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Journal of the Association of Lunar & Planetary Observers

The Strolling Astronomer

Founded in 1947

Volume 50, Number 2, Spring 2008

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Online and in COLOR at http://www.alpo-astronomy.org

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

The Moon as imaged by ALPO member Howard Eskildsen of Ocala, Florida, USA, showing the dramatic difference between First Quarter and Last Quarter phases. See page 5 for details.


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Journal of the Association of Lunar & Planetary Observers

The Strolling Astronomer

Volume 50, No. 2, Spring 2008
This issue published in March 2008 for distribution in both portable document format (pdf) and also hardcopy format.

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

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

For membership or general information about the ALPO, contact:

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ALPO Membership Secretary/Treasurer
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Springfield, Illinois 62791-3456

E-mail to: will008@attglobal.net

Visit the ALPO online at:
http://www.alpo-astronomy.org

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Point of View
New ALPO Web Page Includes All Observing Forms

By Ken Poshedly, editor & publisher,
The Strolling Astronomer

Perhaps one of the bigest "secrets" of the ALPO is the fine library of observing forms available for all to use when preparing reports for our staff observing coordinators.

Long available online at their respective ALPO observing section web pages, we now have them as well at one central location to minimize the time and effort in finding the right ALPO observing form for your particular use.

If you're reading this in the paper Journal, you'll have to key in the entire website address; but if you're reading this online as a pdf file, simply left-click on this link:

http://www.alpo-astronomy.org/publications/ALPO%20Observing%20Forms.html

The new arrangement eases things considerably for those who merely want to collect the entire set with the least effort and then decide what solar system body to observe.

But those who regularly study only one solar system body and consistently log onto that particular ALPO web page will still be able to find that section's observing form there with as before.

The list of currently observing forms now includes:

SolarReportForm.pdf
MercuryReportForm.pdf
VenusReportForm.pdf
LunarObservingForms - All.pdf
Lunar Eclipse Report Form.pdf
MarsReportForm.pdf
JupiterReportForms - all.pdf
GalileanSatelliteReportForm.pdf
SaturnReportForms - All.pdf
RemotePlanetsReportForm.pdf and
RemotePlanetsReportForm - Expl.pdf
CometsReportForm.pdf
MeteorsReportForm.pdf

All forms are in portable document format (pdf), so users must have Adobe Reader installed in order to view and print them.

(Continued on page 16)

ALConExpo 2008

In the Heart of the Heartland

Des Moines, Iowa • July 18-19, 2008

Hosted by the Des Moines Astronomical Society

Please join us for a weekend filled with blue skies, clean air, and plenty of Iowan hospitality during the 66th Annual Astronomical League Convention and Exposition. The Des Moines Astronomical Society will host the convention at the newly renovated Downtown Marriott. To make this event special for 2008, The Association of Lunar and Planetary Observers will be joining us with special speakers, fellowship, and insights. The conference will also feature a special seminar focusing on astronomy club/society improvement coordinated by John Goss, AL Secretary. On Friday, July 18th, a down-home picnic at Ashton Observatory will be held. The event will showcase local foods,a special guest speaker, and a public night of viewing sponsored by Meade Telescopes.

Speakers

Tomas Gonzalez-Torres
Tomas is the goto EVA guy for the next Hubble Space Telescope repair mission. We are pleased Tomas will be with us to explain what will be done to extend the life of the greatest telescope ever constructed by humans to date.

Jason Rhodes
Jason specializes in weak gravitational lensing research, and is currently working on several NASA projects; including the DUNE mission (Dark UNiverse Explorer) and the Gravitaitonal Lensing Experiment.

Norma Cutsforth
Norma is a working mother from Cedar Rapids, Iowa who enjoys her astronomy hobby to the degree she wrote a book about it! "Keeping Starwatch" is a wonderful collection of Norma's insights on astronomy.

Dr. Donald Parker
Don Parker is a well known figure in the amateur astronomy world. His work in astro-imaging has been recognized internationally recording th wonders of our closest neighbors is legendary.

The organizers reserve the right to make such changes to the program and speakers as may be necessary due to conditions outside of their control.

ALConExpo 2008 Registration Information — Fees

(please print)

First Name ______ Last Name ______

Email Address ______

Mailing Address ______

City, State, Country, ZIP/Postal Code ______

Home Phone ______ Phone #2 ______

Club/Society Affiliation ______

Direct questions to: chairman@alconexpo.com • registrar@alconexpo.com

INSTRUCTIONS: Please use one form per attendee; however, one check may be submitted for a group. Payment must be postmarked by June 30 to receive the early registration rate. Mail completed form with a check or money order payable to **ALConExpo2008** - *PLEASE NO CASH.*

ALConExpo 2008
P.O. Box 111
Des Moines, Iowa 50301-0111

REGISTER ONLINE AT:
www.alconexpo.com

PayPal

LODGING: All lodging will be pre-arranged by attendees by contacting Marriott International, Inc. at **1-800-514-4681** and request the "Alcon 2008 Room Rate." Participants can also register for lodging by visiting **www.marriott.com**.

NOTE: Advance registrations must be received by July 10, 2008; registration and dinners limited to maximum capacity of facilities. All tours subject to cancellation if minimums are not met. Children under 16 must be accompanied by an adult on all tours.

Membership Affiliation ☐ AL ☐ ALPO

- ☐ **Two Days** .... $60 — After June 30 ... $70
- ☐ **One Day** .... $35 — Friday or Saturday
- ☐ **Star Bar-B-Que** $30
  - ☐ Transportation ... $15
- ☐ **AL Awards Banquet** $50
  - ☐ Pork ☐ Salmon ☐ Vegetarian
- ☐ ***Council Tour** $10
  - *Thursday, 7:30 - 10:30 PM*
  - Science Center of Iowa
  - Drake Observatory
- ☐ ***Madison County Tour** ... $40
  - *Friday, 9:45 AM - 3:00 PM*
  - John Wayne Birthplace
  - Covered Bridges
- ☐ ***Mansion Tour** $40
  - *Saturday, 9:30 AM - 3:45 PM*
  - Hoyt Sherman Place
  - Salisbury House
- ☐ **Event T-Shirt** $20
  - ☐SM ☐MED ☐LG ☐XL ☐XXL
- ☐ **Astronomical League Donation**

Total Fees ....>

* Transportation Included

Inside the ALPO

Member, section and activity news

News of General Interest

ALPO Conference News and A Call for Papers

ALCON2008 Announcement

The Association of Lunar & Planetary Observers will be meeting with the Astronomical League in Des Moines, IA, this summer as a part of the League's **ALCon Expo 2008**, Friday and Saturday, July 18 and 19, with the closing banquet on Saturday in the evening. The ALPO board of directors will meet on Friday evening, July 18 at 7 p.m.

Hosting the conference will be the Des Moines Astronomical Society. Meeting information can be found at http://www.alconexpo.com/. The venue for the Conference will be the Marriott Hotel, located at 700 Grand Avenue in Des Moines; phone 800-514-4681.

Contacts for ALCon Expo 2008:

DMAS / ALConExpo 2008
P.O. Box 111
Des Moines, IA 50301

info@alconexpo.com

ALPO Call for Papers

The ALPO will have parallel sessions for ALPO papers. If you are interested in presenting a paper, **please submit the following data about your paper no later than May 1**:

- Paper Title
- Presenter(s) – also note if someone will be reading your paper for you, and the name of that individual
- Time requested – including Q&A
- Audio-visual equipment requirements
- Brief abstract; approximately 100 words

If possible, please e-mail Mike Reynolds as soon as possible to let him know of your intent to present and the approximate amount of time you will require for your paper.

Contact info for ALPO papers at AlCon Expo 2008:

Dr. Mike Reynolds
3939 Roosevelt Blvd.
Jacksonville, FL 32205
e-mail 1: alpo-reynolds@comcast.net
e-mail 2: mreynold@fccj.edu

This Month's Front Cover

The Moon as imaged by ALPO member Howard Eskildsen of Ocala, Florida, USA, showing the dramatic difference between First Quarter and Last Quarter phases as it librated from -6.2 degrees (right side) to +7.5 degrees (left side) in one lunation. Howard used the Ptolemaeus group (three distinctive craters near the center of the photo) as the anchor point. First Quarter image taken 2008 /02/14 23:57 UT using a D&G Optical 8-in. (20-cm) refractor (loaned to Howard by Louise Olivarez, widow of the late Jose Olivarez); Last Quarter image taken 2008/02/28 11:01 UT using a Meade 6-in. (15.2-cm) refractor. A MaxView 40 mm eyepiece and a Nikon CoolPix 4300 camera were used for both images. Image processing done in Photoshop Elements Version 2.0. North is at top, east is to right in both views. On 2008/02/14, seeing = 6 out of a possible 10 (10 = best), and transparency = 5 out of a possible 6 (6 = best); on 2008/02/28, seeing = 5, and transparency = 6.

Addition to ALPO Publications Section

Report by Ken Poshedly, Publications Section coordinator

ALPO member and the association's first Remote Plant Section Recorder (now coordinator) Leonard Abbey of Atlanta, GA USA, has joined the Science/Peer Reviewers group.

Having joined the ALPO in 1953 at the age of 15, Lenny proved to be an enthusiastic and prolific observer. While he was especially interested in Mars, Jupiter, Saturn, Uranus and Neptune, "Lenny" was named by ALPO founder Walter Haas to head the newly formed Uranus-Neptune Section in 1956.

Over the years, Lenny has participated in observing projects for NASA, the Smithsonian Astrophysical Observatory, and Har-

Reminder: Address changes

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

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

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

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vard College Observatory. He was elected fellow of the Royal Astronomical Society in 1970. Lenny is also a volunteer programmer for the American Association of Variable Star Observers (AAVSO).

Lenny Abbey "dancing with telescope" too many year ago.

As a JALPO Science/Peer Reviewer, Lenny will draw on his many years of observing experience and accumulated knowledge of solar system astronomy — especially the remote planets — to review reports about those objects.

Lenny is a lifelong resident of Atlanta, and is also the senior member of the Atlanta Astronomy Club where he has held virtually all of its elective offices. He was the featured dinner speaker at the ALPO 1998 Conference when it was held in Atlanta, with a presentation on notable telescopes.

His current interests are astronomical computing and the history of observational astronomy.

Strolling Astronomer Online Indexes Now Available

Indexes to volumes 18 through 29 and 42 thru 48 of *The Strolling Astronomer* are now available online at http://www.alpo-astronomy.org At the ALPO homepage, click on "Publications", then scroll down and click on the "JALPO Indexes" button.

The online indexes to *The Strolling Astronomer* are provided as a service to ALPO members, researchers and interested others whose search brings them to the Assn of Lunar & Planetary Observers.

Additional indexes to the remaining volumes of the Journal will be added as they become available.

ALPO Online Membership Payments are Back

We are pleased to announce that ALPO memberships can once again be purchased online. Direct your web browser to:

http://www.galileosplace.com/ALPO/

The ALPO wishes to thank *Telescopes by Galileo* for hosting the ALPO and accepting ALPO membership payments on our behalf.Their support of the ALPO is most appreciated. See the ALPO membership application form near the back of this issue of your Journal for dues and other details.

ALPO Interest Section Reports

Web Services

Report by Larry Owens, acting section coordinator

Larry.Owens@alpo-astronomy.org

Visit the ALPO home page on the World Wide Web at http://www.alpo-astronomy.org

Computing Section

Report by Kim Hay, section coordinator,

kim@starlightcascade.ca

The ALPO Computing Section (ALPOCS) web page has undergone some changes, but more information and program links to our programmers programs would be welcome.

Jeff Beish has updated his WIMP program, in which links are located at http://www.alpo-astronomy.org/computing

The ALPOCS also has an e-mail list in which people can exchange ideas, ask questions, or upload their programs they would like to share.

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We currently have 255 members signed up to the list. I invite any and all ALPO members to sign up to the ALPOCS e-mail list and help share your knowledge of computer programs – written or commercial, we can all benefit to know how programs work, and which ones are your best and why!

To subscribe, go to *http://groups.yahoo.com/group/alpocs/*

To post, either on the site or via your e-mail program, use *alpocs@yahoogroups.com*.

You can also unsubscribe from the list using *alpocs-unsubscribe@yahoogroups.com* but if you need to go , we understand.

Visit the ALPO Computing Section on the World Wide Web at *http://www.alpo-astronomy.org*, then Computing Section.

Lunar & Planetary Training Program

Report by Tim Robertson, section coordinator
cometman@cometman.net

For information on the ALPO Lunar & Planetary Training Program on the World Wide Web, go to *http://www.cometman.net/alpo/*; regular posal mail to Tim Robertson, 2010 Hillgate Way #L, Simi Valley CA, 93065; e-mail to *cometman@cometman.net*

Instruments Section

Report by Mike Reynolds, acting section coordinator
alpo-reynolds@comcast.net

Visit the ALPO Instruments Section on the World Wide Web at *http://www.alpo-astronomy.org*, then Instruments Section.

ALPO Observing Section Reports

Eclipse Section

Report by Mike Reynolds, section coordinator
alpo-reynolds@comcast.net

The 20-21 February 2008 Total Lunar Eclipse is now history. Please submit observations you made of the eclipse, including any of the following:

- Eclipse visibility (Even a simple "yes, I observed the eclipse" or "no, it was cloudy at my location…" will be useful for the ALPO Journal Eclipse Section Report.)
- Location of where you made your observations and overall conditions
- Contact timings (see note below)
- Crater contact timings
- Estimates of totality's darkness and color, using the Danjon scale if possible
- Photographs of the eclipse
- Other observations you made (such as photometry, occultations timed during the eclipse, etc.)

A form is also available on the ALPO website for reporting lunar eclipse observations. Go to *http://www.alpo-astronomy.org/publications*, then scroll down and click on the "ALPO Observing Forms" button.

This is also a reminder to please send naked-eye limb-contact timings (U1-U2-U3-U4) to me as well as to Dr. John Westfall (P.O. Box 2447, Antioch, CA 94531; *johnwestfall@comcast.net*).

I will be preparing a full section report on the eclipse for the Journal based on observations submitted by ALPO members. Please send your observations and reports via e-mal or to the postal address below:

Dr. Mike Reynolds, Associate Dean of Mathematics and Natural Sciences, Florida Community College, 3939 Roosevelt Boulevard, Jacksonville FL 32205

Please visit the ALPO Eclipse Section on the World Wide Web at *http://www.alpo-astronomy.org*, then Eclipse Section.

Comets Section

Report by Gary Kronk, acting section coordinator
kronk@cometography.com

Comet Holmes has woken up the ALPO Comets Section!

Periodic comet 17P/Holmes became a bright, naked-eye object following an unprecedented outburst in brightness on

Figure 1. Drawing of Comet Holmes by Jay Albert, Lake Worth, Florida, October 30, 2007, using a Celestron NX (Next Star) 10-cm Maksutov-Cassegrain at 75x. Tranparency and seeing data not reported.

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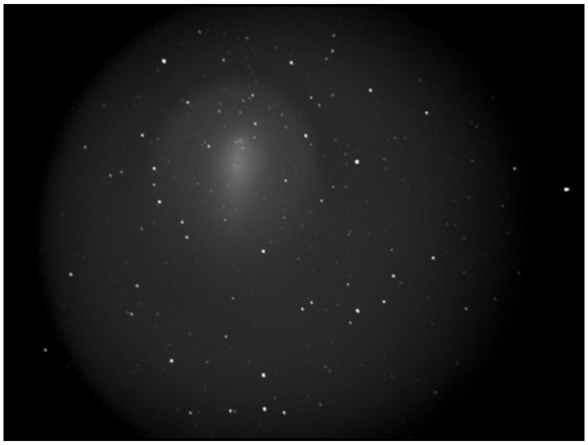

Figure 2. Digital image of Comet Holmes by John D. Sabia, South Abington Township, Pennsylvania, November 25.96, 2007, using a Nikon CP995 digital camera set at ISO 400 coupled to a TeleVue 101 (10-cm / 4-in.) refractor. Image is the result of four 60-second exposures. Mr. Sabia notes that the coma is 35 arc-minutes across. Tranparency and seeing data not reported.

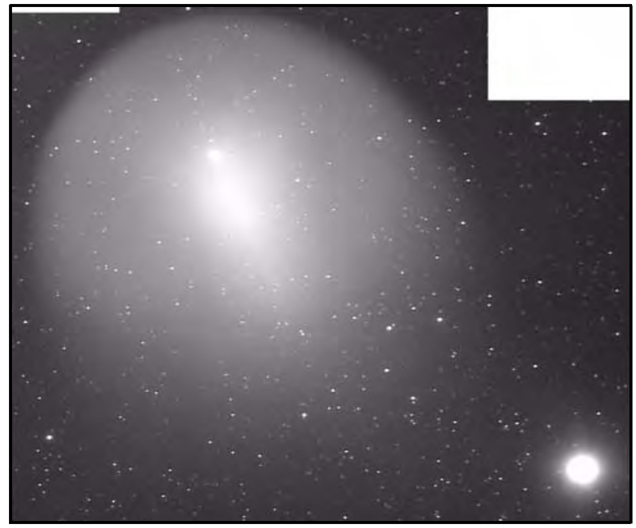

Figure 4:. Digital image by ALPO Comets Section Coordinator Gary W. Kronk, Kronk Observatory, St. Jacob, Illinois, November 17.01-17.05, 2007, using a MallinCam Black and White Hyper CCD video camera coupled to a a Meade LX200 (200cm) Schmidt-Cassegrain. Image is the result of twelve 30-second exposures. No transparency or seeing data reported.

the night of 2007 October 24/25. Thanks to the Internet, ALPO observers began visual and photographic observations on October 25 and these have continued into March 2008.

G. W. Kronk (Kronk Observatory, St. Jacob, Illinois) first detected the comet on October 25. Using 20x80 binoculars, he gave the magnitude as 2.9 and said the coma was about 1arc-minute across.

J. D. Sabia (Pennsylvania) went to Keystone College's Thomas G. Cupillari Observatory on October 26 and he gave the naked-eye magnitude as 2.2. Using the 24-cm Alvan Clark refractor, he found a "ghostly large circular" coma about 2 arc-minutes across. He added, "Within this and ever so slightly off-center is a distinct false nucleus, from which a bright fan tail is projected about halfway to the outer coma. That circular outer coma has the sharpest boundary I have ever seen in a comet."

Figure 3. Digital image by Frank J. Melillo, Holtsville, New York, on December 7.17, 2007, using a Starlight Xpress MX-5 CCD camera and 200 mm telephoto lens. Image is the result of two 60-second exposures North is up and west is to the right. Tranparency and seeing data not reported.

On October 28, Sabia observed but this time using 10x50 binoculars under partly cloudy skies. He gave the magnitude as 2.3 and was able to see the bright inner coma and the sharp outer coma. He said the outer coma seemed a dim blue, while the inner coma was "more white." Kronk gave the magnitude as 2.8 on the same night and said the coma was 7 arc-minutes across.

On the 29th, Kronk gave the magnitude as 2.9 and said the coma was now 9 arc-minutes across. Sabia observed using his 25-cm Maksutov-Newtonian and noted the yellow color of the coma. Using a 51-cm reflector, Sabia wrote, "WOW! What a view! [I was able to see] the inner coma, dark areas, and the dense sections of the outer coma."

On October 31, Sabia observed once again using the large reflector. He said, "At higher magnifications, the sharp edge of the outer coma was seen as an incomplete annular ring. Best seen when slowly slewing the scope in declination. The pseudo nucleus is nearly stellar."

On November 1, Sabia observed with the 10x50 binoculars and reported the magnitude as 2.7 and the coma diameter as 20 arc-minutes.

On November 2, Kronk gave the magnitude as 2.8 and the coma diameter as 15 arc-minutes. Sabia again used the binoculars and reported the magnitude as 2.7 and the coma diameter also as 15 arc-minutes. He added that the Alvan Clark refractor revealed the pseudo-nucleus "had considerably dimmed in brightness" and was more "nebulous" than before.

On November 4, the magnitude was given as 2.64 by W. H. Haas (Las Cruces, New Mexico) and 2.9 by Kronk. Kronk said the coma was 17 arc-minutes across. During the next few days, Haas gave the

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magnitude as 2.52 on the 5th, 2.68 on the 6th and 7th, and 3.38 on the 9th.

On the 11th, Sabia said the comet appeared as a "larger nebulous near circular patch" to the naked eye. He said the 10x50 binoculars revealed a magnitude of 3.2 and a coma 24 arc-minutes across.

On the 12th, Haas gave the magnitude as 3.50. On November 14, the magnitude was given as 3.4 by Sabia and 3.62 by Haas. Sabia said the coma was 30 arc-minutes across in binoculars.

On November 15, Haas gave the magnitude as 3.77. On the 17th, Sabia said the comet was difficult to see with the naked eye due to its proximity to the star Mirfak. Nevertheless, using averted vision, he gave the magnitude as 3.5 and the coma diameter as 33 arc-minutes. On the 18th, the magnitude was given as 3.1 by Kronk and 3.84 by Haas. Kronk said the coma was 30 arc-minutes across. On the 19th, Haas gave the naked-eye magnitude as 3.70. He also observed the comet using 7x35 binoculars and described it as a "roughly circular haze." He suggested the diameter was 10–15 arc-minutes.

On the 20th, Haas gave the magnitude as 3.67. He said the binoculars revealed the major axis of the coma was probably 15–20 arc-minutes across. Kronk gave the magnitude as 3.0 on the 28th and said the coma was 45 arc-minutes across. On November 29, Haas gave the magnitude as 4.57 and said the coma was not visible to the naked-eye. He described the comet as a "very diffuse oval fuzz ball with a major axis of perhaps 40 arc minutes."

On December 3, Haas observed with binoculars and gave the magnitude as 4.55. On the 7th, Sabia said the comet was brighter than the Andromeda Galaxy and the Double Cluster, which have integrated magnitudes of 4.4 and 3.5, respectively. On the 8th, Haas gave the magnitude as 4.58 and said the comet appeared "very faint and diffuse, with no hint of central condensation." On the 14th, Kronk gave the magnitude as 3.1 and said the coma was 55 arc-minutes across.

On December 16, Haas saw the comet in somewhat poor skies and gave the magnitude as 5.51. He described the comet as a "very faint and diffuse oval" with a major axis of perhaps 30–40 arc-minutes.

Kronk has continued to follow the comet, although most of his efforts have concentrated on capturing images. A sample of his brightness estimates reveal the magnitude as 3.3 on December 18 and 31, 3.5 on January 12, 4.0 on January 27, 4.2 on February 3, and 4.3 on February 11. During this same period of time, the coma diameter increased from 60 arc-minutes to 80 arc-minutes. The dimmer magnitudes recorded by Haas in late November and December may well be due to his seeing much less of the very large coma with only 80 mm binoculars."

In the coming months, the comet will become harder to see and image as this area of the sky will be north of the sun.

Visit the ALPO Comets Section on the World Wide Web at http://www.alpo-astronomy.org, then Comets Section.

Meteors Section

Report by Robert Lunsford, section coordinator
lunro.imo.usa@cox.net

ALPO Meteors Section coordinators Robert Lunsford and Robin Gray conducted another successful expedition to the Mojave Desert to view the Geminid meteor shower. We were out for a total of three nights and each of us recorded approximately 1,000 meteors during 15 hours of observing time. Highest rates occurred on December 14 when two one- hour periods produced 117 meteors each. The only interference from clouds occurred on the first night when the second half of our session was clouded out. We also ran a video camera which captured 1,133 meteors during the same time period.

Our next expedition will be to view the Quadrantid shower in January 2009.

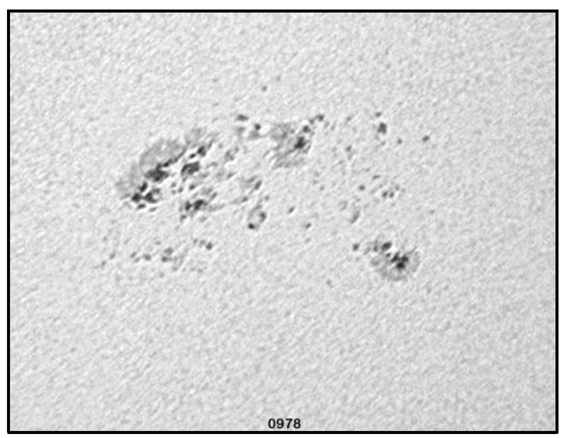
Visit the ALPO Meteors Section on the World Wide Web at http://www.alpo-astronomy.org, then Meteors Section.

Solar Section

Report by Kim Hay, section coordinator
kim@starlightcascade.ca

In our last submission, there was some excitement that Cycle 23 had finished and Cycle 24 had begun. There had been two groups (AR10978 and AR10981) that had produced reversed polarity spots. However sunspot AR10981 was being heralded as the new spot of Cycle 24.

Major observatories (SIDC-Belgium) http://sidc.oma.be/news/100/welcome.html NASA itself had proclaimed the new cycle had started http://sci-



White light image of sunspot group AR 10978 (Carrington Rotation 2064) taken by Howard Eskildsen, Ocala, Florida, December 13, 2007, 13:38 UDT. Equipment details: telescope, Meade ETX 125 Maksutov-Cassegrain on fork-mounting with electric drive; aperture 125 mm, FL 1,900 mm, f/15; AstroSolar Photofilm solar filter. Imaging system, Orion Star Shoot II, W-15 yellow filter. Altitude, 15°; seeing, 2; sky conditions, fog; wind, light.

