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Journal of the Association of Lunar & Planetary Observers

The Strolling Astronomer

Volume 43, Number 4, Autumn 2001

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

Inside . . .

Wondrous!

This excellent Leonid fireball was captured by John Pane from Laurel Mountain State Park near Ligonier, Pennsylvania. Photo is a two-minute exposure taken November 18 at 5:40 a.m. EST. with an ordinary 35mm SLR camera mounted on a tripod, with a "normal" 50mm f/1.4 lens and Kodak TMZ 3200 film. The bowl of the Little Dipper can be seen to the left of the fireball.

Also ..a report this year's Leonid meteor shower -- the best in at least 35 years, plus a report on a lunar dome in the Apennine region south of the lunar crater Archimedes, reports on Venus and Saturn, a book review, ALPO observing section reports and much, much more.

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

Volume 43, No. 4, Autumn 2001
This issue published in December 2001 for distribution in both portable document format (pdf) and also hardcopy format.

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

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

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http://www.lpl.arizona.edu/alpo

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The ALPO Pages:
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Association of Lunar and Planetary Observers (ALPO)

Board of Directors

Executive Director (Chair); Julius L. Benton, Jr.
Associate Director, Donald C. Parker
Founder/Director Emeritus; Walter H. Haas
Member of the Board; Richard Hill
Member of the Board; Ken Poshedly
Member of the Board; Richard W. Schmude, Jr.
Member of the Board; John E. Westfall
Member of the Board, Secretary; Elizabeth W. Westfall
Member of the Board, Treasurer and Membership Secretary; Matthew Will

Publications

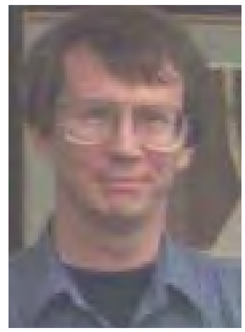
Acting Publisher, Ken Poshedly

Primary Observing Coordinators, Other Staff

(See full listing in *ALPO Resources* at end of book)
Lunar and Planetary Training Program: Coordinator; Timothy L. Robertson
Solar Section: Coordinator, *Website, SolNet, Rotation Report,* handbook; Richard Hill
Mercury Section: Acting Coordinator; Frank Melillo
Venus Section: Coordinator; Julius L. Benton, Jr.
Mercury/Venus Transit Section: Coordinator; John E. Westfall
Lunar Section: Coordinator; *Selected Areas Program;* Julius L. Benton, Jr.
Mars Section: Coordinator, *all observations, U.S. correspondence;* Daniel M. Troiani
Minor Planets Section: Coordinator; Frederick Pilcher
Jupiter Section: Acting Coordinator; Richard W. Schmude, Jr.
Saturn Section: Coordinator; Julius L. Benton, Jr.
Remote Planets Section: Coordinator; Richard W. Schmude, Jr.
Comets Section: Coordinator; Gary Kronk
Meteors Section: Coordinator; Robert D. Lunsford
Meteorites Section (provisional): Acting Coordinator; Dolores Hill
Computing Section: Coordinator; Mike W. McClure
Youth Section: Acting Coordinator; Timothy L. Robertson
Historical Section: Coordinator; Richard Baum
Instruments Section: Acting Coordinator; R.B. Minton
Eclipse Section (provisional): Acting Coordinator; Michael D. Reynolds
Webmaster: Coordinator; Richard Hill

Point of View

By Matthew Will, Membership Secretary & Treasurer, Assn. of Lunar & Planetary Observers



With concerns about Y2K two years ago, and other predictions of doom and gloom, the Year 2000 was supposed to be an epoch beginning or ending year in many people's minds. Without digressing into an argument over what year constitutes the beginning year of the 21st Century, 2000 or 2001, after the excitement of the transition toward 2000, many of us could not anticipate that the very next year, 2001, would be a reality-altering year. The unfathomable events of September 11th and thereafter have changed our view of the world and how we live in it to some extent. While these sad events should not modify our enthusiasm and approach to our beloved interest of lunar and planetary astronomy, on a happier note I can report that the ALPO has undergone a great, positive transformation in this pivotal year of 2001, a transformation that I hope will stimulate new growth and will benefit our organization.

By now, you may have noticed that our Journal has changed in format and has modified its content to reflect what you, the members, have wanted via the ALPO Survey that was conducted some time ago. Ken Poshedly, our new editor, has worked very diligently to install these alterations. In the spirit of this change, the ALPO is always open to suggestions and opinions from members that read our Journal.

The Journal now has the capability of being reproduced electronically, in a PDF format that will allow members to receive the Journal at reduced cost and through the convenience of the Internet. This has given us a color capability that we could not afford through conventional printers, and offers us a tantalizing possibility of incorporating other electronic features in future issues. But I'm over stepping my bounds here and I will let Ken Poshedly introduce and discuss all of his plans in forthcoming issues. Nevertheless, exciting times are ahead for the Journal, and as members, we're glad you're aboard with us!

Continued on page 10

Reminders

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 sucessful.

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.

Minutes of the ALPO Board of Directors Meeting, Frederick, MD, 2001 July 25

Submitted by Elizabeth Westfall, Secretary

Present:

Board: Matt Will, Don Parker, Richard Schmude, Julius Benton, Walter Haas, John Westfall, Elizabeth Westfall. (Rik Hill absent, proxy held by Julius Benton).

Guests: Phil Plante, Bill Stepka, Ken Poshedly, Doc Kinne, Dan Troiani, Dan Joyce.

Julius reviewed the goals set at last year's meeting, and commented on those related to the Journal. We now have a digital journal, published quarterly, not yet 6 times per year as originally projected.

The Minor Planets Section will now be publishing reports in the Journal.

We hope to expand the JALPO from 4 to 6 issues per year over a 1-2 year period, trying initially to publish the 2 extra issues as special issues such as on special topics, conference proceedings, and/or something more informal than the defunct *Through the Telescope* newsletter.

Towards the above-mentioned goal, it was proposed and approved that the current year (Volume 43) run as 4 issues, each about 44-48 pages. For Volume 44, 2 special issues would be produced; for Volume 45, the 2 special issues would be incorporated into the regular JALPO schedule. This plan will be reviewed at the 2002 meeting, and financial aspects of increased issues will be examined.

Treasurer's Report

Because of the change-over of treasurers, some of the numbers reported here are approximate.

ALPO "membership account"	$4,792
Las Cruces account (back issues)	1,608
San Francisco acct (proceedings)	2,800
Memberships not yet deposited	450
Other cash receivables	833
TOTAL CASH ACCTS	10,483
ALPO Endowment Fund	$13,000

The Board approved the transfer of $1,400 from the San Francisco account into the Endowment Fund. John Westfall also reminded us that the Board in prior years had approved transferring membership funds above the basic member rate into the Endowment Fund. The previous treasurer would do this when a sufficient balance had accumulated.

Harry Jamieson, the outgoing treasurer, asked for recommendations regarding ALPO equipment he

The ALPO Board at the Frederick, MD, meeting Standing (left to right): Don Parker, Julius Benton, Richard Schmude, Matt Will and Ken Poshedly. Seated (left to right): Walter Haas, John Westfall and Elizabeth Westfall. Not present: Rik Hill. Photo courtesy of Don Troiani.

had. Some is old, or not worth the shipping cost (dot matrix printer, laminator, paper cutter) and the Board recommended that it be donated locally. The scanner and laser printer may be useful to a section, and an e-mail will be sent to staff and sections to see if it is worth shipping elsewhere. If not, it should be donated locally.

The Board approved a motion that board members can spend up to $200 on equipment/supplies for Board activities. Any amount above that must receive prior approval by the board.

Finally, the Astronomical League (AL) will send ALPO a check for $500 for our participation and preconference support of the Ventura meeting in 2000.

Discussion of ALPO funds and Endowment Fund led to a discussion of establishing a permanent location for better identity, member service, and housing for archives and research materials. We were told that the AL is investigating office space in the central U.S. to meet a similar need. Julius will discuss this common issue with Bob Ghent of the AL.

Publicity/support

Don Parker was contacted by a local Florida telescope maker (name?) of good quality beginner telescopes. ALPO was offered the opportunity to write a blurb to be included with each one along the lines of "Now what do I do with it?" After some discussion, the Board agreed to prepare a short information sheet of simple observing projects and the ALPO contact address. Nothing in the flyer should imply endorsement of the telescope by ALPO. The Board approved this proposal, and Richard Schmude agreed to write the flyer.

Ken Poshedly asked if there is something extra we can provide as an incentive to members who support ALPO above the basic level. The Board is open to suggestions. ALPO should also publicize the idea that members ask if their employer provides matching contributions to employee contributions to nonprofit organizations.

Future Conventions

- 2002 - Salt Lake City with the Astronomical League. Approximate dates are July 30-August 2.
  The Board approved this as our next meeting.
- 2003 - Mahoning Valley Astronomical Society, Youngstown, OH, ALPO meeting. August 6-9.

  The IAPPP and American Lunar Society may also be invited by the local group to meet with us.

  Richard Schmude asked that we try to include workshops for teachers and other activities to draw in youth.

- 2004 - Several ideas were raised for this year.

Chabot Space and Science Center, Oakland, CA. Mike Reynolds at Chabot has expressed interest in hosting an ALPO meeting. John and Beth Westfall will talk with him about the possibilities. The meeting cannot take place during the transit of Venus, as members may be elsewhere for observing.

Toronto - Walter Haas mentioned that it might be time to have another non-U.S. meeting. Consider including the AL in this meeting.

International Space Telescope Project

Don Parker was part of a discussion group of the AL on this project, first mentioned in Ventura. Richard Berry is in charge, there will be a heavy planetary interest, ALPO needs a representative and some travel funds are available. The work group will see if NASA and Boeing are still interested.

At this point, the visitors were thanked for their participation, and asked to leave so that the Board could discuss confidential issues.

ALPO Training Program

Matt Will presented Tim Robertson's outline for ALPO Youth Member Training, which met with Board approval. It distinguishes ALPO programs from AL programs, described by someone as: "ALPO is training people to investigate and research; AL is training educators." These goals are related but use different methods.

It was proposed and approved that Tim Robertson be named as Acting Youth Coordinator.

Matt Will is resigning as Youth and Training Coordinator due to his other responsibilities. Note that the Youth Section and the Training Section remain.

New Board Member

The resignation of Harry Jamieson in July created a Board vacancy. Ken Poshedly was nominated and approved as a new Board member. Upon his election, he was invited to immediately participate in the remainder of the Board meeting.

Directorship

The Board also approved a re-arrangement of the rotating Associate Director/Directorship. Julius Benton remains Director until normal expiration of his term in Summer 2002. Don Parker will step in as Associate Director from the present until Summer

2002, at which time he becomes Director for one year only, until Summer 2003. Richard Schmude will become Don's Associate Director from Summer 2002-2003. Richard assumes Directorship from Summer 2003-2005, and Matt Will becomes his Associate Director. Matt becomes the Director from Summer 2005-2007.

Before 2005, the Board will review the method of selecting the Director/Associate Director.

Treasurer/Membership

Matt Will was nominated and approved as the new Treasurer/Membership Coordinator. He has been working with Harry Jamieson for a smooth transition of accounts and membership records.

Staff Positions

The following staff were approved to have "acting" removed from their titles:

- Richard Baum, Historical Section
- Craig McDougal, Jupiter Section

Peggy Haas Service Award for 2001

The Board unanimously approved the Peggy Haas Service Award be given to Harry Jamieson in recognition of his many years of ALPO service, including terms as Membership Coordinator, Treasurer, Board Member, and Director. These positions are in addition to his work in observing sections.

The Board Meeting was continued to July 26, 2001.

The Staff Guidelines were again reviewed, the remaining issues discussed, Matt Will's recommendations approved, and he will prepare the final copy for distribution.

In connection with the ALPO conference in 2003 with the Mahoning Valley group, issues of cost control and establishment of registration fees were discussed.

Observing forms of the various sections were discussed. It was suggested that each section put them in PDF form on the Web, and make them more consistent as to recording observing information. No action was taken.

A question was raised as to the status of the ALPO Ephemerides. It is not being published in paper form, and there are no plans to re-instate it. Some sections have ephemerides for their objects available on Web pages. It was suggested that we publicize those or other readily available sources.

There being no further business, the meeting was adjourned.

Section Reports: The ALPO Youth Program

By Tim Robertson, ALPO Youth Program Coordinator

The ALPO Youth Program is currently being designed to generate interest and enthusiasm in astronomy and space exploration in our youth.

The ALPO Youth Program is also geared towards training young astronomers in observational terminology and techniques. Upon their completion of the program, they will have the ability to contribute valuable observations to our knowledge of the universe. The program is aimed at interested individuals between the ages of 10 and 17.

A major component of the ALPO Youth Program is the use of individual leaders to facilitate the steps and training throughout the program. A Leader's Guide as well as handbooks for the individual levels of training are currently in develment and should be ready for publication in early 2002.

Astronomy Clubs, Scouts, after-school programs, and other educational based organizations are considered perfect vehicles to facilitate the program. Persons leading the young astronomers through the program should have a basic and current understanding of astronomy. If there isn't a resident expert in astronomy available, then I recommend contacting a local astronomy club.

The ALPO Youth Program is divided into five levels, with each level requiring more advanced training and observational skills. Following the completion of each level, the leader will test the ALPO Youth members on the items discussed. If the member passes the test, then their name will be sent to the ALPO Youth Program Coordinator and they will be presented with a certificate of completion for that level. In addition, their name will be posted on the web page for the ALPO Youth Program. The first four levels of the program are designed to be completed in one year. The final stage is the ALPO Training Program, where completion certifies the students with Observer status in the ALPO. The ALPO Training Program Coordinator administers this level.

The official rollout of the Youth Program will be in the first quarter of 2002.

ALPO Training Program

By Tim Robertson, ALPO Training Program Coordinator

The ALPO Training program is alive and well. Currently we have 4 active participants in the program.

I want to thank Matt Will, the new ALPO Membership Secretary, who was my cohort in the training program for the past 7 years. Without Matt's cooperation and guidance, the program would not be as successful as it has been. Both Matt and I have been in the ALPO since the early 70's, and we both had the same vision for the program, so it was easy working with him from across the county. He is a true asset to the ALPO.

Comets Section

Gary Kronk reports that he needs to hear from all ALPO members interested in helping to bolster this observing section. E-mail him at kronk@amsmeteors.org or write to him at 1117 Troy Ofallon Rd., Troy, IL 62294-2403.

Eclipse Section

By Mike Reynolds

The ALPO Eclipse Section is in the re-organization and start-up phase under a new Acting Section Coordinator.

One of the first section tasks was the establishment of an introductory eclipse section on the ALPO Web site. The ALPO Eclipse Section Web site includes information on viewing both lunar and solar eclipses. The web site will also overview specific eclipse phenomena and data collecting (e.g., crater timings during a partial lunar eclipse or the partial phases of a total lunar eclipse). A primer on eclipse videography and photography will introduce the new observer to some of the techniques-and challenges-of eclipse imaging, both electronically and on photographic emulsion. A list of lunar and solar eclipses from 1900 through 2025 completes the ALPO Eclipse Section Web site. Many of the materials were taken from the Acting Eclipse Coordinator's book on eclipses, *Observe Eclipses*, published by the Astronomical League in 1995.

Since the Acting Eclipse Coordinator co-authored a book on eclipse astronomy, it seems appropriate to introduce and use this work as the ALPO Eclipse Section observing guide. Many long-time ALPO observers contributed photographs, video images, and information to *Observe Eclipses*. The book is available through the Astronomical League's Book Sales, at many museums, planetaria, and science centers, and directly from the acting Eclipse Section Coordinator.

A direct link between the eclipses observing guide and the ALPO Eclipse Section Web site is that the Web site material is taken directly from *Observe Eclipses* and reformatted for ease of use on the computer. The ALPO Eclipse Section Web site is not a "reprint" of *Observe Eclipses*; rather, appropriate excerpts from the book are used. There is also a link between the ALPO Acting Eclipse Coordinator's Science Center Web site (www.chabotspace.org) and the ALPO Eclipse Section Web site. It is the hope of the Acting Section Coordinator that visitors to the Chabot Space & Science Center web site (over one million in the first year) interested in not only eclipse astronomy, but also the observing programs of the ALPO, will link to the ALPO Web site

One of the major goals of the ALPO Eclipse Section is to answer specific eclipse-related questions from both ALPO members and non-members. This will lead to an ALPO Eclipse Frequently Asked Question document, or "FAQ", that could be also used by astronomy clubs, museums, planetaria, and public observatories.

The Acting Section Coordinator also plans to streamline eclipse observation reports and encourages observers to submit observations and reports for publication. These would include publication of eclipse

A 10-photo composite of the 2001 June 21 total solar eclipse, taken by Mike Reynolds from Chisamba, Zambia. The range of exposures is from 1/1000 to 1/15 second and from second to third contacts. Lens was a Tokina 500 mm.

reports, both on-line and for ALPO publications, as well as for presentation of papers at future ALPO Conferences.

Lunar Section: Observation of Lunar Leonid Impacts

By Brian Cudnik, Acting Coordinator, ALPO Lunar Meteoritic Impact Search

An effort to observe the Earthlit part of the waxing crescent Moon was coordinated by Brian Cudnik of the ALPO with the assistance of David Dunham of the International Occultation Timing Assn (IOTA).

As the Earth passed through several ribbons of meteoroids, the Moon was also expected to pass through several ribbons of debris, greatly increasing the chances of spotting impacts of meteoroids on the Moon from the Earth's surface.

Observations were attempted by a number of people in North America, Europe, and the Middle East, mostly with low-light video cameras coupled to telescopes. A number of reports from observers worldwide of possible Leonid meteoroids impacting the Moon have been received.

Thus far, two confirmed impact events have been observed, with many additional candidates awaiting corroboration from additional independent observers. The best of these candidates share several qualities with those that have been confirmed. Each confirmed impact shows up in multiple frames -- "afterglow" images, which were noted in the 1999 lunar Leonid images.

Each confirmed observation appears fairly bright. Both these qualities are shared by the best events that are yet to be validated. The two independently-confirmed observations were made in the United States and the best unconfirmed observations were made in Europe and India. Europe and the Middle East generally saw cloudy conditions during the time of maximum lunar meteoroid flux, limiting observations from this part of the world. However, much of the U.S. saw favorable weather during the times of lunar visibility on the 18th and 19th of November, UT. No positive reports have been received from Asia or Australia as of this writing.

The best observations are summarized in the following tables. Magnitude information and selenographic (Moon-centered) coordinates of each event are not yet available. More information, including the observation times of the remainder of the candidates, can be seen at the ALPO Lunar Meteoritic Impact Search Website

http://www.lpl.arizona.edu/~rhill/alpo/lunarstuff/lunimpacts.html

CONFIRMED IMPACTS

Impact	UT	Observers	Location on Moon
A	Nov 19 00:18:58 .4	Cook/ Dunham/ Palmer	Near center of lunar disk
B	Nov 18 23:19:16	Cook/ Venable	Tranquillitatis or SE Serenitatis

BEST CANDIDATES — LIKELY REAL EVENTS

Impact/UT	Observer	Location on Moon
c1 Nov 17 17:05:04	Costantino Sigismundi	Near Clavius
c2 Nov 17 17:46:10	Jean Bourgeois	n/a
c3 Nov 18 betwn. 12:50 & 15:00UT	Kiran Shah	n/a

OBSERVER INFORMATION

- David Palmer at White Rock, NM (near Los Alamos); 12.7 cm (5-in.) Celestron and PC-23C
- Tony Cook at Alexandria, VA; 20 cm (8-in.) telescopes and Watec 902 video camera
- David Dunham at Laurel, MD; 20 cm (8 in.) telescopes and Watec 902 video camera
- Roger Venable from eastern GA; 40.6 cm (16 in.) f/6 Newtonian at prime focus, no filters, and a PC23A videocamera
- Jean Bourgeois from the Vosgian mountains, France (elev. 1238 m); 23 cm (9 in.) reflector, F/D = 2 equipped at prime focus with a Philips B&W camera through a red filter
- Kiran Shah at Pune, India; a C-8 and Watec 902 camera.
- Costantino Sigismondi, visual (no scope information given)

Mars Section

Anticipation is high among Mars observers as the planet continues to provide observational opportunities due to the mechanics of recent perihelion passage. In addition, over 2,000 observations have already been submitted, so enthusiasm has been abundant. Jeff Beish, long-time recorder for the Section, is already analyzing the data despite the fact that another several months of submissions can be expected. The dust storm of the current apparition, completely out-of-season based on historical record, has subsided during the Martian season when such activity has been most prevalent.

