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The Strolling Astronomer

Founded in 1947

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Journal of the Association of Lunar & Planetary Observers

The Strolling Astronomer

Shawn Dilles, Editor

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

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

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http://www.alpo-astronomy.org

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Point of View:

My Journey to the ALPO

By Carl Hergenrother, executive director, the ALPO

As I'm sure many of you are aware, executive directors of the ALPO serve two-year terms. As the newest executive director, I have the honor of leading the ALPO into its 75th year.

So how did I end up here as executive director? I'm not sure why I became interested in astronomy, but it has been a passion of mine from a very early age. My dad probably had a lot to do with it. Not only was he an amateur astronomer in his youth, but our basement was full of books on astronomy and the space program. My earliest observing memory was my dad showing me Jupiter and Saturn through his 60mm refractor during the triple conjunction year of 1981.

My ALPO journey started in 1990 when I joined as a high school student interested in observing comets and planets. The next year saw me start my undergraduate studies at the University of Arizona. By the mid-1990s, I was observing professionally and spending 1-2 weeks per month at the telescopes. The downside of all this observing was I had less time and desire to engage in backyard observing. As a result, I let many of my memberships and subscriptions lapse, including to the ALPO.

A confluence of events brought back my enjoyment of backyard observing and the ALPO. For starters, a new day job as part of the OSIRIS-REx asteroid sample return mission curtailed my professional observing. That, and moving to progressively darker backyards, rekindled my interest in visual observing. After reading in the 2012 ALPO board meeting minutes that the Comets Section needed help, I offered to help. I guess I must have impressed, since that led to an invitation to join the ALPO Board of Directors.

Turning to the future, the ALPO's 75th anniversary year will be an exciting one. Recent months have seen the creation of a new provisional Exoplanet Section, our first observing section for planets located outside of our solar system. We are also soliciting member interest in the formation of a provisional Radio Astronomy Section which would greatly expand the observed wavelengths for objects such as the Sun, outer planets and meteors. The ALPO has an ever-growing presence across social media outlets such as Facebook, Twitter, YouTube and various podcast channels. A focus of the next year will be looking into a redesign of the ALPO web site and image galleries to make them more dynamic, easier to manage, better integrated with our other social media endeavors, and more supportive of the needs of our observing sections and members.

The future looks clear and bright (or dark for our faint object observers) as the ALPO begins its next 75 years.

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News of General Interest

Our Cover: The 20m Radio Telescope at the Green Bank Observatory

With the ALPO board of directors contemplating the formation of a radio astronomy section or program, we believe it is most fitting to show an instrument that *might* be in the future of some ALPO members.

When impressive facilities like the 20m radio telescope in West Virginia are made available for student and amateur remote use, it offers the potential to advance solar system observing among a wide amateur radio observing group on a prolonged and frequent basis. Observing through the 20m is something the ALPO can encourage among its membership.

The 20m radio telescope commenced operations in 1995, originally for the US Naval Observatory (USNO) as part of their Earth orientation observing programs: the small wobbling motions of the Earth's polar axis, irregularities in the Earth's rate of rotation, and for studies of continental drift and of atmospheric and oceanic currents. In 2008 it observed the radio emissions around the Cygnus X-1 black hole complex. In 2012, the 20m became part of the University of North Carolina's Skynet program for professional, student, and amateur use.

For more information on the telescope's history, its use, its specifications, and performance, go to *https://www.danreichart.com/radio* and *https://www.gb.nrao.edu/fgdocs/20m/GB20m.html*

Jupiter Takes Yet ANOTHER One

Did Jupiter just get smacked again? Amateur astronomer José Luis Pereira of Brazil just discovered a probable new impact at the gas giant on September 13th at around 22:39:30 UT (18:39:30 EDT). Weather conditions were poor at the time, but Pereira decided to search anyway for possible flashes with *DeTeCt* software. The free program, created by planetary observer Marc Delcroix, is a useful tool to check for transient events such as planetary impacts.

Despite poor conditions Pereira suspected something on his first video and ran DeTeCt to check it out. The program alerted him that there was a high probability that what he saw was indeed a collision. He immediately sent a message to Delcroix for confirmation.

If confirmed, it would be the ninth recorded impact at Jupiter since the first in July 1994, when fragments of sundered Comet Shoemaker-Levy 9 slammed into the planet and left a trail of prominent dark scars.

Jupiter rotates rapidly, coming round in just under 10 hours. To find a potential dark spot in the impact's wake, you'll need to know its latitude and longitude. But because the planet isn't a rigid body, its rotation rate varies some by latitude. Equatorial regions spin fastest and polar regions slower. That's why three systems are used to determine a feature's longitude: System I for locations within 10° of the equator (for the current flash), System II for all higher latitudes, and System III to match the rotation of the planet's magnetosphere and Jupiter's official rotation rate. Often, all three longitudes will be given for completeness.

Pereira captured the flash at latitude –5.5° and longitude 105.7° (System I / L1), 83.3° (System II / L2), and 273.4° (System III / L3). To determine the current or a future Jovian longitude in either system, use the Arkansas Sky Observatory's Jupiter Central Meridian site and input the desired UT time. Click here to convert your local time to UT.

(*Source*: *https://skyandtelescope.org/astronomy-news/amateur-spots-possible-new-impact-flash-at-jupiter/*)

ALPO 2021 Conference Update

The official minutes of the ALPO Board of Directors meeting which took place Friday, August 13, are included in this *Journal*.

ALPO Contact Changes

Staff Updates

Due to the elimination in the Lunar & Planetary Lab mail server at Arizona State University, the e-mail addresses for both the ALPO Meteorites Section

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Coordinator Dolores Hill and the ALPO Solar Section Coordinator Richard "Rik" Hill are now as follows:

- Dolores Hill — *dhill1@arizona.edu*
- Rik Hill — *rikhill@arizona.edu*

Other address changes are:

- Scientific Advisor: Alan W. Harris, 4603 Orange Knoll Ave, La Canada, CA 91011-3364; *harrisaw@att.net*
- Assistant Coordinator (Indexer, The Strolling Astronomer); Michael Mattei, 503 South Kelley Rd, P.O. Box 1566, Magdalena, NM 87825-6403; *micmatt@gilanet.com*
- Assistant Coordinator of the Luna Domes Studies Program Jim Phillips can NOW be reached ONLY at *thefamily90@hotmail.com*

Contact information and much more can be found in the *ALPO Resources* section later in this Journal.

General

E-mail addresses may come and go, phone numbers may get dropped and people may move from one location to another, but without informing key people and services of these changes, this creates a "failure to communicate" in providing/receiving those services.

Please inform the ALPO of changes in your contact information as soon as they occur. It takes only a few minutes via e-mail to do so and should be directed to the Membership Secretary, Matt Will at *matt.will@alpo-astronomy.org*.

This applies to both our membership and our volunteer staff.

Regular members who do not inform the ALPO membership secretary about e-mail address changes means missing out on announcements concerning the release of the next *Journal* and other important, time-sensitive news about your ALPO. Also, hard copy issues of our *Journal* may not necessarily be forwarded to you through your vacated, formal postal address.

Volunteer staff, should note that up-to-date contact information such as a current e-mail and postal addresses are crucial for members and observers seeking out staff for the first time for guidance in their programs. Secondary contact information such as phone numbers (which are NOT posted on the website or *Journal*) helps our managing staff in ensuring contact when e-mail won't suffice.

Please take the time to review your current contact information and check to see that the "ALPO Resources" pages in this *Journal* are correct, as well as on the ALPO website.

Hardcopy JALPO Issues Still Available

Please note that for those who still wish to add to their library of hardcopy ALPO Journals, we still have a healthy number of various issues left, some dating back to 1962. One oft overlooked thing about these early Journals is that they pre-date the age of satellite exploration of the Moon, the Sun, the planets and comets. Thus, the observing reports are full of the enthusiasm that comes with knowing that we were not competing with high tech gadgets already orbiting these celestial bodies.

And while the photos in those pages are crude when compared to the CCD and webcam images of today, the text captions that accompany them express how much work went into trying to squeeze out every little detail, no matter how grainy.

Please check the list of available issues in the back of this Journal to see what might suit your own interests.

Book Review Ideas Needed

Bob Garfinkle, our book review editor, states that it's been quite awhile that since he's received suggestions for an astronomy book review.

Surely there have been such books published over the past year or so. And it is Bob himself, who authored the highly prized three-volume "Luna Cognita" (available from Amazon at *https://www.amazon.com/Luna-Cognita-Comprehensive-Observers-Handbook/dp/1493916637*).

Bob can be reached via e-mail at *ragarf@earthlink.net*

Call for JALPO Papers

The ALPO encourages its members to submit written works (with images, if possible) for publication in this Journal.

As with other peer-reviewed publications, all papers will be forwarded to the appropriate observing section or interest section coordinator.

Thus, the best method is to send them directly to the coordinator of the ALPO section which handles your topic.

A complete list of ALPO section coordinators and their contact information can be found in the *ALPO Resources* section of this Journal.

In Memoriam -- Carolyn Shoemaker

The entire astronomy community mourns the passing of the late Carol

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Shoemaker. A writeup about Carol is included in this issue of the Journal.

ALPO Interest Section Reports

ALPO Online Section

Report by Jim Tomney, acting assistant section coordinator
jim@tomney.com

The ALPO website (http://alpo-astronomy.org) was up and available for the for the second quarter of 2021 (April - June) with no reported issues. During that time, approximately 40,000 visits were made to the website, up slightly from the prior quarter (37,000). The most frequently accessed parts of the site were once again Solar, Lunar, Comets and Meteor landing pages.

We continue to work at removing stale links and content from the site. During this quarter we removed the e-mail group information for sections that still referenced the now defunct Yahoo Groups. Section coordinators may want to emulate the Jupiter, Mars and Solar sections in switching over to the Groups.IO platform if they want a suitable replacement. If any help is needed in setting it up, feel free to contact me for assistance.

Section coordinators should also let us know of any corrections or changes needed for their portion of the website. If any section coordinator needs an ID for your section's blog, contact Larry Owens at Larry.Owens@alpo-astronomy.org.

As you might expect, the ALPO website gets visits from across the globe. What you may find interesting, however, is the rankings of those countries in terms of site visits.

We encourage everyone to continue to submit their observations for inclusion in the ALPO gallery by sending them to the appropriate e-mail address listed on the website's Gallery Submission Guidelines page (http://www.alpo-astronomy.org/alpo/?page_id=952). A crucial aspect of the guideline is for the file name to contain the UT date and time of the observation, since it is cumbersome and error-prone to locate that value by examining the image.

If you'd like to offer any comments or feedback about the site please reach out to the ALPO Online Section coordinators using the contact information found at http://www.alpo-astronomy.org/alpo/?page_id=179.

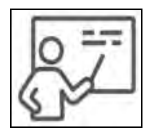
Follow us on Twitter, "friend" us on FaceBook or join us on MySpace.

Rank	APR	MAY	JUN
1	United States	United States	United States
2	Russian Federation	Greece	Russian Federation
3	France	Russian Federation	Great Britain
4	Canada	Iran	France
5	China	India	Thailand
6	Germany	Ukraine	South Korea
7	Brazil	Germany	Sweden
8	Great Britain	Great Britain	Brazil
9	Czech Republic	France	China
10	Spain	Canada	Netherlands

Outreach Section

Lunar & Planetary Training Program

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



The ALPO Training Program currently has four active students at various stages of the program.

The ALPO Lunar & Planetary Training Program is a two-step program, and there is no time requirement for completing the steps. I have seen that those students who are motivated usually complete the steps in a short amount of time. The motivation comes from the desire to improve their observing skills and contribute to the pages of the Journal of the ALPO.

This program is open to all members of the ALPO, beginner as well as the expert observer. The goal is to help make members proficient observers. The ALPO revolves around the submission of astronomical observations of members for the purposes of scientific research. Therefore, it is the responsibility of our organization to guide prospective contributors toward a productive and meaningful scientific observation.

The course of instruction for the Training Program is two-tiered:

- The first tier is the "Basic Level" and includes reading the *ALPO Novice Observers Handbook* and mastering the fundamentals of observing.

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These fundamentals include performing simple calculations and understanding observing techniques.

- When the student has successfully demonstrated these skills, he or she can advance to the "Novice Level" for further training where one can specialize in one or more areas of study. This includes obtaining and reading handbooks for specific lunar and planetary subjects. The novice then continues to learn and refine upon observing techniques specific to his or her area of study and is assigned to a tutor to monitor the novice's progress in the Novice Level of the program.

When the novice has mastered this final phase of the program, that person can then be certified to "Observer Status" for that particular field.