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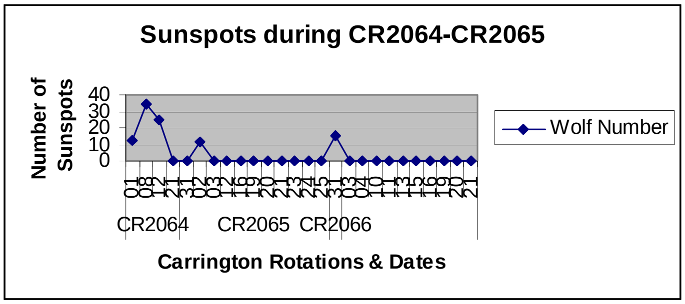

ence.nasa.gov/headlines/y2008/10jan_solarcycle24.htm

Most solar observers are still waiting to see any increase — really, ANY spots at all — as of February 24, 2008, which is into Carrington Rotation CR2067. It was hoped that there might be some increase in activity from a possible flare the following week when a re-current active region returns.

However, there are others that are sceptical that we have entered into Cycle 24. A report from Jan Janssens debunks the possibility of a new cycle *http://users.telenet.be/j.janssens/SC24_start_strength.pdf* but perhaps implies we are heading for a Maunder Minimum instead. The Maunder Minimum is a period of extreme solar inactivity which presented itself in 1645-1715, and was responsible for the “Little Ice Age” in Europe.

There is also another article in the Investor’s Business Daily titled “The Sun also Sets”and which was posted online at *http://ibdeditorial.com/IBDArticles.aspx?id=287279412587175.* This article discusses the possibility of global cooling instead of global warming.

There may be some truth to the opinion that we are not in a new cycle. As below, are my own personal sunspot numbers from CR2064 to CR2066, which takes into account the two groups (AR10978 and AR10981)

ALPO observers have been diligent in their observations, submitted drawings, white light and H-alpha images. Since there are no sunspots in white light, we have been treated to several magnificent prominences over the last two rotations (CR2065-CR2066). The image of the week from February 17-23 of a beautiful prominence from Dave Taylor, Buckinghamshire UK is located at *http://alpo-astronomy.org/pastsolar.html*

Both professional and amateur astronomers are still studying the Sun, and there is always something new to observe and understand. Anything is possible, whether we are in the final end of Cycle 23 or in the beginning phases of Cycle 24, only time will tell.

We are in an interesting time of solar activity, and one way to experience the solar excitement is to join the ALPO Solar Section e-mail list; simply go to *http://ww.yahoo.com* and look for ALPOSS and join. We currently have 301 members on the Solar ALPO e-mail list and look forward to seeing you there.

In other solar news, the Ulysses spacecraft which was launched in 1990 will be non-functioning within a few months. It was placed in orbit to study the Sun’s poles. After almost 17 years in space (four times its expected lifetime), it has supplied data that has helped scientists on Earth with solar and space information. For the full story see *http://www.jpl.nasa.gov/news/news.cfm?release=2008-031*

On the local front Rik Hill, former ALPO webmaster and ALPO Solar Section coordinator posted the following event schedule for all solar enthusiasts:

- Space Weather Workshop - Boulder Colorado, April 29-May 2, 2008; *http://www.swpc.noaa.gov/sww/*
- Solar Physics Division of AAS - 27–30 May 2008 at the Greater Fort Lauderdale-Broward County Convention Center; *http://www.agu.org/meetings/ja08/?content=home*

Till later, clear sunny days to you all!

Mercury Section

Report by Frank J. Melillo, section coordinator
frankj12@aol.com

A report on the 2006 apparitions appears later in this issue.

After the Mariner 10 flyby of Mercury in 1975, it would be another 33 years before another spacecraft would swing by.

Finally, on January 14, 2008, we were treated to a part of Mercury previously unseen at close range. It was on that date that the MESSENGER spacecraft made its first flyby, skimming only 126 miles above the surface. Transmitted back to Earth were over a thousand images showing double-ring craters, smooth plains, bright rayed craters and bright maria. It reminds us of our Moon at a quick glance, but when looking closely at the surface, Mercury seems a lot different.

A recent drawing of Venus’ gibbous disk on February 21, 2008 at 12:15 UT by Carl Roussell of Canada using a 15.2 cm (6.0 in.) REF employing W47 (violet), W25 (red), and W58 (green) filters to help reveal subtle contrasts and banded dusky markings. S=3.5, Tr=3.0. Apparent diameter of Venus is 11.7 arc-seconds, phase (k) 0.889 or 88.% illuminated, and visual magnitude -3.9. South is at top of image.

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Geocentric Phenomena of the 2008-09 Eastern (Evening) Apparition of Venus in Universal Time (UT)		
Superior Conjunction	2008	Jun 09^d (angular diameter = 9.6 arc-seconds)
Greatest Elongation East	2009	Jan 14 (47º east of the Sun)
Predicted Dichotomy	2009	Jan 17.02 (exactly half-phase)
Greatest Brilliancy	2009	Feb 18 (m_v = – 4.7)
Inferior Conjunction	2009	Mar 27 (angular diameter = 59.7 arc-seconds)

Ed Lomeli of California and John Boudreau of Massachusetts have imaged Mercury nearly at the same longitude as seen from new MESSENGER sight. There will be a paper prepared with images and drawings for publication in an upcoming isue of this Journal.

Visit the ALPO Mercury Section on the World Wide Web at http://www.alpo-astronomy.org, then Mercury Section.

Venus Section

Report by Julius Benton, section coordinator
jlbaina@msn.com

Venus remains bright object low in the morning sky just before sunrise. This apparition, the planet has been passing through its waxing phases (a gradation from crescentic through gibbous phases), and as of this writing in ealy March, its gibbous disk is only 11arc-seconds across, continuing to decrease in angular diameter and brightness as it heads toward Superior Conjunction on June 9, 2008 when it will be 9.6 degrees in extent.

Venus reached greatest brilliancy September 23, 2007, theoretical dichotomy (half phase) on October 27th, and Greatest Elongation West on October 28th. During the 2007-08 Western (Morning) Apparition observers have been seeing the trailing hemisphere (dawn side) of Venus at the time of sunrise on Earth. With this apparition rapidly drawing to a close, observers should begin preparing for the 2008-09 Eastern (Evening) Apparition of Venus, for which the following Geocentric Phenomena in Universal Time (UT) are presented:

The Venus Express (VEX) mission started systematically monitoring Venus at UV, visible (IL) and IR wavelengths back in late May 2006. As part of an organized Professional-Amateur (Pro-Am) effort, a few ALPO Venus observers submitted high-quality digital images of the planet taken in the near-UV and near-IR, as well as other wavelengths through polarizing filters. The observations should continue to be submitted in JPEG format to the ALPO Venus Section as well as to the VEX website at:

http://sci.esa.int/science-e/www/object/index.cfm?fobjectid=38833&fbodylongid=1856.

Routine observations of Venus are needed throughout the period that VEX is observing the planet, which continues in 2008-09 and a year or two afterwards. Since Venus has a high surface brightness, it is potentially observable anytime it is far enough from the Sun to be safely observed.

Key observational endeavors include:

- Visual observations and drawings in dark, twilight, and daylight skies to look for atmospheric phenomena including dusky shadings and features associated with the cusps of Venus
- Visual photometry and colorimetry of atmospheric features and phenomena
- Monitoring the dark hemisphere for Ashen Light
- Observation of terminator geometry (monitoring any irregularities)
- Studies of Schröter's phase phenomenon near date of predicted dichotomy
- Routine digital imaging of Venus at visual, UV, and IR wavelengths
- Special efforts to accomplish simultaneous observations (observers are always encouraged to try to view and image Venus simultaneously; that is, as close to the same time and date as circumstances allow, which improves confidence in results and reduces subjectivity.

Contribution of observation data and images to the Venus Express mission is encouraged

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

Complete details can be found about all of our observing programs in the ALPO Venus Handbook.

Individuals interested in participating in the programs of the ALPO Venus Section are cordially invited to visit the ALPO Venus Section on the World Wide Web at http://www.alpo-astronomy.org, then Venus Section.

Lunar Section:
Lunar Topographical Studies / Selected Areas Program

Report by William M. Dembowski, FRAS, program coordinator
bill.dembowski@alpo-astronomy.org

A report on the Banded Craters Program appears later in this issue.

During the fourth quarter of 2007, the Lunar Topographical Studies Section (LTSS) received a total of 226 new images from 19 observers in 7 countries and 9 observers in the United States. Five of the observers were first-time contributors, all of whom cited the Lunar Section Newsletter (*The Lunar Observer*) as the impetus for their participation. As always, copies of observations related to lunar eclipses and LTPs were forwarded to the coordinators of those sections.

Digital archiving of LTSS observations was upgraded with the acquisition and use of an external hard drive in place of DVDs. Being

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Calendar of Lunar Events — April thru June 2008 (all times in UT)

Apr. 02	09:00	Moon 0.28 degrees WSW of Neptune
Apr. 04	07:00	Moon 2.8 degrees NNW of Uranus
Apr. 04	21:00	Moon 4.2 degrees NNW of Venus
Apr. 05	08:00	Moon 5.1 degrees NNW of Mercury
Apr. 06	03:55	New Moon (Start of Lunation 1055)
Apr. 07	20:00	Moon at Perigee (361,082 km - 224,366 miles)
Apr. 12	06:00	Moon 1.2 degrees N of Mars
Apr. 12	18:31	First Quarter
Apr. 15	17:00	Moon 2.3 degrees SSW of Saturn
Apr. 20	10:24	Full Moon
Apr. 23	10:00	Moon at Apogee (405,944 km - 252,242 miles)
Apr. 27	06:00	Moon 2.7 degrees SSE of Jupiter
Apr. 28	14:13	Last Quarter
Apr. 29	20:00	Moon 0.37 degrees NNE of Neptune
May 01	20:00	Moon 1.0 degrees NNW of Uranus
May 04	20:00	Moon 5.9 degrees NNW of Venus
May 05	12:18	New Moon (Start of Lunation 1056)
May 06	03:00	Moon at Perigee (357,771 km - 222,309 miles)
May 06	22:00	Moon 2.5 degrees N of Mercury
May 10	14:00	Moon 0.35 degrees ENE of Mars
May 12	03:46	First Quarter
May 12	22:00	Moon 2.5 degrees SSW of Saturn
May 20	02:11	Full Moon
May 20	15:00	Moon at Apogee (406,402 km - 252,527 miles)
May 24	12:00	Moon 2.4 degrees SSE of Jupiter
May 27	02:00	Moon 0.60 degrees NW of Neptune
May 28	02:57	Last Quarter
May 29	06:00	Moon 3.3 degrees NNW of Uranus
June 03	13:00	Moon at Perigee (357,250 km - 221,985 miles)
June 03	17:00	Moon 4.9 degrees N of Venus
June 03	19:23	New Moon (Start of Lunation 1057)
June 04	04:00	Moon 6.4 degrees N of Mercury
June 08	01:00	Moon 1.0 degrees SSW of Mars
June 09	07:00	Moon 2.8 degrees SSW of Saturn
June 10	15:02	First Quarter
June 16	17:00	Moon at Apogee (406,228 km - 252,418 miles)
June 18	17:30	Full Moon
June 20	14:00	Moon 2.4 degrees SSE of Jupiter
June 23	08:00	Moon 0.78 degrees NW of Neptune
June 25	13:00	Moon 3.6 degrees NNW of Uranus
June 26	12:10	Last Quarter

(Table courtesy of William Dembowski)

a relatively new observing section (12 years) the digital archiving level of LTSS observations is 100%.

Visit the following web sites on the World Wide Web for more info:

- The Moon-Wiki: http://the-moon.wikispaces.com/Introduction
- ALPO Lunar Topographical Studies Section http://www.zone-vx.com/alpo-topo
- ALPO Lunar Selected Areas Program http://www.alpo-astronomy.org, then Lunar Section.
- ALPO Lunar Topographical Studies Smart-Impact WebPage http://www.zone-vx.com/alpo-smartimpact
- *The Lunar Observer (current issue)* http://www.zone-vx.com/tlo.pdf
- *The Lunar Observer* (back issues): http://www.zone-vx.com/tlo_back.html
- Selected Areas Program: http://www.zone-vx.com/alpo-sap.html
- Banded Craters Program: http://www.zone-vx.com/alpo-bcp.html

Lunar Domes Survey

Report by Marvin Huddleston, FRAS, proram coordinator
kc5lei@sbcglobal.net

Lunar astronomy, or selenology, has been largely abandoned by many amateur astronomers. With renewed interest on the horizon for future manned exploration, it is hoped that observers will once again turn their telescopes toward our satellite and assist in accomplishing some science in the process. One of the areas currently in need of further study and where the amateur can make a valuable contribution to science is the area of lunar domes. Our current catalogue is incomplete and is in need of work in order to be useful for scientific research. It is this writer's belief that the foremost important task before us is to clean up the current listing of domes.

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Lunar astronomy must first of all be perceived by potential participants as fun. We are, after all, amateurs. While lunar dome study offers true scientific benefits, interest in it by ameteurs has waned in recent decades. At the same time, never before have amateurs been better equipped for such an enjoying pastime, nor have amateurs had the opportunity to make more valuable scientific contributions.

It is proposed that the ALPO Lunar Dome Survey standardize a collection of lunar domes for the purpose of establishing an observer training/certification program. Observers would concentrate their efforts at observing a standard list of domes selected to be representative of the various classes of domes, and in the process of observing them for training, they would earn a certificate in much the same way that the Astronomical League's "Messier Observing Club"(observe the listed objects and get a pin and certificate).

A proposed preliminary listing of domes is available on the Yahoo Lunar Dome list at:http://tech.groups.yahoo.com/group/lunar-dome/ One use of this list will be fun in nature; observers will observe the list and record their observations. They can then submit these and receive a certificate, similar to the aforementioned Messier certificate. The other value of this process will be used as a training platform for observers. As observers work through the listings, they will gain valuable experience that can be utilized later for more detailed scientific scrutiny of the objects.

Interested observers are invited to contact the author at kc5lei@sbcglobal.net
Participants are encouraged to contact Harry D. Jamieson, e-mail harry@persoftware.com in order to obtain a copy of the *Lunar Observers Tool Kit* (Windows edition).

Visit the ALPO Lunar Domes Survey on the World Wide Web at http://www.geocities.com/kc5lei/lunar_dome.html

Lunar Transient Phenomena

Report by Dr Anthony Cook, proram coordinator
tony.cook@alpo-astronomy.org

Visit the ALPO Lunar Transient Phenomena program on the World Wide Web at

- http://www.alpo-astronomy.org , then Lunar Section, then Transient Phenomena
- http://www.ltpresearch.org/

Lunar Meteoritic Impact Search

Report by Brian Cudnik, program coordinator
cudnik@sbcglobal.net

For information on impact-related events, please visit the ALPO Lunar Meteoritic Impact Search site on the World Wide Web at http://www.alpo-astronomy.org.

Mars Section

Report by Roger Venable, acting assistant section coordinator
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Overhead after evening twilight, Mars is now as conveniently placed as it ever gets for northern hemisphere observers.

With the breakup of the North Polar Hood and the gradual reduction in the size of the North Polar Cap, its atmosphere is relatively humid, so that clouds can often be seen and imaged. They appear especially prominent in blue light. Look for orographic clouds late in the sol (Martian day) around the Tharsis and Elysium volcanoes (Figure 1), and also look for morning limb clouds. Faint streaks of clouds extending from the morning limb across the disc can sometimes be seen (Figure 2).

We wish to document the times, frequencies, and locations of clouds, and we need your observations! Visual descriptions, drawings, and images are all helpful – especially if colored filters are used. One need not be an expert to participate – newcomers are more than welcome.

Join us on the Yahoo Mars observers' message list at http://tech.groups.yahoo.com/group/marsobservers . There you can share in discussions of observing Mars and post your images and drawings.

Visit the ALPO Mars Section on the World Wide Web at http://www.alpo-astronomy.org, then Mars Section.

Minor Planets Section

Report by Frederick Pilcher, section coordinator
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The lightcurve inversion problem — that of inverting lightcurve data into spin/

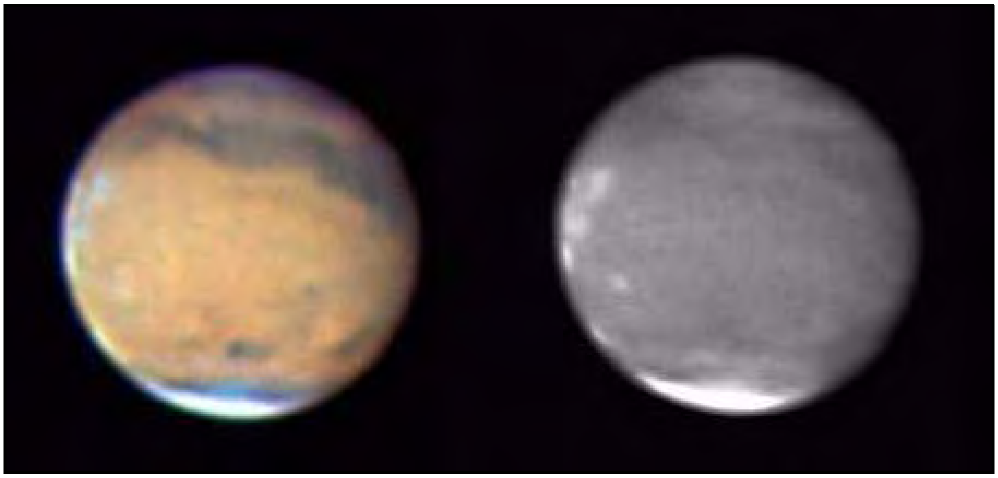

Figure 1. Mars as imaged by ALPO member Rich Jakiel on January 4, 2008, (Ls = 12 degrees, CM = 176 degrees). South is up and planetary east is to the left. Note the prominent white clouds over the Tharsis volcanos near the eastern limb, and note how clearly they are seen in the blue image. Faint streaks of clouds are also seen across the disc in the north and south. Seeing 7.5, transparency 3. Rich used a Schmidt-Cassegrain telescope of 300 mm aperture at f/25, and a DMK 21AF04.AS astronomical digital camera with colored filters. The left image is RGB composite taken at 3:01 UT, and the right one is blue (400 - 505 nm) taken at 2:58 UT.

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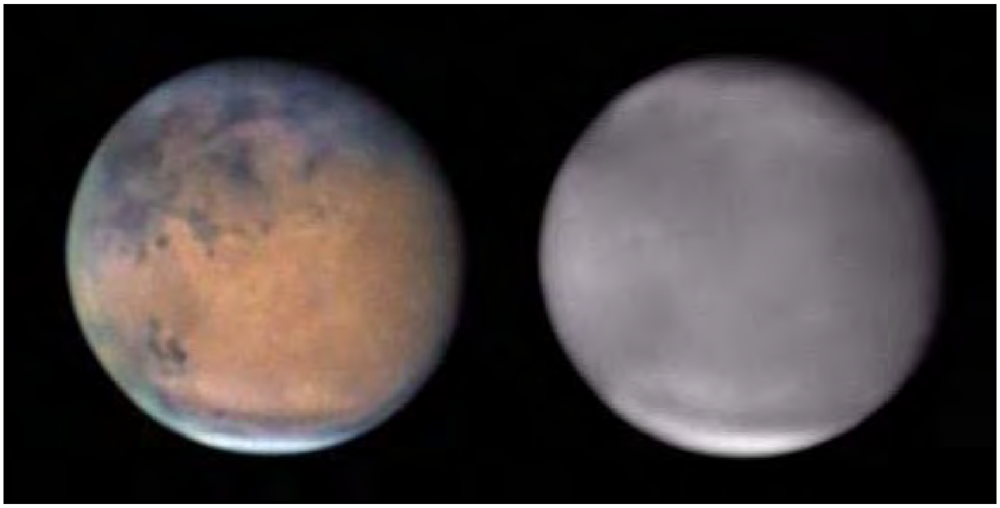

Figure 2. Mars as imaged by ALPO member Bill Flanagan on January 14, 2008 (Ls = 17 degrees, CM = 94 degrees). South is up and planetary east is to the left. Note the streaks of clouds stretching east to west across the northern and the southern realms of the planet, and note how clearly they are seen in the blue image. Faint haze is also seen over much of the eastern quarter of the disc. Seeing 5, transparency 8. Bill used a Schmidt-Cassegrain telescope of 356 mm aperture at f/36, and a Luminera LU-075M astronomical digital camera with colored filters. The left image is an LRGB image and the right one is in blue (408 - 506 nm.) Both were taken at 3:30 UT.

shape models — has historically been intractable and was finally solved only about eight years ago by Mikko Kaasalainen and colleagues at the Rolf Nevanlinna Institute, Helsinki, Finland.

Several tens of asteroids now have sidereal rotation periods in hours correct to five to seven decimal places, pole positions correct within 10 degrees, and shape models correct within 10 percent. Lightcurves at several oppositions well-distributed around the sky are required.

Another drawback is that usually there are two equally likely pole positions on opposite sides of the sky. This ambiguity requires disk-resolved observations from spacecraft or adaptive optics imaging for its removal.

Many amateur photometrists are now contributing CCD lightcurves which are being utilized in these determinations. And now, with the capable help of Mikko Kaasalainen and his colleague Josef Durech of Charles University, Prague, Czech Republic, lightcurve inversions are being done by amateurs.

Brian Warner has published in Minor Planet Bulletin Vol 35, No. 1, 2008 Jan.-March, pp. 13-14, a spin/shape model for 1600 Vyssotsky, period 3.201264 hours, dual north pole positions at longitude 356 degrees latitude +7 degrees, or longitude 219 degrees latitude +54 degrees. His programs, while of course very complicated, are available for all interested users.

Minor Planet Bulletin Vol. 35, No. 1, 2008 Jan.-March, also contains lightcurves with approximate periods and amplitudes for 87 other asteroids. Some of these are new periods, some are redeterminations or improvements of previously published periods, and some are in support of lightcurve inversion for spin/shape modeling.

Featured are asteroids numbered 78, 125, 181, 205, 285, 287, 294, 313, 314, 408, 458, 479, 489, 654, 702, 758, 782, 811, 888, 939, 1044, 1095, 1104, 1206, 1293, 1384, 1428, 1465, 1554, 1558, 1596, 1613, 1623, 1656, 1685, 1704, 1806, 1835, 1862, 1910, 1967, 2037, 2106, 2425, 2472, 2874, 2948, 3013, 3095, 3165, 3170, 3314, 3364, 4411, 4483, 4507, 4936, 5560, 5676, 5854, 6709, 6737, 7304, 8256, 9368, 10227, 12008, 13497, 14142, 14431, 14728, 15317, 15424, 15758, 18486, 19672, 27065, 28736, 30613, 36379, 46598, 48436, 63508, 85275, 119245, 160264, 2006 VV2.

We remind all users and inquirers that the *Minor Planet Bulletin* is a refereed publication and that it is available on line at *http://www.minorplanetobserver.com/mpb/default.htm*.

In addition, please visit the ALPO Minor Planets Section on the World Wide Web at *http://www.alpo-astronomy.org*, then Minor Planets.

Jupiter Section

Report by Richard W. Schmude, Jr., section coordinator
schmude@gdn.edu

A report on the 2003 - 2004 apparition appears later in this issue.

At this writing (early February), Jupiter is visible in the early morning sky. It will be interesting to see what changes have occurred on that planet over the past three months.

I am currently working on the 2006 Jupiter apparition report and have received many high quality images with great detail. I have now have approximately twice as many measurements from the 2006 images as from the 2002 images (even though I received more images in 2002).

There are two things that I would like to stress: 1) Please be sure to double check your date, time and longitudes. There have been cases where the three have not matched, which causes more work before the report can be peer reviewed and issued. Please also make sure that the time is accurate to the nearest minute. There are some neat things that are happening but even a small time error can mask these changes.

2) Please be sure to send red, blue and green light images if you have them. These different colors give us information on the color of features on Jupiter.

Last but not least, please be sure to find and get at John McAnally's book *Jupiter and How to Observe It*.

Visit the ALPO Jupiter Section on the World Wide Web at *http://www.alpo-astronomy.org*, then Jupiter Section.

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Galilean Satellite Eclipse Timing Program

Report by John Westfall, assistant section coordinator
johnwestfall@comcast.net

New and potential observers are invited to participate in this worthwhile ALPO observing program.

Contact John Westfall via regular mail at P.O. Box 2447, Antioch, CA 94531-2447 USA; e-mail to johnwestfall@comcast.net to obtain an observer's kit, which includes Galilean satellite eclipse predictions for the 2007-9 appparition.

Saturn Section

Report by Julius Benton, section coordinator
jlbaina@msn.com

As of this writing in early March, the ALPO Saturn Section has received over 100 reports and images for the 2007-08 observing season. Saturn reached opposition to the Sun on February 24, 2008, so the planet is now well-placed for observing and imaging most of the night. Geocentric phenomena for 2007-08 are presented for the convenience of observers:

The southern hemisphere and south face of the rings are visible from Earth during the 2007-08 observing season, but more and more of the northern hemisphere of Saturn is coming into view since the inclination of the rings to our line of sight is only -8.4° at opposition. There has been limited activity reported by visual observers and those who have been imaging the planet, with only a few reports of small white spots in the SEBZ and STrZ by mid-February.

With the next edgewise orientation of the rings of Saturn forthcoming next year (on September 9, 2009), small inclinations of the rings of Saturn to our line of sight are already permitting observations of satellite phenomena such as transits, shadow transits, etc. In 2009, when the plane of the rings passes through the Sun, the best chances exist for observing transits, shadow transits, occultations, and eclipses of those satellites which are near to Saturn's equatorial plane. Small apertures are usually insufficient to produce good views of most phenomena of Saturn's satellites, except perhaps with the case of Titan. Larger telescopes generally make observations of events involving the satellites more worthwhile. It will be interesting to see what imaging with various instruments will reveal! Controversy still persists as to whether shadow transits of any of the satellites other than Titan are visible from Earth with large instruments.