Dust Abates

Now that Mars is heading into its "normal" season of extensive dust activity, the 2001 storm has subsided. Despite its southernmost exposure possible, this apparition was anticipated even by northern observers owing to its being the first perihelic event since 1988. It was thought that there might be dust cloud activity in the waning portion of the apparition, when the angular diameter of Mars would be less than 12 arc seconds. But the red planet, as we had suspected, is still capable of surprise. While still near 20 seconds apparent diameter, a storm jolted observers expecting to see unobscured views of Mars' well-known albedo features during an equatorial plane-crossing aspect. Observers were keyed into the belief that both hemispheres of Mars would display their prominent features simultaneously. However, members of the OAA were swift and emphatic in their insistence that dust activity was emerging from Hellas (one of the usual suspects) all the way back in June.

Many questions remain, and theforemost of them involve the best description of the event. Was it as opaque as perhaps the 1971 event, which blanked out the surface for the Mariner 9 spacecraft? Was it as extensive? Was it as long-lasting? There appears to be little argument that the event which hindered Mariner would be considered as robust as it gets. Other questions revolve around possible transformation of the terrain in the wake of the event - whether the same albedo features prior to the dust are still there and if there are new ones. If so, historic records could be checked to see if a pattern emerges. It happens that Mars, still near enough to perihelion to maintain high enough orbital velocity to keep reasonable pace with Earth, will still be close enough to enable us to divulge the answers. It is paramount to continue monitoring the situation, as we will not have to witness Mars below 6 arcseconds until mid-January. Even by then, the accelerated orbital motion will continue to push Mars to more favorable positions on the ecliptic for more northerly observers, almost twice as high in a dark sky as at opposition in many cases.

One thing is certain; the polar regions were only marginally obscured. At no point did all the well-known albedo features vanish contemporaneously, even if it was very difficult to discern some of them at all. It is not likely that this event will be categorized with the largest storms, though "planet-encircling" is a term that might well apply. The Hubble image of Mars in early September reveals highly reduced contrast across much of the planet, but not the masking that befell Mariner. The downside of the dust was its effect on those of us who provide public observing sessions; having to show Mars with little or no obvious features to novice observers proved to be frustrating.

There is certainly reason for optimism that continued coverage can be expected. Including CCD imagery uploaded to the MarsWatch site and those submitted to ALPO, we already have in hand over 2,000 observations from our loyal following. The thank-you's ("gratias'", "danke schoen's" and "merci's", etc.) will have to be doled out in a vast armada of upcoming editions of the Martian Chronicle newsletter. In some cases, there will be emphasis on particular contributors, and perhaps we may start with the indefatigable fellow from Japan named Ikemura, who has more than anyone else beset our computers with laborious downloads! It should be intriguing to compare the impressions various observers have had of the apparition that is still well underway as this is written.

Minor Planets Section

By Frederick Pilcher

Minor Planet Bulletin Vol 28, No. 4, 2001 Oct-Dec, contains lightcurves providing new or improved rotation periods, lightcurve amplitudes, and their authors, of the following asteroids:

1135 Colchis	23.47 hours	0.63 mag	R. D. Stephens and G. Malcolm
1166 Sakuntala	6.30 hours	0.69 mag	G. Malcolm
1568 Aisleen	6.68 hours	0.56 mag	G. Malcolm
490 Veritas	7.930 hours	0.50 mag	R. A Koff and S. M. Brincat
640 Brambilla	7.768 hours	0.25 mag	C. Benbrick
96 Aegle	26.53 hours	0.1 mag	S. M. Slivan and E. R. Roller
1069 Plancka	8.643 hours	0.17-0.25 mag	B. D. Warner, G. Malcolm, and R. D. Stephens
489 Comacina	9.02 hours	0.4 mag	R. D. Stephens, S. M. Brincat, and R. A. Koff
611 Valeria	l0.80 hours	0.18 mag	R. A. Koff
986 Amelia	9.52 hours	0.61 mag	R. A. Koff

In addition, a number of observers have been maintaining continuous lightcurves of 5587 1990 SB at its current close approach to Earth for five months, and continuing. Period is about 5.50 hours, but full analysis of the change of lightcurve with aspect and phase angle will not begin until the observing window closes later this fall.

G. Faure and L. Garrett have published improved H values for 23 minor planets based on observations by many observers in the Magnitude Alert Program.

Jupiter Section

By Richard Schmude, Jr.

This section coordinator continues to monitor the brightness and color of Jupiter. Two sets of B, V, R and I photoelectric magnitude measurements were made on 2001 Oct 21 and Nov 10. The results indicate that Jupiter's color became about 5 percent bluer since September. This may be related to the fading of the North Equatorial Belt activity that occurred in September. The brightness of Jupiter was a bit below what was expected and this may be due to the thicker and darker North Equatorial belt. The amount of polarized light reflected by Jupiter increased slightly in October.

There is at least one very dark spot in the North Equatorial belt that needs to be monitored; this spot was at a system II longitude of 166.7 degrees on 2001 Oct 31. Clay Sherrod reports that the Great Red Spot was centered at a System II longitude of 74.8 degrees on 2001 Oct 31. Clay also reports that the mean angular size of the great red spot was 18.47 degrees in system II during Sept-Oct and that the rotational period of this feature was 9h 55m 42.14s.

Remote Planets Section

By Richard Schmude, Jr.

Norman Boisclair, a long-time member of this section, has just sent in his observations of Uranus and Neptune. He used a 50 cm (20 in.) Newtonian telescope to observe the colors of both planets. He reports that Neptune had a deep blue color on 2001 July 15-16 and Aug.16. This section coordinator would like to encourage others with large Newtonian telescopes to monitor the colors of Uranus and Neptune. Both planets will still be visible in December.

About the Authors

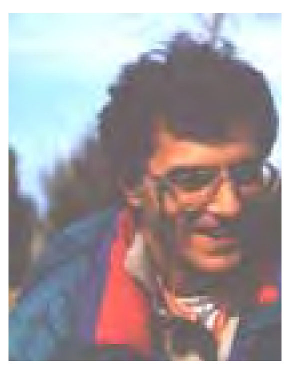
Robert Lunsford has been interested in astronomy as far back as he can recall. His interest in meteor showers was stimulated with the 1966 Leonid display, which he partially observed from his suburban front yard. Robert has been recording and analyzing meteor showers ever since. He joined ALPO in the 1980's, contributing to various planetary sections; he became coordinator of the Meteors Section in 1988 and continues in that post today.

Photometry and Other Characteristics of Venus

Richard Schmude Jr. is coordinator of both the Remote Planets Section and the Jupiter Section of the Assn. of Lunar & Planetary Observers, and is a member of the organization's board of directors. He first became interested in astronomy when he was six years old. At that time he noticed what seemed to be hundreds of stars in the sky -- this inspired him. He purchased his first telescope when he was 15 and showed a neighbor girl (Kathy) the Moon through this telescope. Since then, he has given over 200 astronomy presentations and telescope viewing sessions to the public. He is a member of the Association of Lunar and Planetary Observers (ALPO), the Royal Astronomical Society of Canada (RASC) and of the American Association of Variable Star Observers (AAVSO). His research interests include: measuring the brightness and color of the Moon and planets, planetary nebulae and the impact of acid rain on the environment. Richard lives in Barnesville, Georgia, just southwest or Atlanta.

Dome Near Archimedes

Co-authored by Giancarlo Favero (Osservatorio Guido Ruggieri, Padova, Italy), Raffaello Lena (GLR, Geologic Lunar Researches, Italy), Fabio Lottero (GLR, Geologic Lunar Researches, Italy), and Marco Fiaschi (Osservatorio Giuseppe Colombo, Padova, Italy).



Raffaello Lena founded the Geologic Lunar Research (GLR) group (http://digilander.iol.it/gibbidomine) and has published lunar articles in the *JALPO*, *Selenology* and Italian magazines. His primary interest is the study of lunar domes and their classification. The GLR group has members from several nations that participate in various lunar observing projects (domes, TLP, lunar flashes projects). Raffaello was recently named coordinator of the American Lunar Society's Lunar Impact Project. As such, he has done research on spurious flashes. He can be reached at e-mail address: gibbidomine@libero.it

Giancarlo Favero's (no photo supplied) interest in planetary astronomy was inspired about 1960 while he was in high school by Guido Ruggieri, a leading Italian planetary observer. With a home-made 7-inch reflector Giancarlo started observing Jupiter, Mars and the Moon. He received his degree in chemistry in 1969 and maintained his interest in astronomy, frequenting the Padua Observatory and enjoing the friendship of his director, Prof. Leonida Rosino. Over the 1970s, Giancarlo directed the Jupiter Section of the Unione Astrofili Italiani (UAI) and published three papers in the *Journal of the Assn. of Lunar & Planetary Observers*. He was president of the UAI for six years, and for 30 years was professor of chemistry at the University of Padua. In 2000, he retired and subsequently joined the ALPO and returned to planetary astronomy, his youth's love.

No data supplied on Messrs. Lottero and Fiaschi.

ALPO Observations of Saturn (1998-99)

Dr. Julius L. Benton, Jr. is a native of Albany, Georgia, and joined the ALPO in 1967. He was appointed coordinator of the ALPO Lunar Section in 1970, heading up the Selected Areas Program, and in 1971, he assumed additional duties as coordinator of the Venus and Saturn Sections. He still holds all three posts today, after nearly three decades of successful leadership and administration of ALPO observing programs. In 1994, Julius was elected to the board of directors of the ALPO, and he has served as distribution editor for the *Journal of the ALPO* since 1996. In 1998 he became Associate Director of the organization. He is currently chairman of the ALPO board of directors. In addition to his professional research that has appeared in various technical journals, Julius has written extensively on the subjects of lunar and planetary astronomy for over 25 years. He can be reached at e-mail address: jlbaina@msn.com

Books Received

Robert A. Garfinkle, F.R.A.S. has been a member of the ALPO since the late 1980s. In 1997, Robert was elected a Fellow of the Royal Astronomical Society (F.R.A.S.). He is the author of *Star-Hopping; Your Visa to Viewing the Universe* (Cambridge University Press, 1994), a co-author of *Advanced Skywatching* (The Nature Company, Time-Life Books, 1997), and has had several articles and book reviews published in leading astronomical magazines. Robert serves as a Special Projects editor of this journal. He is presently writing a major lunar observers handbook.

In Passing

Robert "Big Bob" Itzenthaler

By Dan Joyce
Assistant Mars Section coordinator

Back in 1991, a rather jocular young fellow attended a lecture on telescope design and construction I was giving at North Park Village here in Chicago. Not only did Robert "Big Bob" Itzenthaler decide right then to make one for himself, he made a 10-inch f/6 mirror and made his own fiberglass tube under the tutelage of the late Jim Carroll. He then made a 6-inch for his wife, Susan, and had begun work on an 8-inch Daley Solarscope, finishing the primary and having ground the optical window.

Though Bob's primary job was as a school bus driver, he also worked weekends as a show operator at the Cernan Earth & Space Center. His interests grew to the point that he learned much about Mars from our colleague, Dan Troiani, and had developed considerable computer expertise as well. No doubt what will be missed the most will be his uproarious sense of humor and a belly laugh that could be heard all the way to the Sagittarius Arm. He thoroughly enjoyed lending a helping hand to novice telescope makers and would-be observers as well.

Bob was archivist for the Mars Section and was among those who witnessed the flashes seen on Mars in June, 2001. We were looking forward to many more years with our friend; we're all sorry to miss that opportunity now.

Toshihiko Osawa

By Jeff Beish

Toshihiko Osawa, 62, a well- known Mars observer, died in 2001 March from unknown causes after an extended illness. Osawa was a long standing member of the ALPO and of the Oriental Astronomical Association of Japan (OAA).

As a teenager, Osawa began to observe Mars during the 1950's; however, records show that his participation in the ALPO International Mars Patrol observing program began in November 1968. He contributed hundreds of excellent drawings during the 1969 apparition of Mars and each apparition thereafter for more than thirty years.

One is reminded of ancient sayings of Confucius when thinking of Toshihiko Osawa -- one comes to mind: The Master said; "To be able to acquire new knowledge while reviewing the old qualifies one as an instructor of men." This humble man, Toshihiko Osawa, was certainly an instructor of men by his deeds and contributions to our knowledge of the planet Mars.

While few of us met Toshihiko, in many ways, he touched our lives. Lest we forget, his ability to translate on paper what he saw at the telescope is a most noble deed for sure, at least in the eyes of his colleagues. He was admired though our community of Mars observers and those who knew of his works have since made favorable comments to the Mars Section.

We will miss this gentle person and his timely observational reports on Mars.

(Continued from Page 1, *Point of View*)

As for myself, I have taken on the dual role of Membership Secretary and Treasurer. Harry Jamieson, my predecessor, was instrumental in introducing changes in these positions over the years that have led a more efficient and responsive organization. I hope to carry on with these changes and to introduce some of my own, in keeping with past responses to the ALPO Survey.

More than just merely accepting money from members for subscriptions, the Membership Secretary can help to facilitate many functions that can promote the general well being of our organization. With each subscription acknowledgment letter and renewal notice, the ALPO inquires about membership interest through the key codes that many of you have filled out over the years. Although the ALPO survey went into some depth about interest levels and activity in the ALPO sections, the interest key codes have been helpful since the information is always current and easily managed on the ALPO Membership Database. These data have been helpful to section coordinators in recruiting new observers for various observing programs and in particular, programs where geographic distribution of observers or coordination of simultaneous observations is important.

The Membership Secretary always is interested in promoting the ALPO and its programs. We already provide introductory literature for prospective members that describes our observing programs and how the ALPO functions. Longtime member and former Section Coordinator, Leonard Abbey, has with the help of many of our present section coordinators, created a booklet that provides detailed descriptions of many of the ALPO sections and their programs.

For our present members, I would encourage you to review the "ALPO Resources" portion of the Journal. These pages not only contain names and addresses of section coordinators, but information concerning the products and services each observing section may offer for its programs. Members are most welcome to communicate with the section coordinators in obtaining materials that may help them to either participate in an observing program, or to simply expand one's knowledge about an observing topic.

Thanks to Rik Hill and Jon Slaton, our ALPO Web Site Coordinators, there is an abundance of literature and resources available from most sections on the ALPO Web Page.

Still, much needs to be done by the Membership Secretary/Treasurer. More than merely being a custodian for the ALPO's Membership records and money, the Membership Secretary/Treasurer must find ways and means of executing the functions of these offices more efficiently. Understanding membership interest and trends is essential to maintaining this organization. Indeed, the Membership Secretary is the "advocate" for all members. Correspondence as either comments or complaints are always welcome. An organization such as ours cannot grow without such communications. The ALPO does not exist in a vacuum. It is not a static organization that is unchanging, but a very dynamic one.

The ALPO is not just dynamic by what our section coordinators produce or what our Publications Section writes. It is true that we have a very productive staff. But it is through your participation as observers and your feedback as readers that the ALPO continues as a topflight amateur astronomy organization.The Membership Secretary's mailbox is always open to your comments and suggestions.

ALPO Feature: ALPO Meteors Section

An Exceptional Leonid Display, November 2001

By Robert D. Lunsford,
Coordinator, ALPO Meteors Section

The 2001 Leonid meteor shower was well seen by people all over the world. Even those with thin clouds were able to witness bright flashes of fireballs streaking above the clouds. While the peak strength over Asia was less than anticipated, storm rates (in excess of 1,000 meteors per hour) were still seen from North America and throughout the entire Pacific region all the way to the Mideast. Storm rates were first reported near 10:00 Universal Time (UT) on 2001 Nov 18 from eastern North America. This corresponds to 5:00 a.m. EST and 2:00 a.m. PST. Rates climbed steadily for the next 30 minutes, reaching an average Zenith Hourly Rate (ZHR) of 1,500 near 10:30 UT. Rates remained above storm level past 11:00 UT and then slowly descended, reaching a low of 300 per hour near 13:30 UT. As the earth approached the paths created by comet Temple-Tuttle in 1699 and 1866, rates again rose. The secondary peak reached a ZHR of approximately 2,800 near 18:20 UT. Rates remained above storm level for another hour and a half, resulting in good views for the those in the eastern half of Asia.

The 2001 Leonid display was remarkable for the number of bright meteors and the continuous strong activity. This is in contrast to the 1999 display that provided a high concentration of faint meteors and a sudden drop of activity after maximum. While not quite as bright as the famous 1998 display, rates in 2001 were many times higher than that display and still provided numerous fireballs. Many observers set personal records with counts of 20-40 Leonids per minute not uncommon. 2001 Nov 18 will definitely be remembered by all who braved the chilly weather to view this exceptional display of celestial fireworks

An observing team operating in Arizona from the Mt. Lemmon Observing Facility (MLOF) outside of the 40-inch telescope dome had a terrific night, having observed a double-humped and very strong Leonid shower peak of ~2500 meteors/hr ZHR, and lasting from about 10:45-11:15 UTC, with an above “storm strength” activity level (> 1,000 meteors/hr ZHR) lasting from about 10:00-11:30 UTC. Rates for the night began quite good (ZHR > 150 meteors/hr) and ended quite good (ZHR > 350 meteors/hr), with a very rich bright Leonid population throughout (many nice fireballs).

These rates were determined using a team of experienced visual observers: consisting of Jure Atanakov, David Holman, Javor Kac, Tom Kucharski, Robert Lunsford, Ana Mancic, and Jure Zakrajsek. Most of these observers have a higher than normal meteor perception resulting in a higher activity curve. All observers operated remote "smart-mice," which feed into a PC operated by James Richardson, using software developed by Morris Jones to perform real-time ZHR calculations from multiple observers for the NASA / AMES Leonids Campaign. Further analysis of these data will be conducted by Peter Jenniskens and his team.

Figure 1. Darren Talbot, St. Croix Observatory, Halifax, Nova Scotia, Canada, photographed this Leonid fireball as it shot through the constellation of Taurus illuminating a foreground cloud as the Leonid flared up to an estimated -13 at its peak. “It lit up the ground like a lightning bolt casting shadows everywhere. The smoke trail remained in the atmosphere for 20 minutes afterward". Photo taken on 2001 November 18 at 5:00a.m. EST. Equipment incluided 35mm SLR camera with a 28mm F2.8 lens and Kodak p1600 film. Three-minute exposure with the fireball in the constellation of Taurus, very close to the planet Saturn.

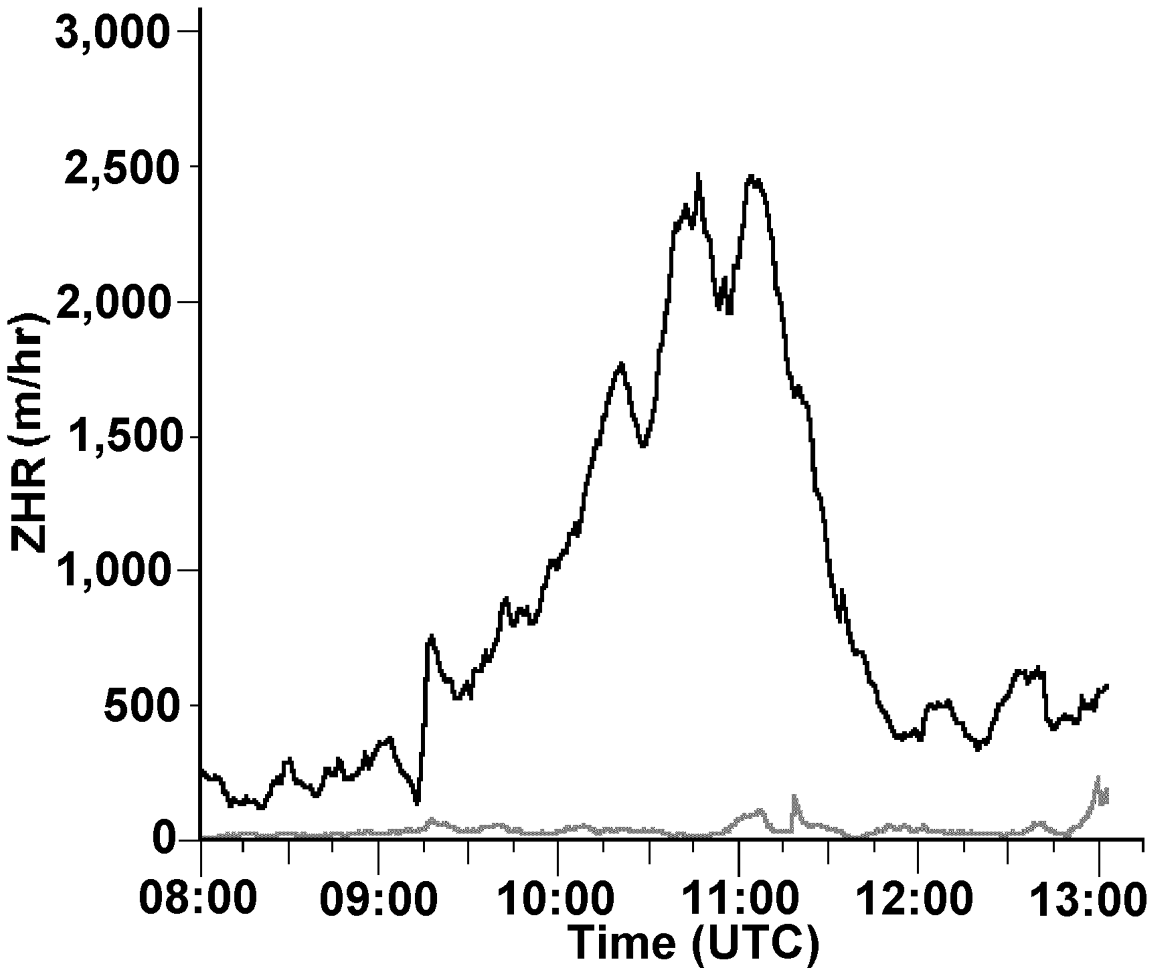


Figure 2. A preliminary graph of the Leonid meteor shower corrected activity curve as seen from Mt. Lemmon, Arizona, on Sunday, 2001 Nov 18: plotting Leonid shower Zenith Hourly Rate (ZHR), in meteors per hour, vs. Universal Time (UTC), in quarter-hour tick-marks. The beginning time of 08:00 UTC corresponds to 1 a.m. MST (Mountain Standard Time) and 13:00 UTC corresponds to 6 a.m. MST. The lower (gray) graph shows the corrected sporadic meteor hourly rate over the same time period.

