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Journal of the Association of Lunar & Planetary Observers

The Strolling Astronomer

Volume 44, Number 3, Summer 2002

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Inside . . .

An honor well-deserved

ALPO Executive Director Donald C. Parker (left) presents Richard W. Schmude, Jr., with the 2002 Walter H. Haas Observing Award in recognition of Richard's contributions to the organization as coordinator of both the ALPO Jupiter Section and Remote Planets Section, and as a very active observer. The award was presented at the Astronomical League's ALCON 2002 convention closing ceremonies banquet held in Salt Lake City July 31 - August 3. Details about the ALPO portion of the convention are inside this *Journal*.

Also ..a observing even with vision problems, a report on the 2001 Leonids, thoughts on changes in the lunar crater Herodotus, frost-flashes on Mars, the 2001 remote planets report and much, much more.

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

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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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Association of Lunar and Planetary Observers (ALPO)

Board of Directors

Executive Director (Chair); Donald C. Parker
Associate Director, Richard W. Schmude, Jr.
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Member of the Board; Richard Hill
Member of the Board; Ken Poshedly
Member of the Board; John E. Westfall
Member of the Board, Secretary; Elizabeth W. Westfall
Member of the Board, Treasurer and Membership Secretary; Matthew Will

Publications

Acting Publisher, Ken Poshedly

Primary Observing Coordinators, Other Staff

(See full listing in *ALPO Resources* at end of book)
Lunar and Planetary Training Program: Coordinator; Timothy 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.
Comets Section: Coordinator; Gary Kronk
Meteors Section: Coordinator; Robert D. Lunsford
Meteorites Section: Coordinator; Dolores Hill
Computing Section: Coordinator; Mike W. McClure
Youth Section: Acting Coordinator; Timothy J. Robertson
Historical Section: Coordinator; Richard Baum
Instruments Section: Coordinator; R.B. Minton
Eclipse Section: Coordinator; Michael D. Reynolds
Webmaster: Coordinator; Richard Hill

Point of View
Where Are the Observations?!

By Donald C. Parker, executive director, ALPO

In August, when I again assumed directorship of the Association of Lunar and Planetary Observers, I found some very positive things about the organization: Julius Benton's excellent organizational skill has left the ALPO running smoothly, making my job much easier. The Web Page, managed by WebMeister Rik Hill, remains second to none, with more and more organizations linking to our site.

The ALPO continues to strengthen its ties with international organizations, notably the British Astronomical Association and the Oriental Astronomical Association. Our journal, *The Strolling Astronomer*, under Ken Poshedly's guidance, has maintained its first-class status, with the papers steadily improving in readability and scientific content. I was particularly struck by the high quality of the ALPO presentations at our meeting in Salt Lake City. But one thing has been nagging me where are the observations?

When Walter Haas and I were discussing solitary reports of unusual Solar System events, Walter mentioned that there surely must have been other amateur astronomers seeing these occurrences. Why, then, have they not reported them? I feel that the main reason is that they feel that their work is somehow inferior: "It's only visual work, a drawing." Nothing could be further from the truth.

We should remember that the primary purpose of the ALPO is to collect data and thus provide a long-term record of the Solar System bodies and that visual observations are still the backbone of this work. At a recent Mars meeting, I was surprised and delighted to see professional planetary astronomers refer to data gleaned from ALPO drawings. But how many more quality observations are gathering dust in some amateur's desk drawer?

When attending club meetings and star parties, let's make an effort to encourage other amateurs to report their observations, explaining that valuable work is often done with very modest equipment. These amateurs don't even need to join our organization, although membership will provide them with a means to better comprehend what they are observing and thus derive more enjoyment from even casual observations of the Moon and planets. So perhaps we should explain to other amateurs why we are members of ALPO being able to appreciate what is happening on other worlds as we gaze upon them through our telescopes is, quite simply, fun!

Letters

The opinions expressed in the “Letters” section of this Journal are those of the writer and do not necessarily reflect the official policies of the ALPO.

(Posted on the ALPO-Members-Dicsussion listserv)

I would like to propose a simple change in the definitions we use for "astronomical seeing" and "transparency" to "atmospheric stability" and "atmospheric clarity." Probably better terms for the masses would be "sky steadiness" and "sky clearness" for the uninitiated and unabashed amateur astronomers who have little use for science and mathematics. We could use a scale like, "steady sky at 10" for the typical scale from 0 to 10 and "clear sky at 6" for a scale of 0 to 8 magnitude stars.

After many years of associating with astronomers and encountering the confusion that many of them have as to what is "seeing" or "transparency" it seems to me a simple change in terminology would stop some of the mystery. Many of the myths associated with astronomy are handed down from publication to publication because writers assume everyone understands all the colloquial jargon we use and simply do not take the time to explain them to the readers. Some are dead wrong, but writers either don't care of don't know any better. Many of the newcomers to our hobby just do not want be embarrassed by asking what may seem to be a stupid question. After all, if someone commented to me during scuba diving lessons that the "seeing" in the water was great -- I may assume the person was talking about seeing sharks or something.

How do we change something than seems to be etched in stone? Well, we "see" our way "clear" of the foggy definitions and just start using new terms in place of old ones. I'm sure someone else may have a better description of these terms than what I have suggested herein.

Jeff Beish

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 sucessful.

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

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Observing Section Reports

Meteors Section

By Robert D. Lunsford, coordinator

The ALPO Meteors Section continues to collect and analyze meteor data collected by its observing team. A maximum effort was made during last year’s Leonid storm. Since then, the Moon and bad weather have prevented many observers from successfully gathering data. The recent Perseid display was enjoyed by many observers and proved entertaining with its many fireballs. Once the data have been more thoroughly analyzed, the results will be submitted as an article in this *Journal*. We also look forward to another successful Leonid campaign and look forward to your data and comments about this upcoming display.

Comets Section

By Gary Kronk, acting coordinator

A flurry of fairly bright comets has appeared in 2002, with the brightest (so far) being C/2002 C1 (Ikeya-Zhang). This has breathed life into the ALPO Comets Section, with several observation reports coming from B. Cudnik, G. W. Kronk, R. B. Minton, G. Nowak, and F. J. Melillo. In addition, images of comets have arrived from Minton and E. Flescher. The recent discovery of comets C/2002 O4 (Hoenig) and C/2002 O6 (SWAN) provides even more objects to observe as we head into autumn.

This is a reminder that report forms are available on the ALPO Comet Section web site at:

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

Photograph Comet C/2002 C1 Ikeya-Zang by Michael Jäger on 2002 March 30.81. The photo is a composite of two 4-minute exposures obtained with a 200/300 Schmidt camera and Kodak Ektachrome 100 film. The field of view measures 6° by 3.5°. Photo copyright 2002 by Michael Jäger.

Images can be e-mailed to Mr. Kronk at:

kronk@amsmeteors.org

Solar Section

By Rik Hill, coordinator

Solar activity continues at high levels. Complex active regions like AR0069 that is currently (08/20) visible on the disk, provide our Section members with great targets for their equipment. This particular active region came on the disk Aug. 11 and was first observed by Bruno Nolf, Franky Dubois, Rick Gossett and Eric Roel in digital images and in drawings by Monty Leventhal and Susan Delaney. It was already a flare-producing, complex region with a MacIntosh Class of Ehi or possibly Fhi! So even though we may be past solar maximum for Cycle 23, still there is a lot of activity to be enjoyed.

Data are literally pouring in to the Section. The latest Rotation Report, published at:

http://www.lpl.arizona.edu/~rhill/alpo/solstuff/rotns/rr1992.html

is clear testimony to this. It covers a number of rotations and contains a tremendous amount of observations: 416 hardcopy (drawings and photo prints), 375 digital images and 25 radio observations. In the last year and a half this puts our submitted observations at 2096! Beyond that, we have a record number of people contributing to that total, with 64 observers who have submitted observations and of these 15 are new.

All these observations are made available to professional researchers through the Rotation Report. Rick Gossett, our assistant coordinator for archiving, is now past the halfway point in digitizing observations from 1982 to present. This is a monumental task; but when done, all ALPO Solar Section observations from the last 20+ years will be available on CDROM to those doing research.

Solar prominences on 08 September 2002, approximately 14:30 UT. Image by Ginger Mayfield and taken from a meadow in the Rocky Mountains west of Colorado Springs, CO; elevation about 8,800 feet; seeing usually not very good "but this morning it did seem a little better than usual," (perhaps a 6). Previous night's weather had been windy with many clouds. Equipment: Olympus C-2100 digital camera, F3.5, 1/100 sec, 7x zoom, TV85 and Solarmax 60.

So if you have even a passing interest in observing the sun, seriously consider joining our efforts and contact the Solar Section coordinator.

Lunar Section: Lunar Meteoritic Impacts Search

By Brian Cudnik, coordinator

The watch for lunar Leonids was successful, with two confirmed impacts reported. At least five good candidates (called "Probable") exist, and these have yet to be confirmed. Activity since the Leonids mainly consisted of a monthly "Earthshine watch" by two dedicated observers; this effort produced a handful of candidates.

The first good lunar meteor viewing opportunity came with the Perseids of mid-August. Many observers monitored the Moon for the tell-tale "flashing stars", and have even produced 52 candidates to date.

However, due to the vast majority of these appearing on only a single frame of people's CCD video cameras (all nine confirmed sightings to-date appear on at least two frames, as do several of the probable events), and/or several impacts not being seen on additional tapes recorded at the same time, and when monitoring the same region of the Moon, we conclude these to be cosmic ray events. Only a handful of the candidates may be real events.

Lunar Transient Phenomena

By Anthony Cook, acting coordinator

I'd like to mention that the LTP page (on the ALPO website) has been updated to include a list of observing times for specific features. Actually I cannot presently see the update when I browse the web site from the UK, but I'm sure Rick Hill will make it appear soon!

The intention here is that whether you be anti-LTP, or pro-LTP, observing on these dates and times will help us to record the appearance of these features under identical solar illumination (to within +/-0.5 deg) conditions to when LTP have been observed in the past. This can then be used to eliminate many of the past LTP reports where the cause were due to things like confusion of detail, tricks of light, shadow, illumination effects. Ideally we should be including identical libration as well, but getting four illumination/viewing parameters to correspond to those from past LTP events (to within say +/-1 deg) is quite a rare event.

This method is nothing new, it was pioneered by ALPO's Lunar tool kit software, and during the Torricelli B observing alert.

Also I would strongly encourage observers not to attempt observing the Moon unless it is at least 20 deg above the horizon. This will avoid arguments for LTP being due to bad seeing and spurious colour associated with observing too close to the horizon.

Please if you are observing these features, simple sketches should suffice to show where the shadows are, brightest features etc. If you wish try to estimate relative brightness. Folks with CCD cameras please have a go at taking high resolution images (with or without filters).

I plan to produce a joint BAA/ALPO newsletter each month and e-mail it to those who wish to receive it. This details observations received, observing techniques, arguments for and against LTP etc.

As to my own opinions on LTP - yes I think there have been a fewunambiguous examples, for example,. Greenacre & Barr's observations, Richard Baum's observation of a coloured Mt on the limb near to Langrenus, the famous Walter Haas Herodotus shadow observation, Torricelli B etc.

However we must also remember that observing campaigns in the past have drawn a blank e.g. Hynek's team spents ~5,000 hours observing the Moon with an electronic moon blink device and could not confirm the LTP events reported by others of that time. An earlier electronic moon blink device, with better sensitivity, run by a different group was able to detect some coloured events. So my guess is that real LTP are very rare.

As to causes, well these have to be relatively benign, possibly low energy events, and not cause permanent changes on the surface, else these would be seen.

Minor Planets Section

By Lawrence S. Garrett, assistant coordinator

The flyby of Asteroid 2002NY40 has for sure kept me busy each day with yet another e-mail to attend. Recently, Rik Hill reported a suspected 10-minute period, in large contrast to the 20-hour value reported before the close approach. Hill also reported not-so-good skies.

While charts and magnitude reports are needed, I wish to report my own efforts to promote observation and background that (I hope) helped readers of the Minor Planet mailing list observe this object.

First, I inquired of the problems some software such as *Guide* (version 7.0) handles very close objects. This led to a discovery of a software error at the Minor Planet Center that kept the daily elements from being posted correctly, thus leaving observers with out-of-date information. Bill Gray, maker of the program, found this error, but I have seen this problem for years at the site, and thought it was because the MPC wanted people to pay for the latest elements. With this discovery, observers were better prepared for this approach.

Also, I suggested an upgrade to the webpage under the Minor Planet Ephemeris Service, which was reviewed, approved and upgraded just 49 minutes after I suggested it! They had never thought to place a longitude/latitude/altitude function on this page, despite its already being on other pages. With this upgrade, observers can produce custom coordinates for their own locations, rather than use the fixed observatory code drop list. Both upgrades helped observers for this flyby.

Also, I promoted the ALPO Minor Planet Section at the excellent NASA website spaceweather.com. My asteroid observing article was posted as a link to the MPS, along with other professional sites and my observing comments were quoted also here.

I promoted observing NY40 and the ALPO at Vermont's Stellafane conference as well. I handed out finder charts and urged the few large telescopes that could reach NY40 to try, with two of the three finding the object. With luck, this was near magnitude 15.0, rather then a possible 16.0 (light curve variation), so smaller scopes could have found it on this excellent night.

I was pleased to use a 25-inch reflector to show this object to about a dozen observers, then later observed NY40's motion and tracked it for over an hour in a 14.5-inch reflector. Our plans to observe NY40 made the local newspaper, the only such observing project reported, with telescopes being the main topic.

Lastly, I was able to get the ALPO mentioned in the *Sky &Telescope* magazine astro-alerts (Minor Planet) by Roger Sinnott. My observing article, plus links to my EASY-VIEW starchart table, went out to inform and prepare these readers, and hopefully get a few to return to the ALPO Minor Planet Section.

My articles posted the minor planet webpage on observing, and the EASYVIEW starchart table reached these readers. Hopefully, some of these readers will make returning to the Minor Planet Section webpage a regular read.

Jupiter Section

By Richard Schmude, coordinator

During the past couple of months, several people have sent drawings, intensity estimates and central meridian transit times. Included are: Alan Heath (United Kingdom), Brian Cudnik (TX, USA), Walter Haas (NM, USA), Tom Buchanan (GA, USA), Dale Dufresne (LA, USA), Detlev Niechoy, (Germany), Dan Boyer (FL, USA), Charles Celia (CT, USA) and Richard Schmude, Jr. (GA, USA). Many more people have been posting CCD images on the Jupiter listserv. The most active people on the Jupiter list serve are Clay Sherrod (AK, USA), Eric Ng, Tan Wei Leong (Singapore), David Moore, Ed Grafton (TX, USA) and Mario Fractal (Italy).