A diffuse white spot is visible near the CM of Saturn in these series of digital images captured by Toshihiko Ikemura of Japan using a 38.0cm (14.9in) Newtonian on February 19, 2008 at 13:53UT. CMI=340.6× CMII=13.9× and CMIII=324.6°. The tilt of the rings is -8.2°. South is at the top in the image. Other observers have been reporting similar features in the STrZ, as well as in the SEBZ.

Nearly all of the satellites are presumed to be too small to cast umbral shadows onto the globe of the planet Saturn.

Those individuals who can image and obtain precise timings (UT) to the nearest second of ingress, CM passage, and egress of a satellite or its shadow across the globe of the planet at or near edgewise presentations of the rings should immediately dispatch such data to the ALPO Saturn Section. The belt or zone on the planet crossed by the shadow or satellite should be included in the reported data. Intensity estimates of the satellite, its shadow, and the belt or zone it is in front of can be very useful as well, and drawings of the immediate area at a given time during the event can be especially valuable.

For 2007-08, the following are activities that are already in progress by ALPO Saturn observers:

- Visual numerical relative intensity estimates of belts, zones, and ring components.
- Full-disc drawings of the globe and rings using standard ALPO observing forms.
- Central meridian (CM) transit timings of details in belts and zones on Saturn's globe.
- Latitude estimates or filar micrometer measurements of belts and zones on Saturn.

Geocentric Phenomena for the 2007-2008 Apparition of Saturn in Universal Time (UT)	
Conjunction	2007 Aug 21^d
Opposition	2008 Feb 24^d
Conjunction	2008 Sep 4^d
Opposition Data:	
Equatorial Diameter Globe	20.0 arc-seconds
Polar Diameter Globe	17.8 arc-seconds
Major Axis of Rings	45.2 arc-seconds
Minor Axis of Rings	6.6 arc-seconds
Visual Magnitude (m_V)	–0.2m_V (in Leo)
B =	–8.4°

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- Colorimetry and absolute color estimates of globe and ring features.
- Observation of "intensity minima" in the rings, plus studies of Cassini's, Encke's, and Keeler's divisions.
- Systematic color filter observations of the bicolored aspect of the rings and azimuthal brightness asymmetries around the circumference of Ring A.
- Observations of stellar occultations by Saturn's globe and rings.
- Visual observations and magnitude estimates of Saturn's satellites.
- Multi-color photometry and spectroscopy of Titan at 940nm – 1000nm.
- Regular imaging of Saturn and its satellites using webcams, digital and video cameras, and CCDs.

Observers are urged to carry out digital imaging of Saturn at the same time that others are imaging or visually watching Saturn (i.e., simultaneous observations).

All observers should compare what can be seen visually with what is apparent on their images, without overlooking opportunities to make visual numerical intensity estimates using techniques as described in the author's new book, ***Saturn and How to Observe It***, available from Springer, Amazon.com, etc. Although regular imaging of Saturn is extremely important and encouraged, far too many experienced observers have neglected making intensity estimates, which are badly needed for a continuing comparative analysis of belt, zone, and ring component brightness variations over time, so this type of visual work is strongly encouraged before or after imaging the planet.

The Saturn Pro-Am effort that began back on April 1, 2004, when Cassini started observing the planet at close range, is still underway. Observers are encouraged to participate in this effort during the 2007-08 apparition and beyond. Employing classical broadband filters (Johnson UBVRI system) on telescopes with suggested apertures of at least 31.8 cm (12.5 in.), Saturn should be imaged as often as possible, as well as through an 890nm narrow band methane (CH_4) filter.

Observers should make note of any features, their motions and morphology, and report such observations promptly. Resulting data serve as input to the Cassini imaging system, thereby suggesting where interesting (large-scale) targets exit. Suspected changes in belt and zone reflectivity (i.e., intensity) and color will be also useful, so visual observers can play a vital role by making careful visual numerical relative intensity estimates in Integrated Light (no filter) and with color filters of known transmission. The Cassini team will combine ALPO images with data from the Hubble Space Telescope and from other professional ground-based observatories. Observations should be immediately dispatched to the ALPO Saturn Section throughout 2007-08 for immediate dispatch to the Cassini team. Be sure to include all supporting data such as time and date (UT), instrumentation used, observing conditions and location, etc., since without such fundamental information, observations are essentially useless.

The ALPO Saturn Section appreciates the work of so many dedicated observers who continue to submit observations and images, prompting more and more professional astronomers to request drawings, digital images, and supporting data from amateur observers around the globe.

Information on ALPO Saturn programs, including observing forms and instructions, can be found on the Saturn pages on the official ALPO Website at*http://www.alpo-astronomy.org*, then Saturn Section.

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

Remote Planets Section

Report by Richard W. Schmude, Jr., section coordinator
schmude@gdn.edu

Please be sure to send any 2007 remote planets observation reports to me as soon as possible so that I can prepare the 2007 remote planets report by this coming June. Last year, Roger Venable recorded the brightness of two of Uranus' moons during an eclipse. This information is valuable and will be reported in the 2007 apparition report.

Richard Miles, John Westfall and James Fox all collected many excellent brightness measurements of Uranus and/or Neptune. In fact, I feel that these measurements are accurate to approximately 0.003 magnitude; I will do what I can to verify this accuracy and report it in the next apparition report.

Pluto is well-placed in the morning sky and is at about 14th magnitude. I am hoping that one or more people will at least attempt to measures that planet's brightness with an electronic camera. Pluto brightens and dims by up to 0.3 magnitudes. Any light curve measurements are also of great value.

Neptune will be visible in the early morning sky in April and Uranus will be visible in early May.

Visit the ALPO Remote Planets Section on the World Wide Web at *http://www.alpo-astronomy.org,* then Remote Planets.

Online observing forms
(Continued from page 3)

Adobe Reader is available at no charge at *http://www.adobe.com*

Note that some forms are multipage (they include forms for observing various facets of a solar system body.)

For instance, "LunarObserving-Forms - All.pdf" includes forms for those interested in the ALPO Lunar Areas Program and the ALPO Lunar Dome Survey.

And "SaturnReportForms - All.pdf" includes a drawing illustrating the general nomenclature of the planet, plus forms for the planet's satellites, transits of the central meridian, and separate forms for recording data while the planet is at various angles of tilt as seen from Earth.

Note that these forms are subject to change without notice and additional forms will added as they become available.

For more information, such as how to complete a certain form and where to send it, contact the section coordinator for the form in question; contact information for all section coordinators is located in the ALPO Resourcs section of this Journal.

Book Review

The Sun Kings

Review by Kim Hay,
acting coordinator,
ALPO Solar Section
kim@starlightcascade.ca

The Sun Kings, by Stuart Clark, Princeton University Press, hardcover, 211 pages; ISBN-13-978-0-691-12660-9. Retail, $24.95.

"We stand on the verge of a vast cosmical discovery such as nothing hitherto imagined can be compared with" quote by John Herschel (1792-1871).

While giving a solar presentation at the General Assembly this year in Calgary, Dr. John E. Westfall of the ALPO (Association of Lunar & Planetary Observers) spoke to me after the talk, and said if I was interested in the roots of history of solar observing, "The Sun Kings" by Stuart Clark, was a book to let you view into the past, and see the men and women who were at the beginnings of solar observing.

This book takes you back to the years of the early 1700's in Europe, where astronomy was unfolding. While new telescopes were being developed all the time, the year that sparked the many facets of modern day solar astronomy and science was the year that Richard Christopher Carrington (1826-1875) observed the first visual solar flare and sketched the flare with great detail. And that year was 1859.

Then, as now, any new discovery needed other observers to back up the observations, and Richard Carrington had observed the solar flare on September 1, 1859. By his mathematical calculations, the flare lasted for five minutes and travelled 35,000 miles (that is four-and-a-half times the diameter of the Earth) across the surface of the Sun. During his quest to find another observer to back up his own discovery, he learned that the astronomers at the Kew Observatory generally took a photograph of the Sun every day.

Upon his arrival at the Kew, the observers on this particular day did not take a solar photograph, nor did anyone see the solar flare, but the good news was that the magnetic instruments at the Kew had indeed captured the disturbance.

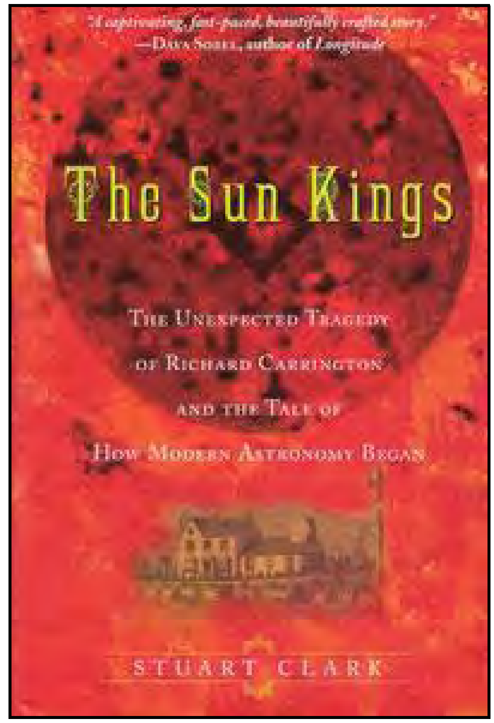
At the same time, that is September 2, 1859, the world was exposed to a very intense auroral display that reached almost to the Equator. There were many reports from sea-faring persons about the aurora, and many reported the event of St.Elmo's Fire. Those on land gave written testimony of the skies filled with red arcs of light, shimmering purple flares and green and blue streaks of light. Some reported these peaks of light looked like a picket fence with an arch and spikes emanating from it. In some localities villagers believed the world was coming to an end.

After this one discovery, many astronomers started to observe the Sun in more detail.

Sketching was still being done by projection; photography was being done using smoked glass as the solar filter, and chemical cameras. This particular flare also started the study of magnetism, trips to solar eclipses, and other sciences. For many years after this event, many were trying to tie the Sun to the Earth, the magnetism of the solar flares and solar wind, the auroras, and climate change.

Of course there were also many astronomers that tried to debunk the link between the Sun and magnetism. The Astronomer Royal, George Biddle Airy, was one such person who did not believe that the Sun could do anything to Earth but give it light. Sir William Herschel, Patrick Wilson, Alexander von Humboldt, Carl Friedrich Gauss, Gustav Spörer, Warren De la Rue, and Joseph von Fraunhofer are just a few of the astronomers and other scientists of that time period who each had discoveries of his own — but it all intertwined with the event of the solar flare discovered by Richard Carrington.

This book takes the reader on a fast pace in history, moving from the past into the future. It has deception, tragedy, politics, greed, love and hate, and it ties up all the



past history of discoveries in a manner that lets even the beginner understand the beginnings of modern day science.

After 140 years, scientists today are still trying to understand the Sun. In October 2003, the Halloween Solar Storms bombarded the Earth with solar wind and particles in which SOHO was shut down due to the concern for the instruments onboard. Going back to my solar observations of the time, the sketches showed 10 large spots on the Sun (AR10484 up to AR10493).

The past observations of the Sun also touched on the climate change, which is affecting our Earth now. Present day scientists are using carbon dating (carbon –14) on the ice and tree rings to show the amount of cosmic ray intensity that had hit the Earth in the past.

Life has come full circle. The past is the present again. Though time and man have passed, the Earth is still at the mercy of the Sun and its universal surroundings. I have only touched on the one major event that sparked the many astronomers and scientists to press on and make discoveries that affect us all in everyday life. There is much more information and interesting facets in this book, and is a must-read for solar observers and historians.

Feature Story:

Index to Volume 49 (2007) of The Strolling Astronomer

By Michael Mattei
E-mail: micmattei@comcast.net

PUBLICATION DATA

AUTHOR INDEX

SUBJECT INDEX

Feature Story:

Mercury Apparition Observations in 2006

By Frank J Melillo, coordinator, ALPO Mercury Section
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Abstract

There were six apparitions of Mercury in 2006. Ten observers submitted 58 observations (17 drawings, 8 CCD images and 33 webcam images) using apertures from 9 to 23.5 cm. The surface features that were identified showed good correlation with the IAU albedo chart prepared by Murray, Smith, and Dollfus (1972).

Introduction

Advanced amateur observing technology such as optics, filters, webcams and Internet communication have made it more productive and more pleasurable to observe Mercury than ever before. The challenge of discerning albedo features is exciting.

We are using Mario Frassati's albedo map as a guide to the identification of features (see Figure 1). This map can also be found in previous articles by this author (Melillo 2004 and 2005b.) Note that the map in Melillo 2004 has north up, while that in Melillo 2005b has south up.

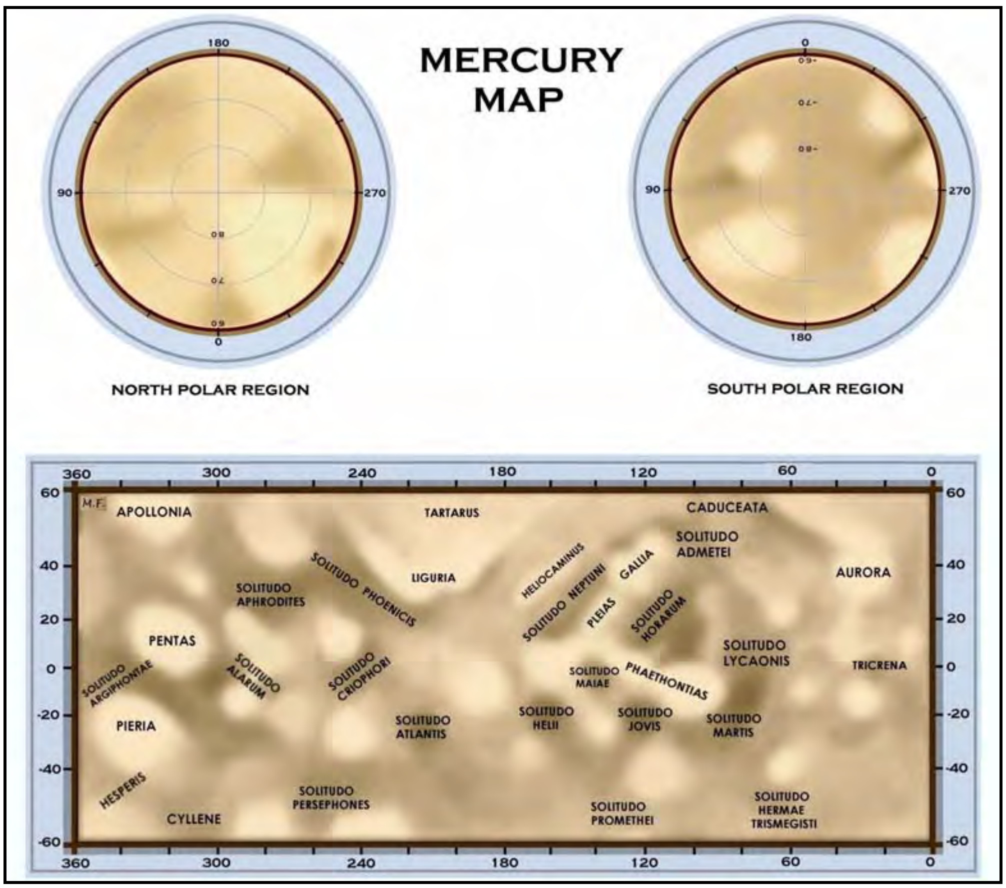

Figure1. Map of the regolith albedo of Mercury based on 144 visual studies by Mario Frassati at Crescentino (VC), Piedmont, Italy, between January 1997 and January 2006 with a 203mm catadioptric telescope, 250x -400x. North is at the top to match the images later in this paper. (Annotated with IAU nomenclature and used with permission of M. Frassati.)

All Readers

Your comments, questions, etc., about this report are appreciated. Please send them to: *poshedly@bellsouth.net* for publication in the next Journal.

Online Features

Left-click your mouse on:

- The author's e-mail address in blue text to contact the author of this article.
- The references in blue text to jump to source material or information about that source material (Internet connection must be ON).

Observing Scales

Standard ALPO Scale of Intensity:
- 0.0 = Completely black
- 10.0 = Very brightest features
- Intermediate values are assigned along the scale to account for observed intensity of features

ALPO Scale of Seeing Conditions:
- 0 = Worst
- 10 = Perfect

Scale of Transparency Conditions:
- Magnitude of the faintest star visible near Mercury when allowing for daylight and twilight

IAU directions are used in all instances (so that Mercury rotates from west to east).

Due to the somewhat tentative nature of the map of albedo features, an image that shows features that do not agree with the map must still be carefully considered.

Nevertheless, fewer observers contributed observations in 2006 than in other recent years. The distribution of observers in northern and southern hemispheres did permit good observations to be made by someone, even when an apparition was unfavorable for the other hemisphere. There were a significant number of independent simultaneous observations.

Also included here is a diagram of Mercury's position with respect to Earth at different phases. See Figure 2.

In 2006, NASA's MESSENGER spacecraft remained in good health on its way to Mercury. Before it can settle into orbit around Mercury, multiple flybys of Venus and of Mercury are necessary to bring its velocity close enough to the orbital velocity of Mercury that its main engine can brake the spacecraft to put it into orbit around Mercury. This braking maneuver is scheduled for March of 2011.

On October 24, 2006, MESSENGE made its first flyby of Venus. The team collected data to assure that the spacecraft was performing properly. The images of Venus were of low resolution and they showed a thick blanket of clouds that hid its surface. Another flyby of Venus occurred in June of 2007, and the first flyby of Mercury occurred in January of 2008.

In addition, we were treated with the transit of Mercury on November 8, which was seen from countries bordering the Pacific Ocean, including Australia, New Zealand and North America. The next transit of Mercury will not occur until May of 2016.

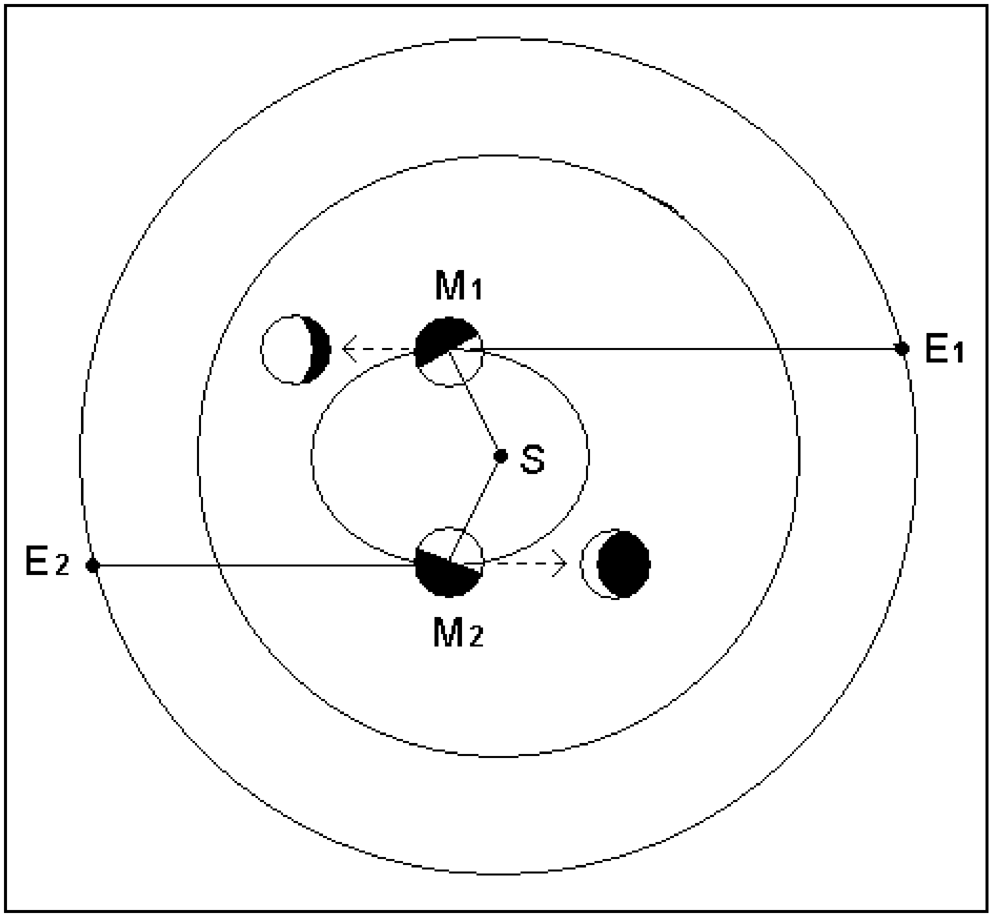

Figure 2. The phase of Mercury at both greatest elongations. In the diagram, S is the Sun, E1 and E2 are two positions of Earth, and M1 and M2 are two positions of Mercury corresponding to E1 and E2. Greatest elongation occurs when the line of sight from Earth to Mercury is tangent to the orbit of Mercury. These greatest elongation lines of sight are drawn in the diagram; E1-to-M1 indicates greatest eastern elongation, and E2-to-M2 indicates greatest western elongation as seen from Earth. The elliptical orbit of Mercury causes its appearance at greatest elongation to vary greatly, because the S - E - M angle varies greatly. S - E1 - M1 is less than 90°, so that Mercury is seen as gibbous, while S - M2 - E2 is greater than 90° so that Mercury is seen as a crescent. The phase of Mercury at elongation can be anywhere from about 35% to 65% illuminated.

Apparition 1: (Evening) Jan 26 to March 11

(See Figure 3.) After superior conjunction with the Sun on January 26, Mercury quickly became visible in the evening sky, and made a good apparition for northern observers. On February 28 local time, the planet made a pretty appearance near the crescent Moon after sunset. Some non-astronomical people did notice a star (Mercury) near the crescent Moon. It was a rare sight for the public, inasmuch as the planet is rarely this easy to find. In spite of its fine appearance, only three observers made reports. It was wintertime in the northern hemisphere, so observing was probably uncomfortable.

Ed Lomeli made his first observation on February 24, the day of greatest elongation. His image at CM = 271 degrees showed a fat crescent. Tim Wilson drew Mercury on February 27 at CM = 286 degrees and depicted a northern, dark feature near the terminator which is very close to the area of Skinakas basin. The drawing also shows Solitudo Criophori just south of the equator. Finally on March 1 at CM = 303 degrees, Carl Roussell made a drawing that shows features similar to those Wilson saw two days earlier.

Apparition 2: (Morning) March 11 to May 18

(See Figure 4.) Five members contributed observations. Three of them live in the southern hemisphere where

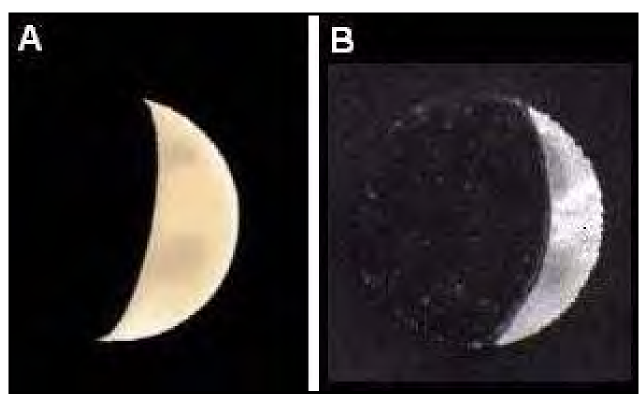

Figure 3. Apparition 1 drawings. North is up and planetary east is to the right. A. Drawing by Tim Wilson, 27 Feb 2006 at 0:15 UT, CM = 286 degrees. B. Drawing by Carl Roussell, 1 Mar 2006 at 23:45 UT, CM = 303 degrees.

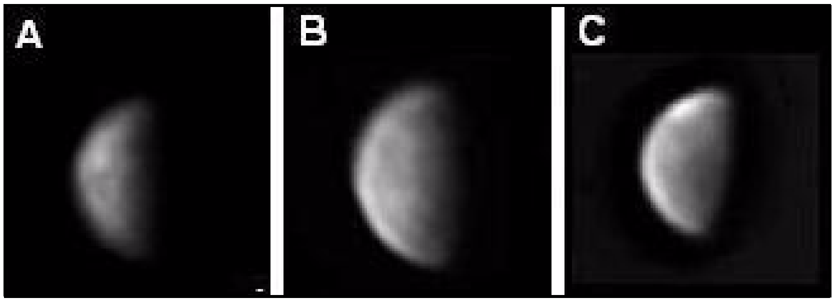

Figure 4. Apparition 2 images. North is up and planetary east is to the right. A. Image by Stu Parker, 11 Apr 2006, CM = 196 degrees. B. Image by Bruce Kingsley, 15 Apr 2006 at 9:45 UT, CM = 215 degrees. C. Image by Steve Massey, 8 May 2006 at 21:27 UT, CM = 321 degrees.

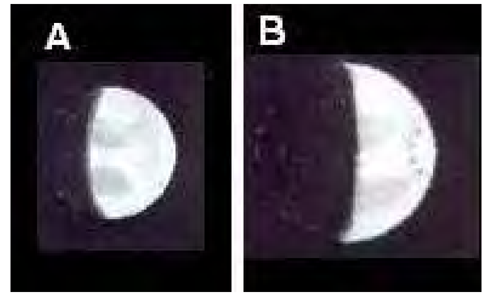

Figure 5. Apparition 3 drawings. North is up and planetary east is to the right. A. Drawing by Carl Roussell, 8 Jun 2006 at 1:27 UT, CM = 85 degrees. B. Drawing by Carl Roussell, 18 Jun 2006 at 1:45 UT, CM = 133 degrees.

Mercury was seen in a favorable position. On April 8, it reached an elongation of 27 degrees from the Sun, the largest distance of the year. The contributions of this apparition were all webcam images.

