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Journal of the Association of Lunar & Planetary Observers

The Strolling Astronomer

Volume 45, Number 2, Spring 2003

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Inside...

Mercury on the Sun shown on the morning of May 7th 2003 and imaged by Adrian Jannetta of the United Kingdom. This image was taken at approximately 08:00 UT with a hand-held Fujifilm FinePix 2600Zoom digital camera through a 250mm (10-inch) Dobsonian reflector stopped down to 100mm; the aperture was protected with Baader Solar Film. The “Black Drop Effect” was observed but not imaged.

Brightness and contrast levels were adjusted in some cases with PaintShop Pro computer software.

This and additional images at http://www.theman.themoon.co.uk/AstroPhotos/Conjunctions/mercury_transit2003.htm

Also...

* Plan now to attend the 2003 ALPO Conference

* Recent professional-amateur collaboration in the ALPO

* A re-publication of the original article from 1956 by Dr. Stuart on a photo-visual observation of an impact of a large meteorite on the Moon

* Volcanic features in the Gemma Frisius region of the Moon

* Were earlier reports of lunar changes all blunders?

* Predicted views of Mars during this summer’s apparition

* A report on the 2001-2002 apparition of Jupiter . . . plus reports about your ALPO section activities and much, much more.

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

Volume 45, No. 2, Spring 2003
This issue published in June 2003 for distribution in both portable document format (pdf) and also hardcopy format.

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

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

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

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(See full listing in *ALPO Resources* at end of book)
Lunar and Planetary Training Program: Coordinator; Timothy J. 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: Coordinator; Richard W. Schmude, Jr.
Saturn Section: Coordinator; Julius L. Benton, Jr.
Remote Planets Section: Coordinator; Richard W. Schmude, Jr.
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Point of View: Professional-Amateur Collaboration

By Richard Schmude, Jr., Associate Director of the ALPO

People with moderate sized telescopes have made great strides in the last few years in the field of planetary astronomy. Current images of Mars, Jupiter, Saturn and even Mercury show much detail that only a few years ago could only be captured by large professional level telescopes.

Amateurs played a key role in detecting the white ovals on Saturn in late 2002 and the discovery of flashes on Mars in June 2001 using new imaging technology. In fact, one of the Mars landers (scheduled to land in January 2004) will explore the region on Mars where the flashes were detected in 2001.

This newfound imaging capability has opened up new opportunities for amateurs to contribute to studies carried out by professional astronomers. There are already several examples of amateurs appearing as co-authors with professional astronomers in the scientific literature. I believe that there will be an even greater opportunity for collaboration between amateurs and professional astronomers in the future.

I would also like to point out the creation of two new observatories that two of our Jupiter Section staff people are helping to build. Both observatories will be professional-level facilities that will be open to amateur use.

First, the Petit Jean Observatory near Conway, Arkansas, has just been completed. Clay Sherrod has played a key role in the construction of this facility. Four computers inside of the Petit Jean observatory will remotely operate the 16-inch telescope which sits on top of 14,300 pounds of concrete.

Second, John McAnally's astronomy club in Waco Texas, is constructing a large observatory near Clifton, Texas, which is about 1 to 2 hours' drive south of the Dallas-Ft. Worth area. This observatory is being designed to meet the needs of local amateur astronomers, educators/school children and professional astronomers.

When completed, this observatory will have a computer-controlled, 24-inch telescope along with an educational building where school children can learn about astronomy. If all goes according to plan the telescope will see first light by the end of this year. I believe that the Petit Jean and Clifton, Texas, observatories will play a key role in professional-amateur collaboration in the future.

Inside the ALPO
Member, section and activity news (continued)

ALPO Conference News

The next annual meeting of the Assn. of Lunar & Planetary Observers will be Thursday through Saturday, August 7 - 9, 2003, at the Holiday Inn- Boardman, Ohio, 7410 South Avenue.

Full details and registration materials are located at the end of this section.

ALPO Membership Online

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

The Astronomical League is offering their secure web site as a collection point for ALPO dues for those wishing to pay by credit card. You can link to that site via the ALPO web site at:

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

Or you can directly go to the Astronomical League web page that has the ordering information and entry page at:

http://www.ec-securehost.com/AstronomicalLeagueSales/ALPO_Membership.html

A couple of IMPORTANT notes:

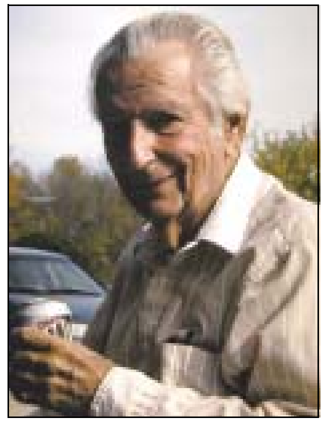
- Please do not send credit card numbers directly to the ALPO membership secretary via e-mail or postal mail. It is very risky to send sensitive information like that via e-mail since it could be intercepted by persons with criminal intentions. Also, it is preferred that members be responsible for processing their own credit card numbers.

- It would be helpful for those paying by credit card to notify the ALPO membership secretary via e-mail or postal mail with their name, address, and the type of membership and amount paid. The ALPO is in the early stages of offering this service, and copying the ALPO membership secretary with this information provides additional verification to ensure that all orders are processed correctly. Perhaps, in the near future, we can forego this step when it is confirmed that this operation is working well.

Finally, I would like to thank Marion Bachtell of the Astronomical League Sales Office for providing the web site and the means of processing these credit card orders. This service will be a boon for our international members that have to seek checks that are drafted with standard US banking codes, a rather costly procedure for some. Without Marion's help, this option for ALPO members would have not been possible. I am, as I'm sure all members of the ALPO are, quite appreciative of her willingness to donate her own time and effort to our cause. Thank you, Marion!

Of course, paying for ALPO memberships by check or money order is still a most welcomed option. Payments of this type should always be postal mailed to the membership secretary at the ALPO address given on the inside title page of this Journal.

Tom Cave: 1923 - 2003



A true friend to the amateur astronomy community at large and the Assn. of Lunar & Planetary Observers in particular passed away on June 4, with the loss of Tom Cave at age 80 due to congestive heart failure.

Born Thomas Roland Cave III in 1923, his career as an observer and contributor to the hobby we all enjoy was prolific. Says ALPO's Tom Dobbins in a write-up for *Sky & Telescope* magazine, "He submitted more than 2,000 meticulous drawings of the red planet to the Association of Lunar and Planetary Observers (ALPO), the British Astronomical Association, and the Oriental Astronomical Association. "

Lenny Abbey of Atlanta, ALPO member and the association's first Remote Planets Section recorder, still owns a Cave 10-inch Astrola reflector and had been associated with Tom "in one capacity or another since 1953."

A full write-up of Tom Cave by those ALPO members who knew him will appear in the next issue of this Journal.

Inside the ALPO

Member, section and activity news (continued)

Reminder: Address changes

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

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

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

Our Advertisers

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

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

Observing Section Reports

Solar Section

Rik Hill, coordinator

The ALPO Solar Section is actively seeking two people for coordinator positions within the Section. The two positions open are:

General Coordinator --

- General coordinating of the Section (email list, archiving, training etc.)
- Announcements of noteworthy activity to various publications
- Writing the summary articles
- Handle any publications
- Pass on data to the archivist

Data Coordinator –

- Receive data in various formats and get copies to the web manager
- Write the Rotation Reports (preferably once per rotation) and get them to the web manager.
- Get data to general coordinator in time for summary reports.

If you have these skills and would like to take on one of these tasks, please contact me at: rhill@lpl.arizona.edu for final consideration and action by the ALPO director.

Visit the ALPO Solar Section on the worldwide web at http://www.lpl.arizona.edu/~rhill/alpo/solar.html

Meteors Section

Robert Lundsford, coordinator

The ALPO Meteors Sections continues to collect data on the sparse winter activity. Contributions have been few since the Quadrantid maximum in early January. The Meteors Section Coordinator led an expedition out to the Mojave Desert in early May to monitor activity from the Eta Aquarid meteor shower. This shower is produced by Halley's comet and can provide up to 30 meteors per hour during the last hours before morning twilight. Results will be published in a forthcoming issue of *The Strolling Astronomer* and the Meteors Section Newsletter.

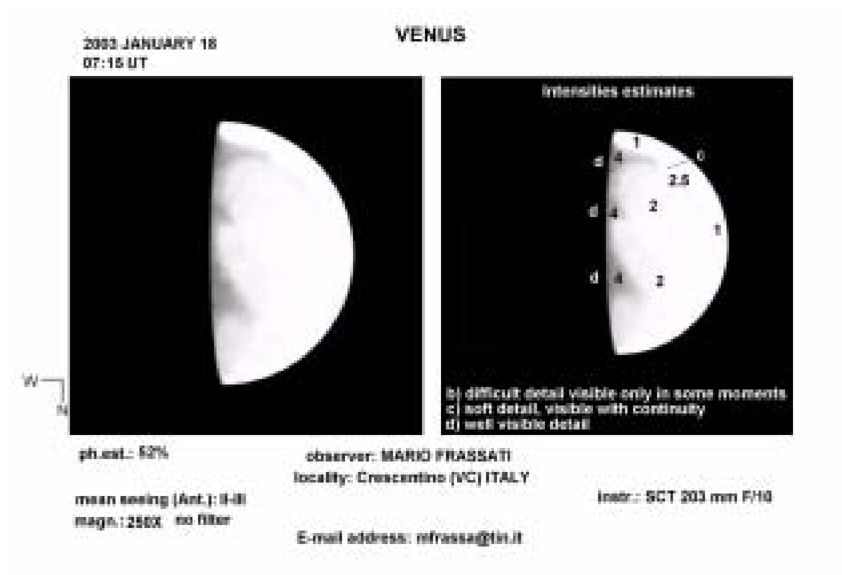
Visit the ALPO Meteors Section on the worldwide web at http://www.lpl.arizona.edu/~rhill/alpo/meteor.html

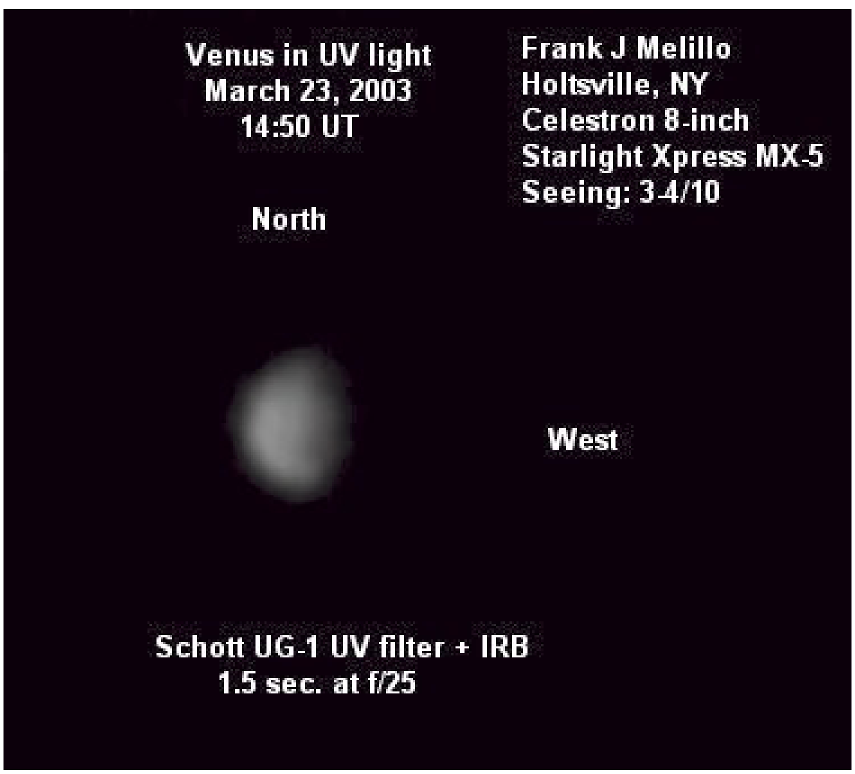
Venus Section

Julius Benton, coordinator

Preliminary results from the 2002 Eastern (Evening) Apparition of Venus, which ended with Inferior Conjunction on 2002 October 31, suggested only limited activity in the atmosphere of the planet. It is quite problematic, however, in any analysis to differentiate between what constitutes real atmospheric phenomena and what is merely illusory on Venus at visual wavelengths. A greater level of confidence in our results improves as observers make an effort to do simultaneous observations, and the ALPO Venus Section is stressing combined visual observations and CCD imaging for comparative analysis of resultant data. There is also a definite need for more ultraviolet imaging of Venus simultaneously with visual observations; for example, some observers apparently have a slight visual sensitivity in the near UV range, whereby they report radial dusky features that are so readily apparent on UV photographs and images.

Inside the ALPO
Member, section and activity news (continued)





ALPO studies of the Ashen Light, which peaked during the Pioneer Venus Orbiter Project, are still continuing every apparition. Constant monitoring of the planet for the presence of this phenomenon by a large number of observers (ideally participating in a simultaneous observing program) remains important as a means of improving our chances of capturing confirmed dark hemisphere events. Imaging with CCD and digital cameras to attempt to capture the faint glow on the dark hemisphere at crescentic phases is an important endeavor that must continue.

As of this writing, the 2002-2003 Western (Morning) apparition of Venus is underway. Venus reached Greatest Elongation West on 2003 January 11 (47°), and it will remain a very brilliant object (visual magnitude -4.0) in the morning sky until Superior Conjunction on 2003 August 18. Venus will re-emerge from the solar glare in mid-September 2003 as an evening object in the western sky after sunset. Sample observations and images from the 2002-2003 Western (Morning) Apparition accompany this brief summary (at left).

It is the ultimate goal of the ALPO Venus Section to attempt to assemble a completely homogeneous mass of accurate, reliable observational data collected over many apparitions, permitting an exhaustive statistical analysis. It is hoped that we might derive enough from painstaking observations and analysis to help provide some answers to questions that continue to perplex us about Venus.

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

Summary of the ALPO Venus Section Observing Programs

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

Inside the ALPO
Member, section and activity news (continued)

1. Visual observation and categorization of atmospheric details in dark, twilight, and daylight skies.

2. Drawings of atmospheric phenomena.

3. Observation of cusps, cusp-caps, and cusp-bands, including defining the morphology and degree of extension of cusps.

4. Observation of dark hemisphere phenomena, including monitoring visibility of the Ashen Light.

5. Observation of terminator geometry (monitoring any irregularities).

6. Studies of Schröter's phase phenomenon.

7. Visual photometry and colorimetry of atmospheric features and phenomena.

8. Routine photography (including UV photography), CCD imaging, photoelectric photometry, and videography of Venus.

9. Observation of rare transits of Venus across the Sun.

10. Simultaneous observations of Venus.

Individuals interested in participating in the ALPO Venus programs should contact the ALPO Venus Section Coordinator at the address (e-mail and regular mail addresse)s provided in the ALPO Resources section of this Journal.

Visit the ALPO Venus Section on the worldwide web at http://www.lpl.arizona.edu/~rhill/alpo/venus.html

Lunar Section:
Lunar Meteoritic Impact Search Section
Brian Cudnik, coordinator

The Moon has not been favorably placed during the first quarter of 2003 so little in the way of observations of lunar meteoritic impacts have been made.

This Coordinator attended the Lunar and Planetary Science Conference in March 2003 to encourage the professional community to get involved, and did the same at the annual Texas Star Party, which was held near Fort Davis, Texas, 27 April to 02 May.

Visit the ALPO Lunar Section Meteoritic Impacts Search on the worldwide web at http://www.lpl.arizona.edu/~rhill/alpo/lunarstuff/lunimpacts.html

Lunar Selected Areas
Julius Benton, coordinator

The success of the ALPO Lunar Selected Areas Program (SAP) is dependent upon long-term systematic observations of specific lunar features not only throughout a given lunation, but also from lunation to lunation for many years. Such regular and careful monitoring will familiarize one with the normal, yet often complex, changes in appearance that many features undergo from lunar sunrise to sunset, and it will be possible for the individual to recognize anomalous phenomena more readily from one lunation to the next, should they occur.

Special inherent talents for drawing lunar features, although definitely helpful, are not necessary, nor is exceptional visual acuity. The most fundamental and essential prerequisite for participation in the SAP is the willingness to follow the Moon and the chosen feature(s) for many consecutive lunations, year after year. Scientific objectivity is mandatory, whereby the observer must develop a constant practice of recording precisely what is seen at the eyepiece, not what one might expect to see (as may be derived from one's previous observations or from studies of published reports from other individuals).

Should there be any doubt whatsoever about what is perceived, the observer must routinely note such uncertainties. The resulting data will be far more reliable and of lasting value. While initial efforts to detect rather delicate details on the lunar surface may result in some disappointment, persistent observations will bring about the reward of eventual successful perception (i.e., through training of the eye) of subtle features at the threshold of vision. The joy of recording phenomena or details hitherto unrecognized is reserved largely for the person who has maintained the perseverance to observe the Moon regularly.

While there is a definite requirement to know how various lunar features change their normal appearance throughout a lunation in response to variations in phase angle, even more intriguing are those lunar features that behave in an unusual, sometimes unpredictable, and non-repeating manner as solar illumination changes. The SAP is chiefly concerned with systematically monitoring regular and cyclical long-term variations during many lunations of specifically

Inside the ALPO
Member, section and activity news (continued)

designated, or "selected," areas on the Moon. The SAP is designed to intensively study and document for each of these features the normal albedo changes in response to conditions of varying solar illumination. The program is equally concerned with the following possible anomalous phenomena:

1. *Tonal and/or Color Variations*. These are variations in tone or color, or in the size and shape of a region of tone or color, that are not related to changing illumination (i.e., the phenomenon does not exactly repeat from lunation to lunation). Areas in lunar features most subject to such anomalous behavior are radial bands, dark patches, and nimbi or haloes.

2. *Shape and Size Changes*. These are variations in the appearance and morphology of a feature that cannot be traced to changing solar illumination or libration.

3. *Shadow Anomalies*. These are deviations of lunar shadows away from the theoretical normal absolute black condition, or a shadow with an anomalous shape or hue, in most cases not attributable to changing phase angle.

4. *Appearance or Disappearance of Features*. Although exceedingly improbable and controversial, these are features that seem to be present now, but appear to be absent on earlier maps or photographs; or, features that are no longer visible today but which are clearly indicated on earlier maps or photographs.

5. *Features Exposed to Earthshine*. These are any anomalous tonal or albedo phenomena (any of the categories listed here) that occur under the conditions of Earthshine.

6. *Eclipse-Induced Phenomena*. These are features that exhibit anomalous characteristics (categories 1 through 4 above) during and after an eclipse, compared with previous eclipses when the same areas were monitored.

Most of the phenomena listed above are related to anomalous variations in morphology, tone (albedo), or color, which cannot be attributed to changing solar angle (phase angle) or libration, and which clearly do not repeat systematically from lunation to lunation. As stated earlier, however, it is essential in our program to establish a record of both the normal and abnormal behavior of suspect lunar areas under all conditions of illumination.

The lunar features that are currently designated as the *official* lunar formations that are being monitored as part of the SAP appear in the table on the next page.

All of the areas listed above were chosen because they are relatively easy to find, convenient to observe, and have historically shown numerous instances of suspected anomalies. Complete outline charts and observing forms are available from the ALPO Lunar Section for each of the features noted.

Official SAP Lunar Features

Feature	Selenographic Latitude	Selenographic Longitude
Atlas	43° E	46° N
Copernicus	20° W	9° N
Plato	9° W	51° N
Theophilus	26° E	11° S
Tycho	11° W	42° S
Alphonsus	4° W	13° S
Aristarchus	47° W	23° N

(Nearby Herodotus with its environs is also considered a part of the program.)

The standard SAP procedure is to visually monitor as many of the selected lunar features as possible throughout successive lunations, employing established systematic, objective methods of observation. Observers should be familiar with their telescopes and accessories, how to recognize scattered or reflected light, irradiation, as well as aberrations caused by the eye, the instrument, and the atmosphere.

Unfortunately, observer participation in the ALPO SAP has been very poor in recent years, and we need a team of individuals willing to observe and record their observations on a consistent basis. A more complete discussion of the Selected Areas Program can be found in *The ALPO Lunar Selected Areas Program: A Manual for Visual Observations*, available from the ALPO Lunar Section. Individuals interested in participating in our programs are encouraged to contact the author for further information and assistance.

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

Inside the ALPO
Member, section and activity news (continued)

Mars Section

By Jeff D. Beish, assistant coordinator

Central Florida: After moving from Cutler Ridge, Florida to northern Virginia and then to Lake Placid, Florida, ALPO Assistant Mars Coordinator Jeff Beish readies his telescopes for use during the 2003 apparition of Mars. Located a mile west of the 28,000-acre Lake Istokpoga in central Florida, he enjoys excellent "astronomical seeing" and observing conditions in his next door observing site and garden. Jeff's newly completed observing site employs the Walter Haas "open-air" telescope method for quick cool down and use. Both telescopes are covered with IR blocking tarps when stored away.

Beish equipment ready and steady: at left, 16-inch, f/6.9 uncovered and ready for use; at right, 12.5-inch, f/7 covered with IR blocking tarp.

The ALPO Mars Section is interested in polar cap measurements and observations of clouds on Mars. For those who would like to contribute, please read Jeff's articles posted on the ALPO Mars Section and Computing Section web pages. Some articles are listed below:

Observing the Planets with Color Filters
http://www.tnni.net/~dustymars/Filters1.htm

Measuring the Polar Caps of Mars from CCD Images
http://www.tnni.net/~dustymars/CCDNPC.htm

"Systematic Errors in Micrometer Measurements using Different Methods for Finding Polar Cap Latitudes of Mars" –
http://www.lpl.arizona.edu/~rhill/alpo/marstuff/articles/MICRO1.HTM

The Sand Ships of Mars
http://www.tnni.net/~dustymars/MarsDust.htm

Astronomical Seeing
http://www.tnni.net/~dustymars/seeing.htm

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Jeff Beish, assistant coordinator of the ALPO Mars Section (and former Senior Mars Recorder), has contributed Mars observations since 1973. Jeff is retired from the U.S. Naval Observatory (USNO) and is now living in central Florida, using his 12.5-inch, f/7 and 16-inch, f/6.9 telescopes in stable and dark sky. He has been a telescope-maker and planetary observer for three decades and has published more than 210 astronomical-related articles and papers. He served in the U.S. Air Force for eight years and worked as an electronics engineer until joining the USNO in 1989. In this photo, Jeff is obviously enjoying a cool Mexican beer at the California Café in Yokohama, Japan, while with members of the ***Communications in Mars Observations*** (Oriental Astronomical Association). He had just given a lecture (in broken Japanese and English) to CMO members on the upcoming 2003 apparition of Mars.

Minor Planets Section

Frederick Pilcher, coordinator

The Minor Planet Bulletin, Vol. 30, pp. 19-35, 2003 April-June published light curves for 22 minor planets obtained by members of the Minor Planets Section. Of these 19 were new, of minor planets for which no light curves had ever been previously published.

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Stephen M. Slivan, Emily C. Bowsher, and Bena W. Chang observed (35396) 1977 XF11 for more than a month in November and December, 2002. The observed synodic period decreased as the west to east motion of this Earth approached slowed, which indicates a prograde as opposed to retrograde rotation. Our members hope to use this technique on other asteroids by obtaining light curves over long time intervals.

There is allure in the unknown, of obtaining a rotation period and amplitude for a minor planet never before studied. Brian D.Warner cautions that only limited information can be obtained in a single apparition, and has published an appea1 for multi-apparition coverage of a single minor planet. This is necessary to obtain a sidereal rotation period of much improved value, approximate pole position, and three-dimensional shape. The opportunities for pioneering research by owners of 8 to 20 inch telescopes with CCD cameras become limitless. Richard Kowalski is announcing that a golden age of amateur asteroid studies is emerging in the field of photometry.

Visit the ALPO Minor Planets Section on the worldwide web at http://www.lpl.arizona.edu/~rhill/alpo/minplan.html

Jupiter Section
Richard W. Schmude, Jr., coordinator

Jupiter will be in the western sky through June. It is hoped that people will continue to monitor Jupiter during this time. The NTB is still faint as of early April but it may become darker at any time so please keep an eye on this feature. Send any data to this coordinator at Schmude@gdn.edu

On another note, the coordinator has just completed the 1996 Jupiter apparition report and is now finishing the 1986-89 Jupiter report. I am planning to begin writing the 2002-03 Jupiter report this summer. Craig MacDougal has produced a Jupiter newsletter on March 18 and planned to release additional newsletters in April and May. Please contact Craig if you would like to get the Jupiter newsletter. John McAnally and Clay Sherrod are busy on several things including the completion of two observatories. Ed Grafton is continuing to image Jupiter and is closely watching a small oval approach the GRS.

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

Saturn Section
By Julius Benton, coordinator

Saturn's southern hemisphere and south face of the rings were seen to maximum advantage during 2002-2003, since the rings were inclined to their maximum extent of nearly -27° to our line of sight during the 2002-2003 apparition. The rings will now appear to gradually "close up," with Saturn diminishing gradually in brightness, as the next edgewise orientation in 2009 approaches.

With respect to recent apparitions of Saturn, all reports for the 2001-2002 apparition have been received, logged into the ALPO Saturn Section database, and are now undergoing detailed analysis. Observer response during 2001-2002 was excellent, with a considerable number of superb CCD and videographic images of Saturn, routine drawings and descriptive reports received. The apparition report for the 2001-2002 will appear soon in this Journal.

The current well-observed 2002-2003 apparition will draw to a close as Saturn reaches conjunction with the Sun on 2003 June 24. Even though our analysis has not yet begun for the 2002-2003 observing season, Saturn's atmosphere has shown some interesting activity over the last 10 months. A few sample images

Geocentric Phenomena in Universal Time (UT) for 2003-2004

Conjunction	2003	Jun	24d
Opposition		Dec	31
Conjunction	2004	Jul	08

Opposition Data:

Equatorial Diameter Globe	20.6"
Polar Diameter Globe	19.0"
Major Axis of Rings	46.9"
Minor Axis of Rings	20.2"
Visual Magnitude	$-0.5m_v$
B =	-25.5°

NOTE: For Saturn, **B** is the planetocentric latitude of the Earth referred to the plane of the rings, positive (+) when north (when **B** is +, the visible surface of the rings is the northern face); **B'** is the planetocentric latitude of the Sun referred to the ring plane, positive (+) when north (when **B'** is +, the north face of the rings is illuminated by the Sun.

Inside the ALPO
Member, section and activity news (continued)

and drawings for 2002-2003 accompany this brief report.

Table 1 provides pertinent data for planning purposes for the forthcoming 2003-2004 apparition.

Present observational pursuits by the ALPO Saturn Section include:

- Visual numerical relative intensity estimates of belts, zones, and ring components.
- Full-disc drawings and sectional sketches of global and ring phenomena (using templates furnished by the Saturn Section).
- Central meridian (CM) transit timings of details in belts and zones on the globe of Saturn.
- Latitude estimates or filar micrometer measurements of belts and zones on the globe of Saturn.
- Colorimetry and absolute color estimates of globe and ring features.
- Observation of "intensity minima" in the rings (in addition to observations of Cassini's and Encke's divisions).
- Observation of the bicolored aspect of the rings of Saturn.
- Observations of stellar occultations by Saturn's rings.
- Specialized observations of Saturn during edgewise ring presentations in addition to routine studies.
- Visual observations and magnitude estimates of Saturn's satellites.
- Multi-color photometry and spectroscopy of Titan to confirm a rotational light curve variation of 7% at 940nm from 1990-93.
- Routine photography, CCD imaging, photoelectric photometry, and videography of Saturn and its ring system.

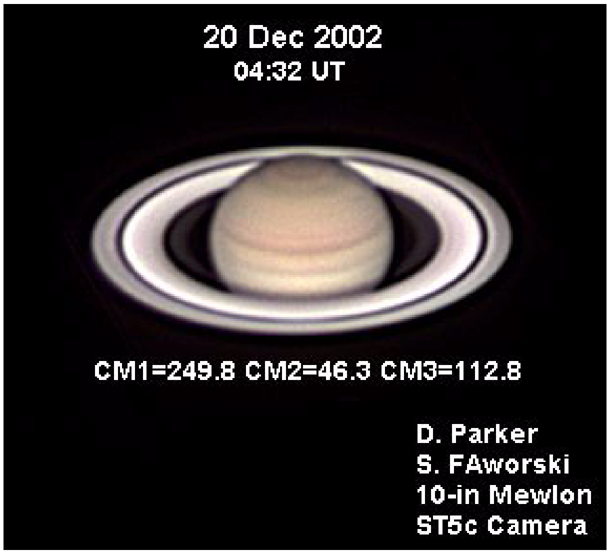
Over the past several years, the ALPO Saturn Section has sought to reduce the level of subjectivity inherent in visual studies of the planet. The challenge has been to increase the incidence of confirmed data, so the Simultaneous Observing Program was organized in recent years to accomplish this task. Simultaneous observations are achieved by observers working independently, doing systematic studies of Saturn using the same methods, equipment, and standardized reporting techniques at the same time on the same date. In addition to visual methods, observers should carry out photography, CCD imaging, videography as part of the simultaneous observing program.