The biggest news during the early part of 2002 has been the passage of the oval BA past the GRS. The GRS was at a system II longitude of 80 degrees during February. During early March, oval BA passed the GRS, and by March 13 the oval was in front of the GRS. Just to the south of oval BA are at least 3 smaller white ovals having diameters of around 4,000 km. There is a large rift in the NEB at a system II longitude of 20 to 90 degrees.

Jupiter is now visible in the early morning sky. Coordinator Schmude recommends that people begin making transit times of various Jovian features and send them in monthly to John McAnally; regular mail address: 2124 Wooded Acres, Waco, TX 76710; e-mail address: CPA-JohnM@aol.com. Drawings and images should be send to Damian Peach; please consult the most recent Strolling Astronomer for his addresses since he has moved a couple of times.

During early 2002, Oval BA passed the Great Red Spot and a preliminary analysis shows that oval BA slowed down slightly as it approached the Great Red Spot and then it accelerated after passing the spot. The dynamics of Jovian storms is of great interest to the ALPO Jupiter section and to professional astronomers.

The 1992-93 Jupiter report has been submitted to the editor. The 2000-2001 report is almost complete and Richard Schmude will begin writing the 2001-2002 report shortly. Let's have a good time this year with observing the giant planet!

Remote Planets Section

By Richard Schmude, coordinator

Brian Loader has recently submitted his photometric measurements of Uranus and Neptune. Brian made his measurements from New Zealand where planets were high in the sky. Brian measured the normalized magnitude of Uranus to be: V (1,0) = -7.13; this value is based on an average of measurements made on four different dates. This normalized magnitude is very close to the measurements that Richard Schmude made from Georgia in the U.S. The measurements made by Brian and Richard are consistent with Uranus continuing a dimming trend that started in the late 1980s.

Several people (Ed. Grafton, Walter Haas, Frank Melillo, Richard Schmude and Doug West) have already sent in observations of Uranus, Neptune and Pluto. A preliminary analysis of the data indicates that Uranus is continuing its decade long trend of becoming dimmer. In early August 2002, Dr. Schmude had the chance of observing both Uranus and Neptune through the 28-inch (0.7 meter) telescope atop Mt. Evans (elevation 14,130 feet); Neptune had a strong blue color, whereas Uranus had a pale greenish color. The color on Neptune was stronger than on Uranus. There were no albedo features on Neptune; a slight darkening near the center of Uranus was suspected. Everyone is encouraged to observe or image Uranus and Neptune on the night of the 14th and 15th of each month in the hope of getting simultaneous observations of the two planets.

Interest Section Reports

ALPO Website

By Rik Hill, webmaster

Currently the A.L.P.O. website contains over 100 Mb of information and observations on everything in the solar system. Here you will find observation forms, information on making various observations and new reports on the latest finds and observations by ALPO members. It is a good resource for teachers and astronomy clubs as well as an introduction to the organization itself.

For those about to join or renew, you should consult the "How to Join" link on the front page of the website for the latest information. At the recent ALPO meeting the Board took some actions that affect membership dues.

On the front page you will not only find the display of the correct Universal Time from the U.S. Naval Observatory but there are a number of tools linked there that will help you plan your observing and aid with identification of objects and features. There is also the Tons-O-Clubs page with the names and URLs for hundreds of astronomical clubs, societies, associations and organizations from around the world, that is constantly growing. If you have one of these you would like listed here, just contact the Web Manager at rhill@lpl.arizona.edu

Instruments Section

By Richard J. Wessling, assistant coordinator

This summer there has been little section activity. There is a growing interest in not just our instruments but how the eye interacts with our instruments and how the brain interprets what we see. The role our eyes play in observing cannot be overstated, and since many people wear corrective lenses, eye relief in eyepiece design is very important. Also, very high quality, wide angle, focal length range of 32 to 50mm in 1.25-inch barrel design would be useful for observers. There are few on the market, but these eyepieces would be welcome.

Some questions were raised about the binocular viewer and if it could help with eye problems. This shows a growing concern with high magnification viewing of the Moon and planets and our eyesight. I have written an article about exit pupil size and eye defects that appears later in this issue of the *Journal*. Observers may at times think their eyes are so bad, that they can no longer observe. If you think this way, drop me an e-mail and I will discuss it with you. You may be surprised at what can be done to help.

ALPO-Member-Discussion Listserv

By Ken Poshedly, list moderator

All members of the Assn. of Lunar & Planetary Observers are encouraged to join and participate on this online feature. Initially, all members with electronic mail addresses were subscribe; many stayed on, but various members dropped off, some due to already too many e-mails from other sources. But those who have stayed on have found it to be a true benefit in learning what other ALPO members have to say about either organizational matters, observing techniques or equipment, or various solar system bodies and events.

Thus far, we have been “spam-free” (no unwanted advertisements), with this trend hopefully to continue indefinitely.

For more information or to join in, send an e-mail to:

poshedly@bellsouth.net

Staff News: Lunar Section

(From Julius Benton, on 23 July 2002)

Effective immediately, I am appointing Marvin Huddleston as Acting Coordinator Lunar Topographical Studies in our Lunar Section to fill the vacancy created by the resignation of our colleague and friend, Bill Dembowski. Marvin has once again become a full member of the ALPO, and many of you will recall that he was on our staff years ago in the Lunar Section. Marvin will immediately begin working with Bill Dembowski to transition the files and observations, continue on-going projects, and begin corresponding with observers.

Everyone please join me in welcoming Marvin back to our staff. I have copied Marvin and Bill on this message in an attempt to minimize the volume of e-mails. I am asking Marvin to develop a "mission statement" for his programs for future publication in the *Journal of the Assn. of Lunar & Planetary Observers*. Marvin, congratulations, and if we can assist you in any way, please do not hesitate to contact us.

Bill, I would be remiss if I did not say once again that we appreciate all of your contributions to the ALPO during your tenure as Lunar Coordinator, and we certainly wish you the very best in your future endeavors. Of course, I realize that you remain an active ALPO member, and I hope you will continue to contribute observations. I also appreciate very much your expressed willingness to assist Marvin during the transition.

About the Some of the Authors

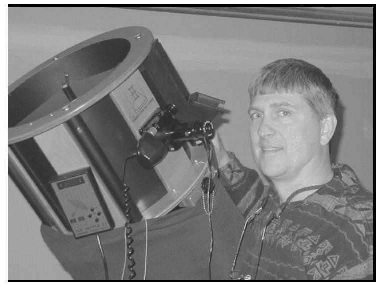
Richard J. Wessling (“Vision Problems” article)

Mr. Wessling is the assistant coordinator of the ALPO Instruments Section. As such, his purpose is to motivate and assist our membership to improve the performance of their telescopes as well as their observing practices. Rich writes articles about different aspects of instrumentation used for observing, including design and construction of telescopes. E-mail contact is encouraged for quick assistance. He has been a member of the ALPO since 1968, acting as director of the lunar and planetary training program in the early 1970s. He has been making telescope optics since 1965, specializing in reflective Newtonian mirrors as well as tilted component telescope optics, and has published several articles about the various instruments he has built. Rich has an optical business where he offers free testing of Newtonian primary and diagonal mirrors. He also offers a refiguring service for the primary mirrors. Richard works as Distinguished Optician at Corning Precision Lens, Inc. located in Cincinnati, Ohio, where he is responsible for developing, testing, and improving prototype lens designs and manufacturing processes.

Walter H. Haas (Herodotus)

Mr. Haas is the founder and director emeritus of the Assn. of Lunar & Planetary Observers. Among the projects he has pursued over a span of 65 years are efforts to detect possible lunar changes caused by lunar eclipses, searches for lunar meteoritic impact-flashes, determination of rotation-periods for features on Jupiter and Saturn, timings of eclipses of the Galilean satellites of Jupiter, estimates of latitudes of the belts on Saturn, and color filter studies of atmospheric phenomena on Mars. He has published many papers in the *Journal of the Association of Lunar and Planetary Observers* and elsewhere. Though retired since 1983, Walter has remained active with lunar and planetary observations secured with 8-inch and 12.5-inch backyard Newtonian reflectors despite growing trees and brightening city lights, with minor editorial chores, and with service on the ALPO Board of Directors.

Eric Douglass (Frost, Dunes on Mars)



Eric has published articles and/or photographs in *Sky and Telescope*, the JALPO, *Astronomy*, and *Selenology*. The majority of these deal with planetary geology, but have also included materials on videoastronomy and seeing prediction systems. He is a coauthor in the new book *Videoastronomy* (published by *Sky Publishing*), is the editor of the *Digital Consolidated Lunar Atlas* (on line at: http://www.lpi.usra.edu/research/cla/menu.html; to be released on CD rom later this year by the Lunar and Planetary Institute), supplied the lunar atlas images to *Observing the Moon* (by Peter Wlasuk), and supplied images and geologic interpretation for the computer program *Lunaview* (by Steve Massey). His primary telescope is a 12.5 inch, f/6 Newtonian. For images, he uses eyepiece projection onto an Astrovid 2000 video camera. The feed from this goes into a digital video processor and in recorded on SVHS. Images are taken from the tape using a Snappy, and processed on the computer. Eric's primary interests are in planetary geology and photogeologic interpretation. E-mail Eric at ejftd@mindspring.com

ALPO Feature:

The ALPO Board Meeting of 01 August 2002, Salt Lake City, Utah

Submitted by Elizabeth W. Westfall, recording secretary
Photos by Matthew Will, treasurer/membership secretary

Present: D. Parker, W. Haas, R. Schmude, M. Will, J. Westfall, E. Westfall, J. Benton (by speaker phone).

Don Parker began his one-year term as Director and Chair, as previously approved by the Board.

Treasurer’s Report

Matt Will referred to his separate written Treasurer’s Report. Based on the information provided there, the Board approved a membership dues increase to be effective January 1, 2003. The approved new dues:

- 1 year, increase $3 to $26.00
- 2 year, increase $6 to $46.00
- Digital subscription 1 year increase $1 to $11.00
- Digital subscription 2 year increase $2 to $19.00

Matt and Ken and Rik will get the new rates published in the Journal and on the Web so members will have a chance to renew at the existing rates before 1 January.

John Westfall reported that the Endowment Fund was at $14, 234 as of 30 June 2002. Because it has been in conservative investments, it did not lose value during the recent stock market decline.

The ALPO display booth at ALCON 2002.

Walter H. Haas, ALPO founder and director emeritus, delivers his paper “Lunar Changes: An Old Example in the Crater Herodotus and Some Thoughts on Their Reccurence” (also published in the issue of the *Journal*).

John recommended, and the Board approved, that John move approximately $1,200 from the San Francisco checking account into the Endowment Fund. The SF account has little activity now, and John will leave enough in it to avoid maintenance charges.

John also noted that at one time, the plan was to direct all memberships above the regular membership fees into the Endowment Fund. After discussion with the Board and Treasurer, it was agreed that our current financial situation would not allow that to be done right now.

Membership

As of July 2002, membership is 418.

The Board agreed to a review of free memberships and lifetime memberships. Walter and John will review a list of such memberships, and document the reasons they were granted.

ALPO Board and Staff Guidelines

The Board approved the Board and Staff Guidelines as prepared and submitted by Matt Will. The Board expressed their thanks to Matt for his diligent work on this project for the past few years.

ALPO Journal Schedule

Ken Poshedly reports that 4 issues per year is manageable and he is working hard to maintain a timely publishing schedule. The Board would like to go to 6 issues as envisioned several years ago, but at present we will stay with the current schedule.

Astronomical League Office Space

Don Parker reports that the AL is leasing headquarters office space in Kansas City, and is interested in ALPO sharing some of the facilities. Details are not yet available, but the ALPO Board is interested and authorized Don Parker to discuss the possibilities with the League. We hope to prepare a plan and present it to the AL at their 2003 meeting in Nashville.

ALPO 2003

The Board heard a very detailed report of further plans for our meeting from Phil Plante. To encourage participation by local people, we suggested that the paper sessions be held on Friday and Saturday so that more locals can attend. The field trip will be on Thursday, and the award dinner will be on Saturday night. The Board approved an advance to the hotel to hold the meeting rooms.

Roger Venable, contributing editor to the ALPO *Journal*, talks about the behavior of light and shadow when observing Venus in "Using a Spreadsheet's Graphic Function to Draw Venus."

ALPO 2004

The Board received an invitation from the Chabot Space and Science Center in Oakland, CA, presented by Mike Reynolds. The Board accepted the invitation, and will work with Mike to decide a date.

ALPO Funding

ALPO has always depended upon memberships and occasional financial gifts for funding. The Board discussed other sources. The two possibilities are educational grants, and merchandise, both within the boundaries of our charter. The best source of grants is for educationally-related projects (broadly interpreted). Beth Westfall and Mike Reynolds will explore sources for lists for available grants. The Board also solicits the membership for anyone with experience in grant-writing to assist this project.

Secondly, the Board agreed to investigate the production and sale of an ALPO calendar, featuring outstanding images and drawings contributed by members.

New Members Outreach

The Board continues to be concerned by a drop in membership. We have been working to recruit younger members. However, our surveys show that we also have new members from those "returning" to the hobby after college or after raising a family. We will try to find ways to reach such persons. In addition, the Board will find ways to reach out to interested persons who may be non-observers (history of astronomy, armchair observers).

Astronomers and Computers

A guest suggested to the Board that we consider a way (perhaps a section or column) of reaching out to "computer nerds". There seems to be a need similar to the Instrument section, whereby computer solutions to observing problems can be discussed; or, evaluations of astronomy Web sites or computer programs evaluated; or, instructions for building specialized astronomical computer hardware be presented.

Staff Changes:

All staff assignments remain the same unless noted below:

- Brian Cudnik, Lunar Section, *Lunar Meteoritic Impacts Search*; coordinator, permanent
- Lawrence Garrett, Minor Planets Section, assistant coordinator, permanent
- Richard Kowalski, Minor Planets Section, assistant coordinator, permanent
- Steve Larsen, Minor Planets Section, Scientific Advisor, permanent
- Richard Schmude, Jupiter Section, coordinator, permanent
- John McAnally, Jupiter Section, assistant coordinator, transit timings, permanent
- Dolores Hill, Meteorites Section, coordinator, permanent
- R.B. Minton, Instruments Section, coordinator, permanent
- Dick Wessling, Instruments Section, assistant coordinator, permanent
- Jonathan Slaton, Website, assistant coordinator, permanent
- Mike Reynolds, Eclipse Section, coordinator, permanent

Since Ken Poshedly was not at the meeting, Don Parker will review all editor staff with him and afterwards make recommendations to the Board.