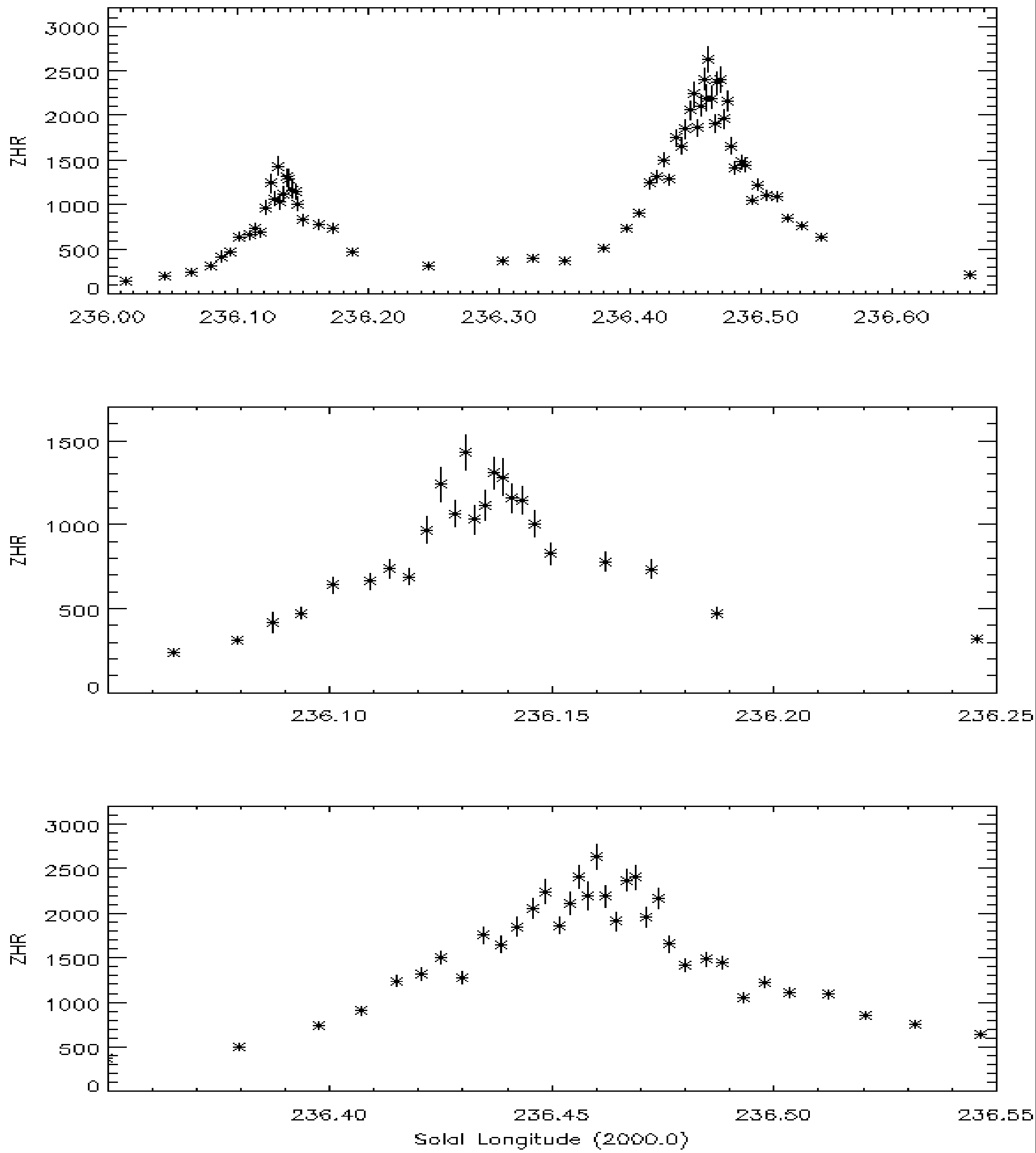


Figure 3. Graphs representing the resulting analysis from the early data received by the International Meteor Organization (IMO) and expressed in degrees of solar longitude. 236.00 degrees is exactly 07:31 UT while 236.50 is exactly 19:20 UT. 0.05 degrees in solar longitude represents approximately 72 minutes. Middle graph shows more detailed view of peak near 236.15 in top graph; bottom graph shows more detailed view of peak near 236.45 in top graph (Courtesy the IMO)

Table 1: Leonid Meteor Counts, 2001 Nov 18

Observer	Location	Time (UT)	Duration (Hrs)	Limiting Mag.	Obstruct.	Leonids	Other
Tomislav Jurkic	Croatia	0011-0126	1.25	5.80	0%	18	8
Farkas Erzsébet	Hungary	0015-0445	3.50	6.00	0%	81	25
Kereszturi Ákos	Hungary	0015-0445	3.50	6.00	0%	111	16
Prohászka Szaniszló	Hungary	0015-0445	3.50	6.00	0%	96	19
Nyerges Gyula	Hungary	0100-0445	3.00	6.00	0%	62	8
Ina Rendtel	Germany	0130-0230	1.00	6.42	0%	23	11
Marion Rudolph	Germany	0130-0245	1.25	6.40	0%	28	11
Tomislav Jurkic	Croatia	0152-0304	1.20	6.00	0%	43	6
Antonio Blanco	Spain	0200-0300	1.00	5.35	0%	2	1
Ina Rendtel	Germany	0230-0330	1.00	6.42	0%	41	13
Tepliczky István	Hungary	0230-0445	1.50	6.00	0%	35	4
Antonio Blanco	Spain	0300-0400	1.00	6.65	0%	6	1
Tomislav Jurkic	Croatia	0316-0442	1.43	5.90	0%	70	9
Pierre Martin	WV	0325-0425	1.00	6.63	0%	0	
Marion Rudolph	Germany	0330-0450	1.21	6.40	0%	57	14
Ina Rendtel	Germany	0333-0450	1.28	6.42	0%	54	14
Antonio Blanco	Spain	0400-0500	1.00	6.12	0%	18	0
Francisco Ramirez	Canary Is.	0407-0508	1.02	6.08	20%	65	7
Pierre Martin	WV	0425-0525	1.00	6.63	0%	12	
Carlos Pineda Ferre	Spain	0434-0545	1.18	5.25	20%	55	4
Antonio Blanco	Spain	0500-0600	1.00	6.12	0%	8	2
Francisco Ramirez	Canary Is.	0508-0636	1.37	5.35	50%	85	2
Michael Doyle	VA	0520-0620	1.00	5.70	0%	25	0
Pierre Martin	WV	0525-0625	1.00	6.63	0%	32	
Edwin Jones	AR	0550-0650	0.83	4.00	30%	8	0
Felix Martinez	VA	0550-0950	2.00			248	10
Ken Legal	PA	0600-0630	0.50		0%	22	2
Frank Melillo	NY	0600-0700	1.00	4.50	0%	22	
Gene Kispert	MN	0600-0700	1.00	5.50	35%	22	1
Michael Doyle	VA	0620-0720	1.00	5.70	0%	51	0
Pierre Martin	WV	0625-0725	1.00	6.95	0%	75	
Edwin Jones	AR	0650-0750	1.00	4.50	85%	11	0
Ken Legal	PA	0700-0800	1.00		0%	68	7
John Sabia	PA	0700-0800	1.00	5.90	0%	94	7
George Gliba	WV	0700-0800	1.00	6.30	0%	136	
Gene Kispert	MN	0700-0800	1.00	5.50	65%	53	1
Kim Youmans	GA	0700-0801	0.98	6.38	0%	57	8
Norman McLeod III	FL	0704-0806	0.97	7.25	10%	67	14
Frank Melillo	NY	0705-0800	0.92	4.50	0%	21	
Javor Kac	AZ	0721-0822	0.77	5.54	30%	32	5
Michael Doyle	VA	0725-0825	1.00	5.30	0%	94	0
Pierre Martin	WV	0725-0825	1.00	6.95	0%	152	
Marco Langbroek	AZ	0733-0834	0.85	6.35	0%	42	1
Robert Lunsford	AZ	0745-0845	1.00	5.15	0%	38	3
Edwin Jones	AR	0750-0850	0.25	4.50	90%	1	0
Walter Haas	NM	0800-0859	0.98	4.50	10%	21	5

Table 1: Leonid Meteor Counts, 2001 Nov 18

Observer	Location	Time (UT)	Duration (Hrs)	Limiting Mag.	Obstruct.	Leonids	Other
Ken Legal	PA	0800-0900	1.00			152	6
John Sabia	PA	0800-0900	1.00	5.90	0%	207	4
George Gliba	WV	0800-0900	1.00	6.40	0%	259	
Steve Page	GA	0800-0900	1.00	6.37	0%	176	
Gene Kispert	MN	0800-0900	1.00	5.50	90%	72	1
Norman McLeod III	FL	0806-0906	1.00	7.30	0%	111	8
Frank Melillo	NY	0809-0906	0.95	4.50	0%	70	
Paul Martsching	IL	0815-0905	0.83	3.30	25%	48	0
Richard Taibi	MD	0819-1045	1.43	4.28	0%	337	1
Kim Youmans	GA	0820-0924	1.05	6.38	0%	196	6
Matthew Collier	TX	0820-0950	1.50	5.77	10%	243	15
Javor Kac	AZ	0822-0921	1.00	5.83	15%	99	10
Pierre Martin	WV	0825-0925	1.00	7.00	0%	482	
Michael Doyle	VA	0830-0850	0.33	2.40	0%	22	0
W.T. Goodart	AZ	0830-0930	1.00	7.00	0%	48	0
Richard Schmude	GA	0839-0940	1.02	5.22	0%	142	4
Robert Lunsford	AZ	0845-0945	1.00	5.88	0%	168	13
Edwin Jones	AR	0850-0950	1.00	4.50	75%	8	0
David Meisel	NY	0900-1000	1.00	6.00	30%	96	
Ken Legal	PA	0900-1000	1.00			344	5
Steve Page	GA	0900-1000	1.00	6.28	0%	413	
Lance Benner	CA	0900-1000	1.00	5.97	15%	226	11
Vladimir Getman	PA	0900-1000	1.00			263	0
George Gliba	WV	0900-1000	1.00	6.50	0%	472	
Walter Haas	NM	0903-1007	1.07	4.25	30%	64	2
Norman McLeod III	FL	0906-1006	1.00	7.30	0%	334	9
John Sabia	PA	0907-1007	1.00	5.90	0%	471	4
Frank Melillo	NY	0910-1050	1.67	4.50	0%	233	
Marco Langbroek	AZ	0916-1016	0.72	6.30	0%	350	
Javor Kac	AZ	0921-1021	0.98	5.76	15%	609	15
Alan MacRobert	MA	0923-1026	1.05	5.80	5%	411	4
Pierre Martin	WV	0925-1025	1.00	7.08	0%	1434	
Paul Martsching	IL	0926-1026	1.00	6.03	15%	224	2
Brenda Branchett	FL	0930-1030	1.00	5.00	20%	130	3
Chaz Hafey	MS	0930-1030	1.00	5.50	0%	372	8
Joseph Gerver	NJ	0930-1045	1.15	4.00	0%	50	0
MarLou Gaudet	CA	0935-1035	1.00	5.50	0%	40	0
Kim Youmans	GA	0939-1100	1.20	6.20	0%	652	3
Richard Schmude	GA	0940-1040	1.00	5.30	0%	299	1
Daniel Simmons	FL	0945-1021	0.60	5.40	0%	188	0
Michael Doyle	VA	0945-1045	1.00	5.38	0%	747	0
Robert Lunsford	AZ	0945-1045	0.95	6.19	0%	694	19
Karl Simmons	FL	0945-1051	1.00	5.40	0%	263	3
Matthew Simmons	FL	0945-1051	1.00	5.40	0%	316	0
Wanda Simmons	Fl	0954-1050	0.93	5.40	0%	276	0
Stephan Simmons	FL	0957-1005	0.10	5.40	0%	32	0
Edwin Jones	AR	0950-1050	1.00	4.50	60%	34	0

Table 1: Leonid Meteor Counts, 2001 Nov 18

Observer	Location	Time (UT)	Duration (Hrs)	Limiting Mag.	Obstruct.	Leonids	Other
Ken Legal	PA	1000-1053	0.88			589	0
David Branchett	FL	1000-1030	0.50	5.50	0%	100	0
David Meisel	NY	1000-1100	1.00	5.50	30%	291	
George Gliba	WV	1000-1100	1.00	5.80	0%	784	
Vladimir Getman	PA	1000-1100	1.00			398	
Steve Page	GA	1000-1100	1.00	6.20	0%	757	
Jim Bedient	HI	1000-1100	1.00	5.50	0%	35	4
Lance Benner	CA	1005-1105	1.00	6.37	15%	554	7
Norman McLeod III	FL	1006-1101	0.92	7.00	0%	458	13
Marco Langbroek	AZ	1016-1116	0.75	6.74	0%	990	
Javor Kac	AZ	1021-1122	0.85	5.50	25%	1491	8
Walter Haas	NM	1022-1120	0.97	4.00	30%	130	0
Pierre Martin	WV	1025-1105	0.67	6.33	0%	1249	
Paul Martsching	IL	1026-1132	1.10	5.70	20%	255	2
Brenda Branchett	FL	1030-1130	1.00	5.50	0%	321	0
Chaz Hafey	MS	1030-1130	1.00	5.30	0%	398	7
Richard Schmude	GA	1040-1110	0.50	5.22	0%	262	1
Michael Doyle	VA	1045-1120	0.58	4.29	0%	259	0
Robert Lunsford	AZ	1045-1145	1.00	6.20	0%	812	13
Vladimir Getman	PA	1100-1130	0.50			42	0
Jim Bedient	HI	1100-1200	1.00	5.50	0%	78	7
Lance Benner	CA	1105-1215	1.17	6.43	15%	410	7
Marco Langbroek	AZ	1116-1246	0.65	6.65	0%	423	
Javor Kac	AZ	1122-1256	1.35	5.38	30%	572	18
Chaz Hafey	MS	1130-1145	0.25	2.50	5%	9	0
Robert Lunsford	AZ	1145-1245	1.00	5.67	0%	264	12
Jim Bedient	HI	1210-1310	1.00	5.25	0%	106	6
Jim Bedient	HI	1350-1410	0.34	5.00	0%	48	1
Sirko Molau	S. Korea	1507-1600	0.91	6.20	0%	53	4
Sirko Molau	S. Korea	1600-1700	0.93	6.20	0%	215	14
Sirko Molau	S. Korea	1700-1800	0.97	6.20	0%	685	13
Sirko Molau	S. Korea	1800-1900	1.00	6.20	0%	1560	3
Girish Kulkarni	INDIA	1846-1946	0.92	5.89	0%	29	8
Sirko Molau	S. Korea	1900-2000	1.00	6.20	0%	924	2
Girish Kulkarni	INDIA	1946-2046	0.90	5.75	0%	26	4
Sushrut Bhanushali	INDIA	2000-2045	0.75	5.80	0%	83	10
Sirko Molau	S. Korea	2000-2100	1.00	6.20	0%	544	5
Amruta Modani	INDIA	2020-2120	1.00	5.68	0%	131	6
Girish Kulkarni	INDIA	2046-2130	0.65	5.73	0%	69	5
Sushrut Bhanushali	INDIA	2130-2200	0.50	5.90	0%	65	7
Amruta Modani	INDIA	2235-2335	1.00	4.97	0%	107	7
Sushrut Bhanushali	INDIA	2300-2330	0.50	5.90	0%	56	2
TOTALS			139.78	5.71	8%	31871	592

NOTE 1: Duration totals do not always agree with the stated times due to observer break-times.
NOTE 2: Obstructions are the percentage of blockage (such as clouds, terrain or trees) within one's field of view.

ALPO Feature

Photometry and Other Characteristics of Venus

By Richard W. Schmude, Jr. and James Dutton
Gordon College
Barnesville, Georgia

Abstract

New photoelectric magnitude measurements are reported and these values have been combined with previously reported measurements in the selection of the photometric constants of Venus. The selected normalized magnitudes of Venus are: B(1,0) = -3.42, V(1,0) = -4.25, R(1,0) = -4.87 and I(1,0) = -5.14, while the selected solar phase angle coefficients for the B, V, R and I filters are: 0.0055, 0.0063, 0.0071 and 0.0062. Dichotomy measurements made between 1919 and 2001 have been reviewed and it is concluded that the Schroeter effect is real and that it is primarily due to two factors: 1) twilight scattering and 2) shading near the terminator. We also conclude that there is no correlation between the Schroeter effect and the 11-year solar cycle and that there is no difference in the magnitude of the Schroeter effect between eastern and western apparitions. There does, however, appear to be a ~35 year cycle in the magnitude of the Schroeter effect during most of the Twentieth Century. We also conclude that the cusp extensions of Venus may affect the observed phase of that planet and that irregularities near the terminator suggest large-scale vertical cloud relief of about 2-5 kilometers.

Introduction

Venus has inspired the interest of astronomers since the 18th century. Some interesting Venus observations include: the green flash (Journal of the British Astronomical Association, 1936), (*Sky & Telescope*, 1973), the Ashen light (Baum, 1957), (Phillips, 1990), visibility of the crescent phase with the naked eye (Graham and Palmer, 1989), and the discrepancy between the observed and predicted phase (Gaftonyuk et al. 1991), (Price, 2000).

During the late 18th century, Jonathan Schroeter made two discoveries: the cusps extended beyond 180 degrees, and Venus always appeared to be less than half-illuminated on the date that it was predicted to be half-illuminated (Sheehan and Baum, 1995). The second discovery just mentioned is called the "Schroeter effect". Vozdvizhenskii and Podobed (1978) point out that the phase defect influences the photographic center of the image. This shift may be important for the precise astrometry of near-Earth asteroids at quadrature. Finally, Gaftonyuk et al. (1991) point out that the phase defect (which

Table 1: Comparison stars used in the magnitude measurements of Venus made in 2000-2001

Star	Right Ascension[a]	Declination[a]	Magnitude[b] B	V	R	I
Alpha-Per	$3^h 24.4^m$	+49º 52.0'	---	1.80	---	---
Alpha-Boo	$14^h 15.7^m$	+19º 10.5'	1.18	-0.05	-1.02	-1.67
Gamma-Aql	$19^h 46.3^m$	+10º 37.0'	4.23	2.71	1.64	0.88
Epsilon-Cyg	$20^h 46.3^m$	+33º 58.6'	3.49	2.46	1.74	1.17
Mu-Peg	$22^h 50.1^m$	+24º 36.6'	4.42	3.48	2.80	2.33
Delta-And	$00^h 39.4^m$	+30º 52.2'	4.60	3.30	2.38	1.72
Alpha-CMa	$06^h 45.2^m$	-16º 43.1'	---	-1.45	---	---
Mu-Leo	$9^h 52.8^m$	+26º 00.0'	---	3.90	---	---
Beta-Oph	$17^h 43.5^m$	+4º 34.0'	---	2.77	---	---
Gamma-Gem	$6^h 37.8^m$	+16º 23.9'	---	1.91	1.91	---
Iota-Gem	$07^h 25.8^m$	+27º 47.7'	4.82	3.79	3.03	2.52
Epsilon-Tau	$04^h 28.7^m$	+19º 11.0'	---	3.54	---	---

[a]From the *Astronomical Almanac* for the year 2001; all positions are for the Epoch 2001.5

[b]Magnitudes for Alpha-Boo and Beta-Oph are from the *Astronomical Almanac's* list of UBVRI standard stars; all other magnitudes are from Iriarte et al. (1965).

includes the Schroeter effect) will influence astrolabe observations of Venus.

This paper will summarize our cusp, phase and photoelectric magnitude observations of Venus. We will also present quantitative measurements of large-scale cloud relief in Venus' atmosphere. Finally, we will review previous work related to the phase, brightness and cusp extensions of Venus. A special emphasis is placed on how these three factors may influence one another.