Stu Parker of New Zealand sent the first image, with CM = 144 degrees, made on April 1. On that day, Mercury showed a fat crescent with hints of detail. Similar, inconclusive suggestions of albedo features are seen in his image of April 11, at CM = 196 degrees, when Mercury was presenting slightly more than half phase. Bruce Kingsley of the UK took his image of Mercury on April 15 at CM = 215 degrees. It showed some shading on the terminator. Could it be Solitudo Atlantis? Parker also imaged Mercury on April 19 (CM = 233 degrees) where it showed a slight marking that may be Solitudo Criophori, near the equatorial region. Ed Lomeli made an image on April 19 at CM = 235 degrees, also showing a hint of detail. David Romero of Peru imaged Mercury on April 25, at CM = 262 degrees, and Steve Massey of Australia did so on May 8, at CM = 320 degrees. Both images show details which are hard to correlate with known or previously suspected albedo features

Apparition 3: (Evening) May 18 to July 17

(See Figure 5.) Greatest elongation occurred on June 20, a full 25 degrees east of the Sun. Due to its northern declination, it set nearly two hours after sunset as seen from north middle latitudes. It remained an evening object for two full months. Despite the favorability of this apparition for northern observers, only one person contributed reports.

Carl Roussell was the sole observer. On June 8, at CM = 85 degrees, he drew a slightly gibbous phase with Solitudo Martis in the south and perhaps Solitudo Lycaonis just north of the equator. Roussell also observed Mercury on June 14, at CM = 113 degrees, and June 18, at CM = 133 degrees, and saw that both of the features seen on June 8 were still prominent as the phase narrowed. Mercury reached superior conjunction on July 17.

Apparition 4: (Morning) July 17 to August 31

(See Figure 6.)This fine morning apparition generated more observation reports than any other of the year. The coordinator received many excellent drawings and many excellent images taken with webcams and CCD's.

Carl Roussell drew the planet on August 1 and 2, at CM = 45 and CM = 51 degrees, respectively, and on both dates he depicted a feature that appears to be Solitudo Lycaonis just north of the equator. This may be the same feature that was seen in the previous evening apparition.

Ed Lomeli took an excellent image the next day, at CM = 57 degrees, showing the crescent phase. Roussell drew Mercury again on August 4, at CM = 62 degrees, and Lomeli imaged it four hours later at CM = 63 degrees. The next day Frank J. Melillo imaged the planet, at CM = 67 degrees. All these images showed its crescent phase well. Nearly simultaneous observations were made on August 6 by Lomeli and Melillo, at 14:40 and 15:00 UT, respectively. Both images show Mercury as a crescent. Lomeli then produced excellent images on six consecutive days, August 8 through 13, at CM's of 84 to 108 degrees. The images show Mercury's phase changing gradually from half to gibbous.

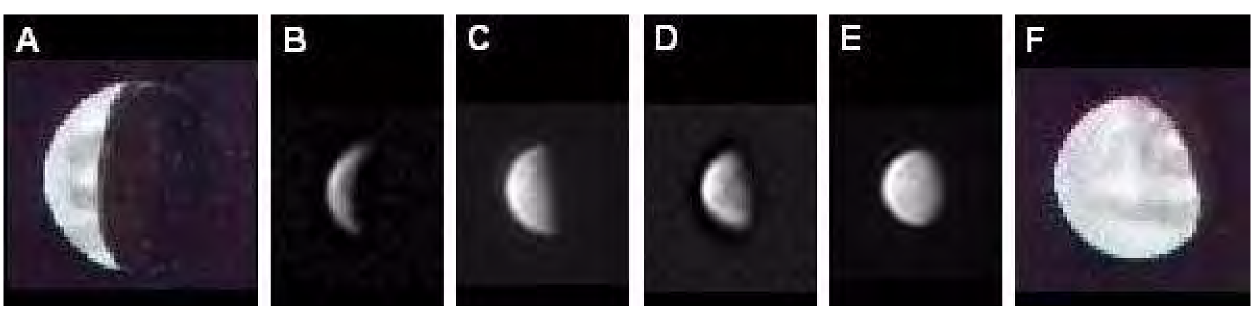

Figure 6. Apparition 4 images and drawings. North is up and planetary east is to the right. A. Drawing by Carl Roussell 4 Aug 2006 10:34 UT, CM = 62 degrees. B. Image by Frank J Melillo, 5 Aug 2006 14:30 UT, CM = 68 degrees. C. Image by Ed Lomeli, 10 Aug 2006 14:40 UT, CM = 93 degrees. D. Image by Frank J Melillo, 13 Aug 2006 14:30 UT, CM = 108. E. Image by Ed Lomeli, 18 Aug 2006 14:27 UT , CM = 130 Degrees. E. Drawing by Carl Roussell, 21 Aug 2006 10:43 UT, CM = 142 degrees.

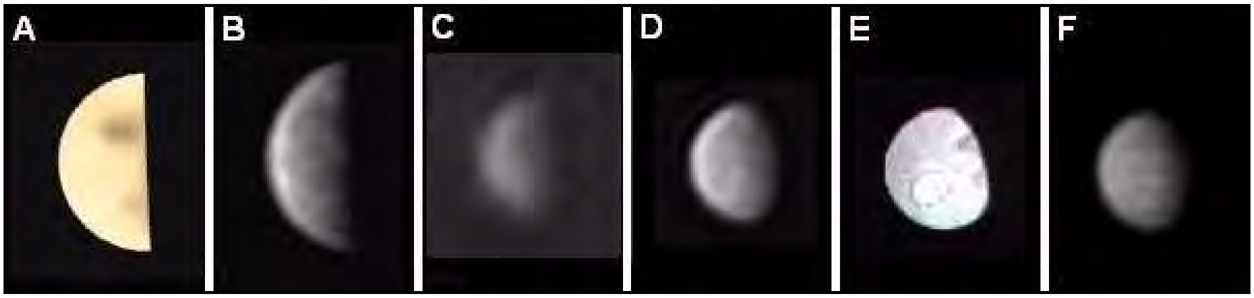

Figure 7. Apparition 6 images and drawings. North is up and planetary east is to the right. A. Drawing by Tim Wilson, 22 Nov 2006 12:45 UT, CM = 270 degrees. B. Image by Andy Allen, 22 Nov 2006 16:27 UT, CM = 271 degrees. C. Image by Frank J Melillo, 24 Nov 2006 15:09 UT, CM = 281 degrees. D. Image by Ed Lomeli, 1 Dec 2006 16:07 UT, CM = 316 degrees. E. Drawing by Carl Roussell, 3 Dec 2006 10:58 UT, CM = 325 degrees. F. Image by Andy Allen, 3 Dec 2006 17:02 UT, CM = 326 degrees.

Another nearly simultaneous group of observations was made on Aug 13, at CM = 107 degrees, by Roussell, Melillo and Lomeli, at 10:25, 14:30, and 14:57 UT. All three detected a slight darkening in the south that is probably Solitudo Martis. Roussell, Melillo and Lomeli continued to observe Mercury under excellent conditions through August 22 (CM = 146 degrees.) All three of them reported a dark band just south of the equator that appears to be Solitudo Martis and Jovis. These features, as well as Solitudo Matae which was too far toward the western limb to be clearly identified, are always prominent on that side of the surface. Mercury went through superior conjunction on August 31.

Apparition 5: (Evening) August 31 to November 8

Unfortunately, this was a poor evening apparition as seen in the northern hemisphere and no report was received. Most of the observers were preparing for the upcoming transit on November 8.

Apparition 6: (Morning) November 8 to January 6, 2007

When Mercury went through inferior conjunction on November 8, it passed in front of the Sun and the transit was observed by many. The total duration of the transit was just under five hours. With an angular diameter of about 10 arc seconds, Mercury appeared as a small dot only 1/195th as wide as the Sun. Many observers measured the times of contacts I and II at ingress and contacts III and IV at egress. Such measurements were formerly used to refine calculations of the orbit of Mercury, but they are now obsolete for that purpose.

A report about this event will be pub-

Table 1: Characteristics of the Apparitions of Mercury in 2006 (all dates UT)

Number and Type	Beginning Conjunction*	Greatest Elongation	Final Conjunction*	Aphelion	Perihelion
1. Evening	26 Jan (s)	24 Feb, 18E	11 Mar (i)		22 Feb
2. Morning	11 Mar (i)	8 Apr, 27W	18 May (s)	7 Apr	
3. Evening	18 May (s)	20 Jun, 25E	17 Jul (i)	4 Jul	21 May
4. Morning	17 Jul (i)	7 Aug, 19W	31 Aug (s)		17 Aug
5. Evening	31 Aug (s)	17 Oct, 25E	8 Nov** (i)	30 Sept	
6. Morning	8 Nov** (i)	25 Nov, 20W	6 Jan (2007) (s)	27 Dec	13 Nov

* (i) – inferior conjunction, (s) superior conjunction
** transit the Sun

Table 2: ALPO Observers of Mercury 2006

Observer	Location	Instrument*	Number & Type of Observations**	Apparition Observed
Andy Allen	Figueroa Mtn., CA, USA	25 cm NT	2 W	6
Pete Grego	Rednal, Birmingham, UK	20 cm SCT	1 D	6
Bruce Kingsley	Maidenhead, UK	28 cm SCT	2 W	2, 6
Ed Lomeli	Sacramento, CA, USA	23.5 cm SCT	21 W	1, 2, 4, 6
Steve Massey	Sydney Australia	24.5 cm NT	1 W	2
Frank J Melillo	Holtsville, NY, USA	20.3 cm SCT	8 CCD	4, 6
Stu Parker	Wyndham, Southland, New Zealand	23.5 cm SCT	6 W	2, 6
David Romero	Lima, Peru	20 cm SCT	1 W	2
Carl Roussell	Hamilton, Ontario, Canada	15 cm RR	13 D	1, 3, 4, 6
Tim Wilson	Jefferson City, MO, USA	9.0 cm RR	3 D	1, 6

* NT = Newtonian, RR = refractor, SCT = Schmidt-Cassagrian
** CCD = CCD imaging, D = Drawing, W = Webcam

lished in a separate paper by John Westfall, the ALPO Transit Section coordinator.

Mercury was well placed in the morning sky for observation from either the northern or the southern hemisphere. The many excellent drawings and images that were received were more revealing than those of any other apparition in the last few years. These observations were particularly valuable because the portion of the planet's surface that was best exposed to us was not mapped by the Mariner 10 spacecraft.

Tim Wilson began with his excellent drawing on November 22, at CM = 270 degrees. A dark area near the terminator just north of the equator is Skinakas basin at around 280 degrees longitude. (Skinakas is an unapproved name for this feature that is probably identical with Solitudo Aphrodites.) Andy Allen, a new contributor, produced an excellent image on November 22 as well, showing details similar to those that Boston University scientists and Ron Dantowitz demonstrated in images made in 1998. The observations by Wilson and Allen were only 4 hours and 45 minutes apart, and they both clearly show Skinakas basin. Ed Lomeli made an image the next day at CM = 276 degrees and it showed a hint of detail.

Four observers, Bruce Kingsley, Tim Wilson, Frank J Melillo and Ed Lomeli observed Mercury on November 24, at CM's of 279 to 283 degrees . Wilson's drawing and Melillo's image show Skinakas basin as a large dark area near the terminator. More images were taken by Melillo on November 25 and by Stu Parker on November 26, at CM's of 286 and 292 degrees, respectively. The images show some details that are difficult to correlate with known or suspected albedo features.

A breakthrough set of observations was made by Ed Lomeli from December 1 through 7. On December 1 and 2, at CM's of 316 and 321 degrees, respectively, his images show three main white regions. These features may be of crater ejecta rays, which are more highly reflective than the surrounding surface, like the rays of crater Tycho on the Moon. One of the bright spots appears to correspond to a radar image of a crater made by Arecibo radio astronomers.

On December 3, at CM's of 325 to 326 degrees, nearly simultaneous observations by Roussell, Melillo, Allen and Lomeli all show white spots at the same location. These spots appear to have followed the rotation of the planet since Lomeli's image of December 1. Further excellent images were taken by Lomeli on December 5 and 7, at CM's of 335 and 344 degrees, respectively. Both images show the same white features that have rotated toward the terminator.

Another bright feature possibly came into view on the limb. Again, Roussell drew the white regions on December 4, at CM = 330 degrees. Finally, Pete Grego observed Mercury on December 9, at CM = 352, and drew a large bright spot close to the terminator. It seems that, due to a mediocre seeing condition, these bright spots appeared to him to have merged into one larger bright area.

No observations were received after that, and Mercury went through Superior conjunction on January 6, 2007. See Figure 6.

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ALPO MERCURY SECTION

NAME________________________________

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ELONGATION:
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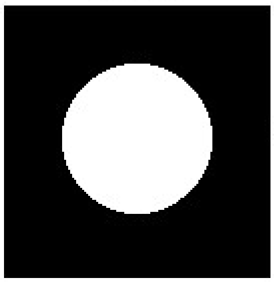
For Coordinator Only:

Sketch

NORTH



WEST

Central Meridian Longitude______°

DATE____________________
TIME (UT)________________
Telescope_____________________________
Magnification__________________________
Filter(s)______________________________
Seeing (10-best/1-worst)_______________
Visual Description:

Photo or CCD

DATE:_____________
TIME (UT):__________

Image 1

Central Meridian Longitude______°

Telescope:______________________
Camera Type:____________________
Exposure:_______________________
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Filter:__________________________

Comments:

Date:_________________
TIME (UT):_____________

Image 2

Central Meridian Longitude______°

Telescope______________________
Camera Type____________________
Exposure_______________________
f/ratio_________________________
Filter__________________________

Comments:

Send all observations to: Frank J Melillo
ALPO Mercury Coordinator
14 Glen-Hollow Dr., E-#16
Holtsville, NY 11742

E-mail for questions, special observations and alerts: frankj12@aol.com

Feature Story:

The ALPO Banded Craters Program

By William M. Dembowski, FRAS
coordinator, ALPO Lunar

This article originally appeared in the January 2007 issue of *The Lunar Observer*, publication of the ALPO Lunar Section.

Topographical Studies Section
dembowski@zone-vx.com

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Left-click your mouse on the author's e-mail addresses in blue text to contact the author of this article.

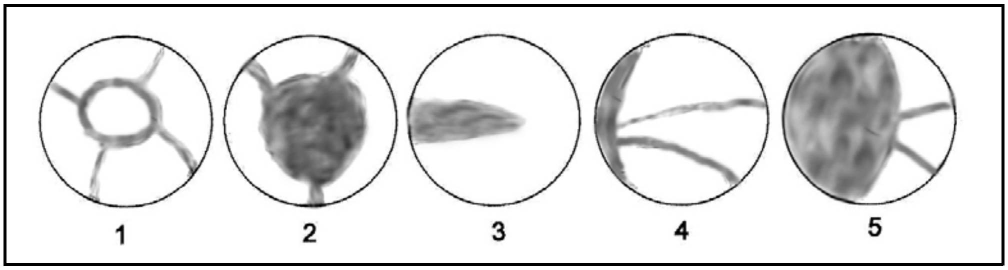

Figure 1. Banded Crater Group Types: These highly stylized drawings (by the author) are intended only to give a general impression of each Group type (see text).

Introduction

Nearly 200 lunar craters have been reported as having dusky radial bands on their inner walls and/or floors. The most prominent of these is Aristarchus, whose bands can easily been seen with a small (7.5cm) telescope. Interestingly, the Aristarchus bands were not recorded by some of the more famous and devoted lunar observers of the past. Neither Schroeter, Beer, Maedler, Lohrmann, nor Schmidt ever included the appearance of these radial bands in their published descriptions of craters. It is not until 1868 that we find their first mention in a work published by John Philips. This is, of course, not to suggest that banding is a recent phenomenon but simply an indication of the relative importance attached to various features by observers in different eras.

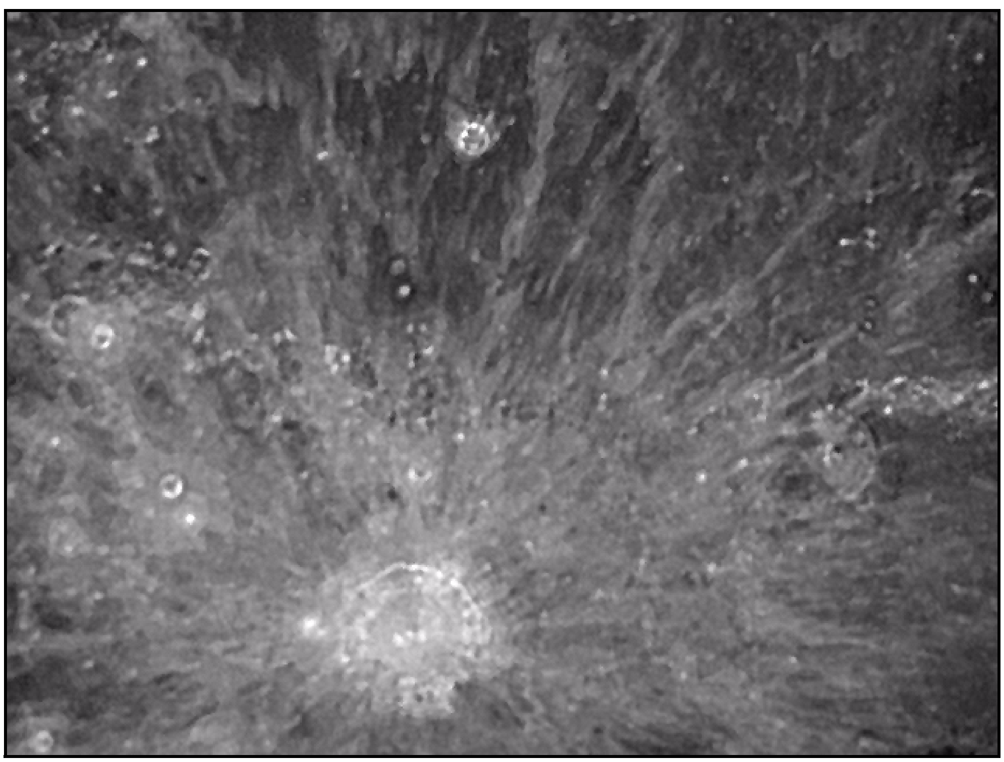

Figure 2. Digital image of Pytheas (at top center, cropped) by William Dembowski of Elton, Pennsylvania, USA taken July 31, 2007, 04:10 UT. Colongitude 108.5°, Seeing 4/10, Transparency 2/6. Celestron 20 cm, f/10 SCT equipped with Orion StarShoot II Camera.

Dusky bands tend to make their appearance shortly after local sunrise and steadily increase in visibility until reaching their peak under a high sun. Changing illumination can affect more than just visibility. Changes in shape, position, and albedo have also been observed. Those having access to Harold Hill's "A Portfolio of Lunar Drawings" will find excellent examples of long term studies of the bands within the craters Birt and Messier.

Some bands appear to be related to topographical features; possibly lava flows into the crater through breaches in the walls or variations in the composition of the lunar surface. Others might simply be dark underlying terrain over which a bright ejecta pattern is displayed. Since not all bands present clues as to their nature, it is more practical to classify them by general appearance alone.

In the March 1955 *Journal of the British Astronomical Association*, K. W. Abineri and A. P. Lenham published a paper in which they suggested that banded craters could be grouped into five categories (See Figure 1):

Group 1 - (Aristarchus type) Craters are very bright, quite small, and have fairly small dark floors leaving broad bright walls. The bands, on the whole, apparently radiate from near the center of the craters. These craters are often the centers of simple bright ray systems.

Figure 3. Digital image of Anaxagoras by Howard Eskildsen of Ocala, Florida, USA, taken June 30, 2007, 02:33 UT. Colongitude 89.0°, Seeing 5/10, Transparency 4/6. Meade 15.2 cm, f/8 refractor equipped with Orion StarShoot II Camera - 2x Barlow

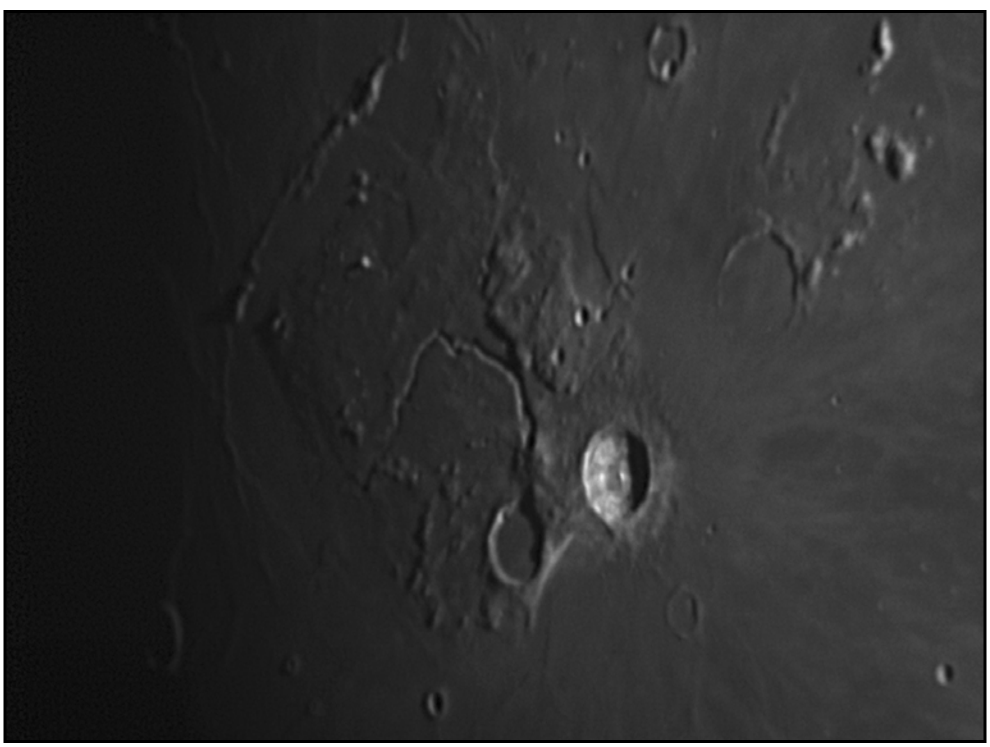

Figure 4. Digital image of Aristarchus by Wayne Bailey of Sewell, New Jersey, USA, taken May 29, 2007, 01:51 UT. Colongitude 57.6°, Seeing 5/10, Transparency 2/6. Celestron 28 cm, f/10 SCT equipped with 2x Barlow, Skynyx 2-1M Camera - Schuler IR72 filter.

Group 2 - (Conon type) Rather dull craters with large dark floors and narrow walls. Very short bands show on the walls but cannot be traced on the floors. The bands, despite their shortness, appear radial to the crater center.

Group 3 - (Messier type) A broad east-west band is the main feature of the floors.

Group 4 - (Birt type) Long, usually curved, bands radiate from a non-central dull area. The brightness and size are similar to the Group 1 craters.

Group 5 - (Agatharchides A type) One half of the floor is dull and the bands radiate from near the wall inside this dull section and are visible on the dull and bright parts of the floor.

Overview of the Banded Craters Program

In 2006 the ALPO Selected Areas Program (SAP), which included the Banded Craters Program (BCP), was transferred to the association's Lunar Topographical Studies Section. Participation in the BCP had been minimal to that point so in the January 2007 issue of the Lunar Section newsletter, a new call for participants in the BCP was issued. As with all lunar topographical programs, drawings, photographs, and digital images were solicited to help support and achieve the following BCP objectives:

1. Detect and catalog craters that exhibit dark and/or bright bands under various lighting conditions throughout a given lunation and from one lunation to another.

2. Determine whether or not there is a relationship between crater brightness at local noon and the visibility of dark or light bands, central peaks, or both.

3. For craters exhibiting banding, determine the relative positions, orientation, and intensities (albedos) of the bands throughout a lunation and from one lunation to another.

4. Investigate what correlations may or may not exist among crater size, the presence of central peaks, and the occurrence of light and/or dark

bands.

5. Observe the radial bands, either visually or photographically, through different colored filters to determine any changes in appearance.

6. Establish whether the banding is related to physical or albedo features, both within and surrounding the crater.

7. Monitor the visibility and morphology of bright and/or banded craters during umbral and penumbral lunar eclipses.

It was emphasized that the submission of a few technically superior but unrelated images is not what was required for the program's success. Instead, a series of well documented observations, even of average technical quality, would be far more meaningful. Contributors were also asked to use the SAP Observing Forms and Procedures established by Dr. Julius Benton, the previous coordinator, since only by doing so would it be possible to meaningfully compare observations. These forms and procedures were then uploaded to the Banded Craters webpage at: http://www.zone-vx.com/alpo-bcp

22 Prominent Banded Craters

Crater Name	Diameter (km)	Longitude	Latitude
Agatharchides A	10	28.4 W	23.2 S
Anaxagoras	51	10.1 W	73.4 N
Aristarchus	40	47.4 W	23.7 N
Aristillus	55	01.2 E	33.9 N
Bessarion	10	37.3 W	14.9 N
Birt	17	08.5 W	22.4 S
Bode	19	02.4 W	06.7 N
Brayley	14	36.9 W	20.9 N
Burg	40	28.2 E	45.0 N
Conon	22	02.0E	21.6N
Dawes	18	26.4 E	17.2 N
Kepler	32	38.0 W	08.1 N
Maury	18	39.6 E	37.1 N
Menelaus	27	16.0 E	16.3 N
Messier	10	47.6 E	01.9 S
Milichus	13	30.2 W	10.0 N
Nicollet	15	12.5 W	21.9 S
Proclus	28	46.8 E	16.1 N
Pytheas	20	20.6 W	20.5 N
Rosse	12	35.0 E	17.9 S
Silberschlag	13	12.5 E	06.2 N
Theaetetus	25	06.0 E	37.0 N

Also, rather than spreading initial efforts over the complete list of approximately 200 known banded craters, it was decided to initially concentrate on a shorter list of the more prominent craters exhibiting these features. (See table at left).

