can find fruitful observational experiences. An example of a very interesting research program is the monitoring of what is known as Lunar Transient Phenomena (LTP). In the very truest sense, LTP represent alleged variations at the lunar surface which are typically of ephemeral or instantaneous nature, usually remaining quite unpredictable. Systematic, simultaneous studies by a team of regular observers using top-quality instrumentation is especially worthwhile, since under optimum conditions LTP events might be glimpsed for only a few seconds to some twenty minutes or so. What is of greatest importance within the scope of such a program is to try to observationally differentiate between LTP reports and bona fide LTP events.

By 1971, the ALPO's Lunar Recorders decided to segregate the study of LTP from the study of long-term or "seasonal" events, forming the LTP Survey for strictly transient lunar events and the Selected Areas Program (SAP) to deal with long-term variations, each area of concentration headed by a dedicated Recorder. In the years that followed this change, observational data were collected by each program, catalogued, reduced, and published in the *Journal of the ALPO*, and the results of both programs showed real promise. There were quite a few instances of LTP events and recognized "seasonal" variations apparent in the accumulated data sample.

Indeed, the Selected Areas Program (SAP) and LTP Survey represent meaningful enterprises at the fundamental level of amateur observational astronomy. A major goal of organizations like the ALPO, these are pursuits that are largely concerned with long-term visual monitoring of variable phenomena at the surface of the Moon. The scope of such work has definitely not been rendered obsolete by spacecraft gathering such a great wealth of information about our satellite. Persistent, patient observers, participating in the ALPO LTP Survey and Selected Areas Program (SAP), can successfully supplement the findings of space missions and other ongoing professional research, increasing our overall knowledge about the Moon.

Today, the ALPO Selected Areas Program (SAP) and LTP Survey persist as active, somewhat separate endeavors, although both programs have achieved greater significance through emerging cooperative ventures of data exchange and comparison in recent years. This trend must continue in order to insure a steady flow of meaningful, scientific data for the future.

ALPO Feature: ALPO Lunar Section A Program for Monitoring the Moon for Meteoritic Impacts: The First Year

By Brian M. Cudnik
**Coordinator, Lunar Meteoritic
Impact Search**

(Editor's Note: This article was originally submitted for publication in the Spring of 2001. Though it is published now, it still communicates the mission of this valuable ALPO lunar section and includes supporting data on how the section performed in its first year.)

Abstract

This article summarizes the first year of activity of the newly formed Lunar Meteoritic Impact Search program of the Association of Lunar & Planetary Observers. This program, within the Lunar Section of the ALPO, was established as a result of the first confirmed lunar meteoritic impact observations, made by the author and others during the Leonid storm of November 1999.

The article includes a summary of these observations and their significance, followed by a brief historical perspective of lunar meteoritic impact observations. The article reviews the methods of the new program and summarizes its observations during its first year. The work of the Geologic Lunar Researchers of Italy concerning spurious flashes on videotape is noted. It then details how observers can help in the search for lunar meteors, with attention to specific observing methods.

Aside from the seven Leonid events, no more lunar meteoritic impacts have been confirmed, but the program shows promise for positive results in the coming years.

The First Confirmed Lunar Impact Observation in History

For the first time in history, independently confirmed observations of meteoritic impacts on the Moon were recorded during the Leonid meteor storm of November 18, 1999 [Dunham, et al, 2000]. Up to that point, there had been reports of phenomena on the Moon resembling the Leonid flashes, but without independent confirmation of the observations one cannot know for sure whether the phenomena were actually lunar meteoritic impacts [Williams, 2000].

In early 1999 November, the suggestion was made for people to observe the Moon in search of possible optical signatures of meteoritic hits during potential Leonid meteor storm conditions. The unusually elevated flux of meteoroids coupled with the high impact velocities (71 km/sec) provided ideal conditions for observing and recording lunar meteoritic phenomena.

A number of events were observed with accurate timings, and seven of them were then found on David Dunham's videotape (see Figure 1, Table 1, and Figure 2). Of these seven, one had been detected visually and six by videocamera. Several more candidates await verification.

These observations establish that the visual signatures of such events take the form of point flashes of light from the nearly instantaneous conversion of kinetic energy to heat.

Historical Perspective

There is an abundance of recorded observations of what are called transient lunar phenomena (TLP). In fact, Winifred Cameron has catalogued 1,468 such events [Cameron, 1978]. Many events have been reported by two or more observers who were in the same geographical location.

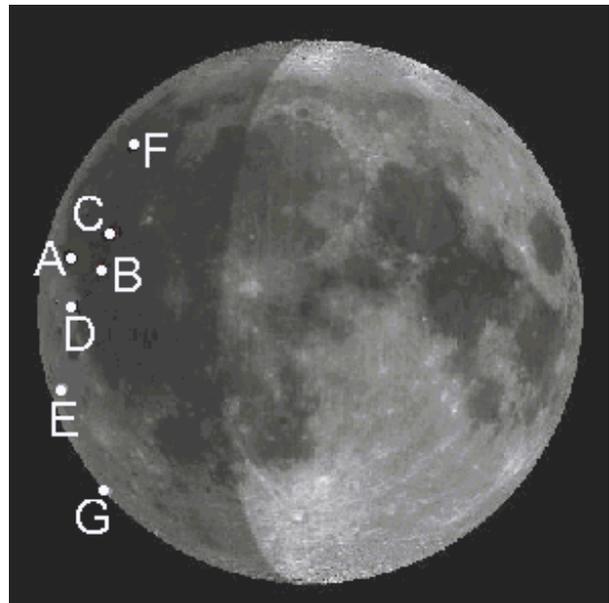


Figure 1. The locations on the Moon of the seven confirmed Leonid meteoritic impact events, which are listed in Table 1.

Table 1: Lunar meteoritic Impacts Confirmed by Dunham, 1999 November 18

Event	UTC h m s	Mag.	Selenographic			Description
			Observer	Long.	Lat.	
F	3:05:44.89	5	Palmer	65W	40N	180km SE of Harding
D	3:49:40.40	3	Palmer*	68W	3N	W. wall of Hevelius
E	4:08:04.10	5	Palmer	78W	15S	140km SW of Rocca
G	4:12:27.83	5	Gural**	90W	40S	on limb
A	4:46:15.52	3	Cudnik	71W	14N	30km NE of Cardanus
B	5:14:12.92	7	Sada	58W	12N	150km E of Galilaei
C	5:15:20.22	4	Sada	58W	20N	100km S of Schiaparelli

*Also confirmed by Sada and Frankenburger

**Found by Peter Gural on Dunham's videotape, and confirmed by Palmer

†Adapted from Dunham et al, 2000.

TLP's can take the form of color changes within a small region of a crater, clouds, hazes, starlike flashes of light, and even lightning flashes. Several scientific sources have attempted to explain such phenomena with a variety of natural processes, from meteoritic impacts, tidally induced volcanic activity (outgassing), or other causes [Kolovos, G., Seiradakis, J.H., et al, 1988; Middlehurst, B., Burley, J.M., et al, 1968; Mills, A.A., 1970; Moore, P.A., 1971]. It is possible that at least a small fraction of TLP is caused by the impact of meteoroids on the surface of the Moon.

One needs only a small telescope to observe copious evidence of past impacts. It appears likely that lunar impacts are fairly common, but due to their largely unpredictable nature, none have been scientifically confirmed before 1999 November. Isolated observations of lunar flashes are reported frequently, including two reports of a single optical flash during the 2000 January total lunar eclipse.

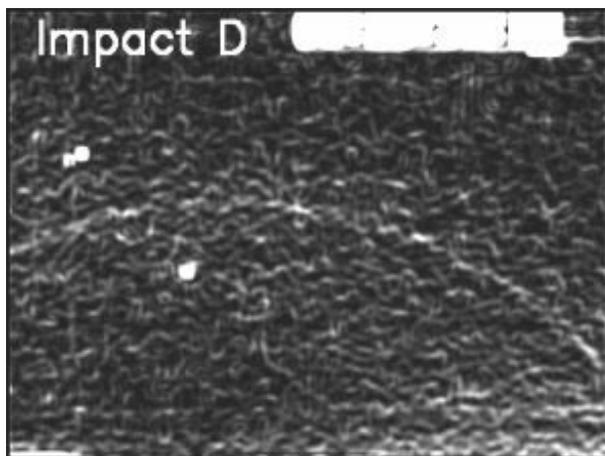


Figure 2. Impact D from David Dunham's videotape with enhancement of the lunar limb. Note the three stars in the upper left part of the image. The bright spot left of center is the meteoritic impact.

In the 12th century, monks witnessed what may have been an impact near the northern cusp of the thin crescent Moon, which might have resulted in the creation of the crater Bruno.

A more recent case is Dr. Leon Stuart's lunar "flare" of 1953, which he observed both visually and photographically.

Organized attempts were made by the ALPO in the 1940's, 1950's, and 1960's to monitor the Moon for meteoritic impacts, but none of the many impact candidates observed during these programs were independently confirmed [Williams, 2000]. The confirmed 1999 Leonid impact observations spurred the organization of a new coordinated effort to look for and document such events systematically.

The Lunar Meteoritic Impact Search Program (LMIS)

The primary goal of this new program is to enable the development of professional research on this form of TLP. The plan is to systematically monitor the Moon under favorable conditions to observe lunar meteoroid impacts. Opportunities include major meteor showers or storms when the Moon is favorably placed for viewing meteoritic impacts and the flux of meteoroids is significant enough in number density and impact velocity to give a reasonable chance of observing one or more impact events.

These events should be observable when a sizable area of Moon, not illuminated by the Sun and receiving meteoritic hits, is directed toward the Earth. At present, in the early stages of the program, we are using available resources and coordinating the observations of willing participants to develop a database of likely lunar impact events.

Questions this program should help to answer include: How common are impact flashes such as those observed recently on the Moon? Is it possible to observe these impacts during the occurrence of every major meteor shower when the Moon is favorably placed? What can these flashes tell us about the meteors themselves? What can the frequency and brightness of the impacts tell us about the size distribution of particles in the meteor stream? What models can theorists derive of meteoroid size, composition, kinetic energy to light efficiency, etc., that best match the observed flashes? How can systematic observations of lunar meteors best complement ground-based observations of meteors burning

up in the earth's atmosphere? Can correlating lunar impact observations with standard meteor observations provide a more comprehensive, three-dimensional picture of a meteoroid stream?

Some Results from the First Year of Observations

The LMIS organized efforts to observe the Moon during six events in 2000 and 2001:

- The Quadrantid meteor shower of 2000 January
- The total lunar eclipse of 2000 January
- The Eta Aquarid meteor shower in 2000 May
- The Perseid and Delta Aquarid showers activity of late July and early 2000 August, but not including the Perseid maximum
- The Ursid shower of 2000 December
- The Quadrantids of 2001 January

Unfortunately, the Moon was unfavorably placed during the maxima of the Perseid, Orionid, Leonid, and Geminid meteor streams in this time interval. A number of candidate events during the observed showers were reported, but none of them have been confirmed independently (Table 2). Three reports of sporadic candidate events were made and are included in the table. People who videotaped the Moon during the times listed in the table are asked to check their videotapes, to ascertain whether these events can be confirmed.

The table includes a pair of intriguing observations during the lunar eclipse of 2000 January 21. The CCD image by Gary Emerson was timed to the nearest second. The confirmatory observation by Costantino Sigismondi was recorded in his notes as approximately 0500 UT. Due to the orientation of the Moon at low altitude as seen from Padua, Sigismondi considers the location of the flash he saw to be compatible with Mare Fecunditatis. Although this pair of observations is very suggestive of a confirmed impact, Anthony Cook recorded the eclipse with video and found no flash on his videotape at the specified time.

Artifacts

The Geologic Lunar Researcher Group (GLR) in Italy has done a study comparing images of noise on videotape to images of actual stars [R. Lena, private communication, 2000]. Operating in complete darkness, a video camera typically produces spurious flashes. A preliminary look at the data showed that the size and intensity profile of a spurious flash is very

similar to that of a stellar image. Since lunar impact events are essentially stellar in appearance, their intensity profile is similar to that of a spurious flash. Some of the unconfirmed observations in Table 2 are likely such noise, rather than real impacts on the Moon. The GLR's finding shows the importance of simultaneous, independent observations by two or more observers.

An object between an observer and the Moon, such as a sunlit artificial satellite of Earth, can cause a flash of light that would appear identically located on the Moon to two observers who are not geographically widely separated. Therefore, the best confirmation of events on the Moon is made by two or more observers who are widely separated on Earth.

How Observers May Contribute to the LMIS Program.

General Principles of Observation.

So that the observation might be confirmed, it is crucial that the reported time be as accurate as possible. The best way to assure this is to record an accurate time signal along with the observation. To do this, use a short wave receiver tuned to station WWV, which transmits time signals at 2.5, 5, 10, 15, and 20 MHz, or to the Canadian station CHU broadcasting at 3.330 MHz and 7.335 MHz. Position the short wave radio so that the hand-held tape recorder (if observing visually) or the microphone of the videocamera (if videotaping) can record a clear signal, along with the observer's voice.

The time and date should be reported in Universal Time (UT). If the observer does not know how to convert the time and date to UT, he must provide the time

zone along with the local time and date.

Accurate locations on the Moon are also important for confirmation. Reporting the name of the mare, crater, or other feature near which an event was observed is sufficient to start with, but the final location should be as accurate as possible.

The observer should describe his equipment, including the type of telescope (e.g., Newtonian, refractor, etc.), the type of mounting (e.g., equatorial) and whether it is driven, the magnification used if the observation is visual, the focal length or field pixel size in arcseconds if the observation is by videocamera, and any filters used.