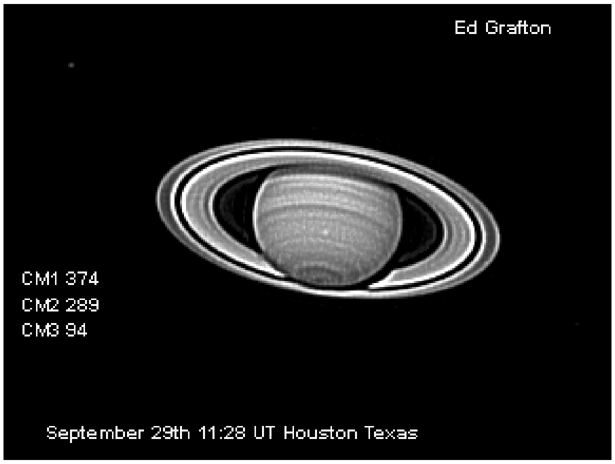
The ALPO Saturn Section is always eager to enlist new observers, and anyone interested in our programs should contact the ALPO Saturn Section Coordinator on how to get started. Further information on ALPO Saturn programs, including observing forms and instructions, can be found on the worldwide web at http://www.lpl.arizona.edu/~rhill/alpo/sat.html

Remote Planets Section

Richard W. Schmude, Jr., coordinator

Uranus, Neptune and Pluto will all be visible during June during the early morning hours. Uranus will be in the constellation of Aquarius while Neptune will be in Capricornus. This coordinator would like to





Saturn images by Don Parker, S. Faworski and Ed Grafton as noted in images. See text of Saturn section report for details.

Inside the ALPO
Member, section and activity news (continued)

encourage people to continue monitoring the brightness of these planets. (More information about these planets can be found in ALPO Monograph #10; see the ALPO Resources section of this Journal for information on obtaining this publication.).

I am also hoping that people will try to capture high-resolution images of Uranus. Finder charts for Uranus, Neptune and Pluto were published in the April 2003 issue of *Sky & Telescope* magazine on page 105.

This coordinator also hopes that people will try to measure the brightness of Pluto with a CCD camera. Doug West has been able to successfully do this during 2001 and 2002.

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

Interest Section Reports

Youth Section

By Tim Robertson, acting coordinator

(The ALPO is a partner with the Federation of Galaxy Explorers, incorporated in the state of Maryland as a 501(c)3 non profit organization and dedicated to inspiring and educating kids in space related science and engineering. Below is a synopsis of this co-op venture.)

One cannot gaze upon the glory of the heavens without wondering. Why did it unfold this way? Is there life out there? What other mysteries wait to be discovered? The study of the cosmos imparts to its students a sense of timelessness that leads one to ask the question of who will take up the challenge of exploring and developing our presence in space after me? That question has been answered, and they are the Federation of Galaxy Explorers.

The Federation of Galaxy Explorers is a 501(c)3 organization dedicated to educating and inspiring America's youth in space related science and engineering. The vision of the Federation of Galaxy Explorers organization is to expand the frontiers of science and technology to explore and develop space. The mission is to educate, guide, and prepare the next generation to accept the challenge of expanding humankind's presence in space.

Background

The Federation of Galaxy Explorers organization is built on the paradigm of a members participatory club where children attend monthly meetings and periodic field trips. Adult volunteers teach Federation of Galaxy Explorers with easy to understand and fun-to-do educational material. The materials use exercises, projects, and field trips to provide a hands-on understanding of space and earth science, and principles of engineering, rocketry and space citizenship (the role of government, the power of citizens in a democracy, the promise of space expressed in art, writing, history, and business).

Galaxy Explorers are organized into Sectors and then local "Mission Teams". These teams meet on a monthly basis, 10 meetings per year. Field trips are also conducted. Some schools have implemented Federation of Galaxy Explorers as an enrichment program after school. Mission Team members wear uniform shirts and are rewarded for participation and achievements with ribbons, patches, medals, and certificates. Awards are an integral part of the program providing children self-esteem through achievement and recognition.

Federation of Galaxy Explorers fills a void in the American educational system by engaging, educating, and motivating children outside the classroom. Federal, State, local agencies, private institutions, and corporations dedicate some resources towards educating children in space related science and engineering. However, curriculum requirements dictate that numerous subjects be taught during primary, middle, and high schools. Little time remains for space subjects, leaving students with no support to pursue those interests. Galaxy Explorers provides an external support network to compensate for this shortfall.

Benefits

The Galaxy Explorers program provides great benefits for the nation:

- Educate America - The Federation of Galaxy Explorers will prepare America's children for employment in the 21st century.
- Galvanize America's support for space - Over time, Federation kids will grow to create a long term citizen activist force in society; shaping the nation's space policy, and furthering the science and engineering required to create a space faring civilization.

Inside the ALPO
Member, section and activity news (continued)

- Economical - The concept of Federation of Galaxy Explorers is an extremely inexpensive means of educating America's next generation by drawing on the volunteer spirit of America. The program provides a critical support infrastructure to motivate and educate children outside of the classroom. This infrastructure is particularly important given America's lack of classroom resources, science and math teachers, and modern day peer pressure.

The Way Forward

To date, Galaxy Explorers pilot programs are at 17 schools in Washington, D.C., Colorado, Maryland, and Virginia, where we recently concluded a summer space camp for 150 children. Our strategic plan is on track to expand the program to additional states in 2003/4. The Federation of Galaxy Explorers expects to have a program of several hundred thousand children in the coming years. To accomplish a nationwide expansion, Galaxy Explorers has established collaborative working relationships with the Association of Lunar and Planetary Observers, National Space Society, American Astronautical Society, Challenger Center, Astronomical League, American Institute of Aeronautics and Astronautics, Air Force Research Laboratories, NASA, National Reconnaissance Office, and many others. In addition, the effort is strongly supported by members of the U.S. Congress and their staff.

Astronomers Wanted

In 2002, the ALPO and FOGE joined youth education efforts. The ALPO coordinator of Youth Programs, Tim Robertson, was appointed to the FOGE Advisory Board to ensure an outstanding working relationship. Since that time, over two hundred children have been trained on astronomy and the basics of planetary observation. The Federation of Galaxy Explorers offers the means to bring children into the field on amateur (and professional) astronomy.

We need astronomers to teach all over the nation. We also need people to start and run Mission Teams and to assist with management issues and administration. We need astronomers who are willing to impart their knowledge to the next generation; and in so doing, change the future of humanity. The Federation has an outstanding leadership team that includes congressman, Service Members, former astronauts, business professionals, astronomers, artists, and more. Join the Federation's team today. We need you. Please take a few moments to learn more about the organization and sign up at http://www.foge.org or call toll free 1 877 761-1266.

For more information on the World Wide Web, go to http://www.foge.org

Visit the ALPO Youth Programs Section on the worldwide web at http://www.cometman.net/youth/

Instruments Section

By Dick Wessling, assistant coordinator

Work is proceeding with lunar and planetary photographic techniques with several ALPO members. The issue centers around if you want to use a computer or not – at least from my perspective. During the last year or two, webcams have become popular and have produced excellent results by stacking images. I am prepared to start this approach, but have not yet tried it. I am using a different technique on the Moon which may be of interest.

Since I build rather large reflecting telescopes on Dobsonian mounts, and since I like to use my Nikon 995 Coolpix camera, I do not need to download shots to my computer at the telescope. I have been using my 14.75 in., f/5.5 Newtonian on a Dobsonian mount which has no drive. The idea is to make exposures with as high a magnification as possible and keep exposures to faster than 1/15 second. This is possible with my scope and I can make exposures of 1/60 second usually and around the terminator between 1/25 and 1/8 second. I use the camera on auto focus and automatic exposure mode. The telescope set-up is like this:

I use this scope usually for lunar & planetary work with the TeleVue 4X Powermate which turns the scope into an effective focal ratio of f/22, or a focal length of 8230mm, (324 inches). This, combined with the Nagler 31mm eyepiece, gives me a wondrous high-power wide-angle view of the Moon and planets at 265X. If the seeing is good, I attach my Maxview 40 eyepiece to the camera lens with its adapter, the cable release and Powermate adapter for 1.25 in. eyepieces. I then remove the Nagler and insert the camera into the Powermate. I only have to adjust the focus slightly on the scope and it's easy with the Feather-touch focuser. I then center the area or move forward so the desired area is at the center of the field of view and click the shutter. The last step is to download the pictures into your computer. Afterwards, I use Adobe Photoshop to enhance them and store them.

This is a very good reason to have a large aperture telescope besides the greater brightness and resolution. If you have a large aperture scope give it a try. At the bottom left of this page is a photograph I took of Tycho on Sunday night, April 13, 2003. The exposure was 1/60th second. Let me know if you try this and like the technique. Don't forget to record all of the usual data required for observations just in case you get an excellent photo.

(Editor's Note: (Walter Haas) If we are photographing without any drive, we need to know that the diurnal drift rate is 15 seconds of arc per second of time at the celestial equator. The rate is not much less in the declinations where the Moon and the planets are found. Then in 1/25 seconds the blur will be 0.6 seconds of arc , or a trifle less, etc.)

Visit the ALPO Instruments Section on the worldwide web at http://www.lpl.arizona.edu/~rhill/alpo/inst.html

ALPO Staff Profile:

Deborah Hines, Acting Mars Section archivist

At an early age, Deborah would be taken out at night by her mother to watch the sky. Later, while establishing a Holter technology career at a leading Chicago hospital, her interest in the celestial went on hold. But not for long. While attending pertinent courses offered at Triton Community College, she began to develop skills in networking and as a computer service technician.

It was there that she attended a public skywatch held on the college campus sponsored by their planetarium theater, the Cernan Earth & Space Center, and the interest was rekindled. Noting that her new-found skills could be applied to astronomy, she attracted the attention of ALPO Mars Section Coordinator Dan Troiani and Assistant Coordinator Dan Joyce, and she was excited to be working with an organization that featured the Red Planet.

To help foster her enthusiasm, Deborah attended the 2000 ALCON-ALPO convention in Ventura, California (while there, she won the grand door prize and met James Doohan, "Scotty" of Star Trek fame). Deborah began to keep pace with ALPO Mars Section activities, attending the 2001 ALPO conference in Frederick, Maryland, where she was prominently mentioned as a replacement for the late Robert "Big Bob" Itzenthaler, who had served as the ALPO Mars Section archivist. She subsequently attended the 2002 Salt Lake City ALPO ALCON-ALPO conference and is planning to attend this year's ALPO conference in Ohio in August.

Besides her ALPO involvement, Deborah, is also a member of the Chicago Astronomical Society and the Astronomical League. Professionally, she is an CompTIA A+ Certified Professional Computer Service Tech.

And while she immensely enjoys viewing the planets, Deborah's favorite star is Canopus, since seeing it means she's at that favorite observing haunt — the Winter Star Party in the Florida Keys.

ALPO Conference 2003, Boardman, Ohio

The 54th Annual ALPO Conference will be held Thursday through Saturday, August 7 - 9, 2003, at the Holiday Inn, Boardman, Ohio, and feature some great field trips in addition to the traditional schedule of ALPO paper sessions.

The location of this year's conference has special significance in that our fearless ALPO founder and director emeritus Walter Haas was born in New Waterford, Ohio, about 15 miles to the south of this meeting site. While this will not be Walter's first return to the area, it will be one in which he will have his ALPO friends and family joining him. We hope that all ALPO members will consider attending this special meeting.

Completed ALPO registration forms (included in these pages) and payment should be received by July 31. Registration, materials pick-up and sign-in will take place at the Holiday Inn Wednesday, August 6, from 3 to 9 p.m., and then again on Thursday, August 7, from 7:30 a.m. to 3 p.m. Those going on the Thursday field trip should arrive by Wednesday evening. This will minimize last minute rushes Thursday morning.

Field Trips

Thursday morning at 9 a.m., participants will assemble at the hotel for a brief welcome. A full day of activity is planned.

First we'll visit the Ward Beecher Planetarium at Youngstown State University. Returning to the hotel around noon, a group lunch buffet will be served for those who purchase this option. The hotel's restaurant, in addition to many nearby national restaurants provide alternatives for lunch.

Next, an early afternoon (approximately 1:30 p.m.) departure takes us to Brashear LP in Wampum, Pennsylvania. This is the optics facility that produced the Subaru Mirror, now in use on Mauna Kea, Hawaii. The tour is expected to last about 90 minutes, including a question/answer session. For security reasons, non-U.S. citizens must bring their passport to enter the Brashear LP facility.

Leaving Brashear LP, we'll stop for dinner at a reasonably-priced, casual-attire restaurant. Meal payments on your own.

Next stop, a 7 p.m. arrival at the Allegheny Observatory in Pittsburgh, where a talk on current research and a tour of the observatory telescopes are planned. Weather permitting, we will observe with the 13-inch Fitz-Clark refractor until 10:30 to 10:45 p.m. Then, we'll start the trip back to the hotel in Boardman. It is hoped to return around midnight, earlier if it is cloudy.

The field trips and lunch will be the only group activities on Thursday. The trips are not strenuous, but the afternoon trip, out of necessity, will be lengthy. Transportation is by air-conditioned bus, providing maximum comfort. There is a limit of 45 people. First come, first served.

ALPO Conference 2003 - Registration Form

Name______________________________________ I am attending with a group _____ (check if yes)

Address_____________________________________ My Group's name is ____________________"

City____ Group total enclosed is $_________________

State/Province________ Zip (or Postal Code) ________ I am an ALPO member______ (check if yes)

Country___________________ My e-mail (optional) is______________________

Telephone (____) - ________ - _________

(Please make photocopies of the registration form as needed and complete a separate form for each member of your group. Groups should pay the total amount due with a single check. Please print neatly or type.)

	Pricing: Up to July 31st	After July 31
Full Three Day Conference (includes Thursday field trips, 45-person limit)	$ 55.00______	$65.00_______
Group Lunch at the hotel (for Thursday field trip only)	$13.00_______	$15.00 _______
Option: Two-day conference paper sessions only (Fri. & Sat.)	$ 35.00_______	$45.00 _____

ALPO Awards Dinner (Saturday evening — select one, includes tax and tip)

Prime Rib (12 oz.), baked potato, steamed veg., salad $30.00_______

Stuffed Chicken Breast, baked potato, steamed veg., salad $21.00_______

Penne Portabello (vegetarian pasta), steamed veg., salad $21.00_______

My total is $___________

Included are dessert (Chocolate Parfait) and beverages (sodas, coffee[decaf & regular], and tea).

Please complete the registration form above and send with payment. Payments must be by check or money order, payable through a U.S. bank, encoded with U.S. standard banking numbers. Please make checks payable to "ALPO" and send to the address below:

ALPO Conference
c/o CisNet, Suite G
6981 Southern Blvd.
Boardman, OH 44512
U.S.A.

Office use:

Conference Activities

The next two days of theALPO conference will feature paper sessions, workshops/discussion groups and ALPO business. Lunch will be on your own. Plans are being finalized to have speakers from the NASA Johnson Space Center (lunar science) and the NASA Jet Propulsion Laboratory (Mars and Cassini missions) as a complement to the ALPO presentations. Please check the meeting website at http://www.alpo2003.org for speaker information, as it become available.

The Friday paper sessions will begin at 9:30 a.m. and last until 5 p.m. This late start will provide extra time for registrations and a late breakfast for those who attended the Thursday field trips and arrived back very late. Friday evening is free (at this time). Saturday paper sessions will be held from 9 a.m. to 5 p.m.

Attendees have the option of skipping the Thursday field trips and registering for only Friday and Saturday paper sessions; simply select the two-day conference option on the registration form.

The Annual ALPO Awards Dinner will be held at the hotel on Saturday evening and plans are being made for a guest speaker. Seating will begin at 6:30 p.m., with dinner served at 7 p.m. The menu selections include Prime Rib (12oz.), Stuffed Chicken Breast, and Penne Portobella (a vegetarian/pasta offering). All meals will include steamed vegetables and a tossed salad. The prime rib and chicken dishes also include a baked potato. Beverages include coffee (decafeinated and regular), hot tea and iced tea, and sodas. Dessert will be chocolate parfait ice cream.

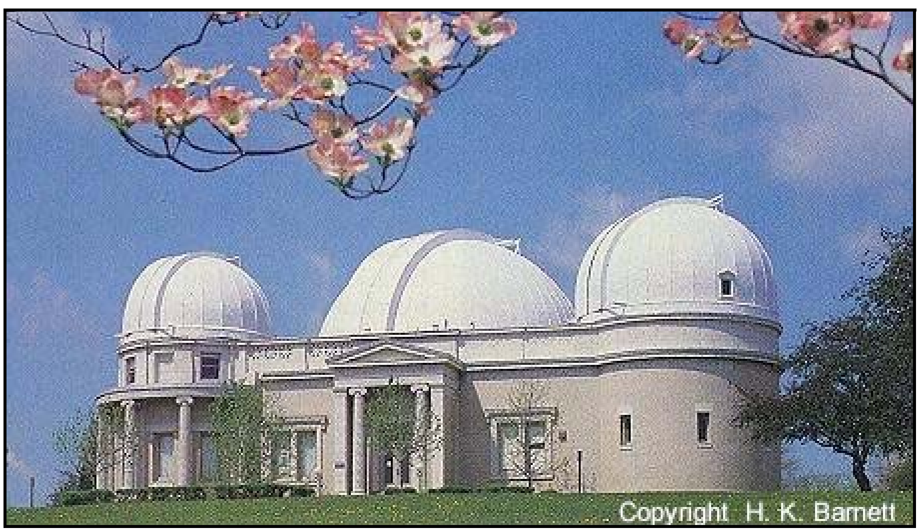
Conference Location

Holiday Inn Boardman
7410 South Avenue
Boardman, OH 44512

(Phone) 330-726-1611
(Website) http://www.hiboardman.com

All meeting activities will originate from or take place at the Holiday Inn, Boardman. The hotel is conveniently located close to exit #11 of Interstate-680. An award-winning facility, this hotel has all of the amenities needed for business meetings. The hotel restaurant, "TJ's," is renowned for its fine culinary offerings. A block of sleeping rooms has been set aside for ALPO conference attendees at a special rate of $89 per night.

Attendees should make their own reservations directly with the hotel. You must mention that you are attending the ALPO conference to obtain the special rate. The special rate will be in effect up to July 17, 2003. After that date, full rates will apply. Major credit cards can be used to hold reservations. Contact the hotel at:



The Allegheny Observatory is one of the major astronomical research institutions of the world. It is located in Riverview Park, four miles north of the Golden Triangle (downtown Pittsburgh) and eight miles from the University of Pittsburgh of which it is an integral part.

Although pioneering in pure research is the chief function of the observatory, its telescopes and instrumental equipment are available for use by students of the university and observatory astronomers teach both credit and non-credit classes at the university. Throughout its long history the observatory has always been aware, too, of its obligation to allow the public to become acquainted with the wonders of the night sky by actual observations and illustrated lectures.

Astronomy the oldest of the sciences, is education in its purest form, for astronomy exists only because people want to know and understand the universe that surrounds them.

--Theodora M. Lauterbach

Alternate Lodging

There are several other hotels a very short drive from the Holiday Inn, as listed below. Please check the meeting website at http://www.alpo2003.org for the area map, contact information on other hotels, meeting information, registration forms and call for papers form.

- **Microtel Inn**
  7393 South Avenue
  Boardman, OH 44512
  (Phone) 330-758-1816

  The Microtel Inn offers low rates and has 92 clean and comfortable rooms which consist of one queen-size bed, cable TV, in-room movies and Nintendo. It is located a short walk south and across the road from the Holiday Inn. The majority of this hotel's clean and up-to-date rooms have one queen-size bed. Maximum occupancy of 2 people. They do have a few with 2 twin or 2 double beds (4 person max) but you need to call the hotel directly for the availability of these rooms. Amenities include in-room movies, cable TV, pets welcome, non-smoking rooms, and daily maid service. Reservation must be cancelled prior to 6pm on the date of arrival. If your reservation is not cancelled and/or you do not have a cancellation number, your credit card will be charged for one night room and tax. Any additional nights on your reservation will be cancelled.

- **Red Roof Inn**
  1051 Tiffany South
  Poland, OH 44514
  (Phone) 330-758-1999

- **Hampton Inn**
  7395 Tiffany South
  Boardman, OH 44512
  (Phone)330-758-5191

- **Residence Inn by Marriott**
  7396 Tiffany South
  Boardman, OH, 44512
  (Phone)330-726-1747

- **Fairfield Inn**
  7397 Tiffany South
  Poland, OH 44514
  (Phone) 330-726-5979

Air Transporation

Those that will be flying to the conference have several airport options including Canton/Akron Airport, Cleveland Hopkins International Airport, and Pittsburgh International Airport. Car rental companies such as Hertz, Budget, etc., are available at the airports.

Shuttles

- **Southern Park Limo, Inc.**
  7338 Southern Blvd
  Boardman, OH 44512
  (1-800-528-9663)

  Southern Park Limo is a local (Boardman) shuttle service that maintains daily scheduled transfers to and from the Pittsburgh Airport. The shuttle driver will greet arrivals in the baggage claim area, next to the Hertz rental station. Drivers wear a bright orange ball cap for easy identification. Southern Park Limo also offers express limo service for Cleveland and Canton/Akron airports (both at a higher cost). The daily Pittsburgh Airport schedule for Southern Park Limo is:

  Departs Pittsburgh at 9:30 a.m., 11:30 a.m., 2 p.m., 5 p.m. and 9 p.m.
  Departs Boardman at 6:30 a.m., 8:30 a.m., 11 a.m., 2 p.m. and 6 p.m.

  Costs: $40 per person (2002 rate), one way. All service by prior reservation only. Travel time approximately 1 hr. 10 min. Be sure to select a flight arrival time in Pittsburgh keeping the shuttle departure schedule in mind. You will need flight numbers in hand, so once your flight has been booked, you can make shuttle reservations by telephone.

- **FAB Limousine, Inc**.
  (Phone) 330-793-5466
  Web: http://www.fablimo.com

  Another local shuttle service (Austintown, OH) is FAB Limousine Inc. which also serves the Canton/Akron, Cleveland and Pittsburgh airports. FAB specializes in group transfers. See their website or phone them for services, pricing and contact information.

FIELD TRIP SCHEDULE

9 a.m. – Meet in hotel meeting room for welcome and opening remarks. Transfer to bus.

9:30 a.m. – Leave Holiday Inn, Boardman for YSU Planetarium

12 Noon – Leave YSU, returning to hotel for lunch

12:30 p.m. – Lunch buffet served at hotel

1:30 p.m. – Leave hotel for remainder of the day.

2:10 p.m. – Arrive at Brashear LP, Wampum, PA for tour.

4 p.m. – Leave Brashear LP

4:20 p.m. – Arrive at Eat'n' Park in Mars, PA (for dinner) See a menu at www.eatnpark.com

6:30 p.m. – Leave Eat'n' Park, going to Allgheny Observatory in Pittsburgh, PA

6:55 p.m. – Arrive at Allegheny Observatory

10:30 p.m. – Leave Allegheny Observatory, returning to hotel.

11:50 p.m. – Arrive at hotel. End of field trip.

ABSTRACT FORM - CALL FOR PAPERS

Please complete this Abstract information form if you wish to make a presentation.

Paper sessions will be given on August 8 and August 9. Please print or type a paragraph length abstract at the bottom of this form. Mail it to the address below no later than July 6, 2003. You may send it along with your registration fees.

Electronic Submissions: If it is more convenient, you may submit abstracts and the related data via e-mail to Don Parker at: park3232@bellsouth.net or to Phil Plante at: pplante@cboss.com Write "ALPO Abstract" in the subject line.

Author's name____

Title of paper/presentation_______________________________

AV equipment you require: Overhead projectors ______ Slide Projectors______
Data Projectors*_______ other____

* If possible, have a copy of your PowerPoint presentations on a CD-Rom or ZIP disk rather than just on a laptop computer. Using a CD or ZIP will facilitate set-up time between speakers and will be the method of choice whenever possible.

Time slots will be 20 minutes, plus 10 minutes for discussion. Estimated duration of your talk is________ minutes

ALPO Conference
c/o CisNet, Suite G
6981 Southern Blvd.
Boardman, OH 44512
U.S.A.

ABSTRACT BELOW:

ALPO Feature:
Recent Professional-Amateur Collaboration in the ALPO

By Richard Schmude, Jr.,
Jupiter and Remote Planets Coordinator

Abstract

This article describes recent examples of collaboration between professional and amateur astronomers in the area of solar system research. In most cases, professionals have used drawings, photographs and images made by amateurs in their research.

Introduction

In this paper, I would like to describe several recent examples of professional-amateur (Pro-Am) collaboration involving solar system studies. Pro-Am collaboration as defined here includes either the collaboration of professional and amateur scientists in a research project or situation where a professional astronomer uses older amateur work in a research project. This collaboration can either occur simultaneously or far apart in time. Both types of collaboration are discussed.

Jupiter

Sanchez-Lavega and co-workers (1998) used several images and photographs of Jupiter made by Miyazaki and Parker (both amateur astronomers) to study the interaction between the Great Red Spot (GRS) and a large storm in the south tropical zone called the white tropical oval or the "WTrO". The WTrO first formed in 1983 and was destroyed by the GRS in May 1997. The images and photographs of Miyazaki and Parker were analyzed and included in the professional study.

In a second study, Sanchez-Lavega and co-workers (1999) again used photographs and images of ovals BC and DE (two large storms in Jupiter's south temperate belt) made by amateurs Miyazaki and Parker. This study focused on the interaction and merger of ovals BC and DE in Feb. 1997 and undoubtedly the images and photographs made by amateur astronomers gave professional astronomers a better understanding of the dynamics of ovals BC and DE.

A third Jupiter study carried out by Garcia-Melendo and co-workers (2000) centered on the study of the north temperate current C. The study was carried out over a seven year period from late 1991 to 1998. Sam Whitby, an amateur astronomer from Virginia, may have been the first person to see and identify the outbreak of dark spots in the North Temperate Current C (NTC-C) on Oct. 10, 1991. Others including the two amateurs Miyazaki and Parker imaged and photographed several dark spots in the NTC-C and once again, their images were used in a professional paper. Miyazaki and Parker were co-authors of all three reports just discussed.

Perhaps the best example of Pro-Am collaboration has been the excellent work of John Rogers (1995) of the British Astronomical Association. John wrote "The Giant Planet Jupiter," which is a book that is cited in numerous professional papers on Jupiter.

Saturn

During late 2002, there were at least three white ovals (storms) that developed on Saturn. One of the storms at 29.5ºS was imaged by the Hubble Space Telescope (HST) on Sep. 21, 2002 and was later imaged by two amateur astronomers (Don Parker and Ed Grafton) around Oct. 7-12, 2002. Parker and Grafton's images were valuable because when these were combined with the HST image on Sep. 21, it enabled professional astronomers to deter-

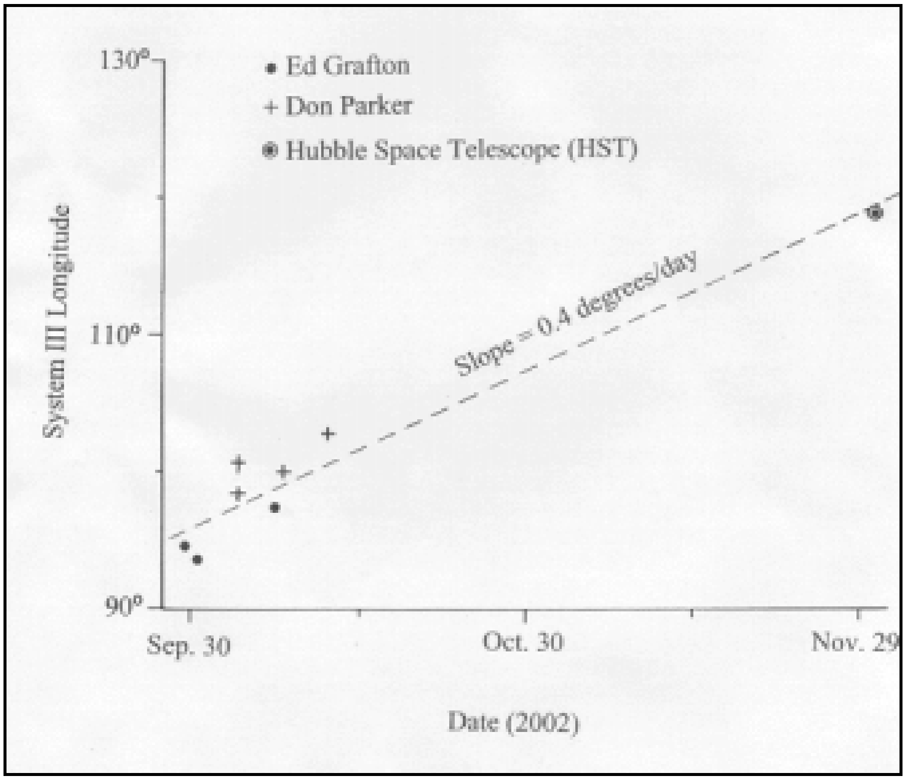


Figure 1: A graph of the longitude of a bright cloud on Saturn plotted against the date. Both amateur and professional data are included in the graph to yield a meaningful slope; the slope is related to the wind speed.. (Ed Grafton and Don Parker are both amateur astronomers.)

mine how fast this storm was moving. Two other storms were imaged at 41.5ºS and images made by both amateur and professional astronomers were combined to yield drift rates and other data on these storms. Figure 1 shows the longitudes of one of the storms (Sanchez, 2002) (Peach, 2002).