Sections

Meteorites and Eclipse Sections are now permanent.

There being no further business, the meeting was adjourned.

ALPO Feature: Vision Problems? You Can Still Enjoy Observing

By Dick Wessling, Instruments Section Assistant Coordinator

It's true that our eyes are a big factor in our observing. So discussing instruments with no thought as to the condition of our eyesight is somewhat limiting. Few of us have perfect eyesight; while with some knowledge about our eyes, we can make adjustments and continue to enjoy observing. Therefore, this article is about how to address our vision defects and how to incorporate new observing techniques to compensate.

Vision defects can be put into two categories; correctable and non-correctable. The first is the correctable defects such as near- and far-sightedness. These are common defects which can be corrected with eyeglasses. These defects do not usually require that we wear our glasses during observing; however astigmatism, if severe enough, may require our glasses. The governing factors will be the amount of magnification being used and the size of the exit pupil on our telescope. As the exit pupil decreases, so does the effect of astigmatism. The exit pupil is the diameter of the focused light bundle after it leaves the eyepiece. To calculate your telescope's exit pupil, divide the aperture in millimeters (mm) by the magnification. For lunar and planetary observing, small amounts of astigmatism may not be a problem, but I would encourage you to test your eyes while viewing at different magnifications with and without your glasses and then judge for yourself.

Some assumptions we shall use in this article are viewing at 100x, 200x and 400x with various aperture telescopes. We shall also use 6-inch, 10-inch, 16-inch and 25-inch apertures for simplification.

The table below shows different size exit pupils (in mm) for the different apertures:

Table of Exit Pupil Sizes (mm)

Aperture in. (mm)	Magnification		
	100x	200x	400x
6 (152)	1.5	0.8	0.4
10 (254)	2.5	1.3	0.6
16 (406)	4.1	2.0	1.0
25 (635)	6.3	3.2	1.6

As the brightness of the light hitting your eyes increases while observing, your eyes' iris will constrict, thereby adjusting to the light. The diameter of your eyes' iris is your eyes' pupil, so there are two pupils to be aware of — the instruments' pupil and your eyes' pupil. A general rule is to keep the telescope pupil smaller than your eyes' pupil, or you are wasting light.

As the light grows dimmer, the iris will open in your eye. Observing the Moon will cause your pupil to become smaller than when observing Saturn. Observing deep sky objects will allow the pupil to grow larger.

We have talked about correctable vision defects, so let's now discuss an uncorrectable defect, such as the cataract.

A cataract is a defect that doesn't move in your eye and is more noticeable using the smaller exit pupils. If it is located in the eyes' central area, it will be blocking light going to the rods, which are used for resolution. If the cataract is small, that is, less than 1mm in diameter, it may be possible to place the telescope's exit pupil just to the side of the cataract and see a clear image. If not, what can we do?

There are two approaches we can take. First, try to measure the diameter of the cataract by viewing it inside the light bundle leaving your telescope. Pick a magnification while viewing the Moon giving a small pupil of about 1mm. Focus the telescope, and then draw your eye back from the eyepiece a small amount and the cataract shape will be noticeable in the circle of light. Judge its size as compared to the diameter of the light circle. This estimate will give you an idea as to the approximate size of your cataract. You can also ask your eye doctor about your eyes and ask him for the measurement.

With the size of the cataract known, you can then decide on a course of action. As the telescope aperture is increased, you will increase the pupil size and lessen the effect of the cataract. Observing Jupiter at 200x using a 6-inch aperture telescope, the pupil size is 0.8mm and with a 16-inch aperture, it is 2.0mm. The rule is to remember that as the telescope aperture doubles, so does the exit pupil for that same magnification. Also, you get four times the brightness with the larger scope and increased resolution.

If the cataract is in your dominant eye (the one you point with), the effect will be a lot worse for your observing. The other option you have is to go to a binocular viewer where both eyes are used or to start using a video camera and TV set with a VCR. The TV set will give you great views of the Moon and planets, and the good part is you will use both eyes so the cataract probably will have little to no effect. Then you can tape the image and watch it over and over again in your living room. I use this technique often with an Astrovid 2000 camera on my 12.5-inch Schiefspiegler. At 250 inches focal length, the Moon's size is large in projecting the image from the small chip. I move the scope ahead of the Moon and turn the drive off and watch the Moon drift across the field. The cataract in my non-dominant right eye has no effect at all. Still other options are CCD cameras and photography.

Video camera on 12.5-inch Buchroeder Tri-Schiefspiegler. FL is 250 inches, videotape in the TV set of the Moon in the dark, but the photo shows the camera hookup.

So think about your options. Test your eyes as well as your telescope and put the whole package together and have fun observing.

ALPO Feature:

Further Insight on the 2001 Leonids and Prospects for the 2002 Return

By Robert D. Lunsford, coordinator
ALPO Meteors Section

After a full nine months since the 2001 Leonid storm, a debate still rages over the exact strength of each of the two main Leonid outbursts seen in 2001. The only agreement lies in the timing of each of the outbursts. The 1767 debris trail produced an outburst visible from American longitudes at 10:39 Universal Time (UT). Rates remained high for the next 20-25 minutes culminating in a secondary outburst at 11:03 UT. The zenith hourly rates (ZHR, i.e., the number of shower meteors per hour an observer might count under perfect sky conditions with the radiant in the zenith) for these two outbursts were similar, peaking near 1,600 meteors per hour.

Several experienced observers dispute these findings citing that their own personal data give rates much higher than these results. The answer to this problem lies in the fact that zenith hourly rates cannot be determined from one person at one location. Numerous datasets from many individuals at many locations are necessary to complete the picture. Individuals with high perceptions will see much more activity than those with low perceptions, even while watching from the same location under similar conditions. It must be remembered that the final ZHR analysis will state what the average observer witnessed under the average conditions. If one's perception is greater than average, then your result will always be greater than the ZHR determined using many individuals.

Leonid rates declined to roughly a ZHR of 400 between the hours of 12:00 to 17:00 UT. At 17:30 UT, rates began to again rise dramatically as the Earth encountered the 1699 debris trail. Rates peaked at 18:03 UT with an estimated ZHR of 2,800. This impressive rate climbed even higher as the Earth also encountered the 1866 debris trail. The combined material from these two debris fields resulted in an estimated ZHR of 3,500 near 18:16 UT. Rates remained above storm level (ZHR = 1000) for at least the next hour.

As for the 2002 display, we will again encounter two of the three debris trails the Earth encountered in 2001. Unfortunately, the timing is bad as the peak of the Leonid activity occurs at the time of the Full Moon. The bright glare from the Moon will obscure the fainter meteors, reducing the activity one will see. The first encounter in 2002 will occur near 04:00 UT on 19 November, when the Earth encounters the debris field created by comet Temple-Tuttle in 1767. It is probable that strong rates will be witnessed from Europe, Africa and the eastern Atlantic region at this time. Some six and one-half hours later, the Earth will encounter the debris field created in 1866. The 10:36 UT of this encounter favors

Figure 1: This brilliant Leonid fireball was captured by Jure Zakrajšek from Mt. Lemmon, Arizona on 18 November 2001. The flare was estimated at magnitude -8 and the persistent train lasted for 12 minutes.

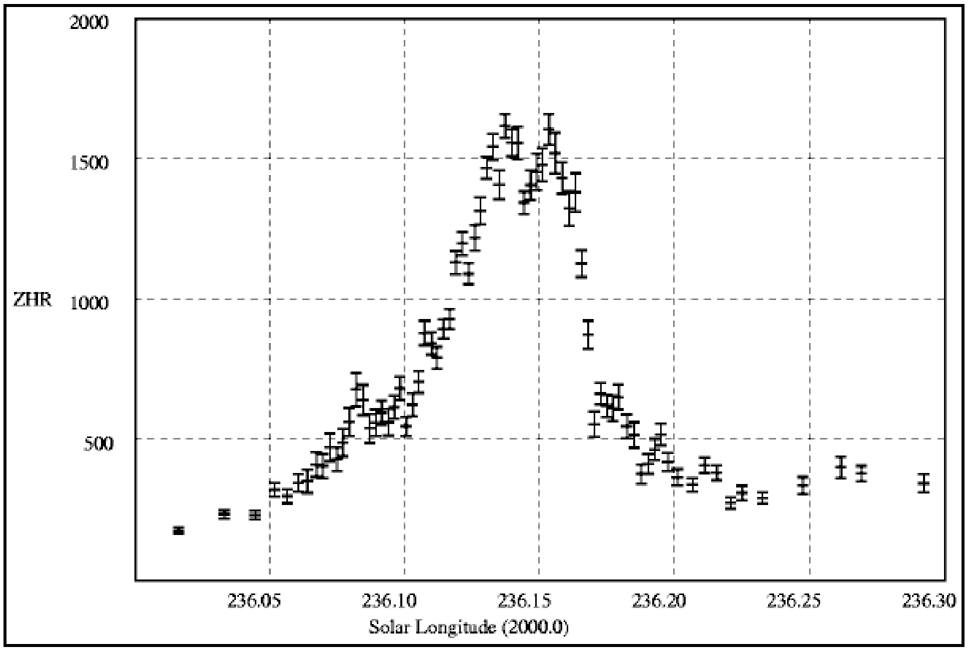


Figure 2: Activity profile of the American Leonid maximum in 2001. (Chart courtesy the I.M.O.)

North and Central Americas. This corresponds to 5:36 a.m. EST and 2:36 a.m. PST.

This timing favors eastern North America, yet is dangerously close to the time of morning twilight for this area. Should the outburst occur any later, then some areas of the east coast will be immersed in morning twilight.

No one knows exactly the strength of each outburst. Predictions on the timing of each outburst have fared much better than the rates actually seen. The strategy this year would be to view from an area with clear, transparent skies. This would reduce the amount of glare from the Full Moon, allowing one to view fainter meteors. Faint meteors would be difficult to detect under humid conditions with so much moonlight scattered by the moisture in the air. If one could also find a hill or mountain to block the Moon, that would further enhance one's view of the event. Even a tree or using the east side of your house to block the Moon would help.

Be sure to start watching at least one hour before the predicted maximum in your area, just in case the timing is incorrect. Be sure to face the eastern half of the sky to keep the direct moonlight out of your field of view. If rates equal the display seen last year, then we are still in store for a celestial treat despite the moonlight. It must be remembered that the great Leonid storm of 1799, observed by F. H. A. Humboldt from Cumana, South America, also occurred under the light of a Full Moon.

And finally, be sure to share your Leonid data and/or experience with the visual program coordinator.

(Explanation of “ZHR” from http://www.imo.net/visual/major01.html)

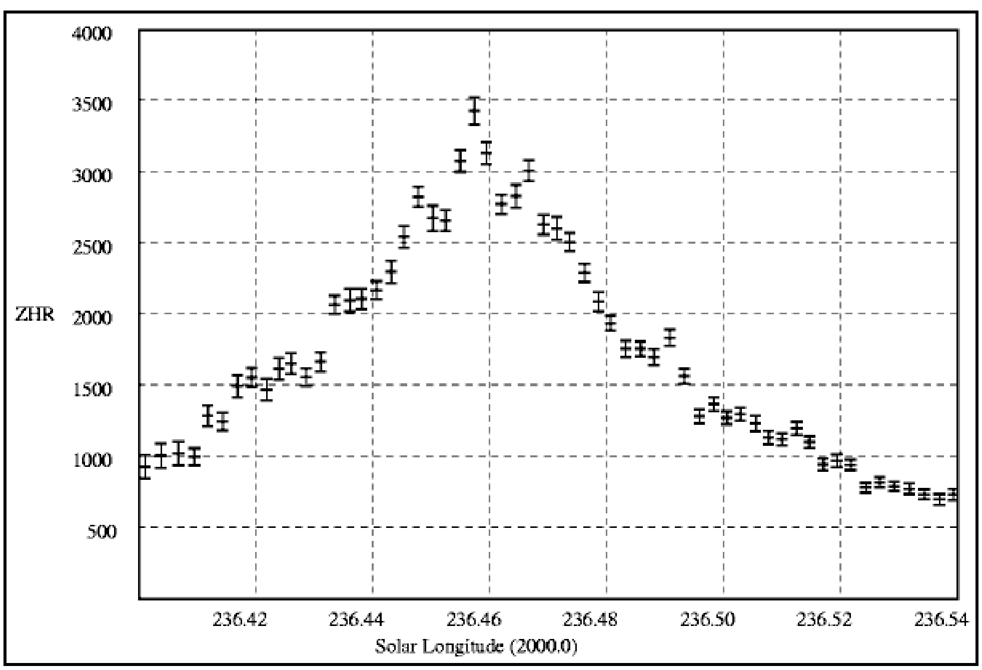


Figure 3: Activity profile of the Asian Leonid maximum in 2001. (Chart courtesy the

ALPO Feature: Lunar Changes --
An Old Example in the Crater Herodotus and Some Thoughts on Their Recurrence

By: Walter H. Haas, Director Emeritus, ALPO

Abstract

The author observed the early morning shadow in the lunar crater Herodotus to be amazingly light on 11 August 1954 near 2:28, (UT) Universal Time. The shadow slowly regained its normal blackness during the next three hours. Subsequent examination of Herodotus under very similar solar illumination on 9 October 1954 showed the expected ordinary aspect. Possible explanations of this apparent change on the Moon are suggested. It is important to relate such reported lunar changes to proper measures of the ever-changing solar lighting and to confirm that they are not just products of that lighting. A short schedule is given for future observations of Herodotus when the lighting will be almost identical to its value during the observed 11 August 1954 oddity.

A Curious Observation

The history of reported lunar CHANGES, as distinct from the considerable variations in aspect of lunar features with changing solar lighting, is full of controversy and contradictions (1). However, in looking over my old observing notebooks for other reasons, I found what appears to be a striking example in the crater Herodotus. The reader may properly wonder why this event was not reported when it occurred, 48 years ago. At the time, I wanted to make other observations under very similar solar lighting in order to confirm that something abnormal had indeed been observed. And after that, the matter just slipped away from memory.