For the first time in history, independently confirmed observations of meteoritic impacts on the Moon were recorded during the Leonid meteor storm of November 18, 1999

Table 1: Table 2. Unconfirmed meteoritic Impact Candidates

Shower	UT Date	UT Time	Observer	Mag	Comment
Geminids	11 Dec 99	22:58:02	Palmer		
"	13 Dec 99	00:47:48	Palmer		
"	"	06:30:xx	English		middle of southern half of dark side.
"	14 Dec 99	02:54:40	Hendrix	4.5	near the center of Mare Imbrium.
"	"	03:17:52	Hendrix	5	
"	"	14:10:46	Li		
"	15 Dec 99	00:55:xx	Cudnik	7	
"	"	01:07:56	Cudnik	7	50% confidence.
"	"	02:12:29	Cudnik	7	50% confidence.
"	"	02:14:51	Cudnik	7	50% confidence.
"	"	02:16:57	Cudnik	5	70% confidence.
"	"	03:05:02	Cudnik	6	70% conf.; 200 km south of Montes Teneriffe.
"	"	03:09:40	Cudnik	6	75% conf.; near center of lunar disc.
(none)	21 Jan 00	05:00:xx	Sigismondi	5	Eclipse. Lower middle of lunar disc. Lasted 1 sec.
(none)	21 Jan 00	05:03:18	Emerson		Eclipse. CCD image. Southern M. Fecunditatis.
(none)	9 Feb 00	19:37:xx	Baio		Kepler, on dark side, lasted 3 to 4 seconds.
Eta Aquar	7 May 00	01:32:xx	Smith		location not noted.
"	"	02:14:06	Falvo		near center of Moon, perhaps Sinus Medii.
"	"	02:24:26	Falvo		south of the center, perhaps crater Maurolycus.
"	"	04:22:27	Anet	6	25 deg. N, 5 deg. E, in Montes Apenninus.
"	"	04:52:42	Anet	6	near Mare Nectaris.
"	8 May 00	02:04:xx	Cudnik		first of 6 events in 4 minutes, near M. Vaporum.
"	"	02:08:xx	Cudnik		last of 6 events, near M. Vaporum. Low confidence.
"	"	02:22:22	Cudnik	6	70 km SE of SE edge of Mare Nubium.
"	"	02:42:00	Cudnik		N shore of Mare Frigoris near W Bond crater.
"	"	02:42:30	Cudnik	7	near crater Kant.
"	9 May 00	05:04:26	Anet		5 events in 2 minutes, M. Imbrium near Archimedes.
Perseids	4 Aug 00	04:30:10	Anet		
"	"	04:38:20	Anet		
"	7 Aug 00	19:35:48	Sorrentino		
"	"	19:47:03	Sorrentino		
"	"	20:58:13	Sorrentino		
"	"	21:14:24	Sorrentino		
"	8 Aug 00	20:26:52	Sorrentino		
"	"	21:08:16	Sorrentino		
"	10 Aug 00	21:36:01	Sorrentino		
"	"	21:44:19	Sorrentino		suspected.
Orionids	22 Oct 00	10:22:xx	Patterson		50 km west of crater Reichenbach.
(none)	4 Dec 00	00:42:20	Cook		46 deg. E, 32 deg. S: SSW of Mare Humorum.

Percent confidence is the observer's estimate of the probability that the event occurred. Lunar directions are IAU east and west. The Geminid events were compiled by David Dunham.

Whether observing by eye or tape, it is important to know how bright representative stars of each magnitude appear with one's equipment. Soon after the flash, one should observe several calibration stars of known magnitude with the same equipment, and compare them with the flash. If possible, observe these stars at an elevation close to that of the Moon when the flash occurred, to lessen the effect of changing atmospheric extinction with elevation.

If the observation is visual, one should include the confidence level of the observation, an estimate of the duration of the flash, a description of weather conditions, an estimate of one's reaction time, and one's degree of fatigue.

Optimizing Your Observation

Since flashes should be brighter in the infrared than the visual, and video cameras are infrared-sensitive, in videotaping it is best not to use any filters.

One video camera of choice is the PC-23C, which can be purchased from www.supercircuits.com. Attached to a telescope, this camera is quite useful, especially when used with a focal reducer. David Dunham used it with his 5-inch Schmidt-Cassegrain telescope and an f/10 to f/6.3 focal reducer to record the Leonid impacts. The focal reducer widens the field of view and shortens the focal length. The wider field of view increases one's chance of recording an impact flash, while the shorter focal length concentrates the flash on fewer pixels to enhance its visibility.

If a video camera has an auto gain setting, disable it. Otherwise one cannot get accurate measurements of the brightness of an impact candidate or a comparison star.

Visual observers should take steps to minimize their fatigue. A fatigued person may be more likely to "see things" that aren't real events or to miss real impact flashes. Avoid severe sleep deprivation and use caffeine to heighten alertness.

Stray light is a special problem in these observations because the sunlit portion of the Moon is so close to the dark side under scrutiny. Quality refractors are well baffled, and Newtonians can be baffled as described recently [Seronik, 2001]. Schmidt-Cassegrains usually scatter more light than other types do. Observers can install an occulting bar at the field stop of the eyepiece. An occulting bar is simply a piece of opaque material, such as black construction paper, dark plastic, or metal. The key is to prevent the bright, sunlit portion of the Moon from saturating one's eye or videocamera and rendering faint impacts inaccessible.

Conclusion and Future Direction

By optimizing the times and methods of observing, the ALPO LMIS is able to increase the likelihood of observing impacts. Readers are encouraged to visit the LMIS web site (<http://www.lpl.arizona.edu/~rhill/alpo/lunarstuff/lunimpacts.html>) for more information and for observation report forms. Persons interested in participating should contact the author at xflare@earthlink.net so that he can add them to his list for the receipt of e-mail announcements of optimal observing times. These announcements will coordinate all the observers.

The observers of the LMIS, the International Occultation Timing Association, the UAI and GLR groups of Italy, and others will continue to monitor the Moon

during meteor showers. There is also a campaign being assembled to observe the Earthlit hemisphere of the waxing crescent Moon each month for impacts of sporadic meteors. This author is writing a book that will provide a catalogue of lunar transient phenomena observations that

are likely to have been lunar meteoritic impacts. The book will describe in detail the procedures for observing these events. Published by the Astronomical League, it will be the observer's handbook for the Lunar Meteor Impact Search program of the ALPO.

Many credible observers have reported brief flashes on the Moon, the likely signatures of impacts. It is possible that impact events are common enough to enable us to obtain useful data in the near future.

The frequency of confirmed observations will determine the feasibility of more serious research concerning lunar impact phenomena.

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Many credible observers have reported brief flashes on the Moon, the likely signatures of impacts. It is possible that impact events are common enough to enable us to obtain useful data in the near future.

ALPO Feature: The Moon Plato's Hook: Still an Open Problem

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[Editor's Note: The following article was originally submitted as a letter to the editor, rebutting points made in two previously published articles in this publication regarding a peculiar shadow called "Plato's Hook" in the lunar crater Plato.

However, due to the extreme length of the piece and the amount of detail included herein, the editor believes it is best presented in this manner.]

On the night of 1952 April 3rd, Patrick Moore and H. Percy Wilkins sketched the lunar crater Plato at the eyepiece of the Meudon's Observatory grande lunette. In their drawings, both the English observers reported a curious hook-shaped shadow projected on the south-east portion of the crater's floor, since then named the "Plato's Hook." This feature attracted some attention from various observers and every now and then it is reported on drawings or photographs, even if the original shape as depicted by Moore and Wilkins is always difficult to recognize.

Two articles by G. Favero et al. ([1], [2]) appeared recently in the ALPO journal proposing an explanation for the hook, which would be originated by a low hill adjacent to the south-east wall of Plato. In spite of the detailed investigation carried out in the above papers, we find the explanation of the hook proposed in [1] and [2] still unconvincing for a number of reasons.

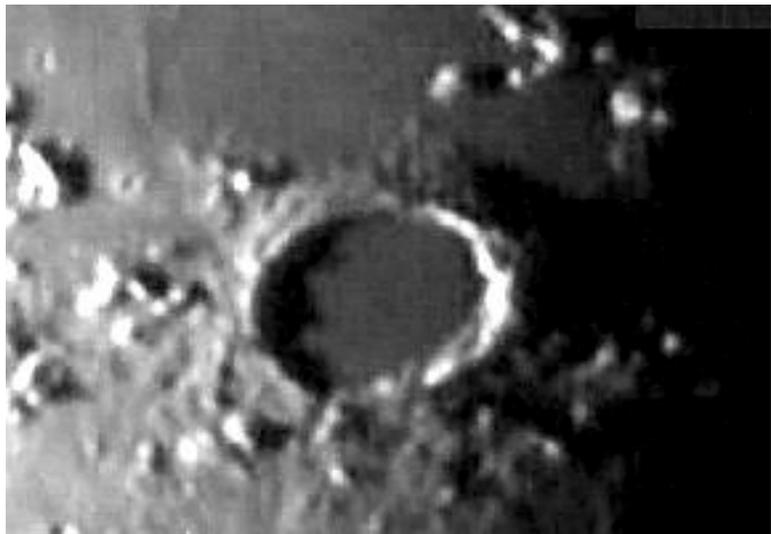
Favero et al. based most of their conclusions on the position of the hook as it can be measured on Moore and Wilkins drawings. In [1], the position of the shadow cast by Plato Gamma peak is compared to the position of the hook in order to demonstrate that the two shadows cannot be shed by the same feature. In [2], the wall's shadow in the 1952 drawings has been superimposed on a Lunar Orbiter image of Plato in order to compare the position of the hook with that of the complex hill named "ch", following the hypothesis that this is the source for the hook.

All of the above requires the 1952 drawings to be reliable as far as the position and the shape of the shadows on Plato's floor (in particular, that of the hook) are concerned. But this is not the case.

All of the CCD images reported in [1] demonstrate that the width and the profile of the east wall shadow as drawn by Moore and Wilkins are mutually incompatible, and that both drawings are only rough sketches of what Moore and Wilkins actually saw.

Favero et al. admit this point in both [1] and [2]; nevertheless, they consider both the position and the shape of the hook reliable, even admitting that the drawings are affected by many inconsistencies, for example the missing of the shadow cast by Plato Gamma peak.

Also, the shape of the east wall shadow in [4] and [5] remains always quite different from that visible in all the CCD images reproduced in [1], even when the "hook" cast by the hill ch is visible. In fact, one can read in [2] on page 28: "It can be concluded that the shape and extension of the shadow of the Plato east wall which appear in the 1952 drawings were not recorded at the telescope. Therefore this shadow cannot be relied upon". In the light of this statement, we have been surprised in reading on the same page 28 that the "...shape and position [of the hook] seem accurate under the limits of a visual observation". If all evidence points toward a certain inaccuracy of the 1952 drawings, we are wondering how the hook - as



Video CCD image of the crater Plato at $H = 4.14^\circ$, $A = 96.11^\circ$, $Col. = 16.7^\circ$ taken by G. Sorrentino on 2000, February 13 with a 20.0 cm Schmidt-Cassegrain telescope. The shadow cast by Plato Gamma shows a significant curvature.

depicted by Moore and Wilkins - can be an exception in this respect, as it is part of the east wall shadow itself.

Based on the above, it can be concluded that neither the position nor the shape of the hook in the 1952 drawings can be assumed a priori as correct because other important details of the wall's shadow are wrong or even completely lacking. As there is no evidence that at least the position of the hook in the drawings agrees with what Moore and Wilkins really saw, the correspondence between the hook itself and the hill profile in [2] (Figures 3 and 4) cannot be considered necessarily as a demonstration of the true origin of the hook, but it could also be a mere coincidence.

Favero et al. wrote in [1] that when the "hook" formed by the complex hill ch becomes visible and the overall shadow profile roughly resembles that reported by Moore and Wilkins, "the [east wall] shadow length measured on the 1952 drawings (0.21-0.22 of Plato's major axis) is incompatible with the value measured on our CCD frames (0.10-0.12)" (page 130). Assuming their interpretation of the hook to be correct, we ascribe this discrepancy to an error made by Moore and Wilkins in recording the time of their observation, which would have been carried out with the Sun "higher than 5.32 degrees" (that is, later than 21:30 UT); otherwise, the hook could not be visible.

But this assumption shall be considered unfounded unless further written records of that night other than those found in [3] and [4] (where 21:30 UT is reported) are produced to demonstrate that the recorded time was wrong. Moore's opinion on the subject [1], although reputable, cannot be considered reliable as the observation goes back 50 years. However, on that night, Moore and Wilkins saw other lunar details, recording the observing UT for each of them, so there is no reason to reject specifically the recorded time for the observation of Plato. If we accept this assumption, at 21:30 UT on 1952 April 3rd, the complex hill ch was completely covered by the wall's shadow and it could not form any hook, as shown in [1] Figure 4.

Moreover, at Meudon on the night of 1952 April 3, the Sun's elevation on Plato could reach a maximum value of 7.1 degrees only at the Moon setting time, 3:14 UT of the following day. Even by supposing that 21:30 UT is not the time of the observation, it is more reasonable to assume that the Sun's elevation on Plato couldn't be more than about 6.5 degrees when the drawings were made, with the Moon already uncomfortably low in the sky. This would exclude the hill ch being the cause of the hook shadow which Favero et al. state is visible under an 8-to-11-degree

altitude range of the Sun on Plato ([1] p. 130, [2] Figure 6).

But did Moore and Wilkins really overestimate the width of the shadow cast by the east wall of Plato, as it has been supposed in [1]? This point is doubtful and we think that only a couple of beginners could make such a gross mistake, and this is not the case with Moore and Wilkins. Our explanation is that the English observers actually have drawn a rough profile of the shadow while still at the eyepiece, but they were concerned mainly with the tiny craterlets on the floor, as it can be deduced from Wilkins' account of that night in [4] and [5]. As far as the wall's shadow is concerned, they limited the drawings to report the approximate width of the wall's shadow (which is in agreement with the recorded time of observation) and the presence of the only "strange" and prominent feature observed, that is the hook, regardless of the true shape of the overall shadow. As it has been correctly pointed out in [2], they had only a limited time available for describing or drawing every chosen major feature seen at the eyepiece. Surely Moore and Wilkins didn't want to waste time in drawing accurately such a relatively uninteresting detail as the wall shadow's profile.

We found in [1] and [2] another controversial point in the absence of the complex hill ch in the drawings of Moore and Wilkins. If Favero et al. are correct, the hill should have been visible to the English observers, as it is the source of the hook itself. On the contrary, between the hook and the crater's wall, they clearly had drawn a dark portion of the floor. If Moore and Wilkins were accurate in drawing the hook's position and shape -- a fundamental assumption in [1] and [2] -- why did they miss the complex hill whose contrast with respect to the crater's floor is so high?

Since in both drawings Plato's wall is reported all around the floor without gaps and the hill is part of the wall itself, it seems incredible that both observers missed reporting this feature. Even if one is drawing only an approximate representation of the crater, as Moore and Wilkins did, this detail cannot escape. It should be noted that in both of the 1952 drawings, the details outside the crater have been completed by Wilkins for publication purposes (as it can be inferred by comparing other drawings of the same Authors) while the floor has been drawn independently by two different observers using different drawing techniques. Both drawings show a dark flat where -- following the hypothesis in [1] -- a bright hill surrounded by the hook should be visible.

In ascribing the hook to the shadow cast by the low hill ch, Favero et al. seem particularly concerned with the missing of the Plato Gamma shadow from the 1952 drawings. This would be a quite strange occurrence as Figures 6 and 7 in [1] show that even when

the shadow of the hill is visible, the shadow of the Plato Gamma peak is more prominent and eye-catching than the "hook". Visual observations carried out by us at a Sun's altitude similar to the above images confirmed this impression.

It is unlikely that Moore and Wilkins forgot to report the Plato Gamma shadow while concentrating on the more subtle "hook". Instead, it is reasonable to suppose that the hook is, in fact, the Gamma peak shadow itself which, in some instances, appears slightly curved at low Sun (see figures 10 and 11 in [1], reference [6]). Its distorted representation (in shape and position) forms the hook in the 1952 drawings, a viewpoint already put forward in [1] by an ALPO Editor and by B. O'Connell in [3].

We agree about the position of Plato Gamma shadow being different from that of the hook in Moore and Wilkins drawings; however, these do contain other inconsistencies, thus, our hypothesis cannot be rejected. Moreover, it appears supported by the absence of the complex hill in the 1952 drawings which indicates that the hook actually developed onto the floor of Plato (see also Figure 9 in [1]) and that it was not simply adjacent to a portion of the crater's wall. The CCD image shown in the attached Figure 1 -- in which the shadow cast by Plato Gamma peak appears to simulate a hook -- is consistent with our viewpoint, despite the Favero et al. assertion that it "never displays significant curvature" ([2] p. 24).