Moon and Earth's shadow

Dr. Leon Stuart, an amateur astronomer from Oklahoma, observed and photographed a bright flash on the Moon in Nov. 1953 (Stuart, 1953). Bonnie Buratti and Lane Johnson, two professional astronomers, analyzed the photograph taken by Dr. Stuart and report that there is evidence of freshly excavated material near where the flash took place. If this had been the case, then Buratti and Johnson calculated that a 20 meter (66 foot) space rock slammed into the Moon in late 1953 releasing as much energy as is released from 500,000 tons of TNT. They also calculated that about 0.3% of the energy from the impact turned into visible light (Perkins, 2002).

[Editor's Note: Unfortunately, it now appears clear that Buratti and Johnson erred in their identification of a lunar crater with the 1953 Stuart flash photo. See *Sky & Telescope* magazine June 2003, page 24.]

Another example of Pro-Am collaboration has been the timing of lunar eclipses (Karkoschka, 1996). Essentially several amateurs including the ALPO members (Brian Cudnik, Phil Plante and Samuel Whitby) recorded the times when lunar craters first entered the umbra part of Earth's shadow. The timings have allowed Soulsby (1990) and Karkoschka (1996) to compute the size of Earth's umbra. The umbra is usually about 2% larger than what is expected from just the solid Earth. The larger size is attributed to the Earth's atmosphere. The question however is how our atmosphere causes the larger umbra. Karkoschka developed a computer model of Earth's atmosphere and discovered that the model fits the amateur data well. He included the effects of ozone and clouds in his model. Karkoschka (1996) thinks that crater timings may yield information on the stratospheric ozone layer.

The lunar flashes discovered by Brian Cudnik and David Dunham (two amateur astronomers), have caught the attention of professional astronomers. At least one group of professionals has modeled the flashes and estimates that the sizes of the impacting objects are in the 0.025 to 5 kg (0.055 to 11 pound) range (Cudnik, 2003).

Mars

Don Parker, Jeff Beish, Dan Troiani, Dan Joyce and Carlos Hernandez have all done an excellent job of both maintaining the ALPO Mars section data base and at the same time interacting with professional astronomers. At the present time, Dr. David Klassen is serving as a mentor for the ALPO Mars section. Past professional mentors have included Charles Capen, Leonard Martin and Jim Bell.

Over the years, the ALPO Mars section coordinators have given several papers at professional meetings and in at least one case, a professional astronomer (Leonard Martin) came to Miami, Florida to study the ALPO Mars archives. Later on, Leonard used several Mars drawings and photographs taken by members of the ALPO in his research.

Dr. Steve Lee at the University of Colorado, requested data on a Martian feature called Cerberus. After receiving data collected by ALPO members related to Cerberus, Dr. Lee made the comment: "This is a great example of professional-amateur cooperation – you have the data; we don't."

Mercury

Frank Melillo, the current coordinator of the ALPO Mercury section has done an excellent job in motivating others to send in their Mercury drawings and images. The activity of the ALPO Mercury section caught the attention of Ann Sprague, a professional astronomer at the Lunar and Planetary Laboratory. Ann has used several images made by the amateurs Mario Frassati, Frank Melillo, Ricardo Nunes, Giovanni Sostero and Tim Wilson, and in a book that will be published later this year.

Conclusion

These are only a few examples of the professional-amateur collaboration that has been taking place during the past several years. Several of the ALPO sections are currently working with professional astronomers and at least three of the sections have professional astronomers as either mentors or directors.

Acknowledgements

The author would like to thank Lenny Abbey, Brian Cudnik, Frank Melillo and Matthew Will for their assistance.

References

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ALPO Feature: A Re-publication of the Original Text

A Photo-Visual Observation of an Impact of a Large Meteorite on the Moon

Note by Editor (2003). This re-publication of the original article is for historical purposes and should be regarded only as such. Dr. Stuart passed on in 1969.

By Leon H. Stuart, F.A.C.R.

Some time ago the writer made a camera to fit over the eyepiece of an eight-inch f/8 reflecting telescope for the special purpose of making pictures of small star fields. For the evening of 1953, November 15, four plates had been taken out of refrigeration for some pictures of the moon at First Quarter. These were to be test plates for focus. The first became light fogged by accident; the second showed only fair focus and the third was not much better. On removal of the fourth from the camera-back after approximately one-half second exposure (black cloth over tube end method) the moon image was seen on the ground-glass as after the exposure of the other plates. This time, however, a bright spot was noted near the terminator's mid-point and immediately test was made for integration with the moon image. Movement of the telescope caused the spot to move with the moon image with no change in relative position to near-by moon objects. When this was determined it was thought better to see if the bright spot were on the plate just exposed and, if not, to expose another as soon as possible. When immediate development showed that it was present, it was also realized that there were no more plates available.

The exposure was made at 2h 0m U.T., locus 95d 55’ 42” W., 36d 11' N. and in the process of focusing no spot was seen. The total photographic-visual time was at first thought to be, roughly, less than thirty seconds but later re-enactment of the entire process of loading, exposing and unloading the camera and making tests averaged about eight seconds. Neither the beginning nor the end of the flare was seen for, on return to the telescope after development of the fourth plate (in ten minutes), no spot was to be seen.

Since this was the last plate out of refrigeration no further photography was done until the next day at 2h 0m U.T., just 24 hours after the time of exposure of the plate showing the spot. There was not sufficient detail on this plate to determine any change on the surface of the moon. The position of the spot is estimated as three-fourths of the distance from Schroeter to Pa11as.

The general impression is that the phenomenon photographed and seen was that of the impact of a meteorite large enough to produce sufficient heat to cause incandescence of involved meteorite-moon structures and being manifested as a short-lived flare. So far as is known to the writer, this is probably the first photo-visual observation of such an occurrence.

It was noted that the visualized spot did not appear as bright as that seen in the picture and a slight halo was noted in the negative that did not show visually. The plate used was Eastman Kodak Co. Spectroscopic 103aF3 which has a special sensitivity in the red part of the spectrum from 4,500 Å to 6,000 Å besides the ordinary sensitivity to shorter wavelengths.

Note by Editor (1956). Dr. Stuart would be glad to hear from A. L. P. O. members about this remarkable visual-and-photographic observation. His address is 411 Medical Arts Bldg., Tulsa 19, Oklahoma.

Photograph of Moon by Leon H. Stuart with 8-Inch Reflector on November l5, 1953 at 2h 0m, U.T. Colongitude 14.6 degrees. Note Brilliant Spot near Middle of Terminator. See Text.

ALPO Feature: The Moon

The Volcanic Features of the Gemma Frisius Region

By Eric Douglass, staff writer
Peer review by Roger Venable

Abstract

The crater Gemma Frisius in the southern highland region of the Moon is the home of both a large volcanic cone and a dark haloed crater. Little else that is volcanic is appreciated, suggesting that this region was generally covered by an ejecta layer after its volcanic period had ceased. By careful examination of the geology, a history of the region can be pieced together.

Introduction

In the southern highlands, in the crater Gemma Frisius, lies an enormous cinder cone (Figure 1, 'A'). This structure is some 22 km in diameter, and contains a pit crater that is approximately 4 km in diameter. It is unlikely that this pit crater represents the size of the original vent, but has been enlarged by meteorite erosion and collapse. Both the cone and the pit crater are large enough to be easily appreciated with earth-based telescopes. A dark haloed crater, which suggests prior volcanism, is also found in the crater (Figure 1, 'B').

Geology of the Region

Gemma Frisius occurs in the Moon's southern highland region. This is an old section of the Moon, which was not resurfaced by the lava flows that formed the maria on the lunar near-side. Some of the craters in this region extend back to the Pre-Nectarian period (greater than 4.2 billion years of age). Gemma Frisius itself, given the general stage of degradation of its side-walls, rim, and central peak (Figure 1, 'C') is probably from the lower Nectarian Period (3.85-4.2 billion years of age; for dating criteria, see Douglass, pp. 14-18, Wilhelms, p. 180).

There are no visible lava beds in this region, and one would not generally expect to find volcanic products in the lunar highlands. However, two pieces of evidence suggest that highland volcanism did occur in this region. First, in the southern floor of Gemma Frisius there is a small dark haloed crater (Figure 1, 'B'). Dark haloed craters have two possible mechanisms of formation. Some are formed when magma under pressure gains access to the lunar surface. Here small amounts of gas entrain magma creating a stream of glass beads (called pyroclastic materials). These fall back around the vent, producing the dark halo. The best known example of this kind of dark haloed crater occurs in crater Alphonsus (Figure 2). The second type of dark haloed crater is formed when an impact excavates a lava bed that is covered by a thin veneer of lighter material. Here the dark lava is excavated by the impact, and now lies on top of the lighter ejecta. One example of this occurs just south-east of crater Copernicus (Figure 3). It is difficult to determine which mechanism produced the present dark haloed crater in Gemma Frisius, but both require the presence of volcanism. Second, a mafic intrusion has been identified near Gemma Frisius. Investigators using multispectral images from

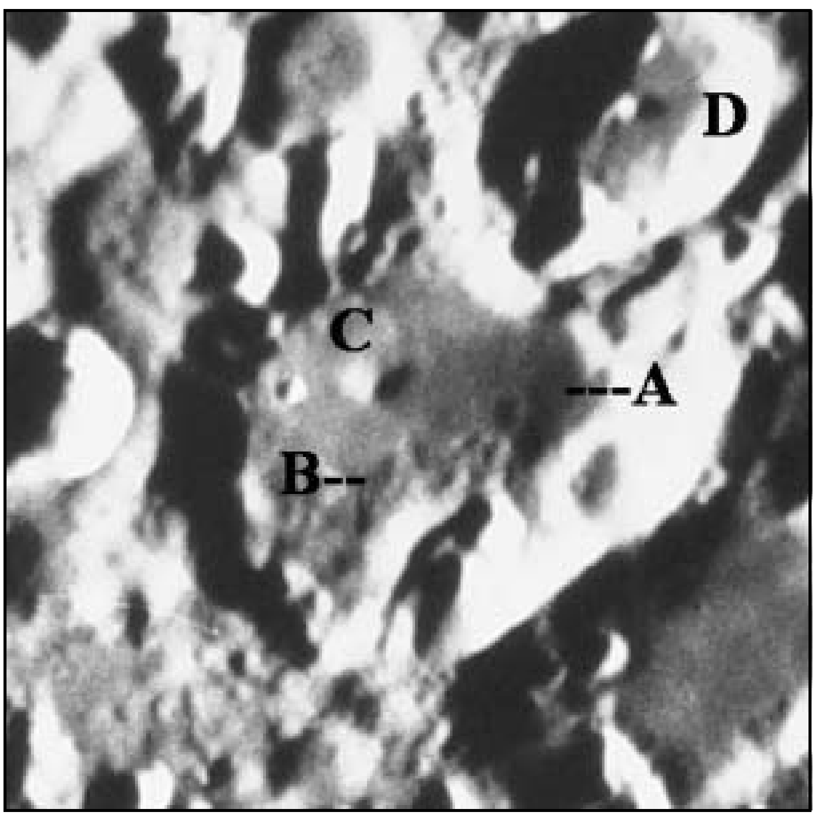

Figure 1: Crater Gemma Frisius, with its cinder cone (A), dark haloed crater (B), and central peak (C). Crater Goodacre (D) overlaps it. North at top. (From Kuiper, et. al. *Consolidated Lunar Atlas*. Digital Edition, E. Douglass, G12.

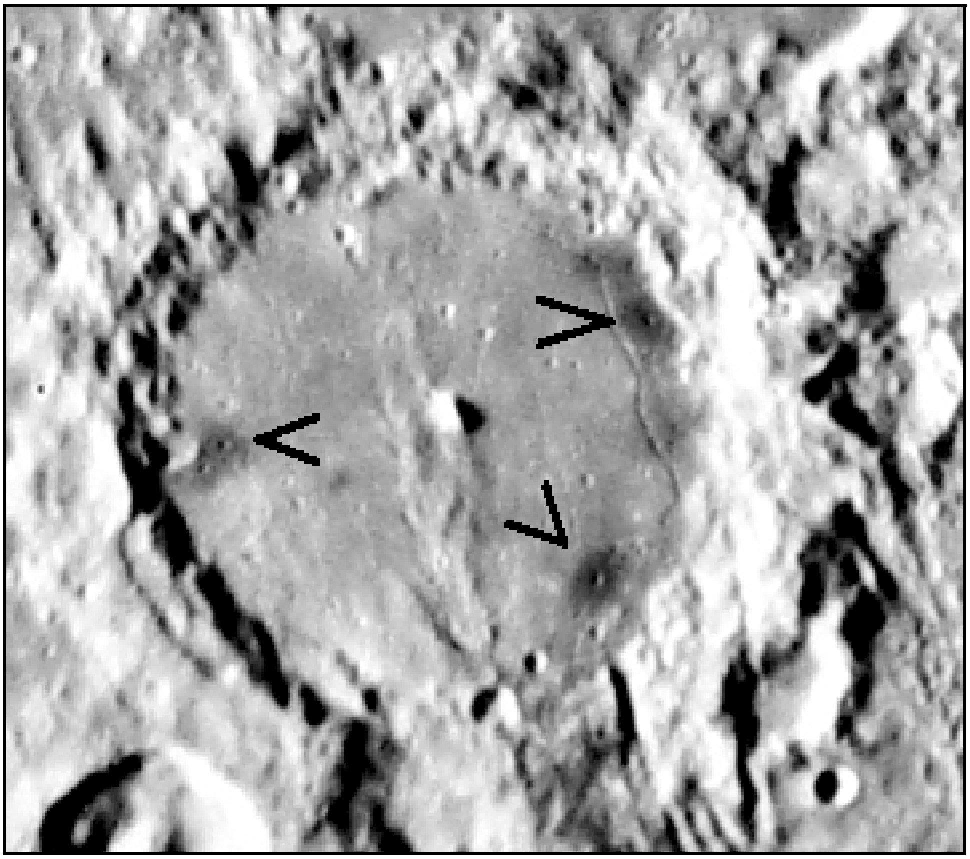

Figure 2: Crater Alphonsus with some of its dark haloed craters marked by arrows. North at top. (From Kuiper, et. al. *Consolidated Lunar Atlas*. Digital Edition, E. Douglass, E13.

pocket created the partial melts necessary to account for the features located in the Gemma Frisius region.

After these partial melts were formed, they began to rise diapirically (due to lower density than the surrounding rock), until they approached the surface. As the surface pressure fell, the gasses dissolved in the magma came out of solution (Basaltic Volcanism on the Terrestrial Planets, p. 759). The primary gas, generally thought to be carbon monoxide (Spudis, p. 704) acted as a propellant, disrupting and entraining the magma, and creating numerous glassy beads. These fell around the vent as pyroclasts and so built a cone.

recent spacecraft have identified high FeO abundances in the ejecta of crater Buch B (Giguere, et. al., 2000). This crater is approximately 80 km southeast of Gemma Frisius. Such high concentrations of iron are correlated with mafic materials (Cattermole, pp. 207-208, 212). These two items suggest that volcanism has occurred in the general area of Gemma Frisius.

Geology of Lunar Cones

On the Moon, volcanic cones are structures constructed by the accumulation of pyroclastic materials. Pyroclastic materials begin as magmas formed deep beneath the lunar surface. Here decay of radioactive elements such as potassium, uranium, and thorium from a KREEP rich layer (acronym for potassium, rare earth elements, and phosphorus) causes partial melting of the surrounding rock. While it is clear that virtually all KREEP materials are found in the Procellarum region (Jolliff, et. al., 1999), it is also clear that isolated pockets of radioactive elements existed elsewhere. An example of elevated thorium concentrations in a highland region is found in the Compton-Belkovich region, which is the site of a cryptomare (Gillis, et. al., 2002). Our assumption is that one such

This present structure appears to be a lunar cone, in that it is “dark, smooth, circular, slightly dome-shaped, and in an area of know pyroclastic volcanism” (personal communication, Jeff Gillis). The vent is clearly visible, the side walls are relatively lacking in structures, and the shape is similar to cones on the Hawaiian shield volcanoes (Figure 4). This structure is considerably larger than other cones on the Moon, which are generally less than three km in diameter (Basaltic Volcanism on the Terrestrial Planets, p. 757). Nevertheless, the general appearance suggests that it was constructed from pyroclastic materials. This suggestion is certainly supported by the presence of a dark haloed crater in Gemma Frisius.

Geologic History of the Gemma Frisius Region

We begin this history with the formation of the crater Gemma Frisius in the lower Nectarian period. At formation, this crater had a sharp rim, terracing in the side-walls, a central peak(s), and an extensive ejecta blanket. Over the next several hundred million years, numerous impacts distorted and degraded the crater walls (including the impact forming Goodacre; Figure 1, ‘D’).

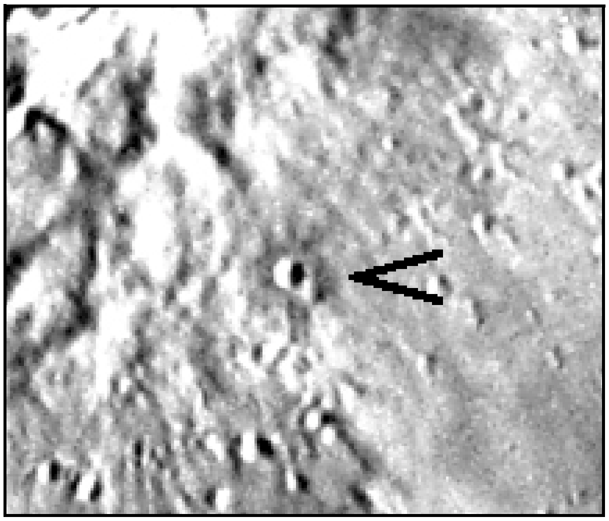

Figure 3: A dark haloed crater southeast of Copernicus. North at top. (From Kuiper, et. al. *Consolidated Lunar Atlas*. Digital Edition, E. Douglass, D19.

During this time, lavas also reached the surface, likely flooding the craters in this region. Because the impacts and flooding were occurring simultaneously, much of the volcanic materials were both destroyed by impacts, and mixed with ejecta. Later basin sized events, such as the Serenitatis (3.88-4.2 billion years of age) and Imbrium impact (3.85 billion years of age) buried these volcanic features with their ejecta (part of the megaregolith). Somewhere in the latter part of this period — but before the Imbrium impact spread its ejecta as light plains material across this region — the cinder cone in Gemma Frisius was formed.

After the Imbrium impact, the rain of meteorites decreased to a much lower rate and contained mostly smaller meteorites and micrometeorites (Heiken, et. al., pp. 83-84). These further eroded the features of the Gemma Frisius region, though at a much slower rate, and built a deep highland regolith. Little has disturbed this region over the last several billion years.

Conclusion

The Gemma Frisius region is yet another example of volcanic features found in the various highland regions of the Moon. It is clear that we can no longer conceive of the Moon's highlands as simple, heavily cratered regions. Much more has occurred throughout their long history, though much of the evidence for these features is either ground up by impacts or covered under layers of ejecta. Nevertheless, with careful study, some of the highland's fascinating geologic history is still being uncovered.

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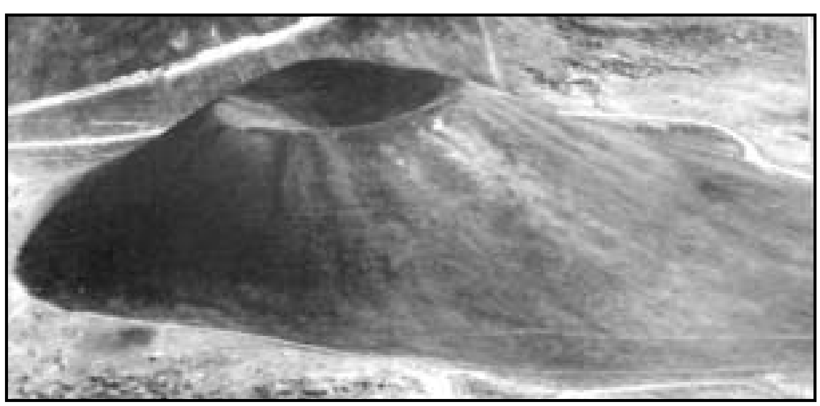


Figure 4: A volcanic cinder cone in Hawaii. (From Carr and Greeley, Volcanic Features of Hawaii, p. 37.

ALPO Features: The Moon
Those Unnumbered Reports of Lunar Changes – Were They All Blunders?

By: Walter H. Haas, ALPO director emeritus

ABSTRACT

Lunar changes are physical variations in lunar features. Reports of such changes over several centuries have been most numerous, but they are also very controversial. They are suspect because of great changes in the appearance of lunar features with changing solar lighting, atmospheric dispersion, and other causes. A very brief outline of the history of reported lunar changes is followed by a discussion of solar lighting parameters. A number of examples of such changes are described, some from experienced and respected lunar observers. A few possible interpretations are offered. Special interest must attach to a brilliant flare, near the crater Pallas, both seen and photographed by Leon H. Stuart on November 15, 1953.

Introduction and Historical Perspective

It was natural for the early telescopic observers to try to make the Moon like the Earth. Thus, they named lunar seas, which are nothing of the sort, mountain ranges, which actually are, and craters, which are many magnitudes more numerous than on our primary planet.

Increasing knowledge showed the Moon to be a very different world, especially with the lack of any noticeable atmosphere. There now began to be reports of changes in the appearance of lunar features. The best known example is the small crater Linné in the Mare Serenitatis. I shall attempt to add nothing here to a very extensive literature on a long controversy. It must be embarrassing to many visual observers that recent excellent photographs from space show Linné to be the most ordinary of lunar features.

Many outstanding lunar observers have insisted that changes in lunar objects do occur. The list includes J. H. Schroeter, Schmidt of Athens, W. H. Pickering, W. Goodacre, H. Percy Wilkins, Robert Barker, R. M. Baum, Patrick Moore, and Winifred Cameron. Perhaps they would not have been keen lunar observers without this motivation. The eminent German lunar cartographer Philip Fauth was a notable exception, finding the Moon changeless; and in more recent years such skilled observers as Elmer Reese and Alika Herring did not record lunar changes. The role of Devil's Advocate has been very capably played by William Sheehan and Thomas Dobbins in a recent article (1).

Very probably motivated by Kozyrev's 1958 report of spectrographic evidence for transient gas emission from the central peak of Alphonsus and by the Greenacre-Barr 1963 record of temporary reddish glows in the Aristarchus region(1), amateur lunar observers in the 1960's found lunar changes in great profusion. They entered the words "Transient Lunar Phenomena" into our vocabulary. It almost seemed as if an inexperienced observer could discover an "event" whenever he or she looked at the Moon! In truth, it is critical that we be very familiar with the normal appearance of a lunar feature before we announce that something abnormal is occurring there.

The Argus Astronet system did indeed achieve, by radio, the badly needed rapid communication among widely separated observers; but one must fear that enthusiasm often went unmixed with good judgment or lunar observing experience. If we are told, for example, to look for "that circular white spot at the top of the dark band on the west inner wall of Aristarchus", agreement scarcely constitutes independent confirmation.

Changing Solar Illumination and Other Problems

To skeptics, all visual observations will always be suspect. They are subject, and in ways not easily quantified, to spurious changes caused by such parameters as the aperture and optical quality of the telescope, the magnification employed, the height of the Moon above the horizon, the atmospheric transparency, the atmospheric steadiness or "seeing", and perhaps most troublesome of all, the complex "personal equation" of the observer. Some of these factors affect the more objective non-visual observations as well.Yet if we are looking for lunar changes, still worse problems arise when we seek to compare observations of a lunar feature made under different solar illuminations, and even in addition under changing directions to the terrestrial observer. It is instructive, for example, to perceive the strikingly different aspects of the crater Eratosthenes near its sunrise and near Full Moon (2).

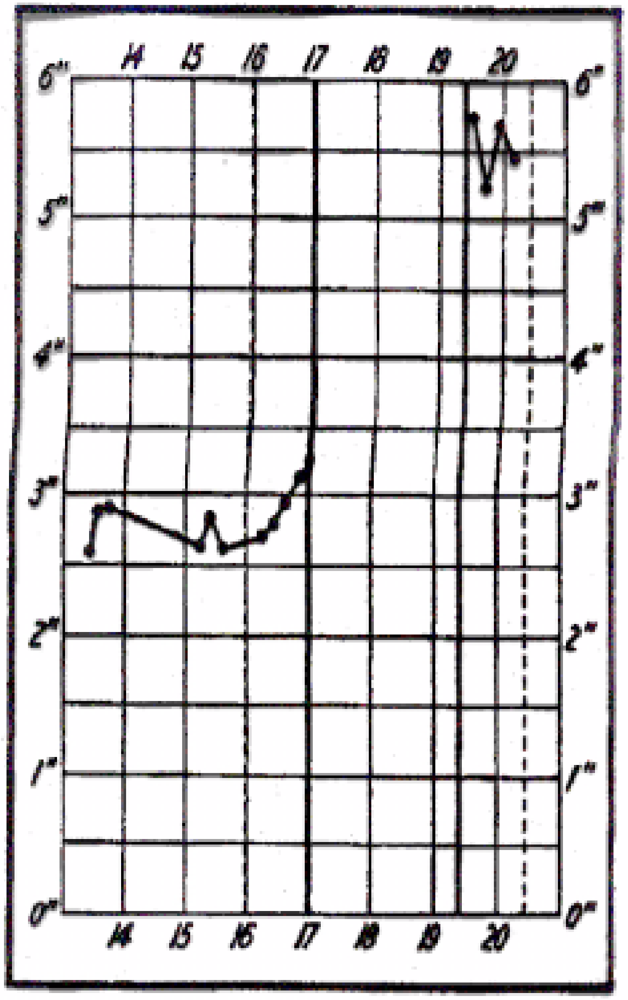


Figure 1. Graph of diameter of Linné White Area during total lunar eclipse of October 16, 1902. Arcseconds vs. Greenwich Mean Time in hours. No measures while in umbra. See also text.

The Sun's selenographic colongitude is a good initial approximate measure of the solar illumination of the Moon — much better than just the Moon's phase. "Colongitude" is defined as the lunar western longitude, between 0 and 360 degrees, of the sunrise terminator at the Moon's equator, where EAST and WEST, throughout this paper, are in the astronautical sense adopted by the International Astronomical Union (IAU) so that Mare Crisium is in the Moon's east hemisphere.The colongitude for a given date and time can be determined from data in many books and ephemerides(3). Its value is APPROXIMATELY 0 degrees at First Quarter, 90 degrees at Full Moon, 180 at Last Quarter, and 270 at New Moon. It increases at a slightly variable rate of 0.5 degrees per hour or 12.2 degrees per day.

Since the Moon's equator is tipped by 1.54 degrees to the plane of the ecliptic (compared to 23.44 degrees for the Earth), colongitude must often be supplemented by the Sun's selenographic latitude to get an adequate measure of the solar lighting at a specified point on the Moon. The need for this correction increases as we move farther and farther away from the Moon's equator and especially when we are near the sunrise or sunset terminator.

The height of the Sun above the horizon at a particular point on the Moon can be expressed in terms of the lunar longitude and latitude of that point and of the Sun's selenographic colongitude and latitude. Though presumably usually less important, the Sun's azimuth for an observer on the Moon can also be similarly expressed. I can send to interested readers several pages with the mathematical details. Other observers may find the needed information in various computer-related sources; I especially recommend Harry Jamieson's *Lunar Toolkit* software program (26).

We now have the solar illumination when we want to check on reported lunar changes; but the Moon's librations in latitude and longitude may also affect the observed appearance, especially near the limb of the Moon. Indeed, in extreme cases a lunar object's aspect can range from greatly foreshortened visibility to invisibility on the averted hemisphere.The needed values of the Sun's selenographic latitude and the lunar librations can be found in almanacs(3).

A further complication is the diurnal libration, which depends on the position of the observer on the Earth's surface and which can be as great as one degree. Finally, lunar changes may be correlated not with solar lighting alone but with such parameters as tidal effects and the Earth's magnetic tail (32).

If the evidence for a lunar change now demands two or more observations at the same selenographic colongitude and latitude, and also with the same values of the two principal lunar librations, we may doubt that we shall ever have such an identity. Perhaps the suggested criteria are too severe. Except near the terminator, the aspect of a lunar feature may undergo no detectable changes while we watch for an hour or two, and hence while the Sun moves half a degree to a full degree in the lunar sky and the Earth's direction from the Moon also changes a little. Remember that the Sun's diameter in the lunar sky is about half a degree, just as in the Earth's. Just how close agreement in the four parameters do we require?

A word of caution is in order here. Unless a star is in the zenith, differential refraction in the Earth's atmosphere transforms its image into a short spectrum, blue or violet at the top and red at the bottom. Remember the "Green Flash" at the top of the rising or setting Sun. In a more subtle way, this atmospheric dispersion can generate false colors for lunar and planetary observers (12), and we must be suspicious of red or blue spots and streaks, at the bottom and top respectively, of lunar features brighter than their surroundings. (Objects darker than their environs can give the reverse effect.) This cause of illusions varies with the changing altitude of the Moon, being greatest at the observer's horizon. The brilliant crater Aristarchus has been a rich source of reported Lunar Transient Phenomena (1), and the critical student of lunar changes must consider atmospheric dispersion in his interpretation.

Now I shall offer for your interest, or perhaps amusement, a number of examples of reported lunar changes or of unusual appearances on the surface of the Moon. The selection is a haphazard one from among hundreds or even thousands of examples. However, I have chosen to go back many years, before LTP's were so fashionable in the 1960's, in the thought that evidence was more objective when the observer reporting a lunar change might expect skepticism or even ridicule.

These unusual lunar appearances went unconfirmed with very few or no exceptions. Efforts to find other observers examining the same lunar feature at the same time regularly failed.