For more information on the ALPO Training Program, contact Tim Robertson at 195 Tierra Rejada Rd #148, Simi Valley CA, 93065; e-mail to cometman@cometman.net

YouTube & 'Observers Notebook' Podcasts

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

The Observers Notebook podcast continues to go strong with over 130 podcasts recorded with various members of the ALPO, mostly section coordinators to highlight the programs within each section. The length of a typical podcast averages around 30 minutes. The longest podcast thus far is over 1 hour and 30 minutes. We can record longer, since there is no time limit – our hosting service has unlimited space available for podcasts.

It takes a great amount of time and money to make and produce the podcast, and thus far, it has been done with the help of service called "Patreon." We currently have 11 supporters – two of whom are NOT even members of the ALPO!

We have two generous Patreon supporters who each donate $35 a month to the podcast, and are, thus, producers of the podcast and who also receive one-year membership to the ALPO! Thanks to Steve Siedentop and Michael Moyer for their generous

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support of the Observers Notebook podcasts.

You, too, can support the podcast by giving as little as $1 a month; for $5 you receive early access to the podcast before it goes public, for a monthly donation $10, you receive a copy of the *Novice Observers Handbook*, and for $35 a month, you receive producer credits on the podcast plus a year's membership to the ALPO. You can help us out by going to the link below:

https://www.patreon.com/ObserversNotebook

Podcasts are released around the 1st and 15th of every month, and if you subscribe to it via iTunes, it will automatically be downloaded to your device.

Our podcasts are also used to get the word out on any breaking astronomy news or events happening in the night sky. Therefore, let me know if you have any breaking news that you want out announced.

If you have a topic that you want covered in the podcast, please drop me a note; I am also looking for member profile pieces where we get to know the members of the ALPO.

Here are a few Observer's Notebook statistics you might be interested in:

- Number of downloads as of July 6, 2021: 52,000+
- Number of subscribers (all formats): 290+
- Average of number daily downloads (last month): 100
- iTunes rating: 5 Stars!
- Locations of most downloads: USA, UK, Canada and Australia.

Check out some of our latest podcasts:

- Episode 120: Lunar Topographical Studies Program Coordinator David Teske.
- Episode 122: Meteors Section Coordinator Bob Lunsford and the Perseids meteor shower.
- Episode 123: Saturn Section Coordinator Julius Benton.
- Episode 124: Jupiter Section Coordinator Richard Schmude.
- Episode 125: President of Meade Instruments and Orion Telescopes Peter Moreo, regarding the recent merger of the two companies.
- Episode 126: Acting Assistant Coordinator of the Lunar Topographical Studies Program Alberto Anunziato of Argentina in a prerecorded talk from the recent ALPO conference discusses amateur studies of Lunar Wrinkle Ridges.

You can hear the podcast on iTunes, Stitcher, iHeart Radio, Amazon Echo, and Google Play. Just search for Observers Notebook, or you can listen to it at the link below:

https://soundcloud.com/observersnotebook

The Observers Notebook is also on Facebook:

https://www.facebook.com/groups/ObserversNotebook/

Remember that the ALPO also has a *YouTube* channel continues to include instructional videos, lectures. We used it to livestream the ALPO 2020 Conference held last fall. Check it out and subscribe to the channel!

https://www.youtube.com/channel/UCEmixiL-d5k2Fx27Ijfk41A?

December 2020 was an interesting month for the *Observers Notebook* podcast. On 4 December, I posted an image on our Facebook page of the progression of the planetary conjunction between Jupiter and Saturn. On that date, the *Observers Notebook* Facebook page had just 110 members. That one image, however, was shared over 3,000 times, with over 237,000 people seeing the post.

Thanks for listening! For more information about the ALPO Lunar & Planetary Training Program or the *Observers Notebook* podcasts, contact Tim Robertson at195 Tierra Rejada Rd #148, Simi Valley CA, 93065; e-mail to cometman@cometman.net

Youth Activities Program

Report by Pamela Shivak, program coordinator
pamelashivak@yahoo.com

I'm happy to report that number of contributors to the ALPO Youth Programs Facebook group continues to grow! Many Space and STEM contributors post and share the resources found on the group page.

Public outreach activities are slowly opening up domestically as well as internationally, but we still have a long way to go.

What's nice about some of the ideas shared on the Facebook group is that many of them can be done virtually, for instance, astronomy related conferences, space launches, planetarium shows and STEM-related opportunities.

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I'm grateful to Tim Robertson for doing a live Zoom/YouTube session for International SUNday which was a HUGE success!

As always, I welcome everyone to join, contribute, and take ideas you find on the group back to your local organizations.

The goal of ALPO's Youth Activities Program is to encourage children and young adults alike to take an interest in astronomy, space, STEM and outreach. We plan to achieve this goal by forming an alliance with astronomy clubs, and other STEM and educational entities. It is our hope that with an ardent and ongoing effort formed with these organizations we can come up with fun and creative ways to get youths involved with any or all aspects of space and science while educating them in the process.

With your help and contributions, I feel we can achieve this goal as the ALPO Youth Program continues to grow with the support, cooperation and commitment of others.

Visit us at *https://www.facebook.com/groups/ALPOYOUTHPROGRAM/*

Publications Section

Report by Ken Poshedly, section coordinator
ken.poshedly@alpo-astronomy.org

All are reminded that the entire library (except for the most recent year) of *The Strolling Astronomer* is available online at the ALPO web site.

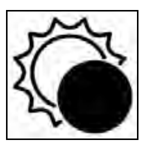
Go to alpo-astronomy.org, then click on the “ALPO Section Galleries” link near the top-right corner of the screen. Next, click on “Publications Section”, then “ALPO Journals”, then click on the desired JALPO volume and issue within that volume.

Note that the most recent issues of the Journal are distributed to only dues-paying ALPO members and are not included on the ALPO web site.

ALPO Observing Section Reports

Eclipse Section

Report by Keith Spring, section coordinator
star.man13@hotmail.com



On Thursday June 10, 2021, the great majority of Europe and some of the northeastern United States experienced the partial section of an annular solar eclipse that crossed over the North Pole (Figure 1).

The next chance to view a solar eclipse will be at the South Pole on December 4, 2021. The duration is expected to be 1 minute, 54 seconds. So, be ready to travel from the "top" of the world to the "bottom"!

As the coordinator of the ALPO Eclipse Section, I would like to personally thank Anthony and Michael Amato, David Tyler, Mário Abade and Paul Andrew for submitting these extraordinary images! The Eclipse Section is still accepting submissions from this event for archival.

For consideration of publication in the next Eclipse Section report in this ALPO Journal, be sure to send your observation reports as soon as possible via e-mail to *eclipse@alpo-astronomy.org* or via regular mail to Keith Spring, 2173 John Hart Circle, Orange Park, FL 32073.

Visit the ALPO Eclipse Section online at *www.alpo-astronomy.org/eclipseblog*

Mercury / Venus Transit Section

Report by Keith Spring, section coordinator
star.man13@hotmail.com

Past Transits

This section is still accepting reports for the November 11, 2019 Mercury Transit for archival. Please send your reports via *eclipse@alpo-astronomy.org* or regular mail to the contact information in the *ALPO Resources* section of this Journal.

Future Mercury Transits

- November 12-13, 2032 - Visible from Europe, much of Asia, Australia, Africa, South/some coastal areas of East North America, South America, Pacific, Atlantic, Indian Ocean and Antarctica.
- November 6-7, 2039 - Europe, much of Asia, Australia, Africa, much of South America, Pacific, Atlantic, Indian Ocean and Antarctica.
- May 7-8, 2049 - Europe, Asia, Africa, North America, South America, Pacific, Atlantic, Indian Ocean, Arctic, Antarctica.

Future Venus Transits

- December 10-11, 2117
- December 8, 2125

Please send your reports via e-mail to *eclipse@alpo-astronomy.org* or regular mail to Keith Spring, 2173 John Hart Circle, Orange Park, FL 32073.

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Visit the ALPO Mercury/Venus Transit Section online at www.alpo-astronomy.org/transit

Meteors Section

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

Autumn is usually the best time of the year for meteor observing from the Northern Hemisphere. And of course, the Moon has a lot to say about that. Unfortunately, the Full Moon will spoil both of the Leonid and Orionid peaks this year and will also hamper those who try viewing the Geminids.

This would be the perfect chance to acquaint yourself with the numerous minor meteor showers that are active this time of year. Take the sigma Hydrids, for instance, which peaks on December 7, and will have no lunar interference and is forecast to produce 3 to 5 swift meteors from the head of constellation Hydra. While that rate does not sound impressive, combine it with a dozen random meteors and activity from the other minor showers active this time of year and it can provide you with an enjoyable viewing session!

For your planning purposes, here is a list of those meteor showers for this quarter (Source: American Meteor Society, https://www.amsmeteors.org/meteor-showers/meteor-shower-calendar/):

- Orionids, active October 3 to November 12, 2021, peaking on October 20-21, 2021, with a 100 percent Full Moon. Shower details - Radiant: 6:19 +15.6° - ZHR: 20 - Velocity: 41 miles/sec (fast - 66km/sec) - Parent Object: 1P/Halley.
- Southern Taurids, active September 28 to December 2, 2021, peaking on November 4-5, 2021, with a 0 percent New Moon. Shower details - Radiant: 3:35 +14.4° - ZHR: 5 - Velocity: 17 miles/sec (slow - 28km/sec) - Parent Object: 2P/Encke.
- Northern Taurids, active October 13 to December 2, 2021, peaking on November 11-12, 2021, with a 55 percent waxing First Quarter Moon. Shower details - Radiant: 3:55 +22.8° - ZHR: 5 - Velocity: 17 miles/sec (slow - 28km/sec) - Parent Object: 2P/Encke.
- Leonids, active November 3 to December 2, 2021, peaking on November 17-18, 2021, with a 99 percent waxing Full Moon. Shower details - Radiant: 10:17 +21.6° - ZHR: 10 - Velocity: 43 miles/sec (fast - 70km/sec) - Parent Object: 55P/Tempel-Tuttle.
- Geminids, active November 19 to December 24, 2021, peaking on November 13-14, 2021, with a 78 percent waxing Gibbous Moon. Shower details - Radiant: 7:34 +32.3° - ZHR: 150 - Velocity: 21 miles/sec (medium - 34km/sec) - Parent Object: 3200 Phaethon (asteroid).
- Ursids, active December 13 to December 24, 2021, peaking on December 21-22, 2021, with a 93 percent waning Gibbous Moon. Shower details - Radiant: 14:36 +75.3° - ZHR: 10 - Velocity: 21 miles/sec (medium - 33km/sec) - Parent Object: 8P/Tuttle.
- Quadrantids, active December 26, 2021 to January 16, 2022, peaking on January 3-4, 2022, with a 4 percent waxing Crescent Moon. Shower details - Radiant: 15:20 +49.7° - ZHR: 110 - Velocity: 25 miles/sec (medium - 40km/sec) - Parent Object: 2003 EH (Asteroid)

Visit the ALPO Meteors Section online at www.alpo-astronomy.org/meteorblog/ Be sure to click on the link to viewing meteors, meteor shower calendar and references.

Meteorites Section

Report by Dolores H. Hill, section coordinator
dhill@lpl.arizona.edu

This report of the ALPO Meteorites Section summarizes new meteorite approvals and revisions from April 17, 2021 through July 4, 2021 from the Meteoritical Society's Nomenclature Committee.

In addition, ALPO members Gregory Shanos and Dolores Hill conferred regarding inquiries about several groups of suspected meteorites (unfortunately they turned out to be "meteorwrongs") and future ideas for the Section.

As of July 4, 2021, the *Meteoritical Bulletin* recognizes a total of 65,753 officially named meteorites. Among the 241 newly approved meteorites for this period are five meteorite falls of several classifications. One noteworthy "old" fall is the Motopi Pan Howardite from Botswana that fell on June 2, 2018. Richard Kowalski of the University of Arizona Lunar and Planetary Laboratory's Catalina Sky Survey observed the parent body, *approaching asteroid* 2018 LA, 8 hours before impact.

The *Bulletin* refined the classification for the Akwanga (Nigeria) H5 chondrite that fell in 1959. The Indonesia Tsunami Early Warning System recorded the sonic

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boom from the Punggur H7-melt fall on January 28, 2021 and the Winchcombe (England) CM2 was caught a month later by the UK Fireball Alliance on Feb. 28, 2021. The latter is a very friable meteorite lending credence to the idea that carbonaceous meteorite falls might be more common than the find statistics suggest because they do not survive initial impact and/or subsequent weathering. Lastly, the Djadjarm L6 fell Nov. 4, 2020 in Iran.