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Jupiter Observing Alert

The following Observing Alert was issued by John McAnally, assistant coordinator of the ALPO Jupiter Section Transit Timings on January 14:

"From A CCD image taken by Maurizio DiSciullo on 2002 January 12/ 0345 hrs U.T., reveals what may be the beginning of the disruption of south temperate oval BA on Jupiter.

"In the image, examined by ALPO observer Clay Sherrod on January 13 and by ALPO Transit Coordinator John W. McAnally on January 14th, BA appears superimposed on top of another oval; or, as though BA has split into two components, one against the other, north to south, with a thin band of dark material separating the two.

"CCD images by Antonio Cidadao of Portugal taken on 2002 January 10 and 11 U.T. also show evidence of this.

"Astronomers are asked to make special efforts to observe this GRS/BA interaction so that a complete sequence of events can be constructed to characterize the behavior of the winds, jetstreams, and other atmospheric conditions surrounding this interaction; data which would be of great value."

And on 2002 January 26, the following:

"A consensus seems to be forming, within the amateur and professional astronomy community, that BA should be expected to survive its conjunction with the GRS. Although BA may be affected in several ways, it will probably, according to Dr. Reta Beebe, be slowed somewhat, then quickly be propelled past the GRS.

"The visual effect of BA being split or piled up on another oval was simply other cloud material circulating around BA, and being compressed between BA and the GRS currents.

"Even though BA may not be disrupted, observers must remain alert. Jupiter has surprised us in past apparitions.

"The professional community is especially interested in any methane images that may be obtained.

"Good observing to everyone and keep up the good work."

ALPO Feature:

Observations of Saturn During the 1999-2000 Apparition

**By: Julius L. Benton, Jr.,
Coordinator, ALPO Saturn Section**

Abstract

Twenty-six observers residing in Canada, Germany, Italy, Japan, Portugal, Puerto Rico, Singapore, Spain, the United Kingdom and the United States contributed a total of 259 visual, photographic, and CCD observations during the 1999-2000 Apparition of Saturn. These observations covered the period from 1999 Jul 09 - 2000 Apr 02. The instruments used ranged in aperture from 10.2 cm (4.0 in.) up to 50.8 cm (20.0 in.). Observers reported sporadic wispy festoons and irregular dusky phenomena among the belts and zones of Saturn's Southern Hemisphere during the apparition. In addition, diffuse white spots were strongly suspected in the planet's Southern Equatorial Zone (EZs) from 1999 July through 2000 January. These atmospheric features were short-lived, however, and recurring central meridian (CM) transit timings were not possible. Consequently, no rotation rates were derived for different Saturnian belt and zone latitudes during the 1999-2000 Apparition. The inclination of the Ring System to Earth, **B**, reached a maximum southerly value of $-21^{\circ}.066$ on 1999 Aug 22, and observers were afforded good views of Saturn's Southern Hemisphere and the South face of the Rings during the apparition. Accompanying this report are references, drawings, photographs, CCD images, graphs, and tables.

Introduction

The following analysis was derived from an excellent collection of 259 visual observations, photographs, and CCD images contributed by ALPO observers from 1999 Jul 09 through 2000 Apr 02, hereinafter referred to as the 1999-2000 "observing season" or Apparition of Saturn. Our discussion is supplemented by drawings and CCD images. All times and dates mentioned in this report are in Universal Time (UT).

Table 1 provides geocentric data for the 1999-2000 Apparition of Saturn. During the observing season the numerical value of **B**, the saturnicentric latitude of the Earth referred to the ring plane (positive when north), ranged between the extremes of $-21^{\circ}.07$ (1999 Aug 22) and $-19^{\circ}.09$ (2000 Jan 05). The value of **B'**, the Saturnicentric latitude of the Sun, ranged from $-18^{\circ}.82$ (1999 Jul 09) to $-21^{\circ}.75$ (2000 Apr 02).

Table 1: Geocentric Phenomena in Universal Time (UT) for the 1999-2000 Apparition of Saturn

Conjunction	1999	Apr	27d	11h	UT
Opposition		Nov	06	14	
Conjunction	2000	May	10	20	

Opposition Data:

Constellation	Aries
Declination	$+13^{\circ}.5$
Visual Magnitude	-0.2
B	$-19^{\circ}.9$
B'	$-20^{\circ}.2$
Globe Diameter	
Equatorial	20".3
Polar	18".5
Ring Axes	
Major	46".0
Minor	15".7

Table 2 lists the 26 individuals who supplied a total of 259 observations to the ALPO Saturn Section for the 1999-2000 Apparition, along with their observing sites, number of dates of observations, and descriptions of their telescopes.

Figure 1 is a histogram giving the distribution of observations by month, showing that most of the data were received for the months of 1999 August through 2000 January (84.2 percent), with a slight decline in the number of observations on either side of this period of greatest activity. Of the submitted observations, 52.9 percent were made before opposition (1999 Nov 06), 0.8 percent on the day of opposition, and 46.3 percent following opposition.

Although studying Saturn during the months including and surrounding opposition is very important, uninterrupted observations of the planet starting when it first appears in the eastern sky before dawn until it next approaches conjunction with the Sun is equally worthwhile.

Figure 2 shows by nation of residence the ALPO Saturn Section observers and observations for 1999-2000. During the apparition, the United States accounted for slightly more than half (56.8 percent) of the contributed observations and nearly two-thirds (61.5 percent) of the participating observers. The remaining 38.5 percent of the ALPO Saturn observers resided in Canada, Germany, Italy, Japan, Portu-

Table 2: Contributing ALPO Observers, 1999-2000 Apparition of Saturn

Observer and Observing Site	Number of Observations	Telescope(s) Used
Benton, Julius L.; Wilmington Island, GA	62	10.2-cm (4.0-in.) REF
Berg, Ray; Crown Point, IN	1	20.3-cm (8.0-in.) SCT
Boisclair, Norman J.; South Glens Falls, NY	1	50.8-cm (20.0-in.) NEW
Cidadao, Antonio; Oeiras, Portugal	5	25.4-cm (10.0-in.) SCT
Crandall, Ed; Winston-Salem, NC	13	25.4-cm (10.0-in.) NEW
Cudnik, Brian; Houston, TX	3	25.4-cm (10.0-in.) NEW
	8	35.6-cm (14.0-in.) SCT
del Valle, Daniel; San Juan, Puerto Rico	1	20.3-cm (8.0-in.) SCT
Di Sciuillo, Maurizio; Coconut Creek, FL	2	25.4-cm (10.0-in.) NEW
Frassati, Mario; Crescentino (VC), Italy	1	20.3-cm (8.0-in.) SCT
Gaherty, Geoff; Toronto, Ontario, Canada	1	15.2-cm (6.0 in.) NEW
Gossett, Richard; Roseville, MI	1	20.3-cm (8.0-in.) SCT
Haas, Walter H.; Las Cruces, NM	2	20.3-cm (8.0-in.) NEW
	22	31.8-cm (12.5-in.) NEW
Ikemura, Toshihiko; Nagoya, Japan	59	31.0-cm (12.2-in.) NEW
Jamison, Eric; Pepperell, MA	1	13.0-cm (5.1-in.) REF
	5	18.0-cm (7.1-in.) REF
Leong, Tan Wei; Singapore	3	20.3-cm (8.0-in.) SCT
	3	27.9-cm (11.0-in.) SCT
Melillo, Frank J.; Holtsville, NY	5	20.3-cm (8.0-in.) SCT
Miyazaki, Isao; Okinawa, Japan	4	40.4-cm (15.9-in.) NEW
Niechoy, Detlev; Göttingen, Germany	10	20.3-cm (8.0-in.) SCT
Parker, Donald C.; Coral Gables, FL	1	40.6-cm (16.0-in.) SCT
Peach, Damian; Norfolk, UK	22	30.5-cm (12.0-in.) NEW
Pearsall, James; McMinnville, TN	5	20.3-cm (8.0-in.) NEW
Plante, Phil; Braceville, OH	7	15.2-cm (6.0-in.) NEW
	2	20.3-cm (8.0-in.) SCT
	2	20.3-cm (8.0-in.) REF
Post, Cecil; Las Cruces, NM	1	30.5-cm (12.0-in.) NEW
Schmude, Richard W.; Barnesville, GA	2	10.2-cm (4.0-in.) NEW
Tobal, Tofol; Barcelona, Spain	3	11.0-cm (4.3-in.) MAK
Wasuita, Myron; Spotsylvania, VA	1	15.5-cm (6.1-in.) REF
Total Number of Observations	259	
Total Number of Observers	26	

* MAK = Maksutov, NEW = Newtonian, REF = Refractor, SCT = Schmidt-Cassegrain.

gal, Puerto Rico, Singapore, Spain, and the United Kingdom, whose contributions accounted for 43.2 percent of the total observations. It is obvious that international cooperation in our programs continued to flourish throughout 1999-2000.

Figure 3 depicts the number of observations by instrument type, and it can be seen that 81.1 percent of the 259 total observations in 1999-2000 were made with telescopes of classical design (refractors and Newtonians). Refractors, and Newtonian reflectors when properly collimated, usually produce supe-

rior resolution and image contrast, and they are often the telescopes of choice for detailed studies of the Moon and planets. Telescopes with apertures 15.2 cm (6.0 in.) or greater accounted for 72.2 percent of the observations contributed during the 1999-2000 Apparition. Readers are reminded, however, that smaller apertures in the range of 10.2 cm (4.0 in.) to 12.8 cm (5.0 in.) are still quite useful for observing Saturn.

The writer expresses his sincere gratitude to all of the individuals mentioned in *Table 2* who contributed

observational reports to the ALPO Saturn Section in 1999-2000. Observers everywhere who desire to undertake systematic studies of Saturn using visual methods, such as drawings and intensity estimates, as well as photography and more sophisticated techniques with CCD and video cameras, are heartily encouraged to join us in the future as we attempt to maintain an international, comprehensive surveillance of the planet. Readers should understand that the ALPO Saturn Section considers all methods of recording observations mentioned above as vital to the success of our programs, whether one's particular preference might be simply drawing Saturn at the eyepiece, making visual numerical relative intensity estimates, doing photography, or pursuing CCD imaging and videography. Novice observers are also urged to contribute, and the ALPO Training Program and Saturn Section will always be pleased offer assistance in getting started.

The Globe of Saturn

This apparition report is derived from an analysis of 259 observations sent to the ALPO Saturn Section during 1999-2000 by the 26 observers listed in Table 2. For brevity, the names of observers have been

omitted from the text unless an individual's identity was pertinent to the discussion. Drawings, CCD images, tables and graphs are included with this summary so that readers can refer to them as they study the text. Readers should note 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 there is no reference given to a particular global feature in our south-to-north discussion, these areas were not reported by observers during the 1999-2000 Apparition.

In developing apparition reports, the ALPO Saturn Section customarily compares data for global atmospheric features between observing seasons. This practice continues with this report to assist the reader in understanding the significance of very subtle, but nevertheless recognizable, variations that may be occurring seasonally on Saturn.

Observational results have indicated that the constantly changing inclination of Saturn's axis of rotation relative to the Sun and Earth contributes to many of the suspected intensity variations among belt and zones, and for the same features over time, which are listed in *Table 3*. Photoelectric photometry

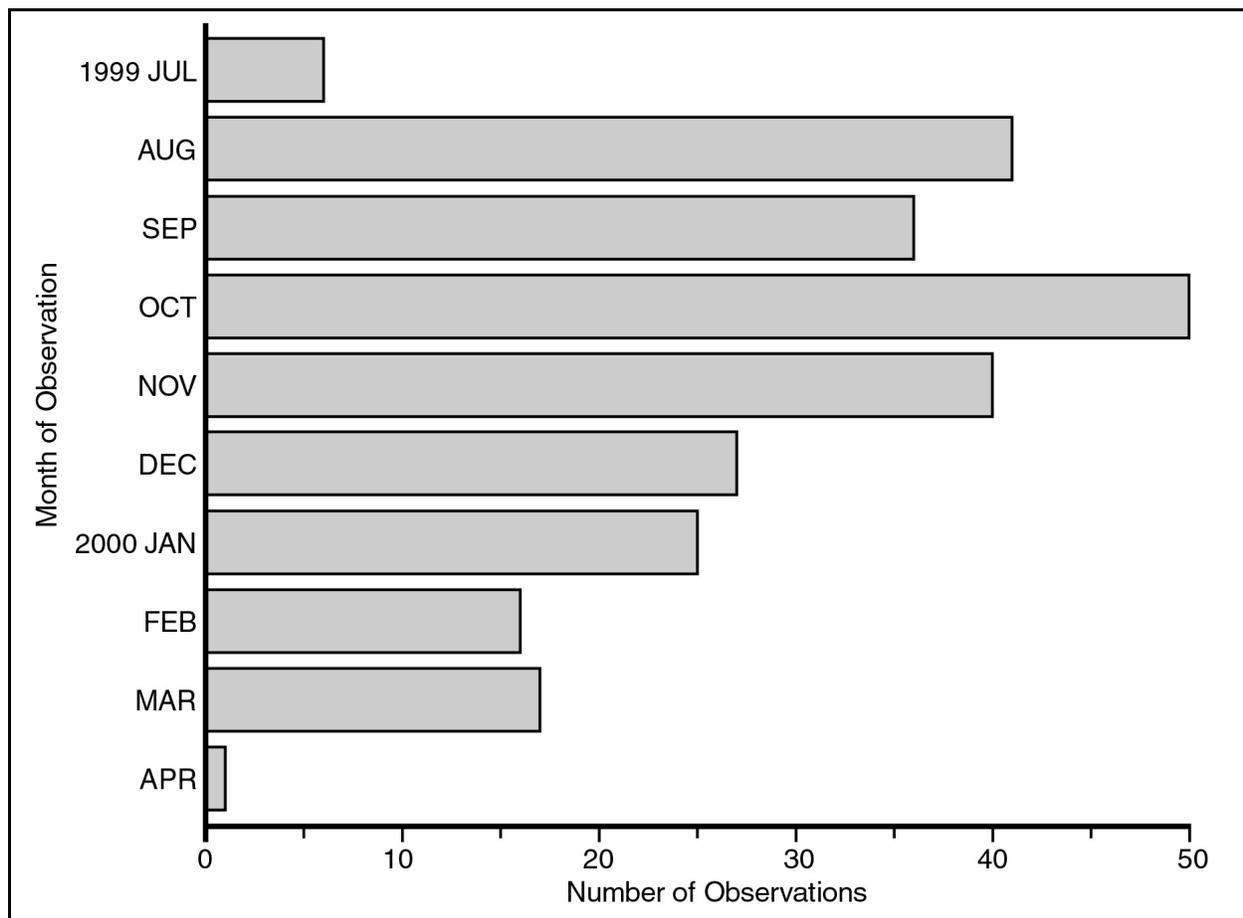


Figure 1. Distribution of Observations by Month, 1999-2000 Apparition of Saturn.