Table 2: Measured Magnitudes of Venus, 2000-2001

Date	Magnitude				α	Comparison star
	B	V	R	I	(º)	
Oct. 15.002, 2000	---	-3.98	---	---	48.1	Alpha-Boo
Nov. 10.991	---	-3.92	---	---	59.2	Alpha-Per
Nov. 14.990	-3.27	---	---	---	59.6	-----
Dec. 1.012	-3.32	---	---	---	65.9	Gamma-Aql
Dec. 3.978	---	---	-4.68	---	67.1	Gamma-Aql
Dec. 5.983	---	---	---	-5.12	68.0	Gamma-Aql
Dec. 14.998	-3.40	-4.17	---	---	71.8	Gamma-Aql
Dec. 18.006	---	---	-4.71	-5.05	73.2	Gamma-Aql
Dec. 18.996	---	---	-4.79	-5.15	73.6	Gamma-Aql
Dec. 22.024	---	-4.29	---	---	75.0	Gamma-Aql
Jan. 4.011, 2001	-3.68	-4.42	---	---	81.3	Epsilon-Cyg
Jan. 5.045	---	---	-4.88	-5.24	81.9	Epsilon-Cyg
Jan. 7.003	---	-4.43	---	---	82.9	Epsilon-Cyg
Jan. 21.040	-3.74	-4.44	---	---	91.0	Epsilon-Cyg(V) Mu-Peg(B)
Jan. 23.049	---	---	-5.10	-5.45	92.2	Mu-Peg
Jan. 25.066	---	---	-5.13	-5.37	93.5	Mu-Peg
Jan. 28.077	---	---	-5.21	-5.55	95.6	Mu-Peg
Feb. 5.043	-3.84	-4.70	---	---	101.3	Mu-Peg
Feb. 6.030	---	-4.66	---	---	102.1	Mu-Peg
Feb. 9.048	---	---	-5.22	-5.60	104.6	Delta-And
Feb. 11.028	---	-4.75[a]	---	---	106.3	Delta-And
Feb. 18.047	-4.04	-4.78	-5.29	-5.61	112.7	Delta-And
Feb. 19.048	---	-4.78	---	---	113.7	Delta-And
Feb. 20.042	-4.00	---	---	---	114.7	Delta-And
Feb. 27.043	---	-4.76	---	---	122.7	Delta-And
March 7.044	---	-4.69	---	---	133.4	Alpha-CMa
March 8.042	-4.01	-4.58	---	---	134.9	Delta-And
March 10.043	---	---	-5.14	-5.51	138.0	Delta-And
March 16.032	---	-4.38	---	---	148.0	Epsilon-Tau
May 4.417	---	-4.57	---	---	119.0	Alpha-Boo
May 15.406	---	-4.45	---	---	108.1	Alpha-Boo
May 18.402	---	-4.60	---	---	105.5	Beta-Oph
Aug. 21.414	---	-3.96	---	---	54.0	Gamma-Gem
Aug. 23.410	---	---	-4.51	---	53.1	Gamma-Gem
Sep. 16.430	---	-3.87	---	---	43.1	Mu-Leo
Sep. 27.440	---	-4.01	---	---	38.7	Iota-Gem
Sep. 28.436	-2.95	---	---	-4.66	38.3	Iota-Gem

[a]Only two measurements were made instead of three.

Photoelectric Photometery

An SSP-3 solid-state photometer, along with filters that have been transformed to the Johnson B, V, R and I system, were used in making all photoelectric magnitude measurements. The photometer and filters are described in more detail elsewhere (Optec, 1997), (Schmude, 1992). A 0.09-meter, f/5.5 Maksutov telescope was also used in the measurements; the telescope aperture was usually reduced by placing a mask in front to prevent saturation of the detector. The magnitude reduction of the mask is 5.10 magnitudes.

Transformation coefficients were measured using the two-star method outlined in Hall and Genet (1988); the transformation coefficients are: $\varepsilon_B = 0.092$, $\varepsilon_V = -0.051$, $\varepsilon_R = -0.021$ and $\varepsilon_I = -0.095$. Magnitudes were measured using the sequence CVCVCVKC where each "C" value was the difference between three 10-second sky measurements and three 10-second star measurements. Each V measurement was computed in the same way, except that Venus was the target. The K is a measurement of a second star, which was either a check star or a star used in determining the extinction coefficient. In some cases, extinction coefficients were also determined by taking measurements of Venus as it approached the horizon.

The comparison stars used in this study are listed in Table 1 while the measured magnitudes are listed in Table 2. Check stars were occasionally measured and the average discrepancy between observed and predicted magnitude was 0.03 magnitudes.

The magnitudes in Table 2 were converted into normalized magnitudes, X(1,α), through:

$$X(1, \alpha) = X_m - 5.0\log[r\ d] + 2.5\text{lok}[k] \quad (1)$$

where α is the solar phase angle of Venus, (the solar phase angle is the angle between the Earth and the Sun measured from the center of Venus), X(1,0) is the normalized magnitude for either the B, V, R or I filter, X_m is the B, V, R or I magnitude, r and d are the Venus-Earth and Venus-Sun distances in astronomical units and k is the fraction of Venus' disc that is predicted to be illuminated. Graphs of X(1, α) versus α were prepared for each of the four filters. The slope and the Y-intercepts were computed. The Y-intercept is the normalized magnitude at α = 0° and the slope is the solar phase angle coefficient, which describes the dimming of the illuminated portion of the disc.

Please note that the solar phase angle coefficient in this paper does not include the 2.5log[k] term. Figure 1 shows the X(1, α) versus α plot for the V filter. The X(1, α) values for α < 120° appear to fall on a straight line; however, the X(1, α) values for α > 120° deviate from linear behavior. This deviation also occurs for the B, R and I filters. Therefore, only X(1, α) values for α < 120° were used in the linear fits. The resulting normalized magnitudes, X(1,0), and solar phase angle coefficients, c_X, values are listed in Table 3.

The behavior of the X(1,α) values for Venus at α < 120 degrees is just the opposite of the Moon's behavior (Schmude, 2001). In the case of the Moon, the X(1,α) value in the B and V filters, falls below what it would be from a linear extrapolation for α < 120 degrees, whereas the X(1,α) value for Venus lies above, or is brighter, than it would be from the same linear extrapolation. We conclude that Venus' atmosphere scatters light in such a way that the brightness of Venus per unit area increases as that planet's solar phase angle increases.

This conclusion is also in agreement with Robinson (1961). Earthshine plays a very limited role in the overall brightness of the Moon for α < 150 degrees (Schmude, 2001).

We also believe that the Ashen Light of Venus should not have a large impact on the X(1,α) value for that planet at (120° < α < 150 degrees) for at least the B, V and R filters, since the Ashen light has often been noted as being similar in intensity to Earthshine on the Moon (Baum 1957, 2000), (Phillips, 1990). Allen and Crawford (1984), for example, report bright areas in Venus' dark hemisphere at infrared wavelengths of 1.5-2.5 micrometers. These bright areas are reported to have an intensity of up to 1 percent of the illuminated hemisphere, and so these areas may play a role in the infrared photometry of Venus.

The X(1, α) values have been computed from other studies. Plots of X(1,α) versus α were prepared and the resulting normalized magnitudes and solar phase angle coefficients were computed and are summarized in Table 3. A weight (w) equal to $QR(N)^{1/2}$ where "Q" is a quality factor (Q = 2 for Irvine et al. 1968 a,b and in the current study and 1 for everything else), R is the range of α and N is the number of measurements. A weight of 400 was assigned to the phase function and B-V values reported by De Vaucouleurs (1964). The selected photometric constants of Venus are listed at the bottom of Table 3.

Dichotomy and the Schroeter Effect

"Dichotomy" is defined as the date when Venus appears to be half illuminated. Over two centuries ago, Schroeter discovered that Venus always appeared to be a bit less than half-illuminated on the date of predicted dichotomy. This phenomenon has

Table 3: A Summary of Photoelectric Magnitude

Filter	X(1,0)	c_X	Number of Points	Weight	Source
B	-3.55	0.00763	*	400	de Voucouleurs (1964)
V	-4.40	0.00881	*	400	"
B	-3.52	0.00546	6	251	Irvine et al (1968a)
V	-4.23	0.00528	6	251	"
B	-3.37	0.00491	62	1285	Irvine et al. (1968b)
V	-4.19	0.00553	62	1285	"
V	-4.30	0.0068	11	148	Schmude (1993a)
V	-3.88	0.0031	5	57	Schmude (1993b)
B	-3.43	0.0062	7	73	Schmude (1999)
V	-4.33	0.0074	7	73	"
R	-5.07	0.0098	7	73	"
I	-5.22	0.0072	7	73	"
B	-3.38	0.0047	9	229	Current work
V	-4.38	0.0074	18	342	"
R	-4.80	0.0061	10	188	"
I	-5.12	0.0059	10	235	"
B	-3.42	0.0055			Selected Value
V	-4.25	0.0063			"
R	-4.87	0.0071			"
I	-5.14	0.0062			"

*This is a review of several studies published prior to 1964.

been observed well over 100 times during the 20th century. There is evidence that Mercury (Giffen, 1965) and the Moon (Gaherty, 1965) also have a Schroeter effect. There are two likely explanations of the Schroeter effect, which are:

- The Schroeter effect is caused by shading near the terminator, as suggested by Heath (1956).
- The Schroeter effect is caused by the scattering of light at high altitudes in the atmosphere of Venus, as suggested by Mallama, (1994, 1996).

In order to investigate the impact of these two factors, I have carried out studies of the phases of the Moon, Venus and Mars during 2001; furthermore, the solar phase angle coefficients of several solar system bodies have been examined. The solar phase angle coefficients for Venus are summarized in Table 3.

The phase of Venus was estimated from drawings and from a grid. The grid was hand made by Schmude and it shows the shape of a circular planet with solar phase angles of between 20 degrees and 160 degrees. This grid was also used in estimating the phase of Mars and the Moon. The Venus estimates were made through a 0.10-meter refractor telescope in the daylight while the Mars estimates were made through the same instrument but during the night.

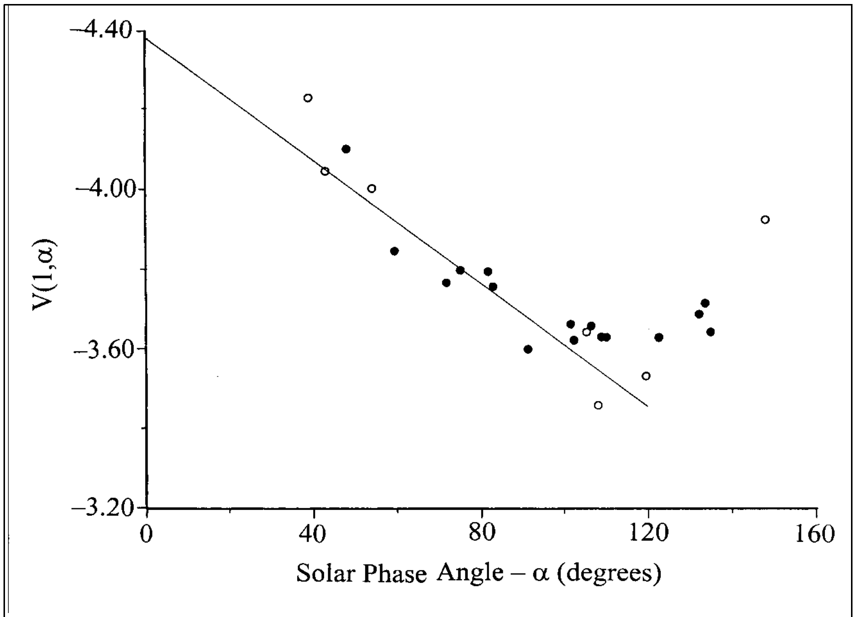


Figure 1: A plot of our normalized magnitudes of Venus during 2000-2001 calculated from equation 1 in the text. The filled circles represent data collected before 2001 Mar 25, whereas the open circles are data collected after that date.

Moon estimates were made at all times (daylight, twilight and night) with the naked eye. The estimated phases of Mars were compared to the predicted (or calculated) values in *The Astronomical Almanac*. The predicted minus the observed phase (in percent), designated as (p – o)% for Mars was 2.4 ± 0.4 percent. The (p – o)% for Venus based on the grid estimates and drawings was 2.9 ± 0.4 percent.

The selected (p – o)% for the Moon is 4.8 percent and this is based on the weighted average of 5.4 percent made by several Montreal Centre members of the Royal Astronomical Society of Canada and 2.5 percent by Schmude (weight = 1).

Photographs of the moon were taken on 2001 April under dark skies with a 0.10-meter, f/9.2 refractor at

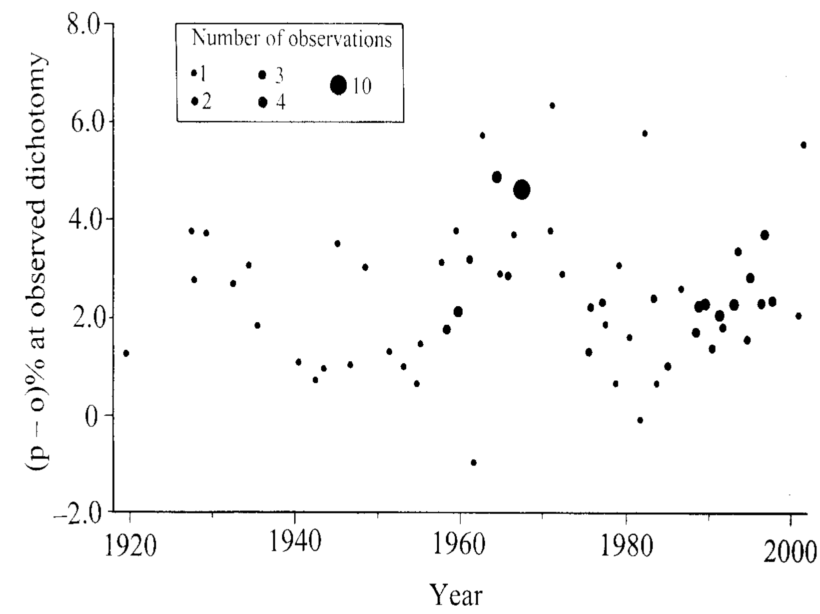


Figure 2. The predicted phase minus the observed phase in percent, (p – o)%, for Venus at observed dichotomy as a function of the year. All predicted phase values were taken from *The Astronomical Almanac*. The size of the dots is proportional to the number of independent measurements made during an apparition.

prime focus. A 35 mm camera and Kodak 100 speed color film were used. Pictures were taken at four different exposure times: 1/120, 1/250, 1/500 and 1/1,000 of a second. The phase of the Moon was measured from the negatives and compared to predicted values. The picture with the shortest exposure time showed the smallest phase. The relation between exposure time (t in seconds) and the (p – o)% value is:

$$(p - o)\% = 3.59 \text{ percent} - 133\, t \quad (2)$$

This relation shows that the terminator shading plays at least some role in the Moon's Schroeter effect.

One of us (Schmude) has carried out an extensive literature search on the Schroeter effect of Venus. A total of 113 different dichotomy measurements were analyzed and these are plotted in Figure 2 (Benton, 1976, 1977a-b, 1980, 1982, 1985, 1989a-b, 1990, 1991a-b, 1992, 1994, 1996a-b, 1998a-b, 1999a-c, 2000a-b), (Binder, 1965), (Cruikshank, 1965, 1972a), (Glasby, 1963), (Haas, 1939), (Heath, 2001), (McEwen, 1927, 1937), (Moore, 1958, 1959, 1961), (Nicolson and Moore, 1964), (Robinson, 1967, 1968), (*Sky & Telescope*, 1966a-b, 1967), (Vetterlein, 1963).

Only those studies where the telescope aperture was reported were considered; furthermore only integrated light values were analyzed. Giffen (1965) and Kirby (1970) report that telescope aperture plays an important role in the observed phase of Mercury and Venus. For each of the dates of observed dichotomy, I looked up the predicted phase of Venus in *The Astronomical Almanac* and then computed the (p – o)% value. A "modified (p – o)%" value was also computed using the formula and recommendations of Giffen (1965). In the end, a (p – o)% versus aperture and a "modified (p – o)%" versus aperture graphs were prepared and equations relating aperture and (p – o)% were computed:

$$(p - o)\% = 3.47 - 0.00269\, A \quad (3)$$

$$\text{modified } (p - o)\% = 5.39 - 0.00589\, A \quad (4)$$

where "A" is the telescope aperture in meters. As it turns out, the modified (p – o)% has a stronger aperture dependence than the (p – o)% value and so the procedure outlined in Giffen was not included for Venus.

The average (p – o)% for 42 western apparition measurements are 2.57 ± 0.27 percent while the corresponding average for 71 eastern apparition measurements are 2.66 ± 0.19 percent. The average of all 113 measurements is 2.63 ± 0.16 percent. In all cases, the uncertainties are the standard deviations divided by the square root of the number of data points. According to the *Astronomical Almanac*, between 1981 and 1988, the phase of Venus changes by 0.529 percent per day near the time of predicted dichotomy.

Therefore a difference of 2.63 percent corresponds to a 5.0-day difference between predicted and observed dichotomy. Sohl and Weber (1993) carried out an extensive review of 3350 visual phase estimates of Venus made between 1897 and 1990. They report equations relating the (p – o)% to the calculated phase. Their "variably weighted equation" yields a predicted phase of 53.61 percent for observed dichotomy; this is equivalent to (p – o)% = 3.61 percent which is somewhat larger than the value selected here.

It should be pointed out that Sohl and Weber considered a wide range of phase angles whereas we focused on phases near dichotomy. We select a (p – o)% value of 3.1 percent which is the average of our result and that of Sohl and Weber; we also select a time difference of 6.1 days between observed and predicted dichotomy which is the average of our value 5.0 days and Sohl and Weber's value of 7.3 days. There is no difference in (p – o)% values between eastern and western apparitions in our study.

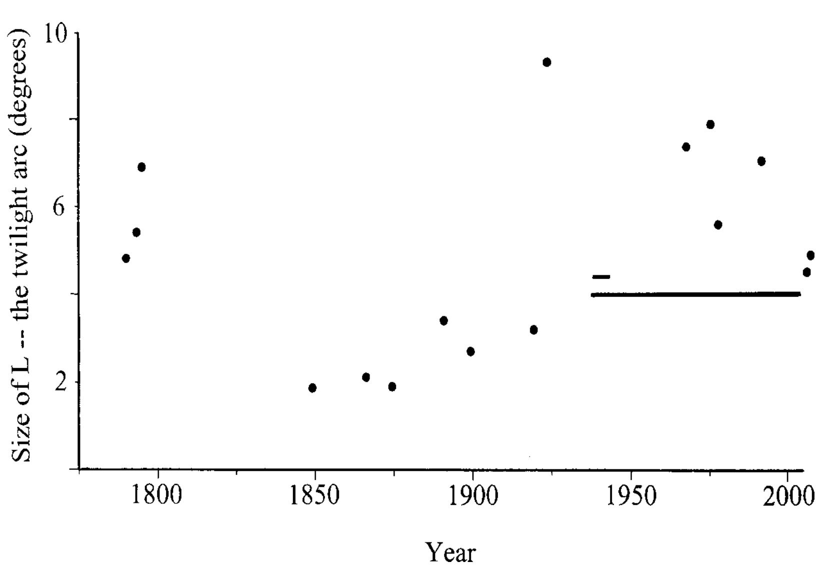


Figure 3: The size of the twilight arc as computed from the equation in Haas (2000) as a function of the year. The two bars are average values for the time increments 1938-1942 and 1937-1998.

Mallama (1994, 1996) reports the results of CCD images of Venus made during the two apparitions of 1993. He used a 0.20-meter telescope in making his images. He selected his best images and then used software to stretch out the terminator region in a horizontal direction. Mallama then converted luminosity into isophotes. (Isophotes are lines on an image showing equal brightness in the same way that lines on a topographic map show equal elevation.) He reports that the terminator of Venus was curved towards the Sun (crescent phase) on a 1993 Jan 20 image; Venus was, however, predicted to have a gibbous phase on that date. Mallama concludes that his 1993 CCD images indicate a difference of 4 days between observed and predicted dichotomy which corresponds to (p – o)% = 2.1 percent. The selected (p – o)% for Venus, however, is 3.1 percent; and it is therefore concluded that the remaining 1.0 percent is due to terminator shading.