The response was minimal, but those contributing to the program have proven to be both skilled and dedicated. With only three observers (Wayne Bailey, Howard Eskildsen, and the author) the number of formally documented observations has at this writing (early August 2007) already exceeded 200.

Observing Banded Craters

Although the bands of Aristarchus are visible in a 7.5cm refractor, larger apertures are often required to study them in detail or to detect the bands in smaller craters. Figure 2 shows the advantage of a larger instrument (28cm f/10 SCT) and the addition of a 2x Barlow.

The monitoring of banded craters throughout a lunation necessitates making observations under a variety of lighting conditions, particularly those of a high Sun. Since many banded craters have very high albedos, care should be taken by lunar imagers not to overexpose the crater interiors thereby obscuring any banding that might be present. Visual observers might find benefit in using a polarizing filter, particularly the type with variable transmission.

Potential participants should not be intimidated by frequently made statements that it is extremely difficult to find one's way about the lunar surface at or near the Full Moon. Most of the craters on the short list are large enough in their own right or adjacent to prominent lunar landmarks to make locating them relatively easy with a little experience. Figure 3 illustrates how the unmistakable crater Copernicus can be used to locate the banded crater Pytheas at Full Moon.

Concentration on the short list of banded craters does not preclude the study of others on the larger list (based largely on that list compiled by Abneri & Lenham), or the search for previously undocumented banded craters. Howard Eskildsen submitted an image of bands within Anaxagoras (Figure 3), a crater not initially included in the full list. Confirming observations by Wayne Bailey resulted in the addition of the 51 km Anaxagoras to the list of prominent banded targets for continued study.

Although this program was not designed for the casual observer, it is well within the capabilities and equipment of the average dedicated amateur. If you are interested in such an endeavor, please visit the Banded Craters Program WebPage at: http://www.zone-vx.com/alpo-bcp or contact the program coordinator at: dembowski@zone-vx.com

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Feature Story: Jupiter

Observations During the 2003 - 2004 Apparition

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This paper includes a gallery of Jupiter images submitted by a number of observers.

Abstract

More than 100 people submitted hundreds of images, drawings, and descriptions of Jupiter during the 2003-04 apparition. The writer measured over 100 drift rates in 19 different currents. A record number of dark spots (21) in the north north temperate current-B appeared and they had an average system II drift rate of -80°/30 days. The average normalized magnitude of Jupiter was V(1,0) = -9.43 ± 0.02, which is brighter than in 1999-2001; this may be due to the thinning of the NEB, the brightening of the EZ and the near absence of the NTB.

Introduction

Professional astronomers published several important Jupiter papers in 2003-04. Morales-Juberias et al. (2003), for example, describe how ovals BE and FA merged in three dimensions. Apparently these ovals began merging when their centers were 9.1° apart, and that the merging process lasted 21 Earth days. Wong and co-workers (2004) report that Jupiter has larger percentages of nitrogen (in the form of NH_3) and sulfur (in the form of H_2S) than the Sun. They also point out that their data are consistent with other processes, besides condensation, being responsible for the depletion of volatiles like ammonia (NH_3) in Jupiter's atmosphere. In a third study, Geissler and co-workers (2004) report that Io's surface underwent 82 changes during the late 1990s, and that explosive volcanic activity was discovered at four new locations on that moon. Brooks and co-workers (2004) report that Jupiter's main ring has an azimuthal brightness variation.

While professional astronomers carried out these studies of Jupiter, amateurs were busy taking over 1,000 images of the giant planet. This report summarizes work done by observers participating in the ALPO program of Jupiter studies. Table 1 lists characteristics of Jupiter during the 2003-04 apparition and Table 2 lists the 2003-04 Jupiter observers. Figures 1 and 2 show a few of their drawings and images. The Jupiter nomenclature is shown in Figure 1. Figure 3 shows a series of graphs of Jupiter's features and Figure 4 shows drawings of the Great Red Spot.

This paper will follow certain conventions. Images are displayed with south at the top of the image. Latitudes are planetographic unless otherwise stated. West refers to the direction of increasing longitude, which is to the right in images displayed with south up. Longitude is designated with the Greek letter λ, followed by a subscript Roman numeral which is the longitude system. For example, $\lambda_I = 54°$ means that the system I longitude equals 54°. The three longitude systems are described by

All Readers

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Online Features

Left-click your mouse on:

- The author's e-mail address in blue text to contact the author of this article.
- The references in blue text to jump to source material or information about that source material (Internet connection must be ON).

Observing Scales

Standard ALPO Scale of Intensity:
- 0.0 = Completely black
- 10.0 = Very brightest features
- Intermediate values are assigned along the scale to account for observed intensity of features

ALPO Scale of Seeing Conditions:
- 0 = Worst
- 10 = Perfect

Scale of Transparency Conditions:
- Magnitude of the faintest star visible near Jupiter when allowing for moonlight and twilight

IAU directions are used in all instances (so that Jupiter rotates from west to east).

Table 1: Characteristics of the 2003-04 Apparition of Jupiter*

First conjunction with the Sun	2003 Aug 22
Opposition date	2004 Mar 4
Second conjunction with the Sun	2004 Sep 22
Apparent equatorial diameter (opposition)	44.6 arc-seconds
Visual stellar magnitude (opposition)	-2.5
Planetographic declination of the Sun (opposition)	1.6ºS
Planetographic declination of the Earth (opposition)	1.9ºS
Geocentric declination of Jupiter	7.6ºN

*Data taken from *The Astronomical Almanac* (2002a b)

Table 2: 2003-04 Apparition Report List of Contributors

Name and Location	Telescope[a]	Type[b]	Name and Location	Telescope[a]	Type[b]
Acquarone, Fabio; Italy	0.23 m SC	I	Iga, Yuichi; Japan	0.28 m SC	I
Adamoli, Gianluigi; Italy	0.11 m RR	D, DN	Ikemura, T.; Japan	---	DN, I
Adelaar, Jan; The Netherlands	0.18 m MC	I	Jensen, Timothy; LA USA	0.25 m SC	I
Akutsu, Tomio; Japan	0.32 m RL	I, M	Khan, Tim; FL USA	0.20 m MC	I
Albert, Jay; FL USA	0.28 m SC	D	Koch, Bob; MN USA	0.30 m SC	I
Alberto, S.; Genova, Italy	0.15 m MC	I	Koet, Jan; France & The Netherlands	0.18 m RR	I
Almeida, Jorge; Portugal	0.20 m	D	Lazzarotti, Paolo; Italy	0.25 m RL	I
Amadori, Vittorio; Italy	0.20 m RL	I	Leong, Tan Wei; Singapore	0.25 m DK	I
Amato, Michael; CT USA	0.20 m RL	D	Lilley, George; GA USA	0.23 m SC	I
Armstrong, Jerry; GA USA	0.36 m SC	DN, I	Limaye, Sanjay; FL USA	0.41 m RL	I
Bates, Don; TX USA	0.25 m RL	DN, I	Loon, Chin Wei; Malaysia	0.20 m SC	I
Beebe, Reta; NM USA	---	DN	MacDougal, Craig; FL USA	0.15 m RL	D, TT
Bell, Charles; MS USA	0.30 m SC	I	Mancilla, Joseph; NM USA	0.20 m RL	D, DN
Bildy, Les; FL USA	0.36 m SC & 0.46 m	I	Maxson, Paul; AZ USA	0.20 m SC	I
Biver, Nicolas; France	0.26 m RL	D	Mayfield, Ginger; CO USA	0.28 m	I
Bonifacio, S; Italy	0.13 m M	D, DN	McAnally, John; TX USA	0.20 m SC	I
Boyar, Dan; FL USA	0.20 m RL	D, DN	Meeckers, Olivier; Belgium	0.23 m RL	I
Brubaker, Susan; VA USA	0.30 m SC	I	Melillo, Frank; NY USA	0.20 m SC	I
Buchanan, Tom; GA USA	Spectroscope	SP	Miller, Stephen; FL USA	0.15 m MC	I
Budine, Phil; NY USA	0.13 m RR	D, DN, SS TT	Miyazaki, Isao; Japan	0.40 m RL	I
Calia, C. Laird; CT USA	0.13 m MC	D, DN	Mollise, Rod; AL USA	0.28 m SC	I
Carbajales, Nicolas; ON Canada	0.25 m SC	I	Moore, David; AZ USA	0.25 m RL	I
Carbognani, Albino; Italy	0.25 m RL	DN, I	Morotzki, Thomas	---	DN
Casquinha, Paulo; Portugal	0.20 m RL	I	Ng, Eric; Hong Kong	0.25 m RL & 0.32 m RL	I
Chang, Daniel; Hong Kong	0.20 m SC	I	Niechoy, Detlev; Germany	0.20 m SC	D, SS
Chavez, Rolando; GA USA	0.20 m SC	I	Paiella, Marco; Italy	---	I
Cheney, P.; FL USA	0.41 m RL	I	Parker, Don; FL USA	0.41 m RL & 0.25 m RL	I, M
Chevalley, Patrick; France	0.20 m SC	I	Peach, Damian; UK	0.28 m SC	DN, I
Chin, William; Malaysia	0.20 m SC	I	Pellier, Christophe; France	0.18 m RL	I
Chuen, Szeto Koon; Hong Kong	0.20 m SC	I	Phillips, Jim; SC USA	0.20 m RR	I
Cidadao, Antonio; Portugal	0.36 m SC	I, M	Robbins, Sol; NJ USA	Several	D, DN
Coelho, Paulo; Italy	0.20 m SC	I	Rogers, John; UK	---	DN
Colville, Brian; ON Canada	0.30 m SC	I, M	Roussell, Carl; ON Canada	0.15 m RL	D, DN, SS, TT
Combs, Brian; GA USA	0.30 m SC	I	Sabia, John; PA USA	0.24 m RR	DN
Credicott, D.; VA USA	0.30 m SC	I	Sanchez, Jesus; Spain	0.25 m RL	I

Table 2: 2003-04 Apparition Report List of Contributors (continued)

Name and Location	Telescope[a]	Type[b]	Name and Location	Telescope[a]	Type[b]
Cristofanelli, Marco; Italy	0.31 m SC	I	Sbarbina, Enzo; Italy	0.23 m SC	I
Cudnik, Brian; TX USA	0.25 m RL	D, DN, SS, TT	Schiralli, Frank, Jr.; NY USA	0.36 m SC	I
Del Valle Hernandez, Daniel; PR USA	0.12 m RR & 0.20 m SC	D, DN, SS	Schmude, Richard, Jr. GA USA	Several	D, DN, Pol, PP
Dierick, Dominique; Belgium	0.18 m MC	I	Schrabler, Sighard; Germany	0.30 m SC	I
Dobbins, Tom; OH USA	0.36 m SC	I	Sherrod, Clay; AR USA	0.41 m SC	DN, I
East Bay Astronomical Soc.; Oakland CA	0.51 m RR	I	Tam, Edward; Hong Kong	---	I
Einaga, Hideo; Japan	0.25 m RL	I	Tasselli, Andrea; UK	0.15 m & 0.20 m MC	DN, I
Eisfeldt, David; TX USA	0.20 m SC	I	Tatum, Randy; VA USA	0.25 m RL	I
Fattinnanzi, Cristian, Italy	0.25 m RL	I	Trapani, Dave; NJ USA	0.36 m SC	DN, I
Faworski, S.; IL USA	0.25 m RL	I	Tyler, Dave; Canada	0.21 m RL	I
Fukui, Hideto, Japan	0.25 m DK	I	Valimberti, Maurice; Melbourne, Australia	0.36 m SC	I
Gaherty, Geoff, Canada	---	DN	Van der Velden, Erwin; Brisbane, Australia	0.23 m SC	I
Gastaldo, Ivan; FL USA	0.25 m SC	I	Vandebergh, Ralf; The Netherlands	0.25 m RL & 0.18 m M	I
Go, Christopher; Philippines	0.20 m SC	I	Venable, Roger; GA USA	---	DN
Go, Kathlyn; Philippines	0.20 m SC	I	Waddington, Bruce; CA USA	0.25 m SC	I
Go, Steven; Philippines	0.20 m SC	I	Waddington, Gaye; CA USA	0.25 m SC	I
Go, Vicky; Philippines	0.20 m SC	I	Walker, Sean: MA USA	0.13 m MN	I
Grafton, Ed; TX USA	0.36 m SC	I	Warren, Joel; TX USA	0.20 m SC	I
Guidoni, N.; Italy	0.18 m MC	I	Weiller, Sylvain; France		I
Haas, Walter; NM USA	0.32 m RL	DN, SS, TT	West, Doug; KS USA	0.25 m SC	PP
Hamilton, Steve; VA USA	0.09 m M	I	Williamson, Thomas; NM USA	0.20 m RL	I
Hatton, Jason; CA USA	0.23 m SC	I	Yan, C. K.; Hong Kong	0.25 m MC	I
Heath, Alan; Nottingham, UK	0.25 m RL	D, DN	Yoneyama, Seiichi; Japan		I
Hernandez, Carlos; FL USA	0.23 m MC	D, DN, SS	Yu, Gu; WV USA	0.32 m RL	I
Herold, Manfred; Germany	0.30 m SC	I	Yunoki, Kenkichi; Japan	0.20 m RL	I
Higgens, Wes; OK USA	0.37 m RL	I	Zannelli, Carmelo; Italy	0.18 m MN	I
Hyndman, Paul; CT USA	0.20 m MN	I	Zanotti, Ferruccio; Italy	0.24 m SC & 0.45 m RL	I

[a]RL = Reflector, RR = Refractor, SC = Schmidt-Cassegrain, DK = Dall Kirkham, M = Maksutov, MC = Maksutov-Cassegrain, MN = Maksutov-Newtonian, C = Cassegrain

[b]I = CCD or video image, D = drawing, DN = Descriptive notes, M = methane band data, Pol = Polarization, PP = Photoelectric photometry, SP = Spectra, SS = Strip Sketch, TT = Transit time

Table 3A: Average Planetographic Latitudes of Belts on Jupiter Measured from Visible Light Images[a,b]

Belt	Planetographic Latitude
SSSTBs	48.8°±1.5°S
SSSTBn	45.7°±1.5°S
SSTBs	43.5°±1.0°S
SSTBn	38.6°±1.0°S
STBs	34.2°±0.5°S
STBn	29.0°±0.5°S
SEBs	23.3°±1.0°S
SEBn	7.5°±0.5°S
EBc	3.1°±1.0°S
NEBs	6.7°±0.5°N
NEBn	18.4°±0.5°N
NTBs (?)	21.7°±0.5°N
NTBn (?)	24.3°±0.5°N
NNTBs	35.0°±1.0°N
NNTBn	36.8°±1.0°N
NNNTBs	41.2°±1.5°N
NNNTBn	44.0°±1.5°N
GRSc	22.1°±0.5°S

[a]The north and south edge of the belts are designated by a small "n" or "s"; for example, the north edge of the north equatorial belt is called "NEBn". A small c means "center".
[b]All uncertainties are estimated by the writer.

Rogers (Rogers, 1995, p. 11) and in the *Astronomical Almanac* (Astronomical Almanac, 2002a, p. L8.) All dates and times are in Universal Time (UT.) The designations of currents are abbreviated; for example, the STrC is the south tropical current and the NNTC-B is the north north temperate current – B. Also, a superscript (starting with the number 3) in the abbreviation refers to how far north or south the feature is from the equator; the S^4TC, for example, is the south south south south temperate current.

Unless stated otherwise, all data are based on visible light images.

The writer measured the latitudes of Jovian features, and the dimensions of white ovals and dark spots, and the relative brightnesses of the polar regions, in the same way as in previous reports in this series. These techniques are described elsewhere (Peek, 1981, for latitudes; and Schmude, 2002a, for ovals and spots; Schmude, 2003a, for polar regions.) The measurements of ovals and spots incorporate adjustments to counter the foreshortened appearance caused by latitude and by rotation away from the central meridian.

Disc Appearance

More than 1,000 visible light intensity estimates of Jovian features were made by Adamoli, Amato, Bonifacio, Calia, Cudnik, Heath, Mancilla, Rousell and the writer. The mean intensities (on the ALPO scale of 10 = white to 0 = black) are: SPR(4.2), S^3TZ(3.2), S^3TB(4.0), SSTZ(3.3), SSTB(4.8), STZ(2.3), STB(4.8), STrZ(1.8), GRS(4.2), SEBs(6.0), SEBz(2.6), SEBn(5.8), EZs(2.3), EB(2.7), EZn(2.3), NEB(6.2), NTrZ(1.8), NTB(2.2), NTZ(1.8), NNTB(4.7), NNTZ(3.5), NPR(4.3) and oval BA(2.0.) Heath also made several dozen intensity estimates through red and blue filters; he found that the GRS was the reddest feature on Jupiter followed by the NEB and SEB.

Table 3A presents the results of belt latitude measurements for the current apparition in visible light while Table 3B shows corresponding latitudes in methane band (0.89 μm) light. These latitudes are similar to 2002-03 results (Schmude, 2003b.)

Tables 4 and 5 summarize measurements of oval and spot dimensions.

In order to check the accuracy of the oval dimensions, I measured the sizes of the four Galilean satellites from images of Jupiter showing at least one of the moons; Jupiter was used as a reference. Both the measured and actual diameters are presented in Table 6. The measured diameters of Io and Europa were larger than the actual values whereas the opposite was the case for Callisto. The measured diameter of Ganymede was very close to the actual value; this may have been due to Ganymede's albedo being close to Jupiter's. The higher the moon's albedo, the greater the overestimation of its size by measurement of images, while the underestimate of Callisto's size corresponds to its low albedo. Extending this finding to the Jovian spots, the spots in the NNTC-B, though dark compared to the surrounding clouds, still have higher albedos than Ganymede, and so the writer feels that their measurements presented in Table 5 are close to reality. The white ovals in Table 4 have albedos near that of Io, but their contrast is much smaller than that of Io on a black sky. The white oval dimensions are probably accurate to ±10%.

Table 3B: Average Planetographic Latitudes of Belts on Jupiter Measured from 0.89 μm Light Images[a,b]

Feature	Planetographic Latitude
SPRn	63.8°±1°S
STBn	31.7°±2°S
SEBs	19.6°±0.5°S
SEBn	3.9°±0.5°S
EBc	3.0°±1°N
NEBs	8.5°±1°N
NEBn	17.3°±0.5°N
NTBs	22.5°±0.5°N
NTBn	28.4°±0.5°N
NNTBs	39.5°±2°S
NPRs	63.2°±1°S

[a]The north and south edge of the belts are designated by a small "n" or "s"; for example, the north edge of the north equatorial belt (0.89 μm) is called "NEBn (0.89 μm)". A small c means "center". The designation of each latitude feature includes the parenthetic "0.89 μm" to clarify that it is distinct from, and at a latitude different from, the correspondingly named feature seen in visible light.
[b]All uncertainties are estimated by the writer.

Figure 5 shows the drift rates of all features south of the SEBc; Figure 6 shows drift rates between the SEBc and the NEBs. Figure 7 shows the remaining drift rates except for those in the NNTC-B, which are in Table 8. Table 7 lists all drift rates south of the SEBn, while Table 8 shows drift rates for all features in the EC and Table 9 lists drift rates of features north of the NEBs.

Region I: Great Red Spot

Figure 4 shows the appearance of the GRS at different times during the apparition.

Heath reported that the GRS had a pink color on March 7 and March 28. Mancilla and Calia reported a salmon color for this

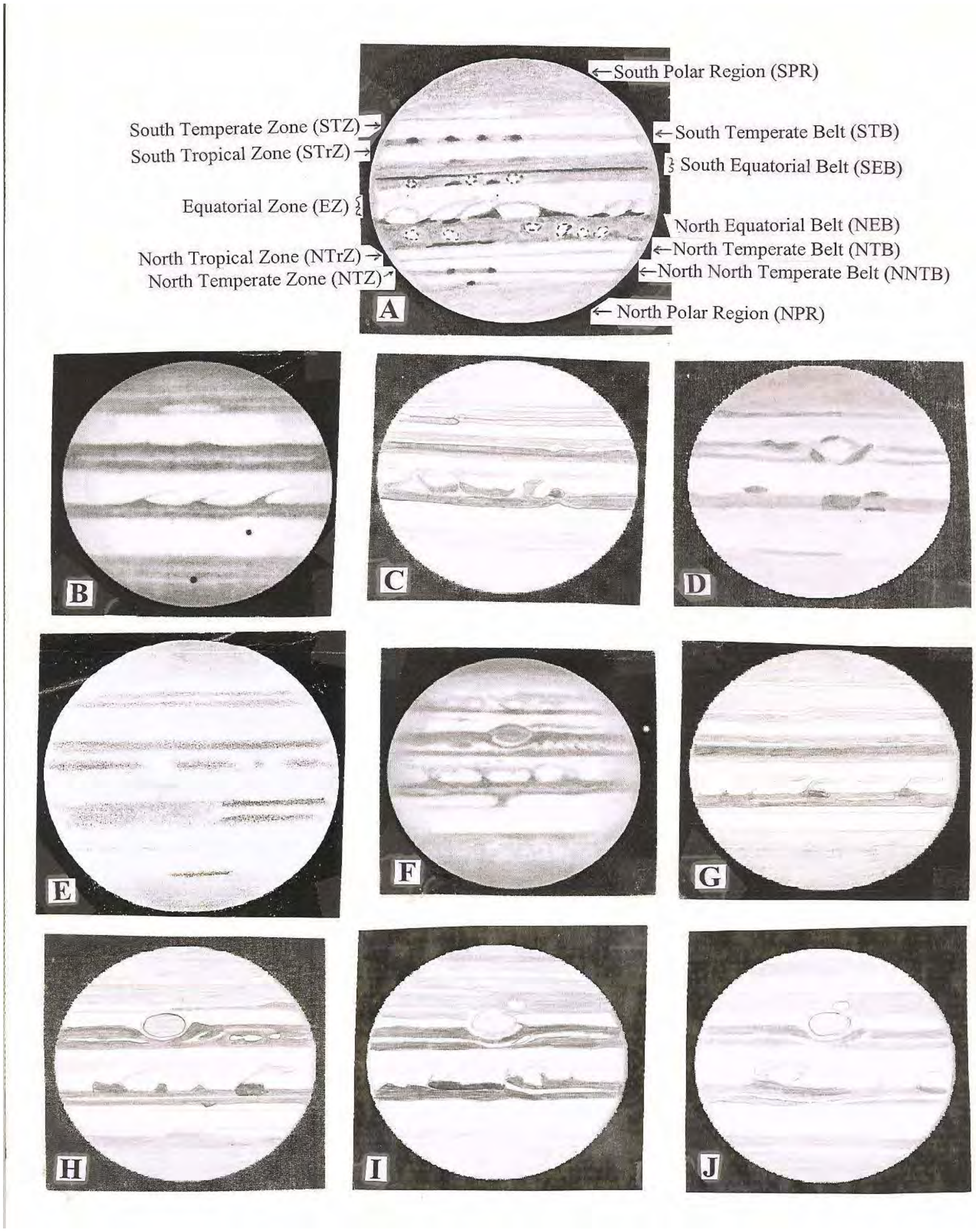

Figure 1: Drawings of Jupiter. A: Mar. 29, 2004 (2:32 UT), Budine, 0.13 m RR, Visible light, λ_I = 222°, λ_{II} = 263°. This drawing shows several of the belts that were visible during the 2003-2004 apparition. B: Dec. 19, 2003 (6:30 UT), Hernandez, 0.23 m MC, Visible light, λ_I = 249°, λ_{II} = 339°. This drawing shows Ganymede and Callisto transiting Jupiter; Callisto is farther north than Ganymede. C: Dec. 20, 2003 (8:45 UT), Cudnik, 0.36 m SC, Visible light, λ_I = 129°, λ_{II} = 211°. This drawing shows a very thin, dark band in the NTrZ. D: Feb. 18, 2004 (4:38 UT), Roussell, 0.15 m RL, Visible light & W21 filter, λ_I = 99°, λ_{II} = 84°. The bright band just west of the GRS is well illustrated in this drawing. E: March 1, 2004 (22:25 UT), Heath, 0.25 m RL, Visible light, λ_I = 126°, λ_{II} = 13°. This drawing shows a large rift in the NEB west of λ_{II} = 20°. F: March 3, 2004 (6:00 UT), Hernandez, 0.23 m MC, Visible light, λ_I = 201°, λ_{II} = 79°. This drawing shows a rare festoon on the NEBn. G: April 14, 2004 (5:30 UT), Cudnik, 0.25 m RL, Visible light, λ_I = 338°, λ_{II} = 255°. The equatorial band is visible as several short, dark strips in this drawing. H: May 7, 2004 (5:19 UT), Cudnik, 0.25 m RL, Visible light, λ_I = 2°, λ_{II} = 104°. This drawing shows two white ovals in the center of the SEB that are west of the GRS. I: June 20, 2004 (1:55 UT), Cudnik, 0.32 m RL, Visible light, λ_I = 339°, λ_{II} = 106°. This drawing shows a white oval being drawn around the northern edge of the GRS. J: July 9, 2004 (2:25 UT), Cudnik, 0.25 m RL, W23A filter, λ_I = 113°, λ_{II} = 96°. Oval BA lies just south of the GRS in this drawing.