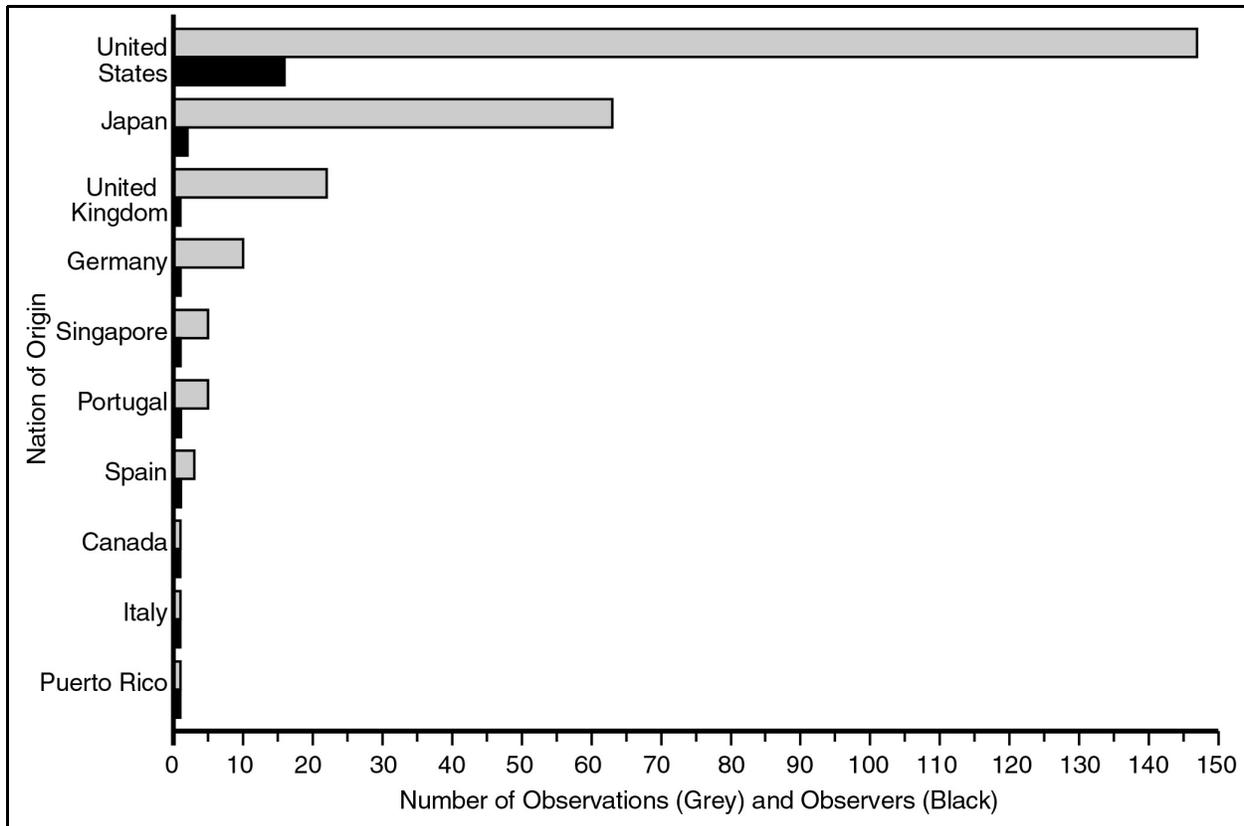


Figure 2. Distribution of Observations and Observers by Nation of Residence, 1999-2000 Apparition of Saturn.

of Saturn in recent years has also demonstrated that delicate oscillations of about 0.10 in visual stellar magnitude occur over time, even when adjusted for Earth-Sun and Saturn-Sun distance and for Ring tilt. Such data have prompted some investigators to postulate that transient and long-enduring atmospheric features in Saturn's belts and zones may induce presumed brightness fluctuations. Routine photoelectric photometry of Saturn, in conjunction with visual numerical relative intensity estimates, remains a very worthwhile project for observers to pursue.

The intensity scale employed is the *ALPO Standard Numerical Relative Intensity Scale*, where 0.0 signifies a total black condition and 10.0 denotes maximum brightness. This scale is normalized by setting the outer third of Ring B at a standard brightness of 8.0. The arithmetic sign of an intensity change is found by subtracting a feature's 1998-99 intensity from its 1999-2000 value. Variations of only 0.10 mean intensity points are not significant, and a perceived intensity fluctuation is not considered really noteworthy unless it is

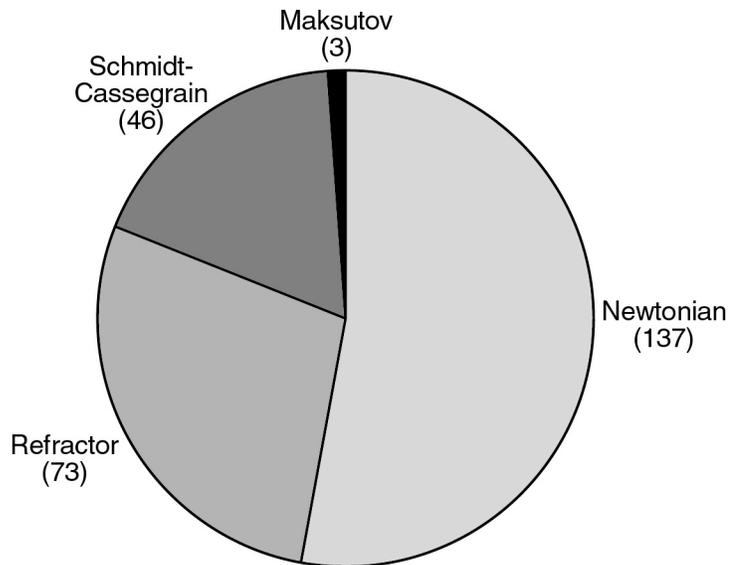


Figure 3. Distribution of Observations by Instrument Type, 1999-2000 Apparition of Saturn.

more than about three times its standard error.

Latitudes of Global Features

Observers used the convenient visual method developed by Haas during the 1960's to estimate Saturnian global latitudes at the eyepiece in 1999-2000. This method requires the observer to estimate the fraction of the polar semidiameter of the planet's disk that is subtended on the central meridian (CM) between the limb and the feature whose latitude is desired.

This procedure is easy to use and generates data that compare quite favorably with latitudes measured from drawings or with a bifilar micrometer.

After mathematical reduction, latitudes of Saturn's global features during 1999-2000 are shown in *Table 4*, but care must be taken not to place high confidence in data generated by only one or two observers.

Haas and others have been employing his visual technique for many years with excellent and reliable results. Observers are encouraged to try this very simple procedure, even if a bifilar micrometer is available, since comparison of latitude data gathered by both methods is useful. A detailed account of this visual technique can be found in *The Saturn Handbook*. Haas recently suggested that, as a control on the accuracy of his method, observers need to 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, notes based on latitude data are incorporated into the text where appropriate.

Southern Portions of the Globe

With the value of **B** at roughly -20° , good views of Saturn's Southern Hemisphere were possible during the 1999-2000 Apparition, while most of the Northern Hemisphere of the planet was invisible due to being blocked by the Rings as they cross the Globe. Most observers agreed that the Southern Hemisphere of Saturn was about the same in overall intensity as in 1998-99. On several instances during the 1999-2000 Apparition observers thought they detected evidence of dusky festoons associated with some of the more prominent belts and zones of the Southern Hemisphere of Saturn, but these features did not persist long enough to be recovered after one or more rotation of the planet. Very diffuse white spots were intermittently reported during 1999-2000 (chiefly during 1999 July through 2000 January) in the Equatorial Zone (EZs), although there were few confirming reports. Like the ill-defined wispy festoons, the whitish features on Saturn were transient and afforded little opportunity for timing of recurring CM transits. More will be discussed about these features in the upcoming section dealing with Saturn's Equatorial Zone.

Figure 4: General Nomenclature of Features of Saturn. B = Belt, C = Cap, G = Globe, R = Region or Ring, Z = Zone; N = North, S = South, f = following, p = preceding; E = Equatorial, P = Polar, Te = Temperate, Tr = Tropical. A, B and C (Crape) are Ring designations, while Cassini, Encke's and Keeler refer to Ring divisions.

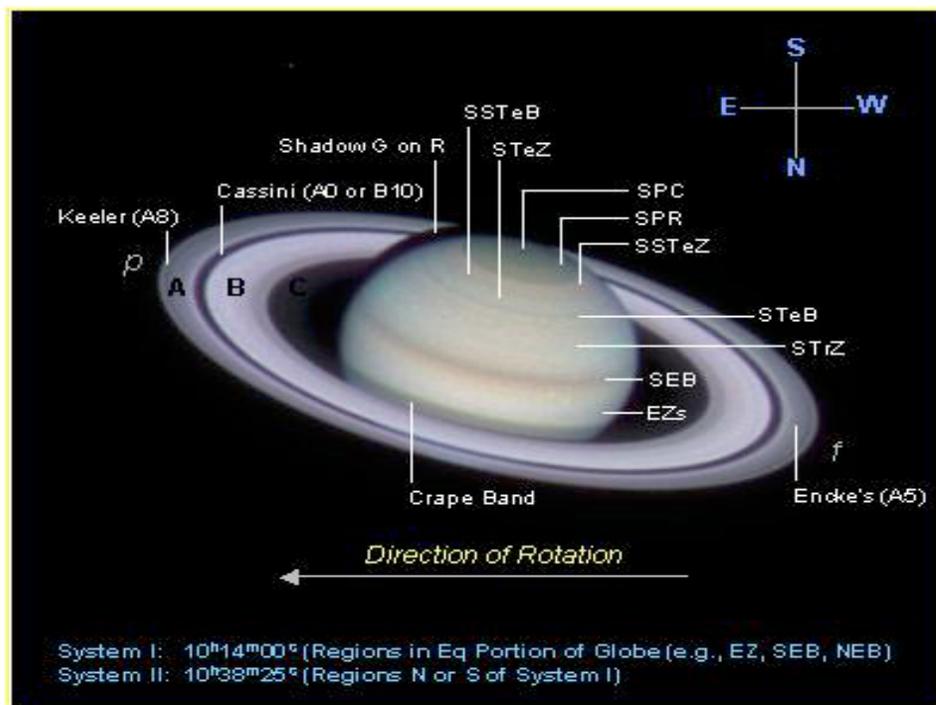


Table 3: Visual Numerical Relative Intensity Estimates and Colors for the 1999-2000 Apparition of Saturn

<u>1999-2000 Relative Intensities</u>				
Globe/Ring Feature	Number of Estimates	Mean and Standard Error	Change Since 1998-99	"Mean" Derived Color in 1999-2000
Zones:				
SPC	15	5.17±0.09	+0.03	Light Grey
SPR	12	4.70±0.37	+0.08	Dark Yellowish-Grey
STeZ	3	5.50±0.41	-1.28	Yellowish-Grey
STrZ	4	6.53±0.09	-0.41	Yellowish-White
SEBZ	4	5.10±0.27	-0.11	Dull Yellowish-Grey
EZs	36	6.90±0.14	-0.29	Bright Yellowish-White
Globe S of Rings	23	5.02±0.12	+0.12	Dull Yellowish-Grey
Globe N of Rings	26	4.87±0.10	-0.23	Dark Yellowish-Grey
NPR	2	6.75±0.53	-----	Yellowish-White
Belts:				
SPB	20	3.79±0.05	+0.70	Dark Grey
STeB	2	6.00±0.00	+0.72	Light Yellowish-Grey
SEB (entire)	11	3.75±0.60	+0.56	Greyish-Brown
SEBs	23	3.63±0.13	-0.38	Dark Grey
SEBn	25	3.06±0.14	-0.48	Very Dark Grey
EB	15	3.97±0.04	-0.56	Dark Grey
Rings:				
A (entire)	22	6.90±0.10	-0.34	Pale Yellowish-White
Ring A (outer 1/2)	14	6.92±0.08	-----	Pale Yellowish-White
Ring A (inner 1/2)	14	6.79±0.11	-----	Pale Yellowish-White
A5	13	3.83±0.10	-0.17	Dark Grey
A0 or B10	25	0.88±0.14	-1.28	Greyish-Black
B (outer 1/3)		8.00 ----	-----	Brilliant White
STANDARD				
B (inner 2/3)	31	7.24±0.05	-0.18	Yellowish-White
B1	2	3.75±0.11	-----	Dark Grey
B2	10	3.84±0.07	-----	Dark Grey
B3	1	4.1 ----	-----	Dull Grey
C (ansae)	24	0.63±0.04	-0.13	Greyish-Black
Crape Band	25	2.23±0.19	+0.33	Very Dark Grey
Sh G on R	28	0.14±0.04	-0.01	Dark Greyish-Black
Sh R on G	9	1.09±0.39	+0.14	Dark Greyish-Black
TWS	14	7.74±0.11	+0.08	Bright 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 ALPO Intensity Scale, where 0.0 denotes complete black (shadow) and 10.0 refers to the most brilliant condition (very brightest Solar System objects). The adopted scale for Saturn uses a reference standard of 8.0 for the outer third of Ring B, which appears to remain stable in intensity for most ring inclinations. All other features on the Globe or in the Rings are compared systematically using this scale, described in *The Saturn Handbook*, which is issued by the ALPO Saturn Section. The "Change Since 1998-99" is in the sense of the 1998-99 value subtracted from the 1999-2000 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.

Table 4: Saturnian Belt Latitudes in the 1999-2000 Apparition

Saturnian Belt	Number of Estimates	Form of Latitude		
		<u>Eccentric (Mean)</u>	<u>Planetocentric</u>	<u>Planetographic</u>
N edge SPB	7	-81°.36±0.34 (-4.02)	-80°.34±0.37 (-4.46)	-82°.27±0.30 (-3.61)
S edge SEB	16	-31°.85±0.24 (+2.79)	-29°.02±0.22 (+2.66)	-34°.83±0.25 (+2.90)
N edge SEB	16	-25°.10±0.12 (+1.16)	-22°.69±0.11 (+1.09)	-27°.68±0.12 (+1.23)
Center EB	13	-20°.73±0.25 (-3.78)	-18°.68±0.23 (-3.46)	-22°.97±0.28 (-4.12)

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 1998-99 latitude value from the 1999-2000 latitude value.

South Polar Region (SPR). The dark yellowish-grey SPR was usually uniform in appearance during 1999-2000, displaying no discernable activity, and it had essentially the same mean intensity as in 1998-99. There were several reports in 1999-2000 of a light-grey South Polar Cap (SPC), slightly brighter than the surrounding SPR, and maintaining essentially the same mean intensity since 1998-99. The dark-grey South Polar Belt (SPB) was reported fairly frequently during 1999-2000 encircling the SPR, and there was an impression by some observers that the

SPB was slightly lighter during this observing season than the last (by +0.70 mean intensity points).

South Temperate Zone (STeZ). The yellowish-grey STeZ was not particularly prominent during 1999-2000 and seldom reported by observers. On those rare occasions when it was seen, the STeZ was thought to be slightly duller in 1999-2000 than in 1998-99 (a difference of -1.28 in mean intensity). Although based on a very few observations, the impression was that the STeZ ranked third behind the

General Comments for Figures 5-17. The 13 CCD images and drawings that follow are all oriented with celestial south at the top and celestial west at the left (unless otherwise stated), which is the normal inverted view when observing objects near the meridian with an astronomical telescope in the Earth's Northern Hemisphere. Seeing was reported on, or has been converted to, the standard ALPO scale, ranging from 0.0 for the worst possible condition to 10.0 for perfect seeing. Transparency is the limiting naked-eye stellar magnitude in the vicinity of Saturn.