This One Was a Blunder

On June 3, 1954, a C.S.T. evening date, Mr. Frank Edwards, then a news reporter and commentator, announced a discovery by a Mr. Frank Manning of a "dark line" on the floor of the lunar crater Piccolomini, extending from the center outward to the wall (4). It was later asserted that the "new marking" had been photographed at several observatories and had been seen by 60 visitors on a public night. Nothing of the kind could be found by a number of leading lunar observers of the 1950's. In truth, on June 3 Piccolomini was not even illuminated by the Sun – but the crater Petavius was, barely inside the sunrise terminator at the time of the "discovery". On the floor of Petavius, a conspicuous cleft runs from the central mountains to the southwest wall. As Mr. Patrick Moore has pointed out, this alleged lunar change is simply a misidentification (5). It shows that lunar observers will do well to guide their steps over the Moon by a source like Mr. Rükl's excellent *Atlas of the Moon*.

Flashing Lunar Mountain and Reddish Area

A second example cannot be so quickly discounted. On January 24, 1956, R. Houghton, INDEPENDENTLY confirmed by Brian Warner, was surprised to see intermittent flashes from the west (inner?) wall of crater Cavendish, then a little inside the sunrise terminator(6). The observers have the greatest confi-

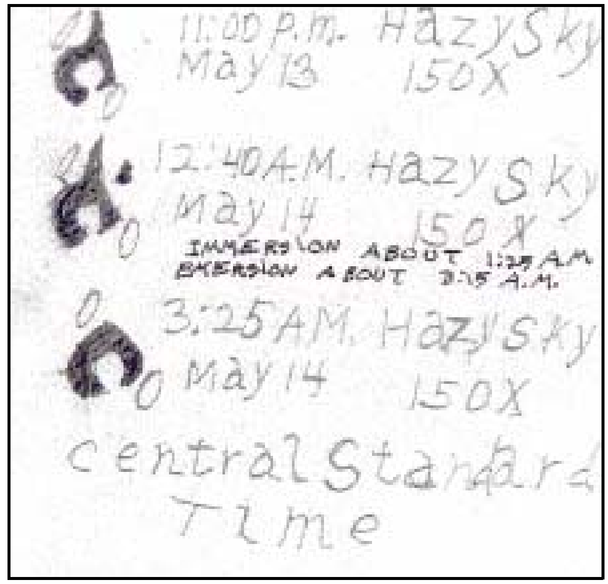


Figure 2. Sketches and notes by Noah W. McLeod of dark area in Riccioli during total lunar eclipse of May 14, 1938. Olcott 5-inch telescope. See also text.

dence that the effect was NOT an optical illusion. They employed a 17-cm. reflector at 230x in seeing good to excellent. First noted at 20 hrs., 34 min., Universal Time (U.T.), the flashes evidently began with a bright glare, continued very bright for about 3 minutes, and then slowly faded until they had disappeared by 20 hrs., 45 min., U. T. There were approximately 1½ flashes per second. Other lunar peaks in the neighborhood were of constant intensity. There were definite indications of reflections of the flashes from the east (inner?) wall of Cavendish, and its floor was faintly lit by the glare.

Finding an explanation for the flashes may be puzzling. Light falling on a symmetrical crystalline surface might produce what was observed, but is such a surface likely to exist at the top of a lunar peak or wall? For those wishing to try to repeat the observation we give the illumination parameters: colongitude 54.5 degrees, Sun's latitude 1.14 degrees north, Earth's selenographic longitude 3.04 degrees west, and Earth's latitude 1.06 degrees north.

Another unusual lunar observation was made by Richard M. Baum on January 21, 1951; he found a red-tinted area to the west of the lunar crater Lichtenberg (7). He employed an 8-cm. refractor at 90x and 100x in seeing fair to extremely good. The tiny red spot was first noticed at 18 hrs., 19.2 min., U.T., and had faded to invisibility by 18 hrs., 38.5 min. Its center was carefully estimated to be near lunar latitude 31 degrees, 24.2 minutes north, longitude 66 degrees, 10 minutes west. Mr. Baum made every effort to rule out atmospheric dispersion as a cause of the red coloration, though it is true that the Moon was rising higher in the sky as the color faded.

It is curious that the 19th century lunar observer Maedler once saw a reddish tint, never later confirmed, near the east wall of Lichtenberg (8). Efforts by David P. Barcroft and Walter H. Haas to recover this hue in the 1940's had limited success; at most they recorded a reddish brown or coppery coloration.(7).

Mr. Baum has suggested that perhaps we are dealing with the reflection of sunlight from some crystalline deposit under very limited conditions of solar illumination. When he first saw the red spot, these conditions were as follows: colongitude 76.67 degrees, Sun's latitude 1.24 degrees south, Earth's longitude 2.57 degrees west, and Earth's latitude 6.07 degrees south.

Transient Bright Spots

We next note two reports of temporary, stationary bright spots on the lunar surface – their total number is legion, but they were to my knowledge always unconfirmed by other visual observers. The first is by a British observer, Mr. F. H. Thornton, using a 23-cm. reflector at 220x (10). On October 19, 1945, at 23 hrs., 24.5 min., U.T., and thus only 30 hours before Full Moon, Mr. Thornton remarked a minute but brilliant flash of light just inside the eastern border of the walled plain Plato. Its color was "on the orange side of yellow". His drawing shows three craters on the floor of Plato. The second report is from A. W. Mount on September 3, 1944, at 3 hrs., 40 min., U.T., with a 20-cm. reflector(11). A small bright point of light appeared suddenly close to the west wall of Plato, glowed briefly as by far the most conspicuous object in the lunar field of view, and vanished quickly after approximately two seconds. It was star-like in appearance and was stationary on the Moon's surface. The Moon was seven hours past Full. The view was good enough that the near-central craterlet in Plato was very evident. Mr. Mount remarked: "To the writer, however, the distinctness and the complete sense of reality of the object observed, the entire absence of illusions of a similar appearance either before or since [up to 1947], and the fixed position in the field of view all point to this object as a lunar feature and leave no doubt of its objective nature".

Of course, terrestrial meteors exactly at their radiants in front of the Moon can explain the Thornton-Mount observations and many others, but the mathematical probability that all such meteors moved EXACTLY on the line of sight to the Moon is exceedingly small. Neither does it appear easy to invoke other bright objects in the Earth's atmosphere.

An Obscuration in Plato?

The literature abounds with references to "obscurations", when detail readily found under less favorable conditions of observation simply could not be distinguished. We give an example involving skilled lunar observers and unusually large apertures. On November 23, 1920, W. H. Steavenson with the 71-cm. Greenwich refractor made a detailed drawing of the walled plain Plato and showed a large craterlet, with an interior shadow, perhaps 8 km inside the west wall. The feature was then almost as conspicuous as the famous pair of craterlets in the north central part of Plato. Near 20 hrs., 45 min. U.T., on April 3, 1952, H. Percy Wilkins and Patrick Moore examined Plato critically with the Meudon 83-cm. refractor at 460x

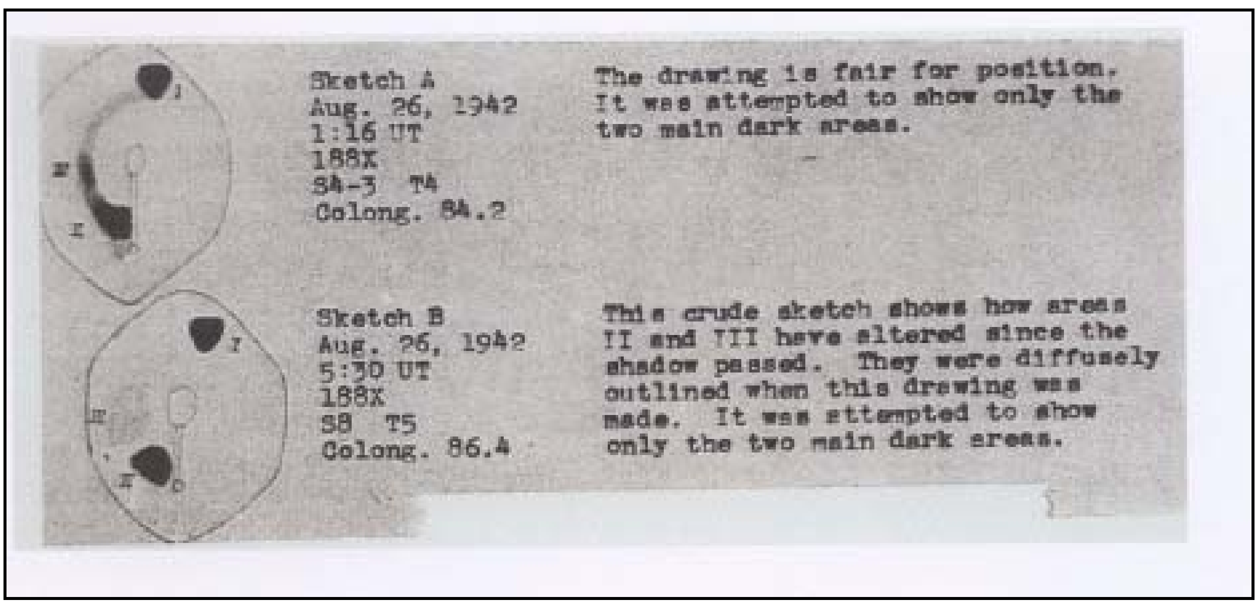
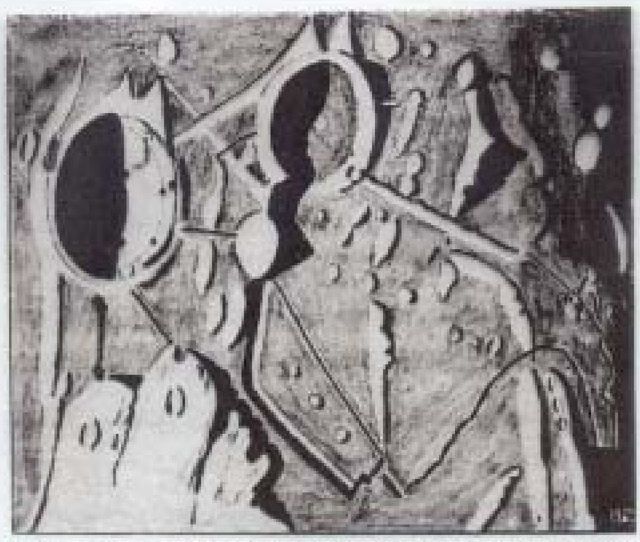


Figure 3. Rough sketches by Walter H. Haas of major dark areas in Atlas during total lunar eclipse of August 26, 1942. 15-cm. reflector. Seeing (S) on scale of 1 to 10 with 10 best. Transparency (T) on scale of 1 to 5 with 5 best.

near colongitude 16 degrees (low morning lighting) under excellent conditions. They could not see a trace of Dr. Steavenson's craterlet (13,14). They **did** see the four familiar crater-cones very plainly, plus many small white spots. About 6 hours later, near 2 hrs., 45 min. U.T., on April 4, 1952, T. A. Cragg observed Plato with a 31-cm. reflector at 420x in fairly good seeing (15). He was amazed to see absolutely NOTHING on the floor of Plato, even though he soon thereafter drew some lunar detail elsewhere which is ordinarily much more difficult than the four major floor craterlets in Plato.

It is tempting to FANCY that some obscuring medium concealed Steavenson's craterlet when Wilkins and Moore observed and had spread eastward over the whole floor of Plato before Cragg observed. But on our atmosphereless Moon? Were all the observers just badly mistaken?



VII. Aristarchus, Herodotus, and the Serpentine Valley (Dr. H. P. Wilkins, F.R.A.S.). The gr crater-valley extending northwards from Herodotus is well seen, although the Cobra-Head is mark by shadow. Several of the clefts shown in the drawing, which was made March 30, 1950. b Dr. Wilkins using his 15½-in. reflector, were new discoveries.

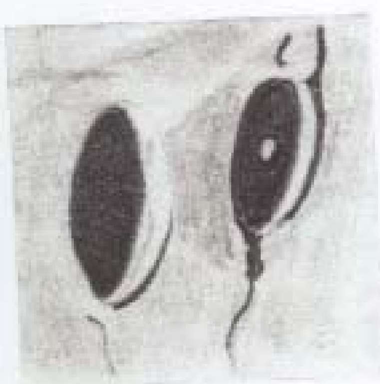


Figure 7. Aristarchus-Herodotus
June 27, 1950
2h 30m U.T. Col. 53°.2
3.5-inch reflector at 100X
T-3 S-4
James C. Bartlett, Jr.

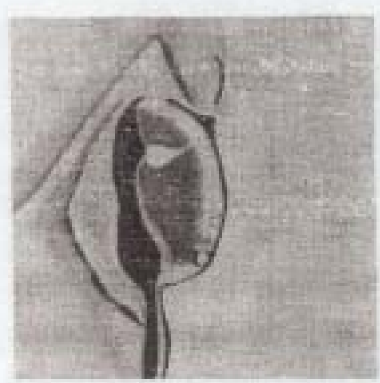


Figure 9. Herodotus
Sept. 10, 1954
2h 00m U.T. Col. 59°.9
6-inch reflector at 220X
S-3 to S-4 T-4
E. J. Reese

Figure 4. Selected drawings of Aristarchus-Herodotus Neighborhood on Moon. Same seeing and transparency scales as on Figure 3. See also text.

Lunar Changes and Lunar Eclipses

When it was just barely permissible to talk about snow, clouds, and primitive plants on the Moon, it was also permissible to wonder whether the very great temperature changes occurring on the lunar surface during an eclipse of the Moon might cause some changes. A proper visual search for such eclipse-caused changes required watching our selected lunar subject very carefully just as it entered the umbral shadow and just as it left. A complication was that our lunar feature was lit more and more dimly by the Sun as it became closer to the edge of the umbra. It further was important, when an eclipse-caused change was suspected, to examine the lunar feature carefully in other lunations at the same solar illumination; there are often opportunities 59 days before the date of the eclipse (2 synodic months) and also 59 days after.

The few positive reports of lunar changes during lunar eclipses would support three conclusions:

1. Most lunar features are totally unaffected.
2. A few objects do show apparent changes related to the shadow's passage. These effects are temporary, lasting at most a few hours.
3. A lunar feature altered by an eclipse will behave differently at different eclipses.

The most striking eclipse-related change known to me concerns the white spot surrounding crater Linné at Full Moon. On October 16, 1902, William H Pickering found this spot so greatly enlarged when it first emerged from the umbra that he initially doubted its identity (16). The amount of the enlargement was 2.75 arcseconds, and there was no decrease in size for 45 minutes after the shadow had left. The evidence consists of an extensive set of filar micrometer measures obtained with the Harvard 38-cm. refractor at 550x in seeing fairly good and nearly uniform throughout the observations. See Figure 1.

Lunar observers are familiar with the heart-shaped dark area in the walled plain Riccioli near Full Moon. At the eclipse of May 14, 1938, Noah W. McLeod with a 13-cm. telescope at 150x found the south tip of this dark area to be missing when Riccioli left the umbra and to be still absent 30 minutes later (17). Mr. McLeod wrote on June 7, 1938: "There is no doubt but that the southern tip of the spot had vanished after totality". See Figure 2.

One more eclipse example will suffice. I summarize my studies of the crater Atlas during the total eclipse of August 26, 1942, with a 14-cm. reflector (18). Atlas was in the umbra from 2:53 to 5:13, U.T. Views from 1:15 to 2:50 showed the two expected Full Moon very dark areas, one near the south wall and one in the northeast part of the floor; and the latter exhibited a fainter southern extension, which was joined to the southern dark area by a faint, narrow, and curving dark band. At 5:30, the post-eclipse aspect of Atlas amazed the observer. The aforementioned southern extension had faded almost to invisibility, and appeared to be diffusely outlined; and the curving band could not be seen. These changes are the more certain because the seeing since totality had become very good. (No one will believe me now!)

This aspect was much the same at 5:56 and 7:09; at 7:59 and 8:41 the affected areas were thought to be slowly darkening. At 9:04, the connecting band was seen for the first time since totality, in spite of worsening seeing; and indeed, the pre-eclipse aspect was almost re-established, confirmed to be the normal aspect by observations on August 27. See Figure 3.

As a young man, I felt very confident that I had witnessed a change on the Moon. As an old man, I still think so, but must confess to being unable to offer an explanation.

Some Oddities in the Lunar Craters Herodotus and Conon

Reports of appearances and disappearances of lunar craterlets, peaks, spots, rilles, etc., are legion. A curious example is a brilliant white spot observed in the center of Herodotus, when the crater was full of early morning shadow, by James C. Bartlett, Jr. on June 27, 1950, with a 9-cm. reflector at 100x (19). The

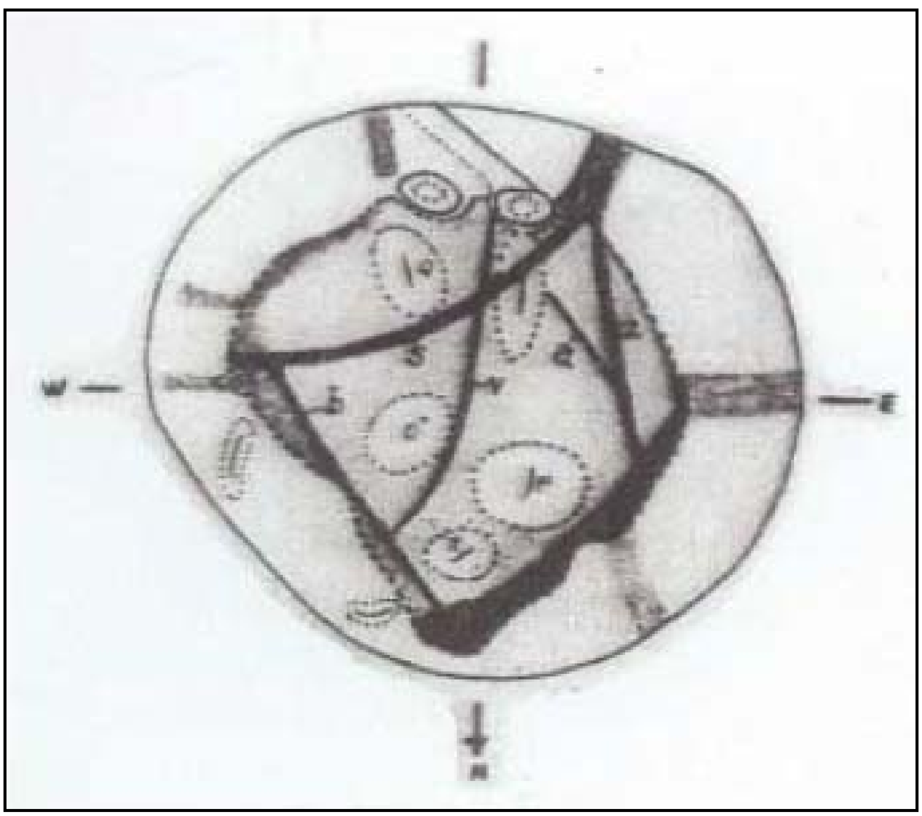


Figure 5. Map of Lunar Crater Conon by Elmer J. Reese. Based upon many observations by himself and others, chiefly in 1947-49.

Figure 6. Photograph of Moon by Leon H. Stuart on November 15, 1953 with an 8-inch reflector at 2 hours , 0 minutes , Universal Time. Note the very bright "flare" near the middle of the terminator.See also discussion in text. Image contributed by Leonard B. Abbey.

same central white spot is present on a detailed drawing by H. Percy Wilkins on March 30, 1950, when he used a 38-cm. reflector (20). While we quickly think of a central peak, a whole series of outstanding lunar observers agree that the floor of Herodotus shows NO central peak, and indeed not much of anything else. Though Bartlett occasionally drew the "peak" in casual views of Herodotus on other dates in 1949-50, he was amazed to find it missing when he started a critical study of this part of the Moon in 1954. Several other ALPO observers contacted by Bartlett in 1954 fully agreed with him in finding no central bright spot (19). There is assuredly nothing on Mr. Rükl's map of the Moon (21). It has been suggested that the central white spot is a field of rock crystals, reflecting a limited portion of the brilliantly sunlit west inner wall in a narrow beam (22). The beam then reaches the terrestrial observer only under very limited conditions of solar illumination and librations. See Figure 4.

It is interesting that I myself observed a striking abnormally light shadow here in Herodotus on August 11, 1954, near 2:28, U.T., with a 32-cm. reflector at 303x (28). The shadow had gradually regained its normal blackness by 5:20,U.T. The shadow was quite normal under similar lighting on October 9, 1954, and on several 2002 dates. At 2:28 on August 11, the Sun viewed from the center of the floor of Herodotus had a height of 3.45 degrees and an azimuth of 92.41 degrees (28). Harry Jamieson's *Lunar Toolkit* software program can enable us to plan future observations when the solar lighting is almost identical (26).

By now enough has been said about apparent lunar changes that a reader must heartily agree with Mr. Rükl that "any observer wishing to search for such events will soon find that it is an exacting and problematical undertaking" (23). We present the experience of Mr. Elmer J. Reese on the crater Conon half a century ago. He supplemented his prolonged visual studies with detailed examinations of prints made from Lick, Yerkes, and Mount Wilson photographs of the Moon (24).

The nomenclature referenced below is that on Reese's personal map of Conon (25). The map appears here as Figure 5. Curiously, he found his "Streak S" completely absent on those photographs examined, even though the visual evidence for its existence (and occasional prominence) appears incontestable. He further noted (24): "On December 20, 1950, at colongitude 39.1 degrees, I found 'S' distinctly visible as a narrow dark line. 'Z' was also clearly seen, being slightly fainter than 'S'. 'A' was not seen, ALTHOUGH LOOKED FOR. Now Lick Photo M3 [at colongitude 37.5 degrees] clearly shows 'A' and 'V' but not 'S' or 'Z'. However, Yerkes Photo M2 [at colongitude 25 degrees] very clearly shows 'Z' and 'A' but not 'S' or 'V' (except for north end). This is all very confusing, isn't it?"

Brilliant Lunar Flare and Suggested Impact-Crater

What is the best we have saved for the last. On November 15, 1953, Dr. Leon Stuart took four plates of the First Quarter Moon in order to determine photographic focus on star fields(9,27). When he removed the last plate near 2 hrs., 0 min., Universal Time, colongitude 14.6 degrees and the Moon 18 hours past First Quarter, he was surprised to see on the ground glass a very bright spot near the middle of the terminator. The spot moved with the Moon image. When the plate was quickly developed, the spot was clearly present on it. We thus have BOTH visual and photographic evidence of its reality. Figure 6 is taken from a copy of the original photograph, and Figure 7 is a more detailed view of the immediate vicinity of the spot. When Dr. Stuart was able to look again 10 minutes later, the spot was gone. Careful re-enactment of his telescope procedures indicated to him that the spot was under observation for about 8 seconds. Neither its beginning nor its disappearance was seen. His estimated position of the center of the bright spot on the Moon was three-fourths of the distance from crater Schroeter to crater Pallas. John Westfall who serves as a peer reviewer for articles which appear in this Journal has now obtained these values from a series of measures: longitude 3.31 degrees west, latitude 4.30 degrees north, RMS error +/- 2.2 km.(29). Since there was only one photograph to measure, the RMS was determined from the RMS errors of the 8 control points near the position of the spot.

If the spot, or should we really call it a "flare," was seen, it was not a photographic flaw. If it was photographed, it was not a visual illusion. If it moved with the Moon's image and endured for 8 seconds or more, it was not a bright meteor seen head-on nor any other object located between the observer and the Moon. The only remaining explanation must be the tremendous explosion following the impact of a very large meteoroid on the Moon.

It was hence exciting news when Bonnie Buratti and Lane Johnson proposed that an apparently fresh, unusually blue, rayed 1-km. craterlet close to the site of the 1953 flare had been created by the impact Stuart observed (30). Their craterlet was present on a Clementine image from 1994 and seemingly absent on pre-1953 photos. We might like the story to end there. However, Westfall has identified and measured the suggested craterlet on a Clementine image mosaic and on four old, high-resolution photographs of the Moon, two of them BEFORE 1953(29). He places the craterlet at 2.31 degrees west longitude, and 3.92 degrees north latitude, RMS 0.6 km. The center of the Stuart spot is thus about 32 km. (note position above) — or fully 14 standard deviations — WNW of the Buratti-Johnson feature. It is not thought that seeing tremors or geometric perspective on a lunar fireball produced at impact can possibly explain the discrepancy.

Perhaps finding the craterlet whose creation Dr. Stuart witnessed must await our return to the Moon.

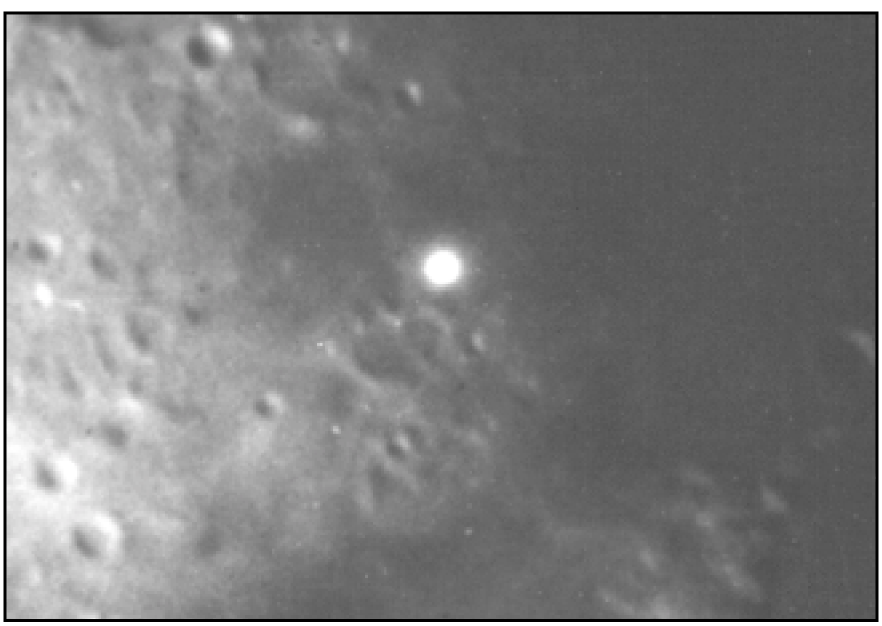


Figure 7. Immediate vicinity of lunar "flare" photographed by Leon H. Stuart on November 15, 1953. Image contributed by Leonard B. Abbey.

Concluding Remarks

There are those who think that the Moon is geologically very dead, with the only events on its surface the impact of meteoroids and very occasional minor planets(1,31). Others will attach more weight to careful records by respected observers, such as some in this article, however they are to be explained. Dr. Anthony Cook directs the Lunar Transient Phenomena studies of both the BAA and the ALPO. He provides his observers with a monthly newsletter; it reports current observations and lists lunar objects needing observation when coming solar lighting is similar to that when past oddities were reported.

Remember, we can watch the Moon from our own backyard, with no need to travel to a distant dark-sky site. Such systematic observations have already suggested ordinary explanations of some reported past LTP's. Perhaps they will also eventually show that a few things do happen on the Moon.

It is a pleasure to thank Mr. J. O. Hughes of Las Cruces, NM, for most valuable help with the illustrations in this paper.

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ALPO Feature: Mars
Predicted Views of the August Apparition

By Dan Troiani, Mars Section coordinator

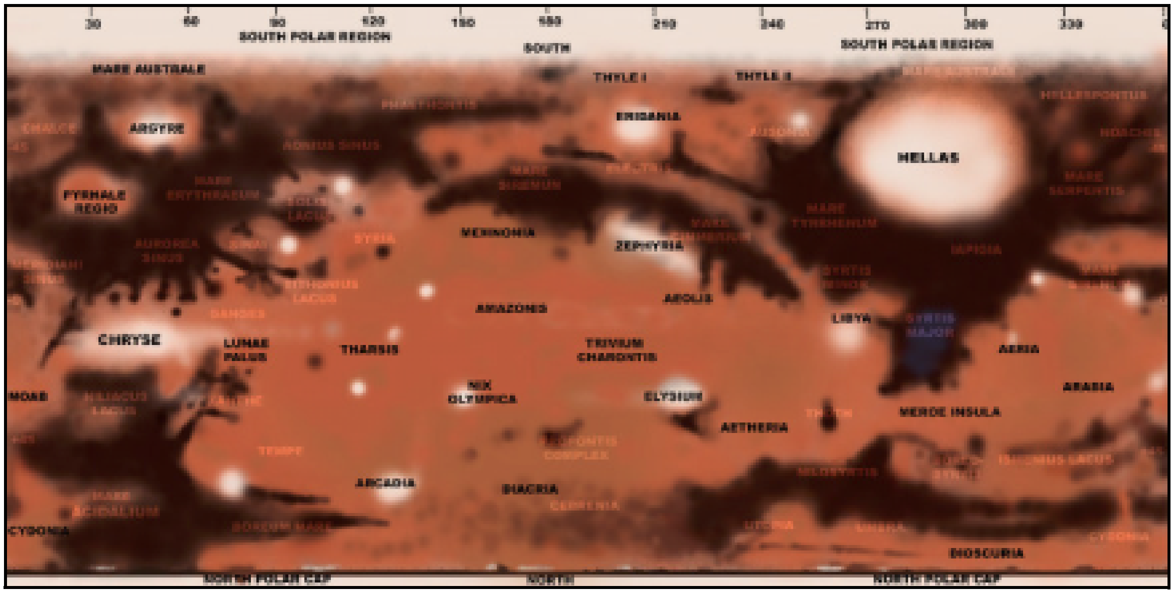


Figure 1: Color version of the 2000-2001 Mars apparition map. South is at top. The white seen over the South Polar Region during most of the observing season is the South Polar Cap. North is at bottom and shows the bright white North Polar Cap as seen close to opposition date displaying the NPC outliers. Most white areas were clouds, with the "Syrtis Blue Cloud" over Syrtis Major at times. Fog was in the Hellas region and Chryse had a mix of white clouds with a little dust. Orographic clouds were observed over great volcanoes in the Tharsis region. This map was produced by the author using the computer program "PhotoStyler". The hues and colors fit the CCD images perfectly. It was produced using all the data (CCD's, drawings, and photos) that were made using the Meade 12-inch LX200 and in June, 2001, the Meade 8-inch LX200 from the Florida Keys. The original black and white surface map took about 45 hours of computer time to produce. The data from the ALPO Mars Section was used to verify all the features in this map.