Table 4: Dimensions of White Ovals During the 2003-04 Apparition

Feature	Dimensions (km)		Aspect[a]	Area[a] 10^6 km^2
	east-west	north-south		
A1	4300	4800	1.13	16±2
A3a	3600	3400	0.95	10±1
A3b	3400	3700	1.08	10±2
A4	3800	4300	1.13	13±2
A2a	3800	3700	0.97	11±2
A2b	3900	3600	0.93	11±3
B2	4400	3600	0.83	12±2
B3	4100	3600	0.88	12±2
B3a	3700	3300	0.88	10±1
B4	4600	3300	0.72	12±2
B5	5400	4100	0.77	17±2
B6	4300	3700	0.86	12±2
B8	3000	2800	0.91	7±1
Oval BA	10,000	6700	0.67	52±7
Oval BA (0.89 μm light)	8500	7000	0.83	47±6
S1 (before transiting GRS)	4900	3100	0.63	12±2
S1 (after transiting GRS)	3500	2300	0.66	6±1
S5	3800	2700	0.71	8±1
H35	6200	4500	0.72	22±3
H36	3400	2800	0.83	8±1
H37	5000	3600	0.71	14±2
H38	3700	3100	0.82	9±1
I6	5500	4700	0.86	21±3
I9	5900	5200	0.88	24±4
I12	4000	4000	0.99	13±2
I14	3300	3200	0.97	8±1
GRS (0.89 μm light)	20,500	11,400	0.56	183±9

[a]The aspect is the north-south dimension divided by the east-west dimension. All areas were computed by assuming an elliptical shape. All east-west and north-south dimensions have estimated uncertainties of 10%. The area uncertainties equal the standard deviation divided by the square root of the number of measurements.

feature on several dates. Boyar reported an orange-pink color on Feb. 23, but Niechoy reported a distinct red color in March.

Rogers (1995, p194) reported that between 1963 and 1974, the GRS underwent a small oscillation in longitude with a period of 90 days. The writer looked for this oscillation in 2003-04. Figures 3A and 3B show the average latitude and longitude of the GRS at 20 day intervals starting on Nov. 21, 2003. There appears to be a small periodic change in both latitude and longitude; the line in Figure 3B shows the mean drift rate. The longitude oscillated once every 80±10 days with an amplitude of 1°±0.5°, which is consistent with 2000-01 results (Rogers, *et al*, 2004, p204.) Figure 3A shows that the GRS's latitude oscillated by a few tenths of a degree with a period of ~100 days in 2003-2004. The GRS did not have a periodic change in appearance during this time.

The dimensions and areas of the GRS in methane band light (wavelength = 889 nanometers) are in Table 4. The area of the GRS has remained virtually the same in methane band light since late 2001 (Schmude, 2003a, b.)

Between May 5 and 7, the southern border of the GRS became flatter. The flat southern border is also evident in the June 25 and July 7 & 12 drawings in Figure 4. The close passage of oval BA may have led to the flat southern border in June and July. One can also see the round southern border in Figure 2B and the flat southern border in Figure 2L.

Region II: South Polar Region to the South Tropical Zone

The SPR was brighter than the NPR in 43% of the ultraviolet images and both regions were equal in the other 57%. The numbers were similar to this for near infrared images (wavelength of 700 – 1000 nm.) The SPR was always brighter than the NPR in methane band images (wavelength of 889 nanometers) and it was slightly brighter than the NPR in visible light. These results show that the SPR was brighter than the NPR at several wavelengths. In all cases, the SPR and NPR correspond to areas that are pole ward of 60°.

Several white ovals (A1, A3a, A3b, A4) were imaged in the S^5TC. Feature A3a was renamed A3b because the drift rate changed. The appearance of a dark spot, A5, on April 2 at λ_{II}=84° may have caused the drift rate change. The average system II drift rate for the S^5TC was -8.0°/30 days, which is similar to previous values (Rogers, 1995, 240.)

One dark spot (A5) was in the S^4TC. The S^4TC drift rate is a bit more negative than the values in Schmude (2003a) and in Rogers (1995), but is consistent with the average value reported in Schmude (2003b.)

Table 5: Dimensions of Dark Ovals in the NNTC-B During the 2003-04 Apparition

Feature	Dimension (km)		Aspect[a]	Area[b] 10^6 km^2
	east-west	north-south		
H1	3800	2600	0.69	8±1
H2	2700	1900	0.70	4±1
H3	2700	2300	0.82	5±1
H4	2700	2400	0.89	5±1
H5	3000	2600	0.86	6±1
H6	3300	3000	0.92	8±1
H7	3200	2400	0.76	6±1
H9	4000	3300	0.82	10±2
H11	3200	2700	0.87	7±1
H14	2300	2100	0.93	4±1
H17	2700	2300	0.84	5±1
H19	2800	3100	1.08	7±2
H20	2700	2200	0.80	5±1
H21	3200	2600	0.82	7±1
H22	2100	2000	0.97	3±1
H27	3000	2700	0.88	6±1
H28	2700	2700	1.01	6±1
H29	3300	3300	1.02	9±1
H30	3600	3100	0.87	9±1
H31	2900	3000	1.02	7±1
Average	3000	2600	0.88	6

[a]Please see the note in Table 4 about the aspect.
[b]Area uncertainties equal the standard deviation divided by the square root of the number of measurements. The east-west and north-south dimensions have estimated uncertainties of 10%.

A white oval (A2a and A2b) was imaged in the S^3TC. The drift rate of A2a changed around April 1 and it was then renamed A2b. A large white band developed near λ_{II} = 310°W in early April, which may have caused the drift rate change.

The white ovals A1, A3a, A3b, A4, A2a and A2b had an average area of 12 x 10^6 km^2, which is similar to areas of corresponding features in 2001-03 (Schmude, 2003a, b.)

Several white ovals (B1-B6 and B8) were in the SSTC. The average SSTC drift rate was -28.5°/30 days, which is consistent with previous results (Rogers, 1995.) Figure 2H shows B2. Ovals B2 and B5 appeared as bright spots in methane band images.

Oval B3 began moving at a different drift rate around April 1 and so it was renamed B3a. A faint, dark bar developed between B2 and B3 sometime in late March; this bar may have caused the drift rate to change. Throughout April and May, B3a was approaching B2. The two ovals may have merged in July.

The average area and aspect of the SSTB ovals were 12 x 10^6 km^2 and 0.84; the aspect is the north-south dimension divided by the east-west dimension. The average area is lower than the 2002-03 area of 18 x 10^6 km^2 (Schmude, 2003b.)

Oval BA had a system II drift rate of -13°/30 days, which is more negative than the 2002-03 rate of -9.3°/30 days. This difference is probably due to the more negative drift rate, that is, the more rapid eastward motion that oval BA has as it approaches the GRS from the west (Rogers, 1995, p226.)

Figure 3C shows the distance in longitude between the centers of Oval BA and the GRS. Based on these data, BA passed the GRS on about July 16, 2004. Figure 3C shows three subtly different slopes. Between April 1 and May 6, oval BA was gaining on the GRS at a rate of 0.44°/day, but between May 10 and June 6, this rate increased to 0.56°/day; the rate dropped back to 0.51°/day between June 15 and July 14. Figure 2F shows BA when it was far from the GRS and Figures 1I, IJ, 2I – 2L show BA when it was near the GRS.

Figures 3D and 3E show the latitude and area of oval BA before and during its encounter with the GRS. Oval BA did not move further south as it approached the GRS, which is different from its behavior in 2002 (Schmude, 2003a, 60.) The area of BA increased as it approached the GRS, which is similar to 2002 (Schmude 2003a, 60.)

A distinct dark spot (S1) developed just south of the GRS. The first image of this spot was made by Einaga and Fukui on Oct. 8, and it was not visible on a Sep. 29 image made by Iga. This feature remained dark and distinct until mid-April; see Figure 2B. On several occasions, S1 was the darkest feature on its side of Jupiter, but it was not as dark as Ganymede in visible light as that moon transited Jupiter.

Region III: South Equatorial Belt

White oval S5 was at the SEBs and it had a system II drift rate of 76.9°/30 days (see Figure 6); this is different from 2001-03 results (Schmude, 2003a,b.) The only drift rates similar to S5 are those between 1898 and 1939 inside the south tropical disturbance (Rogers, 1995, 161.)

The writer measured drift rates for two groups of features in the SEBc. White oval S4 was at 11.1°S and it had a system II drift rate of -73.9°/30 days; it was east of the GRS and it is shown in Figure 1E. Features S2, S3, S7, S8, S9, S10 and S11 were at 14.3°S and were 5° to 60° west of the GRS. These features had an average system II drift rate of -56.5°/30 days,

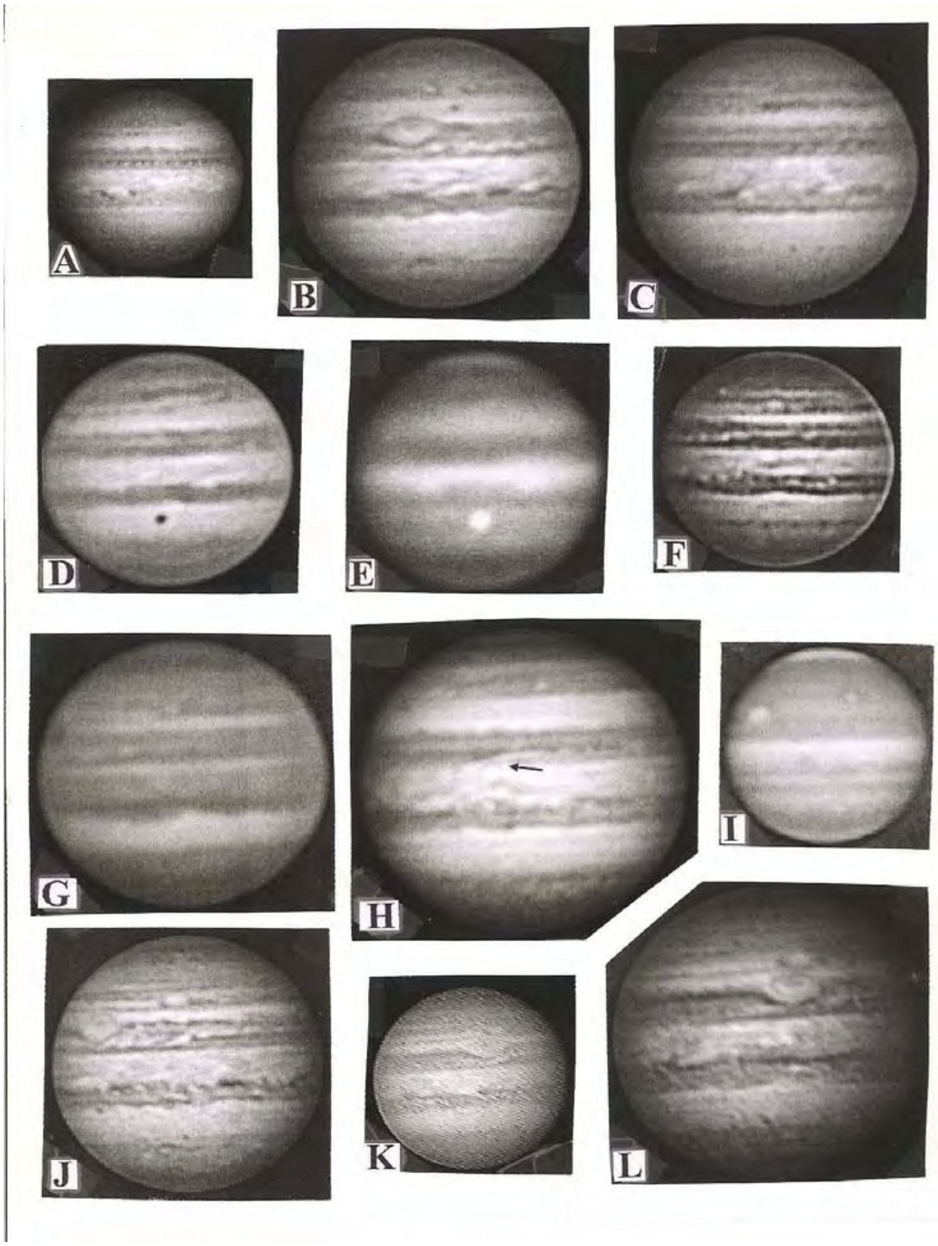

Figure 2: Images of Jupiter. A: Dec. 17, 2003 (4:14 UT), Peach, 0.28 m SC, red light, λ_I = 210°, λ_{II} = 316°. This image shows a thin, dark band in the NTrZ. B: Dec. 29, 2003 (18:02 UT), Ng, 0.32 m RL, Visible light, λ_I = 90°, λ_{II} = 100°. This figure shows the dark barge N11 in the NEB just right of the central meridian. C: Dec. 29, 2003 (21:52 UT), Ng, 0.32 m RL, Visible light, λ_I = 230°, λ_{II} = 239°. A thin dark band in the SEB can be seen in this image along with a faint and dark band running across the NTrZ. D: Jan. 9, 2004 (18:30 UT), Akutsu, 0.32 m RL, Visible light, λ_I = 45°, λ_{II} = 331°. Ganymede is darker than any feature on Jupiter and it is transiting Jupiter's NTrZ in this image. E: Jan. 9, 2004 (18:19 UT), Akutsu, 0.32 m RL, Methane band light (893 nm), λ_I = 38°, λ_{II} = 324°; the brightest spot is Ganymede in transit. Taken only 11 minutes before image D, the methane-band features can be compared with the visible light features of that image. F: Jan. 15, 2004 (9:14 UT), Sherrod, 0.41m SC, Visible light, λ_I = 294°, λ_{II} = 177°. This image shows oval BA when it was far from the GRS. G: Mar. 2, 2004 (2:25 UT), Pellier, 0.18 m RL, Ultraviolet light, λ_I = 272°, λ_{II} = 159°; a particularly clear UV image. The northern edge of the NEB is much more uneven than in visible light. H: March 3, 2004 (23:25 UT), Sanchez, 0.28 m SC, Visible light, λ_I = 118°, λ_{II} = 350°. The arrow points to a rift in the SEB. I: March 4, 2004 (23:21 UT), Cidadao, 0.36 m SC, Methane band light (889 nm), λ_I = 274°, λ_{II} = 138°; an excellent display of the relative methane band brightnesses of the GRS (the large spot), oval BA (the small spot above right-center), and other features. J: May 3, 2004 (12:51 UT), Chang, 0.20 m SC, Visible light, λ_I = 6°, λ_{II} = 137°. This image shows several white spots that are within the SEB and west of the GRS. K: June 25, 2004 (0:27 UT), Parker, 0.41 m RL, Visible light, λ_I = 354°, λ_{II} = 84°. This image shows oval BA as it approached the GRS. L: July 7, 2004 (10:27 UT), Go, 0.20 m SC, Visible light, λ_I = 92°, λ_{II} = 87°. The thin equatorial band can be seen in this image. The shape of the southern border of the GRS is flatter than what it is in Figure 2B.

Table 6: Measured Sizes of the Four largest Moons of Jupiter

Moon	Measured Diameter (km)	Literature Diameter (km)[a]	Measured ÷ Literature Diameter	Albedo[a]
Europa	3603	3130	1.15	0.67
Io	3956	3643	1.09	0.63
Jupiter	-----	-----	1.00b	0.52
Ganymede	5119	5268	0.97	0.44
Callisto	4381	4806	0.91	0.20

[a]Astronomical Almanac for the Year 2004 (2002b) p. F3
[b]Satellite diameters were measured with respect to Jupiter

which is similar to 2001-03 (Schmude, 2003a, b.) Figures 1F, 1H, 2B and 2J show the individual white spots west of the GRS; Roussell observed a white band just west of the GRS (Figure 1D), which was a series of these white spots. Dobbins reported that a large blue spot was in the EZ at λ_I = 120° on Feb. 29. Melillo independently pointed out this spot in his images and in Schiralli's image; it had an east-west dimension of 30,000 km, a north-south dimension of 6,500 km and an area of 1.5 x 10^8 km^2. On March 1 the blue spot cleared and a narrow white rift became visible; see Figure 2H (arrow.) The eastern point of this rift was named S12. The drift rate of S12 is close to that of the long-lived great white spot in the 1980s (Rogers, 1995, 153.)

The SEB was wider at longitudes west of the GRS as in 2002-03.

Region IV: The Equatorial Zone

Figures 1 and 2 show the general appearance of the EZ. Visual observers reported no color in the EZ except for the blue feature discussed in the previous section. The EB was occasionally visible; see Figure 1C, 1E, 1G and 2L. Del Valle reported the EB as being faint on March 29.

Nine NEBs blue features (BF1, BF2, BF5, BF5a, BF6, BF10-BF12, BF20) developed and were often the bases of festoons. The blue features changed rapidly and the writer was often unable to recognize a feature after a few days. The average system I drift rate and rotation period of these features was 3.3°/30 days and thus 9h 50m 35s. The corresponding averages for the festoons were 8.3°/30 days and 9h 50m 41s and so the festoons were not able to quite keep up with the blue features. A rift (N12) that later turned into a loop (N13) on the NEBs followed the equatorial current (see Table 8.)

Region V: North Equatorial Belt

Figures 3F – 3H show characteristics of the NEB. Mackal (1966) and Peek (1981) discussed long-term variations in NEB latitudes. The width of the NEB fluctuated every 3-6 years during the first half of the 20th century and most of the fluctuation was caused by the changing latitude of the NEB; this was also the case in 2001-04.

Longitudes and drift rates for three white spots (N10, N11 and N15) and one dark anvil-shaped spot (N14) were near the NEBc. Figure 2B shows N11. The average system II drift rate of these features was 8.1°/30 days, which is more positive than the rate of NEB white ovals in 2001-03 (Schmude, 2003a,b.)

A white oval (N1), four dark northward pointing projections (N2-N5) and two shallow dents (N6, N7) were at the NEBn. The average drift rate of N6 and N7 is close to similar features in 2002-03. The four low projections (N2-N5) have an average drift rate that is similar to those of barges in 2001-03. The oval, N1, had a drift rate that is close to drift rates of NEB ovals in 2001-03 (Schmude, 2003a,b.)

Region VI: North Tropical Zone to the North Polar Region

A thin dark band was in the NTrZ; see Figures 1A, 1C, 1G, 1H, 2A – 2D, 2F and 2L. This band was darker in red and green light than in blue light during March. This dark band may have been part of the NTB. The writer was unable to find a stable feature in this band and so no drift rate in this band is reported.

A record number (21) of dark spots (H1-H7, H9, H11, H14, H17, H19-22 and H26-H31) in the North North Temperate Current-B (NNTC-B) formed. Features H7 and H9 were drawn by Budine and are shown in Figure 1A. The average system II drift rate for these features was -80°/30 days, which is consistent with the NNTC-B (Peek, 1981, 78), (Rogers, 1995, 97.) Table 5 lists the dimensions of most of the NNTC-B dark spots. The average area of these spots was 6 x 10^6 km^2 and the average aspect was 0.88. These spots were not as dark as Ganymede in visible light as that moon transited Jupiter

Two dark spots (H33, H34), one gap (H32) and four white ovals (H35-H38) developed in the NNTB. The drift rates and latitudes for these features are consistent with the NNTC (Rogers, 1995, 89.)

Five dark spots (I2, I5, I10, I11 and I13) and four white ovals (I6, I7, I9 and I12) developed in the N^3TC. The mean system II drift rate for all nine features is -17.5°/30 days, which is close to the 2002-03 value of -21.1°/30 (Schmude, 2003b) and with earlier values (Peek, 1981, 72), (Rogers, 1995, 90.) The drift rate reported by Schmude in 2001-02 for the N^3TC was 3.7°/30 days, which is different probably because of the latitude of the features - 42.3°N, which is further south than the latitudes of most N^3TC features-45°N (Rogers, 1995, 90.)

The latitude of the white oval I14 is 54.6°N, which places it in the N^4TC (Rogers, 1995, 90.) According to Rogers (1990, 88), the southern edge of the N^5TB is at a latitude of 56.6°N, which is probably the southern edge of the N^5TC. The drift rate for I14 was 3.7°/30 days, which is consistent with the "north polar spots" in Peek (1981, 71) and with the N^4TC rates in (Rogers, 1995, 90.)

Wind Speeds

Table 10 summarizes wind speeds. Wind speeds and uncertainties were measured with respect to the system III longitude

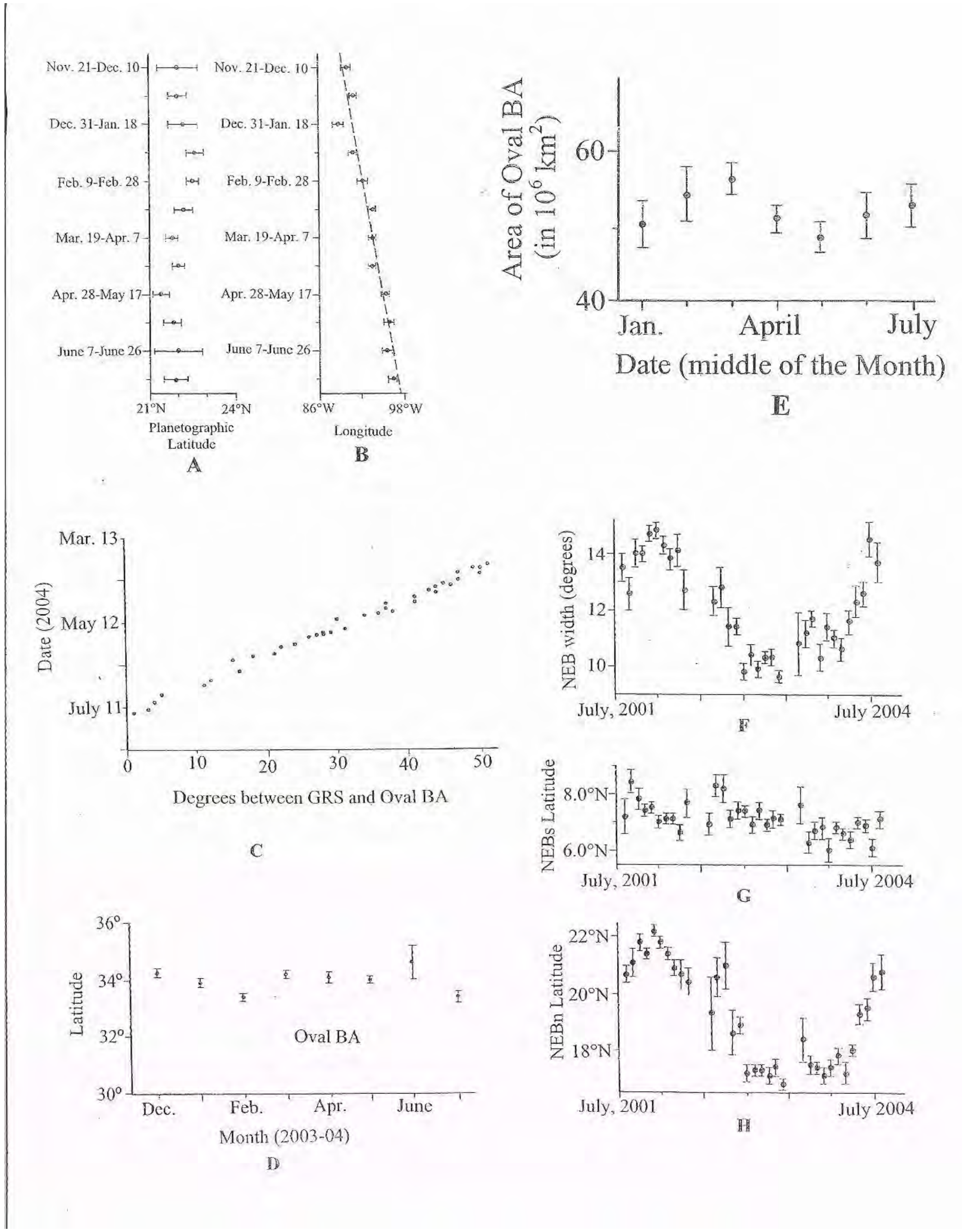

Figure 3: A: Average latitude of the GRS during each of 12 twenty day intervals; B: Average system II longitudes of the GRS during each of 12 twenty day intervals; C: The average separation in degrees of longitude between the centers of the GRS and Oval BA; D: Average planetographic latitudes of Oval BA for different months in 2003-04; E: Average area of Oval BA during different months in 2004; F: Monthly average width of the NEB in degrees of latitude during the 2001-04 apparitions; G: Monthly average planetographic latitude of the NEBs during the 2001-04 apparitions; H: Monthly average planetographic latitude of the NEBn during the 2001-04 apparitions. The error bars for each point in Figures A-B and D-H equal the standard deviation divided by the square root of the number of measurements.