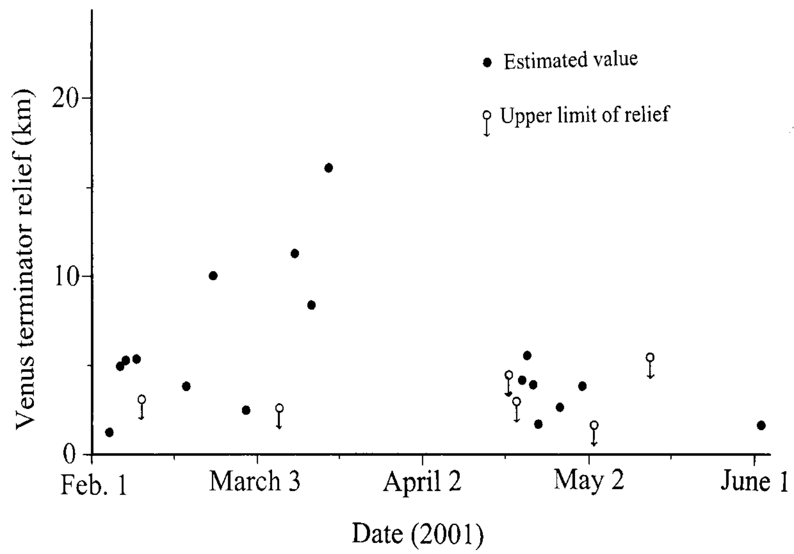


Figure 4. Computed terminator relief based on observations made by Schmude in 2001 as a function of the date. The relief values were computed from equation 6 in the text, which is from Haas and Johnson (1943). Open circles with a downward arrow are upper limits while solid circles are computed values.

Bronshten (1971) and Sharonov (1964) point out that different people will estimate the phase of Venus differently. They argue that the Schroeter effect is due to psychological effects and it cannot be used to investigate twilight phenomena in the atmosphere of Venus. The current authors believe that there are significant random discrepancies in the observed phase due to personal equations and psychological factors. We have carried out a broad literature search of the Schroeter effect in the hope that many of the psychological factors will average out. We point out that in 111 out of 113 cases, the phase of Venus was estimated to be less than 50.0 percent at the time of theoretical dichotomy and that this result cannot be attributed to random psychological errors. We believe that the phase discrepancy of Venus is real, but that psychological factors are very important and in fact they limit our ability to fully understand the Schroeter effect.

Twilight Arc and Cusp Extensions

The extension of Venus' cusps is due to the scattering of light by that planet's upper atmosphere (Russell, 1899). Haas and Johnson (1943) carried out a study to determine the effective angular width (ϕ) of the twilight arc using:

$$\sin(\phi + \tau/2) = \sin\alpha \sin\{(p - 180°)/2\} \quad (5)$$

where p is the angular distance from one cusp to the other cusp measured along the illuminated limb, α is the solar phase angle of Venus and τ is the angular size of the Sun measured from Venus ($\tau = 0.74°$). Haas and Johnson (1943) report a value of $\phi = 4.4°$ based on several measurements made between 1938 and 1942. More recently, Haas (2000) reports a value of $\phi = 3.6° \pm 0.5°$ based on all of his measurements between 1937 and 1998. Haas (2000) used the equation: $\sin(L) = \sin a \cos(p/2)$ where $L = \phi + \tau$.

I used a 0.10-meter refractor telescope in the daytime along with a grid to estimate the cusp extensions on Venus. Based on 15 different estimates between 2001 Jan 31 and Mar 25, I computed a value of $\phi = 4.1 \pm 0.6°$; an additional 15 estimates of the cusp extension were made between 2001 Apr 18 and June 2 and the resulting value is: $\phi = 4.5 \pm 0.3°$. The uncertainties were computed by dividing the standard deviation by the square root of the number of data sets and do not include possible systematic errors arising from changing sky brightness and other factors.

Cusp extension data dating back to 1790 (Baum, 1995), (Cruikshank, 1972b), (Haas and Johnson, 1943), (Journal of the British Astronomical Assn, 1922), (McEwen, 1937), (Robinson, 1976a-b, 1977), (Russell, 1899) have been reevaluated using the formula in Haas (2000). The resulting cusp extensions are summarized in Figure 3. The twilight arc and dichotomy were well measured in 1967 June by ALPO members; the results of this study show an unusually large twilight arc of 7.4 degrees and a large (p – o)% value of 4.6 percent. Considering the findings of Mallama (1994, 1996), it seems that a large twilight arc would lead to a high (p – o)% value. The authors feel that the correlation between the width of the twilight arc and the difference between observed/ predicted dichotomies needs to be investigated further.

Terminator Irregularities

Terminator and limb irregularities have been photographed (Benton, 1985 – Figure 44), (Dobbins et al. 1992), and drawn by several people (Moore, 1953), (McCue and Baum, 1990). In fact, Schroeter observed terminator irregularities back in the Eighteenth Century (Dick, 1838). One of the authors (Schmude) also observed the terminator irregularities in 2001.

Two types of terminator irregularities were observed in 2001, which are called "dents" and "bulges." A dent is an indentation of the dark side into a small portion of the illuminated side of Venus whereas a bulge is an extension of the illuminated portion into the unilluminated portion of Venus. A bulge would occur when sunlight struck a high altitude cloud, which was on the dark side of Venus, whereas a dent would occur when sunlight does not strike the bottom of a cavern in the cloud layer. A total of 12 dents and 6 bulges was recorded on 19 drawings between 2001 Feb 4 and Mar 25, whereas 16 dents and 1 or 2 bulges were recorded on 16 drawings between 2001 Apr 18 and July 23. All drawings were done during the daytime or during very bright twilight. Haas and Johnson (1943) point out that the linear height of a cloud on Venus can be determined from:

$$\beta' = [12{,}300 \text{ km } (\theta)^2]/[\delta^2 \cos^2 (\omega)] \qquad (6)$$

where 12,300 km is the diameter of Venus including its atmosphere, θ is the angular width of the terminator irregularity in arc-seconds, δ is the angular diameter of Venus plus atmosphere in arc-seconds and $\omega = | 90^\circ - \alpha |$ where α is the solar phase angle of Venus. Schmude estimated the total width of all terminator irregularities and then inserted this value into equation 6 and computed the vertical relief.

As an example, on 2001 Feb 23, I estimated terminator irregularities to be 1.0 arc-second wide. Values of δ, ω and θ were thus 30.9 arc-seconds, $\omega = 11.2^\circ$ and $\theta = 1.0$ arc-second; the resulting vertical relief, β', was 9.7 km. The value of δ was computed by multiplying the angular size of Venus in *The Astronomical Almanac* by 1.0164 to account for the atmosphere. The average vertical terminator relief is plotted in Figure 4. One can see that the relief was greater before conjunction on March 30. This difference may be due to the fact that the direction of the solar radiation, as seen from the Earth, switched after conjunction. Alternatively, the upper atmosphere may have had greater relief before conjunction.

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Astronomical photometry

Astronomical photometry is the measure of the light emitted by a celestial source. A number of optical, photographic and electronic procedures are used in order to measure the luminous flux (that is the energy that hits a detector per unit time). The ancient astronomers had already subdivided the stars into classes, according to their apparent brightness, but on the basis of their observations carried out by naked eye. With the invention of the astronomical instruments, the photographic films and, later, of the photoelectric and electronic detectors, quantitative measures were obtained.

Astronomical photometry is based on the concept of magnitude, which is the measure of the intensity of the light emitted by a star. It got its name from the Latin word meaning "bigness", because in ancient times it was thought that the brightest stars were also the biggest. For the same reason, the ancient astronomers had divided the stars in 6 classes of size: the stars of the first magnitude were the brightest, those of the sixth magnitude the weakest.

The scale of magnitude used today uses the same terminology, so the number indicating the magnitude increases as the brightness decreases. The magnitude of the brighter celestial bodies (like the Sun, Venus or Jupiter), is indicated by a negative number.

The magnitude scale is not linear, but geometrical: two stars, whose luminous intensity ratio is 100 differ by 5 magnitudes; they differ by one magnitude when their luminosity ratio is 2,512. Only stars up to the sixth magnitude can be observed with the bare eye, while objects with a much smaller intensity, that is a bigger magnitude, up to over 23, can be observed with a telescope.

These considerations refer to the luminous energy that reaches the Earth, that is to its apparent magnitude: if two identical stars have different distances from us, the nearest appears to be the brightest. With equal intrinsic luminosity, the apparent magnitude of an object is inversely proportional to the squared distance of the same object. In order to set a real luminosity scale, independent of the distance, we ideally set all the stars at the same distance, that is 10 parsec (32.6 light years), and we call absolute magnitude of these stars the apparent magnitude that they would have at that distance.

For example, the Sun has an apparent magnitude of -26.5, due to its closeness, but if it were placed at a distance of 10 parsec, it would appear to us as a star of magnitude 4.8, which, in fact, is its absolute magnitude. Source:http://www.pd.astro.it/E-MOSTRA/NEW/A4001FOT.HTM

ALPO Feature: The Moon

A Previously Unreported and Unclassified Dome Near Archimedes

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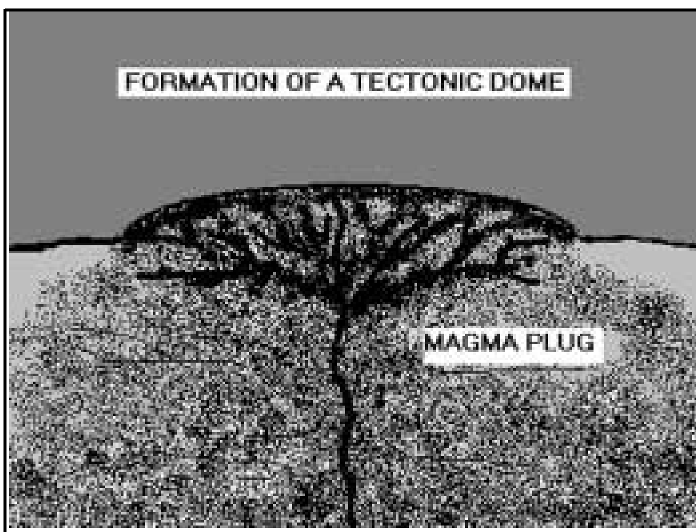
Abstract

This study describes a previously unreported and unclassified dome in the lunar Apennine region south of Archimedes and near the crater Huxley. Located at -0.071+0.353 (longitude -4.35 degrees, latitude 20.67 degrees), this structure does not appear in the *ALPO Lunar Dome Survey* database and appears to require specific lighting conditions to be visible. This may explain why it has eluded most observers to date, though an indistinct structure is recorded at these coordinates in *Atlas of the Moon* by A. Rükl (1).

Introduction: Geology and Geologic History of the General Area

The geology of this lunar region is remarkable for its complexity. The oldest materials visible are those from the impact that produced the Imbrium Basin, a multi-ring structure formed 3.85 billion years ago (2). The outermost ring is visible as the mountain range called Montes Apenninus. Multiple inner rings also formed, though only the highest points of these are now visible above the later forming lavas (below). Examples of such peaks to the north are Montes Spitzbergen and Mons Piton.

During a subsequent period of several hundred million years, partial melts formed deep under the Imbrium Basin, due to heat released by radioactive decay of elements like potassium, uranium, and thorium (5). These melts tracked up faults created by the shock wave from the Imbrium impact, and resulted in the deposition of lava within the basin itself. The earliest (oldest) lavas visible are probably those of the lighter albedo plains units inside the main Imbrium ring. These occur between Archimedes and Montes Apenninus, though some extend out nearly to the crater Timocharis (note that this visible section is only a small part of the lateral extent of the original flows). Called the Apennine Bench Formation, these plains are notable for their "roughness," lighter color, tectonic features (grabens), and domes. While other explanations for the Apennine Bench formation are possible, a volcanic origin is suggested by the presence of domes on the Bench and the finding of



What Is a Lunar Dome?

While there are no large volcanoes on the Moon, a few smaller volcano-like features have been recognized. These features are mostly fairly small. Few are more than a few thousand feet (few hundred meters) high, or more than 10 - 15 km (6 - 10 miles) across. They are also somewhat irregular in outline, and most are not very striking in appearance. Few show any large central pit or vent structures, but many do have very small central pits or craters.

These lunar constructs resemble small cinder cones and volcanic domes on the Earth. However, such cones and domes may form differently on the Earth and Moon. On the Earth, cinder cones form when small explosive eruptions pile up pieces of lava around a central vent. On the Moon, however, such eruptions will throw things much farther, leaving little to pile up near the vent. Instead of a volcanic cone, such lunar eruptions should form a broad, thin layer around the central vent (a dark mantling deposit). Similarly, lava domes on Earth form from very thick, pasty lavas. Basaltic lavas are more liquid, and tend to form broad, flat lava flows. On the Moon, most of the domes and cones appear to be made of basalts. Thus, they cannot have formed like Earth domes from thick, non-basaltic lavas. Instead, the lunar domes/cones may mark places where the erupted basalts were just barely molten.

appropriate types of volcanic rock in the Apollo 15 specimen collection.

More recent lava flows in the Imbrium Basin were of different mineral composition and consequently displayed different albedo and color. These were much darker, covered most of the Apennine Bench lavas, and covered many of the inner rings of the Imbrium Basin. Only the topographical highs within the rings themselves remained above these later lavas (or for that matter, above the earlier ones). Note that all flows in this stage were “sheet” flows, generally erupting from fissures, with no formation of volcanoes. As the final stages of volcanism came toward their end, the viscosity of the erupting lavas also changed, primarily as a decrease in temperature. In addition, the lower rate of lava effusion produced shorter flows (9) that remained near the vent, aiding in the construction of these domes (3). This type of formation on Earth produces basaltic shields, which is the form most lunar domes take (4). Thus, in the final states of lunar volcanism, there was a switch from extensive sheet flows to the construction of domes. Further, since these lavas tracked up deep seated faults (created by the massive impacts that produced the basins), it is not surprising that they tend to occur in clusters, as is the case here.

Observations

On 2000 July 9, at 21:00 UT (Colongitude 8.97 degrees, Solar Altitude 4.26 degrees) Raffaello Lena observed two domes located to the south of the crater Archimedes. Figure 1 shows the aspect of this region as sketched under good (II Antoniadi scale) seeing conditions.

The Archimedes region was closely monitored between 1995 and 1999 as part of an extended

Figure 2. Image of the Archimedes region obtained by Francesco Baladotti with a video camera and a 250mm f/10 SCT, 1999 May 23, 19:15 UT, [C = 11.9°, H = 6.5° , A = 94.1°]. North at top.

observational survey by the Geologic Lunar Research Group. During this period, only the large dome located at -0.073 + 0.375 (longitude -4.52°, latitude 22.02°) was recorded. This more northerly dome is a well-known structure, about 13km in diameter, a value determined visually and as reported in the ALPO Lunar Dome Survey database (8). The following illustration (Figure 2) shows a video image of the region.

The dome located at -071 + 353 is not clearly evident in this image, probably because the rising sun angle was already too high by the time this feature emerged from the shadows of the Apennines. The dome is readily observed, however, under a setting Sun, near the Moon's last quarter. Since this is a period during the lunation when comparatively fewer observers are active, this dome has generally eluded detection until now (though it is noted in Rukl).

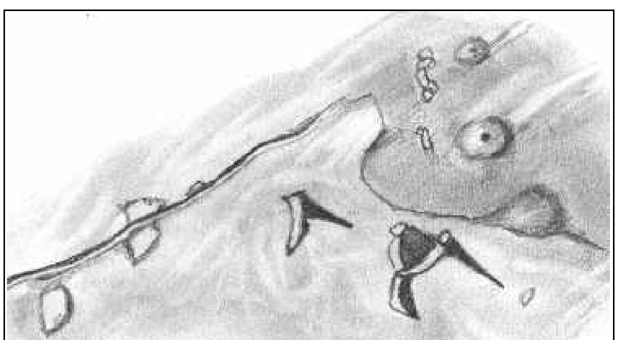


Figure 1. Drawing of the Archimedes region by R. Lena, on 2000 July 9, 21:00UT, using a 100mm f/15 refractor at 250x. C = 8.97°, H = 4.26°, A = 91.81° [C = solar colongitude, H = solar elevation, A = solar azimuth]. The drawing shows one dome following closely along the same line as Rima Bradley. This dome appears hemispherical, with a small dark area on top indicating a possible craterlet, and requires a narrow solar angle for viewing (probable range 2.2 -5.0 °).

A CCD image by Giorgio Mengoli on 2000 March 13, at 18:10 UT shows both domes in the same field of view (Figure 3). This image was obtained using a 152-ED refractor and HX516 Starlight Express CCD coupled to a Celestron Ultima Series 1.83x Barlow. The integration was 0.12 sec and the software used was Astroart and Pix Win 4.

Figure 5 reveals much finer detail in the dome than can be detected by traditional earth-based imaging, including two enigmatic small prominences. Two possible mechanisms for the origin of these prominences are (1) that they are floor ridges which were embayed by the dome, and (2) that they are endogenic, created as small cinder cones on top of the dome. The latter mechanism is suggested by the difference in

Figure 3. Archimedes region imaged by Giorgio Mengoli, 2000 March 13, 18:10 UT. [C = 7.11°, H = 2.16°, A = 92.09°].

shape and size of the prominences, but embayment is indicated by their alignment with ridges to the north. Our study of this elusive dome is the first to be added to the ALPO Lunar Dome Survey and to include CCD imaging. This has made it possible to extract additional information on both this dome and its more northerly neighbor. Using unsharp masking and geometric deformation, we were able to obtain several enlargements of these images (figures 6, 7, 8), and reveal to the presence of dark areas on the top for both domes. Close inspection, particularly of Mengoli's frame (figures 3, 6, 7, 8) shows this most distinctly.

Using Mengoli's images, we were able to measure the diameter of both domes in this region. These were obtained by enlarging the images, counting the number of pixels in the object of interest, and then converting this into kilometers per pixel (Table 1). The estimated position of the newly reported dome at -071+353 was confirmed by Harry Jamieson, former coordinator of the ALPO Lunar Dome Survey, using measurements taken from plate D3-a of the *Orthographic Lunar Atlas*.

Table 2: Archimedes Region Domes

Position	Diameter (km)	Major/Minor Axes
-0.071+0.353	10.0	1.16
-0.073+0.375	12.9	1.14

The average slope angle of a dome can be considered to equal the current solar altitude, when it is ¼ covered by shadow (see Reference 7). The height (in meters) is then calculated by the formula:
Height = (diameter/2) * (Tangent of average slope angle)

Close inspection of the photo reproduced from the *Consolidated Lunar Atlas* (Figure 4), reveals that the shadow profile on -071+353 covered about ¼ of the

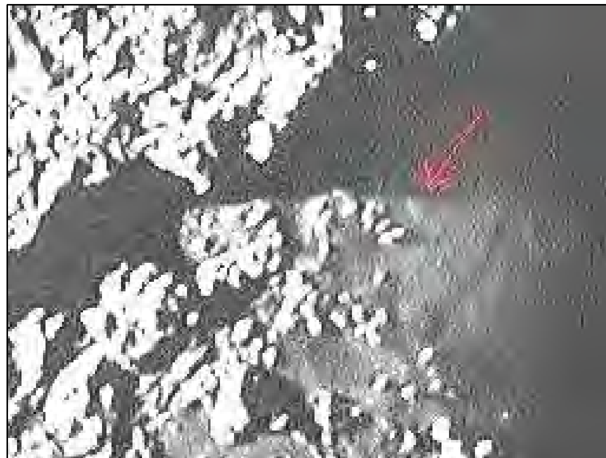


Figure 4. Image from the *Consolidated Lunar Atlas*, with south at bottom and north at top. The arrow shows the dome located at -071+353. Photograph taken 1967 19 January 3:35 UT [C = 7.2°, H = 2.23° and A = 92.45°]

dome's surface at the time this image was taken. From this, we estimate its height at about 195 meters, which would correspond to a moderate slope angle of 5 degrees. This estimate is comparable to the value measured in the frame shown in Figure 3. The height of this dome was also calculated from the length of its shadow using Jamieson's "Lunar Toolkit" program. The resultant 198 meters is comparable to the value obtained from the *Consolidated Lunar Atlas*.

Using the Westfall Classification Scheme (see Reference 6), we categorize the unlisted dome as DW/2a/6f/7K 8n. The dome located at -073+375 has been classified as DW/2a/6f/7J 8n .

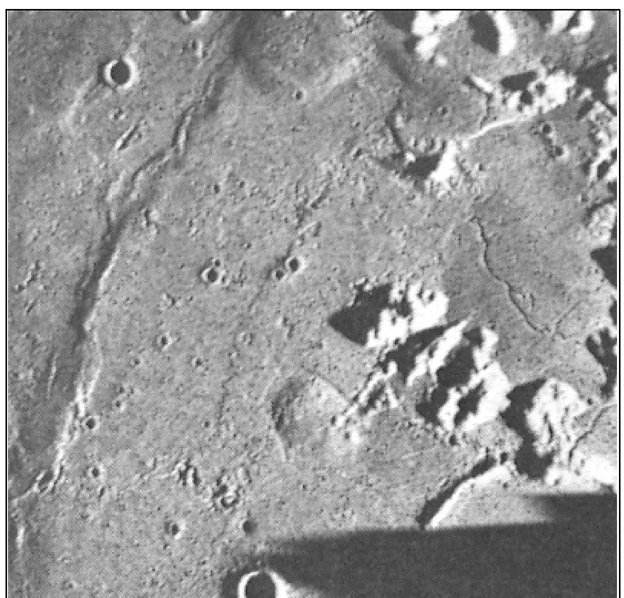


Figure 5. Image from AS 17-2433 (m) from "Apollo Over the Moon," NASA SP 362, reversed with south at bottom and north at top.