Figure 2: Mars as it should appear at its closest approach to Earth in over 59,000 years. Meridiani Sinus is on the central meridian, with Mare Acidalium to the right with white clouds that usually appear in Chryse. Syrtis Major is on the evening limb to the left. Above Syrtis Major is the Hellas region as it appears when filled with fog. There are also clouds in Argyre along with some south polar clouds on the top limb. The small North Polar Cap is at the bottom of the image.

Mars Globe Data
South at top, with view as seen in a simply inverting telescope.
Date: August 27, 2003
C.M. = 0 degrees at 01:32 UT
Ls: 249 degrees
De: -19.0 degrees
Ds: -23.7 degrees
Diameter.: 25.1”
Visual magnitude: -2.9
Dec.: -15.7 degrees
R.A.: 22:38.8

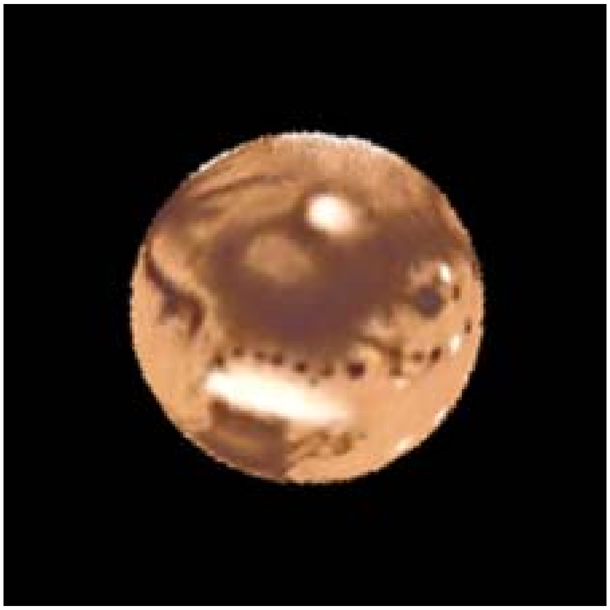


Figure 3: Meridiani Sinus is near the evening limb, with Mare Acidalium directly on the central meridian with white clouds that usually appear in Chryse; these white clouds sometimes appear slightly brighter when a red filter is used, as some dust can get mixed in with the clouds. There are also clouds in Argyre along with some south polar clouds on the top limb. The small North Polar Cap can be seen on the bottom of the image. The Tharsis region is to the right near the morning limb. Solis Lacus is near the southern morning limb.

Mars Globe Data
South at top, with view as seen in a simply inverting telescope.
Date: August 27, 2003
C.M. = 45 degrees at 04:37 UT
Ls: 249 degrees
De: -19.0 degrees
Ds: -23.7 degrees
Dia.: 25.1"
Visual magnitude: -2.9
Dec.: -15.7 degrees
R.A.: 22:38.8

Figure 4: Mare Acidalium is on the evening limb with white clouds that usually appear in Chryse. As stated in Figure 3, these white clouds sometimes appear slightly brighter when a red filter is used as some dust can get mixed in with the clouds. There are also clouds in Argyre along with some south polar clouds on the top limb. The small North Polar Cap can be seen on the bottom of the image. The Tharsis region is seen to the right of the central meridian. Solis Lacus is directly on the central meridian with Tithonuis Lacus just below it. The large bright white cloud just south of the north polar region is Nix Olympica.

Mars Globe Data
South at top, with view as seen in a simply inverting telescope.
Date: August 27, 2003
C.M. = 90 degrees at 07:42 U.T.
Ls: 249 degrees
De: -19.0 degrees
Ds: -23.7 degrees
Dia.: 25.1"
Visual magnitude. : -2.9
Dec.: -15.7 degrees
R.A.: 22:38.8

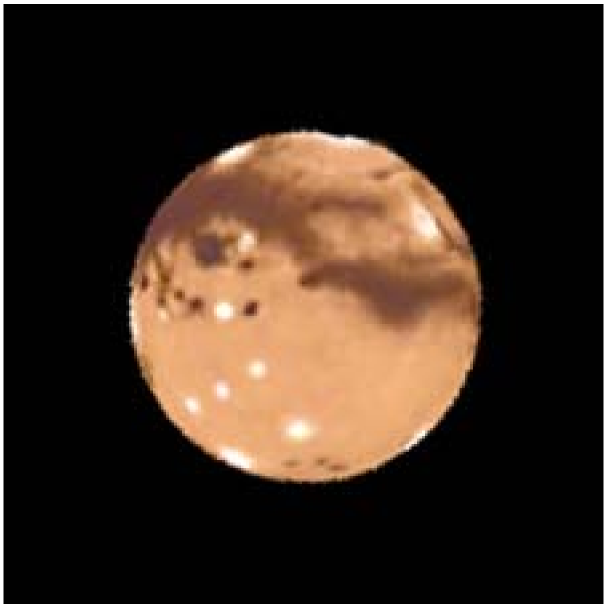


Figure 5: The small North Polar Cap is at the bottom of the image, with the Tharsis region to the left of the central meridian. Solis Lacus is directly on the evening limb in the south with Tithonius Lacus just below it. The large bright white cloud just south of the north polar region is Nix Olympica, while above Nix Olympica is the great Amazonis region.

Mars Globe Data
South at top, with view as seen in a simply inverting telescope.
Date: August 27, 2003
C.M. = 135 degrees at 10:47 U.T.
Ls: 249 degrees
De: -19.0 degrees
Ds: -23.7 degrees
Dia.: 25.1"
Visual magnitude: -2.9
Dec.: -15.7 degrees
R.A.: 22:38.8

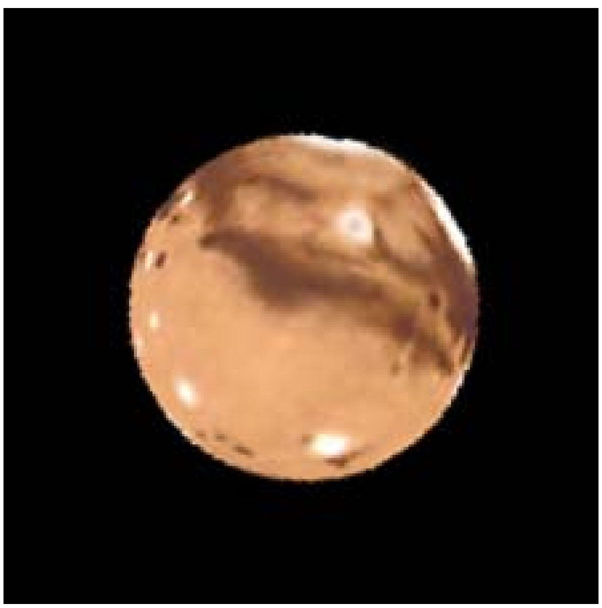


Figure 6: The small North Polar Cap can be seen on the bottom of the image, and the desert region directly on the central meridian is Amazonis. To its left and slightly north is Nix Olympica. Occasionally, this volcano can be seen when it's covered by white clouds. The two very dark features in the south are Mare Sirenum and Mare Cimmerium.

Mars Globe Data
South at top, with view as seen in a simply inverting telescope.
Date: August 27, 2003
C.M. = 180 degrees at 13:51 U.T.
Ls: 249 degrees
De: -19.0 degrees
Ds: -23.7 degrees
Dia.: 25.1"
Visual magn. : -2.9
Dec.: -15.7 degrees
R.A.: 22:38.8

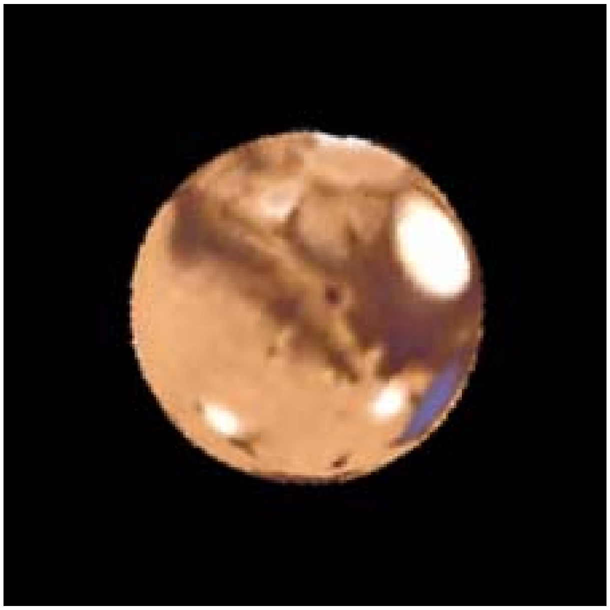


Figure 7: The small North Polar Cap can be seen on the bottom of the image, while just off the central meridian to the left is Elysium, a region that can exhibit white cloud features. Just north of it is the dark feature Aetheria, which is a widely variable feature that needs to be watched. Another area that occasionally exhibits white cloud features is Libya, which is right next to Syrtis Major (at right on globe).

Mars Globe Data
South at top, with view as seen in a simply inverting telescope.
Date: August 27, 2003
C.M. = 225 degrees at 16:56 U.T.
Ls: 249 degrees
De: -19.0 degrees
Ds: -23.7 degrees
Dia.: 25.1"
Visual magn. : -2.9
Dec.: -15.7 degrees
R.A.: 22:38.8

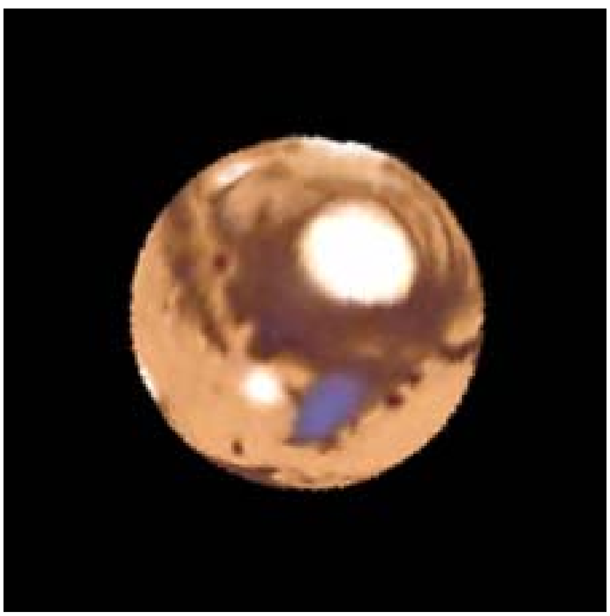


Figure 8. The small North Polar Cap can be seen on the bottom of the image. The large dark albedo feature directly on the central meridian is Syrtis Major. To its south is the large impact region Hellas. Hellas can fill in with fog at times and appear as bright as the polar caps. It is sometimes mistaken for the South Polar Cap.

Mars Globe Data
South at top, with view as seen in a simply inverting telescope
August 27, 2003
C.M. = 270 degrees at 19:59 U.T.
Ls: 249 degrees
De: -19.0 degrees
Ds: -23.7 degrees
Dia.: 25.1"
Visual magn. : -2.9
Dec.: -15.7 degrees
R.A.: 22:38.8

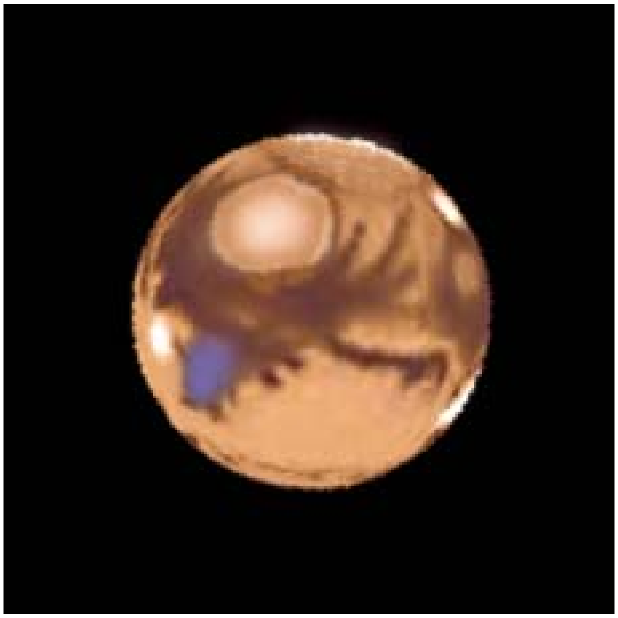
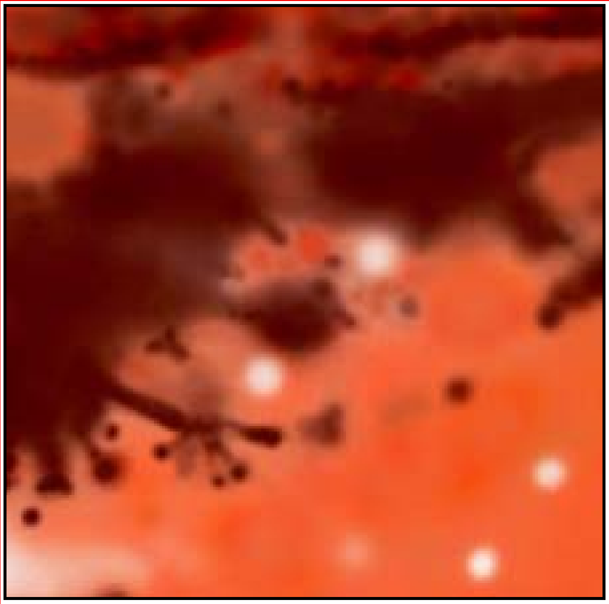


Figure 9. The small North Polar Cap can be seen on the bottom of the image. Syrtis Major is to the left of the central meridian, with the desert region of Aeria to its right. The albedo feature Sinus Sabaeus is near the center of the following limb with the Edom region just to its north. This is where the flashes were observed in June 2001.

Mars Globe Data
South at top, with view as seen in a simply inverting telescope.
Date: August 27, 2003
C.M. = 315 degrees at 23:04 U.T.
Ls: 249 degrees
De: -19.0 degrees
Ds: -23.7 degrees
Dia.: 25.1"
Visual magn. : -2.9
Dec.: -15.7 degrees
R.A.: 22:38.8



Solis Lacus, the "Eye of Mars"

Central latitude: 28.0 south.
Central longitude: 90.9 west.

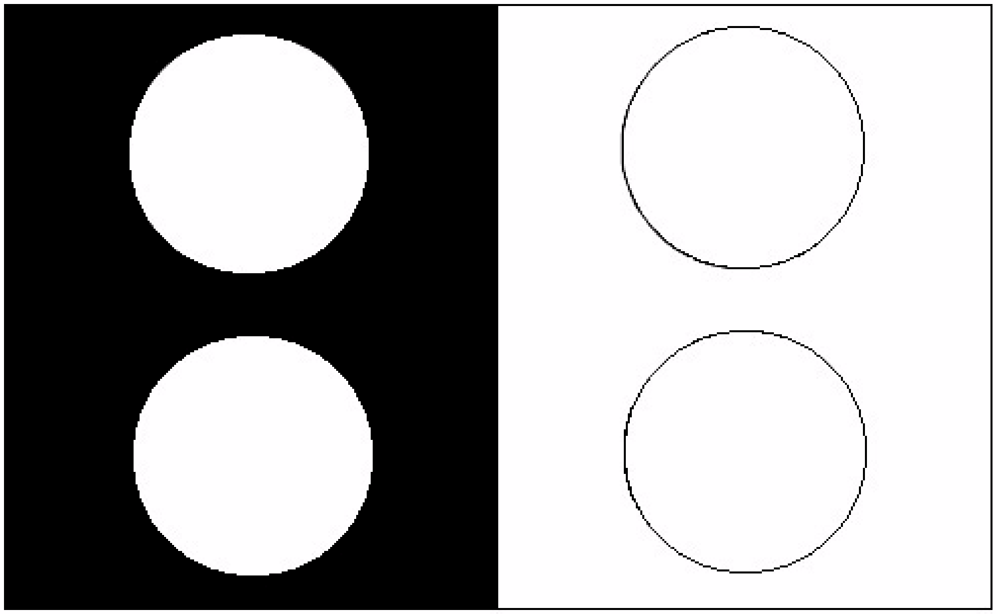
An area of great interest to observers due to its great variability and a tendency for dust clouds is an albedo feature called Solis Lacus (Lake of the Sun). Also known as the "Eye of Mars" because it sometimes seems to resemble an eye, this changeable and elongated area was first observed and drawn by Jacques Philippe Maraldi in 1704, though it was originally named by Giovanni Virginio Schiaparelli. Solis Lacus is roughly 500 miles long and 300 miles wide. The records are not complete, but it appeared to remain as originally observed until 1926 when the longer axis was found to be north-south. Later that year, Eugène Michael Antoniadi observed it as three separate patches of dark features, with the central one divided by a dusky bridge. It then turned back to more normal appearances. In the Mars 1939 apparition, Solis Lacus again changed; for instance, it once was observed to be made up of a number of small dark spots contained in a generally dusky area.

The Great Dust Storm of October 1973 started in the Solis Lacus region and grew rapidly to enshroud the entire planet. These kinds of global dust storms are quite rare, with only five reported in 1956 and later. The dust storms that happen here and at other places in the southern Martian hemisphere are larger and more dramatic when they occur during southern summer.

One great dust cloud that started in Solis Lacus soon after the close approach in September 1988, was on Thanksgiving Day in 1988. This Great Thanksgiving Dust Storm, as it now known, developed along the northern edge of Solis Lacus and in the weeks that followed, it covered about 70 percent of the southern hemisphere.

Solis Lacus can not only change its shape, but can also appear lighter at times. Use a red filter to best notice any brightening. You never know when you might be first to observe a new dust cloud.

A.L.P.O. Mars Section Observation



Top: Time (UT):______________________ Bottom: Time (UT):____________________
CM:________________° W CM:________________° W
Filter:____________________(W / S) Filter:____________________(W / S)

Date (UT):________________________
Time (UT):____________ - ____________
CM: ____________° W - ____________° W
D_E:____________° - L_S:____________°
Dia. ("):__________ k (phase): __________
Telescope:______ f/_____(in. / cm. ; RL . RR . SC)
Magnification:_______x _______x _______x
Filters:____________________(W / S)
Seeing (0-10):________ Antoniadi (I-V):________
Transparency (1-6):______(Clear / Haze / Int. Clouds)
Blue (Violet) Clearing (0-3):__________

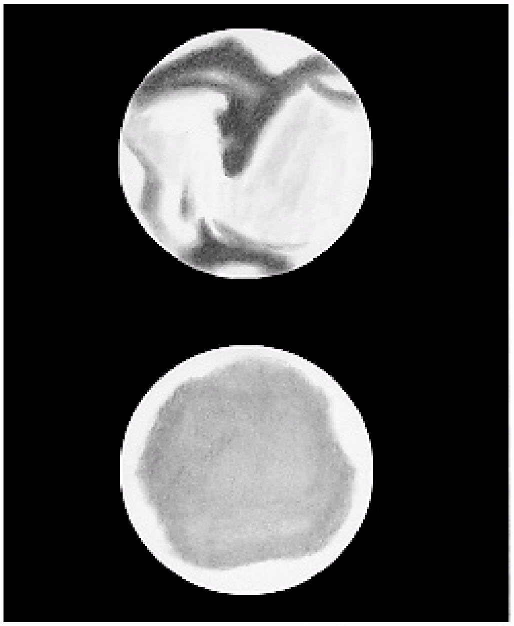
Observer:________________________
Address:________________________
Observing Station:________________________
E-mail (optional):________________________

Notes

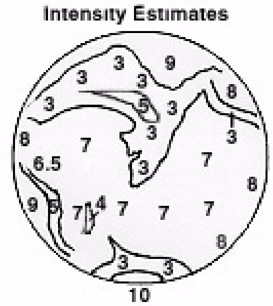
(Continue on back if needed)

Use this form to record your observations of Mars (see example on reverse side)

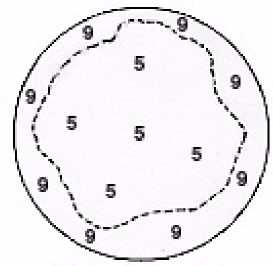
A.L.P.O. Mars Section Observation



Intensity Estimates



(Wratten 23A (light red))



(Wratten 38A (blue))

Top: Time (UT): 02:00
CM: 300 W
Filter: 23A (light red) (W / S)

Bottom: Time (UT): 02:10
CM: 302.4 W
Filter: 38A (blue) (W / S)

Date (UT): April 1, 1995
Time (UT): 01:45 - 02:30
CM: 296.4 ° W - 307.2 ° W
D_E: 20.00 ° - **L_s:** 270.0 °
Dia. ("): 12.0 **k (phase):** 0.99
Telescope: 8 f/ 7 (in. / cm. ; RL . RR . SC)
Magnification: 230 x 350 x 440 x
Filters: 23A, 38A (W . S)
Seeing (0-10): 7-8 **Antoniadi (I-V):** II
Transparency (1-6): 6 (Clear / Haze / Int. Clouds)
Blue (Violet) Clearing (0-3): 0

Observer: Carlos E. Hernandez
Address: 3225 SW 94 Place
Miami, FL 33165
Observing Station: Same as above
E-mail (optional): ceh@netside.net

Notes

(A) Syrtis major is prominent on the central meridian (CM) with Moeris Lacus noted along preceding (p) border. Sabaeus Sinus (preceding end) noted towards the south following (Sf) limb. Ausonia separated from Mare Tyrrhenum by a dull (5/10) strip. Hellas is extremely bright (9/10) towards the southern limb. Hellespontus noted as a dark (3/10) strip appearing to extend south from Iapygia Viridis. Elysium appears extremely bright (9/10) along the preceding limb. Nodus Alcyonius visible as a dusky (4/10) wedge south and preceding a dark (3/10) Casius extending from Utopia (3/10). Dark (3/10) collar comprised by Utopia, Cecropia, and Ortygia noted to surround a brilliant (10/10) North Polar Cap (NPC). Boreosyrtis noted following Casius and south of Cecropia.

(B) Martian disk surrounded by extremely bright (9/10) ring along all limbs using a Wratten 38A (blue) filter. No blue (violet) clearing noted at this time.

(Continue on back if needed)

Sample of completed Mars observation form (see blank form on previous page).

ALPO Feature: Jupiter
A Report on the 2001-2002 Apparition

By Richard W. Schmude, Jr., coordinator
Peer Review by Klaus Brasch

Abstract

The drift rates for 80 different features in over a dozen Jovian currents are reported. Over a dozen dark elongated features (barges) appeared in the NEB before Aug. 2001. Oval BA passed the Great Red Spot on Feb. 25, 2002; during this passage, oval BA did not change in altitude but it increased in area and was displaced 1.5º south. Based on photoelectric measurements, the selected normalized magnitudes of Jupiter are: B(1,0)=-8.55±0.02, V(1,0)=-9.40±0.02, R(1,0)=-9.87±0.01 and I(1,0)=-9.77±0.02. All of the belts and zones had albedos in visible light of between 0.4 and 0.7.

Introduction

The two highlights of the 2001-02 apparition were the outbreak of several dark bar-like features (called "barges") within the North Equatorial Belt and the movement of oval BA past the Great Red Spot (GRS). This report summarizes the 2001-02 apparition of Jupiter.

The general characteristics of Jupiter during 2001-02 are listed in Table 1 while Table 2 lists the participating observers. Figure 1 shows drawings of Jupiter made throughout the apparition. The Jupiter nomenclature is the same as what was used in Schmude (2002a); essentially the North Equatorial Belt is the NEB, the North Polar Region is the NPR, the northern edge of the NTB is NTBn, etc.

The planetographic latitude will be used throughout this paper. "West" will refer to the direction of increasing longitude. Longitude will be designated with the Greek letter lambda, λ, followed by a subscript roman numeral that designates the longitude system. As an example, $\lambda_I = 54°$ means that the system I longitude equals 54°. The three longitude systems are described more fully elsewhere (Rogers, 1995, 11), (*Astronomical Almanac*, 2000b, L8). All dates and times will be in Universal Time (UT).

Disc Appearance

Heath made 884 intensity estimates of Jovian belts and zones in integrated light and through red (W25), and blue (W44a and #47) filters. Intensities were estimated on a scale of 0 = white to 10 = black, and light intensities were made on a scale of 10 = white to 0 = black. The ALPO intensity scale corresponds to Heath's light intensity scale. Heath's average light intensity values for the period Nov. 25, 2001 to Feb. 12, 2002 are: SPR (7.0), STB (6.1), STrZ (8.6), GRS (6.5), SEB (5.3), EZ (8.7), EB (7.1), NEB (5.0), NTrZ (8.7), NTB (5.0), NTZ (8.6) and NPR (7.0). Heath also concludes that both components of the SEB had an equal light intensity, the Polar Regions showed little color and the NEB had an orange-brown color and was redder than the SEB. Heath also notes that the GRS became redder after Jan. 1. Others (Calia, Cudnik, Del Valle, Frassati, Haas, Santacana and the author) also made intensity estimates; these are consistent with those made by Heath. It appears that the SEB may have darkened a bit in April.

The planetographic (or zenographic) latitudes for several Jovian features were measured from several CCD images taken between August 2001 and June 2002. The latitudes are listed in Table 3, and were determined from the formulas in Peek (1981, 49); the necessary sub-Earth latitudes were taken from the *Astronomical Almanac* (2000a, b). Latitudes in Table 3 are consistent with historical values (Peek, 1981, 67); one exception however, is the NEBn, which was at 21.3°N compared to a historical value of 18°N (Rogers, 1995, 126-127). This discrepancy may be due to the outbreak of the barges and ovals within that belt.

I measured the north-south and east-west dimensions of several white ovals from CCD images of Jupiter

Table 1: Characteristics of the 2001-2002 Apparition of Jupiter*

First conjunction with the Sun	2001 June 14
Opposition date	2002 Jan. 1
Second conjunction with the Sun	2002 Jul. 20
Apparent equatorial diameter (opposition)	47.1 arc-seconds
Visual stellar magnitude (opposition)	-2.7
Planetographic declination of the Sun (opposition)	2.1ºN
Planetorgraphic declination of the Earth (opposition)	2.1ºN
Geocentric declination of Jupiter	23.0ºN

* Data taken from *The Astronomical Almanac* (2000a,b).

Table 2: List of Contributors to This Apparition Report

Contributor*	Location	Instrument*	Type**
Tomio Akutsu	Tochigi, Japan	0.32 m RL	CCD
Jay Albert	Boca Raton, FL USA	0.18 m Mak-Cass	S
Tsuyoshi	Arakawa Japan	0.30 m RL	CCD
Jeff Barbour	Boulder Creek, CA USA	0.15 m Mak-Cass	DN
Don Bates	Houston, TX USA	0.25 m RL	P
Reta Beebe	Las Cruces, NM USA	---	DN
Jeff Beish	Lake Placid, FL USA	0.32 m RL	DN
Dan Boyar	Boynton Beach, FL USA	0.15 m, 0.18 m RL	D, DN
Nigel Bryant	United Kingdom	0.25 m SC	CCD
Tom Buchanan	Alpharetta, GA USA	Spectroscope	SP
C. Laird Calia	Ridgefield, CT USA	0.13 m Mak-Cass	D, DN, TT
Lawrence Carlino	Lockport, NY USA	0.18 m Mak-Cass	D
		0.15 m RR	
Patrick Chevalley	Geneva, Switzerland	0.15 m RL	CCD
Antonio Cidadao	Oeiras, Portugal	0.25 m SC	CCD
Paulo Coelho	Montijo, Portugal	0.20 m SC	CCD
Brian Colville	Cambray, ON, Canada	0.30 m SC	CCD, M
Ed Crandall	Winston-Salem, NC USA	0.25 m RL	CCD
Brian Cudnik	Weimer, TX USA	0.25 m, 0.32 m RL	D,DN, TT
		0.36 m SC	
Andrew Dan	near Budapest Hungary	0.25 m RL	CCD
Daniel Del Valle	Aguadilla, PR USA	0.20 m SC	D, DN, TT
Maurizio Di Sciullo	FL, USA	0.25 m RL	CCD
Dale Dufresne	St. Rose, LA USA	0.25 m RL	D
Jeffrey Edmonds	Kansas USA	---	DN
Hideo Einaga	Hyogo Pref., Japan	0.32 m RL	CCD
Jim Ferreira	Livermore, CA USA	0.15 m Mak-Cass	V
Mike Foulkes	Herts, UK	0.25 m SC	CCD
Mario Frassati	Crescentino, Italy	0.32 m RL	D, DN, SS, TT
		0.20 m SC	
Geoff Gaherty	Toronto, ON, Canada	0.20 m RL	DN
		0.15 m Mak-Newt	
Ed Grafton	Houston, TX USA	0.36 m SC	CCD
Walter Haas	Las Cruces, NM USA	0.20 m RL	DN, S, SS, TT
		0.32 m RL	
Christian Harder	near Hamburg, Germany	0.25 m RL	TT
Alan Heath	Long Eaton, UK	0.25 m RL	DN, TT
Darren Hennig	Edmonton, AB Canada	0.10 m RR	DN
Carlos Hernandez	Miami, FL USA	0.20 m KC	DN, TT
Kuniaki Horikawa	---	0.15 m RL	TT
Jared Huckaby	Thomaston, GA USA	0.11 m RL	CCD, D, DN, TT
Toshihiko Ikemura	Nagoya, Japan	0.31 m RL	CCD
Noriyuki Ito	Japan	0.60 m Cass	CCD
Albert Jansen	Prince Albert, South Africa	0.25 m SC	DN
Gabor Kiss	Hungary	0.25 m Cass	CCD
Jan Koet	Wateringen, Holland	0.18 m RR	CCD
Robert Korn	near Munich, Germany	0.20 m SC	D, TT
Akira Kozemoto	Kyoto, Japan	0.31 m RL	CCD
Frank Kraljic	Scottsdale, AZ USA	0.25 m RL	S
Rick Krejci	Scottsdale, AZ USA	0.20 m SC	CCD
Tan Wei Leong	Singapore	0.28 m SC	CCD
John McAnally	Waco, TX USA	0.20 m SC	DN
Frank Melillo	Holtsville, NY USA	0.20 m SC	CCD
Hans-Joerg Mettig	Freiburg, Germany	Monitor	DN
David Moore	Phoenix, AZ USA	0.36 m SC	CCD
Mitsuji Morita	Japan	0.21 m RL	CCD
Masahito Miikawa	Sakai, Osaka, Japan	0.28 m SC	CCD

and the results are summarized in Table 4. Dimensions were measured in the same way as is described in Schmude (2002a, 28-29).