The observation was made on 11 August 1954 at 2:18 - 2:39 UT. A copy of a rather poor drawing is provided as the left image in Figure 1. The following notes were made: "The appearance of the floor is VERY PECULIAR; nowhere is the 'shadow' (necessarily existing with the Sun only a few degrees above the horizon at Herodotus) nearly so dark as in the adjacent crater Aristarchus. The land just north of Herodotus, and perhaps that in the north part of the crater as well, looks AS IF it may be very dark because very slantingly illuminated. The view is often good enough to show the two crater-pits at the foot of the two main dark bands on the east (now IAU west, the hemisphere of Mare Imbrium) inner wall of Aristarchus as two humps on the large interior shadow." At 3:03, UT, the curious appearance was confirmed. At 4:05, it was noted that the "shadow" was much darker than on the earlier drawing, but still less black than the Aristarchus interior shadow. At 5:09-5:28 UT, another drawing was made, here copied as the center image in Figure 1. A note says: "The shadow is of normal blackness now!".

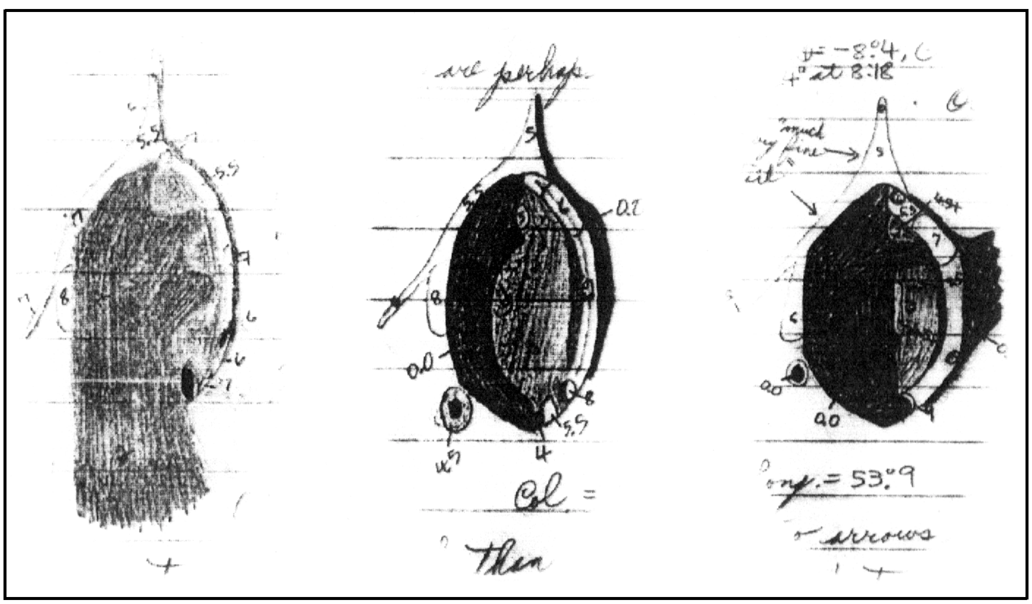


Figure 1: Drawings of lunar crater Herodotus made by Walter H. Haas as viewed through 12.5-inch (32-cm) reflector. Simply inverted images with lunar south at top. Left drawing: 11 August 1954; 2:18-2:39 UT; 303x, seeing poor, transparency variable. Center drawing: 11 August 1954; 5:09-5:28 UT; 303x, seeing bad-to-fair, sky clear. Right drawing: 09 October 1954; 2:21-2:51 UT; 367x, seeing fair-to-good, sky clear, solar lighting for left and right drawings almost the same. Numbers for features on all three drawings are estimated intensities on a scale of 0 (normal shadows) to 10 (most brilliant features).

Since the synodic month is about 29.5 days, lighting conditions for a particular lunar feature return approximately after 59 days. Thus, I drew Herodotus again on 09 October 1954 at 2:21-2:51 UT, the right image in Figure l. It was remarked: “The peculiar lightness of the shadow on 11 August 1954, whatever its nature, is certainly not present tonight. In fact, the Herodotus shadow was of normal blackness at 1:45 UT”. The observations are summarized in Table l.

It is difficult to explain this observation. Lunar atmospheric obscurations and mists have often been invoked in the past to explain curious appearances, but it is very hard to reconcile them with the known EXTREME tenuity of any lunar atmosphere. Perhaps a meteoritic impact could raise dust from the lunar surface and the suspended particles could obscure underlying shadows, but I have no idea how great an area might be affected, nor for how long. However, I do have great confidence that the appearance remarked on 11 August 1954 was not that normal for the existing lighting. PERHAPS there is even a relationship to some puzzling aspects of Herodotus recorded in the 1950's(2). An APPARENT bright central peak drawn by two regular lunar observers in 1949-50 is missing from a legion of drawings and photographs both before and after those years.

Richard Baum has called my attention to recent evidence for lunar dust veils(9) which may be relevant to the Herodotus oddity. Surveyors 5,6, and 7, and perhaps Clementine as well, detected a patchy glow along the sunset terminator

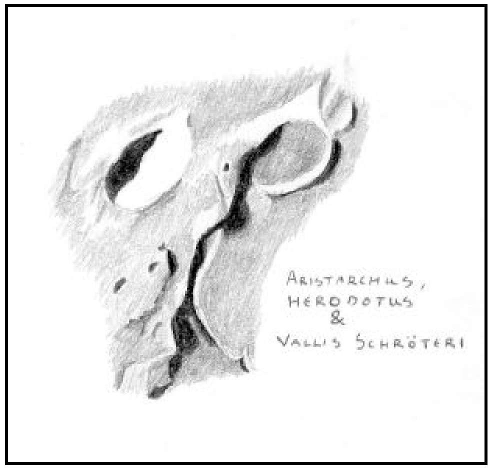
Table 1: Geometric Conditions During Herodotus Shadow Observations (4)

Universal		Sun’s*			Earth’s		Shadow
Date	Time	C	H	A	Lo	La	
1954 11 August	2:28	53.82	4.11	90.84	-5.18	0.94	Definitely not black
11 August	3:03	54.11	4.11	90.84	-5.18	0.91	Definitely not black
11 August	4:05	54.64	4.94	90.84	-5.20	0.84	Not quite black
11 August	5:20	55.27	5.57	90.84	-5.22	0.76	Black and normal
1954 09 October	1:45	53.47	3.76	91.52	-6.64	-5.14	Black and normal
09 October	2:36	53.90	4.20	91.52	-6.60	-5.17	Black and normal

* All values are in degrees
C = Sun’s selenographic colongitude.
H = Sun’s height and A = Sun’s azimuth above a point in Herodotus at lunar logitude 49.7 degrees west and lunar latitude 23.2 degrees north.
Lo = Earth’s selenographic longitude, positive when west.
La = Earth’s selenographic latitude, positive when north.

Crater Herodotus: Little Brother to Aristarchus

(From a writeup at http://users.eggconnect.net/iknight/ob15.htm by Ian Knight)



The extremely bright Aristarchus can be easily picked out within the vast Oceanus Procellarum, contrasting with with its ancient flooded neighbour Herodotus to its right. The brightness of Aristarchus is directly attributable to the ejecta created during its recent formation. Ejecta deposits to the immediate right of this crater also help to pick out the edges of Herodotus to the right.

Under highest magnification (240x) the Vallis Schroteri feature below these two craters becomes easily recognisable. At the head of this impressive valley feature, a crater known as the Cobras Head can be seen. Under this magnification, a rille emerging from the Cobras Head and meandering across the floor of Vallis Schroteri, can also just be made out.

It is believed by some that this valley feature was formed by an eruption of lava from the Cobras Head crater, an explanation that certainly fires the imagination !

(10,12). The glow advanced westward at the same rate as the sunset terminator and disappeared about 20 miles, or a little more than two hours, into the lunar night. Dr. D. R. Criswell has proposed that the glow is produced by very small dust grains elevated above the lunar surface by electrostatic fields, which had been produced by solar x-rays ionizing atoms on sunlit surfaces and making them positive relative to their shadowed neighbors. The charges become neutral and the dust grains fall 20 miles beyond the terminator. Also, the microparticle detector left on the Moon by the Apollo 17 astronauts found evidence for dust particles moving westward at sunrise and eastward at sunset, especially in the interval from about 40 hours before sunrise until about 30 hours after that event (11). This appears to be a classic example of electrostatic particle levitation.

A Falsely Reported Apparent Lunar Change

A recent example illustrates how easily we can report spurious lunar changes. On 14 June 2000, Mr. Kenneth Fields of the Three Rivers Observatory, photographed the Moon. Later examination of the image showed him a short, bright "plume" extending from the crater Horrebow toward the northwest limb(8). He suggested that we were seeing dust and gas somehow raised from the lunar surface. However, the plume is very distinct on a CCD image taken by Dr. John E. Westfall on 08 August 1995 (5), is less clearly present on an old 1901 photograph (6), and presumably can be found on many other lunar images. The plume is merely the unresolved image of a chain of bright peaks on the west wall of the lunar crater John Herschel. As Dr. Westfall has concluded, the feature is a product of insufficient resolution and can be recorded every lunation over a suitable range of solar lighting (7). Better resolution, he reports, such as a 0.7-km. pixel size on a CCD image, will show the individual peaks.

It should be clear from this incident that we should not report a Lunar Transient Phenomenon, as these events have come to be called, until we have verified that it is not a normal appearance repeated whenever the solar illumination is the same.

Measuring Solar Lighting

We have as an approximate measure of illumination the Sun's selenographic colongitude, defined as the lunar western longitude of the sunrise terminator at the Moon's equator. This colongitude is APPROXIMATELY 0 degrees at First Quarter, 90 degrees at Full Moon, 180 degrees at Last Quarter, and 270 degrees at New Moon.

If an unexpected lunar appearance is due to lighting only, it should repeat for a particular fixed observer on the Earth's surface at intervals of about 59 days. If it fails to repeat, we may need to seek a different explanation. However, the height and azimuth of the Sun at a particular point on the Moon are determined not just by the Sun's selenographic colongitude but also by its selenographic latitude, especially for features well away from the Moon's equator. Though the role of azimuth is probably usually very minor, we should try to repeat the observation at the same value of the Sun's height.

It is true, however, that the needed later observation can hardly ever be at the same values of the Moon's librations in latitude and longitude, which will have greatest effects near the limb of the Moon.

Besides these geocentric librations, there is also the *topocentric* libration, which can be as large as about one degree and which varies with time and the position of the observer on the Earth's surface.

Solar eclipse chasers are familiar with the "saros", the interval of time after which the Sun, the Moon, and the Earth return to almost exactly their original positions. A saros is 18 years, 10 or 11 days (depending on how many Leap Years intervene), and about 8 hours. Except for its great length and the resultant frequent difficulty of duplicating the original conditions of observation, here is the ideal interval after which to look for a repetition of a suspected lunar event. Dr. Anthony Cook has pointed out that topocentric libration may cause the best match to be a few months on either side of the moment of the saros (13). Of course, re-observations after two or more saroses are also excellent, though the small differences from the initial alignment must slowly increase with time. Also, it becomes ever-harder to duplicate the conditions of the original observation after 36, 54, or more years.

Table 2: Schedule for Future Observations of Herodotus Shadow (4)

Universal Time		Sun's*		
Date	**Time**	**Colongitude**	**Height**	**Azimuth**
2002 18 October	6:39	53.82	4.12	88.83
16 November	20:13	53.82	4.12	89.55
16 December	10:31	53.82	4.12	90.40
2008 12 September	0:22	53.81	4.121	90.80
* All values are given in degrees.				

A Well-Evidenced Apparent Lunar Change

There has been a recent attempt to recover a well-observed LTP one saros later. On 29 January 1983, a number of British observers found the small crater Torricelli B on the Sinus Asperitatis, not far from Theophilus, to be temporarily the most brilliant feature on the whole Moon and to exhibit color abnormalities generally at the violet end of the spectrum (3). Observations in following years showed curious variations in brightness and color (3). Special efforts to monitor Torricelli B were made one saros after the original report, that is, on 09 February 2001 near 4:53 UT. The Wilhelm Foerster Observatory in Germany supervised an intensive international examination of Torricelli B, but the reported 1983 events in brightness and color were not observed. My own personal observations with 20- and 32-cm, reflectors on 09 February and adjacent dates showed only the most ordinary aspects.

Future Opportunities

Table 2 lists dates in 2002 when the solar lighting of Herodotus will be almost identical to that when the curious 1954 observation of an abnormal shadow was made. For lunar observers in the United States the last best opportunity this year will occur on 18 October 2002. We also supply the date for 2008, which is three saroses after the initial observation. Readers are invited to examine Herodotus at these times, and perhaps they will find some clues to explain the surprising appearance on 11 August 1954. It is a pleasure to acknowledge the assistance of Mr. Julian Baum in Chester, England and Mr. J. O. Hughes in Las Cruces, NM, in the preparation of the illustration Figure 1 for this publication.

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Lunar Transient Phenomena

(From the http://www.lpl.arizona.edu/~rhill/alpo/lunarstuff/ltp.html)

The definition of Lunar Transient Phenomena (LTP) is a short lived phenomenon observed on the Moon. This can consist of red glows, flashes, obscuration, and abnormal albedo and shadow effects.

The purpose of the LTP section is to evaluate observations concerning possible LTP events. This department also establishes programs in which observers can participate. The best example is the recent mission to the Moon by the Clementine spacecraft. The ALPO had the opportunity to participate with this mission by conducting ground based observations on specific lunar formations as the spacecraft passed over them.

The LTP program consists of different levels of participation by the observer. The first level is just general observing of the Moon. If an observer detects anomalous behaviour they would then submit an LTP report. The second level would be to conduct systematic observation of select Lunar features for LTP. The third level consists of a coordinated observing effort of a specific lunar formation on a specific date and time. The fourth level consists of ground based observation in conjunction with a lunar spacecraft mission.

Individuals who which to participate in this program need to have a working knowledge of lunar observing. They should be skilled observers familiar with the Moon and its many aspects of illumination and libration. If you have been an active observer of the Moon and feel this program is for you please contact the LTP coordinator for more information.

ALPO Feature:
Frost, Dunes on Mars, and Specular Reflections

By Eric Douglass

Abstract

Observers have recently recorded "flashes" in Edom Promontorium on Mars. One hypothesis for these flashes is that they are reflections from frost on sand dunes. This study tests this hypothesis by producing frost of various types on soils that approximate the size and composition of Martian sand. Examination of this frost under various lighting angles did not reveal any specular reflections.