Table 7: Drift Rates of Features Between the South Pole and the Northern Portion of the SEB, 2003-04 Apparition

I.D.	Number of Points	Time Interval	Planetographic Latitude	Drift Rate (deg./30 days) (System II)	Rotation Rate
South South South South South Temperate Current					
A1	8	Dec. 14 – Feb. 10	58.4°S	-0.3	9h 55m 40s
A3a	28	Feb. 14 – Apr. 16	59.9°S	-2.4	9h 55m 37s
A3b	9	Apr. 11 – May 20	61.9°S	-31.6	9h 54m 57s
A4	25	Mar. 7 – June 8	59.4°S	2.4	9h 55m 44s
	Average		*59.9°S*	*-8.0*	*9h 55m 30s*
South South South South Temperate Current					
A5	14	Apr. 2 – May 25	55.3°S	-17.2	9h 55m 17s
South South South Temperate Current					
A2a	21	Feb. 8 – Mar. 30	51.2°S	-1.3	9h 55m 39s
A2b	7	Mar. 27 – May 21	51.3°S	-16.4	9h 55m 18s
	Average		*51.3°S*	*-8.9*	*9h 55m 29s*
South South Temperate Current					
B1	8	Nov. 22 – Dec. 30	37.9°S	-27.6	9h 55m 03s
B2	61	Dec. 12 – May 26	40.8°S	-25.6	9h 55m 06s
B3	40	Dec. 15 – Mar. 23	41.5°S	-28.2	9h 55m 02s
B3a	17	Apr. 1 – May 26	41.5°S	-34.7	9h54m53s
B4	64	Jan. 4 – July 6	42.0°S	-28.3	9h 55m 02s
B5	70	Dec. 16 – July 6	41.4°S	-27.6	9h 55m 03s
B6	53	Dec. 15 – June 14	41.6°S	-29.3	9h 55m 01s
B8	40	Feb. 7 – June 16	41.6°S	-26.4	9h 55m 05s
	Average		*41.0°S*	*-28.5*	*9h 55m 02s*
South Temperate Current					
Oval BA	93	Nov. 30 – July 14	34.0°S	-13.0	9h 55m 23s
S1	67	Nov. 25 – Apr. 25	31.9°S	-17.3	9h 55m 17s
	Average		*33.0°S*	*-15.2*	*9h 55m 20s*
South Tropical Current					
GRS	108	Oct. 19 – July 14	22.1°S	1.1	9h 55m 42s
South Equatorial Belt Current (SEBs)					
S5	12	Mar. 23 – Apr. 11	23.3°S	76.9	9h 57m 26s
South Equatorial Belt Current (SEBc, preceding the Great Red Spot)					
S4	11	Mar. 2 – Mar. 19	11.1°S	-73.9	9h 54m 00s
South Equatorial Current (SEBc, following the Great Red Spot)					
S2	15	Feb. 29 – Mar. 16	14.2°S	-52.2	9h 54m 29s
S3	14	Feb. 29 – Mar. 16	15.0°S	-57.0	9h 54m 23s
S7	5	Apr. 1 – Apr. 7	12.7°S	-50.4	9h 54m 32s
S8	8	Apr. 1 – Apr. 13	14.5°S	-49.4	9h 54m 33s
S9	8	Apr. 1 – Apr. 14	14.7°S	-69.7	9h 54m 05s
S10	7	Apr. 1 – Apr. 14	14.2°S	-68.3	9h 54m 08s
S11	15	Apr. 16 – May 1	14.8°S	-48.5	9h 54m 34s
	Average		*14.3°S*	*-56.5*	*9h 54m 23s*
South Equatorial Current (SEBn)					
S12	10	Mar. 1 – Mar. 14	7.5°S	-193.0	9h 51m 18s

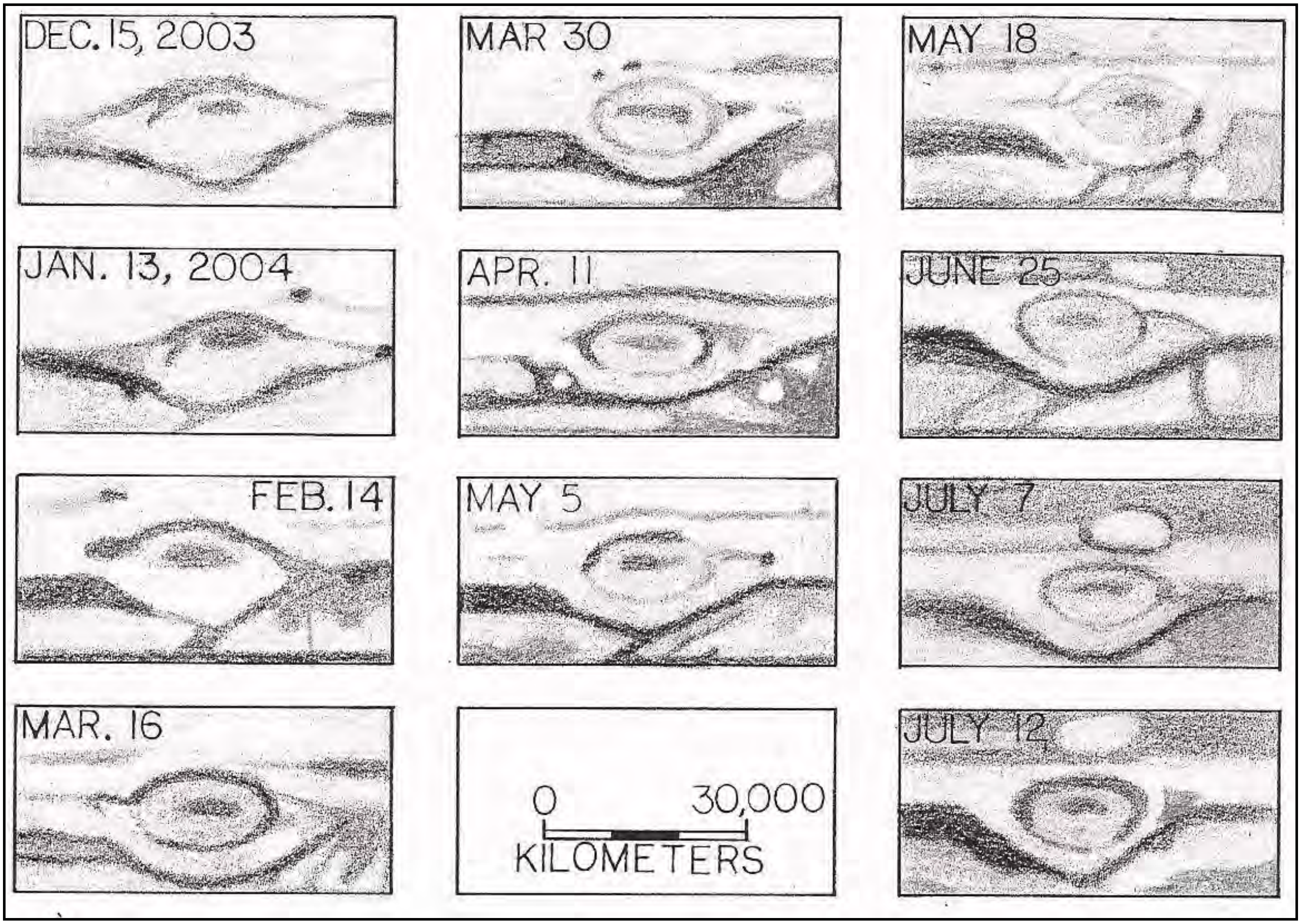

Figure 4: Drawings of the GRS made at irregular intervals in the 2003-04 apparition. The writer made all of these drawings, based on the submitted electronic images. South is up.

and were computed in the same way as in (Rogers, 1995, 392) and (Schmude, 2002a, 2003a.) As such, they represent the speeds of drift of visible cyclones and anticyclones in the currents associated with the belts and zones, but they do not represent the vorticial wind speeds within those storms.

Methane Band Images

Methane band images (CH_4 images) are made in light that methane absorbs. All CH_4 images were made with light having a wavelength of 889 nanometers (889 nm.) These images are useful because they give information about the altitudes of clouds, with the higher clouds appearing brighter because they are above the level of greatest absorption by methane. More information can be found elsewhere (Schmude, 2004.) Akutsu, Cidadao, Colville, Melillo and Parker sent in over a dozen high-quality CH_4 images.

Based on these images, I estimated the order of brightness of Jovian features (brightest to dimmest) as: GRS, EZs, SPR, Oval BA, NTrZ, NPR, NTZ, EZn, STrZ/STZ, Oval B2, Oval B5, EB, NTB, SEB and NEB.

In a Jan. 9 image (Figure 2E), Ganymede was brighter than all belts and zones in CH_4 light as it transited Jupiter.

Figure 2I is a CH_4 image showing the GRS and Oval BA as white spots.

Table 3B lists the belt latitudes in methane band light. Belts are defined by their latitude in visible light. In the cases of borders for the North and South Equatorial Belts, the discrepancy in latitude between visible and methane band light (0.89 mm) exceeds the combined uncertainties. Rogers et al (2004, 320) also report latitude discrepancies exceeding 1.5 degrees for visible and 0.89 μm light for the SEBn and NEBn in 2000-2001. I have listed the belts with the wavelength beside them in Table 3B to alert the reader that these features may not be what are listed in Table 3A. The largest change was the southern movement of the NPRs during the last two apparitions.

Table 8: Drift Rates of Features within the Equatorial Zone, 2003-04 Apparition

I.D.	Number of Points	Time Interval	Planetographic Latitude	Drift Rate (deg./30 days) (System I)	Rotation Rate
Equatorial Current (festoons)					
E1	28	Nov. 25 – Feb. 26	6.7°N	9.1	9h 50m 42s
E2	9	Dec. 16 – Jan. 13	6.7°N	12.8	9h 50m 47s
E3	6	Dec. 16 – Jan. 2	6.7°N	10.8	9h 50m 45s
E4	31	Mar. 7 – Apr. 19	6.7°N	9.9	9h 50m 43s
E5	45	Nov. 25 – May 6	6.7°N	7.9	9h 50m 41s
E6	36	Nov. 30 – Apr. 13	6.7°N	6.8	9h 50m 39s
E7	45	Dec. 4 – Apr. 22	6.7°N	6.8	9h 50m 39s
E8	46	Jan. 25 – May 21	6.7°N	11.0	9h 50m 45s
E9	9	Feb. 3 – Feb. 25	6.7°N	1.1	9h 50m 31s
E10	34	Feb. 10 – Apr. 21	6.7°N	4.1	9h 50m 36s
E11	23	Feb. 29 – Apr. 9	6.7°N	2.8	9h 50m 34s
E12	42	Mar. 5 – May 30	6.7°N	8.4	9h 50m 41s
E13	8	Mar. 17 – Apr. 5	6.7°N	5.7	9h 50m 38s
E14	19	Mar. 21 – Apr. 16	6.7°N	1.9	9h 50m 33s
E15	14	May 1 – June 2	6.7°N	22.8	9h 51m 01s
E16	25	Apr. 9 – June 4	6.7°N	10.9	9h 50m 45s
	Average		*6.7°N*	*8.3*	*9h 50m 41s*
Equatorial Current (NEBs blue features)					
BF1	17	Nov. 25 – Jan. 11	6.7°N	5.1	9h 50m 37s
BF2	5	Dec. 28 – Jan. 24	6.7°N	-1.2	9h 50m 29s
BF5	6	Nov. 21 – Dec. 12	6.7°N	8.1	9h 50m 41s
BF5a	12	Mar. 28 – Apr. 26	6.7°N	6.4	9h 50m 39s
BF6	17	Nov. 21 – Feb. 1	6.7°N	4.6	9h 50m 36s
BF10	6	Feb. 13 – Mar. 9	6.7°N	4.1	9h 50m 36s
BF11	11	Mar. 9 – Mar. 23	6.7°N	-7.7	9h 50m 20s
BF12	11	Apr. 8 – Apr. 28	6.7°N	8.0	9h 50m 41s
BF20	6	Jan. 22 – Feb. 29	6.7°N	2.0	9h 50m 33s
	Average		*6.7°N*	*3.3*	*9h 50m 35s*
Equatorial Current (NEBs)					
N12	13	Mar. 25 – Apr. 8	6.7°N	11.9	9h 50m 46s
N13	7	Apr. 10 – Apr. 17	6.7°N	11.9	9h 50m 46s
	Average		*6.7°N*	*11.9*	*9h 50m 46s*

CH_4 images usually showed a straight border at the NEBn, whereas visible and ultraviolet light images show this border as irregular. Festoons were usually faint or invisible in CH_4 images.

Ultraviolet Images

Akutsu, Parker and Pellier submitted over a dozen high-quality ultraviolet images of Jupiter; one of these is shown in Figure 2G.

Based on Pellier's images (wavelength of 365-370 nm), I estimated the brightness of Jovian features (brightest to dimmest) as: NTrZ, NTZ, EZs = STrZ/STZ, Oval BA, SPR = EZn, EB, SEB, NPR, NEB and GRS.

Akutsu recorded an ultraviolet image (at a wavelength of 340 nm) on Jan. 9; this image showed Ganymede transiting Jupiter. Ganymede was dimmer than the NTZ, EZs and STrZ/STZ but it was brighter than the EZn, SPR, SEB, NPR and NEB.

Table 9: Drift Rates of Features Between the North Equatorial Belt and the North Pole

I.D.	Number of Points	Time Interval	Planetographic Latitude	Drift Rate (deg./30 days) (System II)	Rotation Rate
North Equatorial Belt Current (NEBn)					
N1	62	Nov. 25 – May 22	18.4°N	-7.7	9h 55m 30s
N2	41	Feb. 10 – May 3	18.4°N	-6.5	9h 55m 32s
N3	10	Feb. 16 – Mar. 11	18.4°N	-6.7	9h 55m 31s
N4	56	Feb. 29 – June 6	18.4°N	0.5	9h 55m 41s
N5	24	Mar. 4 – Apr. 27	18.4°N	-5.4	9h 55m 33s
N6	18	Mar. 23 – Apr. 20	18.4°N	7.8	9h 55m 51s
N7	13	May 1 – May 27	18.4°N	1.9	9h 55m 43s
	Average		*18.4°N*	*-2.3*	*9h 55m 37s*
North Equatorial Belt Current (NEBc)					
N10	24	Feb. 28 – Mar. 31	14.4°N	8.4	9h 55m 52s
N11	10	Dec. 12 – Jan. 3	15.2°N	3.1	9h 55m 45s
N14	12	Apr. 10 – Apr. 26	17.1°N	12.8	9h 55m 58s
N15	12	Apr. 10 – Apr. 26	17.0°N	8.0	9h 55m 52s
	Average		*15.9°N*	*8.1*	*9h 55m 52s*
North North Temperate Current - B					
H1	35	Feb. 28 – May 2	35.3°N	-85.5	9h 53m 44s
H2	27	Feb. 28 – Apr. 25	35.8°N	-83.4	9h 53m 47s
H3	10	Feb. 28 – Mar. 31	34.3°N	-73.2	9h 54m 01s
H4	31	Feb. 29 – May 3	34.4°N	-80.9	9h 53m 50s
H5	30	Feb. 29 – May 3	34.8°N	-79.0	9h 53m 53s
H6	31	Feb. 29 – May 3	34.9°N	-76.9	9h 53m 56s
H7	26	Feb. 29 – Apr. 26	35.2°N	-77.5	9h 53m 55s
H9	24	Mar. 8 – Apr. 26	35.6°N	-76.5	9h 53m 56s
H11	29	Mar. 8 – May 21	35.0°N	-75.9	9h 53m 57s
H14	9	Mar. 30 – Apr. 13	35.6°N	-98.0	9h 53m 27s
H17	13	Apr. 17 – May 21	35.2°N	-79.7	9h 53m 52s
H19	14	Jan. 24 – Mar. 4	35.0°N	-82.5	9h 53m 48s
H20	20	Jan. 24 – Mar. 4	35.3°N	-80.9	9h 53m 50s
H21	7	Jan. 24 – Feb. 17	35.6°N	-81.8	9h 53m 49s
H22	8	Apr. 1 – Apr. 10	35.4°N	-67.5	9h 54m 08s
H26	6	Apr. 16 – May 2	36.1°N	-96.0	9h 53m 30s
H27	8	Apr. 27 – May 21	35.0°N	-79.7	9h 53m 52s
H28	9	Apr. 27 – May 21	34.9°N	-79.6	9h 53m 52s
H29	9	Apr. 27 – May 21	34.6°N	-77.3	9h 53m 55s
H30	8	Apr. 27 – May 21	34.9°N	-79.4	9h 53m 52s
H31	8	Apr. 1 – Apr. 10	35.2°N	-69.2	9h 54m 06s
	Average		*35.1°N*	*-80.0*	*9h 53m 51s*
North North Temperate Current					
H32	8	Dec. 6 – Dec. 28	40.2°N	6.7	9h 55m 50s
H33	6	Dec. 21 – Jan. 4	40.0°N	-8.1	9h 55m 30s
H34	7	Jan. 24 – Feb. 11	40.2°N	-6.6	9h 55m 32s
H35	9	Jan. 24 – Feb. 28	41.3°N	-16.1	9h 55m 19s
H36	21	Feb. 26 – Apr. 22	40.9°N	-6.5	9h 55m 32s
H37	20	Apr. 19 – July 5	41.4°N	-0.4	9h 55m 40s
H38	10	May 2 – June 12	40.7°N	7.1	9h 55m 50s
	Average		*40.7°N*	*-3.4*	*9h 55m 36s*
North North North Temperate Current					
I2	9	Jan. 24 – Feb. 28	45.4°N	-19.9	9h 55m 14s
I5	9	Jan. 24 – Feb. 28	45.8°N	-15.5	9h 55m 20s
I6	21	Feb. 26 – Apr. 2	43.7°N	-20.5	9h 55m 13s
I7	10	Feb. 29 – Mar. 20	43.8°N	-14.5	9h 55m 21s
I9	41	Jan. 30 – May 19	44.4°N	-22.8	9h 55m 10s
I10	7	Mar. 5 – Mar. 17	46.2°N	-17.0	9h 55m 17s
I11	5	Mar. 7 – May 28	45.7°N	-6.8	9h 55m 31s
I12	24	Mar. 5 – Mar. 17	45.7°N	-14.7	9h 55m 21s
I13	9	Mar. 17 – Apr. 7	42.7°N	-25.9	9h 55m 05s
	Average		*44.8°N*	*-17.5*	*9h 55m 17s*
North North North North Temperate Current					
I14	9	Mar. 2 – Apr. 13	54.6°N	3.7	9h 55m 46s

Table 10: Average Drift Rates, Rotation Periods and Wind Speeds for Several Currents on Jupiter, 2003-04 Apparition

Current	Feature(s)	Drift Rate (deg/30 days)			Rotation Period	Wind Speed (m/s)
		Sys. I	Sys. II	Sys. III		
SSSSS Temp. Cur.	A1, A3a, A3b, A4	220.9	-8.0	0.0	9h 55m 30s	0±3.0[a]
SSSS Temp. Cur.	A5	211.7	-17.2	-9.2	9h 55m 17s	2.6±1.0 [a]
SSS Temp. Cur.	A2a, A2b	220.0	-8.9	-0.9	9h 55m 29s	0.3±1.8[b]
SS Temp. Cur.	B1-B6, B8	201.1	-27.8	-19.8	9h 55m 03s	7.4±0.4[b]
S Temp Cur.	S1, Oval BA	213.7	-15.2	-7.2	9h 55m 20s	3.0±0.7[b]
S Trop. Cur.	GRS	230.0	1.1	9.1	9h 55m 42s	-4.1±0.2[a]
SEC (SEBs)	S5	305.8	76.9	84.9	9h 57m 26s	-37.9±1.0 [a]
SEC (SEBc preceding GRS)	S4	155	-73.9	-65.9	9h 54m 00s	31.2±1.0[a]
SEC (SEBc following GRS)	S2, S3, S7-S11	172.4	-56.5	-48.5	9h 54m 23s	22.7±1.5[b]
SEC (SEBn)	S12	35.9	-193.0	-185.0	9h 51m 18s	88.3±1.0[a]
Eq. Cur. (festoons)	E1-E16	8.3	-220.6	-212.6	9h 50m 41s	101.6±0.7[b]
Eq. Cur (NEBs blue features)	BF1, BF2, BF5, BF5a, BF6, BF10-BF12, BF20	3.3	-225.6	-217.6	9h 50m 35s	104.0±0.8[b]
Eq. Cur. (NEBs)	N12, N13	11.9	-217.0	-209.0	9h 50m 46s	99.9±1.0[b]
N Eq. Belt cur. (NEBc)	N10, N11, N14, N15	237.0	8.1	16.1	9h 55m 52s	-7.4±0.8[b]
N Eq. Belt Cur. (NEBn)	N1-N7	226.6	-2.3	5.7	9h 55m 37s	-2.6±0.9[b]
NN Temp. Cur. B	H1-H7, H9, H11, H14, H17, H19-H22, H26-H31	148.9	-80.0	-72.0	9h 53m 51s	28.9±0.6[b]
NN Temp. Cur.	H32-H38	225.5	-3.4	4.6	9h 55m 36s	-1.7±1.1[b]
NNN Temp. Cur.	I2, I5-I7, I9-I13	211.4	-17.5	-9.5	9h 55m 17s	3.3±0.6[b]
NNNN Temp. Cur.	I14	232.6	3.7	11.7	9h 55m 46s	-3.4±1.0[a]

[a]Estimated uncertainty

[b]These uncertainties equal the standard deviation of all features in a given current divided by the square root of the number of features.

In ultraviolet images, the SSTB ovals and Oval BA were faint while the GRS was usually the darkest feature on Jupiter.

The irregular northern border of the NEB showed up well in ultraviolet, but festoons were barely visible (see Figure 2G).

Photoelectric Photometry and Polarimetry

The writer made photoelectric magnitude measurements of Jupiter using the same equipment and procedure as in (Schmude, 2003a, 50.) The magnitude measurements are in Table 11. In all cases, the comparison star was Iota-Geminorum and its magnitudes are in (Iriarte et al., 1965.)

The normalized magnitudes and solar phase angle coefficients of Jupiter are in Table 12. The normalized magnitude is the magnitude that a planet has if it is 1.0 astronomical unit (93 million miles) from both the Earth and the Sun and is at a solar phase angle of 0°. The solar phase angle is the angle between the observer and the Sun measured from the target. The solar phase angle coefficient describes how much shading is present as a result of sunlight not hitting a planet directly as seen from the Earth. The larger the value of the solar phase angle coefficient, the greater is the shading.

Jupiter's V(1,0) value was more negative in 2004 than in the previous four apparitions, which means that this planet reflected more light. This may be due to the thin NEB, the bright EZ and the near absence of the NTB. The solar phase coefficients in the V, R and I filters were close to those in 2001 (Schmude, 2003a, 53.)

Whole disc polarimetric measurements of Jupiter were made in the same way as in (Schmude, 2002b, 106) and (Dollfus, 1961, 343.) The polarization measurements in the V filter were: Jan. 14.269 (+2.8), Jan. 22.277 (+2.5) and April 10.207 (+1.1) and one measurement in the blue filter was Jan. 22.296 (-1.2.).

Satellite Observations

Akutsu, Albert, Biver, Chin, Go, Graften, Hernandez, Maxson, Miyazaki, Pellier and Sanchez either imaged or drew Ganymede as it transited Jupiter. In almost all cases, Ganymede was darker than any feature on Jupiter. At opposition, Ganymede had an albedo of 0.43 in white light (Schmude, 2004) and so a lower limit to the albedo of Jovian features is about 0.45. Hernandez's Dec. 19 drawing (Figure 1B) shows both Ganymede and Callisto transiting Jupiter; Callisto is further north than Ganymede.

Cudnik drew a black drop effect for Ganymede's shadow as it moved onto Jupiter's disc on June 15. He attributed this to "Jupiter's shimmering limb".

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Table 11: Photoelectric Magnitude Measurements of Jupiter Made During the 2003-04 Apparition

Date (2004)	Filter	Solar Phase Angle (degrees)	Measured Magnitude	Normalized Magnitude
Jan. 14.297	V	8.6	-2.28	-9.35
Jan. 17.276	V	8.2	-2.32	-9.37
Jan. 17.300	R	8.2	-2.76	-9.82
Jan. 20.228	V	7.9	-2.29	-9.33
Jan. 20.243	B	7.9	-1.49	-8.53
Jan. 20.263	I	7.9	-2.67	-9.71
Jan. 29.235	V	6.6	-2.39	-9.38
Feb. 18.240	V	3.1	-2.52	-9.43
Feb. 18.251	B	3.0	-1.59	-8.51
Feb. 18.265	R	3.0	-2.89	-9.81
Feb. 18.284	I	3.0	-2.81	-9.73
Mar. 11.196	V	1.4	-2.50	-9.41
Mar. 11.216	B	1.4	-1.59	-8.49
Mar. 11.232	R	1.4	-2.96	-9.86
Mar. 12.273	I	1.7	-2.78	-9.68
Mar. 17.201	V	2.6	-2.49	-9.41
Mar. 17.217	B	2.6	-1.62	-8.53
Apr. 7.178	B	6.4	-1.54	-8.53
Apr. 7.190	V	6.4	-2.33	-9.32
Apr. 9.081	R	6.7	-2.84	-9.84
Apr. 9.092	I	6.7	-2.67	-9.66
May 4.115	B	9.7	-1.39	-8.53
May 4.126	V	9.7	-2.21	-9.35
May 4.141	R	9.7	-2.63	-9.78
May 4.152	I	9.7	-2.46	-9.61

Table 12: Photometric Constants for Jupiter During the 2003-04 Apparition[a]

Filter	Normalized Magnitude	Solar phase angle coefficient (Magnitude/degree)
B	-8.51±0.01	(-0.003)
V	-9.43±0.02	0.010±0.005
R	-9.86±0.01	0.007±0.002
I	-9.73±0.03	0.009±0.007

[a]Uncertainties were computed in the same way as is described in Schmude (1998).