The average aspect of the SSTB ovals B1-B4, B7-B10 is 0.84, which is similar to the values of 0.88 and 0.90 in 1992-93 and 1991-92 (Schmude, 2002a, 2003), but is less than the 1.0 value reported by Morales-Juberias et al. (2002, 81) for the 1994-2000 period. The aspect is the north-south dimension divided by the east-west dimension. The average area of the SSTB ovals was 1.3 x 10^7 km^2, which compares well with the area reported by Morales-Juberias et al. (2002, 81). The average aspect of the NEB ovals is 0.62. Morales-Juberias et al. (2002, 81) also report low aspect values for ovals at 23.2°N.

Region I: Great Red Spot (GRS)

The GRS was reported to have either no color or a faint orange-pink color. Several people reported that the GRS was faint especially in March and April. Post, for example, reports that the GRS was faint on April 23 even though that feature was on the central meridian.

The northern portion of the GRS was brighter than the southern portion; see Figures 2 and 3. This may be due to the ingestion of smaller eddies by the GRS (Simon-Miller et al. 2002, 251), (Rogers, 1995, 96). Three eddies were consumed by the GRS (features S10, S11 and S14) and their longitudes are plotted in Figure 4.

Dark spots were imaged within the GRS and near its edge on Dec. 29 (Ito, Cidadao), Feb. 25 (Grafton, Ito, Cidadao), Mar. 6-7 (Sherrod, Cidadao twice), Mar. 21 (Cidadao twice) and March 23 – 2 features (Sherrod, Cidadao). A mean velocity of 100±8 meters/second was measured from the six spots. This velocity is the wind speed within the GRS and is consistent with Voyager and Galileo (1996) results but is lower than Galileo (2000) results (Rogers, 1995, 195), (Simon-Miller et al. 2002, 255).

Table 2: List of Contributors to This Apparition Report (cont.)

Contributor*	Location	Instrument*	Type**
Eric Ng	Hong Kong, China	0.25 m SC	CCD
Detlev Niechoy	Göttingen, Germany	0.20 m SC	D, SS, TT
Jose Olivarez	Ocala, FL USA	0.20 m RR	D, DN, TT
Vic Palmieri	NJ, USA	0.10 m RR	S
Donald Parker	Coral Gables, FL USA	0.40 m RL	CCD
Timothy Parker	Highland Park, CA USA	0.15 m RR	CCD
Damian Peach	Kent, UK	0.28m & 0.30 SC	CCD
Christophe Pellier	France	---	DN
Phil Plante	Poland, OH USA	0.15 m RL and 0.20 m SC	D
Cecil Post	Las Cruces, NM USA	0.20 m RL	DN, TT
John Rogers	Cambridge, England UK	---	DN
John Sabia	Fleetville, PA USA	0.61 m RL 0.24 m RR	S
Jesus Sanchez	Cordoba, Spain	0.28 m SC	CCD
Augustin Sanchez-Lavega	Spain	---	DN
Guido Santacana	San Juan, PR USA	0.20 m SC	D, SS, TT
Ken Schmidt	Cleveland, OH USA	0.37 m RL	CCD
Mark Schmidt	Racine, WI USA	0.36 m SC	CCD
Richard Schmude, Jr.	Barnesville, GA USA	0.10 m RR 0.007 m SC	TT, PP, P
Brian Sherrod	Conway, AR USA	0.41 m RL	SS
Clay Sherrod	Conway, Arkansas, USA	0.30 SC	CCD, DN
Dominique Suys	France	0.62 m SC	DN
Andrea Tasselli	Mahlow, Germany	0.15 m Mak-Newt	CCD, DN
Gerard Teichert	near Colmar France	0.28 m SC	D
Jim Tomney	Towson, MD USA	0.25m RL	D
Sam Whitby		0.15 m RL	DN
Cai-Uso Wohler	Hamburg, Germany	0.20 m RL	DN
Seiichi Yoneyama	Yokohama, Japan	0.20 m RL	CCD

*RL = Reflector, RR = Refractor, SC = Schmidt-Cassegrain, KC = Klevtzov-Cassegrain, Mak-Cass = Maksutov-Cassegrain, Mak-Newt = Maksutov-Newtonian, Cass = Cassegrain

**CCD = CCD image, D = drawing, DN = descriptive notes, M = methane band data, P = photograph, S = Satellite studies, SP = Spectra, SS = strip sketch, TT = transit time, V = Video images

The longitudes of the GRS are plotted in Figure 4.

Region II: South Polar Region to the South Tropical Zone

The SPR and NPR had nearly equal light intensities based on estimates made by the visual observers: Calia, Cudnik, Del Valle, Haas, Heath, Santacana and this author. Several CCD images made at ultraviolet (~340 nm), blue, green, red, near infrared (~850 nm) and methane band (889 nm) light were analyzed to see if the polar regions had any color difference or light intensity differences. The analysis included placing strips of paper covering ~90% of each image so that just the Polar Regions showed. The relative brightness of the NPR and SPR was estimated and then the CCD image was rotated 180° and the estimate was repeated. I discovered that lighting conditions can influence the relative brightness of the NPR and SPR and that is why the images were rotated 180°. The CCD images revealed that the NPR and SPR were equally dark in the ultraviolet, blue, green and red light. The two regions were close to equally bright in the near infrared but the SPR darkened compared to the NPR after Feb. 1. The NPR was clearly darker than the SPR in methane band light throughout the apparition; the difference in brightness was most obvious before Feb. 1. Figures 4 and 6 show the longitudes for features near the SPR and NPR.

On a few occasions, two dark belt sections were imaged at 46°S and 53°S; these belts are the S^3TB and the S^4TB (Rogers, 1990, 88). One oval (A1a) was tracked for several weeks. This oval either changed velocity or a new oval formed (A1b).

Eleven ovals were tracked within the SSTB; their longitudes are plotted in Figure 4 or are listed in Table 5 and their drift rates and latitudes are summarized in Table 6. Oval B4 was at the same longitude as oval BA around Feb. 11 and it appears that oval B4 may have slowed down a bit and then accelerated past oval BA in mid-February. I suggest this because most of the longitudes for this feature are to the right of the best-fit line in the longitude plot in Figure 4 before Feb. 11 but are to the left of the line after that date. The area of oval B4 dropped after Feb. 11; see Table 4.

Ovals B2 and B3 merged in late March forming oval B10. Figure 3 shows the development of this merger while Figure 7 shows the separation of ovals B2 and B3 before the merger. Ovals B2 and B3 began approaching each other in early February at a rate of 0.90 meters/second, but between Mar. 4 and 21, the rate of approach increased to 3.9 meters/second. The merging of ovals B2 and B3 followed the sequence of: 1) the aspects of both ovals increased as they approached one another, and 2) after the ovals merged, the new oval was ~0.75 times the sum of the areas of the two merging ovals. This sequence has been observed in previous oval mergers: (Sanchez-Lavega et al., 1999, 121), (Sanchez-Lavega et al., 2001, 494), (Schmude, 2002a, 27).

Four different methods were used in determining the date when oval BA transited the GRS. These four

Table 3: Average Planetographic Latitudes of Belts on Jupiter *

Belt	Planetographic latitude (Integrated light)	Planetographic latitude (Methane band light)
NPR	---	70º±2ºN
N^5TBs	54º±2ºN	---
N^4TB	46.7º±1.5ºN	---
N^3TBs	42.4º±1.5ºN	---
NNTBn	39.9º±1ºN	---
NNTBs	36.7º±1ºN	---
NTBn	30.8º±0.5ºN	30.8º±1ºN
NTBs	25.5º±0.5ºN	24.9º±1ºN
NEBn[a]	21.3º±0.5ºN	19.1º±1ºN
NEBs[a]	7.7º±0.5ºN	7.4º±1ºN
EBc	0.7º±1ºN	---
SEBn[b]	7.7º±0.5ºS	3.5º±1ºS
SEBs[b]	22.1º±1ºS	20.4º±1ºS
STBn	27.0º±1ºS	---
STBs	31.1º±1ºS	---
SSTBn	36.1º±1ºS	37.9º±1ºS
SSTBs	41.9º±1ºS	---
S^3TBn	44.8º±1ºS	---
S^3TBs	47.3º±1ºS	---
S^4TBn	52.6º±1ºS	---
SPR	---	65º±1ºS
GRS	21.1º±0.5ºS	20.5º±1ºS

* The north and south edges of the belts are designated by a small "n" or "s"; for example, the north edge of the north equatorial belt is called "NEBn". A small c means "center". A few methane band images from the ALPO Japan webpage were used in determining the latitudes.

[a] Opposition averages in integrated light

[b] The southern edge of the north component of the SEB was at 13.3ºS and the northern edge of the south component of the SEB was at 16.8ºS in integrated light.

methods and the transit date in parentheses are: 1) all longitudes of the GRS and oval BA considered (Feb. 25.3), 2) all longitudes considered except those between Feb. 15 and Apr. 1 (Feb. 23.7), 3) only the longitudes between Feb. 15 and Mar. 31 considered (Feb. 25.7) and 4) Longitude differences between Jan. 11 and Apr. 17 considered (Feb. 24.9). The selected transit date is the average of the four dates which is Feb. 24.9, 2002; the uncertainty is 1.0 day. The longitudes of both oval BA and the GRS are plotted in Figure 4. Oval BA appears to have slowed down as it approached the GRS as seen by the large number of points to the right of the line in February. By early March, the situation changed and oval BA was once again moving at its normal rate. Figure 8 shows the planetographic latitude of oval BA and the GRS throughout the apparition. Oval BA was nudged 1.5 degrees south as it passed the GRS. The area of oval BA increased as it transited the GRS; see Figure 8. McAnally analyzed several images of the GRS in February and March and he found that there was no significant change in the shape of the GRS during this period.

Region III: South Equatorial Belt

Both the north and south components of the SEB had features that were tracked throughout the apparition. The most distinct features within the SEB were the white ovals following the GRS. Olivarez noticed a very bright oval in the SEB zone (feature S10) and he quickly notified Parker who imaged this feature on Dec. 15 at $\lambda_{II} = 142^\circ$. This feature changed from a round shape on Dec. 15 to an elongated shape on Dec. 19.

Region IV: The Equatorial Zone

Frassati reports that on Sep. 27, 2001, the EZn had a yellowish color. According to Heath's intensity estimates, the EZ had the same color as the NTrZ, NTZ and STrZ.

A total of seven festoons were followed for at least three weeks; however, only two festoons survived over two months (N1 and N2). As a comparison, I was able to follow seven festoons in 1991-92 and nine festoons in 1992-93 for over two months. The mean rotation rate of the six festoons in 2001-02 was $9^h\ 50^m\ 42^s$ (Table 7), which is a bit slower than the historical average (Peek, 1981, 107), (Rogers, 1995, 144). Festoon N6 was not included in the average because of its unusual rotation period. The festoon rotation rate in 2001-02 is also longer than the more recent values of: $9^h\ 50^m\ 32^s$ (Schmude, 2002a, 33), $9^h\ 50^m\ 31^s$ 1992-93 (Schmude, 2003), and 1995: $9^h\ 50^m\ 28^s$ (Foulkes and Rogers, 2000, 248); however, it is close to the 1996 rate of $9^h\ 50^m\ 42^s$ (Foulkes and Rogers, 2001, 74). The shorter lifetimes of the festoons in 2001-02 may be due to changes within the NEB or it may be due to their slower rotation rate.

Region V: The North Equatorial Belt

The NEB was often described as having a brownish-red hue. This color was also evident in color CCD images made by Grafton and Cidadao. The red minus blue intensity value estimated by Heath was

Table 4: Dimensions of White Ovals During the 2001-2002 Apparition *

Feature	Dimension (km)		Aspect	Area
	east-west	north-south		(10^6 km^2)
A1a	4100	2100	0.52	7±2
B1	5600	4800	0.84	21±2
B2 (before Mar. 20)	5100	4000	0.80	16±2
B3 (before Mar. 20)	5100	4100	0.82	16±2
B10[a]	6800	4600	0.67	24±3
B4 (before Feb. 11)	3700	3100	0.84	9±1
B4 (after Feb. 11)	2700	2700	1.01	6±1
B5	2500	2700	0.90	5±2
B6	2100	2600	0.83	4±1
B7	5000	4400	0.87	17±3
B8	5200	4100	0.78	17±2
B9	5700	5500	0.97	25±1
Oval BA				
(before Feb. 16)	11,300	6800	0.61	60±5
(after Mar. 10)	11,500	6800	0.59	62±4
S13	4300	3800	0.90	13±1
N16	5800	3800	0.65	17±1
N17	6000	3200	0.53	15±1
N18	5000	3300	0.65	13±2
N24	4500	2800	0.63	10±1
N25	5400	3300	0.61	14±2
N29	4100	2800	0.70	9±2
N34	5200	3000	0.59	12±1
G11	4600	3900	0.86	14±2

* The aspect is the north-south dimension divided by the east-west dimension. All areas were computed by assuming an elliptical shape for each feature. All east-west and north-south dimensions have uncertainties of 500 km.

[a] Oval B10 is the oval that resulted from the merging of ovals B2 and B3.

1.4 for the NEB, which is consistent with a reddish color. The width of the NEB was measured at different system II longitudes for each month between September, 2001 and May 2002; the results are plotted in Figure 9.

The 2001-02 width is much larger than its historical width (Peek, 1981, 67), (Rogers, 1995, 113). In addition to the increased NEB width, about a dozen dark bar-like features (called "barges") and a half-dozen bright ovals developed within the NEB. The longitudes of the barges and ovals are plotted in Figure 5. The ovals were along the northern edge of the NEB and they had a mean rotational period of 9^h 55^m 33^s, which is close to the historical value (9^h 55^m 29^s) for this area (Peek, 1981, 99-100). The average latitude of the ovals was 19.3°N, which is close to the historical value for similar ovals (Rogers, 1995, 399).

The barges were at latitudes ranging from 15.4°N to 20.0°N, but the average latitude was 16.7°N, which is close to the historical average (Rogers, 1995, 399). There was no correlation between the barge latitude and barge rotation period, which is different from the usual trend of faster rotation periods for features in the middle section of the NEB when compared to features on the northern edge of the NEB (Garcia-Melendo and Sanchez-Lavega, 2001, 325). The average rotation speed for the 13 barges tracked by the author is 9^h 55^m 37^s. A close look at Figure 5 will reveal that the ovals at longitudes 180°-240° (N24 and N18) moved at a different rate than the ovals at the other longitudes. I feel that this difference is not due to random errors but instead indicates that the drift rate can vary with longitude.

One bright spot (feature N31) located near the center of the NEB survived for over a month, which is longer than most features in this area. Feature N31 is also responsible for eliminating barge N23 in early February.

Region VI: North Tropical Zone to the North Polar Region

This region was dominated by the NTB. There were often 1 to 3 additional faint belts and the latitudes of these are listed in Table 3.

There were no dark features along the NTBs, which followed north temperate current C. Dark features in this area were followed for all apparitions between 1992 and 1999 (Garcia-Melendo et al., 2000, 517). There were, however, a couple of small ovals (or rifts) located in the central portion of the NTB (features F6 and F7) that were followed. Features F6 and F7 appear to resemble spots in the north temperate current B (Peek, 1981, 83); however, the average 2001-02 drift rate is over a minute longer than historical values (Peek, 1981, 84), (Rogers, 1995, 107).

The longitudes of four north-pointing projections along the NTBn (F1 – F4) are plotted in Figure 6. These features had a mean rotational period of 9^h

Table 5: Longitudes of Features Not Plotted in Figures 4 through 6, 2001-02 Apparition

Feature	System II Longitudes
N30:	Dec. 21.3 (140,137,139º), Dec. 23.4 (136º), Dec. 24.2 (134º), Dec. 26.3 (138º), Dec. 28.4 (133º), Dec. 30.4 (130º), Jan. 4.4 (131º), Jan. 5.2 (126º), Jan. 7.2 (121º)
S15:	Feb. 24.2 (41º), Feb. 27.0 (42º), Feb. 27.1 (37º), Mar. 1.1 (39º), Mar. 4.0 (33º), Mar. 6.1 (30º), Mar. 13.1 (19º), Mar. 20.1 (17º)
S11:	Dec. 23.4 (140º), Dec. 24.2 (138º), Dec. 26.3 (136º), Dec. 28.4 (133º), Dec. 30.4 (130º), Jan. 2.3 (132º), Jan. 4.3 (132º), Jan. 7.2 (128º), Jan. 9.3 (124º)
F2:	Dec. 18.3 (70º), Dec. 19.2 (69º), Dec. 20.4 (66º), Dec. 21.3 (67º, 70º), Dec. 23.3 (67º, 69º), Dec. 26.2 (71º), Dec. 30. (70º), Jan. 2.2 (81º)
H6:	Jan. 2.2 (45º), Jan. 4.3 (44º), Jan. 5.1 (45º), Jan. 11.3 (49º), Jan. 12.1 (49º), Jan. 12.2 (47º), Jan. 14.2 (49º)
B5	Dec. 15.1 (174º), Dec. 19.3 (170º), Dec. 21.3 (173º), Dec. 28.4 (159º), Jan. 4.4 (158º)
B6	Dec. 15.1 (144º), Dec. 19.3 (142º), Dec. 21.3 (138º), Jan. 2.3 (130º)

56^m 10^s and lie within north temperate current A (Peek, 1981, 80).

Several features were tracked at planetographic latitudes of between 38° and 42°; these latitudes are considered to lie within the domain of the NNTB and N^3TB (Rogers, 1990, 88). The NNTB values in Table 8 are consistent with historical rotation rates of the NN temperate current A (Peek, 1981, 77); however, the rates for the N^3TB are a little slower than the historical rate for this current (Peek, 1981, 72), (Rogers, 1995, 90).

A bright oval feature H8 and a dark spot H9 were present near the N^4TB. Both features had drift rates consistent with historical values at ~53.5° (Rogers, 1995, 90).

Methane Band Results

Methane band images are images that are recorded at a wavelength of 889 nanometers (nm), which is a wavelength of light that methane (CH_4) absorbs. (One nm equals 1.0 x 10^{-9} meters.)

Methane band images are useful because they show the relative altitudes of Jovian cloud features. A cloud that appears bright in this type of image, indicates that methane absorption is low above the feature and so it has a high altitude. The order of brightness of Jovian features in methane band light starting with the brightest is: EZs, EZn, GRS, SPR, NTZ, Oval BA, NPR, STrZ, NTrZ, STZ, STB, SEBn, NTB, SEBs, NEB. These results confirm the high altitude of the GRS. The relative brightness of oval BA and the STrZ did not change as oval BA passed the GRS.

Latitudes of a few belt edges are listed in Table 3 in methane band light. The NEB appeared narrower than in visible light and the barges and NEB ovals were not visible. It is therefore concluded that the barges and ovals are at relatively low altitudes.

The flattening value (F) of Jupiter was measured for integrated, infrared (830 nm –1200 nm), methane band (889 nm) and ultraviolet light (340 nm) using:

$$F = [(E/P_{th}) - (E/P)] \quad (1)$$

Where (E/P) is the measured value of the equatorial diameter divided by the polar diameter in the image and $(E/P)_{th}$ is the theoretical value of this ratio (*Astronomical Almanac*, 2000a,b). The respective average values of F for the ultraviolet, visible, infrared and methane band light were -0.003 ± 0.006, 0.007 ± 0.003, 0.016 ± 0.003 and 0.043 ± 0.003. Minton (1972) pointed out the large F value for methane band light. The value of F for methane band light did vary with the solar phase angle in degrees of Jupiter (α) as:

$$F = 0.0388 + 0.00048\alpha \quad (2)$$

Table 6: Drift Rates of Features Between the South Pole and the Central Portion of the SEB, 2001-02 Apparition

I.D.	Number of Points	Time Interval	Planetographic Latitude	Drift Rate (degrees/30 days) (SystemII)	Rotation Rate
South South South South Temperate Belt					
A1a	25	Nov.7-Feb.15	51.4ºS	-15.8	9h55m19s
A1b	9	Feb.25–Apr.23	50.9ºS	0.1	9h55m41s
		Average	51.2ºS	-7.9	9h55m30s
South South Temperate Belt					
B1	66	Nov.11–Apr.23	41.4ºS	-27.4	9h55m3s
B2	53	Nov.6–Mar.4	41.3ºS	-27.7	9h55m3s
B3	42	Nov.6–Mar.4	40.9ºS	-28.7	9h55m2s
B4	43	Nov.13–Mar.13	41.4ºS	-27.9	9h55m3s
B7	11	Nov.7–Jan.4	40.8ºS	-26.2	9h55m5s
B8	32	Nov.14–Mar.6	41.0ºS	-25.8	9h55m5s
B9	51	Nov.12–Apr.6	40.7ºS	-26.1	9h55m5s
B10	8	Mar.23–Apr.23	41.1ºS	-33.2	9h54m55s
B11	12	Jan.4–Mar.6	40.6ºS	-26.0	9h55m5s
		Average	41.0ºS	-27.7	9h55m3s
South Temperate Zone					
B5	5	Dec.15–Jan.4	39.3ºS	-26.8	9h55m4s
B6	4	Dec.15–Jan.2	37.5ºS	-23.5	9h55m9s
		Average	38.4ºS	-25.2	9h55m6s
South Temperate Belt					
OvalB[a]	50	Sep.22–May15	33.2ºSa	-11.7	9h55m25s
C2	45	Oct.8–Feb.18	31.2ºS	-11.8	9h55m24s
C8	20	Dec.21–Mar.28	33.5ºS	-13.5	9h55m22s
		Average	32.6ºS	-12.3	9h55m24s
South Tropical Zone					
GRS	100	Aug.19–May29	21.1ºS	1.4	9h55m43s
South Equatorial Belt (southedge)					
S4	13	Oct.30–Nov.26	22.1ºS	6.8	9h55m50s
S13	25	Jan.21–Apr.11	22.1ºS	5.7	9h55m49s
		Average	22.1ºS	6.2	9h55m49s
South Equatorial Belt (Interior)					
S5	8	Nov.5–Dec.7	17.7ºS	8.9	9h55m53s
S6	5	Nov.10–Nov.25	15.6ºS	3.5	9h55m46s
S10	15	Dec.15–Jan.9	13.7ºS	-49.2	9h54m34s
S11	10	Dec.23–Jan.9	14.2ºS	-46.8	9h54m37s
S12	15	Jan.15–Feb.8	13.5ºS	-42.9	9h54m42s
S14	11	Jan.27–Feb.18	13.8ºS	-53.8	9h54m27s
S15	8	Feb.24–Mar.20	15.0ºS	-34.3	9h54m54s

[a] Does not include latitudes measured between Feb.5 and Mar.17.

Table 7: Drift Rates of Features in the Great Equatorial Current (northern portion of the SEB to the southern portion of the NEB), and the North Temperate Belt Fast Current, 2001-02 Apparition

I.D.	Number of Points	Time Interval	Planetographic Latitude	Drift Rate (degrees/ 30 days) System I	Rotation Rate
Equatorial Zone (central portion)					
E1	5	Nov. 10 – Nov. 16	0º	13.1	9h 50m 48s
E2	6	Nov. 14 – Nov. 25	0º	-1.2	9h 50m 29s
E3	7	Nov. 13 – Dec. 1	0º	6.4	9h 50m 39s
E4	7	Dec. 2 – Dec. 15	0º	0.9	9h 50m 31s
E5	8	Dec. 11 – Dec. 27	0º	19.5	9h 50m 56s
E6	6	Feb. 25 – Mar. 5	0º	8.6	9h 50m 42s
		Average	**0º**	**7.9**	**9h 50m 41s**
North Equatorial Belt (festoons along the southern edges)					
N1	56	Oct. 27 – Feb. 19	7.7ºN	11.5	9h 50m 46s
N2	43	Oct. 29 – Feb. 21	7.7ºN	7.9	9h 50m 41s
N4	12	Dec. 2 – Jan. 5	7.7ºN	3.3	9h 50m 34s
N5	7	Jan. 3 – Feb. 9	7.7ºN	6.9	9h 50m 39s
N6	7	Jan. 3 – Jan. 21	7.7ºN	-16.4	9h 50m 08s
N7	6	Jan. 11 – Jan. 26	7.7ºN	11.5	9h 50m 46s
N8	4	**Mar. 19 – Apr. 11**	**7.7ºN**	**12.3**	**9h 50m 47s**
		Average	**7.7ºN**	**8.9**[a]	**9h 50m 42s**

[a] Does not include feature N6, which is considered to be an outliner.

The solar phase angle of Jupiter is the angle between the observer and the Sun measured from the center of Jupiter. Several images from the ALPO Japan webpage were used in determining average F values.

Satellite Observations

Kiss, Leong and Peach all imaged detail on Ganymede. The angular diameter of Ganymede was around 1.5 arc-seconds during early 2002 and so these people imaged features on Ganymede that were considerably less than 1.5 arc-seconds.

Frank Kraljic observed Io transiting Jupiter on Feb. 12, 2002 and he noticed that the polar regions of Io were darker than the equatorial regions. The darker polar caps on Io have been observed several times between 1890 and 1990 (Rogers, 1995, 326) and this leads the author to conclude that major changes in the appearance of Io's polar regions have not occurred in the last 112 years. The author is requesting more observations of Io especially when it is transiting the disc of Juptier. The reader, however, must be aware of the trap of seeing detail that is not on Io (Peek, 1981, 224).

Transit observations of satellites across Jupiter are valuable for two reasons: 1) they yield information about Jupiter's limb darkening and 2) they yield information about the albedos of Jovian belts and zones. Observers are encouraged to monitor the transits of all four moons across Jupiter. (The satellite shadows are of no interest at this time.)