Introduction

Observing Mars' Edom Promontorium visually and by video, Parker's group recently witnessed and recorded transient brightenings (Parker, 2002). These were of two types, a quicker five-second flash and a slower, gradually evolving brightening. Given the relative positions of Sun and Earth, the orientation of Edom Promontorium required the reflecting surface be tilted 19 degrees from the mean spherical surface of Mars. One hypothesis for these flashes is that a large number of sand dunes accumulated an icy surface that created the specular reflection. The advantage of this hypothesis is that dune fields exist in Edom, and both fog and frost have been recorded there.

The present study attempts to produce frost in temperatures, atmospheric composition, and with dune particle sizes similar to those of Mars, and to examine that frost for specular reflecting characteristics.

Background

Most dunes on Mars are barchan (transverse), though Pathfinder did identify linear dunes (Smith et. al., 1997). However, all dune types are expected to occur. Pathfinder found that the angles of repose for Martian soils were 30 to 38 degrees (Matijevic et. al., 1997), so that dunes with a 19-degree slope are possible. However, when Embabi examined the barchan dunes of Egypt as an analog of Martian dunes (Embabi, 1982), he found that the most prevalent slope angles on all dunes were less than 12 degrees. These gentle slopes constituted 92-97 percent of small dunes, and 82 percent of large dunes. The second most prevalent slopes were those of greater than 32 degrees, which are the slip-faces of barchans, and constitute 7 percent of small and 15 percent of large dunes. Of the 3 percent or less of dune surfaces remaining, most were of intermediate slope angle, from 13 to 15 degrees. This suggests that the amount of slope available for reflection at 19 degrees is very small. This is not ameliorated by the angle of inclination of the regional surface of Mars in Edom, which is only 1 km vertical elevation per 600 km horizontal distance (Batson et. al., 1979).

The soils of Mars are not well constrained. Greeley demonstrated that, at Mars's atmospheric pressure, soil grains of around 100 microns are the most easily moved by wind (Greeley et. al., 1992), and so this is the particle size expected. However, at the Viking lander sites, most drift materials were less then 100 microns (Greeley et. al., 1992), and at Pathfinder sites, track experiments suggested sizes of 40 microns or less (Matijevic et. al., 1997). Aerosol particles at Viking and Pathfinder sites were only 1 to 2 microns in diameter (Smith et. al., 1997). Thus, it is difficult to assess the particle size of Martian dunes. Viking and Pathfinder experiments both found the soil to be composed of iron-rich clay (Greeley et. al., 1992; Smith et. al., 1997). Given that Mars has little if any recycling (though Pathfinder did find rocks of composition consistent with Andesite), it is likely that these soils represent basaltic weathering products.

The atmosphere of Mars is 95 percent carbon dioxide (Kieffer et.al., 1992). Edom is near latitude zero, where the temperature is expected to range from 170 to 275 K (Carr, 1981). However, at the specified times of Martian day (late morning) and year (appx. 370 sols), temperatures are 235 to 250 K. This is well above the freezing point of carbon dioxide, but well below that of water.

In temperate latitudes of Earth, most frost crystalizes directly from water vapor when the air is exposed to a cold surface. This is called "hoar frost." On Mars, rime frost may be more common. This type develops when water droplets (fog) are supercooled and, upon contacting a surface, freeze immediately. An "ice fog" will develop below 233 K.

Materials and methods

Samples: For each of the three experiments, four soil samples were prepared. Three of the samples were respectively of fine sand, silt, and clay, to study the effect different particle sizes have on the reflecting characteristics of frost. The fourth was of commercially available "Martian Regolith Simulant", in which the dominant mineral is palagonite, with grain sizes from 1mm to 20 microns. This was used to approximate the chemical composition of sand on Mars

(Allen). The samples were poured into 3 x 3 x 3-inch wooden sample boxes and shaken to level the surface. The samples were kept in an icebox filled with dry ice.

Atmosphere: In the apparatuses described below, dry ice was used as the coolant, and as it sublimated it produced a carbon dioxide atmosphere in the enclosures. The partial pressures of gases in these synthetic atmospheres were not measured.

Experiment 1: The apparatus was a cardboard box approximately two feet in height and width, with a curved sheet of Plexiglas covering the front. Attached to the box were two swing arms, one inside and one outside, with their axes oriented horizontally. To the inside arm was attached a light source, and to the outside arm, a video camera. The sample box was placed inside this box at the back, and dry ice was packed at the sides to a depth of five inches. At 15 minutes, the light source was activated and placed directly above the sample. At this time, the dry ice was removed and the sample was scratched once with a flat object to reveal a streak of the dark sample material below the frost. The video camera was placed directly above the sample, and while imaging the sample, was slowly swung through an angle of 60 degrees (from 90 to 30 degrees) from horizontal. Then the direction of illumination was sequentially placed at 80, 60, and 45 degrees from horizontal, while at each stop the video camera moved slowly from 90 to 30 degrees. This process was repeated for each sample.

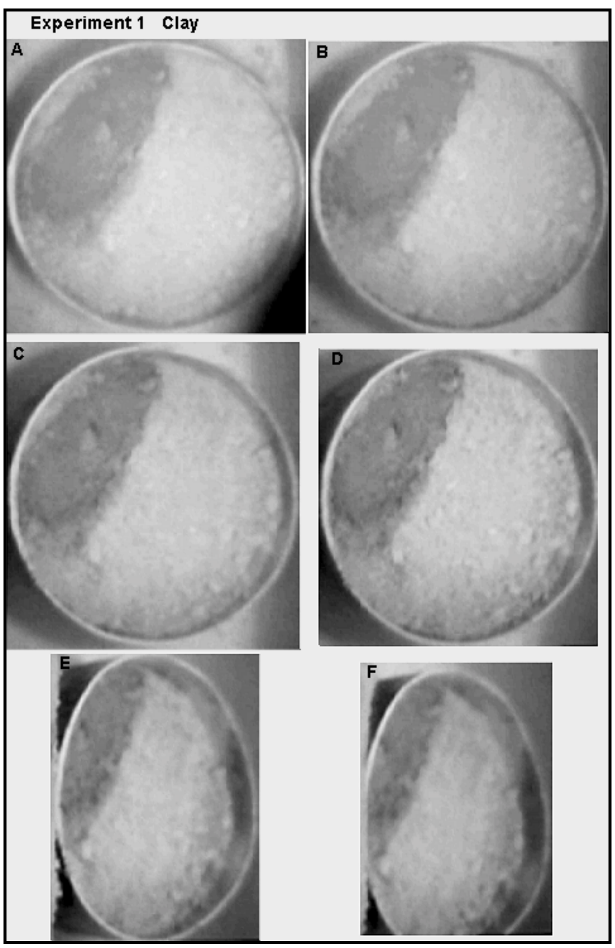

Figure 1: Sample images from Experiment 1.

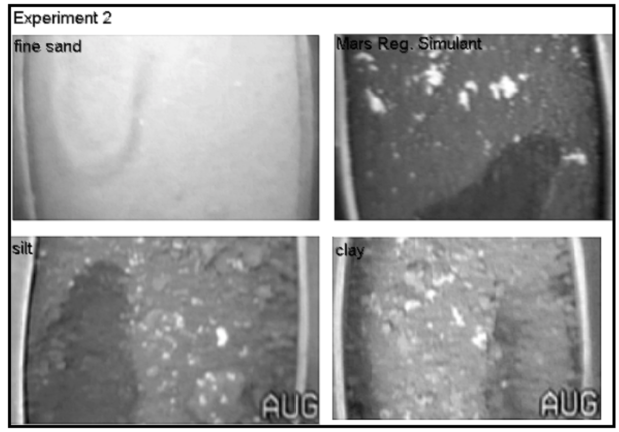

Figure 2: Sample images of the four soils

Sample images from one such experimental run, with the light source at 90 degrees, are found in Figure 1 (NOTES: the dark streak in each image is where the surface was scratched to reveal the sample beneath the frost; the images have low contrast because they have not been processed).

Experiment 2: The apparatus was a box with bottom dimensions of 10 x 8-inches, and a height of 23 inches. Four inches from the bottom was a grating, producing a lower space. A door in the lower wall allowed sample introduction and removal from this lower space. Dry ice was stacked on top of the grating to the depth of the structure. A nebulizer was filled with ice water, and its cloud was directed to the top of the structure. The nebulizer was operated for 10 minutes, and the sample was then removed, scratched as in experiment 1, observed at a variety of angles, and imaged. Video imaging involved swinging the camera through an arc from 90 to 30 degrees from horizontal, while the light source remained directly above the sample. Then the sample was returned to the box and the nebulizer was operated intermittently for 45 more minutes. Finally, the sample was removed, scratched, observed at a variety of angles, and photographed with both the camera and the light source directly above the sample. The process was repeated for each sample.

Sample images of the four soils, with the light source at 90 degrees, are found in Figure 2 (NOTES: the larger crystalline structures formed on the dry ice and fell onto the surface; the dark streaks are where the surfaced was scratched to reveal the sample beneath

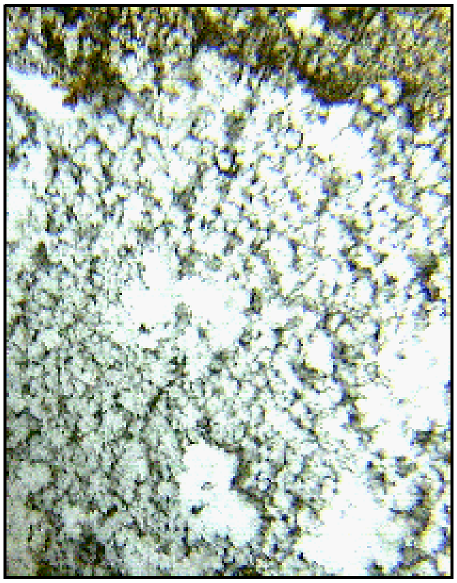

Figure3: close-up of the Mars Regolith Simulant sample.

the frost). Figure 3 shows a color, close-up of the Mars Regolith Simulant sample.

Experiment 3: The apparatus was the same experiment box used in Experiment 1. Sample and dry ice placement were as in experiment 1. At 10 minutes, 70 minutes, and 140 minutes, the sample was removed, scratched as in experiment 1, and imaged with the camera and light source both within 5 degrees of the vertical with respect to the sample. The process was repeated for each sample.

Images of the four samples, with the light source at 90 degrees, are found in Figure 4.

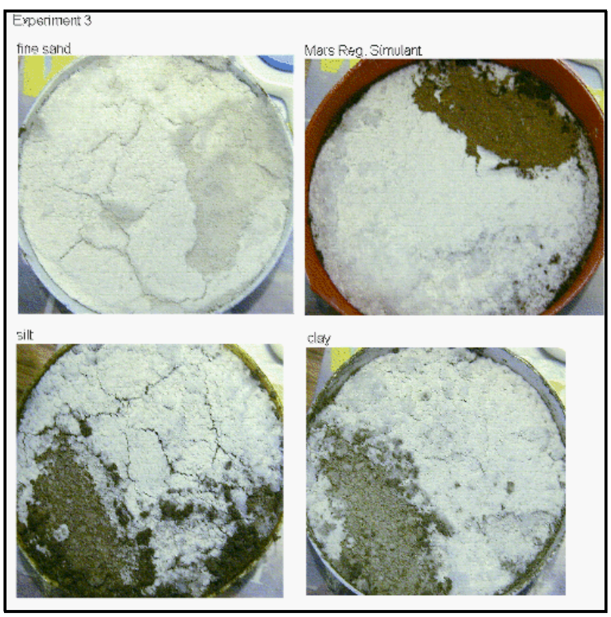

Figure 4: Images of the four samples, with the light source at 90 degrees.

Results

In each experiment, a layer of frost developed on the surface of each sample, with an attendant increase in reflectivity that was demonstrated by comparison of the frost-covered surface with the scratched surface. In the first experiment, hoar frost covered the sample surfaces, while in the second experiment, it was rime frost.

In none of the samples of Experiments 1 and 2 was any specular reflection detectable, despite observation and imaging at a wide variety of light-source and video imaging angles. The 45-minute deposition time in Experiment 2 likewise did not result in specular reflections.

In the Experiment 3, after a longer period of deposition of hoar frost (up to 140 minutes), no specular reflection was observed, and when imaged at high illumination angles no such reflection was evident.

Discussion of Results

Specular, or mirror-like, reflections consist of intense reflection at a very narrow angle. The flashes discussed by Parker appeared specular in that they were of brief duration and were significantly brighter than the usual albedo. If any ice on an experimental surface is to model such a reflection, it must show a significant heightened reflectivity in a narrow range of phase angles.

Specular reflection must not be confused with the "opposition effect," which is a nonlinear increase in brightness as the difference between the direction of observation and the direction of incident light approaches zero. It is due to coherent backscattering and shadow hiding (Nelson, 1997). Although this can occur on flat or inclined surfaces, it does not produce sudden brightenings. Thus, in an experiment, a gradual increase in recorded brightness as the phase angle approaches zero does not qualify as a specular reflection, but instead represents the opposition effect.

Randomly oriented ice crystals in frost cannot produce a specular reflection as coherently oriented crystals can. In the present experiments, it is likely that the first-forming ice crystals were randomly attached to various soil particle faces, and so were random in crystal orientation. Their failure to produce any specular reflections suggests that Martian frost is not responsible for the specular reflections seen by Parker's group.

There are differences between the conditions of these experiments and the conditions on Mars. First, it was not possible to mimic the atmospheric pressure on Mars. Second, temperature was not monitored, so that it is not known whether the temperature at the samples' surfaces was in the 235 to 250 K range expected on Mars. Third, sunlight was not used as the light source. Fourth, the samples merely approximate the Martian dune material.

Some thoughts on the phenomenon

Frost also occurs on sand dunes in Great Sand Dunes National Park. The office there has informed the author that specular reflections are not seen on the dunes.

Dunes do not have sharp changes in their slope angles. Thus, any flashes produced by frost on dunes should have a gradual onset with maxima reached where the slope is maintained for the greatest distance, and a gradual decrease afterwards, followed by a similar series of changes when the sun reaches the opposite side of the dune. This does not appear to be the pattern of flashes observed on Mars.