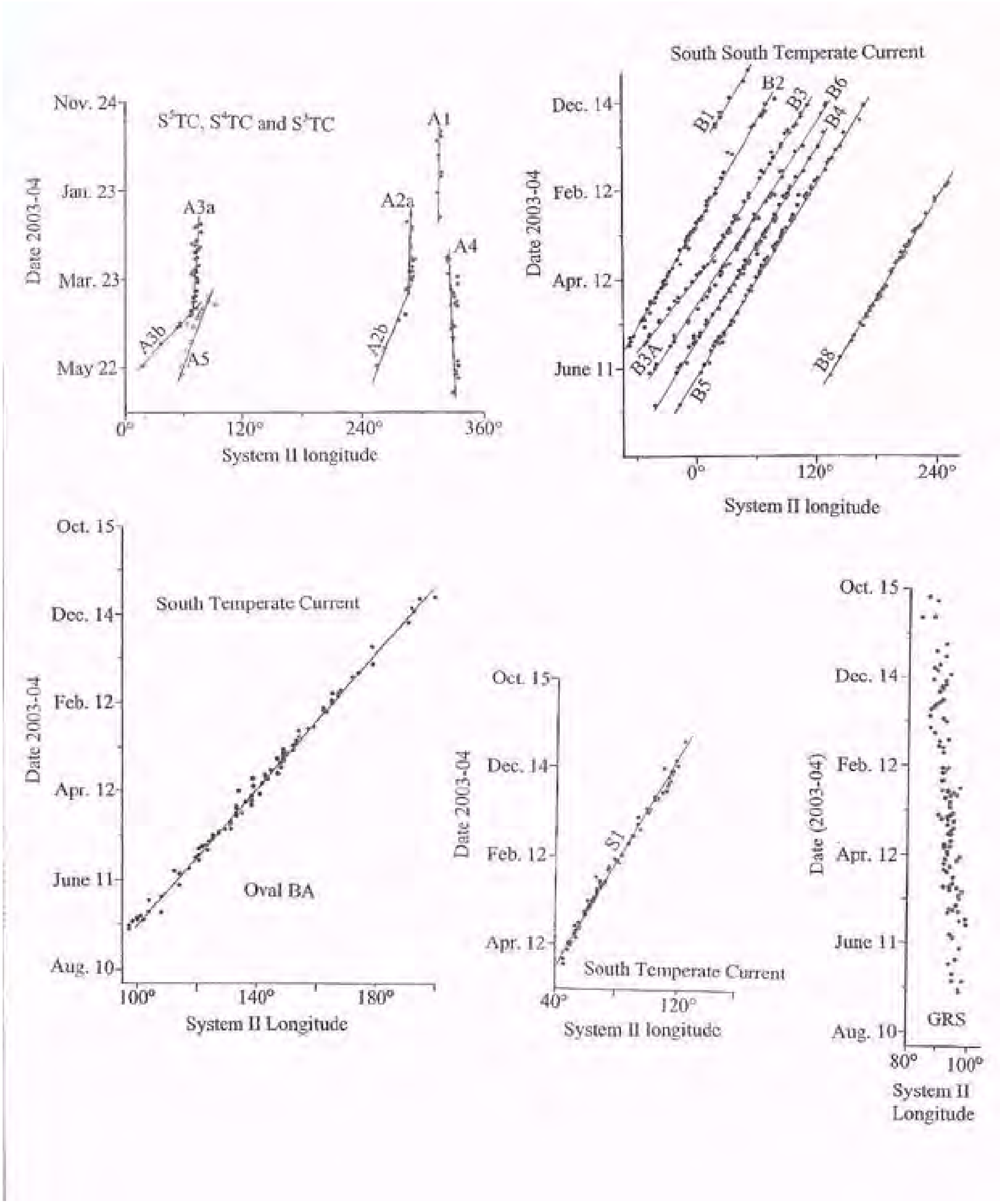

Figure 5: The changes in longitude of various features in the southern hemisphere of Jupiter. A spot's drift on these diagrams to the left or right over time corresponds to the direction of drift that would be seen on serial images of the planet oriented with south up, as in the drawings and images presented in Figures 1 and 2.

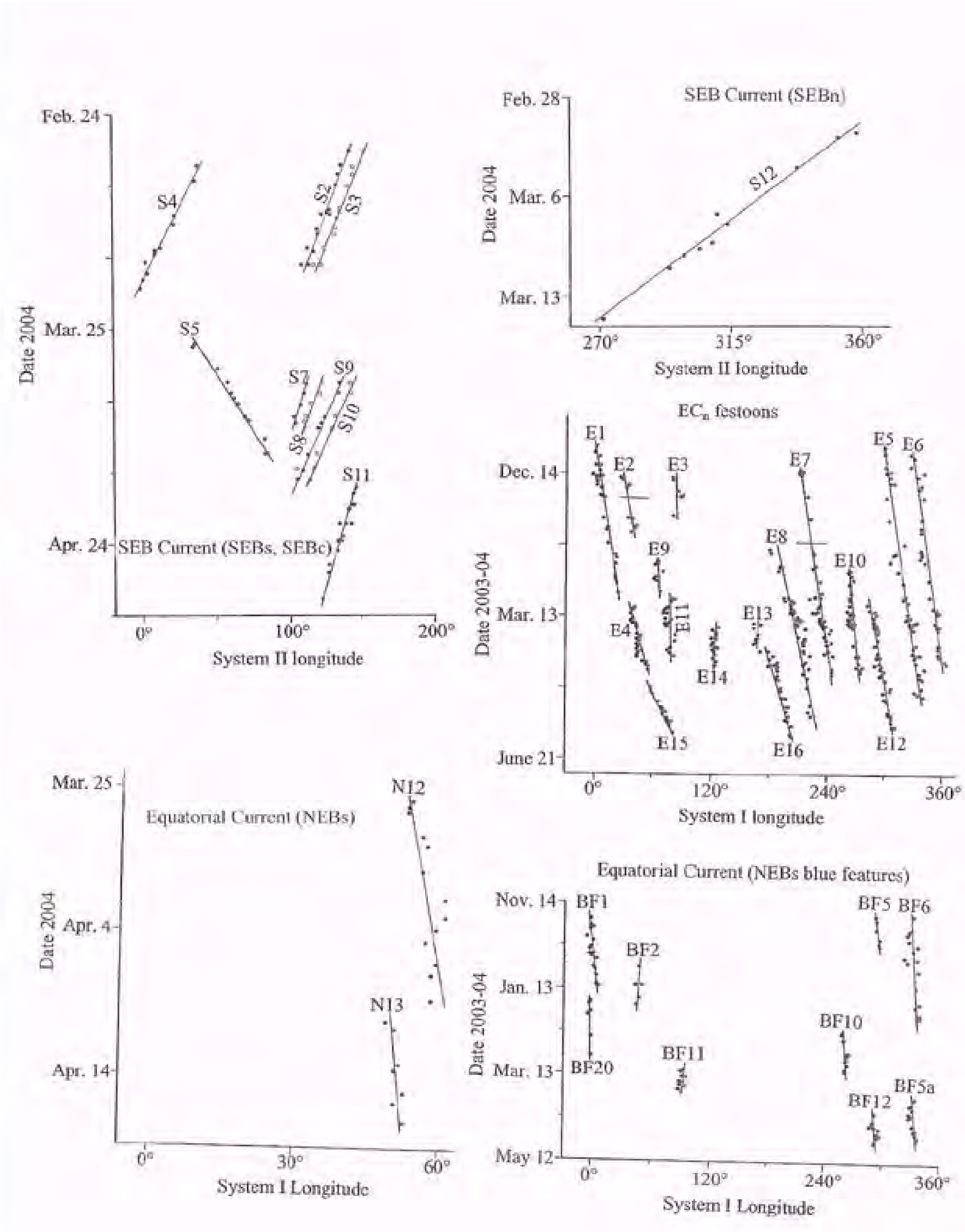

Figure 6: The changes in longitude of various features in the SEB, EZ and NEBs; the horizontal lines are estimated longitudes measured from drawings. As with Figure 5, a spot's drift on the diagram to the left or right over time corresponds to the direction of motion that would be seen on serial images of Jupiter oriented with south up.

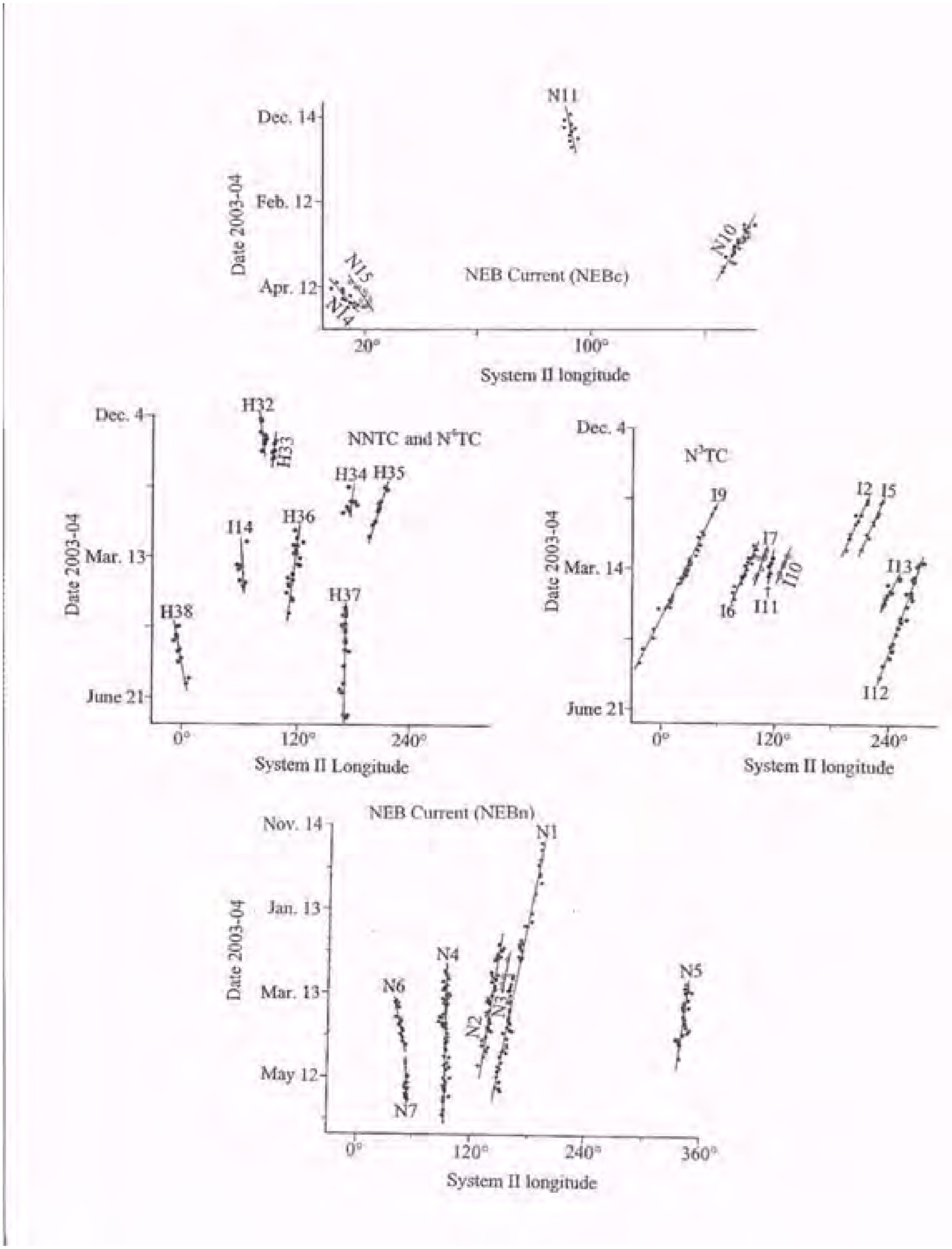

Figure 7: The changes in longitude of various features in the northern hemisphere of Jupiter.

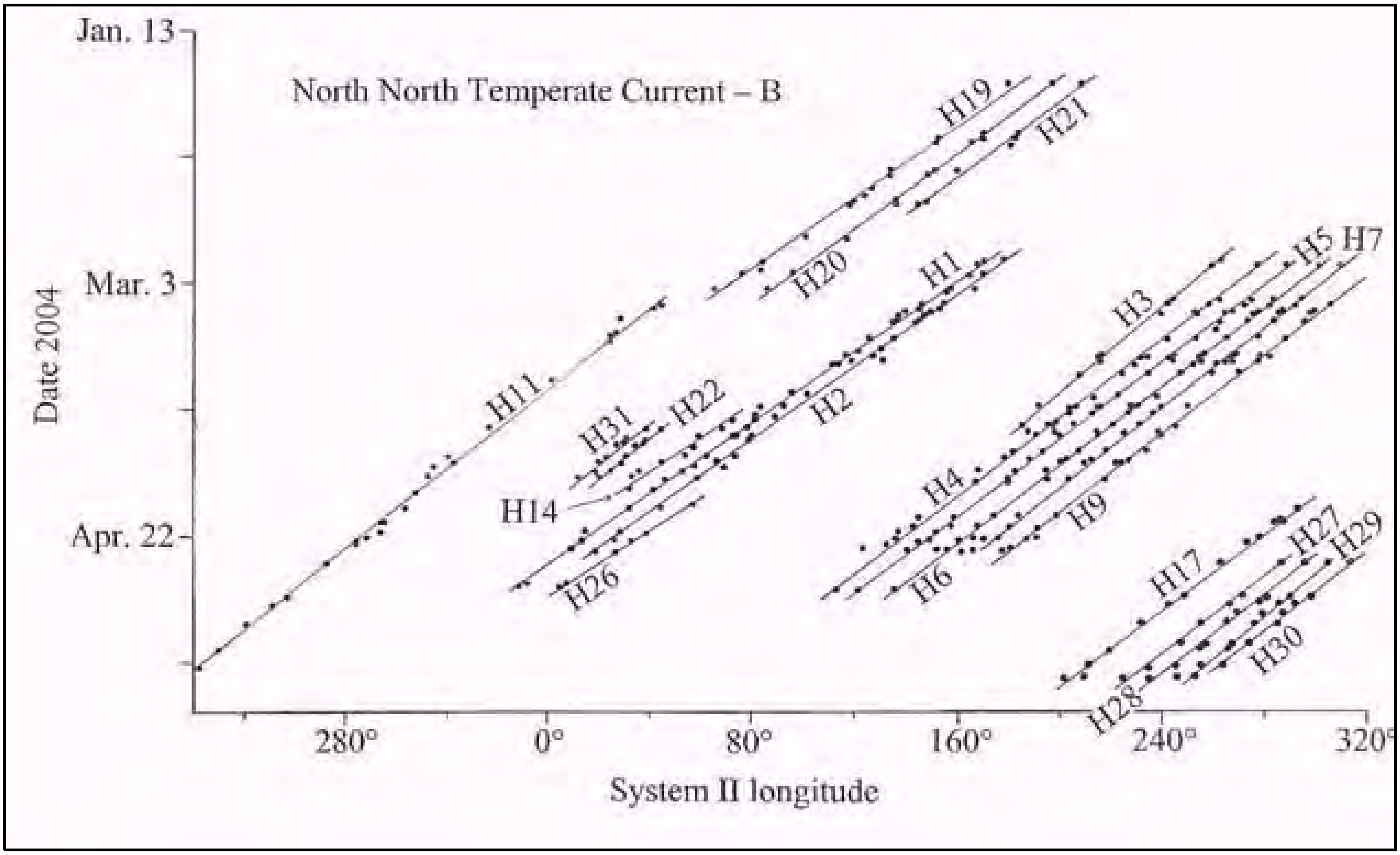

Figure 8: The changes in longitude of features in the North North Temperate Current – B.

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Mars Section

http://www.alpo-astronomy.org , then Mars Section

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- Coordinator; Julius L. Benton, Jr., Associates in Astronomy, P.O. Box 30545, Wilmington Island, Savannah, GA 31410

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- Coordinator; Richard W. Schmude, Jr., 109 Tyus St., Barnesville, GA 30204

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- Acting Coordinator; Gary Kronk, 132 Jessica Dr, St. Jacob, IL 62281-1246

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http://www.alpo-astronomy.org , then Meteorite Section

- Coordinator; Dolores Hill, Lunar and Planetary Laboratory, University of Arizona, Tucson, AZ 85721

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- Coordinator; Michael D. Reynolds, associate dean, Math & Science, Florida Community College, 3939 Roosevelt Blvd, E-345, Jacksonville, FL 32205

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- **Monograph No. 1.** *Proceedings of the 43rd Convention of the Association of Lunar and Planetary Observers. Las Cruces, New Mexico, August 4-7, 1993.77* pages. Hard copy $12 for the United States, Canada, and Mexico; $16 elsewhere .
- **Monograph No. 2**. *Proceedings of the 44th Convention of the Association of Lunar and Planetary Observers. Greenville, South Carolina, June 15-18,*

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1994.52 pages. Hard copy *$7.50* for the United States, Canada, and Mexico; $11 elsewhere.

- **Monograph No. 3**. *H.P. Wilkins 300-inch Moon Map.* 3rd Edition (1951), reduced to 50 inches diameter; 25 sections, 4 special charts; also 14 selected areas at 219 inches to the lunar diameter. Price: $28 for the United States, Canada, and Mexico; $40 elsewhere.
- **Monograph No. 4.** *Proceedings of the 45th Convention of the Association of Lunar and Planetary Observers. Wichita, Kansas, August 1-5, 1995.127* pages. Hard copy $17 for the United States, Canada, and Mexico; $26 elsewhere.
- **Monograph No. *5*.** *Astronomical and Physical Observations of the Axis of Rotation and the Topography of the Planet Mars. First Memoir; 1877-1878.* By Giovanni Virginio Schiaparelli, translated by William Sheehan. 59 pages. Hard copy $10 for the United States, Canada, and Mexico; $15 elsewhere.
- **Monograph No. *6*.** *Proceedings of the 47th Convention of the Association of Lunar and Planetary Observers, Tucson, Arizona, October 19-21, 1996.20* pages. Hard copy $3 for the United States, Canada, and Mexico; $4 elsewhere.
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Order the following directly from the appropriate ALPO section coordinators; use the address in the listings pages which appeared earlier in this booklet unless another address is given.

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- **Lunar and Planetary Training Program:** *The Novice Observers Handbook* $15. An introductory text to the training program. Includes directions for recording lunar and planetary observations, useful exercises for determining observational parameters, and observing forms. Send check or money order payable to Timothy J. Robertson, 2010 Hillgate Way #L, Simi Valley, CA 93065.
- **Lunar (Dembowski):** (1) *The ALPO Lunar Section's Selected Areas Program (*$17.50). Includes full set of observing forms for the assigned or chosen lunar area or feature, along with a copy of the *Lunar Selected Areas Program Manual.* (2) *Observing Forms,* free at *http://www.alpo-astronomy.org* (then Topographical Studies and Selected Areas Home Page), or $10 for a packet of forms by regular mail. Specify *Lunar Forms*. NOTE: Observers who wish to make copies of the observing forms may instead send a SASE for a copy of forms available for each program. Authorization to duplicate forms is given only for the purpose of recording and submitting observations to the ALPO lunar SAP section. Observers should make copies using high-quality paper.)
- **Lunar**: *The Lunar Observer*, official newsletter of the ALPO Lunar Section, published monthly. Free at *http://www.zone-vx.com/tlo.pdf* or 70 cents per copy hard copy; send SASE with payment (check or money order) to: William Dembowski, Elton Moonshine Observatory, 219 Old Bedford Pike, Windber, PA 15963
- **Lunar (Jamieson):** *Lunar Observer's Tool Kit*, price $50, is a computer program designed to aid lunar observers at all levels to plan, make, and record their observations. This popular program was first written in 1985 for the Commodore 64 and ported to DOS around 1990. Those familiar with the old DOS version will find most of the same tools in this new Windows version, plus many new ones. A complete list of these tools includes Dome Table View and Maintenance, Dome Observation Scheduling, Archiving Your Dome Observations, Lunar Feature Table View and Maintenance, Schedule General Lunar Observations, Lunar Heights and Depths, Solar Altitude and Azimuth, Lunar Ephemeris, Lunar Longitude and Latitude to Xi and Eta, Lunar Xi and Eta to Longitude and Latitude, Lunar Atlas Referencing, JALPO and Selenology Bibliography, Minimum System Requirements, Lunar and Planetary Links, and Lunar Observer's ToolKit Help and Library. Some of the program's options include predicting when a lunar feature will be illuminated in a certain way, what features from a collection of features will be under a given range of illumination, physical ephemeris information, mountain height computation, coordinate conversion, and browsing of the software's included database of over 6,000 lunar features. Contact *harry@persoftware.com*
- **Venus (Benton):** (1) *ALPO Venus Observing Kit,* $17.50; includes introductory description of ALPO Venus

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observing programs for beginners, a full set of observing forms, and a copy of *The Venus Handbook.* (2) *Observing Forms,* free at http://www.alpo-astronomy.org (then Venus Section), or $10 for a packet of forms by regular mail (specify *Venus Forms).* To order either numbers (1) or (2), send a check or money order payable to "Julius L. Benton, Jr." All foreign orders should include $5 additional for postage and handling; p/h included in price for domestic orders. Shipment will be made in two to three weeks under normal circumstances. NOTE: Observers who wish to make copies of the observing forms may instead send a SASE for a copy of forms available for each program. Authorization to duplicate forms is given only for the purpose of recording and submitting observations to the ALPO Venus section. Observers should make copies using high-quality paper.

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- **Jupiter:** *(1) Jupiter Observer's Handbook*, $15 from the Astronomical League Sales, c/o Marion M. Bachtell, P.O. Box 572, West Burlington, IA 52655; FAX: 1-319-758-7311; e-mail at alsales@astronomicalleague.com. (2) *Jupiter*, the ALPO section newsletter, available online only via the ALPO website; (3) *J-Net*, the ALPO Jupiter Section e-mail network; send an e-mail message to Craig MacDougal. (4) *Timing the Eclipses of Jupiter's Galilean Satellites* observing kit and report form; send SASE to John Westfall. (5) *Jupiter Observer's Startup Kit*, $3 from Richard Schmude, Jupiter Section coordinator.

- **Saturn (Benton):** (1) *ALPO Saturn Observing Kit*, $20; includes introductory description of Saturn observing programs for beginners, a full set of observing forms, and a copy of *The Saturn Handbook*. Newly released book *Saturn and How to Observe It* (by J. Benton) replaces to *The Saturn Handbook* in early 2006. (2) *Saturn Observing Forms*, free t http://www.alpo-astronomy.org (then Saturn Section), or $10 by regular mail. Specify *Saturn Forms.* NOTE: Observers who wish to make copies of the observing forms may instead send a SASE for a copy of forms available for each program. Authorization to duplicate forms is given only for the purpose of recording and submitting observations to the ALPO Saturn section.

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- **Minor Planets (Derald D. Nye):** *The Minor Planet Bulletin*. Published quarterly; free at http://www.minorplanetobserver.com/mpb/default.htm or $14 per year via regular mail in the U.S., Mexico and Canada, $19 per year elsewhere (air mail only). Send check or money order payable to "Minor Planet Bulletin" to Derald D. Nye, 10385 East Observatory Dr., Corona de Tucson, AZ 8564I-2309.

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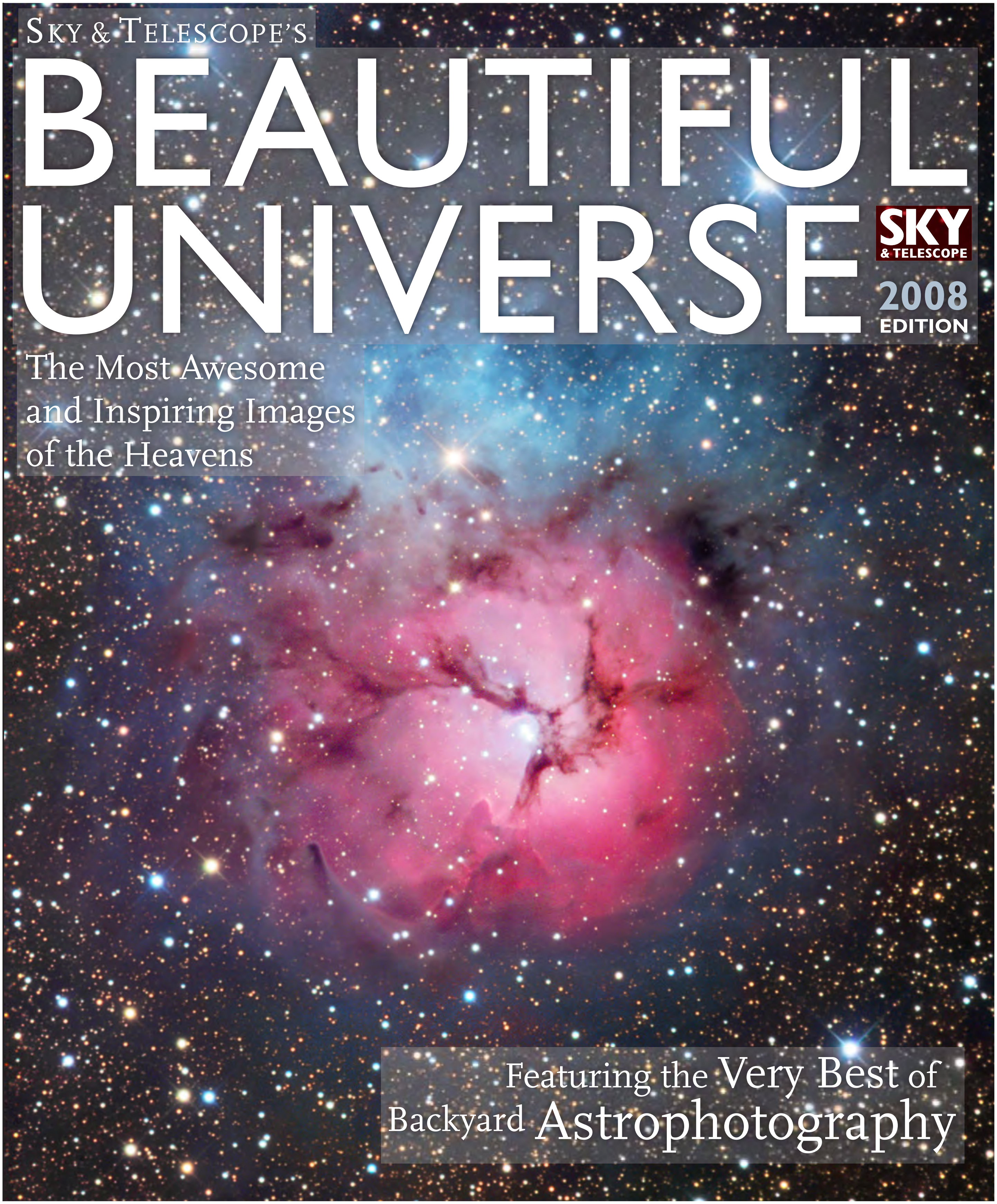

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