The brightness of Jupiter's belts and zones were compared to the brightness of Io and Ganymede as these two moons transited Jupiter. The geometric albedo of Ganymede ranges from 0.46 at $\alpha = 0^{o}$ to 0.35 at $\alpha = 11^{o}$, whereas the geometric albedo of Io ranges from 0.73 at $\alpha = 0^{o}$ to 0.54 at $\alpha = 11^{o}$; where α is the solar phase angle. The albedo is the fraction of light reflected by an object. Based on these satellite albedos along with Albert's and Haas's visual observations and CCD images, it is concluded that at the central meridian, the NTrZ, STrZ and EZs had albedos of ~0.63 for $\alpha = 4^{o}$, the SEBz, STZ and EZn had albedos of ~0.55 for $\alpha = 4^{o}$ and that the STB, EB, NNTB, SEB and NEB had albedos of between 0.43 and 0.55 during the apparition; these albedos are a bit lower than those measured in 1978-79 by Klimenko et al. (1980, 355). Barges N9, N10 and N12 had albedos above 0.35 while barges N11 and N19

Table 8: Drift Rates of Features Between the Central Portion of the NEB and the North Pole, 2001-02 Apparition

I.D.	Number of Points	Time Interval	Planetographic Latitude	Drift Rate (degrees/30 days) System II	Rotation Rate
North Equatorial Belt (central area excluding barges and ovals)					
N27	12	Dec. 19 – Jan. 5	16.2ºN	-31.9	9h 54m 57s
N30	11	Dec. 21 – Jan. 7	15.7ºN	-25.3	9h 55m 06s
N31	19	Jan. 11 – Feb. 17	14.7ºN	-61.6	9h 54m 17s
N32	12	Jan. 1 – Feb. 12	18.6ºN	6.4	9h 55m 50s
North Equatorial Belt (barges)					
N9	69	Oct. 2 – Feb. 8	15.4ºN	-1.9	9h 55m 38s
N10	12	Oct. 13 – Nov. 17	19.5ºN	0.2	9h 55m 41s
N11	65	Sep. 28 – May 31	17.0ºN	-5.4	9h 55m 33s
N12	19	Sep. 22 – Nov. 10	15.7ºN	3.1	9h 55m 45s
N12A	14	Sep. 22 – Nov. 5	15.4ºN	-6.2	9h 55m 32s
N13	52	Oct. 17 – Apr. 15	16.4ºN	-1.9	9h 55m 38s
N15	61	Oct. 8 – May 6	16.3ºN	-4.3	9h 55m 35s
N19	66	Nov. 6 – May 18	16.5ºN	0.7	9h 55m 42s
N22	16	Nov. 5 – Dec. 19	20.0ºN	-4.1	9h 55m 35s
N23	32	Nov. 14 – Feb. 1	15.4ºN	2.8	9h 55m 45s
N26	16	Nov. 17 – Jan. 18	16.9ºN	1.7	9h 55m 43s
N33	27	Jan. 29 – Apr. 23	18.7ºN	-9.5	9h 55m 28s
N35	73	Nov. 14 – Apr. 4	15.8ºN	-7.7	9h 55m 30s
		Average	**16.8ºN**	**-2.5**	**9h 55m 37s**
North Equatorial Belt (ovals)					
N16	64	Sep. 28 – May 31	19.0ºN	-4.9	9h 55m 34s
N17	95	Oct. 2 – Apr. 23	19.6ºN	-9.6	9h 55m 28s
N18	50	Nov. 6 – Apr. 13	18.7ºN	0.5	9h 55m 41s
N24	20	Nov. 18 – Mar. 24	19.4ºN	-0.8	9h 55m 40s
N25	53	Nov. 26 – Mar. 13	18.9ºN	-8.3	9h 55m 29s
N29	21	Dec. 11 – Feb. 14	19.3ºN	-8.1	9h 55m 30s
N34	34	Jan. 22 – May 15	20.0ºN	-9.5	9h 55m 28s
		Average	**19.3ºN**	**-5.8**	**9h 55m 33s**
North Temperate Belt (rifts)					
F6	25	Feb. 12 – Apr. 4	28.2ºN	-52.9	9h 54m 28s
F7	12	Mar. 23 – Apr. 23	28.2ºN	-57.3	9h 54m 22s
		Average	**28.2ºN**	**-55.1**	**9h 54m 25s**

had albedos exceeding 0.41; barge N15 had an albedo below 0.43. The average albedo of Jupiter based on V(1,0) = -9.40 is 0.51.

Wind Speeds

Tables 6-8 summarize the drift rates for 80 features and Table 9 lists wind speeds. Most of the longitudes in Table 5 and in Figures 4-6 were measured from CCD images using a device described by Rogers

Table 8: Drift Rates of Features Between the Central Portion of the NEB and the North Pole, 2001-02 Apparition (cont.)

North Temperate Zone					
F1	18	Oct. 31 – Dec. 21	32.4ºN	25.1	9h 56m 15s
F2	10	Dec. 18 – Jan. 2	31.5ºN	20.6	9h 56m 9s
F3	13	Jan. 1 – Jan. 15	30.7ºN	16.0	9h 56m 3s
F4	9	Jan. 1 – Jan. 23	30.7ºN	23.3	9h 56m 13s
		Average	**31.3ºN**	**21.3**	**9h 56m 10s**
North North Temperate Belt					
G1	31	Oct. 2 – Dec. 11	38.4ºN	-8.4	9h 55m 29s
G2	26	Nov. 6 – Feb. 14	40.1ºN	3.3	9h 55m 45s
G3	24	Oct. 15 – Dec. 23	37.7ºN	-4.7	9h 55m 34s
G5	14	Dec. 21 – Jan. 14	40.2ºN	2.6	9h 55m 44s
G10	13	**Feb. 14 – Mar. 23**	**40.6ºN**	**1.0**	**9h 55m 42s**
		Average	**39.4ºN**	**-1.2**	**9h 55m 39s**
North North North Temperate Belt					
G4	14	Dec. 7 – Jan. 14	42.6ºN	6.2	9h 55m 49s
G6	7	Jan. 2 – Jan. 14	42.4 ºN	12.5	9h 55m 58s
G7	12	Dec. 21 – Jan. 29	42.2ºN	1.7	9h 55m 43s
G11	17	Feb. 19 – Apr. 12	41.8ºN	-5.7	9h 55m 33s
		Average	**42.3ºN**	**3.7**	**9h 55m 46s**
North North North North Temperate Belt					
H8	9	Jan. 15 – Feb. 8	54.3ºN	4.2	9h 55m 46s
H9	14	Feb. 8 – Mar. 6	52.6ºN	0.7	9h 55m 42s
		Average	**53.5ºN**	**2.4**	**9h 55m 44s**

(1995, 391). Longitudes were also obtained from central meridian transit times and drawings.

Garcia-Melendo and Sanchez-Levega (2001, 318-319) point out that changes not related to Jovian currents can influence wind measurements. These changes were considered as I made the longitude measurements. In a few cases, albedo features were not considered because of possible systematic errors.

Wind speeds are given with respect to the system III longitude, which is thought to be the rotation period of Jupiter's interior; see Table 9. The wind speeds and corresponding uncertainties were computed in the same way as in the 1991-92 apparition (Schmude, 2002a, 31) except that the errors in the wind speeds (K) were computed from:

$$K = u\,\{[(\sigma/N)^2 + 0.25]^{1/2}\}/\Delta\lambda_{III} \qquad (3)$$

All symbols are defined in Schmude, 2002a, 31.

Photoelectric Photometry and Photoelectric Polarization Measurements

The author used an SSP-3 solid-state photometer along with a Maksutov telescope stopped down to an aperture of 0.007 m to measure the brightness of Jupiter in late 2001. Filters that were transformed to the Johnson B, V, R and I system were also used; more details on the equipment can be found elsewhere (Schmude, 1992, 20), (Optec, 1997). The peak wavelengths for the filter-detector system are: B-420 nm, V-540 nm, R-700 nm and I-860 nm. A list of the magnitude measurements is given in Table 10. All measurements were corrected for atmospheric extinction and transformation in the same way as is outlined in Hall and Genet (1988, 196-200). The comparison star for all observations was Iota-Geminorum, which had magnitudes of B = 4.82, V = 3.79, R = 3.03 and I = 2.52 (Iriarte et al. 1965, 27).

The normalized magnitudes and solar phase angle coefficients of Jupiter are listed in Table 11 and were determined in the same way as is described in

Table 9: Average Drift Rates, Rotation Periods and Wind Speeds for Several Currents on Jupiter, 2001-02 Apparition

Current	Feature(s)	Drift Rate (deg./30 days) Sys. I	Sys. II	Sys. III	Rotation Period	Wind Speed[d] (m/s) System III
SSSS Temp. Cur.	A1a,A1b	221.0	-7.9	0.1	9h 55m 30s	0.0±2[a]
SS Temp. Cur.	B1-B4, B7-B11	201.2	-27.7	-19.7	9h 55m 3s	7.4±0.3
S Temp. Zone	B5,B6	203.7	-25.2	-17.2	9h 55m 6s	6.6±0.5
S Temp. Cur.	Oval BA,C2,C8	216.6	-12.3	-4.3	9h 55m 24s	1.8±0.3
S Trop. Cur.	Great Red Spot	230.3	1.4	9.4	9h 55m 43s	-4.3±0.2
SEBs Cur.	S4,S13	235.2	6.3	14.3	9h 55m 49s	6.4±0.3
Eq. Cur.	E1-E6	7.9	-221.0	-213.0	9h 50m 41s	102.4±1.4
Eq. Cur.[b]	N1,N2,N4,N5,N7,N8	8.9	-220.0	-212.0	9h 50m 42s	101.1±0.7
N Eq. Cur. (barges)	N9-N13,N15,N19, N22,N23,N26,N33, N35	226.4	-2.5	5.5	9h 55m 37s	-2.5±0.5
N. Eq. Cur. (ovals)	N16-N18,N24,N2, N29,N34	223.1	-5.8	2.2	9h 55m 33s	-1.0±0.7
N Eq. Cur. central	N27,N30-N32		c			
N Temp. Cur. B?	F6,F7	173.8	-55.1	-47.1	9h 54m 25s	20.3±0.7
N Temp. Cur. A	F1-F4	250.2	21.3	29.3	9h 56m 10s	-12.2±0.7
NN Temp. Cur.	G1-G3,G5,G10	227.7	-1.2	6.8	9h 55m 39s	-2.6±0.8
NNN Temp. Cur.	G4,G6,G7,G11	232.6	3.7	11.7	9h 55m 46s	-4.3±1.2
NNNN Temp. Cur.	H8,H9	231.3	2.4	10.4	9h 55m 44s	-3.1±0.4

[a] The estimated uncertainty is 2 m/s.

[b] The average wind speed and drift rate does not include feature N6 which is considered to be an outliner

[c] The computed wind speed range is -6.6 to 28.8 m/s

[d] Wind speed sign is defined in Rogers, 1995, p. 392.

(Schmude and Lesser, 2000, 69). The uncertainties were computed in the same way as in (Schmude, 1998, 178-197). The normalized magnitudes are very close to the values measured in 1999 and 2000 (Schmude and Lesser, 2000, 70), (Schmude, 2002c). I conclude that Jupiter's brightness and color remained nearly constant between 1999 and 2001.

Whole-disc polarimetric measurements of Jupiter were made with the same photometer, telescope and filters used in Schmude (2002b, 106). The amount of polarized light reflected by Jupiter was computed in the same way as is described elsewhere (Schmude, 2002b, 106), (Dollfus, 1961, 343). Essentially 10 polarization units equals 1% polarized light. Figure 10 shows the amount of polarized light reflected by Jupiter in the V filter for different values of the solar phase angle. The results in 2001-02 are similar to those obtained by Lyot between 1923 and 1926 (Dollfus, 1961, 392).

Table 10: Photoelectric Magnitude Measurements of Jupiter Made During the 2001-02 Apparition

Date	Filter	a	Measured Magnitude	Normalized Magnitude
Sep. 27.40	B	11.1	-1.20	-8.34
Sep. 27.38	V	11.1	-2.15	-9.30
Sep. 27.42	R	11.1	-2.64	-9.79
Sep. 27.43	I	11.1	-2.54	-9.69
Oct. 21.36	B	10.9	-1.43	-8.42
Oct. 21.34	V	10.9	-2.31	-9.30
Oct. 21.32	R	10.9	-2.79	-9.78
Oct. 21.34	I	10.9	-2.66	-9.65
Nov. 10.33	B	9.4	-1.58	-8.44
Nov. 10.35	V	9.4	-2.48	-9.34
Nov. 10.30	R	9.4	-2.96	-9.82
Nov. 10.32	I	9.4	-2.86	-9.72
Nov. 18.35	B	8.4	-1.63	-8.44
Nov. 18.34	V	8.4	-2.52	-9.33
Nov. 21.23	R	8.0	-3.01	-9.80
Nov. 21.21	I	8.0	-2.90	-9.69
Dec. 9.24	B	4.9	-1.80	-8.52
Dec. 9.22	V	4.9	-2.66	-9.38
Dec. 9.20	R	4.9	-3.10	-9.81
Dec. 9.21	I	4.9	-2.98	-9.69
Dec. 18.26	B	3.0	-1.85	-8.54
Dec. 18.25	V	3.0	-2.65	-9.34
Dec. 18.28	R	3.0	-3.16	-9.85
Dec. 18.29	I	3.0	-3.03	-9.72
Dec. 26.11	B	1.4	-1.80	-8.48
Dec. 26.09	V	1.4	-2.73	-9.41
Dec. 26.13	R	1.3	-3.20	-9.88
Dec. 26.14	I	1.3	-3.11	-9.79

NOTE: Column “a” = phase angle of Jupiter

Polarization measurements were also made through the B, R and I filters. Between March 24 and April 7, the average amount of polarized light reflected by Jupiter (in polarization units) was: B (-2.1±0.3), V (-2.2±1.0), R (-3.6±0.3) and I (-2.8±0.6).

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Table 11: Normalized Magnitudes and Average Solar Phase Angle Coefficients for Jupiter During the 2001-02 Apparition

Filter	X(1,0)	cx
B	-8.55±0.02	0.014±0.006
V	-9.40±0.02	0.009±0.004
R	-9.87±0.01	0.008±0.002
I	-9.77±0.02	0.009±0.005

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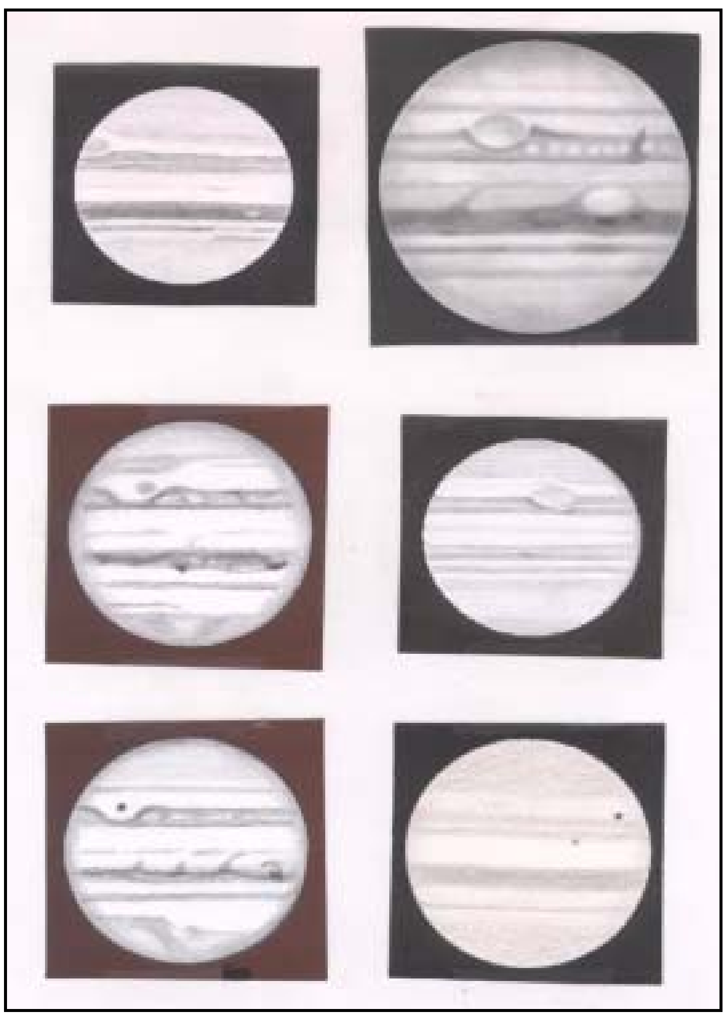

NOTES ON JUPITER DRAWINGS — These drawings are based on the appearance of Jupiter during the 2001-02 apparition.

Figure 1: (**top left**) B. Cudnik, 2001, Sep. 8 (11:40 UT) 0.25 m Newtonian reflector, 250 X, seeing = 5-8, $\lambda_{I} = 171^{o}$, $\lambda_{II} = 127^{o}$; (**top right**) M. Frassati, 2001, Oct. 13 (4:45 UT) 0.20 m Schmidt-Cassegrain, 250 X, seeing = 7, $\lambda_{I} = 43^{o}$, $\lambda_{II} = 94^{o}$; (**middle left**) L. Carlino 2002, Feb. 18 (0:25 UT) 0.15 m refractor 130X-200X, seeing = 7, $\lambda_{I} = 307^{o}$, $\lambda_{II} = 103^{o}$; (**middle right**) B. Cudnik, 2002 Feb.25 (4:18 UT) 0.25 m reflector 125X, 250 X, seeing = 6-8, $\lambda_{I} = 114^{o}$, $\lambda_{II} = 216^{o}$; (**lower left**) L. Carlino, 2002 April 19 (0:11 UT) 0.18 m Maksutov-Cassegrain 160X, seeing = 6-7, $\lambda_{I} = 44^{o}$, $\lambda_{II} = 103^{o}$, note shadow of Ganymede near right RSH; (**lower right**) C. Post, 2002 June 8 (2:46 UT) 0.20 m reflector, 214X, seeing = 1-2, $\lambda_{I} = 102^{o}$, $\lambda_{II} = 138^{o}$, note shadow of Ganymede near the following limb and fainter shadow of Europa near north edge of the SEB. South is at the top and the preceding limb is on the left in all.

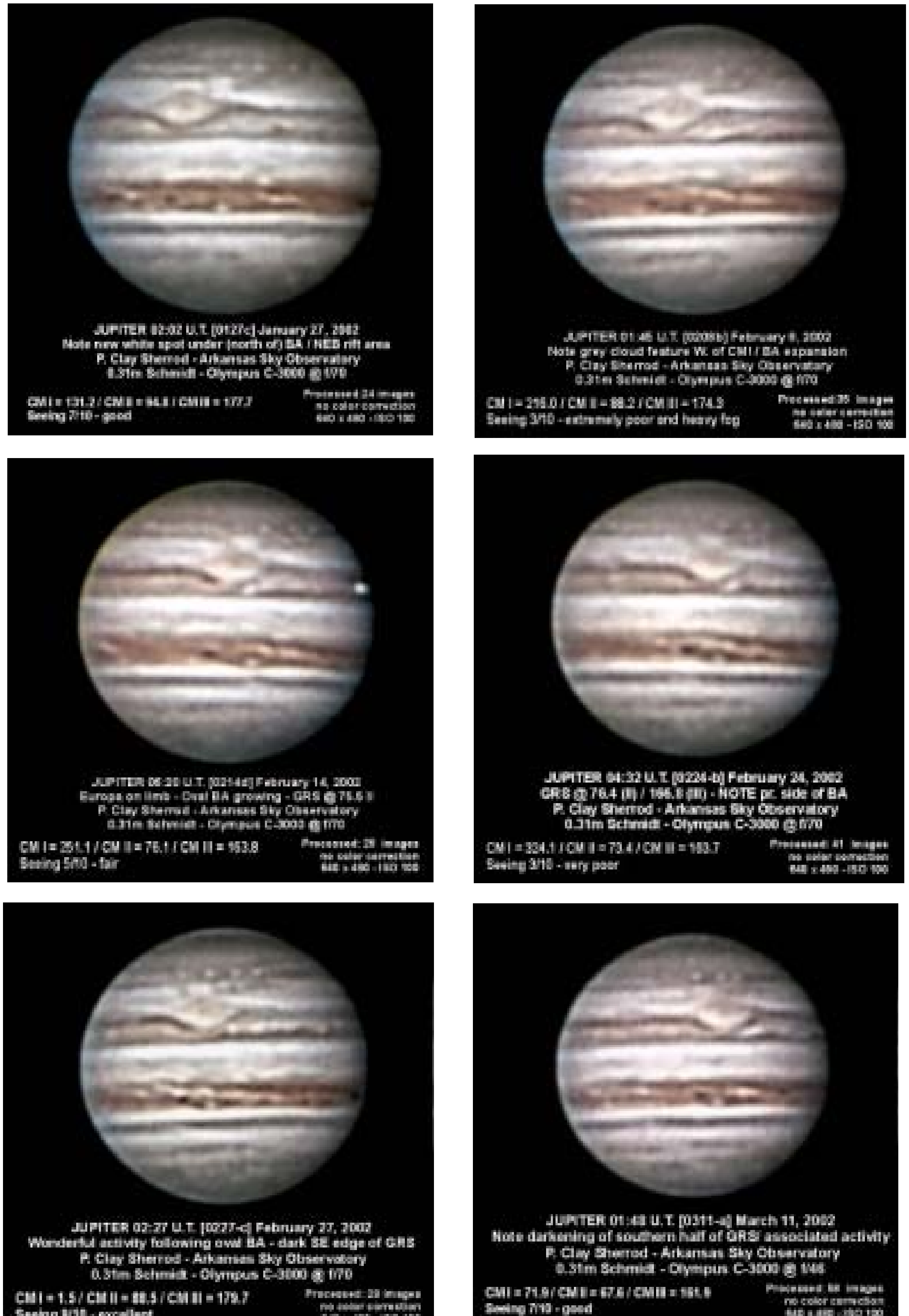

Figure 2: CCD images of Jupiter in 2002.; All images were made by Clay Sherrod and illustrate the movement of oval BA past the Great Red Spot. **Top left**: Jan. 27 (2:02 UT), λ_I = 132º, λ_{II} = 95º; **top right**: Feb. 8 (1:45 UT), λ_I = 217º, λ_{II} = 89º; **middle left**: Feb. 14 (6:20 UT), λ_I = 252º, λ_{II} = 77º, note Europa on following limb; **middle right**: Feb. 24 (4:32 UT), λ_I = 325º, λ_{II} = 74º; **lower left**: Feb. 27 (2:27 UT), λ_I = 2º, λ_{II} = 89º; **lower right**: Mar. 11 (1:48 UT), λ_I = 72º, λ_{II} = 68º. In all cases, south is at the top and the preceding limb is on the left.

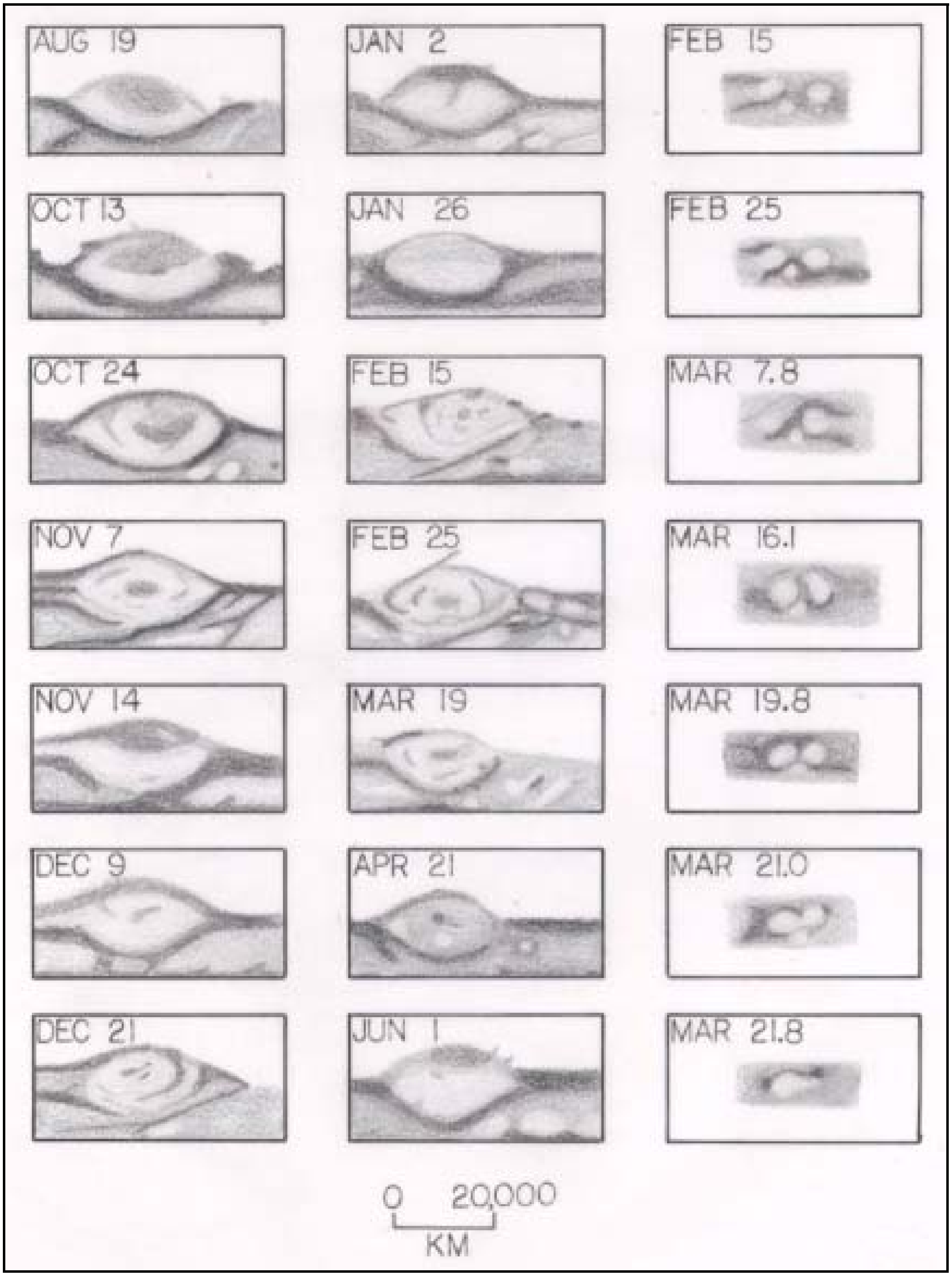

Figure 3: Drawings of the Great Red Spot and the merging of ovals B2 and B3, 2001-2002 Apparition. All drawings were made from CCD images except for the one on Jan. 26, which was made by the author using a 10.2 cm refractor.

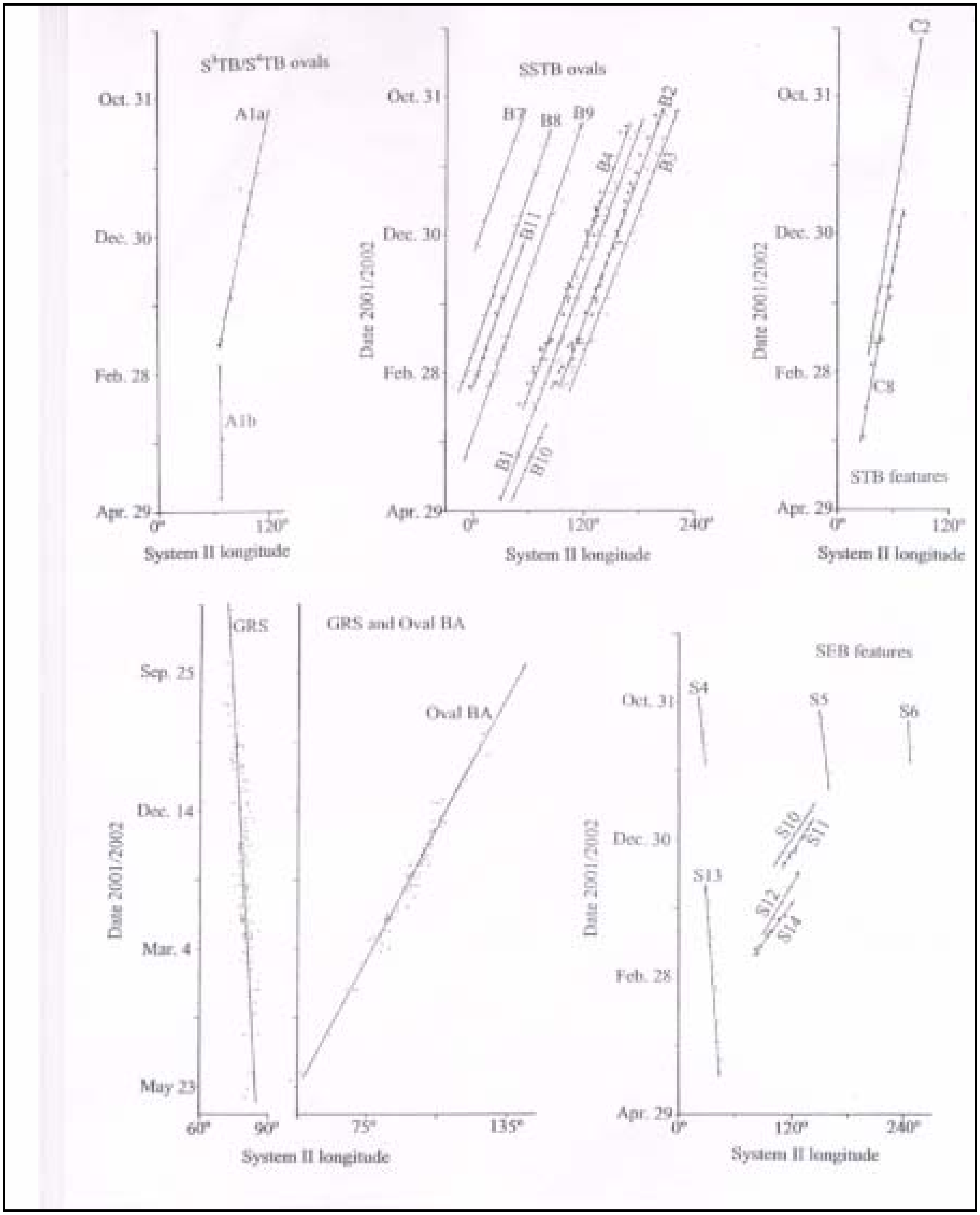

Figure 4: Drift Rates of various features in the southern hemisphere of Jupiter. Dots and x's correspond to longitude measurements.