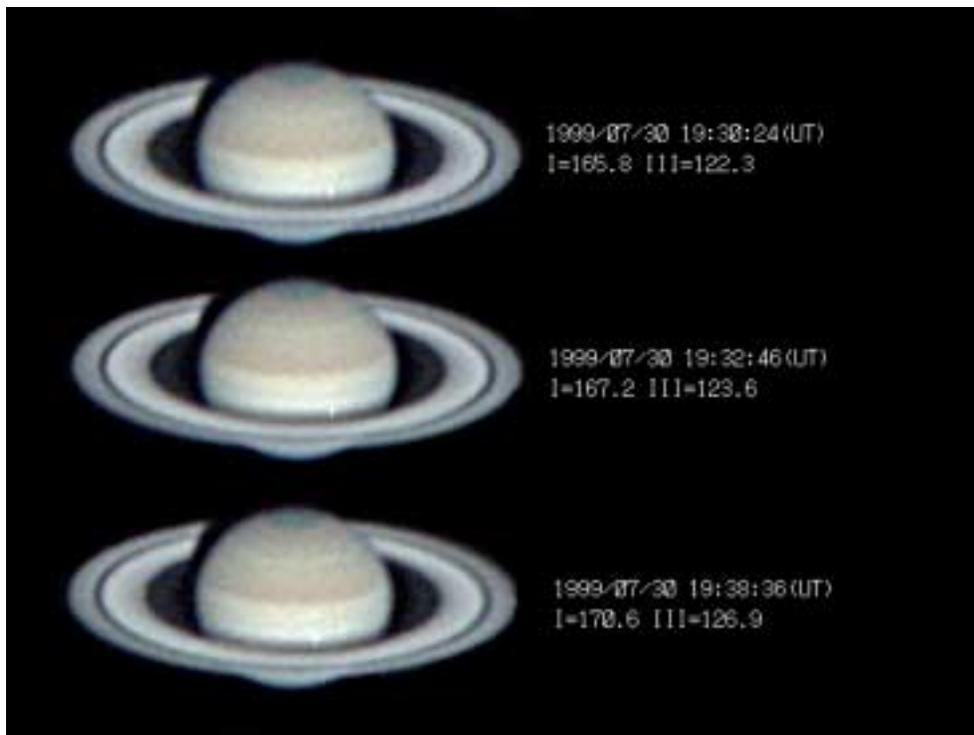


Figure 5: 1999 JUL 31 [sic.]; 19:30:24, 19:32:46 and 19:38:36 UT. T. Ike-mura. 31.0-cm (12.2-in.) NEW, NEC PICONA Digital Camera, 1/7 sec, 5X Barlow, f/33, composite image. White spots in EZs. CM I = 289°.3, 290°.5 and 294°.0; CM II = 093°.2, 094°.3 and 097°.7. B = -21°.0, B' = -19°.1. Globe = 17".9 X 16".3, Rings = 40".5 X 14".5.

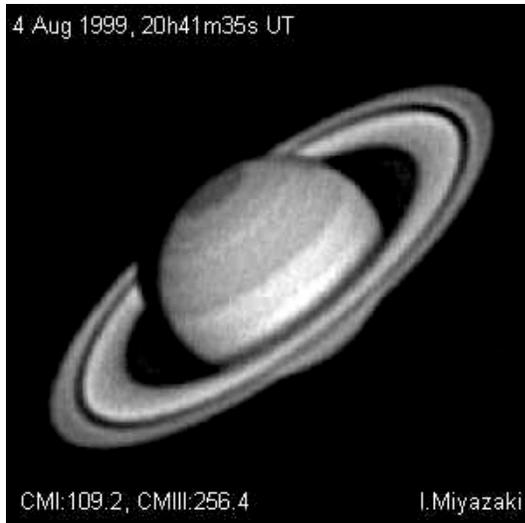


Figure 6: 1999 AUG 04, 20:41:35 UT. I. Miyazaki. 40.4-cm (15.9-in.) NEW, LynxxPC CCD Camera, Integrated Light. CM I = 108°.3, CM II = 141°.4. B = -21°.0, B' = -19°.1. Globe = 18".0 X 16".4, Rings = 40".8 X 14".6. South to upper left.



Figure 7: 1999 AUG 28, 18:00:28 UT. T. Ikemura. 31.0-cm (12.2-in.) NEW, NEC PICONA Digital Camera, 1/7 sec, 5X Barlow, f/34, composite image. CM I = 118°.2, CM II = 099°.8. B = -21°.1, B' = -19°.4. Globe = 18".8 X 17".2, Rings = 42".6 X 15".3.



Figure 8: 1999 AUG 28, 18:18:36 UT. T. Ikemura. 31.0-cm (12.2-in.) NEW, NEC PICONA Digital Camera, 1/7 sec, 5X Barlow, f/34, composite image. CM I = 128°.8, CM II = 109°.9. B = -21°.1, B' = -19°.4. Globe = 18".8 X 17".2, Rings = 42".6 X 15".3.

EZs and STrZ in 1999-2000 as the brightest zone in the Southern Hemisphere of Saturn, just as in 1998-99. The STeZ exhibited uniform intensity throughout the apparition with no clearly-defined activity. Compared with the STrZ, the STeZ was darker by -1.03 mean intensity points.

South Temperate Belt (STeB). The STeB was reported on only two occasions during the 1999-2000 Apparition, as light greyish-yellow in hue, and according to those who saw the feature, it may have been slightly lighter in intensity (by +0.72 mean intensity points) since 1998-99. The STeB exhibited no activity as it ran uninterrupted across the Globe from limb to limb.

South Tropical Zone (STrZ). Just like the duller STeZ, the yellowish-white STrZ was infrequently detected by observers in 1999-2000, and its mean intensity remained almost stable since 1998-99 (a difference of only -0.41 mean intensity points). Other than the EZs, the STrZ was the brightest zone in the Southern Hemisphere of Saturn, and it was reported to be completely devoid of activity throughout the observing season.

South Equatorial Belt (SEB). During 1999-2000, the SEB, taken as a whole, was a distinct greyish-brown feature, with a mean intensity change since 1998-99 of +0.56, an almost negligible increase in brightness. It was more commonly described as being differentiated into SEBn and SEBs components (where n refers to the North Component and s to the South Component), but a well-defined intervening South Equatorial Belt Zone (SEBZ) was referred to on only four occasions in 1999-2000. The dull yellowish-grey SEBZ was essentially unchanged (-0.11 mean intensity points) in brightness since 1998-99. The SEB was the darkest and most conspicuous belt in the Southern Hemisphere of Saturn in 1999-2000, and considering the two dark-greyish SEB components, the SEBn was always slightly darker than the adjacent SEBs. Although some individuals felt that the SEBn and SEBs were slightly darker in 1999-2000 than in 1998-99. Mean intensity data in 1999-2000, compared with 1998-99, suggests that the SEBn and SEBs were slightly darker (apparent changes of -0.48 and -0.38 mean intensity points, respectively)."

There were a few reports during 1999-2000 of diffuse dark spots and dusky projections that emanated from the northern border of the SEBn, extending into the EZs. These transient features did not remain visible for a few complete rotations of Saturn, preventing systematic CM transit timings.

Equatorial Zone (EZ). The bright yellowish-white southern half of the Equatorial Zone (EZs) in 1999-2000 was the region of the EZ seen between where

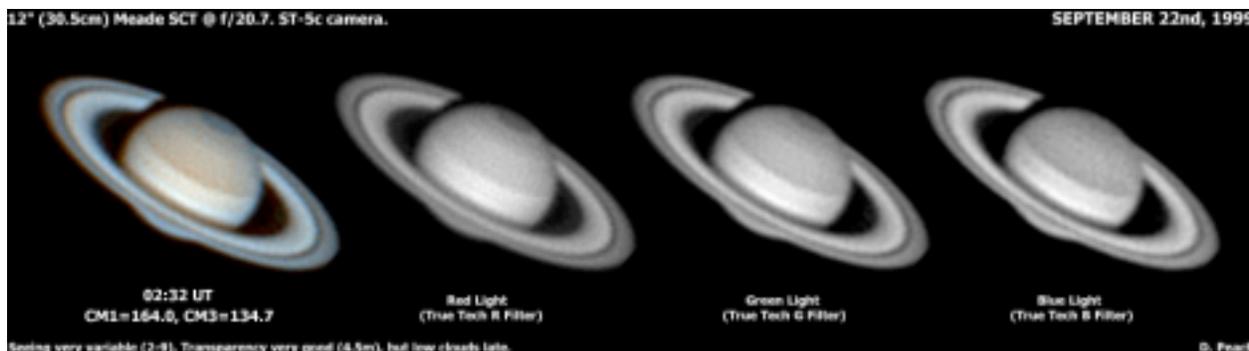


Figure 9: 1999 SEP 22, 02:32 UT. D. Peach. 30.5-cm (12.0-in.) SCT, CCD, Integrated Light, red, green, and blue light, composite images. S = 4.5 (avg), Tr = 4.5. CM I = 163°.8, CM II = 078°.6. B = -20°.8, B' = -19°.7. Globe = 19".5 X 17".9, Rings = 44".3 X 15".8. South to upper right.

the Rings cross the Globe of the planet and the SEB; the EZs was not visible during the observing season. The mean intensity of the EZs was virtually the same as in 1998-99 (an apparent change of only -0.29 mean intensity points), and it was consistently the brightest zone on Saturn during the 1999-2000 Apparition and equal to Ring A (taken as a whole) in mean intensity. In 1999 July through 2000 January, observers called attention to several diffuse, ill-defined white spots in the EZs. However, as in the 1998-99 Apparition, none of these features lasted long, nor did they appear as bright as those suspected back in 1996-97. Ikemura in Japan captured one of the reported white spots on CCD images taken on 1999 Jul 30 between 19:30 and 19:38 UT, and Plante in the United States drew a white spot in the EZs on 1999 Oct 12 from 03:55 to 04:15 UT (see Figure 10). Pearsall in the United States may have also imaged white spots in the EZs on 2000 Jan 22 from 00:24 to 00:39 UT, but they were close to the threshold of visibility. Efforts to recover these white spots in the EZs at subsequent rotations of Saturn during 1999-2000 were not successful, barring useful CM transit timings.

In 1999-2000 several observers noticed the Equatorial Band (EB) as a dark grey, roughly linear feature

extending across Saturn's Globe. Mean intensity data in 1999-2000 suggested that the EB was a little darker than in 1998-2000, but again, a mean change of -0.56 since 1998-99 is not considered statistically significant.

Northern Portions of the Globe

Because of Saturn's increasingly negative ring tilt in 1999-2000, which exposed ever more of the Southern Hemisphere of the planet, virtually no features in the Northern Hemisphere could be seen to advantage except perhaps the North Polar Region (NPR). The Globe north of the Rings was a rather uniform dark yellowish-grey throughout the observing season, and this region did not appear differentiated in 1999-2000, nor had it changed much in mean intensity since 1998-99.

Shadow of the Globe on the Rings (Sh G on R). The Sh G on R was seen by observers as a dark greyish-black feature with regular form on either side of opposition during 1999-2000. Any perceived departure from a true black (0.0) intensity was a result of poor seeing conditions or scattered light.

Table 5: Observations of the Bicolored Aspect of Saturn's Rings During the 1999-2000 Apparition

Observer	UT Date and Time		Telescope			Filter			
			Type and Aperture	X	S	Tr	BI	IL	Rd
Crandall	1999 SEP 14	09:40-10:25	NEW 25.4 cm. (10.0 in.)	220	5.5	4.0	=	=	E
Haas	1999 NOV 06	06:03-07:18	NEW 31.8 cm. (12.5 in.)	366	3.5	4.0	E	=	=
Haas	2000 MAR 09	02:06-03:34	NEW 20.3 cm. (8.0 in.)	231	3.0	3.5	E	=	=
Haas	2000 MAR 17	02:05-02:20	NEW 31.8 cm. (12.5 in.)	202	2.0	3.5	E	=	=

Notes: NEW = Newtonian, X = magnification. Seeing (S) is in the 0-10 ALPO Scale, and Transparency (Tr) is the limiting visual magnitude in the vicinity of Saturn. Under "Filter," BI 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 west, "W" that the west ansa was the brighter, and "=" means that the two ansae were equally bright. East and west directions are in the IAU sense.

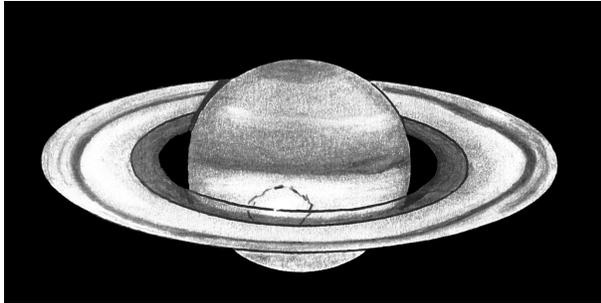


Figure 10: 1999 OCT 12, 03:55-04:15 UT. P. Plante. 20.3-cm (8.0-in.) SCT, Integrated Light, 250X. S = 6.5, Tr = 5.0. White spots suspected in EZs. CM I = 179°.9-192°.2, CM II = 167°.5 - 178°.7. B = -20°.5, B' = -19°.9. Globe = 20".0 X 18".3, Rings = 45".4 X 15".9.

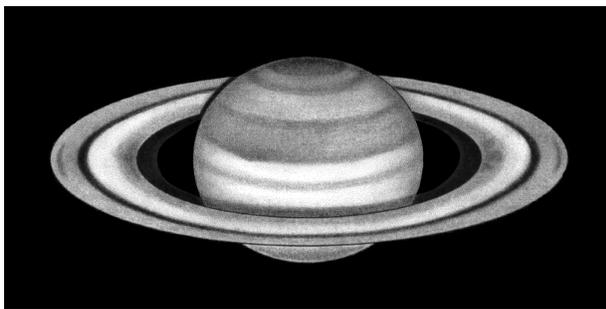


Figure 11: 1999 OCT 31, 22:15-22:30 UT. M. Frassati. 20.3-cm (8.0-in.) SCT, Integrated Light, 250-400X. Spokes suspected at ansae in inner edge of Ring B. Superb drawing! Saturn nearing opposition (1999 NOV 06). CM I = 310°.0-318°.8, CM II = 017°.5-026°.0. B = -20°.1, B' = -20°.1. Globe = 20".2 X 18".5, Rings = 45".9 X 15".8.



Figure 12: 1999 NOV 28, 16:40 UT. T. Leong. 20.3-cm (8.0-in.) SCT, ST7E CCD camera, f/20.5. CM I = 165°.0, CM II = 246°.7. B = -19°.5, B' = -20°.4. Globe = 20".1 X 18".3, Rings = 45.5 X 15".2.