Newly approved meteorites include 135 ordinary chondrites (56 H, 62 L, 15 LL, 2 L-melt rocks), 1 EL, 2 acapulcoites; 4 achondrites-ungrouped; 2 aubrites; 24 carbonaceous chondrites (2 C3-ungr, 6 CK, 1 CM2, 4 CO, 8 CV3; 2 CR2; 1 R chondrite); 7 mesosiderites; 2 irons; 27 HEDs (4 Howardites, 16 Eucrites, 7 Diogenites); 5 ureilites; 3 Winonaites; 20 Lunar; 9 Martian.

More information and official details on particular meteorites can be found at: https://www.lpi.usra.edu/meteor/metbull.php

Visit the ALPO Meteorites Section online at www.alpo-astronomy.org/meteorite/ for a very detailed explanation of all facets of meteorite studies.

Comets Section

Report by Carl Hergenrother, section coordinator
carl.hergenrother@alpo-astronomy.org

The final months of 2021 may see as many as eight comets brighter than magnitude 12, though not all may be visible, depending on your latitude. Among the brighter objects are short-period comets 8P/Tuttle (magnitude 8.6), 19P/Borrelly (magnitude 9.3), 67P/Churyumov-Gerasimenko (magnitude 8.9) and long-period C/2021 A1 (Leonard) (magnitude 3 to 6, see more below).

- 4P/Faye - French astronomer Herve Faye visually discovered 4P in November 1843 at the Royal Observatory in Paris, during an abnormally bright apparition when the comet reached 5-6th magnitude. Since then, the comet usually becomes no brighter than 9-10th magnitude as it did in 1991 and again 2006. This year marks the comet's 22nd observed return and is a moderately good one, with perihelion on September 8 at 1.62 au and closest approach to Earth on December 5 at 0.94 au. The comet will be at its brightest (magnitude 10.3) as October begins and should steadily fade to 12th magnitude by the end of the year. Both northern and southern observers will be able to follow Faye as it moves through

Founded in 1947

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Table of Ephemerides for Comets 4P/Faye, 6P/d'Arrest, 8P/Tuttle, 19P Borrelly, 67P/Churyumov-Gerasimenko, 104P Kowal, C/2019 L3 (ATLAS) and C/2021 A1 (Leonard)

Date	R.A.	Decl.	r (au)	d (au)	Elong (deg)	Mag	Const	Max El 40N	Max El 40S
4P/Faye									
2021-Oct-01	06 00.5	+16 14	1.634	1.166	97M	10.3	Ori	63	31
2021-Oct-11	06 19.3	+14 51	1.651	1.113	102M	10.4	Ori	64	32
2021-Oct-21	06 34.6	+13 18	1.674	1.064	108M	10.4	Gem	63	34
2021-Oct-31	06 46.1	+11 44	1.702	1.020	115M	10.6	Mon	62	36
2021-Nov-10	06 53.3	+10 14	1.736	0.983	123M	10.7	Mon	60	39
2021-Nov-20	06 56.1	+08 55	1.774	0.955	131M	10.9	Mon	59	41
2021-Nov-30	06 54.6	+07 54	1.816	0.939	141M	11.2	Mon	58	42
2021-Dec-10	06 49.6	+07 16	1.862	0.939	150M	11.5	Mon	57	43
2021-Dec-20	06 42.2	+07 05	1.911	0.958	159M	11.9	Mon	57	43
2021-Dec-30	06 34.0	+07 19	1.963	0.998	164M	12.3	Mon	57	43
6P/d'Arrest									
2021-Oct-01	18 43.7	-27 26	1.363	0.892	91E	10.6	Sgr	21	68
2021-Oct-11	19 21.8	-30 00	1.381	0.951	90E	10.2	Sgr	19	67
2021-Oct-21	20 01.2	-31 27	1.408	1.022	88E	10.0	Sgr	18	65
2021-Oct-31	20 40.5	-31 47	1.443	1.103	86E	9.8	Mic	18	62
2021-Nov-10	21 18.4	-31 10	1.485	1.196	85E	9.9	Mic	19	58
2021-Nov-20	21 54.0	-29 46	1.533	1.298	83E	10.0	PsA	20	54
2021-Nov-30	22 26.9	-27 47	1.587	1.411	80E	10.3	PsA	22	48
2021-Dec-10	22 57.4	-25 24	1.645	1.532	78E	10.7	PsA	24	43
2021-Dec-20	23 25.4	-22 46	1.707	1.662	75E	11.3	Aqr	27	38
2021-Dec-30	23 51.4	-20 01	1.772	1.799	72E	11.9	Aqr	29	33
8P/Tuttle									
2021-Oct-01	10 36.0	-21 40	1.150	1.852	33M	8.6	Hya	0	15
2021-Oct-11	11 11.7	-28 35	1.224	1.910	34M	9.0	Hya	0	16
2021-Oct-21	11 48.3	-34 35	1.308	1.986	35M	9.5	Hya	0	17
2021-Oct-31	12 25.6	-39 35	1.399	2.076	35M	10.1	Cen	0	18
2021-Nov-10	13 03.0	-43 36	1.495	2.174	36M	10.7	Cen	0	18
2021-Nov-20	13 40.0	-46 46	1.595	2.274	36M	11.4	Cen	0	19
2021-Nov-30	14 15.9	-49 09	1.697	2.371	37M	12.1	Cen	0	19
2021-Dec-10	14 50.2	-50 56	1.800	2.462	38M	12.7	Lup	0	20
2021-Dec-20	15 22.3	-52 12	1.903	2.542	40M	13.4	Lup	0	22
2021-Dec-30	15 52.0	-53 07	2.006	2.610	42M	13.9	Nor	0	25

the morning constellations of Orion, Gemini and Monoceros. CCD observers should be on the lookout for a long dust trail as was seen at previous apparitions, especially when the Earth crosses the comet's orbital plane in early October.

- 6P/d'Arrest - Heinrich Louis d'Arrest discovered 6P/d'Arrest visually in June 1851 at the Leipzig Observatory in Germany, though we now know that it was previously observed by French astronomer Phillipe la Hire in 1678. Long-time comet watchers may remember this comet's excellent apparition in 1976 when it passed 0.15 au from Earth and reached 5th magnitude. d'Arrest's perihelion is larger now at 1.35 au so such close approaches are currently not possible. This year perihelion was on September 17 at 1.35 au and closest approach to Earth on August 2 at 0.75 au. Most comets fade as they move away from the Sun and Earth, but d'Arrest experiences a seasonal effect resulting in a peak brightness up to 60 days after perihelion. As a result, a maximum brightness around magnitude 9.8 should occur in the late October early November time frame. d'Arrest is an evening object during the last three months of 2021 and will be visible from all latitudes.
- 8P/Tuttle - In January 1790, Pierre François André Méchain of Paris, France, made the first discovery of 8P/Tuttle. Its namesake, Horace Parnell Tuttle, re-discovered the comet five orbits or 68 years later in January 1858 at the Harvard College Observatory, Cambridge, Massachusetts, USA. With a 13.6-year period, 8P/Tuttle is making its 13th observed return having been missed in 1953 and at the four

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19P/Borrelly									
2021-Oct-01	23 29.0	-58 49	1.910	1.235	116E	13.0	Tuc	0	71
2021-Oct-11	23 15.8	-57 42	1.837	1.216	111E	12.5	Tuc	0	72
2021-Oct-21	23 07.2	-55 31	1.765	1.203	106E	12.1	Gru	0	75
2021-Oct-31	23 04.2	-52 26	1.696	1.194	101E	11.6	Gru	0	78
2021-Nov-10	23 06.8	-48 32	1.629	1.186	96E	11.2	Gru	2	79
2021-Nov-20	23 14.1	-43 55	1.565	1.180	91E	10.7	Gru	6	73
2021-Nov-30	23 25.2	-38 40	1.506	1.176	87E	10.3	Gru	11	64
2021-Dec-10	23 39.3	-32 49	1.453	1.173	84E	9.9	Scl	17	54
2021-Dec-20	23 55.8	-26 27	1.406	1.175	80E	9.5	Scl	24	45
2021-Dec-30	00 14.2	-19 38	1.366	1.181	77E	9.3	Cet	30	37
67P/Churyumov-Gerasimenko									
2021-Oct-01	04 59.9	+21 28	1.274	0.500	111M	10.4	Tau	72	28
2021-Oct-11	05 45.4	+23 41	1.241	0.462	110M	10.0	Tau	74	25
2021-Oct-21	06 31.3	+25 16	1.219	0.437	110M	9.6	Gem	75	23
2021-Oct-31	07 14.5	+26 11	1.210	0.424	110M	9.3	Gem	76	21
2021-Nov-10	07 52.3	+26 36	1.214	0.420	112M	9.1	Gem	77	19
2021-Nov-20	08 22.7	+26 45	1.231	0.421	115M	8.9	Cnc	77	19
2021-Nov-30	08 45.0	+26 53	1.260	0.427	120M	8.9	Cnc	77	19
2021-Dec-10	08 58.6	+27 12	1.300	0.437	127M	8.9	Cnc	77	20
2021-Dec-20	09 03.8	+27 43	1.349	0.452	136M	9.0	Cnc	78	22
2021-Dec-30	09 01.8	+28 19	1.406	0.476	146M	9.2	Cnc	78	22
104P/Kowal									
2021-Oct-01	21 50.4	-05 11	1.670	0.776	139E	14.7	Aqr	45	55
2021-Oct-11	21 43.8	-06 55	1.585	0.762	127E	14.2	Aqr	43	57
2021-Oct-21	21 42.2	-08 23	1.502	0.757	117E	13.7	Cap	42	58
2021-Oct-31	21 46.1	-09 27	1.421	0.755	108E	13.2	Cap	41	56
2021-Nov-10	21 55.6	-10 04	1.344	0.753	100E	12.8	Cap	40	51
2021-Nov-20	22 10.4	-10 13	1.272	0.746	93E	12.3	Aqr	40	45
2021-Nov-30	22 30.3	-09 52	1.208	0.735	87E	11.8	Aqr	40	38
2021-Dec-10	22 55.1	-09 00	1.153	0.717	83E	11.3	Aqr	41	32
2021-Dec-20	23 24.7	-07 36	1.111	0.695	80E	10.9	Aqr	42	28
2021-Dec-30	23 59.1	-05 38	1.083	0.670	79E	10.6	Psc	43	25

Tuttle's best return was in 2008 when it passed 0.25 au from Earth and brightened to 5th magnitude. The current return is a poor one and invisible to northern observers. This year saw perihelion on August 27 at 1.03 au with a closest approach to Earth on September 12 at 1.81 au. Southern observers will be able to follow Tuttle in the morning sky as it fades from around magnitude 8.6 on October 1 to ~14 at the end of December. Its next return in 2048 will be much better with a close approach to Earth of 0.17 au resulting in a peak brightness of 4-5th magnitude.

- 19P/Borrelly - Alphonse Louis Nicolas Borrelly found 19P during a routine search for comets at Marseilles, France, on 1904 December 28; it was one of 10 finds he made during his visual comet hunting career. The current apparition is Borrelly's 16th observed return. Its best returns were in 1911, 1918 and 1987 when it passed between 0.48-0.50 au from Earth and reached 7th magnitude. Its next return in 2028 will be even better with a close approach to Earth of 0.41 au. The current return isn't quite as good, with perihelion on 2022 February 1 at 1.31 au and minimum from Earth on December 11 at 1.17 au. The last three months of 2021 will see Borrelly brighten from magnitude 13 to 9.3 on its way to a peak of 8.9 in January. While well placed for southern observers through the end of 2021, northern observers will have to wait till November as Borrelly races northward through Tucana, Grus, Sculptor, and Cetus. In 2001, NASA's Deep Space 1 spacecraft flew past Borrelly revealing a dark 8-km long bowling pin-shaped nucleus.