The observers did note that there was gradual brightening of the Edom region of Mars across the several days of observation. This is consistent with a developing rime frost. Given the atmospheric and bedrock temperatures of this area, such frost can form, but it likely sublimates during the day due to the equatorial location of Edom. Thus, other possibilities for the brightening of the Edom region should be considered, such as changing sand deposition that uncovers reflective rock surfaces, or meteorological phenomena.

Conclusion

In this study with simulated Martian soils, the failure of hoar frost and rime frost to show specular reflection is evidence that specular reflections are not produced by frost on sand dunes. The temporal pattern of the Edom brightenings is inconsistent with reflection from dunes, while the probable dearth of dunes with a 19-degree slope implies that some other mechanism is responsible.

Acknowledgment

Many thanks to Dr. Jerry Watson for his advice on the experiments.

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ALPO Feature:
The Uranus, Neptune and Pluto Apparitions in 2001

By Richard W. Schmude, Jr., coordinator, ALPO Remote Planets Section

Abstract

The selected V (1,0) values for Uranus, Neptune and (Pluto + Charon) are: -7.13 ± 0.01, -7.01 ± 0.02 and –0.93 ± 0.10, respectively. Photoelectric magnitudes made since 1927 suggest that the southern hemisphere of Uranus is darker than the northern hemisphere; furthermore, the record shows that Uranus dimmed after its solstices in 1946 and 1985. Based on the 08 September 2001 Titania occultation event, an upper limit of 1.0 microbar is selected for the surface atmospheric pressure of that moon.

Introduction

In March 2002, the Advanced Camera for Surveys was installed in the Hubble Space Telescope (HST) (Cowen, 2002a, 132; 2002b, 163). This camera has twice the resolution of the previous camera on HST. A second major development has been the tentative approval of a Pluto probe that will arrive at Pluto around 2015 (Cheng, 2002, 47). In addition to these major developments, several important studies have been reported in the last two years, which are summarized below. In all cases, the IAU (International Astronomical Union) standard for north and south is used here.

Hammel and co-workers (2001, 232) report that winds in the southern hemisphere of Uranus have remained almost constant between 1986 and 2000. Young and co-workers (2001, 242) report a large temperature drop in the atmosphere of Uranus between 1983 and 1998 at the 1.0-microbar level. (Since Uranus does not have a solid surface, altitudes are given in terms of the atmospheric pressure; 1.0 microbar is equal to about 0.000001 of Earth's atmospheric pressure at sea level.) Another recent discovery has been that bright clouds develop in Uranus' northern hemisphere as soon as the first rays of sunlight strike (Cowen, 2001, 56), but after a couple of years, these clouds become dimmer. Romon et al. (2001, 310) report that Sycorax (a recently discovered satellite of Uranus) had a slightly reddish color and a V-filter magnitude of 20.75 on 08 August 2001. Karkoschka (2001a, 76) reports sizes for the 10 moons of Uranus discovered by Voyager in 1985-1986.

Roe and co-workers (2001, 1636) used 3- and 10-meter telescopes to study a thick cloud on Neptune at the 4 bar level. They report that the cloud is probably composed of H_2S (hydrogen sulfide) and that it has albedos of 0.23 and 0.18 at wavelengths of 1.27 and 1.56 micrometers, respectively. Martin and co-workers (2001, 1079) used the Keck II telescope to investigate the speeds of bright features at 12 different latitudes and concluded that the wind profile on Neptune was the same in 2001 as it was in 1989.

Grundy and Buie (2001, 248) imaged the infrared spectra of (Pluto + Charon) on 83 different nights

Table 1: Contributors to the ALPO Remote Planets Section in 2001

Name	Location	Type of Observation
Patrick Abbott	AB, Canada	VP
Michael Amato	CT, USA	C
Ray Berg	IN, USA	C, V
Norman Boisclair	NY, USA	C, V
Dan Boyar	FL, USA	C, V
Antonio Cidadao	Portugal	CCD
Brian Cudnik	TX, USA	C, V, VP
Mario Frassati	Crescentino, Italy	C, V
Ed Grafton	TX, USA	CCD
Robin Gray	NV, USA	C, V, VP
Anna Jensen	GA, USA	V
Jerome Liverette	GA, USA	V
Brian Loader	Darfield, New Zealand	PP
Frank Melillo	NY, USA	CCD, S, PP
Mark Moffatt	GA, USA	V
Phil Plante	OH, USA	C, V, VP
Richard Schmude, Jr.	GA, USA	C, PP
Roger Venable	GA, USA	V
Doug West	KS, USA	PP, S
John Westfall	CA, USA	PP
John White	GA, USA	V
VP=Visual Photometry; C=Color Estimate; V=Visual (drawing, notations, etc.; CCD=Charge Coupled Device; PP=Photoelectric Photometry; S=Spectroscpopy		

between 1995 and 1998, and from this, were able to constrain the longitudinal and latitudinal distribution of frozen carbon monoxide, nitrogen and methane on Pluto. Microwave spectra of Pluto's atmosphere suggest that gaseous carbon monoxide is present (Bockelée-Morvan et al., 2001, 343). Using only microwave data, Lellouch and co-workers (2000, 583) concluded that Pluto's surface is very porous based on microwave data, while Buie (2001, 4) reported that Pluto became about 0.05 magnitudes dimmer between 1986 and 1998 in visible light. Buie and Grundy (2000, 324) also reported that Charon's surface contains water ice.

In addition to the breakthroughs made by professional astronomers, members of the Association of Lunar and Planetary Observers (ALPO) Remote Planets Section made important measurements in 2001. Cidadao, for example, measured the brightness of the star HIP 106829 as Titania occulted it. West measured the V-filter magnitude of Pluto-Charon with a CCD camera; furthermore, Venable and four assistants were able to see Pluto's moon Charon separated from Pluto with an image-intensified eyepiece. Finally, several people made high-quality photoelectric magnitude measurements of Uranus and Neptune. This paper will summarize the observations of Uranus, Neptune and Pluto made by ALPO members.

A total of 21 people submitted observations of Uranus, Neptune and Pluto during 2001-2002, and their names, locations and types of observations are listed in Table 1. The characteristics of the 2001 apparitions of Uranus, Neptune and Pluto are listed in Table 2.

Photoelectric Photometry

Five people submitted photoelectric magnitude measurements of the remote planets in 2001. Four of these (Loader, Melillo, Westfall and the author) used an SSP-3 solid-state photometer, along with filters that have been transformed to the Johnson B, V, R and I system. This instrument is described elsewhere (Schmude, 1992, 20), (Optec, 1997). Doug West used a CCD camera along with a filter that was transformed to the Johnson V system to measure the magnitudes of Uranus, Neptune and Pluto. The comparison stars used in all photoelectric magnitude measurements are listed in Table 3. Measurements made by Loader, West, Westfall and the author were corrected for both atmospheric extinction and transformation as described in Hall and Genet (1988, 199). These measurements were then used in computing average normalized magnitudes for all three planets. Individual magnitudes for Uranus, Neptune and Pluto are summarized in Tables 4, 5 and 6, while the average normalized magnitudes are listed in Table 7.

Figure 1 is a plot of the measured brightness of Uranus as a function of the time on 23 July 2001. Measurements were taken over a 5.3-hour period, corresponding to about 30% of the Uranus rotation period during this time. Uranus had an almost constant brightness. These results are consistent with similar data obtained on 11 July 1996 (Schmude, 1998a, 122), 11 July 1997 (Schmude, 1998b, 168), 22 July 1998 (Schmude, 2000a, 15) and 20 June 1999 (Schmude, 2000b, 161).

Figure 2 shows the normalized V-filter magnitude determinations for Uranus made since 1927. Earlier measurements were taken from Hardie and Giclas (1955, 460) and (Appleby and Irvine, 1971, 618). Data after 1990 are taken exclusively from Schmude, (2001, 35) and the current paper. One evident trend in the figure is that Uranus became dimmer after its 1946 and 1985 solstices; solstice and equinox dates for Uranus and Neptune are from Meeus (1997, 332). The dimming from the mid-1930s to 1964 is ~0.14 magnitudes. Lockwood and Thompson (1999, 7) report that between 1972 and 1986, the y-filter magnitude of Uranus increased by 0.12 magnitudes. The y filter has a peak wavelength at 5510 Å, which is close to the peak wavelength of the Johnson V-filter. It therefore appears that Uranus may have reached a V-filter, brightness minimum around 1972 or a few years earlier. The author concludes from this that the normalized V-filter magnitude of Uranus changes by at least 0.2 magnitudes throughout the planet's 84-year seasonal cycle. The minimum brightness appears to have occurred in 1996, during the northern hemisphere autumn equinox (IAU standard). Maximum brightness is predicted to occur again in about 2025. It also appears that the northern hemisphere is about 0.1 to 0.2 magnitudes

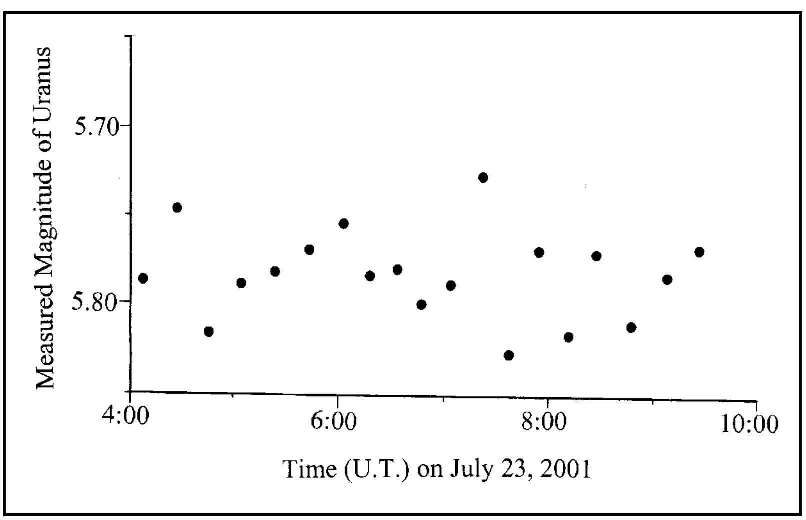

Figure 1: Measured magnitudes made of Uranus on the evening of 22-23 July 2001 from a site near Thomaston, Georgia, U.S.A. All measurements were corrected for both transformation and extinction.

Table 2: Table 2: Characteristics of the 2001 Apparitions of Uranus, Neptune and Pluto (Data from the *Astronomical Almanacs* for the years 2000-2002)

Parameter	Uranus	Neptune	Pluto
First conjunction date	09 February 2001	26 January 2001	04 December 2000
Opposition date	15 August 2001	30 July 2001	04 June 2001
Angular diameter – opposition (arc-sec.)	3.7	2.4	0.1
Right ascension – opposition	21h 42^m	20h 39^m	16h 55^m
Declination – opposition	-14º 36.3	-18º 17.1	-11º 48.7
Second conjunction date	2001 Feb. 13	2002 Jan. 28	07 December 2001

brighter than the southern hemisphere. Visual magnitude analyses by Becker indicated a brightening trend in the early 1930s (Alexander, 1965, 252), or about one Uranian year before 2025.

Westfall attempted to measure the solar phase angle coefficients for Uranus and Neptune. His results indicate that the solar phase angle coefficient of both planets is very low, in agreement with similar studies by Lockwood and Thompson (1999, 5; 1986, 1543), who also reported very low values for the solar phase angle coefficients for both planets.

Melillo has monitored the near infrared magnitude of Uranus at 8600 Å for several years, and reports that the planet's brightness has dropped by about 0.2 magnitudes since 1997. This dimming trend is consistent with HST results obtained by Karkoschka (2001b, 84).

Figure 3 shows the normalized magnitude measurements for Neptune since 1937. The 1937 value is from (Calder, 1938, 26) and was computed by using a magnitude of +6.37 for 80-Leo and 1937 data from the *Astronomical Almanac* for the year 1937 to compute normalized magnitudes. Measured magnitudes for 1949-1954 were taken from Hardie and Giclas (1955, 462), while those for 1964 are from Appleby (1973, 110). All measurements between 1991 and 2000 are from Schmude (2001, 35). The one obvious trend in Figure 3 is that Neptune increased in brightness during its 1997 solstice.

Doug West measured the V-filter magnitude of (Pluto + Charon) nine times and the results are listed in Table 6. The normalized magnitudes, V (1,0), were computed using a solar phase coefficient of 0.041 mag./degree which is the value for Pluto + Charon (Binzel and Mulholland, 1984, 1759). The average normalized magnitude of Pluto + Charon based on Table 6 data is V (1,0) = -0.93 ± 0.10; however, it must be pointed out that not all longitudes were measured. In spite of this, West's data represents the first attempt by an amateur astronomer to measure the V-filter magnitude of Pluto using photoelectric equipment. West is off to an excellent start with Pluto!

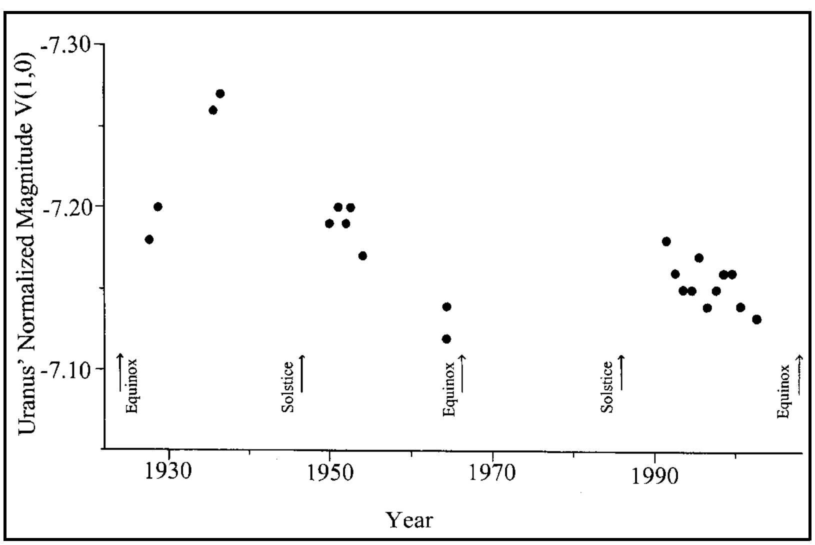

Figure 2: The normalized magnitudes , V(1,0) of Uranus between 1927 and 2001. Arrows indicate dates of the equinoxes and solstices.