Shadow of the Rings on the Globe (Sh R on G). Observers in 1999-2000 described this shadow as a dark greyish-black feature south of the Rings where they crossed the Globe. Reported variations from an intrinsic black (0.0) condition were due to the same causes as listed in the preceding paragraph.

Saturn's Ring System

This section of the 1999-2000 Apparition report concerns investigations of Saturn's Ring System, including a continuing comparative analysis of mean intensity data that has been a practice in previous observing seasons. Views of the southern face of the Rings were increasingly favorable during 1999-2000 as the negative value of **B** increased.

Ring A. Ring A as a whole appeared pale yellowish-white throughout 1999-2000 with no obvious change in mean brightness since 1998-99. On several occasions, observers described pale yellowish-white outer and inner halves of Ring A, both similar in overall intensity, with an intervening dark greyish Encke's Division (A5) visible sometimes at the ring ansae. No other intensity minima in Ring A were reported in 1999-2000.

Ring B. The outer third of Ring B is the standard of reference for the ALPO Saturn Visual Numerical Relative Intensity Scale, with an assigned value of 8.0. For the entire 1999-2000 Apparition, this region of Ring B was brilliant white, maintained its usual stability in intensity, and was always the brightest feature on Saturn's Globe or in the Ring System. The inner two-thirds of Ring B, which was described as yellowish-white in color and uniform in intensity, was basically the same mean intensity in 1999-2000 as in 1998-99. Frassati on 1999 Oct 31 suspected dusky "spokes" at the inner edge of Ring B near the ansae (see *Figure 11*), but confirming reports were lacking. Observers also suspected dark grey intensity minima at B1, B2, and B3 during 1999-2000.

Cassini's Division (A0 or B10). Observers saw the greyish-black Cassini's division (A0 or B10) at both ansae during 1999-2000, several saying that they could follow this feature around the entire Ring System in favorable seeing and with larger apertures. These improved views were possible because of increased ring inclinations during 1999-2000, where the numerical value of **B** averaged about -20°.0 in 1999-2000 as opposed to -15°.0 in 1998-99. It should be pointed out that a divergence from a totally black intensity for Cassini's Division is due to extraneous effects such as scattered light, poor seeing, inadequate aperture, and so forth. Although the mean intensity data hint at a slightly darker appearance for Cassini's Division since 1998-99 (by -1.28 mean intensity points), this impression was probably due to

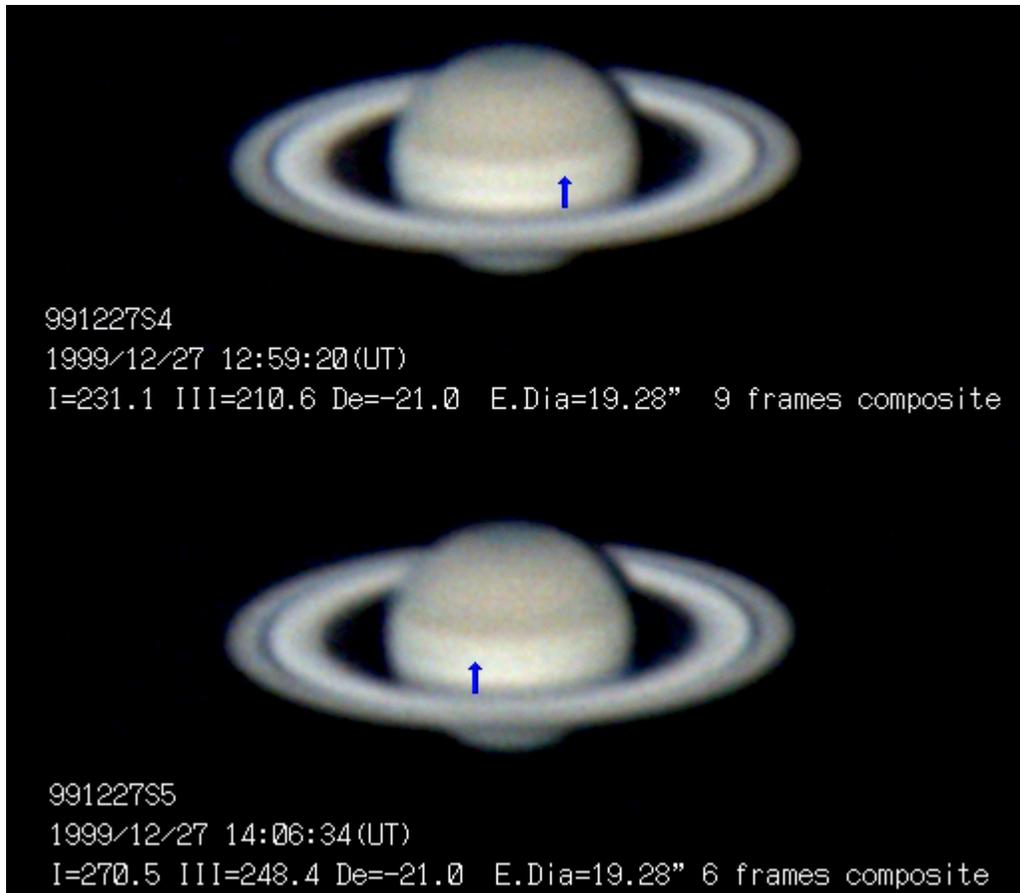


Figure 13: 1999 DEC 27, 12:59:20-14:06:34 UT. T. Ikemura. 31.0-cm (12.2-in.) NEW, NEC PICONA Digital Camera, 1/7 sec, 5X Barlow, f/30, composite images. CM I = 230°.2-269°.4, CM II = 270°.2-307°.9. B = -19°.1, B' = -20°.8. Globe = 19".4 X 17".7, Rings = 43".9 X 14".4.

increased ring tilt and thus the better visibility of the feature during 1999-2000.

Ring C. The greyish-black Ring C was often reported at the ansae throughout 1999-2000, showing no real difference in mean intensity since 1998-99. Where Ring C crossed Saturn's Globe (the Crape Band), it was uniform in intensity and very dark grey in appearance. It is fairly easy to understand that when **B** and **B'** are both negative, and **B** < **B'**, the shadow of the Rings on the Globe will be cast to their south, which occurred during the 1999-2000 observing season during 1999 Apr 20 to Oct 31. The Crape Band is then also to the south of the projected Rings A and B. If **B** > **B'**, the shadow is north of the projected Rings, which took place in 1999-2000 beginning about 1999 Nov 01. When the Ring C projection and the shadow of Ring B are superimposed, they are not easily distinguished from each other in ordinary apertures and seeing conditions, and the shadow of Ring C is most certainly an added complication.

Terby White Spot (TWS). The TWS refers to a brightening of the Rings that may be seen immediately adjacent to the Sh G on R. On quite a few occasions in 1999-2000 observers called attention to a bright TWS (mean intensity of 7.74), but this feature is of no real importance. The TWS is almost certainly a spurious contrast phenomenon and not an intrinsic

feature on the planet Saturn. Yet, it is still useful to attempt to determine what correlation might exist between the visual numerical relative intensity of the TWS and the changing tilt of the Ring System, including its brightness and visibility in variable-density polarizers and color filters of precisely-known transmission.

Bicolored Aspect of the Rings. The bicolored aspect is a perceived variation in color between the East and West ansae (IAU direction system) when systematically compared with W47 (Wratten 47), W38, or W80A (all blue) and W25 or W23A (all red) Filters. Although a number of observers studied the ring ansae for this effect in 1999-2000, only Crandall and Haas described a bicolored aspect of the ring ansae, on four separate occasions during the apparition. *Table 5* lists the circumstances of those observations. Note that the directions in *Table 5* refer to Saturnian or IAU directions, where West is to the right in a normally-inverted telescope image (observer located in the Northern Hemisphere of the Earth) which has South at the top.

To attempt to fully understand the bicolored aspect of the Rings, the ALPO Saturn Section strongly encourages observers to participate in organized simultaneous observing programs based on a schedule developed to insure that individuals in various loca-

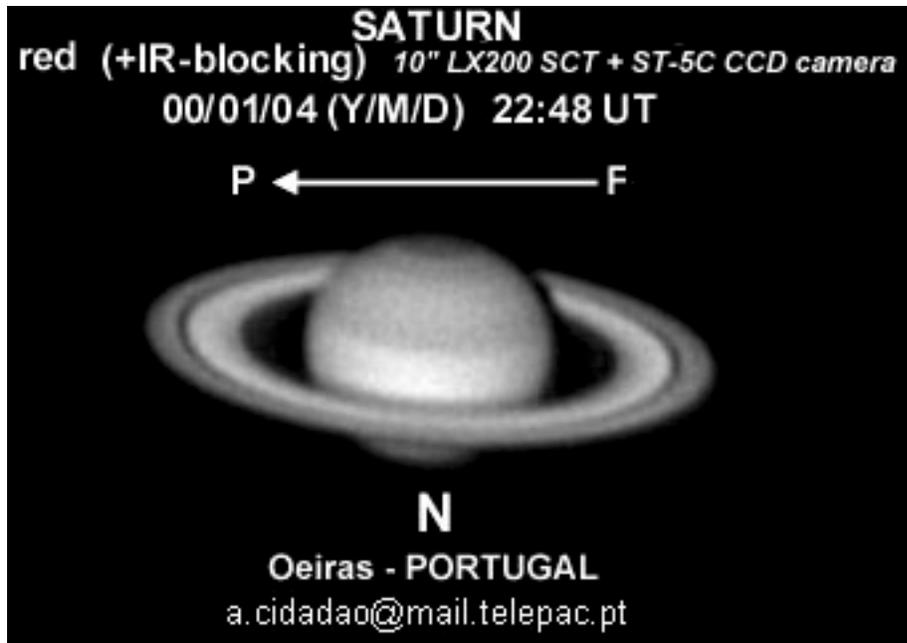


Figure 14: 2000 JAN 04, 22:48 UT. A. Cidadao. 25.4-cm (10.0-in.) SCT, ST-5C CCD Camera, Red Light + IR blocking filter. CM I = $129^{\circ}.7$, CM II = $258^{\circ}.0$. B = $-19^{\circ}.1$, B' = $-20^{\circ}.8$. Globe = $19''.1 \times 17''.4$, Rings = $43''.3 \times 14''.2$. (Note: Original had north at the top.)

tions are viewing Saturn on the same date and at the same time. The greater the number of people taking part in this effort, making independent, systematic visual estimates with color filters and doing CCD work and photography in the corresponding wavelengths, all at the same time, the greater will be the chances of shedding some new light on this intriguing and poorly-understood phenomenon.

Saturn's Satellites

Observers in 1999-2000 did not contribute systematic visual estimates of Saturn's satellites employing recommended methods discussed in *The Saturn Handbook*, but Tobal and Melillo did submit CCD images of Saturn's satellites. Photoelectric photometry and systematic visual magnitude estimates of Saturn's satellites are strongly encouraged for future apparitions.

The ALPO Saturn Section has been invited to participate in an amateur-professional cooperative project that involves regular spectroscopy of Titan. It is known that Titan is quite a dynamic satellite, exhibiting transient and long-term variations due to a number of different reasons. Despite the fact that Titan has been sporadically monitored by large Earth-based instruments, as well as the Hubble Space Telescope, a definite need exists for truly systematic observations with instrumentation available to amateurs.

From 3000\AA to 6000\AA Titan's color is dominated by the reddish methane haze in its atmosphere, while longward of 6000\AA , increasingly deeper methane absorption bands occur in its spectrum. Between these methane bands are "windows" to the lower atmosphere and surface. For example, daily monitoring in these "windows" using photometers or spectrophotometers can be useful for cloud and surface studies, and long-term studies of other areas apparition-to-apparition can shed light on Titan's seasonal variations.

Melillo was the first ALPO observer to try his hand at rudimentary spectroscopy of Titan during 1999-2000, and he hopes to expand

these studies in subsequent apparitions. Suitably-equipped observers are, therefore, urged to participate in this very interesting project. More details on this endeavor can be found on the Saturn page of the ALPO website at <http://www.lpl.arizona.edu/alpo/>.

Simultaneous Observations

Simultaneous observations, which are defined as studies of Saturn by individuals working independently of one another but at the same time and on the same date, provide much-needed verification of ill-defined phenomena on Saturn's globe and in the Ring System. Such efforts significantly reinforce the level of confidence we have in data submitted for each apparition. A few simultaneous, or near-simultaneous, observations of Saturn were submitted during 1999-2000, but as in the 1998-99 Apparition, the occurrence of such observations was generally fortuitous. The ALPO Saturn Section has organized simultaneous observing teams so that several individuals in reasonable proximity to one another will be viewing Saturn at the same time using similar equipment and methods. Although it is important that at least our more experienced observers take part in this effort, newcomers to observing Saturn are welcome to contribute. Readers are urged to inquire about how to join the simultaneous observing team in future observing seasons.

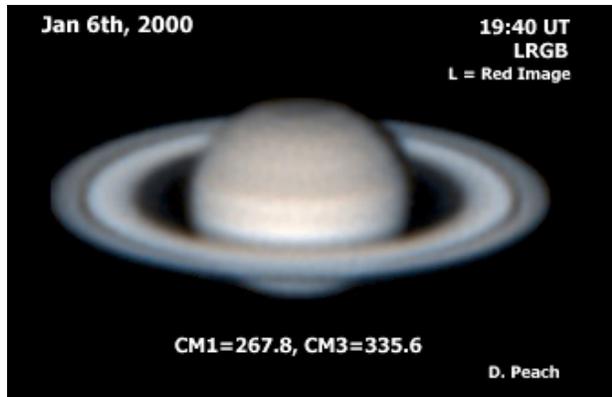


Figure 15: 2000 JAN 06, 19:40 UT. D. Peach. 30.5-cm (12.0-in.) SCT, CCD, Red + IR blocking filters, composite image. CM I = 267°.9, CM II = 335°.9. B = -19°.1, B' = -20°.9. Globe = 19".0 X 17".4, Rings = 43".2 X 14".1.

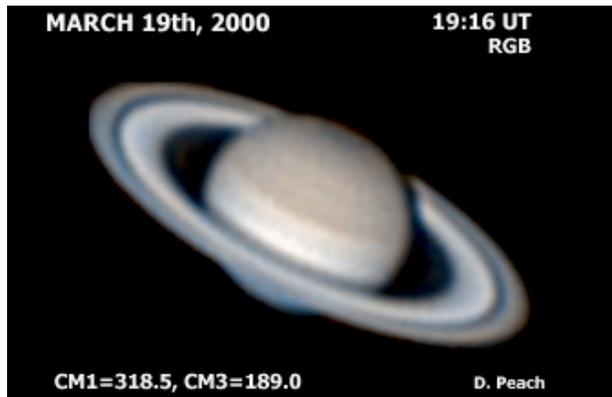


Figure 16: 2000 MAR 19, 19:16 UT. D. Peach. 30.5-cm (12.0-in.) SCT, CCD, Integrated Light, composite image. S = 7.0, Tr = 3.5. CM I = 318°.7, CM II = 189°.3. B = -20°.6, B' = -21°.6. Globe = 16".9 X 15".4, Rings = 38".3 X 13".5. South to upper right.