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C/2019 L3 (ATLAS)									
2021-Oct-01	07 30.0	+43 07	3.671	3.692	80M	11.1	Aur	63	0
2021-Oct-11	07 37.6	+42 18	3.649	3.533	88M	10.9	Lyn	71	1
2021-Oct-21	07 43.3	+41 27	3.630	3.374	96M	10.8	Lyn	79	3
2021-Oct-31	07 46.4	+40 35	3.612	3.218	105M	10.6	Lyn	88	5
2021-Nov-10	07 47.1	+39 41	3.597	3.069	114M	10.5	Lyn	90	7
2021-Nov-20	07 45.2	+38 43	3.584	2.931	124M	10.4	Lyn	89	10
2021-Nov-30	07 40.7	+37 38	3.574	2.809	134M	10.3	Lyn	88	12
2021-Dec-10	07 33.7	+36 23	3.565	2.708	145M	10.2	Lyn	86	14
2021-Dec-20	07 24.8	+34 57	3.559	2.634	156M	10.1	Gem	85	15
2021-Dec-30	07 14.7	+33 18	3.555	2.591	166M	10.0	Gem	83	17
C/2021 A1 (Leonard)									
2021-Oct-01	11 18.6	+37 44	1.858	2.445	43M	14.3	UMa	21	0
2021-Oct-11	11 27.9	+36 42	1.710	2.187	49M	13.8	UMa	27	0
2021-Oct-21	11 38.1	+35 47	1.560	1.904	54M	13.2	UMa	34	0
2021-Oct-31	11 49.9	+34 58	1.407	1.597	60M	12.4	UMa	40	0
2021-Nov-10	12 04.7	+34 11	1.252	1.267	66M	11.6	UMa	46	0
2021-Nov-20	12 27.1	+33 10	1.098	0.918	70M	10.4	CVn	51	0
2021-Nov-30	13 13.5	+30 33	0.946	0.558	69M	8.9	Com	50	0
2021-Dec-10	15 49.3	+12 10	0.805	0.257	39M	6.6	Ser	15	0
2021-Dec-20	20 14.0	-29 06	0.689	0.387	32E	7.0	Sgr	3	7
2021-Dec-30	21 28.6	-35 02	0.622	0.757	39E	8.1	PsA	2	16

- 67P/Churyumov-Gerasimenko - 67P was discovered in September 1969 by Kiev University Astronomical Observatory astronomers Klim Ivanovic Churyumov and Svetlana Ivanovna Gerasimenko working with a 50-cm Maksutov astrograph at the Alma-Ata Astrophysical Institute in current-day Kazakhstan. This apparition is 67P's 9th observed return with perihelion occurring on 2021 November 2 at 1.21 au. A close approach to Earth at 0.42 au on November 12 results in the comet's best return since 1982 when it came marginally closer to Earth at 0.39 au. At that return, a peak brightness of 9th magnitude was reached. A similar brightness should occur this November and December when it will be a morning object visible from both hemispheres. Like 19P, 67P was also the target of a spacecraft mission. The ESA Rosetta and Philae crafts are the only spacecraft to have orbited and landed on a comet. This will be 67P's first return since Rosetta ended its mission by soft landing onto the comet's surface.

- 104P/Kowal - This comet's observability is a bit of question mark. Not only is it outburst-prone but its brightness has been variable from return to return. The first observation of 104P was by visual comet hunter Leo Boethin of the Philippines on 1973 January 11. Though Boethin first saw the comet at magnitude 9.5, it quickly faded after only a few days, probably due to a recent outburst. By the time his report was received at the Minor Planet Center in Massachusetts, the comet was lost. An orbit later on 1979 January 27, 28 and 29, Charles T. Kowal imaged the comet as a faint 17th magnitude object on photographic plates taken with the 1.2-m Schmidt on Mount Palomar. The link between the 1973 and 1979 comets was made in 2003 by former ALPO Comets Section Coordinator Gary Kronk. Kowal comes to perihelion on 2022 January 11 at 1.07 au and closest to Earth on January 28 at 0.64 au. Observers at all latitudes will be able to monitor 104P in the evening sky. How bright it will become is uncertain, but it could be as bright as magnitude 10 by the end of the year.

- C/2019 L3 (ATLAS) - C/2019 L3 is a large perihelion long-period comet with the next perihelion on 2022 January 9 at 3.57 au. The large perihelion distance means C/2019 L3 could remain a visual object well into 2022. Comet ATLAS should start October around magnitude 11.1 and brighten to magnitude 10.0 by the end of December. It is well-placed for northern observers in the morning to opposition sky. It will be low for southern observers, but becomes better placed as the year ends.

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- C/2021 A1 (Leonard) - C/2021 A1 (Leonard) was discovered on 2021 January 3 by Greg Leonard with the 1.5-m reflector at the Mount Lemmon Observatory in Arizona, USA. At discovery, it was around 19th magnitude and located 5.1 au from the Sun. C/2021 A1 has the potential to become a nice object at the end of the year. In its "plus" column, it has a relatively small perihelion of 0.62 au on 2022 January 3, a close approach to within 0.233 au from Earth on December 12, and a phase angle that reaches a maximum of 160 degrees on December 14. The high phase angle may result in 2-3 magnitudes of enhanced brightness due to forward scattering of light by cometary dust. Working against it will be a small solar elongation at the time of maximum brightness (a minimum elongation of 15 deg). Also in the minus column is the comet's slow rate of brightening. The comet has been brightening at a rate of 2.5n ~ 7.6. Extrapolating that into the future produces a peak brightness of magnitude 6.3 in mid-December. Dust forward scattering may increase its peak brightness to magnitude 3 or 4; even then, Leonard may be a difficult object to observe so close to the Sun. Before then, northern observers will have a clear view of the comet as it dives closer to the Sun in late November and December in the morning sky. Southern observers should be able to pick up the comet in the evening after mid-December.

As always, the Comet Section is happy to receive all comet observations, whether images, drawings, magnitude estimates, and even spectra. Please send your observations via e-mail to carl.hergenrother@alpo-astronomy.org

Drawings and images of current and past comets are being archived in the ALPO Comets Section image gallery at http://www.alpo-astronomy.org/gallery/main.php?g2_itemId=4491

Visit the ALPO Comets Section online at www.alpo-astronomy.org/comet

Solar Section

Report by Rik Hill, section coordinator & scientific advisor
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A report on Carrington Rotations 2238 thru 2241 appears later in this Journal.

Solar activity is rising, but apart from the anomalous CR 2237-38 spike (late November thru early December 2020) and several good-sized flares in recent weeks, it is still on the lower predicted rise track. (**see accompanying plot**).

The plot shows the two predicted rises to the next maximum and we are pretty clearly on the lower one. NASA announced in June that this is now predicted to be the weakest solar maximum in 200 years. Even so, the observers in the ALPO Solar Section continue to monitor and record the slowly rising activity.

Section staffing remains stable and functional during this period of low activity. Assistant Coordinator Kim Hay does the individual Carrington Rotation Reports which are posted on the website and are helpful in the preparation of activity reports. Assistant Coordinator Pam Shivak is active with the Facebook Solar Activity page and the Picture of the Day there.

If you are interested in solar observing, don't think your telescope is inadequate or your work is not up to par. We can help you get the most out of what you have be it a 40mm PST or the ubiquitous 2.4" refractor. Just contact this coordinator at the address that immediately precedes this report

For information on solar observing – including the various observing forms and information on completing them – go to www.alpo-astronomy.org/solar

Mercury Section

Report by Frank J. Melillo, section coordinator
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I am hoping all of you enjoyed your summer. Now we're heading into the fall season! Mercury displayed a fine evening appearance in May while Venus was on the rise. This observing section received at least some observations, including mine. I observed and took some images of Mercury in the evening, I always prefer the morning apparition where I find the air much more stable. I simply cannot get higher quality images in the evening like I do in the morning. Many observers agree.

I must say that there is a new aspect to imaging Mercury that amateurs have recently discovered. Back in the 1990s, some planetary scientists were suspicious that Mercury might have a super thin atmosphere. Pick up any astronomy book and turn to a chapter on Mercury and you might read that it has no atmosphere, but this is about to change.

The MESSENGER probe confirmed that Mercury has an exosphere which includes sodium molecules. And while it's

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not really an atmosphere as we know it, those molecules are far apart and they're scattered above the surface.

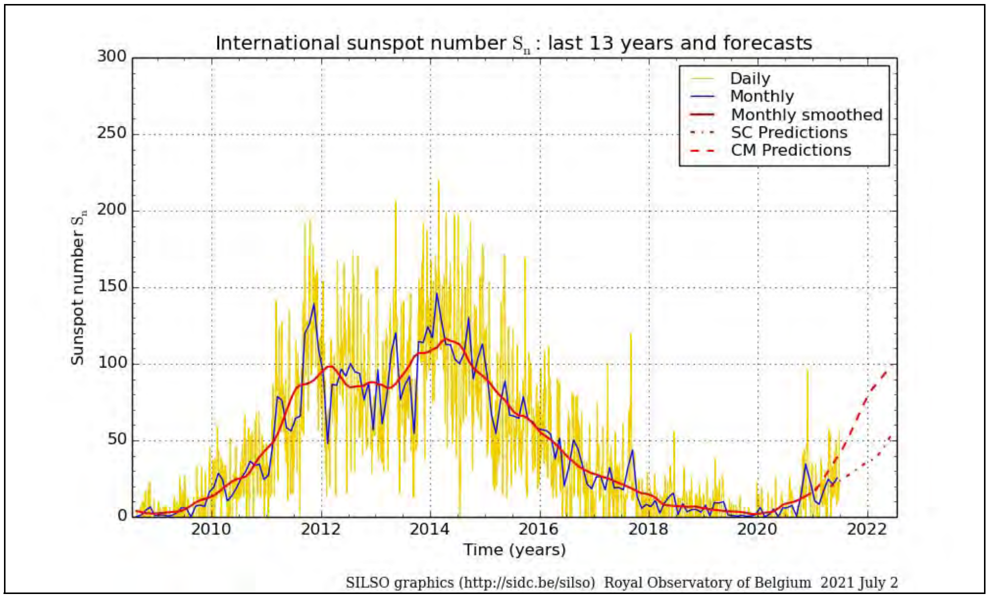
Being that Mercury is so close to the Sun, the powerful sunlight pushes the sodium molecules away and it forms a tailspin out into space. From a distance, it looks like a comet! I have received a few sodium-tail images of Mercury, but these images must be taken through a sodium filter, which has a spectral peak response at 589nm. The sodium light emits strongly at this wavelength. So, imaging Mercury at the right time with the filter can capture the sodium tail pointing away from the Sun. Again, this opens up a new chapter of imaging Mercury! Look for more about this in later reports.

Looking ahead, you will find Mercury in the evening sky this fall. But it will be such a poor apparition that you will be lucky to see the planet. Perhaps around mid-September, you can use Venus as a guide to find Mercury towards the lower right, about 30 minutes after sundown. But you must use binoculars!

I suggest waiting to see Mercury until its finest appearance before sunrise — late October into early November would be a good time to do this. On October 25, Mercury will reach its greatest elongation, 18 degrees west of the Sun when it will shine brightly at -0.6 magnitude. By the last days of October, it will reach -0.8 magnitude.

Telescopically, Mercury will show three quarters of the gibbous phase at 6 arc seconds disk diameter. If the air is still stable, you might be lucky enough to see some rayed craters as bright spots. Mercury will continue to show well into November, reaching Superior Conjunction with the Sun on November 29.

If you are interested in observing Mercury don't hesitate to contact me. For current observers, please send in your observations to the Mercury Section. Visit the ALPO Mercury Section online at *www.alpo-astronomy.org/mercury*



Plot of solar activity per Solar Section Report by Rik Hill.

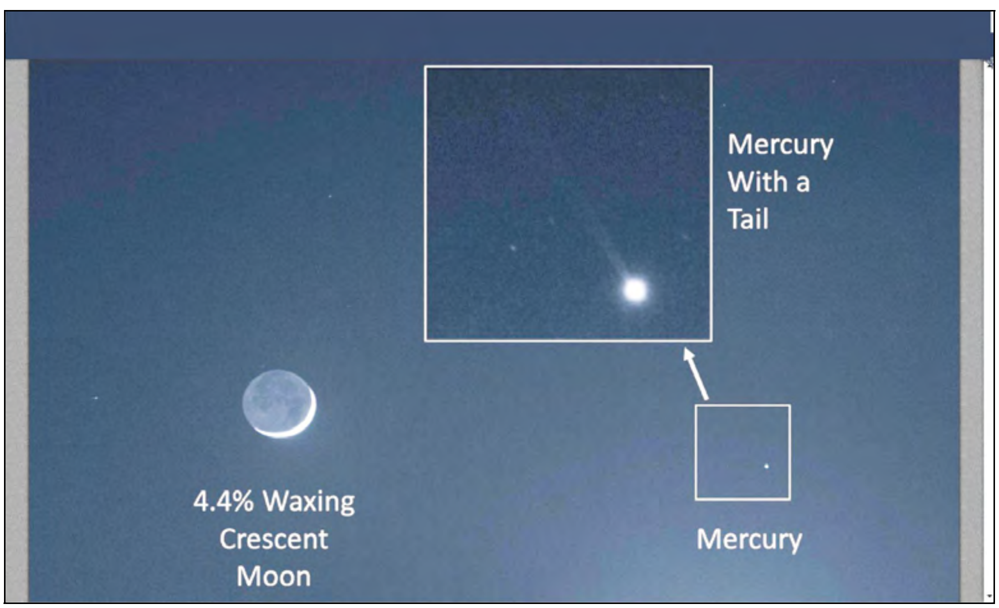


Image of Mercury's sodium "tail" as captured by Steve Bellavia from Mattituck, NY, on 14 May 2021 at 01:44 UT using a Cannon EF 100 f/2 telephoto lens equipped with a ZWO ASI 294mm Pro (cooled) camera and an Edmund Optics 589mm bandpass filter.