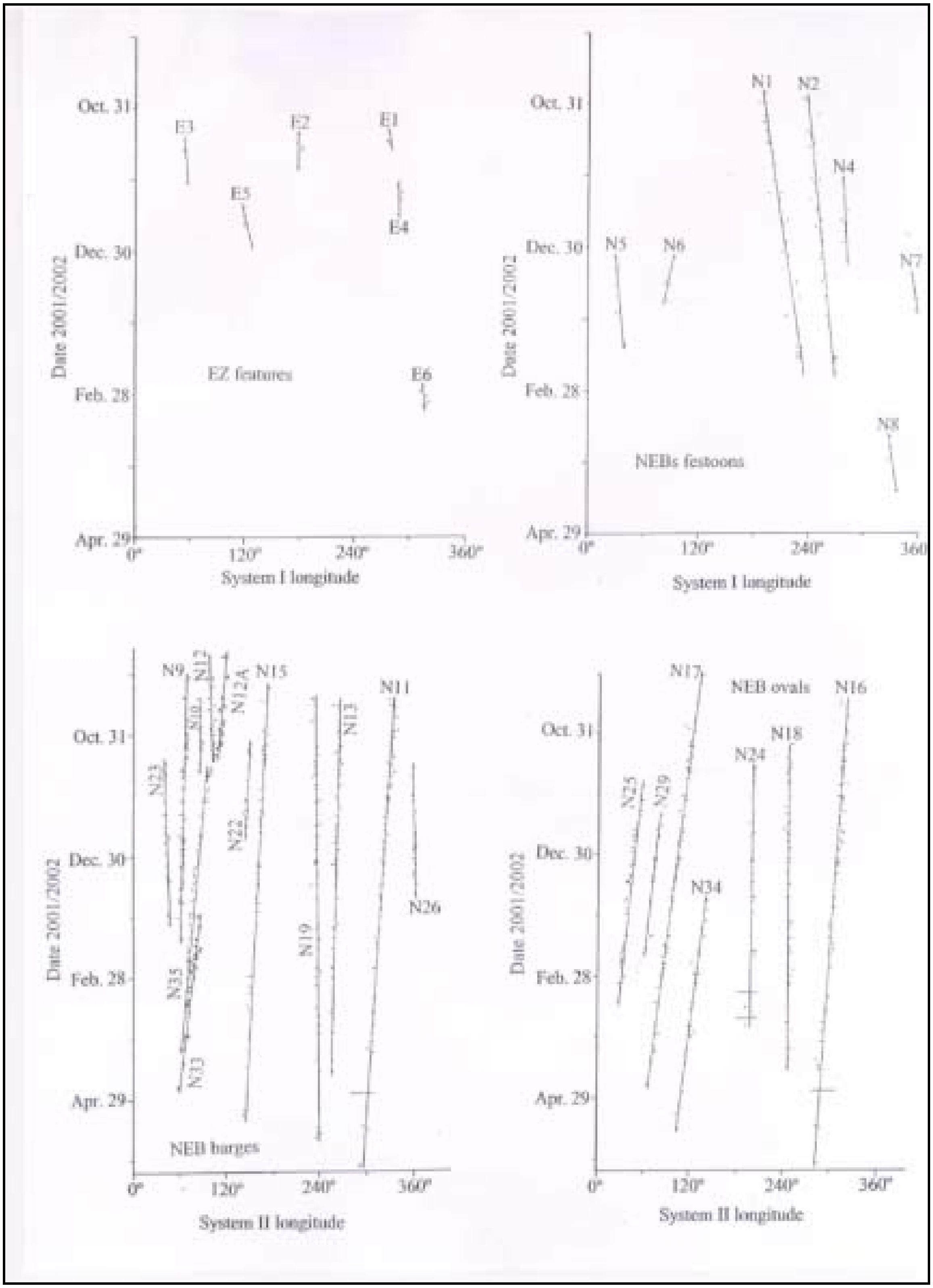

Figure 5: Drift rates of various features in the equatorial zone and in the north equatorial belt. Dots and x's correspond to individual longitude measurements made from CCD images or from central meridian transit times. Horizontal lines are measurements made from drawings and were only used if no CCD images were available.

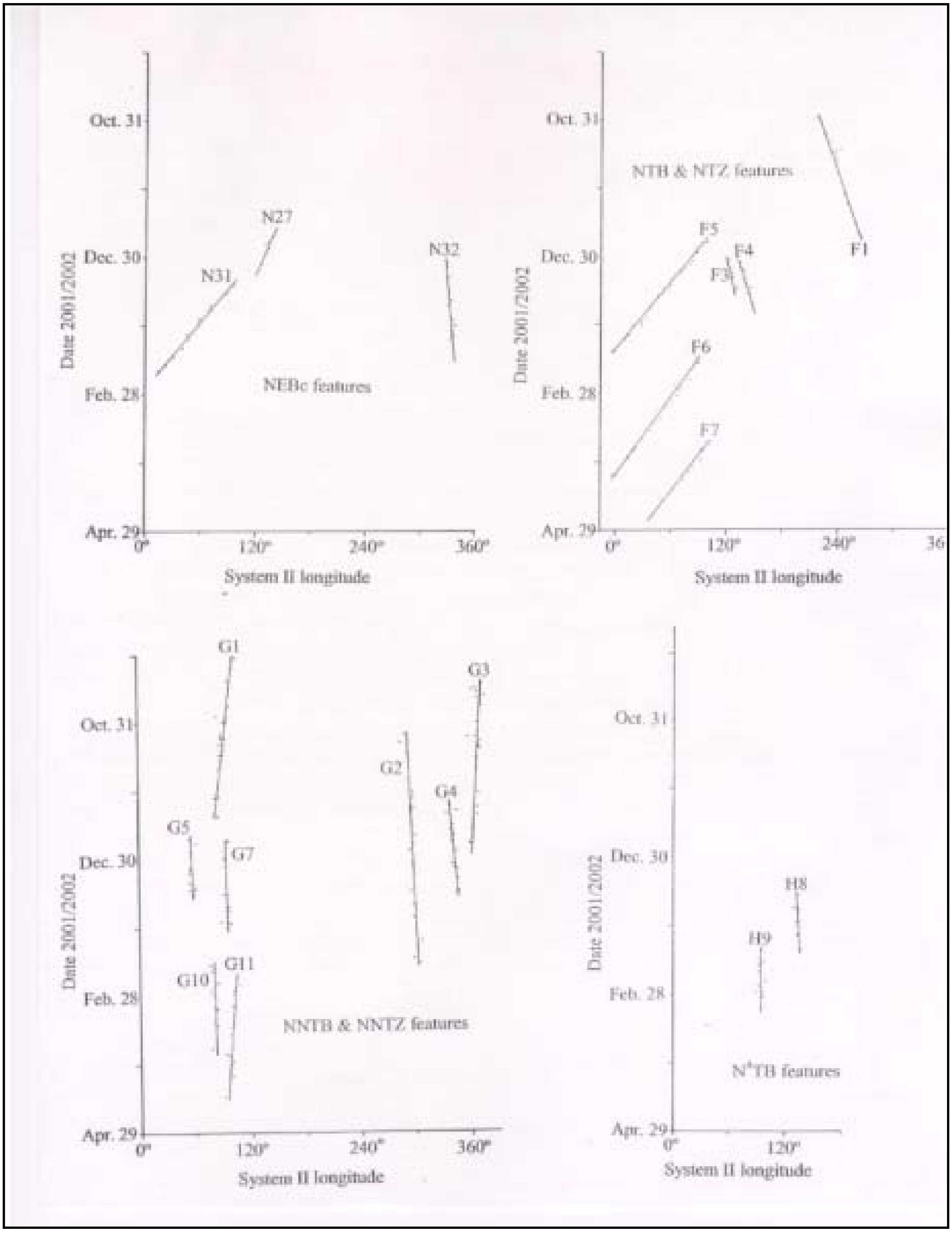

Figure 6: Drift rates of various features in the northern hemisphere of Jupiter. Dots correspond to individual longitude measurements.

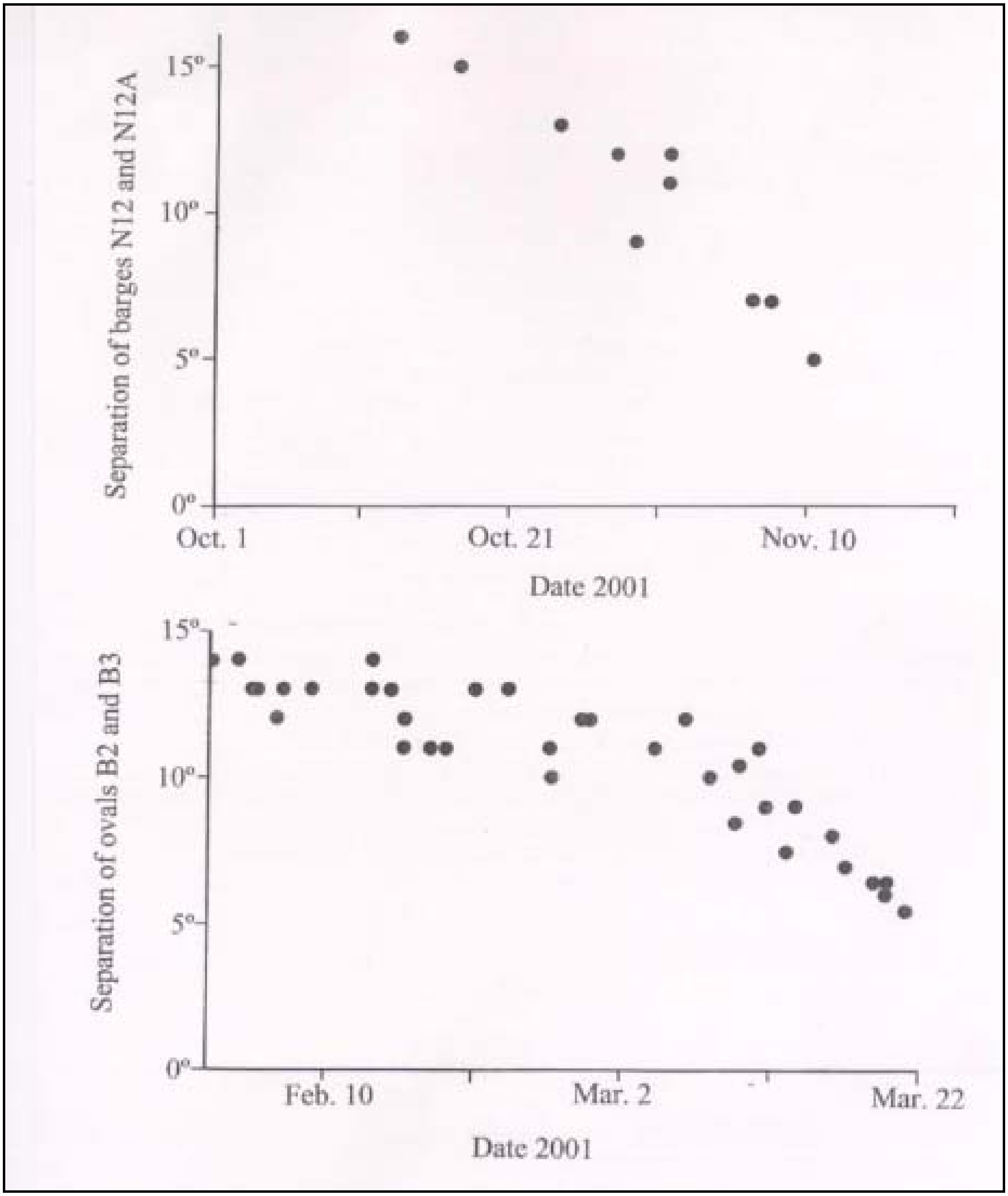

Figure 7: Graphs showing the separation of barges N12 and N12A during late 2001 (top) and the separation of ovals B2 and B3 during early 2002.

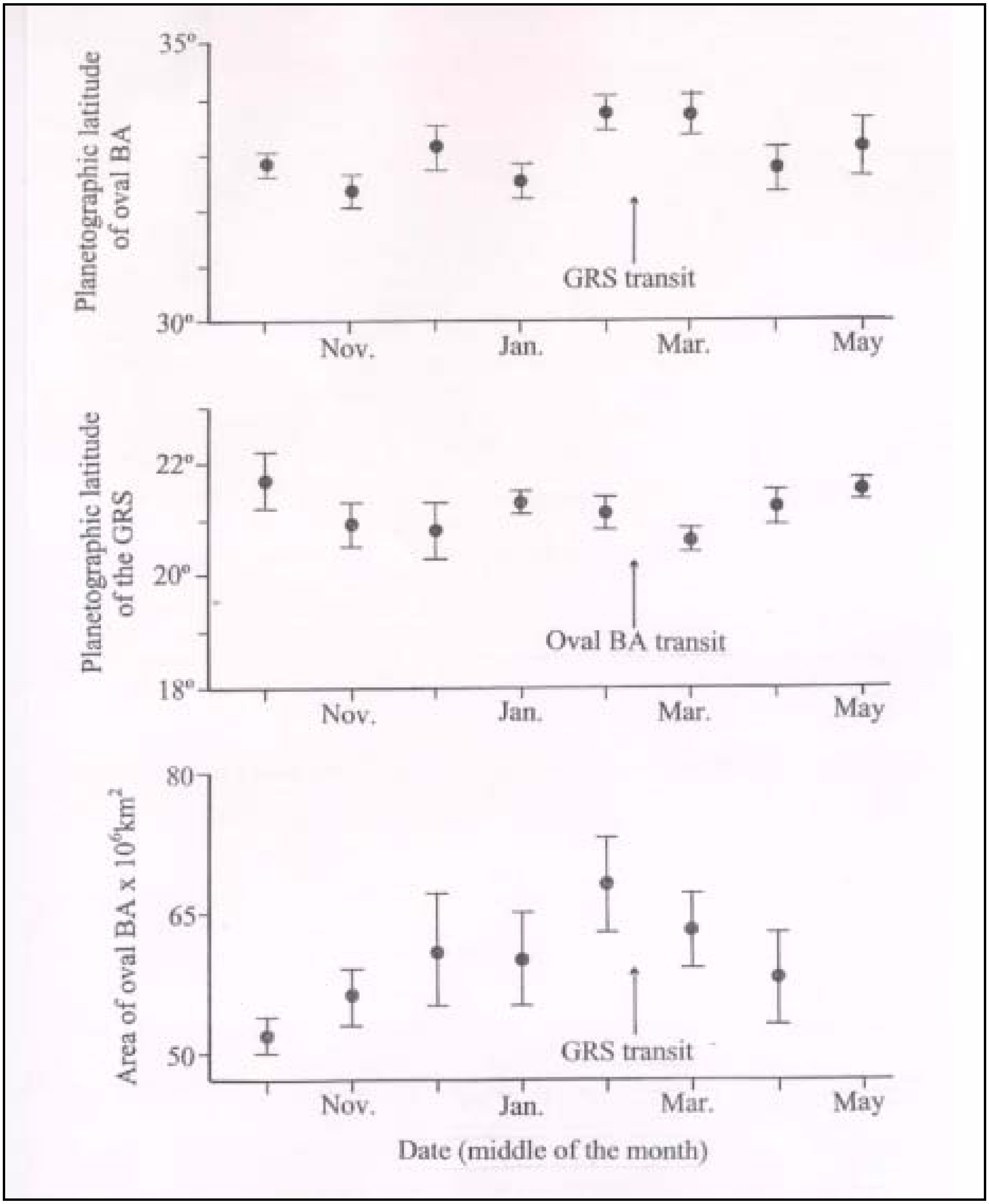

Figure 8: Graphs of the planetocentric longitude of oval BA (top) and the Great Red Spot (middle) versus the month in late 2001 and early 2002. The bottom graph show the area of oval BA as it transited the Great Red Spot in February 2002.

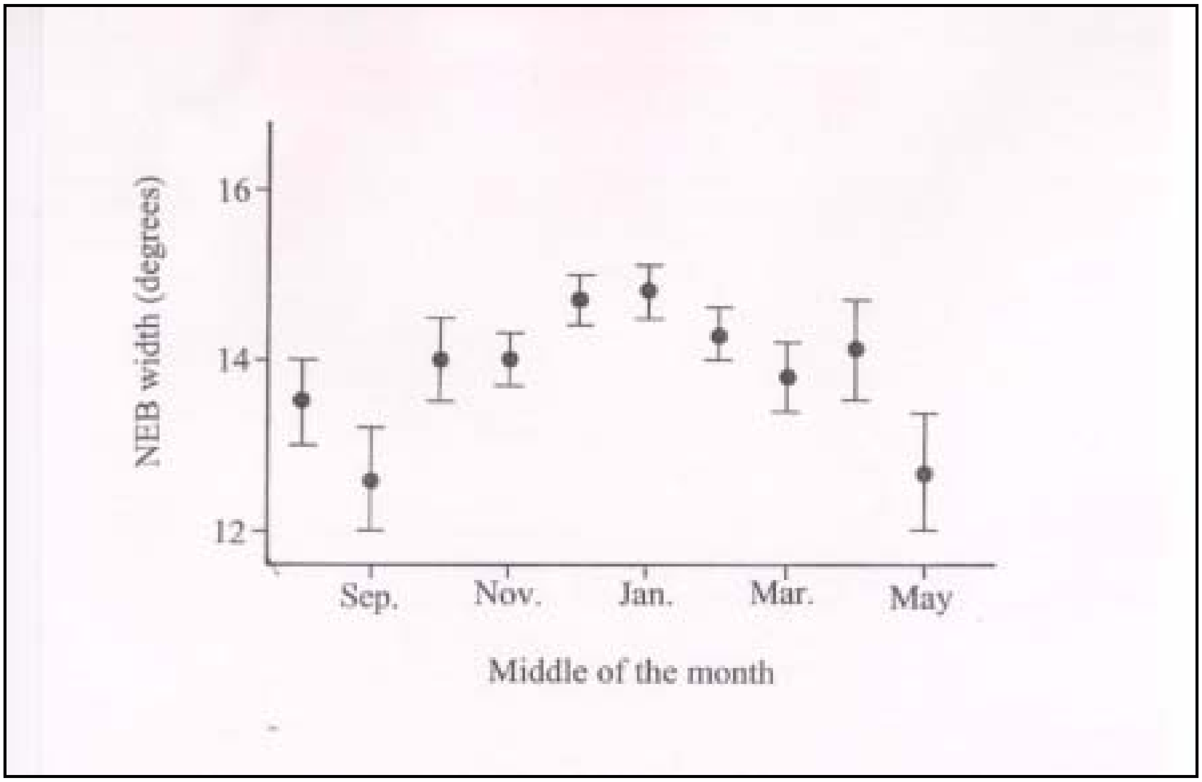

Figure 9: A graph of the width of the North equatorial belt of Jupiter during the 2001-02 apparition.

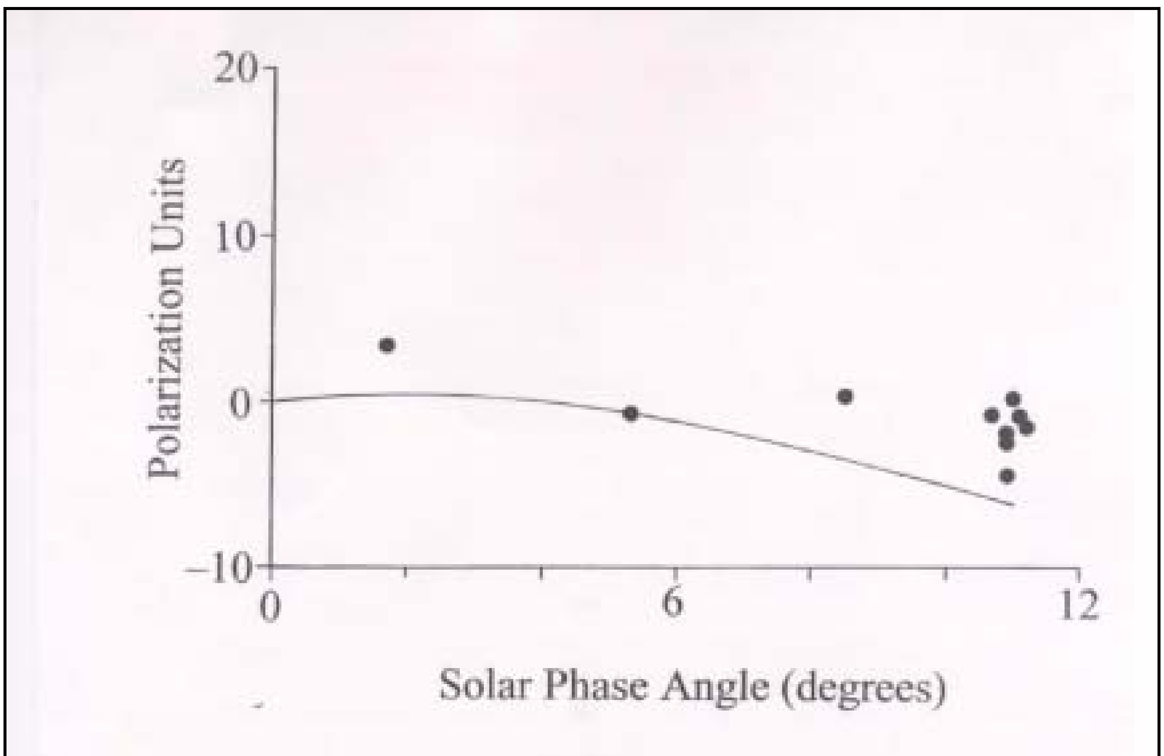

Figure 10: Amount of polarized light reflected by Jupiter as a function of the solar phase angle during the 2001-02 apparition shown as dots. All measurements were done in the V filter. The curve is based on Lyot's measurements made between 1923 and 1926 (Dollfus, 1961, 392).

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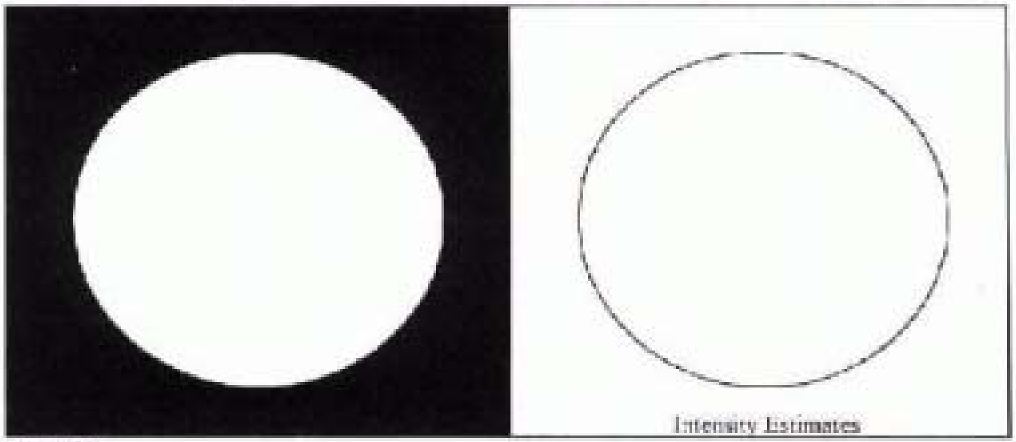

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- **Monograph Number 10.** *Observing and Understanding Uranus, Neptune and Pluto*. By Richard W.

ALPO Resources (continued)

Schmude, Jr. 31 pages. Price: $4 for the United States, Canada, and Mexico; $5 elsewhere.

ALPO Observing Section Publications

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

- **Lunar and Planetary Training Program (Robertson):** *The Novice Observers Handbook* $15. An introductory text to the training program. Includes directions for recording lunar and planetary observations, useful exercises for determining observational parameters, and observing forms. To order, send check or money order payable to "Timothy J. Robertson."
- **Lunar (Benton):** (1) *The ALPO Lunar Section's Selected Areas Program (*$17.50). Includes a full set of observing forms for the assigned or chosen lunar area or feature, together with a copy of the *Lunar Selected Areas Program Manual.* (2) *Observing Forms Packet,* $10. Includes observing forms to replace those provided in the observing kit described above. Specify *Lunar Form*s. (See note for Venus.)
- **Lunar (Jamieson):** *Lunar Observer's Tool Kit*, price $50, is a computer program designed to aid lunar observers at all levels to plan, make, and record their observations. This popular program was first written in 1985 for the Commodore 64 and ported to DOS around 1990. Those familiar with the old DOS version will find most of the same tools in this new Windows version, plus many new ones. A complete list of these tools includes Dome Table View and Maintenance, Dome Observation Scheduling, Archiving Your Dome Observations, Lunar Feature Table View and Maintenance, Schedule General Lunar Observations, Lunar Heights and Depths, Solar Altitude and Azimuth, Lunar Ephemeris, Lunar Longitude and Latitude to Xi and Eta, Lunar Xi and Eta to Longitude and Latitude, Lunar Atlas Referencing, JALPO and Selenology Bibliography, Minimum System Requirements, Lunar and Planetary Links, and Lunar Observer's ToolKit Help and Library. Some of the program's options include predicting when a lunar feature will be illuminated in a certain way, what features from a collection of features will be under a given range of illumination, physical ephemeris information, mountain height computation, coordinate conversion, and browsing of the software's included database of over 6,000 lunar features. Contact hjamieso@midsouth.rr.com; web site at http://members.telocity.com/hjamieson/TKWebPage.htm#Jamieson's
- **Venus (Benton):** (1) *The ALPO Venus Observing Kit,* $17.50. Includes introductory description of ALPO Venus observing programs for beginners, a full set of observing forms, and a copy of *The Venus Handbook.* (2) *Observing Forms Packet,* $10. Includes observing forms to replace those provided in the observing kit described above. Specify *Venus Forms.* To order either numbers (1) or (2), send a check or money order payable to "Julius L. Benton, Jr." All foreign orders should include $5 additional for postage and handling; p/h included in price for domestic orders. Shipment will be made in two to three weeks under normal circumstances. NOTE: Observers who wish to make copies of the observing forms may instead send a SASE for a copy of forms available for each program. Authorization to duplicate forms is given only for the purpose of recording and submitting observations to the ALPO Venus, Saturn, or lunar SAP sections. Observers should make copies using high-quality paper.
- **Mars (Troiani):** (1) *Martian Chronicle;* published approximately monthly during each apparition; send 8 to 10 SASEs; (2) *Observing Forms;* send SASE to obtain one form for you to copy; otherwise send $3.60 to obtain 25 copies (make checks payable to "Dan Troiani").
- **Mars:** *ALPO Mars Observers Handbook,* send check or money order for $10 per book (postage and handling included) to Astronomical League Book Service, c/o Paul Castle, 2535 45th St., Rock Island, IL 61201.
- **Jupiter:** (1) *Jupiter Observer's Startup Ki*t, $3 from the Jupiter Section Coordinator. (2) *Jupite*r, ALPO section newsletter, available online via the ALPO website or via snail-mail; send SASE to the Jupiter Section Coordinator; (3) To join the ALPO Jupiter Section e-mail network, *J-Ne*t, send an e-mail message to the Jupiter Section Coordinator. (4) *Timing the Eclipses of Jupiter's Galilean Satellites* observing kit and report form; send SASE with 55 cents in postage stamps to John Westfall.
- **Saturn (Benton):** (1) The *ALPO Saturn Observing Ki*t, $20; includes introductory description of Saturn observing programs for beginners, a full set of observing forms, and a copy of *The Saturn Handboo*k. (2) *Saturn Observing Forms Packe*t, $10; includes observing forms to replace those provided in the observing kit described above. Specify *Saturn Forms.* To order, see note for *Venus Forms*.
- **Meteors:** (1) Pamphlet, *The ALPO Guide to Watching Meteors,* send check or money order for $4 per book (postage and handling included) to Astronomical League Book Service, c/o Paul Castle, 2535 45th St., Rock Island, IL 61201. (2) *The ALPO Meteors Section Newslette*r, free (except postage), published quarterly (March, June, September, and December). Send check or money order for first class postage to cover desired number of issues to Robert D. Lunsford, 161 Vance St., Chula Vista, CA 91910.
- **Minor Planets (Derald D. Nye):** *The Minor Planets Bulleti*n, published quarterly $14 per year in the U.S., Mexico and Canada, $19 per year elsewhere (air mail only). Send check or money order payable to "Minor Planets Bulletin" to 10385 East Observatory Dr., Corona de Tucson, AZ 8564I-2309.

ALPO Resources (continued)

- **Computing Section (McClure):** Online newsletter, *The Digital Lens,* available via the World Wide Web and e-mail. To subscribe or make contributions, contact Mike McClure

Other ALPO Publications

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

- ***An Introductory Bibliography for Solar System Observers.* Free** for a stamped, self-addressed envelope. A 4-page list of books and magazines about Solar System bodies and how to observe them. The current edition was updated in October, 1998. Order from: ALPO Membership Secretary.
- *ALPO* ***Membership Directory.*** $5 in North America; $6 elsewhere. Latest updated list of members on 3.5-in. MS-DOS diskette; either DBASE or ASCII format. Make payment to "ALPO" Also available via e-mail as portable document format (pdf) file to requester's e-mail address. Provided at the discretion of the Membership Secretary. Order from Matthew Will, ALPO membership secretary/treasurer.
- **Back issues** of *The* ***Strolling Astronomer (JALPO).*** Many of the back issues listed below are almost out of stock, and it is impossible to guarantee that they will remain available. Issues will be sold on a first-come, first-served basis. In this list, volume numbers are in italics, issue numbers are in plain type, and years are given in parentheses. The price is $4 for each back issue; the current issue, the last one published, is $5. We are always glad to be able to furnish old issues to interested persons and can arrange discounts on orders of more than $30. Order directly from and make payment to "Walter H. Haas"(see address under “Board of Directors,” page 64):

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

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

Membership dues include a subscription to this Journal and option to participate on the ALPO-Member-Discussion e-mail listserv. Membership dues are:

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THE ASSOCIATION OF LUNAR AND PLANETARY OBSERVERS (ALPO)

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

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

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To join online, go to the Astronomical League web page that has the ordering information and entry page at: http://www.ec-securehost.com/AstronomicalLeagueSales/ALPO_Membership.html Afterwards, e-mail the ALPO membership secretary at will008@attglobal.net with your name, address, and the type of membership and amount paid.

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