Figure 6. Enlargement of the dome located at -0.071+0.353.

Conclusion

The lunar dome we have described here (-071 + 353) is located just south of the Apennine Bench formation. It is probably not a part of that formation, however, since its lava color appears much darker than the Bench; indeed, it is much darker than other domes of that formation (especially those visible in the western part of the Apennine Bench).

Figure 7. Enlargement of the dome located at -0.073+0.375

Thus, we feel that the present dome is probably unconnected to that early pulse of volcanism, though lava had to traverse the Apennine Bench layer to reach the surface. Our sense is that the present dome represents that final pulse of volcanism, which was cooler

See for Yourself!

Use the table below to view dome "-0.071+0.353" at the same solar elevation as listed in figures 1, 2, 3 and 4 of this article. (Source: *Lunar Observer's Toolkit Ver. 1.0*)

Figure 1, Solar Elevation = 4.26°
2002 Jan 22, 00:56 UT
Figure 2, Solar Elevation = 6.5°
2002, Jan 22, 05:43 UT
Figure 3, Solar Elevation = 2.16°
2002, Feb 20, 11:13 UT
Figure 4, Solar Elevation = 2.23°
2000, Feb 20, 11:54 UT (twilight)

and lower in volume. As is observed, the color of the lava in this region would be expected to be different from that of the surrounding earlier flows. This dome occurs in a larger field, with another dome 30 km to the north, and is probably very different in age from those other massifs just to the north and east, since they are remnants of the (much older) Imbrium basin ring.

This dome at -071 + 353 is another clear example of the elusive nature of these volcanic structures on the Moon and the need for more work in this challenging area. At the same time, this study shows that a combination of careful visual and CCD observations by different observers provides powerful tools in the study of lunar domes.

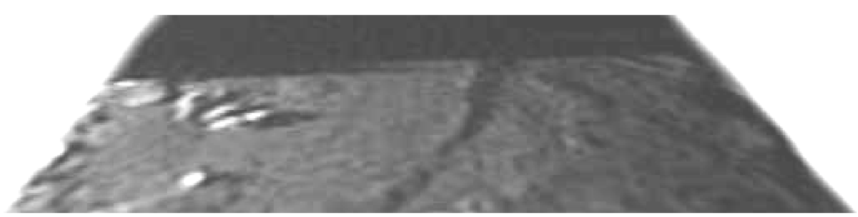


Figure 8. Geometric deformation of the Archimedes region

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ALPO Feature

ALPO Observations of Saturn During the 1998-99 Apparition

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Abstract

Eighteen observers residing in France, Germany, Italy, the United Kingdom, New Zealand, and the United States submitted 175 visual, photographic, and CCD observations of Saturn during the 1998-99 Apparition, covering the period from 1998 June 26 - 1999 March 28. Instruments used in performing these observations ranged in aperture from 10.2 cm (4.0 inches) up to 50.8 cm (20.0 inches). Observers reported periodic, but extremely vague, festoons and other dusky phenomena among the belts and zones of Saturn's Southern Hemisphere during the apparition. Several very ill-defined white ovals were suspected in the planet's Southern Equatorial Zone (EZs) from early 1998 August through late 1999 January. These Saturnian atmospheric features were too transient for meaningful central meridian (CM) transit timings, and it was not possible to derive rotation rates for different Saturnian latitudes during the 1998-99 Apparition. During the 1998-99 observing season, the inclination of the Ring System to our line of sight, **B**, reached a maximum value of -16º.728 on 1998 August 09. With the Rings steadily opening after the edgewise Ring presentations of 1995-96, observers experienced improved views of Saturn's Southern Hemisphere and the south face of the Rings. Accompanying this report are references, drawings, CCD and video images, graphs, and tables.

Introduction

An interesting mix of CCD, video, photographic, and visual observations of Saturn and its Ring System was contributed by ALPO observers during the 1998-99 Apparition. This analytical synopsis is derived from data submitted for the observing season ranging from 1998 Jun 26 through 1999 Mar 28 and is supplemented by drawings, photographs, and video and CCD images. All times and dates mentioned in this report are in Universal Time (UT).

Table 1 provides geocentric data in UT for the 1998-99 Apparition of Saturn. During the observing season, the numerical value of **B**, the Saturnicentric latitude of the Earth referred to the ring plane (+ when north), ranged between the extremes of -16º.73 (1998 Aug 09) and -14.º19 (1998 Dec 25). The value of **B'**, the Saturnicentric latitude of the Sun, ranged from -13º.94 (1998 Jun 26) to -17º.56 (1999 Mar 28).

Table 1: Geometric Phenomena in Universal Time for the Saturn 1998-99 Apparition

Conjunction	1998	Apr	13d	12h	UT
Opposition		Oct	23	19	
Conjunction	1999	Apr	27	11	

Opposition Data:

Constellation	Pisces
Declination	+8º.94
Visual Magnitude	-0.0
B	-15º.29
B'	-15º.56
Globe Diameter	
Equatorial	19".95
Polar	17".95
Ring Axes	
Major	45".48
Minor	11".99

Table 2 lists the 18 individuals who contributed a total of 175 observations to the ALPO. Saturn Section for the 1998-99 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, illustrating that most of the data were received for the months of 1998 August - 1999 January (85.1 percent), with a slight decline in the number of observations on either side of this period of greatest activity. Of the submitted observations, 44.0 percent were made before opposition (1998 Oct 23), 0.6 percent on opposition day, and 55.4 percent following opposition. Although studying Saturn during the months of and surrounding opposition is important, uninterrupted observations of the planet from the time it first appears in the eastern sky before dawn until it approaches the next conjunction with the Sun are even more valuable.

Figure 2 lists the 18 ALPO Saturn Section observers for 1998-99, including the international distribution of the 175 observations that were submitted. During

Table 2: Contributing ALPO Observers, 1998-99 Apparition of Saturn

Observer and Observing Site	No. of Observations	Telescope(s) Used (See list of abbreviation at bottom)
Baker, Phil; Christchurch, NZ	1	10.2-cm (4.0-in.) REF
Benton, Julius L.; Wilmington Island, GA	39	15.2-cm (6.0-in.) REF
Boisclair, Norman J.; South Glens Falls, NY	1	50.8-cm (20.0-in.) NEW
Crandall, Ed; Winston-Salem, NC	28	25.4-cm (10.0-in.) NEW
Daly, Kevin; Wolcott, CT	1	20.3-cm (8.0-in.) NEW
Frassati, Mario; Crescentino (VC), Italy	1	20.3-cm (8.0-in.) SCT
Haas, Walter H.; Las Cruces, NM	1	15.2-cm (6.0-in.) NEW
	8	20.3-cm (8.0-in.) NEW
	24	31.8-cm (12.5-in.) NEW
Jamison, Eric; Pepperell, MA	1	18.0-cm (7.1-in.) REF
Kuberek, Robert C.; Daytona Beach, FL	1	20.3-cm (8.0-in.) SCT
McAnally, John W.; Waco, TX	4	20.3-cm (8.0-in.) SCT
Melillo, Frank J.; Holtsville, NY	13	20.3-cm (8.0-in.) SCT
Moore, David M.; Phoenix, AZ	3	36.2-cm (14.3-in.) CASS
Niechoy, Detlev; Göttingen, Germany	1	15.2-cm (6.0-in.) REF
	17	20.3-cm (8.0-in.) SCT
Parker, Donald C.; Coral Gables, FL	6	40.6-cm (16.0-in.) SCT
Peach, Damian; Norfolk, UK	5	30.5-cm (12.0-in.) NEW
Plante, Phil; Poland, OH	9	20.3-cm (8.0-in.) SCT
Schmude, Richard W.; Barnesville, GA	1	15.2-cm (6.0-in.) NEW
	2	20.3-cm (8.0-in.) SCT
	2	25.4-cm (10.0-in.) NEW
	1	50.8-cm (20.0-in.) NEW
Teichert, Gérard; Hattstatt, France	5	28.0-cm (11.0-in.) SCT
Total Observations	**175**	
Total Observers	**18**	

List of Abbreviations: CASS = Cassegrain, NEW = Newtonian, REF = Refractor, SCT = Schmidt-Cassegrain.

the apparition, the United States accounted for the majority (82.9 percent) of the contributed observations and a slightly smaller percentage of the participating observers (72.2 percent). International cooperation in our programs continued throughout 1998-99, with observers in New Zealand, Italy, France, Germany, and the United Kingdom submitting reports.

Figure 3 graphs the number of observations by type of instrument, showing that telescopes of classical design (refractors and Newtonians) were utilized in making roughly two-thirds (64.0 percent) of the 175 total observations in 1998-99. Refractors and Newtonian reflectors typically produce good resolution and image contrast, the reason why they are often the telescopes of choice for detailed studies of the Moon and planets. Telescopes with apertures equal to or greater than 15.2 cm (6.0 inch) accounted for 99.4 percent of the observations contributed during the 1998-99 Apparition. The trend in recent apparitions of ALPO observers using larger apertures to view Saturn continued in 1998-99, and there appears to be more emphasis lately on aperture when choosing a telescope than there is on a specific design. Readers are reminded, however, that smaller apertures in the range of 10.2 cm (4.0 inch) to 12.8 cm (5.0 inch) are still quite useful for observing Saturn.

The writer wishes to thank all of the dedicated observers mentioned in Table 2 who contributed reports to the ALPO Saturn Section in 1998-99. Observers throughout the United States and elsewhere who would like to pursue systematic studies of the planet Saturn are urged join us in future apparitions as we strive to maintain an international, comprehensive surveillance of the planet. Novice observers are also cordially welcome to contribute, and the ALPO Training Program and Saturn Section will always be delighted to provide assistance in getting started.

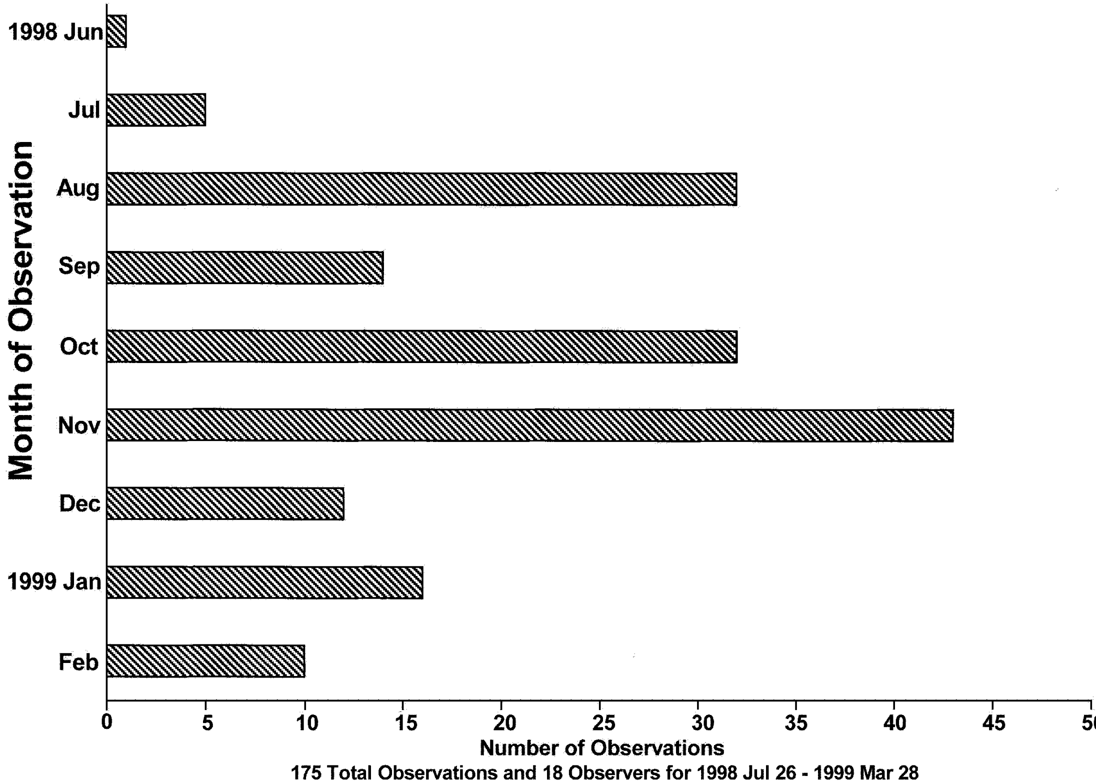

Figure 1: Distribution of Observations by Month, 1998-99 Apparition of Saturn.

The Globe of Saturn

This apparition report is based on an analysis of 175 observational reports that were sent to the ALPO Saturn Section during 1998-99 by the 18 observers listed in Table 2. To maintain brevity, the names of observers have been omitted from the text unless the identity of an individual is relevant to the discussion. Drawings, video and CCD images, tables, and graphs accompany this observational synopsis, and we recommend that readers refer to them as they study the text. Note that features on the Globe of Saturn are

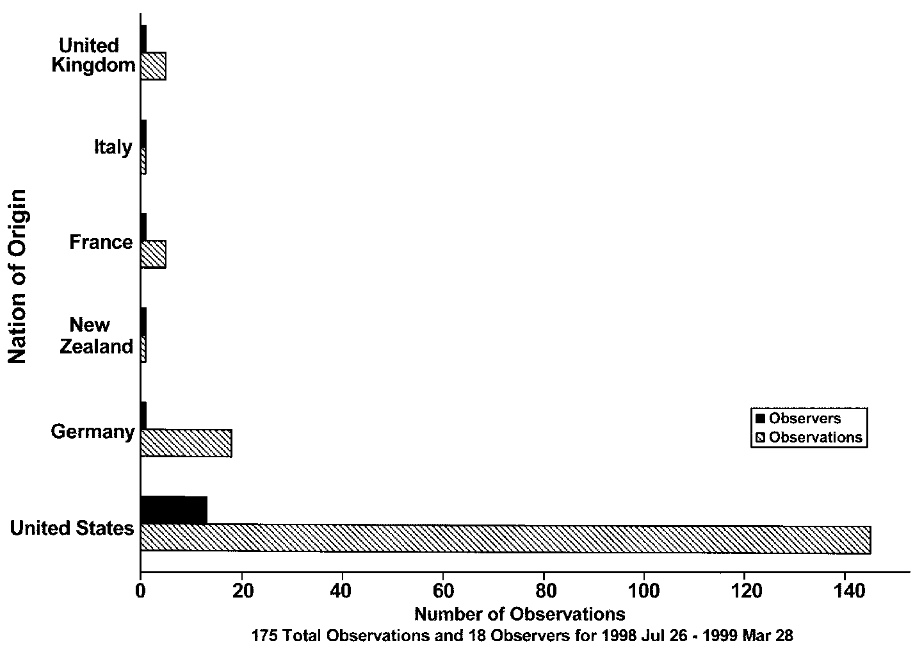

Figure 2: Distribution of Observations and Observers by Nationality, 1998-99 Apparition of Saturn.

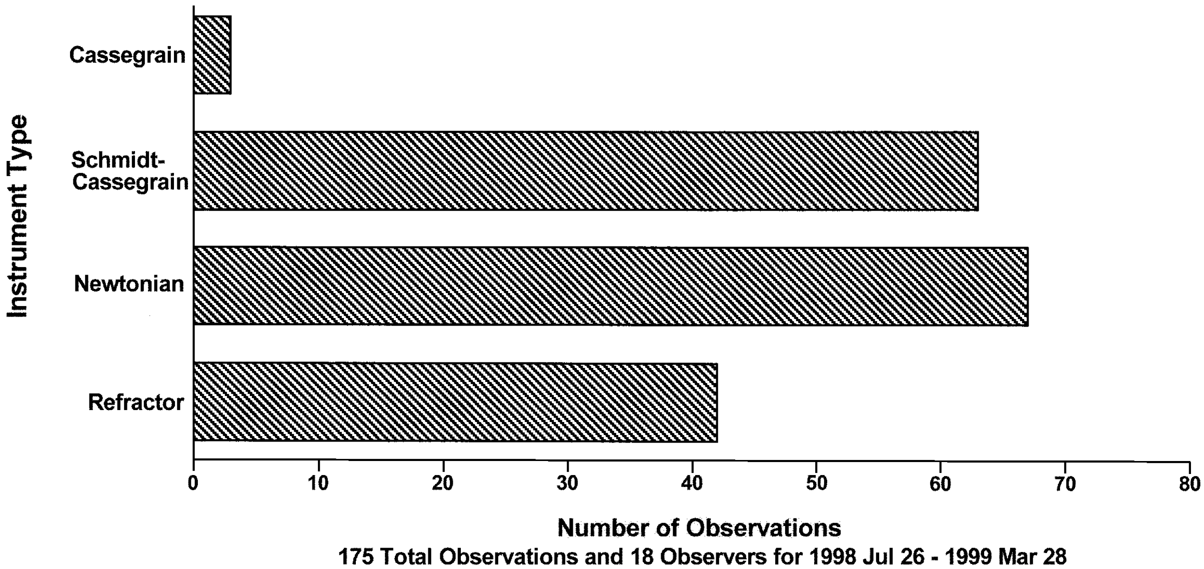

Figure 3: Distribution of Observations by Instrument Type, 1998-99 Apparition of Saturn.

described in south-to-north order and can be identified by looking at the nomenclature diagram shown in Figure 4.

In preparing apparition reports, it has been customary for the ALPO Saturn Section to compare and contrast data for global atmospheric features among observing seasons.That practice continues with this report to help the reader understand the significance of very subtle, but nonetheless discernible, variations that may be occurring seasonally on Saturn.

Observational results suggest that the constantly changing inclination of Saturn's axis of rotation relative to the Sun and Earth contributes to perceived variations in belt and zone intensities, which are listed in Table 3. Photoelectric whole-disk photometry of Saturn in recent years has also revealed slight oscillations of about 0.10 visual magnitude with time, causing some investigators to postulate that transient and long-enduring atmospheric features in Saturn's belts and zones may induce brightness fluctuations. Routine photoelectric photometry of Saturn, in conjunction with visual intensity estimates, remains a valuable project for observers to pursue.

The intensity scale employed here 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 1997-98 intensity from its 1998-99 intensity. Variations of only 0.10 mean intensity points are not considered to be of any real significance. Likewise, a perceived intensity fluctuation is not considered noteworthy unless it is more

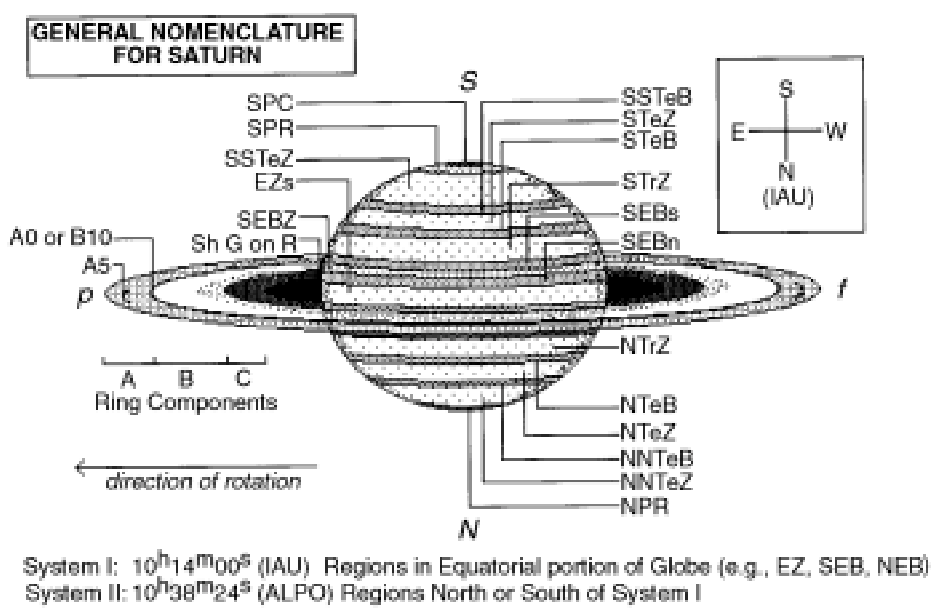

Figure 4: General Nomenclature of Features of Saturn.