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Venus Section

Report by Julius Benton, section coordinator
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The Venus 2017-2018 Western (Morning) apparition report appears later in this Journal.

Table Geocentric Phenomena of the 2021-22 Eastern (Evening) Apparition of Venus in Universal Time (UT)

Superior Conjunction	2021 March 26^{d} 00^{h} UT (angular diameter = 9.8″)
Theoretical Dichotomy	2021 October 28.61^{d} UT (Venus is predicted to be exactly half-phase)
Greatest Elongation East	2021 October 29^{d} 00^{h} UT (47.0°)
Greatest Illuminated Extent	2021 December 07^{d} 00^{h} UT ($-4.8m_{v}$)
Inferior Conjunction	2022 January 08^{d} 00^{h} UT (angular diameter = 63.3″)

Venus remains visible in the evening sky after sunset for the rest of the current 2021-22 Eastern (Evening) apparition. Venus is passing through its waning phases (a progression from a nearly fully illuminated disk through its crescent phases).

Observers, therefore are witnessing the leading hemisphere of the planet as it increases its apparent diameter at the time of sunset on Earth. Venus is predicted to reach theoretical dichotomy (half phase) on October 28 and then subsequently attain its greatest illuminated extent by December 7, 2021 at visual magnitude -4.8. Venus will reach Inferior Conjunction with the Sun on January 8, 2022, thereby ending the 2021-22 Eastern (Evening) apparition.

For the convenience of observers, the accompanying table of Geocentric Phenomena in Universal Time (UT) pertains to the current 2021-22 Eastern (Evening) apparition and is included here for the convenience of interested observers.

As of the date of this report (mid-summer 2021), observers have submitted numerous drawings in integrated light (no filter) and using different color filters, as well as digital images taken at UV, visual, and near IR wavelengths of Venus for the current observing season. An example of recent observations is included with this update.

Venus Pro-Am Activities

Regular readers of this Journal should be familiar with our continuing collaboration with professional astronomers as exemplified by our sharing of visual observations and digital images at various wavelengths during ESA's previous Venus Express (VEX) mission that ran for about nine years, from 2006 until the mission ended in 2015. It remains as one of the most successful Pro-Am efforts to date, involving ALPO Venus observers around the globe. Such observations will remain important for further study and will continue to be analyzed for several years to come as a result of this endeavor.

For reference, the VEX website is *http://sci.esa.int/science-e/www/object/index.cfm?fobjectid=38833&fbodylongid=1856.*

A follow-up collaborative Pro-Am effort remains underway during the 2021-22 Eastern (Evening) Apparition in

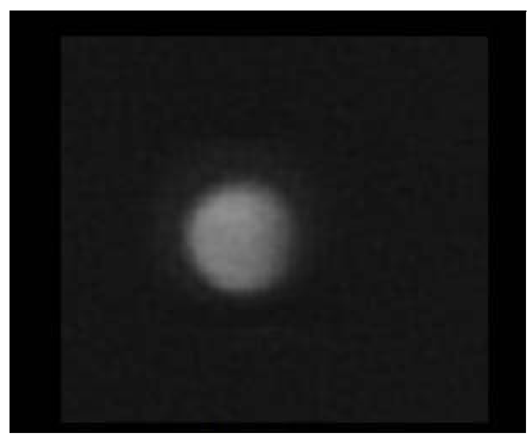

Illustration 1 (above left): Paul G. Abel of Leicester, UK, submitted a colorful drawing in integrated light (no filter) of the gibbous disk of Venus on May 18, 2021, at 17:02 UT using a 20.3 cm (8.0 in.) under good seeing conditions. His drawing depicts banded dusky markings across the disk. The apparent diameter of Venus is 10.1", phase k=0.972 (97.2% illuminated), and visual magnitude 3.8. South is at the top of drawing.

Illustration 2 (above right): Digital image captured by Frank J. Melillo of Holtsville, NY, using a UV filter with a 25.4cm. (10.0 in.) SCT on June 10, 2021 at 23:38 UT. The image barely shows horizontal V, Y, or ψ (psi)-shaped dusky clouds that are typically revealed in UV wavelengths as well as amorphous dusky features on the gibbous disk of Venus. The apparent diameter of Venus is 10.6", phase k=0.937 (93.7% illuminated), and visual magnitude -3.7. South is at the top of drawing.

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continuing support of Japan's (JAXA) *Akatsuki* mission that began full-scale observations starting back in April of 2016. The website for the *Akatsuki* mission remains active so interested and adequately equipped ALPO observers can still register and start submitting images if they have not already done so.

As always, more information will continue to be provided on the progress of the mission in forthcoming reports in this Journal. It is extremely important that all observers participating in the programs of the ALPO Venus Section always first contribute their observations to the ALPO Venus Section at the same time submittals are sent to the Akatsuki mission.

Breaking recent news from the *Akatzuki* mission at the time of this report is the mission's discovery of some interesting atmospheric phenomena on Venus in the form of a giant discontinuity and disruption rapidly propagating along the middle and lower clouds of Venus that is not readily visible in the upper clouds of the planet. This atmospheric phenomenon is comparable with other planetary patterns spotted at the super-rotating upper cloud levels like the horizontal V, Y, or ψ (psi)-shaped dusky clouds that are roughly aligned along the planet's terminator typically seen in images captured UV wavelengths. A study of past observations with ground-based telescopes and data from the earlier Venus Express mission shows evidence that this is a quasi-permanent feature of the atmosphere of Venus that presumably has been missed since at least the year 1984.

While this phenomenon is very challenging to observe on the dayside upper clouds with usual UV imaging techniques, it may be that the dayside middle clouds could be marginally noticeable on images taken at visible and near-IR wavelengths). In fact, wavelengths longer than 700nm seem to be better suited for earth-based observers participating in our pro-Am efforts to see what they can accomplish with perhaps detecting the middle cloud phenomena reported by Akatsuki scientists. More on these developments will be forthcoming in a subsequent update.

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We are continuing our full coordination and strong teamwork with the *Akatsuki* mission team in collection and analysis of all observations. If anyone has questions about our Pro-Am efforts, please do not hesitate to contact the ALPO Venus Section for guidance and assistance. Those still wishing to register to participate in the coordinated observing effort between the ALPO and Japan's (JAXA) *Akatsuki* mission should utilize the following link:

https://akatsuki.matsue-ct.jp/

The observation programs of the ALPO Venus Section are listed on the Venus page of the ALPO website at http://www.alpo-astronomy.org/ as well as in considerable detail in the author's *ALPO Venus Handbook* available free as ALPO Monograph 15 on the ALPO website. (Go to www.alpo-astronomy.org, click on the ALPO home page, lick on the *ALPO Section Galleries* link near the top-right corner of the page, click on Publication Section, click on ALPO Monographs, then click on "ALPO Monograph 15 - Venus Handbook (Revised Edition 2016)".)

Observers are urged to attempt to make simultaneous observations by performing digital imaging of Venus at the same time and date that others are imaging or making drawings of the planet at visual wavelengths. Regular imaging of Venus in both UV, near-IR and other wavelengths is important, as are visual numerical relative intensity estimates and reports of features seen or suspected in the atmosphere of the planet (e.g., dusky atmospheric markings, visibility of cusp caps and cusp bands, measurement of cusp extensions, monitoring the Schröter phase effect near the date of predicted dichotomy, and looking for terminator irregularities). Routine use of the standard ALPO Venus observing forms will help observers know what should be reported in addition to supporting information such as telescope aperture and type, UT date and time, magnifications and filters used, seeing and transparency conditions, etc.

Under favorable circumstances during future apparitions, Venus observers should monitor the dark side of Venus visually for the Ashen Light and use digital imagers to capture any illumination that may be present on the planet as a cooperative simultaneous observing endeavor with visual observers. Also, observers should undertake imaging of the planet at near-IR wavelengths (for instance, 1000 nm) around the dates on either side of inferior conjunction, whereby the hot surface of the planet becomes apparent and occasionally mottling shows up in such images attributable to cooler dark higher-elevation terrain and warmer bright lower surface areas in the near-IR.

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

Routine use of the standard ALPO Venus observing form will help observers know what should be reported in addition to supporting information such as telescope aperture and type, UT date and time, magnifications and filters used, seeing and transparency conditions, etc. The ALPO Venus observing form is located online at:

http://alpo-astronomy.org/gallery3/var/albums/Publications-Section/Observing-Section-Publications/Venus/VenusReportForm.pdf?m=1521162039

Individuals interested in participating in the programs of the ALPO Venus Section are encouraged to visit the ALPO Venus Section online *http://www.alpo-astronomy.org/venusblog/*

Lunar Section

Lunar Topographical Studies / Selected Areas Program

Report by David Teske, program coordinator
drteske@yahoo.com

The ALPO Lunar Topographic Studies Section (ALPO LTSS) received a total of 240 observations from 37 observers in 13 countries during the April-June 2021 quarter. The countries represented by observers were Argentina (16), USA (9), Italy (2), Columbia (1), Uruguay (1), France (1), United Kingdom (1), Luxembourg (1), Bolivia (1), Greece (1), India (1) and Venezuela (1) and the Dominican Republic (1). It is most impressive to have so many high-quality lunar observations submitted from so many observers throughout the world, particularly Latin America.

Thirty-eight articles were published in addition to numerous commentaries on images selected in the monthly newsletter *The Lunar Observer* (TLO). The TLO had an average page count of 77 pages per issue during the quarter. Throughout the quarter, TLO contained a section, "By the Numbers", which looked at observer's locations and telescopes used for Moongazing. In all three months, Schmidt-Cassegrain telescopes, followed by Maksutov-Cassegrain telescopes, were the most common telescope for lunar observations. This trend in telescope type use has been consistent for many months. The TLO was placed on the *Cloudy Nights* website and viewed an

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average of 185 times in each month of the quarter.

The *Focus-On* series continued under Jerry Hubbell, with the continuation of the Lunar 100 objects during this quarter. These are based on the Lunar 100 by Charles Wood. Every other month starting in May 2020, *Focus-On* explores 10 of the Lunar 100 targets. In May 2021, the seventh 10 of the Lunar 100 were featured in *Focus-On*. This article featured lunar targets such as Rümker, the site of the recent Chinese moon-lander, Descartes (Apollo 16), Hadley Rille (Apollo 15) and Fra Mauro (Apollo 14). An incredible response from across the globe allowed featuring many images and drawings of these lunar subjects. As the number of the Lunar 100 gets higher, the lunar features begin to get more challenging to observe and image.

Future *Focus-On* articles will highlight observations from the Lunar 100 observing list. The Lunar 100 observing list was compiled by Charles Wood as a list of 100 targets to observe on the Moon from very easy (Lunar 100 number 1, the Moon) to very challenging (Lunar 100 number 100, Mare Marginus swirls). Every other month will feature 10 of the Lunar 100 targets in the Focus-On series. September 2021 will feature Lunar 100 targets 81-90 and November 2021 will feature Lunar 91-100. Articles and images of the lunar targets must be submitted to David Teske and Alberto Anunziato by the 20th of the month prior to publication.

The TLO also featured articles concerning lunar topographic studies, featuring familiar and not-so-familiar lunar targets. These articles ranged in sizes from one to four pages in length.

Also each month, the TLO features an in-depth article from Dr. Anthony Cook on the BAA's Lunar Geologic Change Detection Program. Other features are articles about lunar features, articles about lunar domes and images of recent lunar topographic studies.

Electronic submissions can now be made by emailing to the coordinator. Hard copy submissions should continue to be mailed to the coordinator at the address listed in the ALPO Resources Section of this Journal.

The lunar section image gallery/archive is also now active. Wayne Bailey continues to submit archived images to the Lunar Gallery. This coordinator is now adding current lunar image submissions to the Lunar Gallery. Also, thanks to the hard work by Theo Ramakers, all issues of *The Lunar Observer* — including those from its beginning in 1997 as an American Lunar Society publication to June 2004 when it became the newsletter of this ALPO program — are now available on the ALPO website at *http://www.alpo-astronomy.org/gallery3/index.php/Lunar*.

Also, in the ALPO Lunar Gallery images and reports can be found in the Lunar Dome section.

Lunar Meteoritic Impacts

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

Please visit the ALPO Lunar Meteoritic Impact Search site online at *http://alpo-astronomy.org/lunarupload/lunimpacts.htm*

Lunar Transient Phenomena

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

No new LTP reports have been received since the last section report here. However, we continue to receive excellent repeat illumination observations that can be used to disprove or correct information about some past LTP reports.