Visual Magnitude Estimates

Five individuals submitted a total of 69 visual eyeball magnitude estimates of Uranus and 21 eyeball magnitude estimates of Neptune during 2001-2002. The average normalized magnitudes of Uranus and Neptune based on these estimates are: -7.2 ± 0.01 and –6.9 ± 0.03 respectively.

The 08 September 2001 Titania Occulation Event

On 08 September 2001, Uranus' largest moon, Titania, occulted the 7.2 magnitude star HIP 106829. This event was widely publicized (Sinnott, 2001, 95) and was watched from several locations (Sicardy et al., 2001, 1130). Antonio Cidadao measured the occultation at 38.685° N and 9.324° W, which is near Lisbon, Portugal. He used a 0.25-meter LX200 Schmidt-Cassegrain telescope, coupled with an f/6.3 focal reducer and a SBIG ST-237 refrigerated CCD camera operating at a resolution of 14.8-micrometer pixels. He used integrated light and recorded a total of 9999 frames between 1:37:39 U.T. and 3:27:46 U.T. Each frame had an integration time of 0.1 seconds and was corrected for both bias and dark current; a frame was taken every 0.301 seconds. The time was synchronized by an Internet connection with the "tick" server of the United States Naval Observatory. The ratio of (Titania + star) flux to the (Uranus) flux was measured throughout the observational run. The ingress and egress portions of the occultation are shown in Figure 4.

When Pluto (Stern and Mitton, 1998, 113) and Triton (Elliot et al., 2000, 347) occulted separate stars a few years ago, the starlight faded progressively over a period of 10-30 seconds, indicating that it was being refracted by the atmospheres on these two bodies. In contrast, the star occulted by Titania (Figure 4) faded within 0.6 seconds, or less than one-tenth of the time for the Pluto and Triton occultations. The surface pressures on Triton and Pluto are a few microbars, suggesting that the surface pressure on Titania is less than 1.0 microbar, and probably less than 0.5 microbars.

The Titania occultation lasted for 59.3 seconds, which corresponds to 1,204 km. Figure 5 shows a diagram of Titania during the occultation based on Cidadao's measurements along with the right ascension and declination data in the Astronomical Almanac for the year 2001. The center of Titania reached a minimum distance of 510 ± 20 km from Cidadao's location. The 20 km uncertainty is due to uncertainties in Titania's shape, elliptical orbit and topography.

Table 3: Comparison Stars Used in Photoelectric Magnitude Measurements of Uranus, Neptune and Pluto During 2001

StarName	Magnitude			
	B	V	R	I
Gamma-Cap	4.00	3.68	3.45	3.32
Theta-Cap	4.06	4.07	-----	4.08
44-Cap	6.135	5.88	-----	-----
Rho-Cap	5.18	4.80	-----	-----
HIP 83016	-----	9.88	-----	-----
HIP 82815	-----	8.98	-----	-----
HIP 83127	-----	10.13	-----	-----
HD 196979	8.196	6.95	-----	-----
HD 196436	9.31	7.86	-----	-----
TYC 5650 1618 1	-----	10.89	-----	-----
TYC 5650 1137 1	-----	10.87	-----	-----
TYC 5650 1402 1	-----	11.31	-----	-----
TYC 5651 462 1	-----	10.81	-----	-----
TYC 5651 120 1	-----	9.56	-----	-----
TYC 6335 998 1	-----	9.94	-----	-----
TYC 6335 1037 1	-----	10.07	-----	-----
TYC 6335 1397 1	-----	8.95	-----	-----
TYC 5800 530 1	-----	11.01	-----	-----
TYC 5800 457 1	-----	10.76	-----	-----

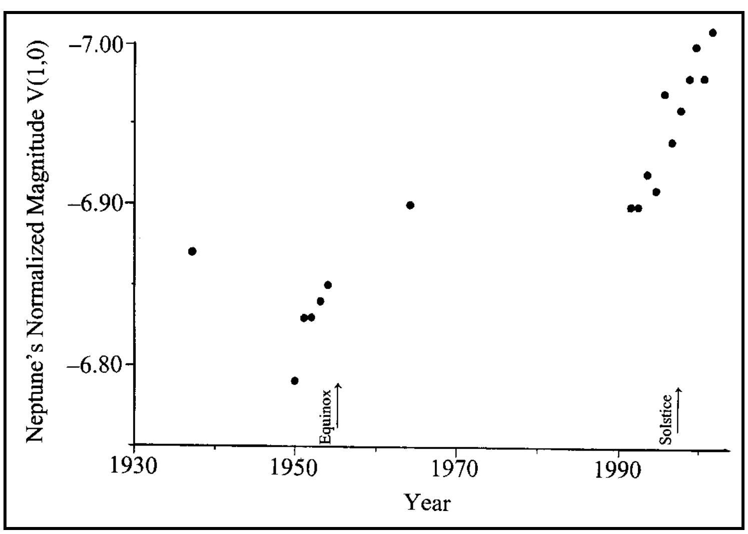

Figure 3: The normalized magnitudes, V(1,0) of Neptune between 1937 and 2001. Arrows indicate the equinox and solstice dates.

The author also carried out measurements on 08 September 2001 from 33.791° N and 84.935°W, which is near Villa Rica, Georgia (U.S.A.). Uranus, Titania and the star to be occulted were all placed in the photometer field of view and 10-second brightness measurements were recorded; see Figure 6. There were no drops in the brightness greater than 0.04 magnitudes and so it is concluded that the occultation was not visible from Villa Rica, Georgia. There was also no unusual behavior as Oberon's orbit passed in front of the star. Frank Melillo also carried out measurements from Long Island, New York, and also failed to detect an occultation.

Table 4: Photoelectric Magnitude Measurements of Uranus Made During the 2001 Apparition

Date (2001)	Observer Initials	Filter	Raw Magnitude	X(1,a)	Comp. Stars
Apr. 23.435	DW	V	5.87	-7.17	TYC 58005301
					TYC 58004571
May 19.389	RS	V	5.86	-7.14	Gamma-Cap
May 23.368	RS	V	5.88	-7.10	"
May 23.383	RS	V	5.92	-7.07	"
May 25.748	BL	V	5.86	-7.12	44-Cap
May 25.766	BL	B	6.35	-6.63	"
June 18.272	RS	V	5.82	-7.12	Gamma-Cap
July 23.172	RS	V	5.79	-7.11	"
July 23.185	RS	V	5.75	-7.15	"
July 23.198	RS	V	5.82	-7.08	"
July 23.211	RS	V	5.79	-7.11	"
July 23.225	RS	V	5.78	-7.12	"
July 23.238	RS	V	5.77	-7.13	"
July 23.251	RS	V	5.75	-7.15	"
July 23.263	RS	V	5.78	-7.12	"
July 23.273	RS	V	5.78	-7.12	"
July 23.284	RS	V	5.80	-7.10	"
July 23.295	RS	V	5.79	-7.11	"
July 23.306	RS	V	5.73	-7.17	"
July 23.318	RS	V	5.83	-7.07	"
July 23.330	RS	V	5.77	-7.13	"
July 23.341	RS	V	5.82	-7.08	"
July 23.353	RS	V	5.77	-7.13	"
July 23.367	RS	V	5.81	-7.09	"
July 23.381	RS	V	5.78	-7.12	"
July 23.394	RS	V	5.76	-7.14	"
July 24.735	BL	V	5.78	-7.12	44-Cap
July 24.749	BL	B	6.24	-6.66	"
Aug. 7.239	JW	V	5.76	-7.14	Gamma-Cap
Aug. 13.128	RS	B	6.22	-6.67	"
Aug. 13.143	RS	V	5.69	-7.20	"
Aug. 13.156	RS	R	5.96	-6.93	"
Aug. 14.337	JW	V	5.76	-7.13	"
Aug. 16.305	JW	V	5.75	-7.14	"
Aug. 17.305	JW	V	5.75	-7.14	"
Aug. 18.303	JW	V	5.74	-7.15	"
Aug. 19.282	JW	V	5.76	-7.13	"
Aug. 22.297	JW	V	5.75	-7.14	"
Aug. 23.308	JW	V	5.76	-7.14	"
Aug. 25.284	JW	V	5.75	-7.14	"
Aug. 26.299	JW	V	5.75	-7.14	"
Aug. 28.277	JW	V	5.76	-7.13	"
Aug. 29.334	JW	V	5.76	-7.14	"
Sep. 3.287	JW	V	5.77	-7.13	"
Sep. 4.276	JW	V	5.77	-7.13	"
Sep. 5.290	JW	V	5.77	-7.13	"
Sep. 8.284	JW	V	5.76	-7.14	"
Sep. 10.269	JW	V	5.77	-7.14	"
Sep. 10.413	BL	V	5.78	-7.13	"
Sep. 10.431	BL	B	6.31	-6.59	"
Sep. 11.261	JW	V	5.78	-7.13	"

NOTE: The observers are: Brian Loader (BL), Richard Schmude, Jr. (RS), Doug West (DW) and John Westfall (JW).

Methane Band Images of Uranus

Frank Melillo used a 0.2-meter Schmidt-Cassegrain telescope, a CCD camera and a methane band filter (peak transmission at 8900 angstroms or Å) to image Uranus and the nearby star HIP 106829. Methane band images were recorded on 03 September (5:07 – 6:05 U.T.), 07 September (4:28 – 5:00 U.T.), 08 September (4:34 – 4:55 U.T.) and 10 September (3:12 – 3:45 U.T.). In all images, Uranus was either very faint or not visible at all. The author believes that Uranus may have been a bit brighter on 07 September than on 03 September and 08 September. Melillo states that Uranus "seems to be a touch fainter" in 2001 than in 2000. He has done an excellent job of obtaining methane band images of Uranus. The author hopes that others with large telescopes will obtain methane band images of Uranus at wavelengths of between 8,900 and 20,000 Å.

Disc Appearance: Uranus and Neptune

Frassati, Boisclair, Venable, Amato, Berg, Gray, Cudnik and the author all made visual observations of the remote planets. Boisclair has used a 0.50 meter Newtonian to study the remote planets during the past few years. In addition to this, Grafton and Melillo obtained excellent CCD images of Uranus. No belts or zones were seen or suspected by anyone on the following dates in 2001 (Uranus: May 28.4; June 17.3; July 15.3, 16.3, 17.9, 29.0; Aug. 12.3, 15.3, 16.3, 18.3, 22.2; Sep. 6.1, 11.1, 12.1, 13.2, 19.3; Oct. 1.0, 9.1, 14.0, 16.0, 21.1 and Nov. 4.0) and (Neptune:

Table 4 (continued): Photoelectric Magnitude Measurements of Uranus Made During the 2001 Apparition

Date (2001)	Observer Initials	Filter	Raw Magnitude	X(1,a)	Comp. Stars
Sep. 12.259	JW	V	5.76	-7.15	Gamma-Cap
Sep. 13.265	JW	V	5.77	-7.14	“
Sep. 14.268	JW	V	5.77	-7.14	“
Sep. 17.241	JW	V	5.78	-7.14	“
Sep. 18.254	JW	V	5.77	-7.14	“
Sep. 19.233	JW	V	5.77	-7.14	“
Sep. 20.239	JW	V	5.77	-7.14	“
Sep. 21.245	JW	V	5.79	-7.12	“
Sep. 22.269	JW	V	5.78	-7.14	“
Sep. 24.263	JW	V	5.79	-7.13	“
Sep. 26.227	JW	V	5.79	-7.13	“
Sep. 30.192	JW	V	5.79	-7.14	“
Oct. 1.233	JW	V	5.79	-7.14	“
Oct. 2.189	JW	V	5.80	-7.13	“
Oct. 3.201	JW	V	5.79	-7.14	“
Oct. 4.203	JW	V	5.80	-7.13	“
Oct. 7.205	JW	V	5.80	-7.14	“
Oct. 10.167	JW	V	5.81	-7.13	“
Oct. 19.145	JW	V	5.83	-7.13	“
Oct. 21.177	JW	V	5.83	-7.13	“
Oct. 22.151	JW	V	5.82	-7.14	“
Oct. 23.150	JW	V	5.81	-7.15	“
Oct. 24.136	JW	V	5.83	-7.13	“
Nov. 1.122	JW	V	5.86	-7.13	“
Nov. 5.112	JW	V	5.86	-7.15	“
Nov. 5.418	BL	V	5.87	-7.13	“
Nov. 5.436	BL	B	6.52	-6.47	“
Nov. 8.111	JW	V	5.84	-7.15	“
Nov. 15.112	JW	V	5.86	-7.15	“

NOTE: The observers are: Brian Loader (BL), Richard Schmude, Jr. (RS), Doug West (DW) and John Westfall (JW).

Ed Grafton took a CCD image of Uranus on 22 August 2001 at 6:49 UT from Houston, Texas. He used a 0.36-meter Schmidt-Cassegrain telescope and an ST6 CCD camera along with several filters to capture images of Uranus at different wavelengths. One of these images displays sharp limbs, slight limb darkening and a slight polar flattening (0.03). The images of the satellites taken at the same time appear circular, indicating no serious tracking errors. No belts, zones or dark polar areas are evident either.

In a second image, Grafton used cyan, red and infrared filters to image Uranus, but again, no details were recorded. The quantum efficiency of Grafton's camera drops to nearly zero at wavelengths above 10,000 Å and so no imaging was possible at that wavelength. Melillo recorded a one-second exposure CCD image of Uranus on 22 August 2001. In addition to obvious limb-darkening, the image shows marked limb darkening and a polar flattening of 0.1, a value proba-

June 17.3; Aug. 12.3, 18.3, 19.2; Sep. 6.1, 11.0, 12.1, 22.2; Oct. 1.0, 9.1, 14.1, 16.0, 21.0 and Nov. 11.0); all dates are in Universal Time (UT). Uranus was more green than blue, while Neptune was more blue than green in 2001. Norman Boisclair felt that the colors of Uranus and Neptune were "pronounced and quite striking" during mid-2001. Boisclair has used a 0.50 meter Newtonian to study the remote planets during the past few years.

Frassati stated that on 17 July (22:00 UT), the limb darkening on Uranus was more pronounced on the north limb than on the south limb. There also appears to be a difference in limb darkening in three Neptune drawings (Dollfus, 1961, plate 45) along with two unpublished drawings of Uranus made by O'Meara. To verify this, the author hopes that people will watch the limb darkening closely in future years, paying particular attention to any differences in the limb darkening between the preceding and following limbs for Uranus and Neptune.