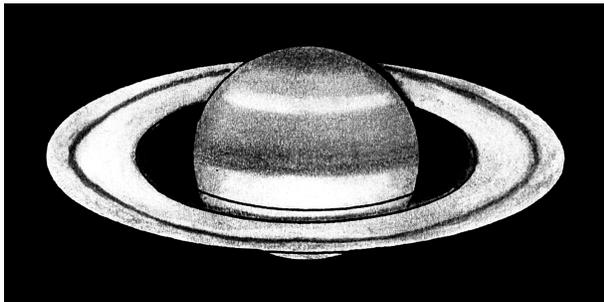


Figure 17: 1999 APR 01, 01:10-01:35 UT. P. Plante. 20.3-cm (8.0-in.) SCT, Integrated Light, 250X. S = 3.5, Tr = 3.5. CM I = 215°.8-230°.4, CM II = 050°.9-065°.0. B = -21°.0, B' = -21°.7. Globe = 16".7 X 15".2, Rings = 37".8 X 13".5.

Conclusions

Saturn's atmosphere was relatively quiet during 1999-2000, similar to the situation in the immediately preceding apparition. Subtle highlights of the 1999-2000 Apparition were ill-defined dusky festoons seen intermittently during the apparition, as well as several suspected white spots in the EZs from 1999 July through 2000 January. These phenomena were too short-lived to permit obtaining useful CM transit timings.

The author wishes to thank all observers mentioned in this summary who contributed visual drawings, photographs, CCD images, and descriptive reports to the ALPO Saturn Section during the 1999-2000 observing season. Such dedicated, systematic observational work in support of our programs helps amateur and professional astronomers alike gain a better understanding of Saturn as a planet.

Interested observers everywhere are cordially invited to join us in our pursuits in future apparitions of Saturn, and the ALPO Saturn Section is always delighted to offer guidance for beginning, as well as advanced, observers. Readers who were fortunate enough to attend the ALPO meetings at *ALCON 2001* in Frederick, Maryland, witnessed an appeal, and challenge, to young astronomers to start studying the Solar System. A very meaningful resource for learning how to observe and record data on the Moon and planets is the ALPO Training Program, and one of our organizational responsibilities is to encourage development of special talents a particular observer might bring to our programs.

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**ALPO Feature:
Index to Volume 43 of the "Strolling Astronomer",
Journal of the Assn. of Lunar & Planetary Observers**

By Michael Mattei

Publication Data

Issue Number: 1, Winter 2001,.....pp. 1-36
2, Spring 2001,.....pp. 1-45
3, Summer 2001.....pp. 1-45
4, Autumn 2001.....pp. 1-49

(Abbreviations: I. =Issue, IFC = Inside Front Cover,
IBC = Inside Back Cover, OFC = Outside Front Cover)

Author Index

Baum, Richard

Venus- CCD/UV Images of Venus Revive Interest
in a 104-year-old Mystery..... No. 1, pp. 6-7

Beish, Jeffrey D.

The 2001 Perihelic Apparition of Mars: A Request
for Observations..... No. 1, pp. 11-22
Osawa, Toshihiko..... No. 4, pp. 9-10

Benton, Julius

ALPO Observations of Saturn During the 1998-99
Apparition..... No. 4, pp. 31-43
Lunar Section:Selected Areas Program.....
..... No. 3, pp. 4-5
Observations of Venus During the 1998 Western
(Morning) Apparition No. 3, pp. 17-23
Saturn Section No. 3, pp. 7
Venus Section No. 3, pp. 4

Cudnik, Brian

Lunar Meteoritic Impact Search Report
..... No. 3, pp. 5-6
Observation of Lunar Leonid ImpactsNo. 4, pp. 6

Douglass, Eric

The Moon- The Aristarchus Plateau.....
..... No. 1, pp. 8-10

Douglass, Eric; Badalotti, Francesco; Venturin, Gia-
como; Lena, Raffaello; and Santacana, Guido

Observing for Lunar Flashes: Spurious vs. Real
Signals No. 2, pp. 24-29

Garcia, Gordon

Product Review: A New Solar Filter Material-
Baader Planetarium Astrosolar ... No. 1, pp.29-30

Favero, Giancarlo, Lena, Raffaello, Lottero, Fabio
and Fiaschi, Marco

The Nature of the Hook-like Shadow on Plato's
Floor Observed by Wilkins and Moore in 1952
Part II. Simulations with a Computer and a Plasti-
cine Model..... No. 3, pp. 24-29

Gingrich, Mark

A Prime Opportunity to see the "Ashen Light" of
Venus No. 2, pp. 23

Haas, Walter

Guest Column: No. 1, pp. 1,3
Can the Galilean Satellites of Jupiter Be Seen With
the Naked Eye? No. 2, pp. 35-37

Hill, Rik

ALPO Solar Section, Solar Activity Report Car-
rington Rotations 1901-1910 (1995-09-29.81 to
1996-06-28.70) No. 2, pp.9-15
ALPO Solar Section, Solar Activity Report Car-
rington Rotations 1911-1922 (1996-06-28.70 to
1997-05-22.10)..... No. 3, pp. 11-16
The Value of Synoptic Solar Observations With
Small Telescopes No. 2, pp.16-17
Solar Section No. 3, pp. 2-3
ALPO Web Site News.....
..... No. 2, pp. 5-6, No. 3, pp. 43

Joyce, Daniel P.

Mars Section:Dust Subsiding??? No. 3, pp. 6
In Passing: Robert "Big Bob" Itzenhaller.....
..... No. 4, pp. 9

Lamm, Jim

Mercury -- Finding that Little Rock. No. 1, pp. 4-5

Lena, Raffaello; Mengoli, Giorgio; Badalotti, Salim-
beni; Piergiovanni; Douglass, Eric; Santacana, Guido
A Previously Unreported and Unclassified Dome
Near Archimedes..... No. 4, pp. 27-30

Lunsford, Robert

Meteor Section No. 3, pp. 6, No. 4, pp. 11-16
An Exceptional Leonid Display, November 2001
..... No. 4, pp. 11-16

Mattei, Michael
Index to Volume 42 of the "Strolling Astronomer"
Journal of the Assn. of Lunar & Planetary Observ-
ers..... No. 3, pp. 38-40

Melillo, Frank J, and Baum, Richard
Has Lowell's spoke System on Venus Been
Imaged? No. 2, pp.18-23
Mercury Section No. 3, pp. 3

Pilcher, Frederick
The Minor Planets Section of the ALPO
.....No. 2, pp. 33-34, No. 4, pp. 7-8

Poshedly, Ken
Guest Column..... No. 3, p. 1

Reynolds, Mike
Eclipse Section No. 4, pp. 5-6

Robertson, Tim
ALPO Training Program..... No. 4, pp. 5
The ALPO Youth Program Coordinator
..... No. 4, pp. 4

Schmude, Richard
Jupiter Section No. 3, pp. 7, No. 4, pp. 8
Observations of the Remote Planets in
2000.....No. 3, pp. 30-37
Remote Planets Section
.....No. 3, pp. 7-8, No. 4, pp. 8

Schmude, Richard, and Dutton, James
Photometry and Other Characteristics of Venus
..... No. 4, pp. 17-26

Stryk, Ted
An English Language Translation of M. Camille
Flammarion's "Phenomena Observed on the
Planet Mars" No. 2, pp. 30-32

Venable, Roger
Mars (Part 1): Tides and the Future of Phobos
..... No. 1, pp. 23-25
(Part 2): Observing Phobos and Deimos
..... No. 1, pp. 26-28

Wessling, Richard J.
The Binocular Viewer..... No. 2, pp. 38

Westfall, Elizabeth
Minutes of the ALPO Board of Directors Meeting,
Frederick, MD, 2001 July 25 No. 4, pp. 2-4

Will, Matthew
Point of View..... No. 4, pp. 1, 10

Subject Index

About the Authors

Richard Myer Baum No. 1, 2, pp. 7
Julius Benton No. 3, pp. 9-10, No. 4, pp. 9
Eric Douglas.....No. 1, pp.10, No. 2, pp. 7
Robert Garfinkle..... No. 4, pp. 9
Gordon Garcia No. 1, pp. 30
Gianncarlo Favero, Raffaello Lena, Fabio Lottero,
Marco Fiaschi No. 3, pp. 10, No. 4, pp. 8-9
Walter Haas..... No. 2, pp. 7
Rik Hill.....No. 2, pp. 7, No. 3, pp. 9
Jim Lamm..... No. 1, pp. 4-5
Robert Lunsford No. 4, pp. 8
Michael Mattei No. 3, pp. 10
Frank J. Melillo No. 2, pp. 8
Donald C. Parker..... No. 2, pp. 8
Frederick Pilcher..... No. 2, pp. 8
Robert Reeves No. 1, pp. 31
Richard Schmude.....No. 3, pp. 10, No. 4, pp. 8
Ted Stryk..... No. 2, pp. 8
Richard J. Wessling..... No. 2, pp. 8

ALPO

Board of Directors (List) No. 1, 2, 3, 4, pp. 1
Membership in ALPO No. 4, pp.49
Primary Observing Coordinators, Other Staff
..... No. 1, 2, 3, 4, pp. 1
Publications..... No. 2, 3, 4, pp. 1

ALPO Announcements (Section Changes, Other ALPO News)

Minutes of the ALPO Board of Directors Meeting,
Frederick, MD, 2001 July 25 No. 4, pp. 2-4
Reminders..... No. 4, pp. 2

ALPO Pages (Member, section and activity news

A Call for Papers: ALPO at ALCON Approaches
..... No. 1, pp. 2
ALPO at ALCON Approaches No. 2, pp. 3
ALPO Meeting Highlights No. 2, pp. 2
ALPO Web Site News
..... No. 1, pp. 3, No. 2, pp. 5-6, No. 3, pp. 43
ErrataNo. 2, pp. 2, No. 3, pp. 10
History Section..... No. 1, pp. 2
Important Announcement No. 2, pp. 2
Jupiter, Youth and Remote Planets Sections
..... No. 1, pp. 2-3
Letters: Reference follow-up needed, Equation
clarification..... No. 3, pp. 2
Mercury Section No. 1, pp. 2
Obituary: Robert A. Itzenhaller No. 2, pp. 2
Publication Guidelines..... No. 2, pp. 2
Solar Section No. 1, pp. 2

ALPO Resources (People, Publications, Etc. to help our members)

Board of Directors
..... No. 1, pp. 32, No. 2, 3, pp. 41, No. 4, pp. 45

The Strolling Astronomer

- Board/Staff E-Mail Directory
..... No. 1, pp. 34, No. 2, 3, pp.43, No. 4, pp. 47
- Book Review Editor
..... No. 1, pp. 32, No. 2, 3, pp. 41, No. 4, pp. 45
- Comets Section
..... No. 1, pp. 33, No. 2, 3, pp. 42, No. 4, pp. 46
- Computing Section
..... No. 1, pp. 34, No. 2, 3, pp. 42, No. 4, pp. 46
- Eclipse Section
..... No. 1, pp. 34, No. 2, 3, pp. 43, No. 4, pp. 47
- General Editors (Acting)
..... No. 1, pp. 32, No. 2, 3, pp. 41, No. 4, pp. 45
- Graphics (Acting)
..... No. 1, pp. 32, No. 2, 3, pp. 41
- Historical Section
..... No. 1, pp. 34, No. 2, 3, pp. 43, No. 4, pp. 47
- Instruments Section
..... No. 1, pp. 34, No. 2, 3, pp. 43, No. 4, pp. 47
- Jupiter Section
..... No. 1, pp. 33, No. 2, 3, pp. 42, No. 4, pp. 46
- Lunar Section
..... No. 1, pp. 33, No. 2, 3, pp. 42, No. 4, pp. 46
- Lunar and Planetary Training Program
..... No. 1, pp. 32, No. 2, 3, pp. 41, No. 4, pp. 45
- Mars Section
..... No. 1, pp. 33, No. 2, pp. 42, No. 4, pp. 46
- Mercury Section
..... No. 1, pp. 32, No. 2, 3, pp. 41, No. 4, pp. 45
- Mercury/Venus Transit Section
 No. 1, pp. 33, No. 2, 3, pp. 41, No. 4, pp. 45
- Meteors Section
..... No. 1, pp. 33, No. 2, 3, pp. 42, No. 4, pp. 46
- Meteorites Section
..... No. 2, 3, pp. 42, No. 4, pp. 46
- Minor Planets Section
..... No. 1, pp. 33, No. 2, 3, pp. 42, No. 4, pp. 46
- Publication Staff
..... No. 1, pp.32, No. 2, 3, pp. 41, No. 4, pp. 45
- Remote Planets Section
.... No. 1 , pp. 33, No. 2, 3, pp. 42, No. 4, pp. 46
- Saturn Section
..... No. 1, pp. 33, No. 2, 3, pp. 42, No. 4, pp. 46
- Science Editors
..... No. 1, pp. 32, No. 2, 3, pp. 41, No. 4, pp. 45
- Solar Section
..... No. 1, pp. 32, No. 2, 3, pp. 41, No. 4, pp. 45
- Staff Writers (Acting)
..... No. 1, pp. 32, No. 2, 3, pp. 41, No. 4, pp. 45
- Translators (Acting)
..... No. 1, pp. 32, No. 2, 3, pp. 41, No. 4, pp. 45
- Venus Section
..... No. 1, pp. 33, No. 2, 3, pp. 41, No. 4, pp. 45
- Website
..... No. 1, pp. 34, No. 2, 3, pp. 43, No. 4, pp. 47
- Youth Section
..... No. 1, pp. 34, No. 2, pp.43,
..... No. 3, pp. 42, No. 4, pp. 46
- Upcoming Meetings
 ALPO at ALCON Approaches..... No. 2, pp. 3
- ALPO Convention
 ALPO Meeting Highlights No. 2, pp. 2
- Book Reviews (Robert A. Garfinkle)
 Observing the Moon: The Modern Astronomer's
 Guide No. 4, pp. 44
- Comets Section
 No. 1, pp. 33, No. 2, 3, pp. 42, No. 4, pp.5
- Computing Section
 No. 1, pp. 34, No. 2, 3, pp. 42, No. 4, p. 46
- Eclipse Section
 No. 1, pp. 34, No. 2, 3, pp. 43, No. 4, pp. 5-6
- Guest Column
 Haas, Walter..... No. 1, pp. 1, 3
 Poshedly, Ken..... No. 2, pp. 1
 Will, Matthew No. 4, pp. 1, 10
- History Section
 No. 1, pp. 34, No. 2, 3, pp. 43, No. 4, p. 47
- Index
 Volume 42 of the JALPO..... No. 3, pp. 38-40
- In Memoriam
 Itzenthaler, Robert "Big Bob" No. 4, pp. 9
 Osawa, Toshihiko No. 4, pp. 9-10
- Instruments
 Binocular Viewer No. 2, pp. 38
 New Solar Filter Material-Baader Planetarium
 Astrosolar No. 1, pp.29-30
 Section No. 1, pp. 34, No. 2, 3, pp. 43,
 No. 4, p. 47
- Journal of the ALPO
 In This Issue: (The ALPO Pages-Features-ALPO
 Resources).....No. 1, 2, 3, 4, IFC
 Our Very Active Sun..... No. 3, OFC
 The Dust Storms of Mars No. 2, OFC
 This Month's Cover No. 2, pp. 8
 The Spokes of Venus No. 1, OFC
 Thinking of Contributing?
 No.1, pp. 22, No. 2, pp. 2
 Wondrous!..... No. 4, OFC
- Jupiter
 SectionNo. 3, pp. 7, No. 4, pp. 8
- Lunar
 Meteoritic Impact Search Report.... No. 3, pp. 5-6
 A Previously Unreported and Unclassified Dome
 Near Archimedes..... No. 4, pp. 27-30
 Observing for Flashes: Spurious vs. Real Signals
 No. 2, pp. 24-29
 Observation of Leonid Impacts..... No. 4, pp. 6