For example, according to JALPO Vol 5, No. 7, pp. 5,7-8, Richard Baum (Whitchurch, UK) saw on 1951 Jan 21 UT 18:21, a red tint east (IAU) of Lichtenberg crater. The strength and center of the red tint varied over time. A repeat illumination observation by Nigel Longshaw (BAA) shows a couple of faint red tinges to the north and south of the crater (Figure A, far left), but the shadow was all wrong compared to the Baum sketch (Figure D, far right). What if Richard mistakenly used GMAT instead of UT? In that case, we should get the appearance as seen in Valerio Fontani's (UAI) 2021 May image (Figure B) - though again, there is a too much shadow. What if Richard got the date wrong by one day, that is, 1951 Jan 22 and not Jan 21? Figure C by Valerio Fontani (UAI), shows what it should have looked like and the shadow is now correct! The date of Richard Baum's observation has now been corrected in the ALPO/BAA LTP database.

Of course, it's possible to check up on shadows with simulation software such as LTVT, however only visual observing and images can take into account natural surface colour, ray material, etc. This now begs the question why the difference elsewhere in appearance and colour in Richard's sketch (Figure D, far right) with the 2021 Feb 26 image? It's unlikely to

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be chromatic aberration or atmospheric spectral dispersion, as these tend to be seen on bright contrasty edges. Clearly, we need to make more colour observations of Lichtenberg in the future.

General Information:

For repeat illumination (and a few repeat libration) observations for the coming month - these can be found on the following web site: http://users.aber.ac.uk/atc/lunar_schedule.htm

By re-observing and submitting your observations, only this way can we fully resolve past observational puzzles. To keep yourself busy on cloudy nights, why not try "Spot the Difference" between spacecraft imagery taken on different dates? This can be found on: http://users.aber.ac.uk/atc/tlp/spot_the_difference.htm . If in the unlikely event you do ever see a LTP, firstly read the LTP checklist on http://users.aber.ac.uk/atc/alpo/ltp.htm , and if this does not explain what you are seeing, please give me a call on my cell phone: +44 (0)798 505 5681 and I will alert other observers. Note when telephoning from outside the UK you must not use the (0). When phoning from within the UK please do not use the +44! Twitter LTP alerts can be accessed on https://twitter.com/lunarnaut .

Dr Anthony Cook, Department of Physics, Aberystwyth University, Penglais, Aberystwyth, Ceredigion, SY23 3BZ, Wales, United Kingdom. E-mail to atc@aber.ac.uk

Monthly summaries of the observations received as well as the best observation from each observer that can provide useful science on re-evaluation past LTP reports are published in the ALPO Lunar

Crater Gassendi as imaged by Felix León, Santo Domingo, República Dominicana. 27 March 2021 00:10 UT. 5 inch Maksutov-Cassegrain telescope, DMK21618AU camera.

Crater Copernicus as imaged by Guy Heinen, Linger, Luxembourg. 24 March 2021 20:26 UT. Takahashi Mewlon 250 CRS Dall-Kirkham telescope, IR pass filter, Skyris 236 camera, mosaic of 6 images.

Craters Campanus and Mercator as imaged by Guido Santacana, San Juan, Puerto Rico, USA. 23 March 2021 02:50 UT. 120 mm, f/8 refractor telescope, 2x barlow, ZWO ASI224mc camera. Seeing 8/10, transparency 3.5/6.

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Section newsletter *The Lunar Observer* (http://moon.scopesandscapes.com/tlo.pdf) – often 10 or more pages per month.

We receive repeat illumination reports from astronomers across the world, most notably the UAI in Italy, the BAA in the UK, the AEA and SLA in Argentina, and LIADA members in Bolivia and Uruguay. In the U.S., our most active ALPO contributors are Jay Albert, Rik Hill and Gary Varney.

We welcome observations from visual observers, and also astronomers with color imaging capability, who are able to record subtle natural colors on the lunar surface.

We also welcome new participants, whether they are experienced visual observers or high-resolution lunar imagers.

LTP observational alerts are given on the Twitter page: https://twitter.com/lunarnaut

Please visit the ALPO Lunar Transient Phenomena site online at http://users.aber.ac.uk/atc/alpo/ltp.htm

Lunar Domes Studies

Report by Raffaello Lena, program coordinator
raffaello.lena@alpo-astronomy.org

We have received 68 images, including some by Michael Barbieri, Jean Pierre Brahic, Robert Cazilhac, Maurice Collins, Howard Eskildsen, Guy Heinen, Richard Hill, Raffaello Lena, Luigi Morrone, Roberto Paletta, KC Pau, Zlatko Pasko, Frank Schenck, Martin Stenke, Andrea Vanoni, Christian Viladrich. Many images are of high resolution and of great interest for our program.

- Heskildsen has imaged the Marius dome field catching first light of the rising Sun. He also imaged the Gruithuisen highland domes, Mairan T domes, Herodotus omega, Rümker volcanic complex under higher solar illumination angles.
- Heinen has imaged the Gruithuisen highland domes, Herodotus omega dome, and Arago domes.
- Lena has imaged the Rümker volcanic complex, Gruithuisen highland domes, and another highland dome, Mons Hansteen. He also imaged the Herodotus omega dome, Marius hills, a possible dome detected near Grimaldi C in the Sirsalis Region, the Hyginus and Manilius domes, M24, and domes in Milichius-T. Mayer-Hortensius region.
- Cazilhac has imaged Ina, the Petavius 1 dome, Gassendi 1 dome, Capuanus domes, Maniulis domes, Mons Hansteen and the dome Yangel 1 (Ya1). This dome, which was studied in the past, lies immediately to the south of a lava-flooded mare crater which is approximately 7.5 km in diameter, and is partially buried along its southern rim by the domes northern flank. With a diameter of 5.2 km, and a height of 620 m, the dome Ya1 exhibits evidence of pyroclastic volcanic deposits, both on its surface and peripherally. For more details see: https://www.sciencedirect.com/science/article/abs/pii/S0032063314000166?via%3Dihub
- Stenke has imaged the Gambart domes and the dome Petavius 1.
- Collins has imaged the Hortensius domes and Rümker.
- Pau has imaged the dome Gassendi 1 and the domes in Cauchy region.
- Barbieri has imaged the region around Prinz Aristarchus, with the dome Herodotus omega, the small dome Gassendi 1, Hortensius-Milichius domes, Kies pi dome and Marius hills volcanic complex.
- Morrone has imaged the Birt domes and Archytas 1-2 domes.
- Pasko has imaged Griuthuisen highland domes.
- Paletta has imaged Mare Insularum with Milichius-T.Mayer and Hortensius domes.
- Hill has imaged the Piccolomini dome, INA: It's only 1.9x2.9km in size on a plateau in the middle of Lacus Felicitatis.
- Brahic has imaged the volcanic region near Sosigenes.
- Schenck has imaged the domes Between Reinhold and Lansberg, named Reinhold 1 and Reinhold 2.
- Vanoni has imaged INA, Birt bisected domes, Marius hills, Archytas 1-2 domes and the domes near Hyginus.

Twenty images in high-resolution taken by Viladrich have been examined. He has imaged the domes in Maskelyne and in Rhaeticus identified based on the Lunar Reconnaissance Orbiter WAC imagery. The dome Rhaeticus 1, termed "Rh1", is located at 3.29° E and 0.45° N, with a diameter of 5.5km ± 0.3km. The height is determined 80m ±10m, yielding an average flank slope of 1.7° ± 0.1°. The dome edifice volume is determined to be 0.9km³ assuming a parabolic shape. The first examined dome in Maskelyne region (termed Maskelyne1) is located at 26.70°

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E and 1.70° N, with an estimated diameter of 18km ± 0.5km. The height amounts to 85 ± 10 m, yielding an average flank slope of 0.6° ± 0.1° (Fig. 9a). The dome edifice volume is determined to 10.8 km³ assuming a parabolic shape. The second examined dome (termed Maskelyne2) is located at 26.19° E and 1.12° N, with a diameter estimated of 3.0 km ± 0.3 km. The height amounts to 45 ± 5 m, yielding an average flank slope of 1.2° ± 0.1°. Thus it is more prominent and has higher slope angle than Maskelyne1. It is connected on the margin of a wrinkle ridge.

Teodorescu has imaged five domes in Brayley region well detectable in his image taken under low solar illumination angle. These domes are under investigation.

Interested observers can publish their newly acquired images using the e-mail *lunar-domes@alpo-astronomy.org* . Preference for the filename would be to start with the date as YYYY-MM-DD-HHMM with leading zeros where appropriate. This than could follow with the Observer's ID. This than could be followed with the name(s) of the features shown.

Images received are also shared in our Facebook group Lunar Dome Atlas Project: *https://www.facebook.com/groups/814815478531774/*.

Interested observers can also participate in the lunar domes program by contacting and e-mailing their observations to both Raffaello Lena, Lunar Dome Studies Program coordinator, at (*raffaello.lena@alpo-astronomy.org*) and Jim Phillips, assistant coordinator, at (*thefamily90@gmail.com*).

Mars Section

Report by Roger Venable, section coordinator
rjvmd@hughes.net

Mars is now low in the evening sky after sunset, having been at 30 degrees elongation from the Sun on July 9. It will not be 30 degrees elongated in the morning sky until January 9. We'll publish a description of the coming apparition in this Journal before the viewing gets good.

When it is near the Sun, Mars is sometimes observed in the daytime sky. Such observations are difficult, not only due to its very small apparent size. But because it does not have the surface brightness of Venus or Mercury, so daytime observations tend to display its small disc in low contrast. Simon Kidd of Cottered, UK, has set the bar for such daylight observations with the image that accompanies this report. It was taken on 2021 July 7 at 18:44 UT, when the apparent diameter of Mars was only 3.80 arc seconds. It was at 27 degrees altitude as seen from Simon's location, and only 30.4 degrees from the Sun, which was still 12 degrees above his afternoon western horizon.

The image here is presented with south up, and shows the bright streak of Xanthe and Chryse above center and extending leftward nearly to the limb. Above this bright streak, dark Mare Erythraeum and its appendages, Sinuses Aurorae and Margaritifer, are prominent. Dark Niliacus Lacus and Mare Acidalium are clearly seen below the bright streak, and even Lunae Lacus is visible near image center. Below Lunae Lacus is bright Tempe. Solis Lacus near the upper right terminator is less prominent than

Mars as imaged by Simon Kidd of Cottered, UK, on 2021 July 7 at 18:44 UT. See text of report for details.

the nearly horizontal, dark arc of Melas, Tithonius, and Noctis Lacus below it. Notice the South Polar Cap at the bottom.

Were there any regional dust storms or clouds, this image would have shown them. With this image, Simon Kidd has demonstrated that observers can document important features of the Red Planet even when it is imaged in daytime and smaller than 4 arc seconds in apparent diameter.

Be sure to send your observations to *mars@alpo-astronomy.org* and to the section coordinator at *rjvmd@hughes.net*.

We invite you to join the 1,000 members of the marsobservers group of groups.io (*https://groups.io/g/marsobservers*). Observers upload their images or drawings to the photos section there, and share their thoughts about their observations.

To check the ALPO Mars image gallery on the ALPO website, first, go to *http://www.alpo-astronomy.org*, then click on

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the "ALPO Section Galleries" link at the upper right corner of the screen. Next click on the "Mars images and observations" icon, then click on the Mars image folder for the desired year.

Minor Planets Section

Report by Frederick Pilcher, section coordinator
pilcher35@gmail.com

Presented here are highlights published in *The Minor Planet Bulletin*, Volume 48, No. 3, 2021 July - September, which represent the recent achievements of the ALPO Minor Planets Section.

The ALPO Minor Planet Section honors Derald D. Nye (1935-2021) in memoriam. Derald was the distributor of the *Minor Planet Bulletin* for 37 years, 1983-2019, spanning volumes 10-46. He was also an active member of the ALPO for several decades, with his wife Denise an active solar eclipse chaser with 28 expeditions prior to Denise's passing in 2006, and subsequently14 other expeditions.

Tom Polakis and Robert Stephens find evidence for a satellite of 1803 Zwicky. Brian Warner, Robert Stephens, and Daniel Coley also find evidence for satellites of asteroids 2419 Moldavia, 2873 Binzel, 3561 Devine, 4383 Suruga, 4666 Dietz, 16525 Shumarinaiko, 88188 2000 XH44, 416694 2004 YR32, and 1999 RM45.