Table 3: Visual Numerical Relative Intensity Estimates and Colors, 1998-99 Apparition of Saturn

1998-99 Relative Intensities

Globe/Ring Feature	No. of Estimates	Mean and Standard Error	Change Since 1997-98	"Mean" Derived Color in 1998-99
Zones:				
SPC	7	5.14±0.19	+1.29	Light Grey
SPR	26	4.62±0.18	-0.56	Yellowish-Grey
SSTeZ	2	6.75±0.18	+0.87	Yellowish-White
STeZ	9	6.78±0.24	+0.69	Yellowish-White
STrZ	12	6.94±0.07	+0.82	Yellowish-White
SEBZ	11	5.21±0.26	-0.25	Dull Yellowish-White
EZs	63	7.19±0.13	+0.08	Bright Yellowish-White
Globe S of Rings	32	4.90±0.05	+0.21	Dull Yellowish-Grey
Globe N of Rings	48	5.10±0.07	+0.24	Dull Yellowish-Grey
NTrZ	1	6.00 -----	+0.60	Yellowish-White
NTeZ	1	6.00 -----	0.00	Yellowish-White
Belts:				
SPB	10	3.09±0.11	+0.71	Dark Grey
SSTeB	1	6.20 -----	-----	Light Greyish-White
STeB	4	5.28±0.49	-0.05	Greyish
SEB (entire)	24	3.19±0.24	-0.62	Greyish-Brown
SEBs	39	4.01±0.20	+0.46	Dark Grey
SEBn	39	3.54±0.22	+0.19	Dark Grey
EB	8	4.53±0.36	+0.29	Dark Grey
NTeB	1	5.50 -----	-----	Light Grey
Rings:				
A (entire)	57	7.24±0.07	+0.34	Pale Yellowish-White
A5	5	4.00±0.08	-0.60	Grey
A0 or B10	30	2.16±0.14	+0.20	Greyish-Black
B (outer 1/3)	STANDARD	8.00 ----	-----	White
B (inner 2/3)	60	7.42±0.04	+0.31	Yellowish-White
B2	2	3.65±0.04	-----	Grey
C (ansae)	31	0.76±0.10	-0.55	Greyish-Black
Crape Band	34	1.90±0.09	+0.34	Dark Grey
Sh G on R	40	0.15±0.04	-0.03	Dark Greyish-Black
Sh R on G	17	0.95±0.25	+0.26	Dark Greyish-Black
Terby White Spot	27	7.66±0.04	-0.14	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 1997-98" is in the sense of the 1997-98 value subtracted from the 1998-99 value, positive denoting an increase in brightness and negative indicating a decrease (darkening). When the apparent change is less than about 3 times the standard error, it is probably not statistically significant.

than about three times its standard error.

Latitudes of Global Features

Observers employed the visual method introduced by Haas during the 1960s to estimate Saturnian global latitudes at the eyepiece in 1998-99. Using Haas's method, observers 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 produces results that compare favorably with latitudes measured from drawings or with a bifilar micrometer.

After mathematical reduction, latitudes of Saturn's global features during 1998-99 are shown in Table 4, but one must be cautious not to place too much 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.

Table 4: Saturnian Belt Latitudes in the 1998-99 Apparition

Saturnian Belt	Planetocentric		Eccentric		Planetographic	
	Form of Latitude					
N edge SPB	-75º.88 -----	(--------)	-77º.34 -----	(--------)	-78º.66 -----	(--------)
Center STeB	-61º.01 -----	(--------)	-63º.68 -----	(--------)	-66º.17 -----	(--------)
S edge SEB	-31º.68±0º.40	(-4º.88)	-34º.64±0º.42	(-5º.25)	-37º.73±0º.43	(-5º.43)
N edge SEB	-23º.78±0º.42	(-4º.18)	-26º.26±0º.46	(-4º.46)	-28º.91±0º.49	(-4º.81)
Center EB	-15º.22±0º.21	(-7º.82)	-16º.95±0º.23	(-8º.75)	-18º.85±0º.25	(-9º.55)

NOTES: For belt nomenclature see Figure 4. Latitudes are calculated using the appropriate geocentric tilt, B, for each date of observation. 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 arctangent of the geometric mean of the tangents of the other two latitudes. The change shown in parentheses is the result of subtracting the 1997-98 latitude value from the 1998-99 latitude value.

Observers are encouraged to use this very simple procedure, even if a bifilar micrometer is available, since comparison of latitude data gathered by both methods is very useful. A full discussion of Haas's visual technique can be found in the *Saturn Handbook* (Benton 1996).

Haas recently suggested that, as a control on the accuracy of his method, observers should include in their estimates the positions on the CM of the projected ring edges and the shadow of the rings. The actual latitudes can then be computed from the known values of **B** and **B'** and the dimensions of the rings, but this suggested test cannot be applied readily when **B** and **B'** are near their maximum attained numerical values. In discussing each feature on Saturn's Globe, notes regarding latitude data are incorporated into the text where appropriate.

Southern Regions of the Globe

Progressively improved views of Saturn's Southern Hemisphere occurred during the 1998-99 Apparition as these regions were being progressively tilted toward us since the edgewise apparition of 1995-96. Accordingly, much of the Northern Hemisphere of the planet is now invisible (blocked by the Rings as they cross the Globe), but a few belts and zones at corresponding latitudes in both hemispheres could still be compared with one another in 1998-99. Observers mentioned that the Southern Hemisphere of Saturn appeared to have about the same overall intensity as the planet's Northern Hemisphere in 1998-99 (a difference between the two of only -0.20 mean intensity points is not significant), an impression that contrasted somewhat with the immediately preceding apparition. Throughout the 1998-99 Apparition, a few observers thought they detected evidence of sporadic dusky festoons associated with a few of the most prominent belts and zones of the Southern Hemisphere of Saturn, but these discrete phenomena were apparently not visible again after a few rotations of the planet. Also, poorly-defined white spots were reported sporadically in the Equatorial Zone (EZs) during the observing season, but there were no confirming reports submitted. Like the dark festoons, the whitish features were transient and afforded no opportunity for making recurring CM transit timings. These features will be discussed further in the later section dealing with Saturn's Equatorial Zone.

South Polar Region (SPR) The yellowish-grey SPR remained uniform in intensity during 1998-99 and displayed no discernible activity. The SPR was slightly darker in 1998-99 by a mean intensity factor of only -0.56 when compared with 1997-98. There were a few reports in 1998-99 of a light grey South Polar Cap (SPC), which was described as being slightly lighter than its surroundings and a little more conspicuous than in the previous apparition (a mean intensity difference of +1.29 in 1998-99 versus 1997-98). The dark grey South Polar Belt (SPB) was reported intermittently in 1998-99 encircling the SPR, and observers agreed that this feature was not quite as dark this apparition (a change since 1997-98 of +0.71 mean intensity points).

South South Temperate Zone (SSTeZ) The SSTeZ was sighted on two occasions during 1998-99, and was described as a yellowish-white feature of consistently uniform intensity, displaying a slight elevation in brightness since 1997-98 (+0.87 mean intensity points).

South South Temperate Belt (SSTeB) A narrow light greyish-white SSTeB was sighted only once during the 1998-99 observing season, and since it was not reported in 1997-98, no comparison of mean intensity data could be made between apparitions.

South Temperate Zone (STeZ) The yellowish-white STeZ displayed about the same overall intensity as the SSTeZ during 1998-99, and the STeZ showed only a minor increase in its mean brightness from 1997-98 to 1998-99 (a difference of +0.69 in mean intensity). The STeZ ranked third behind the EZs and STrZ in 1998-99 as the brightest zone in the Southern Hemisphere of Saturn, and it exhibited uniform intensity throughout the apparition with no clearly-defined activity. Compared with the NTeZ, the STeZ was brighter by +0.78 mean intensity points.

South Temperate Belt (STeB) The STeB was greyish in color during 1998-99 and exhibited no activity as it ran uninterrupted from limb to limb across the globe. The mean intensity of the STeB was essentially unchanged from 1997-98 to 1998-99. The STeB was just -0.22 mean intensity points darker than the NTeB in 1998-99.

South Tropical Zone (STrZ) A mean intensity difference of +0.82 from 1997-98 to 1998-99 for the yellowish-white STrZ suggested perhaps a slight, if any, elevation in brightness between apparitions. Other than the EZs, the STrZ was the brightest zone in the Southern Hemisphere of Saturn. The STrZ remained stable in brightness and devoid of activity throughout the observing season, and it appeared lighter than the NTrZ by a mean intensity value of +0.94.

South Equatorial Belt (SEB) During 1998-99, the SEB was a distinct greyish-brown feature, slightly darker in mean intensity since 1997-98 (by -0.62 mean intensity points), and it was frequently differentiated into SEBn and SEBs components (where n refers to the North Component and s to the South Component). Observers also noticed that the SEB occasionally had an intervening dull yellowish-white South Equatorial Belt Zone (SEBZ). The mean intensity of the SEBZ had not changed significantly since 1997-98 (-0.25 mean intensity points). With the exception of the South Polar Belt (SPB), the SEB was the darkest and most conspicuous belt in the Southern Hemisphere of Saturn in 1998-99. Comparing the two dark greyish SEB constituents, the SEBn was always perceived to be slightly darker (by -0.47 mean intensity points) than the adjacent SEBs, and from 1997-98 to 1998-99, the SEBn was essentially unchanged in mean intensity.

A few sporadic reports were received in 1998-99 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 even a few rotations of the planet, preventing systematic CM transit timings.

Equatorial Zone (EZ) The bright yellowish-white EZs was the region of the EZ seen to greatest advantage during 1998-99, where the EZs was the region of the EZ lying between where the Rings crossed the Globe and the SEB. The EZn, normally the the portion of the EZ between where the rings cross the globe and the NEB, was not reported in 1998-99. The intensity of the EZs was virtually unchanged since 1997-98, and it was consistently the most brilliant zone on Saturn during the 1998-99 Apparition, almost as bright as Ring A and the inner two-thirds of Ring B. Some have suggested that the enduring prominence of the EZs the past two or three apparitions may be partially attributable to the aftermath of diffuse white spots detected in 1996-97; but more likely, the brilliance of the EZs was a function of the changing tilt of Saturn to the Sun and Earth. In early 1998 August through late 1999 January observers described vague, isolated white spots in the EZs, but none of these features was long-lived or appeared as bright as those suspected in the preceding two apparitions of Saturn. Efforts to recover these white spots in the EZs at subsequent rotations of Saturn were unsuccessful, prohibiting reduction of CM transits to rotation rates at that latitude.

In 1998-99 several observers noticed the Equatorial Band (EB) as a dark grey, ill-defined linear feature extending across Saturn's globe. Mean intensity data suggested that the EB had not changed much since the 1997-98 Apparition (change of +0.29 mean intensity points).

Northern Portions of the Globe

In 1998-99 the Northern Hemisphere of Saturn did not fluctuate much in mean intensity since 1997-98 (a difference of only +0.24 mean intensity points), nor did regions north of the Rings display activity of any significance throughout the apparition.

North Equatorial Belt (NEB) The NEB was not reported during 1998-99.

North Tropical Zone (NTrZ) The yellowish-white NTrZ, reported only once during the apparition, appeared only +0.60 mean intensity points brighter in 1998-99 than in 1997-98, was usually uniform in intensity across the Globe from limb to limb, and was identical in brightness to the NTeZ.

North Temperate Belt (NTeB) The NTeB was seen only once by ALPO observers during 1998-99, and it was described as a poorly-defined light-grey feature. Since it was not reported in 1997-98, mean intensity data could not be compared between apparitions.

North Temperate Zone (NTeZ) In 1998-99 the yellowish-white NTeZ was sighted only twice, with no comparative difference in intensity since 1997-98, and the STeZ was brighter than the NTeZ by +0.78 mean intensity points.

North North Temperate Belt (NNTeB) Observers did not report this feature during the 1998-99 Apparition.

North North Temperate Zone (NNTeZ) Observers did not report the NNTeZ during the 1998-99 Apparition.

North Polar Region (NPR) Observers did not report the NPR during the 1998-99 Apparition.

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 on either side of opposition during 1998-99, regular in form. Any perceived departure from a true black (0.0) intensity was a result of poor seeing conditions or scattered light.

Shadow of the Rings on the Globe (Sh R on G) Observers in 1998-99 described this shadow as a dark greyish-black feature north 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 1998-99 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 1998-99 as the numerical value of **-B** increased.

Ring A Ring A as a whole appeared pale yellowish-white throughout 1998-99, with a slight elevation in mean brightness since 1997-98 (+0.34 mean intensity points), and in terms of intensity, observers did not report any obvious outer and inner halves of Ring A. Melillo submitted a CCD image which appears to have captured Encke's Division (A5) at the ring ansae on 1998 Sep 20 (see Figure 8) while other observers reported the grey A5 intensity minimum only very rarely during 1998-99. No other intensity minima in Ring A were reported in 1998-99.

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 1998-99 Apparition, this region of Ring B was brilliant white, remained stable in intensity, and was always the brightest feature on Saturn's

Table 5: Observations of the Bicolored Aspect of Saturn's Rings During the 1998-99 Apparition

			Telescope				Filter		
Observer	UT Date and Time		Type and Aperture	X	S	Tr	Bl	IL	Rd
Haas	1998 AUG 18	10:48-11:32	NEW 31.8 cm. (12.5 in.)	321	2.5	4.5	E	=	=
Haas	1998 OCT 08	06:25-07:01	NEW 31.8 cm. (12.5 in.)	321	3.0	4.0	E	=	=
Crandall	1998 OCT 30	03:29-03:47	NEW 25.4 cm. (10.0 in.)	295	5.0	3.0	E	=	=
Haas	1998 NOV 05	05:20-07:04	NEW 31.8 cm. (12.5 in.)	321	3.0	3.5	E	=	=
Crandall	1998 NOV 08	02:30-02:42	NEW 25.4 cm. (10.0 in.)	220	3.5	4.0	E	=	=
Haas	1998 NOV 14	05:46-06:31	NEW 31.8 cm. (12.5 in.)	321	3.5	4.0	E	=	=
Crandall	1998 NOV 28	00:51-01:15	NEW 25.4 cm. (10.0 in.)	220	4.0	3.5	E	=	=
Haas	1999 JAN 03	03:13-03:51	NEW 31.8 cm. (12.5 in.)	321	2.5	3.5	E	=	=
Haas	1999 JAN 14	02:14-02:44	NEW 31.8 cm. (12.5 in.)	321	2.0	4.0	E	=	=
Haas	1999 FEB 02	03:11-03:31	NEW 31.8 cm. (12.5 in.)	321	2.5	3.5	E	=	=
Haas	1999 FEB 10	01:37-02:17	NEW 31.8 cm. (12.5 in.)	321	3.5	3.5	E	=	=
Haas	1999 FEB 13	01:47-02:20	NEW 31.8 cm. (12.5 in.)	321	2.0	3.5	E	=	=
Haas	1999 MAR 01	01:54-02:13	NEW 15.2 cm. (6.0 in.)	171	3.0	4.0	E	=	=
Haas	1999 MAR 09	01:56-02:25	NEW 20.3 cm. (8.0 in.)	231	3.0	4.0	W	=	=
Haas	1999 MAR 10	01:57-02:20	NEW 20.3 cm. (8.0 in.)	231	3.0	4.0	W	=	=
Haas	1999 MAR 14	01:46-02:15	NEW 20.3 cm. (8.0 in.)	231	2.5	3.5	W	=	=
Haas	1999 MAR 20	01:55-02:13	NEW 20.3 cm. (8.0 in.)	203	2.5	3.5	W	=	=

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," Bl refers to the blue W47 or W80A Filters, IL to integrated light (no filter), and Rd to the red W25 or W23A Filters. E means the East ansa was brighter than the W, W that the West ansa was the brighter, and = means that the two ansae were equally bright. East and West directions are in the IAU sense.

General Comments for Figures 5-17. The 13 drawings and images that follow are all oriented with celestial south at the top and celestial west at the left, which is the normal inverted view when observing objects near the meridian with an astronomical telescope in the Earth's middle northern latitudes. 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.

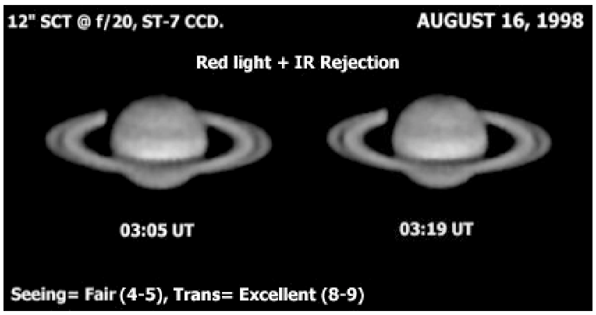

Figure 5: 1998 AUG 16, 03:05-03:19 UT. D. Peach. 30.5-cm (12.0-in.) SCT, CCD, Red Light, IR Rejection Filter. S = 4.5, Tr = +6.0. CMI = 265º.8-274º.0, CMII = 204º.3 -212º.4. Globe 18".5 X 16".7, Rings 42".3 X 12".2. B = -16º.7, B' = -14º.6.

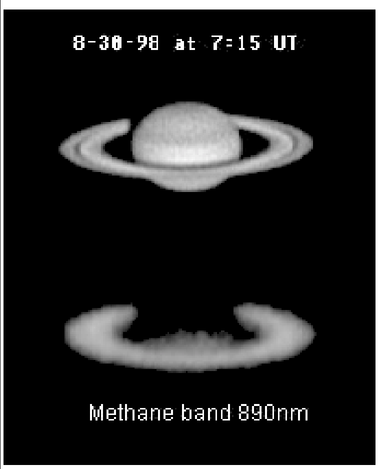

Figure 6: 1998 AUG 30, 07:15 UT. F.J. Melillo. 20.3-cm (8.0-in.) SCT, Starlite Xpress MX5 CCD, Integrated Light, methane-band filter. Exp 2.0s at f/20. S = 8.0. CMI = 353º.8, CMII = 194º.6. Globe 19".0 X 17".1, Rings 43".3 X 12".4. B = -16º.6. B' = -

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, had a +0.31 difference of mean intensity from 1997-98 to 1998-99 which represents virtually no change in brightness. During 1998-99, Ring A was only slightly dimmer than the inner two-thirds of Ring B, as witnessed by most observers, but this difference was far from being statistically significant (mean intensity difference of +0.18 between the inner two-thirds of Ring B and Ring A). Niechoy suspected vague dusky "spokes" in the inner two-thirds of Ring B at the ansae on 1998 Nov 20, but there were no confirming observations of such phenomena. Observers also suspected a grey intensity minimum B2 on at least two occasions during 1998-99.

Cassini's Division (A0 or B10) Observers sighted the greyish-black Cassini's division (A0 or B10) at both ansae during 1998-99, and a few individuals thought they could see this feature around much of the Ring System in good seeing and with larger apertures. Better views were possible due to the increased ring inclination during 1998-99, when the numerical value of B averaged about -15°.0, as opposed to -10°.0 in 1997-98. It should be understood that any divergence from a totally black intensity for this feature is almost certainly due to the scattering of light, poor seeing, inadequate aperture, and so forth, and since 1997-98, the mean intensity of Cassini's division appeared largely unchanged.

Ring C The greyish-black Ring C was seen at the ansae quite often during 1998-99, when it appeared -0.55 mean intensity points darker than it had in 1997-98. The Crepe Band (Ring C across the Globe) was noted to be uniform in intensity and dark grey in color. It is fairly easy to understand that when **B** and **B'** are both negative, and numerically **B** > **B'**, the shadow of the Rings on the Globe will be cast to their south, which occurred during the 1998-99 observing season prior to 1998 Oct 17. The Crepe Band is then also to the south of the projected Rings A and B. If numerically **B** < **B'**, the shadow is cast to the north of the projected Rings (as shwon in figures 14 - 17), which took place in 1998-99 beginning 1998 Oct 18.

Figure 7: 1998 SEP 08, 06:01-06:03 UT. D. Parker. 40.6-cm (16.0-in.) SCT, CCD Lynxx PC, Integrated Light + BG12 (blue), VG9 (green), RG610 (red) Schott Filters. Eyepiece Projection at f/22. S = 7.0. CMI = 349º.9-351º.1, CMII = 261º.7-262º.8. Globe 19".3 X 17".3, Rings 43".9 X 12".4. B = -16º.5, B' = -15º.0.

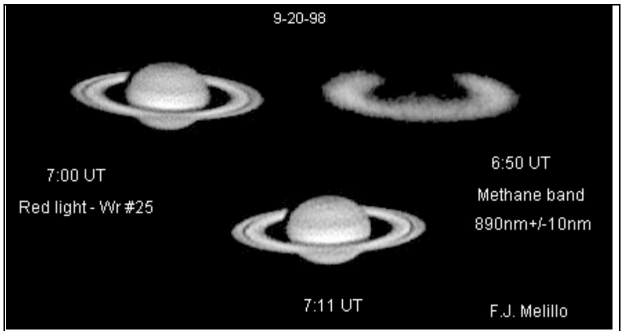

Figure 8: 1998 SEP 20, 06:50-07:11 UT. F.J. Melillo. 20.3-cm (8.0-in.) SCT, Starlite Xpress MX5 CCD, Integrated Light + W25 (red) and 890-nm Filters. Exp 2.0s at f/20. S = 8.0. CMI = 071º.4-083º.8, CMII = 314º.5-326º.4. Globe 19".6 X 17".6, Rings 44".6 X 12".4. B= -16º.2, B' = -15º.1. Encke's Division (A5) captured on image.