The Strolling Astronomer

- Section..... No. 1, pp. 33, No. 2, 3, pp. 42,
No. 4, p. 46
Selected Areas Program No. 3, pp. 4-5
- Mars
- A Martian Double Header No. 2, pp. 5
Dust Subsiding??? No. 3, pp. 6
English Language Translation of Camille
Flammarion's "Phenomena Observed on the
Planet Mars" No. 2, pp. 30-32
Tides and the Future of Phobos (Part 1):
..... No. 1, pp. 23-25
(Part 2): Observing Phobos and Deimos
..... No. 1, pp. 26-28
More from Don Parker on the Martian Dust Storm
..... No. 2, pp. 5
Section..... No. 1, pp. 33, No. 2, pp. 42,
..... No. 4, pp. 6-7
2001 Pherilic Apparition: A Request for
Observations No. 1, pp. 11-22
- Mercury
- News..... No. 1, pp. 4, No. 3, pp. 3
Mercury Now No. 2, pp. 4
Section News No. 2, pp. 4
Section.... No. 1, pp. 2, No. 3, pp. 3, No. 4, p. 45
Finding that Little Rock No. 1, pp. 4-5
- Meetings
- ALPO at ALCON Approaches..... No. 2, pp. 3
ALPO Meeting Highlights..... No. 2, pp. 2
Minutes of the ALPO Board of Directors Meeting,
Frederick, MD, 2001 July 25 No. 4, pp. 2-4
- Meteors
- Exceptional Leonid Display, November 2001
..... No. 4, pp. 11-16
Section..... No. 3, pp. 6
- Minor Planets
- Section.....No. 2, pp. 33-34, No. 4, pp. 7-8
- Moon; General
- Observing for Lunar Flashes: Spurious vs.
Real Signals No. 2, pp. 24-29
- Moon; Craters, Features, and Regions
- Aristarchus Plateau No. 1, pp. 8-10
Nature of the Hook-like Shadow on Plato's Floor
Observed by Wilkins and Moore in 1952
Part II. Simulations with a Computer and a Plasticine
Model No. 3, pp. 24-29
A Previously Unreported and Unclassified Dome Near
Archimedes..... No. 4, pp. 27-30
- New Books Received (reviewer's name in
parentheses)
- Telescopic Martian Dust Storms: A Narrative and Cata-
logue (Donald C.Parker) No. 2, pp. 39-40
Wide-Field Astrophotography (Klaus Brasch)
..... No. 1, pp. 31
- Obituaries
- Itzenhaller, Robert A..... No. 2, pp. 2
Osawa, Toshihiko..... No. 4, pp. 9-10
- Observations
- Saturn observing report..... No. 3, pp. 8-9
Sun No. 3, pp. 9
Titania Occultation Alert..... No. 2, pp. 34
- Publications, ALPO
- Observing Section Publications
..... No. 1, pp. 35-36, No. 2, 3, pp. 44-45,
..... No. 4, pp. 48-49
Other Publications..... No.1, pp. 36,
..... No. 2, 3, pp.45,
..... No. 4, pp. 48-49
The Monograph Series No. 1, pp. 34-35,
..... No. 2, 3, pp.43-44,
..... No. 4, pp. 47-48
- Remote Planets, Uranus, Neptune, Pluto
- Observations of Remote Planets in 2000
..... No. 3, pp. 30-37
Remote Planets Section..... No. 3, pp. 7-8, No. 4, p. 46
- Satellites
- Can the Galilean Satellites Be Seen With the Naked
Eye?..... No. 2, pp. 35-37
- Saturn
- Observations During the 1998-99 Apparition
..... No. 4, pp. 31-43
Section..... No. 3, pp. 7
- Solar
- Activity Report Carrington Rotations 1901-1910 (1995-
09-29.81 to 1996-06- 28.70)
..... No. 2, pp.9-15
Activity Report Carrington Rotations 1911-1922
(1996-06-28.70 to 1997-05- 22.10)
..... No. 3, pp. 11-16
Section..... No. 3, pp. 2-3
Value of Synoptic Solar Observations
With Small Telescopes..... No. 2, pp.16-17
- Training Programs
- ALPO Training Program..... No. 4, pp. 5
Lunar and Planetary
..... No. 1, pp. 32, No. 2, 3, pp. 41
- Venus
- CCD/UV Images Revive Interest in a 104-year-old Mys-
tery No. 1, pp. 6-7
Has Lowell's spoke System Been Imaged?
..... No. 2, pp.18-23
Observations During the 1998 Western (Morning) Appa-
rition No. 3, pp. 17-23
Photometry and Other Characteristics
..... No. 4, pp. 17-26
Prime Oppertunity to See the "Ashen Light"
..... No. 2, pp. 23
Section..... No. 3, pp. 4
- Web
- Web SiteNews..... No. 2, pp. 5-6, No. 3, pp. 43
Webite..... No. 1, pp. 34, No. 2, 3, pp. 43
- Youth Section
- Youth Program Coordinator No. 4, pp. 4

ALPO Reviews

Book: *The Moon: A Biography*

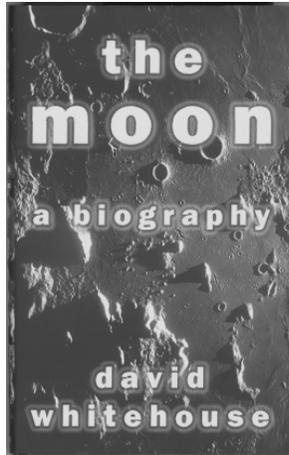
Software: *Lunaview*

The Moon: A Biography

Reviewed by Robert A. Garfinkle,
F. R. A. S.

Author: David Whitehouse

Publisher: Headline Book Publishing, 338 Euston Rd., London, NW1 3BH, UK; ISBN 0-7472-7228
Copyright 2000, 312 pages, clothbound \$21.36 U.S.



I found this little gem of a Moon book in July 2001 in a bookshop at the London-Heathrow Airport as we waited to fly home after seeing the eclipse in Zimbabwe, Africa. The book is not a lunar observer's handbook, but instead it is a survey of what we know about the Moon, from our ancient concepts and cave paintings of it to our modern scientific knowledge of its makeup. BBC science correspondent Dr. David

Whitehouse has weaved an interesting collection of lunar lore and exploration information into a very readable work. Dr. Whitehouse is also the science editor for the BBC News Online.

Whitehouse covers such varying topics as lunar mythology, and the race to the Moon, mapping and naming the Moon and its features, and lunar influences on Earth, such as the tides and "lunacy." He also covers the controversy of what if there was no Moon and what life on Earth might have been like without the gravitational effects of the Moon that have caused a change in our rotational speed and so many other phenomena on our home planet.

If I had a complaint against this book, it is why is there no bibliography. I really liked this book and found it a delight to read both on the airplane and on cloudy nights when I could not go out and observe our celestial neighbor. Whitehouse's writing style is friendly and non-technical, yet very informative. This book is packed with background material on the history of our observation of the Moon with some history of the Moon itself included. I highly recommend

that you add this lunar book to your astronomical library.

Lunaview

Reviewed By Bill Harsh

Tested on: A 133 Mhz Hitachi laptop equipped with 32 Mb of memory and Windows 95. *Background:* The program is downloaded in a "zipped" format and a zip utility is used to "unzip" the program. A self-extracting zip file would be helpful. The program locates itself in a directory without any problem.

Review:

The first sight of the program leaves you with a large image of the Moon (full) and many options on the right palet for: lunar labels of caters, images (closer images but no variable zoom), the current shape of the Moon, distance, and the "rise and set" for any date. The time zone option is unclear--Pst does not work (8 timezones west of Greenwich does work. A help feature would be helpful but almost all is intuitive from the options listed. The program is easy to use and does display higher resolution images when you click on a "listed" crater. The program is provided with a read-me file which gives the history and hints that the program may allow the user to enter custom images into the database and display them. No part of this works or is supported in the beta test version.

Reactions:

I am left wondering what is the purpose of the program: to educate on Moon topography--more images are needed (and I assume are provided on the CD) -- or to be used as a database for your own images. Nothing in the program gives a hint of the database function(s) provided and how they will be implemented. As a Moon program, it is adequate for what it provides (in the beta) but there are many programs which give the lunar phase, etc., more easily.

As it stands for \$35--without seeing more--a good lunar atlas would be a better buy. As a program to provide lunar data (rise/set, distance; etc), there are shareware and free programs which do it better and more cheaply. I would not recommend this program based on the beta version I have. I would be willing to review a more robust demo or the actual CD.

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ALPO Publications:

The Monograph Series

ALPO monographs are publications that we believe will appeal to our members, but which are too lengthy for publication in *The Strolling Astronomer*. They should be ordered from *The Strolling Astronomer* science editor (P.O. Box 2447, Antioch, CA 94531-2447 U.S.A.) for the prices indicated, which include postage. Checks should be in U.S. funds, payable to "ALPO".

- **Monograph Number 1. *Proceedings of the 43rd Convention of the Association of Lunar and Planetary Observers. Las Cruces, New Mexico, August 4-7, 1993.*** 77 pages. Price: \$12 for the United States, Canada, and Mexico; \$16 elsewhere.
- **Monograph Number 2. *Proceedings of the 44th Convention of the Association of Lunar and Planetary Observers. Greenville, South Carolina, June 15-18, 1994.*** 52 pages. Price: \$7.50 for the United States, Canada, and Mexico; \$11 elsewhere.
- **Monograph Number 3. *H.P. Wilkins 300-inch Moon Map.*** 3rd Edition (1951), reduced to 50 inches diameter; 25 sections, 4 special charts; also 14 selected areas at 219 inches to the lunar diameter. Price: \$28 for the United States, Canada, and Mexico; \$40 elsewhere.
- **Monograph Number 4. *Proceedings of the 45th Convention of the Association of Lunar and Planetary Observers. Wichita, Kansas, August 1-5, 1995.*** 127 pages. Price: \$17 for the United States, Canada, and Mexico; \$26 elsewhere.
- **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-***

ALPO Resources (continued)

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 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.

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

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- **Lunar (Benton):** (1) *The ALPO Lunar Section's Selected Areas Program (SAP, \$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 Forms*. (See note for Venus.)
- **Lunar (Dembowski):** *The Lunar Observer*, a monthly newsletter, available online at the ALPO website homepage, <http://www.lpl.arizona.edu/alpo/>. For hard copies, send a set of self-addressed stamped envelopes to Bill Dembowski (see address in listings section earlier in this section).
- **Lunar (Jamieson):** *Lunar Observer's Tool Kit*, price \$25, is a PC program consisting of several scheduling and observing aids. 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. This program is DOS-based, and intended for more advanced lunar observers. Available by e-mail only; contact hjamieso@telocity.com.
- **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 SASEs; (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 \$9 per book (postage and handling included) to Astronomical League Sales, P.O. Box 572, West Burlington, IA 52655.
- **Jupiter:** (1) *Jupiter Observer's Startup Kit*, \$3 from the Jupiter Section Coordinator. (2) *Jupiter*, ALPO section newsletter, available online via the ALPO website or via snail-mail; send SASE's to the Jupiter Section Coordinator; (3) To join the ALPO Jupiter Section e-mail network, *J-Net*, 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 with 55 cents in postage stamps to John Westfall.
- **Saturn (Benton):** (1) *The ALPO Saturn Observing Kit*, \$20; includes introductory description of Saturn observing programs for beginners, a full set of observing forms, and a copy of *The Saturn Handbook*. (2) *Saturn Observing Forms Packet*, \$10; includes observing forms to replace those provided in the observing kit described above. Specify *Saturn Forms*. To order, see note for *Venus Forms*.
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- **Minor Planets (Derald D. Nye):** *The Minor Planets Bulletin*, published quarterly \$9 per year in the U.S., Mexico and Canada, \$13 per year elsewhere (air mail only). Send check or money order payable to "Minor Planets Bulletin" to 10385 East Observatory Dr., Corona de Tucson, AZ 85641-2309.
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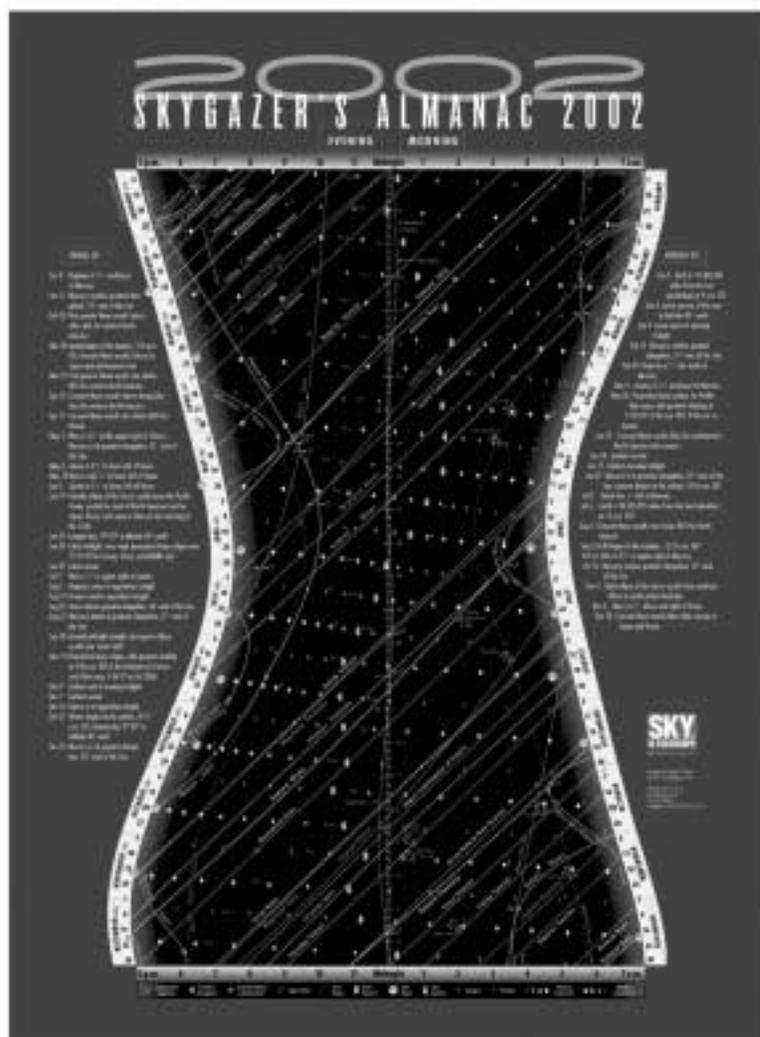
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Almanac 2002
Wall Chart*



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