For 1803, 4383, and 4666, well-defined dips in the rotational light curve caused when the satellite transits or is eclipsed or occultated by the larger body establish the period of revolution around the main body. The existence of the satellite is considered secure. For the others, the evidence is more tenuous and the satellite's existence is only tentative.

Peter Birtwhistle has photometrically observed nine very small asteroids passing within a few lunar distances from the Earth, 2020 TB12, 2020 YE5, 2021 AU, 2021 CO, 2021 DP, 2021 DX1, 2021 EB1, 2021 EX1, 2021 FH. For all nine asteroids he finds rotation periods shorter than the centrifugal limit at which small pieces detach from the surface and move away. All nine of these objects are solid rocks without significant regolith. Among these 2021 DP and 2021 DX1 have light curves that do not repeat with successive rotational cycles. This indicates tumbling behavior in which the rotation axis itself precesses around a second axis in space.

Two other asteroids that reveal tumbling behavior because their light curves do not repeat with successive rotational cycles are 1513 Matra, a main belt object, reported by F. Pilcher and V. Benishek; and the Earth-approacher 2020 YQ3, reported by B. Warner and R. Stephens.

Brian Warner, Robert Stephens, and Daniel Coley present spin-shape models and new dense light curves for 153 Hilda, 1164 Kobolda, 1413 Roucarie, 1998 Titius, 2233 Kuznetsov, 2511 Patterson, 3198 Wallonia, 5040 Rabinowitz, 5096 Luzin, and 23186 2000 PO8.

Asteroids with newly published light curves extending over a sufficient range of phase angles for reliable H and G parameters to be found include 472 Roma and 3332 Raksha by L. Franco and colleagues; and 65717 1993 BX3, and 2004 QD3 by B. Warner and R. Stephens.

In addition to asteroids specifically identified above, light curves with derived rotation periods are published for 155 other asteroids as listed below:

47, 190, 279, 282, 341, 357, 374, 414, 440, 504, 527, 576, 593, 594, 684, 702, 748, 768, 783, 786, 983, 1041, 1106, 1117, 1128, 1152, 1158, 1202, 1228, 1331, 1442, 1568, 1574, 1591, 1610, 1612, 1675, 1844, 1920, 1939, 2035, 2045, 2067, 2099, 2158, 2180, 2243, 2253, 2273, 2288, 2437, 2438, 2468, 2533, 2655, 2699, 2712, 2746, 2779, 2831, 2950, 2961, 3029, 3061, 3084, 3108, 3248, 3313, 3339, 3390, 3506, 3760, 3935, 3955, 3989, 4021, 4103, 4170, 4422, 4612, 4632, 4724, 4774, 4794, 5182, 5431, 5747, 5879, 5996, 6237, 6524, 6526, 6859, 6901, 7458, 7527, 7660, 8425, 8441, 8743, 9044, 9098, 9545, 9563, 10037, 10859, 11927, 12844, 15123, 16435, 16452, 17823, 18640, 19979, 20384, 21242, 25343, 26895, 27011, 27064, 30781, 33808, 34817, 35194, 42320, 44896, 45068, 46598, 49483, 49548, 68347, 99942, 138175, 162186, 164201, 169078, 206359, 216707, 332446, 380359, 418849, 438902, 455432, 468909, 468910, 494999, 512245, 522684, 2003 YM1, 2003 AF23, 2008 BC22, 2015 AS45, 2018 PP10, 2020 WM3, 2020 UE5.

Secure periods have been found for some of these asteroids, and for others only tentative or ambiguous periods. Some are of asteroids with no previous light curve photometry, others are of asteroids with previously published periods that may or may not be consistent with the newly determined values.

Newly found periods that are consistent with periods previously reported are of more value than the uninitiated may

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realize. Observations of asteroids at multiple oppositions widely spaced around the sky are necessary to find axes of rotation and highly accurate sidereal periods.

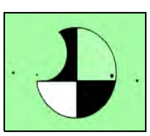
We congratulate the authors of all of these papers for their excellent writing of the technical details of all of these projects. Their competent explanations will reward careful reading of their *Minor Planet Bulletin* papers.

The *Minor Planet Bulletin* is a refereed publication and that it is available online at its NEW online location: "https://mpbulletin.org

Please visit the ALPO Minor Planets Section online at http://www.alpo-astronomy.org/minor

Jupiter Section

Report compiled by Richard Schmude, section coordinator, and Craig MacDougal, assistant section coordinator



JJupiter will be well-placed in the evening sky in early October at right ascension 21h 40m and declination 15° S in the constellation Capricornus.

Assistant Jupiter Section Coordinator Craig MacDougal reports that the Great Red Spot is prominent and that the North Equatorial Belt is very narrow and has several large barges near it. He also reports the North Temperate Belt is prominent. Craig also states the online ALPO-Jupiter discussion group has 41 members and that 351 images have been uploaded to the ALPO website as of early July including the accompanying image by Clyde Foster. Note the narrow NEB.

This writer had recorded several J and H filter brightness measurements of Jupiter in early 2021. The mean normalized magnitudes are similar to those in previous years.

To subscribe to this group send a blank e-mail (with a blank subject line) to:

ALPO-JUPITER+subscribe@groups.io

A continuing request from the ALPO Jupiter Section staff: The NASA Juno mission is currently enthusiastically accepting images of Jupiter from amateur observers. And because Juno is not primarily an imaging mission, the mission coordinators are especially interested in our (ALPO member) contributions. Please check this article for general background: https://skyandtelescope.org/astronomy-news/observing-news/juno-pro-am-workshop-05252016/ . After sending your images to us, you're invited to also send your Jupiter images to the JunoCam homepage at: https://www.missionjuno.swri.edu/junocam . The JPL hopes the Juno mission will be extended for another three years past July of 2021.

Finally, this is to remind all that the updated Jupiter manual, *Observing Jupiter in the 21st Century* is still available from the Astronomical League. Because there are several important updates in this revised version, all who observe or image Jupiter are strongly urged to obtain a copy. Go to:

t https://store.astroleague.org/index.php?main_page=index&cPath=1

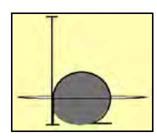
Another reminder, all contributors are advised to send all images ONLY to Jupiter@alpo-astronomy.org where they will be scanned for viruses before being forwarded on to me. Those received images will also be posted in the ALPO Jupiter Images and Observations gallery.

Jupiter as imaged by Clyde Foster of Gauteng, South Africa, on July 10, 2021 at 3:20 UT. North is at the top in this image.

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

Saturn Section

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



The 2021-22 apparition is now well underway, with Saturn reasonably well-placed in the evening sky most of the night following opposition that occurred on August 2, 2021.

The geocentric phenomena for this apparition are presented in the table that accompanies this report.

The ALPO Saturn Section has already received more than 250 individual visual observations and multi-wavelength images for the current 2021-22 observing season. Observers have been repeatedly capturing images, that have included small white spots in the EZn

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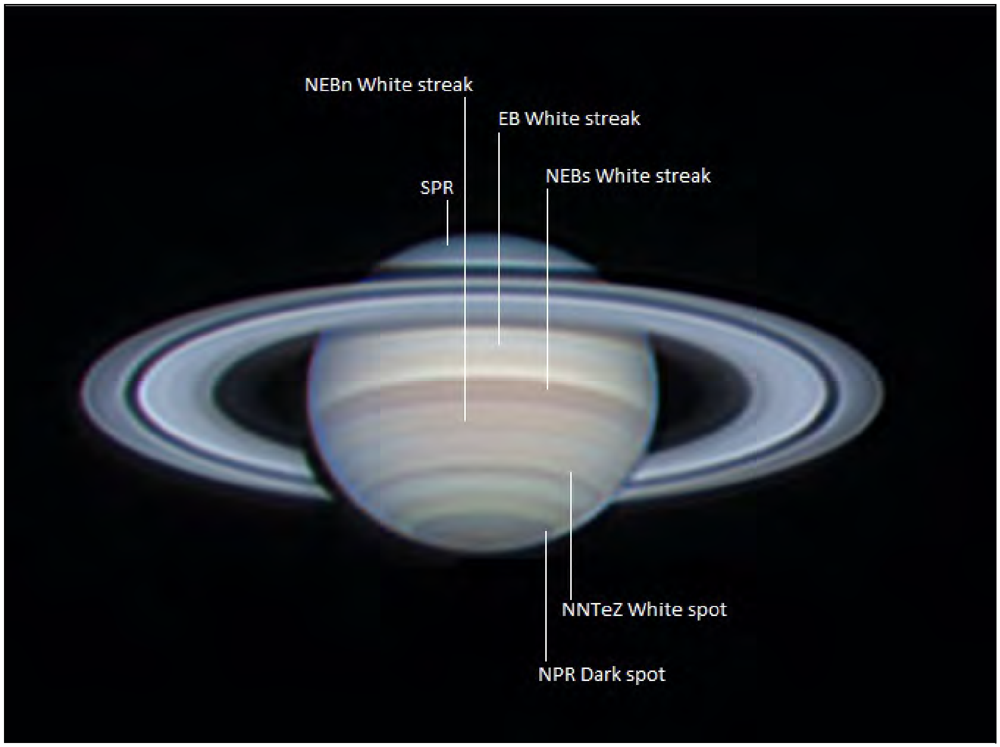
(northern half of the Equatorial Zone) interacting with the adjacent EB (Equatorial Band), plus sporadic small white spots in the EZs (southern half of the Equatorial Zone), as well as a curious persistent white ripple or streak midway within the EB (Equatorial Belt) as well as a persistent narrow white streak within the NEBs (North Equatorial Belt, southern component) and a similar feature within the NEBn (North Equatorial Belt, northern component). Observers are reporting white and dark spots the NNNTeB (North North North Temperate Belt as well as in the NPR (North Polar Region).

The aforementioned atmospheric phenomena reported in 2021-22 were often depicted in images using RGB, red, and 685nm IR filters. It is extremely important for observers to continue to image Saturn with the same multi-wavelength filters to determine if the same or similar features will persist and change morphologically with time during the current 2021-22 apparition. With the rings tilted by about +18° toward our line of sight from Earth in 2021-22, observers still have reasonably favorable opportunities to view, draw, or image the northern hemisphere of the globe and north face of the rings even though the inclination of the rings toward Earth is diminishing slowly and with Saturn's southerly declination of -18.4° for Northern hemisphere observers. It has been noticed in Many of the submitted images that the SPR (South Polar Region) of Saturn's globe is now visible south of where the rings cross the globe.

Pro-Am cooperation actively continues during the 2021-22 apparition of Saturn, and our team of observers are routinely monitoring Saturn for atmospheric phenomena and actively sharing our results and images with the professional community. This maintains



Detailed RGB image of Saturn taken by Trevor Barry of Broken Hill, Australia on June 4, 2021, at 17:56 UT with RGB filters with a 40.8 cm (16.0 in.) Newtonian in good excellent seeing conditions. Several belts and zones of the northern hemisphere of Saturn are shown on this image, with a white ripple or streak midway within the EB (Equatorial Belt) as well as persistent narrow white streaks within the NEBs (North Equatorial Belt, southern component) and the NEBn (North Equatorial Belt, northern component). It may be that the aforementioned white streaks could be the result of numerous small white spots that have all merged together across the globe. A small white spot is noticed in the NNTeZ (North North Temperate Zone) as well as a possible dark spot in the NPR (North Polar Region). The Sh G on R (Shadow of the Globe on the Rings is visible in this image as well as Cassini's Division (A0 or B10) and Encke's Complex (A5). The SPRR (South Polar region) is visible south of where the rings cross Saturn's globe. The apparent diameter of Saturn's

Table of Geocentric Phenomena for the 2021-22 Apparition of Saturn in Universal Time (UT)

Conjunction	2021 Jan 24^d 00^h UT
Opposition	2021 Aug 02^d 06^h UT
Conjunction	2022 Feb 04^d 00h UT
Opposition Data for August 2, 2021	
Equatorial Diameter Globe	18.5″
Polar Diameter Globe	16.3″
Major Axis of Rings	42.0″
Minor Axis of Rings	13.0″
Visual Magnitude (m_v)	+0.2
B = Declination Constellation	+18.1° +18.4° Sagittarius

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our collaborative historical efforts with the Cassini mission that started its amazing odyssey back on April 1, 2004 until the spacecraft plunged into Saturn's atmosphere on September 15, 2017.

For many years to come, planetary scientists will be carefully studying the vast database of images and data gleaned from the Cassini mission, including images provided during the mission by ALPO observers. Therefore, anyone around the globe who wants to join us in our observational endeavors is highly encouraged to submit systematic observations and digital images of the planet at various wavelengths throughout the current observing season.

Observers are also reminded that visual numerical relative intensity estimates (also known as visual photometry) remain an extremely important part of our visual observing program and are badly needed to ascertain recurring brightness variations in the belts and zones on Saturn as well as the major ring components.