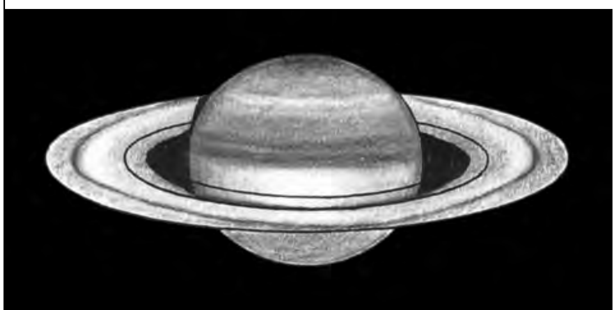

Figure 9: 1998 OCT 02, 02:05-02:35 UT. P. Plante. 20.3-cm (8.0-in.) SCT, Integrated Light, W23A (red) Filter, 250X. S = 5.0 Tr = +4.0. CMI = 317º.4-334º.6, CMII = 270º.9-287º.9. Globe 19".8 X 17".8, Rings 45".1 X 12".4. B = -15º.9, B' = -15º.3.

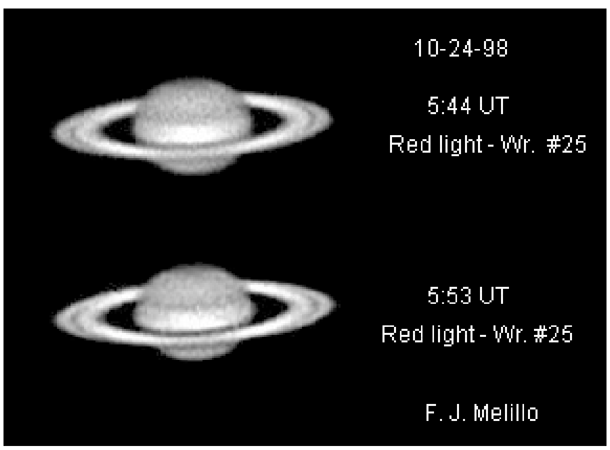

Figure 10: 1998 OCT 24, 05:44-05:53 UT. F.J. Melillo. 20.3-cm (8.0-in.) SC, Starlite Xpress MX5 CCD, W25 (red) Filter. Exp 2.0s at f/20. S = 8.0. CMI = 302º.1-307º.4, CMII = 168º.4-173º.5. Globe 20".0 X 18".0, Rings 45".5 X 12".0. B = -15º.3, B' = -15º.6. Image is roughly 11 hours after opposition.

When the shadow of Ring A, Ring B, and the Ring C projection are superimposed, they are not easily distinguished from each other with ordinary apertures and seeing conditions, and the shadow of Ring C is surely a further 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 1998-99 observers called attention to a bright TWS (intensity of 7.7). The TWS is almost surely a spurious contrast effect and not an intrinsic feature on Saturn. Even so, it is still useful to attempt to ascertain if any correlation exists between the perceived visual numerical relative intensity of the TWS and the changing tilt of the Ring System, including the former's brightness and visibility with variable-density polarizers and color filters of known transmission.

Bicolored Aspect of the Rings The bicolored aspect is a perceived variation in color between the east and west ring ansae (IAU system) when systematically compared with W47 (Wratten 47), W38, or W80A (all blue) and W25 or W23A (red) Filters. Crandall and Haas were the only observers during 1998-99 who detected a bicolored aspect of the ring ansae, and Table 5 lists the circumstances of their observations. Readers should 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 (i.e., with the observer located in the middle northern latitudes on Earth and Saturn near the meridian) 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 locations 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

Unfortunately, as in the past few apparitions, observers in 1998-99 did not contribute systematic visual estimates of the magnitudes of Saturn's satellites employing recommended methods discussed in the *Saturn Handbook*. Photoelectric or CCD photometry and systematic visual magnitude estimates of Saturn's satellites are strongly encouraged for future apparitions.

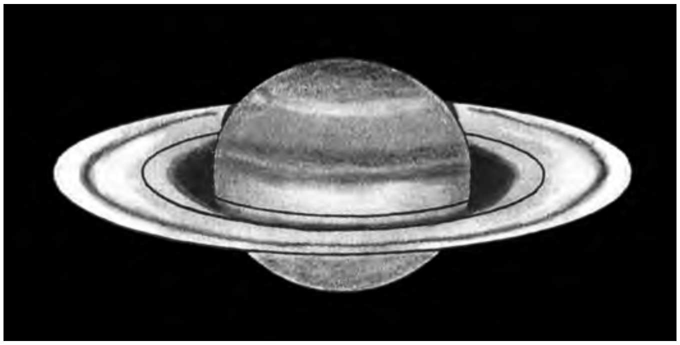

Figure 11: 1998 OCT 24, 01:40-02:28 UT. P. Plante. 20.3-cm (8.0-in.) SCT, Integrated Light, W23A (red) Filter, 250X. S = 6.5, Tr = +4.5. CMI = 158º.9-187º.1, CMII = 123º.7-149º.9. Globe 20".0 X 18".0, Rings 45".5 X 12".0. B = -15º.3, B' = -15º.6.

Figure 12: 1998 OCT 31, 03:14-03:59 UT. D. Parker. 40.6-cm (16.0-in.) SCT, CCD Lynxx PC, Integrated Light + BG12 (blue), VG9 (green), RG610 (red) Schott Filters. Eyepiece Projection at f/22. S = 8.0, Tr = +5.0. CMI = 004º.7-031º.1, CMII = 008º.3-033º.7. Globe 19".9 X 17".9, Rings 45".4 X 11".8. B = -15º.1, B' = -15º.7. White spots in EZs difficult to see in this image.

Figure 13: 1998 NOV 15, 03:52 UT. D.M. Moore. 36.2-cm (14.3-in.) CASS at f/30. Integrated Light + IR Rejection filter. S = 7.5. CMI = 092º.2, CMII = 330º.5. Globe 19".8 X 17".8, Rings 45".1 X 11".4. B = -14º.7, B' = -15º.9. Astrovid 2000 Video Camera + Snappy frame-grabber, enhanced with Megafix and Paint Shop Pro.

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 1998-99, but as in the 1997-98 Apparition, the occurrence of such observations was quite fortuitous. The ALPO Saturn Section has organized a simultaneous observing team so that several individuals in reasonable proximity of 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.

Conclusions

The foregoing summary suggests that Saturn's atmosphere was essentially quiet during 1998-99 itself, and also when compared with the past three apparitions. Were one to cite highlights of the 1998-99 Apparition, the likely candidates are the sporadic dark festoons seen throughout the apparition and several suspected white spots in the EZs during 1998 August and 1999 January. These features were far too transient for observers to successfully track their passage across Saturn's CM.

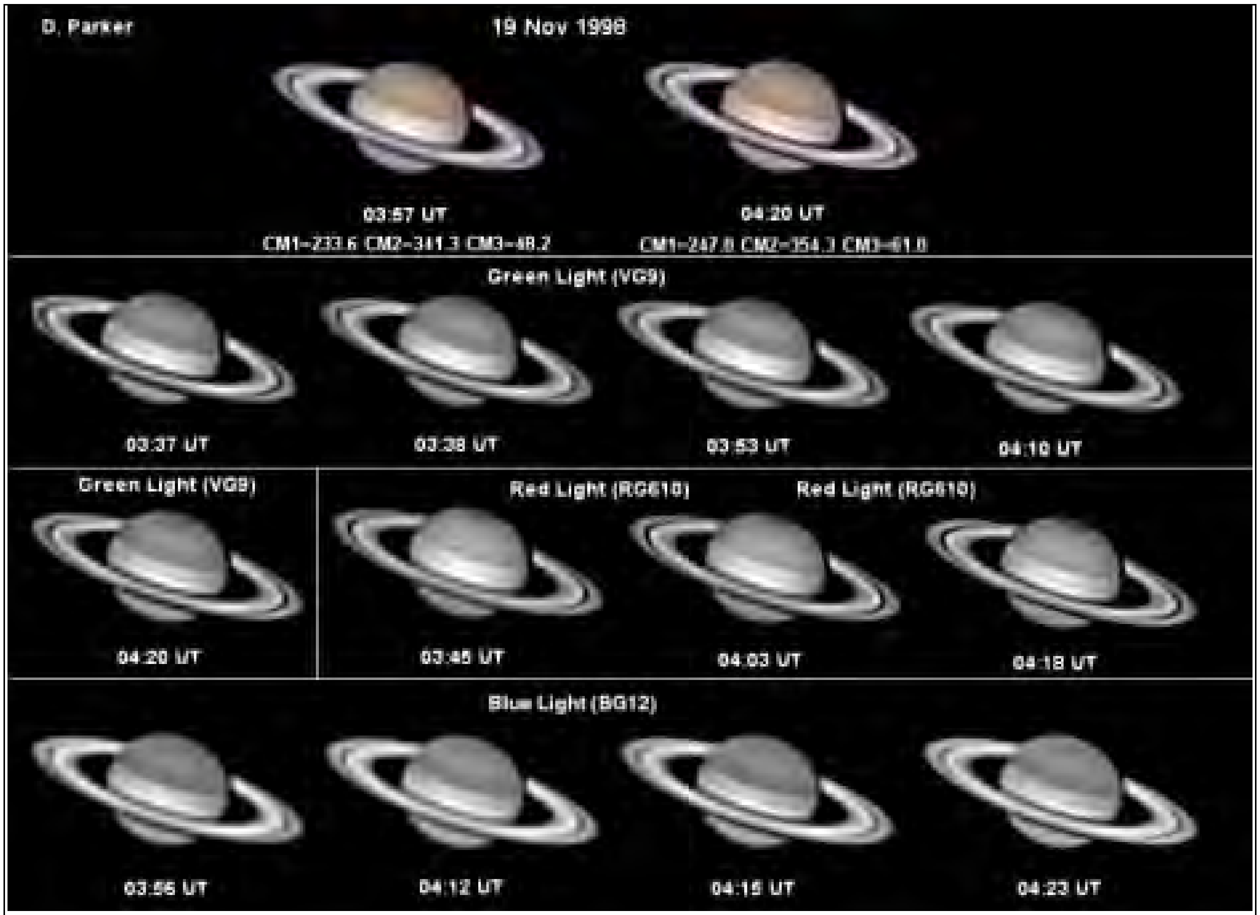

Figure 14: 1998 NOV 19, 03:57-04:20 UT. D. Parker. 40.6-cm (16.0-in.) SCT, CCD Lynxx PC, Integrated Light + BG12 (blue), VG9 (green), RG610 (red) Schott Filters. Eyepiece Projection at f/22. S = 8.0, Tr = +5.0. CMI = 232º.5-246º.0, CMII = 341º.4 -354º.4. Globe 19".7 X 17".7, Rings 44".9 X 11".3. B = -14º.6, B' = -15º.9. White spots in EZs. SIMULTANEOUS OBSERVATION with Figure 15.

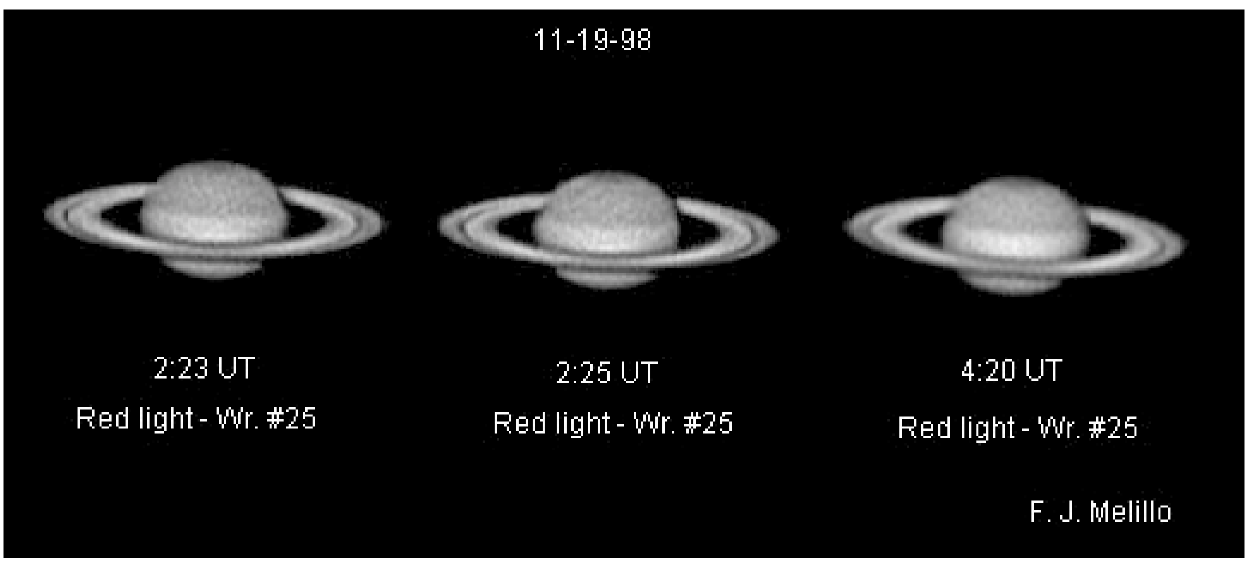

Figure 15: 1998 NOV 19, 02:23 - 04:20 UT. F.J. Melillo. 20.3-cm (8.0-in.) SC, Starlite Xpress MX5 CCD, W25 (red) Filter. Exp. 2.0s at f/20. S = 8.0. CMI = 177º.4-246º.0, CMII = 288º.4-354º.4. Globe 19".7 X 17".7, Rings 44".9 X 11".3. B = -14º.6, B' = -15º.9. White spots not obvious in EZs. SIMULTANEOUS OBSERVATION with Figure 14.

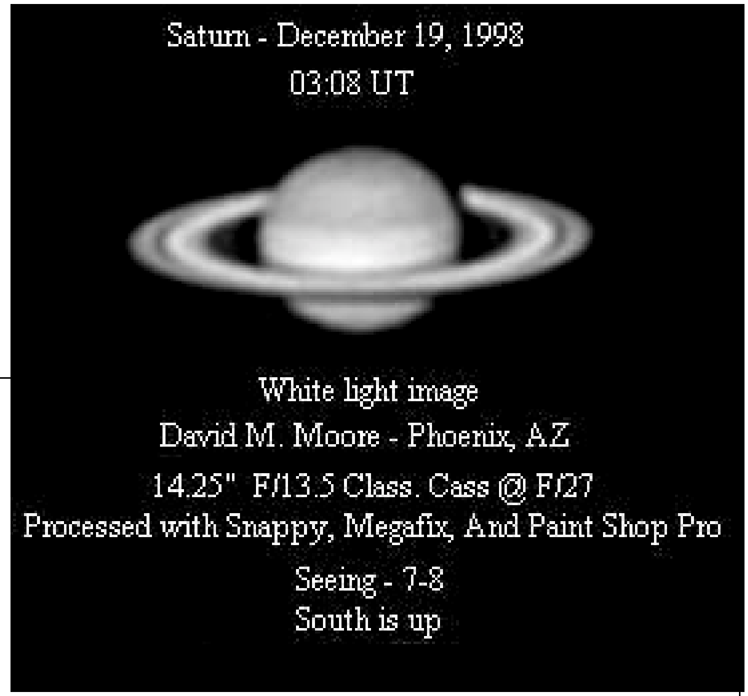

Figure 16: 1998 DEC 19, 03:08 UT. D.M. Moore. 36.2-cm (14.3-in.) CASS at f/27. Integrated Light + IR Rejection filter. S = 7.5. CMI = 332º.3, CMII = 193º.4. Globe 18".9 X 17".0, Rings 43".1 X 10".6. B = -14º.2, B' = -16º.3. Astrovid 2000 Video Camera + Snappy frame-grabber, enhanced with Megafix and Paint Shop Pro.

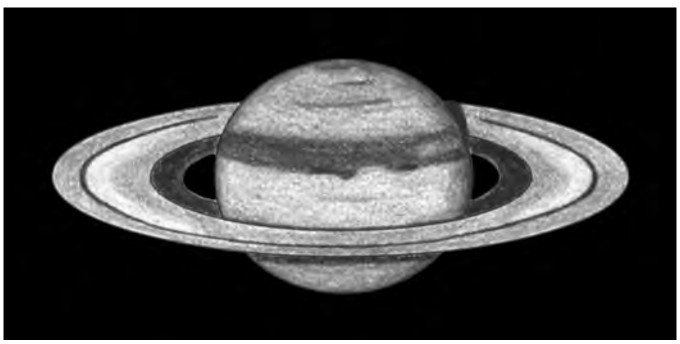

Figure 17: 1999 JAN 17, 02:18-02:48 UT. R.W. Schmude. 25.4-cm (10.0-in.) NEW. Integrated Light, 380X. S = 7. CMI = 305º.3, CMII = 310º.9. Globe 18".1 X 16".4, Rings 41".0 X 10".2. B = -14º.4, B' = -16º.7. Drawing showing suspected dark features along SEBn.

The author sincerely appreciates the efforts of all of the observers mentioned in this report who submitted drawings, photographs, videos, CCD images, and descriptive reports to the ALPO Saturn Section during the 1998-99 observing season. Without such dedicated work, our programs and endeavors to gain further understanding of the planet Saturn would not be possible.

Interested observers in the United States and abroad are encouraged to join our team and submit observational reports to the ALPO Saturn Section, which is always pleased to provide guidance for the novice as well as advanced observers. Also, aspiring young astronomers, who may have been introduced to lunar and planetary subjects for the first time in their school years, are cordially welcome to join us. One very meaningful resource for learning how to observe and record data for the Moon and planets is the ALPO Training Program, and one of our responsibilities is to always encourage development of special talents a particular observer might bring to our programs.

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ALPO Book Review

Observing the Moon: The Modern Astronomer's Guide

By Robert A. Garfinkle, F. R. A. S.

Author: Gerald North
Publisher: Cambridge University Press, 40 West 20th Street, New York, N.Y. 10011-4211
ISBN 0-521-62274-3
October 2000, 381 pages, hardback $39.95 U.S.

This book is another in a series of lunar observer's handbooks to hit the astronomy marketplace in recent years. Gerald North is the capable author of several other popular amateur astronomy books, but he takes a bad stumble with this one. He states that his intention is to give amateur astronomers a "primer," but I think a novice lunar observer will be hopelessly lost with this book. I was hoping to be able to give this book a good review, but unfortunately I cannot give you a positive report.

This book has the look and feel of a work that was hastily thrown together. The order of items in the table of contents is a jumble. The first chapter jumps from a very brief introduction of how the Moon orbits the Earth, touches on libration, and has the reader doing timings of occultations all within the first 27 pages. In his discussion on the lunar features, North basically talks about 48 highlighted area/features (with a few extra features thrown in), thereby practically omitting any discussion of almost 400 additional named features on the nearside. North wanted only to give his readers a representative sampling of the types of lunar features. I find that is not enough for a lunar observer's handbook.

The scant artwork looks like the author submitted photocopies of low-quality computer-generated files that the publisher then took out-of-focus images of and printed them. The work suffers from a lack of drawings to help explain the lunar terminology being introduced to novice lunar observers.

The author's selection of lunar images could certainly have used more thought. As an example, he has two images that are purportedly of a partial solar eclipse. The Sun is very small (less than 3cm in diameter) since the photographs were taken with a 58mm lens, is shrouded in clouds, and the pictures are very grainy. You have to look very hard to see that a tiny bit of the Sun is missing in the second photograph. North offers one image as a good example of "the deleterious effects of photographic grain," but far too many of the other lunar images in the book are either out-of-focus or are too grainy. Most of the CCD images are over pixilated.

For an Earth-based telescopic primer, North has also relied too heavily upon spacecraft imagery and the works of professional observatories, both of which can give the novice lunar observer a false impression of what he can see in a small telescope.

Unfortunately this work is full of errors and typos. A really glaring error has the Earth passing through its own shadow during a lunar eclipse. When I read that, I knew I had to be on the watch for other errors and believe me, they are there.

Then there is the major problem of recommending additional reference works, but the author then admits that he has not read any of them himself. Then what did he use for his reference materials to write this book? I have to wonder, because there is no glossary or bibliography. The index is missing many of the entries that should be there. The writing style is chatty and the author complains in numerous places about the lack of space in this book and the restrictions on page length imposed by his publisher, but then takes up valuable space to recommend that you read his other books for more information.

Being a Cambridge author myself, I really hate to discourage you from adding a Cambridge University Press book to your astronomy library, but you just may want to leave this one in the bookstore and search for many of the better lunar observers' handbooks in the second-hand section or on the Internet.

Letters and comments about any of the articles you see in this Journal are
welcome and will be used in the "ALPO Pages" portion of this publication.
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