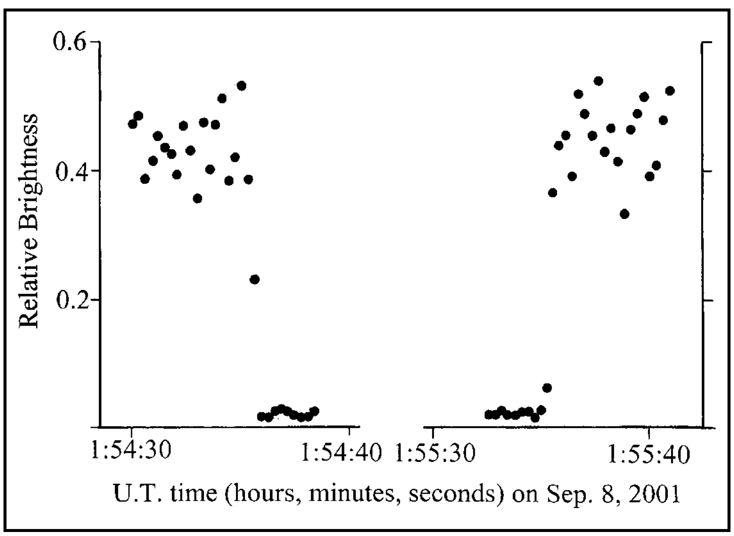

Figure 4: Measurements of the occultation of HIP 106829 by Titania made by Antonio Cidadao. Each measurement is the brightness of Titania plus HIP 106829 divided by the brightness of Uranus. Each measurement represents an integration time of 0.1 seconds.

Table 5: Photoelectric Magnitude Measurements of Neptune Made During the 2001 Apparition

Date (2001)	Observer Initials	Filter	Raw Magnitude	X(1,a)	Comp. Stars
Apr. 17.436	DW	V	7.84	-6.96	TYC 63359981
					TYC 633510371
					TYC 633513971
Apr. 23.419	DW	V	7.81	-6.98	“
May 1.430	DW	V	7.76	-7.02	“
May 14.415	DW	V	7.78	-6.99	“
May 25.698	BL	V	7.72	-7.04	HD 196979
May 25.718	BL	B	8.14	-6.62	“
July 24.698	BL	V	7.66	-7.05	HD 196436
Aug. 7.243	JW	V	7.72	-6.99	Theta-Cap
Aug. 13.241	JW	V	7.75	-7.00	“
Aug. 14.319	JW	V	7.68	-7.03	“
Aug. 16.277	JW	V	7.71	-7.00	“
Aug. 17.289	JW	V	7.70	-7.01	“
Aug. 18.285	JW	V	7.72	-7.00	“
Aug. 19.266	JW	V	7.70	-7.02	“
Aug. 22.104	RS	V	7.77	-6.95	Rho-Cap
Aug. 22.119	RS	B	8.17	-6.54	“
Aug. 22.132	RS	V	7.76	-6.96	“
Aug. 22.144	RS	B	8.18	-6.54	“
Aug. 22.174	RS	V	7.75	-6.97	“
Aug. 22.188	RS	B	8.17	-6.54	“
Aug. 22.283	JW	V	7.72	-6.99	Theta-Cap
Aug. 23.294	JW	V	7.69	-7.02	Theta-Cap
Aug. 25.269	JW	V	7.71	-7.00	“
Aug. 26.285	JW	V	7.71	-7.01	“
Aug. 28.263	JW	V	7.71	-7.01	“
Aug. 29.320	JW	V	7.69	-7.04	“
Sep. 3.276	JW	V	7.70	-7.02	“
Sep. 4.264	JW	V	7.70	-7.02	“
Sep. 5.278	JW	V	7.71	-7.02	“
Sep. 8.141	RS	V	7.74	-6.99	“
Sep. 8.271	JW	V	7.72	-7.01	“
Sep. 10.257	JW	V	7.73	-7.00	“
Sep. 10.364	BL	V	7.77	-6.96	Rho-Cap
Sep. 10.385	BL	B	8.15	-6.58	“
Sep. 11.242	JW	V	7.73	-7.00	Theta-Cap
Sep. 12.248	JW	V	7.72	-7.02	“
Sep. 13.254	JW	V	7.73	-7.01	“
Sep. 14.258	JW	V	7.72	-7.01	“
Sep. 17.231	JW	V	7.74	-7.00	“
Sep. 18.244	JW	V	7.74	-7.00	“
Sep. 19.223	JW	V	7.73	-7.01	“
Sep. 20.229	JW	V	7.74	-7.00	“
Sep. 21.233	JW	V	7.73	-7.01	“
Sep. 22.259	JW	V	7.73	-7.02	“
Sep. 24.253	JW	V	7.73	-7.01	“
Sep. 26.217	JW	V	7.72	-7.03	“
Sep. 30.178	JW	V	7.73	-7.02	“

NOTE: The observers are: Brian Loader (BL), Richard Schmude, Jr. (RS), Doug West (DW) and John Westfall (JW).

bly attributable to significant east-west tracking error.

Roger Venable used a 0.4-meter Newtonian telescope and an image-intensified eyepiece (the I-cubed piece manufactured by Collins Electro Optics; see http://www.ceoptics.com), to look for Pluto and Charon. He was able to resolve both objects on 22 July 2001 at 3:45 UT at a magnification of 960x and on 07 August 2001 at 2:00 UT at the same magnification. Four members of the Augusta Astronomy club (Anna Jensen, Jerome Liverette, Mark Moffatt and John White) confirmed the Charon observation on 22 July. All Charon observations were carried out near Augusta, Georgia, under dark, clear skies when Pluto's altitude was at least 40°. Roger Venable, along with his co-workers, should be congratulated for being the first people to see Pluto and Charon separated from one another.

Spectroscropy

Spectra were recorded for Uranus on April 23.44; May 1.44; Aug. 16.19, 22.19, 23.22, 26.24 and September 17.18, while spectra for Neptune were recorded on April 17.44 and May 1.44. Doug West recorded the spectra on April 17, 23 and May 1 while Frank Melillo recorded the remaining spectra. The spectra were constructed as described by Schmude (2001, 33). The resolution in all cases is ~50 Å at a wavelength of 6000 Å. All spectra show absorption features near 5400, 6200, 7300 and 7900 Å, all indicative of methane. Melillo's Uranus spectrum on 17 September also shows the 8900 Å absorption band.

Satellites

Melillo recorded unfiltered images of Oberon, Titania and Umbriel and from these, he was able to measure relative magnitudes. On 27 August, Titania was 0.30 magnitudes brighter than Oberon while on 07 September, Titania was 0.33 magnitudes brighter than Oberon. On 08 September at 3:06 UT, Oberon was 1.02 magnitudes brighter

Table 5 (continued): Photoelectric Magnitude Measurements of Neptune Made During the 2001 Apparition

Date (2001)	Observer Initials	Filter	Raw Magnitude	X(1,a)	Comp. Stars
Oct. 1.217	JW	V	7.75	-7.00	Theta-Cap
Oct. 2.179	JW	V	7.73	-7.02	"
Oct. 3.192	JW	V	7.75	-7.01	"
Oct. 4.190	JW	V	7.74	-7.01	"
Oct. 7.192	JW	V	7.77	-6.98	"
Oct. 10.157	JW	V	7.76	-7.01	"
Oct. 19.134	JW	V	7.74	-7.03	"
Oct. 21.164	JW	V	7.76	-7.01	"
Oct. 22.140	JW	V	7.77	-7.01	"
Oct. 23.138	JW	V	7.76	-7.02	"
Oct. 24.125	JW	V	7.75	-7.03	"
Nov. 1.112	JW	V	7.79	-7.00	"
Nov. 5.101	JW	V	7.79	-7.00	"
Nov. 8.100	JW	V	7.78	-7.01	"
Nov. 15.099	JW	V	7.79	-7.01	"
NOTE: The observers are: Brian Loader (BL), Richard Schmude, Jr. (RS), Doug West (DW) and John Westfall (JW).					

Table 6: Magnitude Measurements of Pluto + Charon During 2001 (all measurements by Doug West

Date (2001)	Raw Magnitude	Solar phase angle (degrees)	V(1,0)	Comparison Stars
April 17.419	13.63	1.4	-1.20	TYC 5651 120 1
				HIP 83127
Apr. 23.429	14.06	1.2	-0.76	TYC 5651 462 1
				HIP 83127
Apr. 25.423	14.12	1.2	-0.70	"
May 1.423	13.79	1.1	-1.02	HIP 83016
				HIP 83127
May 7.426	13.75	0.9	-1.05	"
May 8.425	14.14	0.9	-0.66	HIP 83016
				TYC 5650 1402 1
May 14.425	13.62	0.7	-1.17	"
May 19.170	13.83	0.6	-0.95	HIP 83016
				TYC 5650 1618 1
May 24.177	13.88	0.6	-0.90	HIP 82815
				TYC 5650 1137 1

Table 7: Selected Normalized Magnitudes for Uranus, Neptune and Pluto During 2001

Planet	B(1,0)	V(1,0)	R(1,0)
Uranus	-6.60±0.04	-7.13±0.01	-6.93±0.04
Neptune	-6.56±0.02	-7.01±0.02	---
Pluto	---	-0.93±0.10	---

than Umbriel. According to the Astronomical Almanac, Oberon is 0.87 magnitudes brighter than Umbriel in the V-filter. It must be pointed out though that the moons of Jupiter vary in brightness with longitude (Beebe, 1994, 102) and this may be the case for the moons of Uranus as well.

Conclusions

A total of 21 different people submitted a variety of observations of Uranus, Neptune and Pluto in 2001-2002. A total of 80, 62 and 9 photoelectric magnitude measurements were obtained for Uranus, Neptune and Pluto respectively in 2001. The selected normalized magnitudes for Uranus are: B (1,0) = -6.60 ± 0.04, V (1,0) = -7.13 ± 0.01 and R (1,0) = -6.93, while the corresponding values for Neptune are: B (1,0) = -6.56 ± 0.02 and V (1,0) = -7.01 ± 0.02. The selected normalized magnitude for Pluto + Charon is V (1,0) = -0.93 ± 0.10. The 2001 measurements are consistent with the recent dimming trend of Uranus and the recent brightening trend of Neptune. Photometric measurements made between 1927 and 2001 indicate two trends for Uranus: 1) Uranus dimmed after its solstices in 1946 and 1985, and 2) the southern hemisphere is darker than the northern hemisphere.

Cidadao recorded the brightness of Titania + HIP 106829 on 08 September while that star was being occulted. The starlight vanished within 0.6 seconds, which is consistent with an upper limit surface pressure of 1.0 microbar for an atmosphere of Titania. No occultation was observed from Villa Rica, Georgia, or Long Island, New York.

Roger Venable and four others observed Charon separated from Pluto in mid-2001. Melillo used unfiltered CCD images to measure the relative brightness of Titania, Oberon and Umbriel. He found Titania to be 0.33 and 0.30 magnitudes brighter than Oberon on 27 August and 07 September 2001, and found Oberon to be 1.02 magnitudes brighter than Umbriel on 08 September. Methane absorption bands were present in the 2001 spectra of Uranus and Neptune.

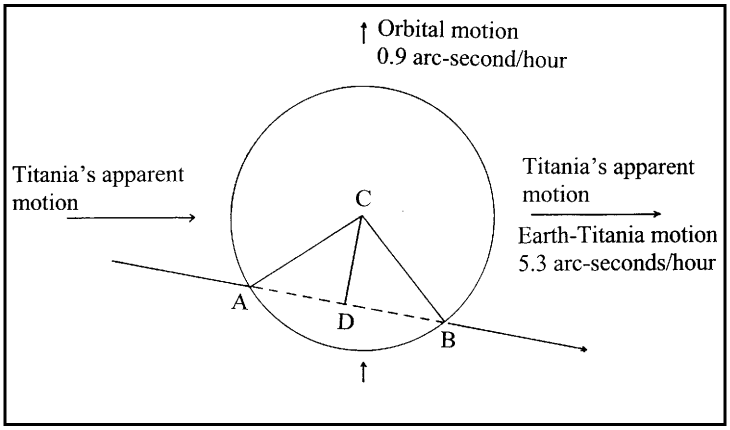

Figure 5: A profile of Titania as seen by Antonio Cidadao from Lisbon. Segment CD is perpendicular to segment AB. C is the center of Titania and segment AB represents the path that the star followed as Titania moved. Segment CA is the radius of Titania (789 km) and segment AD is 602 km long; this is half of segment AB, which is 1204 km long. From the Pythagorean theorem, segment CD is computed to be 510 km.

Acknowledgements

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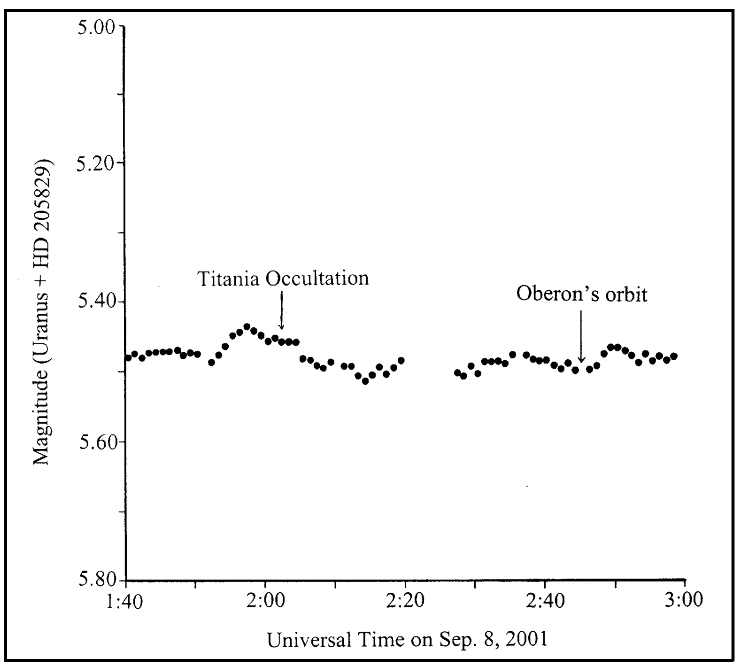

Figure 6: A plot of the magnitude of Uranus plus HD 205829 is plotted as a function of time on Sep. 8, 2001; these measurements were made from Villa Rica, Georgia. Each point is the average of six, ten-second measurements. Since there was no sharp drop as the orbit of Titania passed HD 205829, no occultation took place as seen from Villa Rica, Georgia.

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