ALPO Saturn observing programs are listed on the Saturn page of the ALPO website at *http://www.alpo-astronomy.org/saturn* as well as in more detail in the author's book, *Saturn and How to Observe It*, available from Springer, Amazon.com, etc., or by writing to the ALPO Saturn Section for further information.

Also consult "ALPO Monograph 14 - Theory and Methods for Visual Observations of Saturn" available online at *http://alpo-astronomy.org/gallery3/index.php/Publications-Section/ALPO-Monographs/ALPO-Monograph-14-Theory-and-Methods-for-Visual-Observations-of-Saturn*

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

The ALPO Saturn Section thanks all observers for their dedication and perseverance in regularly submitting so many excellent reports and images in recent years. The professional community continues to solicit drawings, digital images, and supporting data from amateur observers around the world in our active ALPO Pro-Am cooperative effort.

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

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@gordonstate.edu

The planet Uranus will be visible in the late evening during October 2021 in the constellation Aries and have a right ascension of 2h 46m and declination of 15.6° N. Neptune will be visible as soon as it gets dark in early October in the constellation Aquarius and will have a right ascension of 23h 29m and declination of 4.7° S.

The 2020-2021 Remote Planets Apparition Report is now completed and will be forwarded onto the JALPO staff for inclusion in a future Journal. Two highlights of this report are that Neptune showed less cloud activity in late 2020 than a year earlier and the bright North Polar Hood on Uranus was smaller than in 2019. Please continue imaging Uranus in red and near-infrared light.

On June 17, 2021, this coordinator was able to measure the brightness of Neptune. Its V-filter brightness based of four measurements was magnitude 7.77, which is near its expected brightness based on values in 2020.

To find any of the remote planets for telescopic observations, it is suggested that you first use a star chart which shows the position of the target, then use binoculars to find the target. Note that Sky & Telescope magazine (*http://skyandtelescope.org*) is a great source to find specific locations of sky objects.

Next, locate the target in the finder scope of your telescope. Finally, center your target in the field of view using a low-power eyepiece. You may need a dark site to locate Neptune both in binoculars and in your finder scope.

Both Uranus and Neptune have albedo features which can be imaged with a near-infrared filter. Uranus has a bright North Polar Region while Neptune may have irregular bright spots.

Finally, my usual reminder that the book *Uranus, Neptune and Pluto and How to Observe Them* is available from Springer at *www.springer.com/astronomy/popular+astronomy/book/978-0-387-76601-0* or elsewhere (such as *www.amazon.ca/Uranus-Neptune-Pluto-Observe-Them/dp/0387766014*).

Visit the ALPO Remote Planets Section online at *www.alpoastronomy.org/remote*

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Exoplanets Section

Report by Jerry Hubbell
acting section coordinator
jerry.hubbell@alpo-astronomy.org

It is hard sometimes starting out on a new path or going in a new direction, and it can be slow to convince some, let alone a large number, to join in the journey. I will be the first to admit that observing exoplanets — no matter how exciting it sounds — can be difficult and requires a level of commitment that is considerable. Believe me when I say the commitment is worth it if you are capable. The purpose of the ALPO Exoplanet Section is to help those that are excited about the possibilities of seeing for themselves the evidence of these enigmatic objects and to make it easier to commit the time and effort needed. Through our training materials and mentoring opportunities, we will help you to make your own personal exoplanet discoveries.

Part of making it easier is to be able to utilize your existing tools, knowledge and skills that you developed observing variable stars, minor planets and other objects. Using your knowledge of photometry, doing light-curves and planetary systems in general goes a long way to making it easier to commit. I invite all who have the equipment, skills, and knowledge to study one of the hottest areas of amateur astronomy: observing exoplanet transits. If you already observe variable stars or minor planets and record their light-curve data, then here is one more exciting field to apply your skills and knowledge. If you are new to aperture photometry and want to learn the techniques involved in taking photometric data on any object and creating a light-curve, then the Exoplanet Section is your ticket to learning how to do that also.

Please contact me via e-mail if you are interested in learning these new tools, or if you are an experienced observer and citizen scientist doing photometric work, I especially want to talk to you about possibly becoming an assistant coordinator. My plans include the creation of the following groups in the Exoplanet Section: Instrumentation, Observing Program, Analysis & Modeling, Data Reporting, and Observation Training. When you contact me, be sure to indicate which groups you are interested in.

Thanks your interest, I look forward to hearing from you soon.

Notable Deaths

Carolyn Shoemaker (June 24, 1929 - August 13, 2021)

Text courtesy of US Day News; Mary Chapman, USGS Astrogeology; and Lisa Gaddis, LPI

American astronomer and co-discoverer of Comet Shoemaker-Levy 9, Carolyn Shoemaker, passed away on August 13, 2021, at the age of 92.

"Carolyn was quite extraordinary," noted Lisa Gaddis, Director of the Lunar and Planetary Institute. "Although her scientific career began after she and her husband Gene raised their family, she became one of the world's foremost discoverers of comets and asteroids. She was smart, witty, and just so practical; she was an example to younger women and budding scientists everywhere as someone who made a difference in her own way. Later in life, she was celebrated widely for her many scientific accomplishments, but as a friend and colleague to many across the world, she also will be remembered for her kindness and humor. She will be deeply missed."

Born in Gallup, New Mexico, to Leonard and Hazel Arthur Spellmann, Carolyn Shoemaker went to Chico, California, along with her family, where she and her brother Richard grew up.

She earned bachelor's and master's degrees in history, political science, and English literature from Chico State University, but she had little interest in science until she met and married geologist Eugene M. ("Gene") Shoemaker. She later stated that the stories of his work inspired her. Notwithstanding her relative inexperience and lack of a science degree, the California Institute of Technology (Caltech) had no problem with her joining Gene's team there as a research assistant. She had shown herself to be unusually patient and proved exceptional stereoscopic vision,

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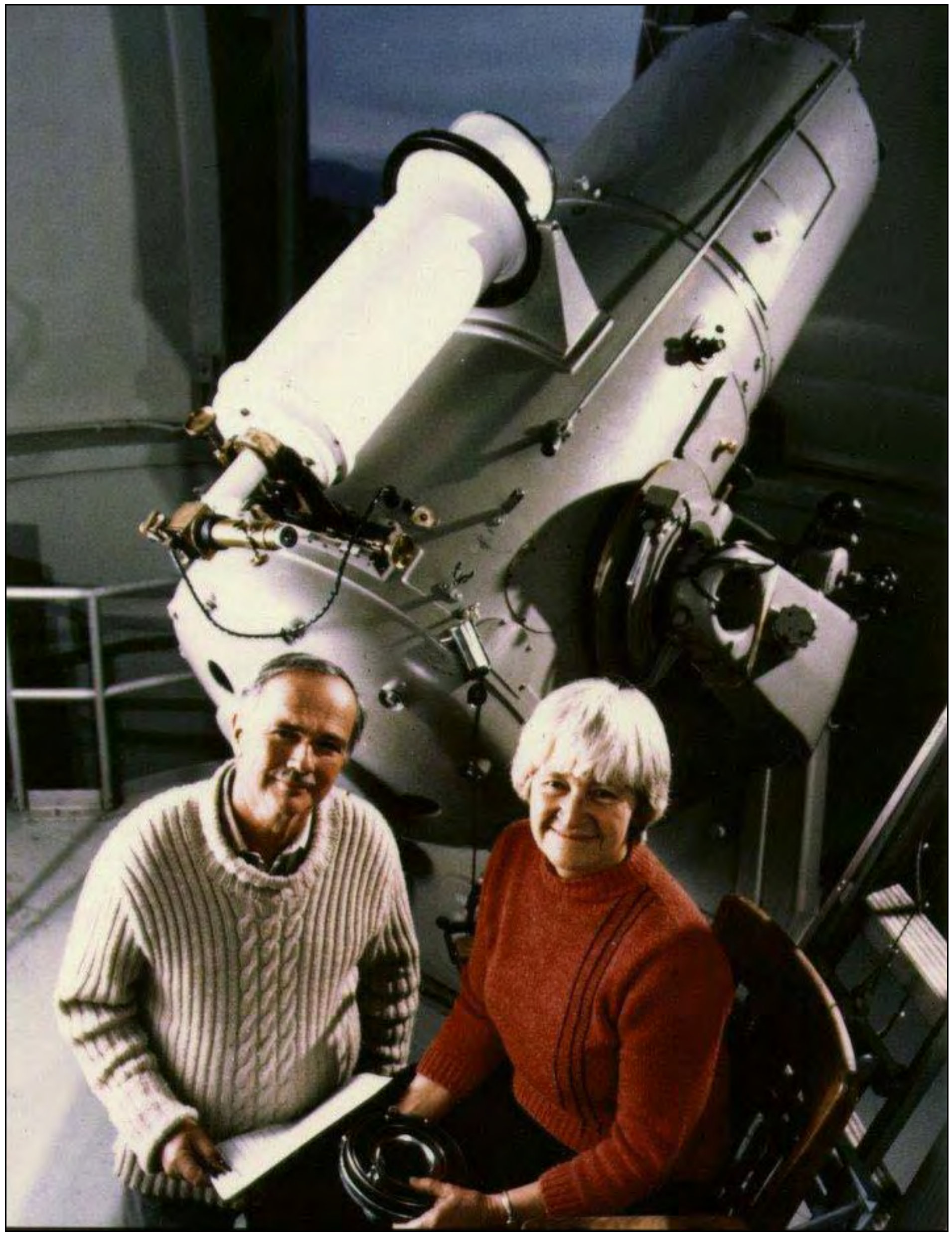
which was a precious quality for looking for objects in near-Earth space. Her work involved the search for near-Earth asteroids and comets so that the potential risks of an impact for the future of life on Earth could be understood.

Her passion for her work sustained her through the painstaking work of combing through exposed films, searching for asteroids and comets. "My real love for the night skies developed while observing at Palomar Observatory in California, and that love has never diminished." Carolyn Shoemaker once spoke about her feelings when she finds the latest comet, "I want to dance."

Shoemaker received an honorary Doctor of Science from Northern Arizona University (NAU), Flagstaff, Arizona in 1990; the NASA Exceptional Scientific Achievement Medal in 1996; became a Cloos Scholar at Johns Hopkins University in 1990; and was elected to the American Academy of Arts and Sciences in 1996. Affiliated at times with the U.S. Geological Survey's Astrogeology Science Center, Lowell Observatory and NAU, she once held the record for the most comets discovered by an individual.

Shoemaker received the Rittenhouse Medal of the Rittenhouse Astronomical Society in 1988 and the Scientist of the Year Award in 1995. She and her husband Gene won the James Craig Watson Medal by the U.S. National Academy of Sciences in 1998.

The Hildian asteroid 4446 Carolyn, discovered by colleague Edward Bowell



at Lowell Observatory in 1985, was named in her honor.

Papers & Presentations

ALPO Virtual Board Meeting Minutes, August 13, 2021

Minutes provided by Matt Will, ALPO Secretary / Treasurer
matt.will@alpo-astronomy.org
***Zoom* screen conference image provided by Tim Robertson**
cometman@cometman.net

Call to Order

On Friday, August 13, 2021, at 4:10 p.m. PDT (Pacific Daylight Time), ALPO Executive Director and Board Chairman Julius L. Benton, Jr., called the ALPO Board of Directors meeting to order. This meeting was conducted as a virtual event through the teleconferencing capabilities of Zoom Video Communications, Inc., offering audio and video communications of the proceedings to participants at the meeting. The ALPO Board was grateful to ALPO Board member Tim Robertson for providing technical support for our meeting. This ALPO Board meeting was held during the 2021 virtual annual conference of the ALPO, where paper presentations were given via Zoom, on August 13th and 14th.

Board Members & Attendees Present

Present were ALPO Board Members Julius L. Benton, Jr. (executive director and chairman), Carl Hergenrother (associate executive director), Matthew L. Will (corporation secretary and treasurer), Sanjay Limaye, Kenneth T. Poshedly, Tim Robertson, and Richard W. Schmude, Jr. Also in attendance were ALPO staff members Wayne Bailey, Anthony Cook, Rik and Dolores Hill, Jerry Hubbell, Bob Lunsford, David Teske and Roger Venable, along with ALPO member John Nagle. A few unidentified individuals may have joined briefly during the meeting in progress.

Issue One: Approval of the Board Meeting Minutes of 2020

(Introduced by Matthew Will)

The Board meeting minutes for our 2020 ALPO Board meeting were approved by all the Board members last fall.

Issue Two: Future Annual Meeting Venues

(Introduced by Carol Hergenrother)

Carl Hergenrother introduced to the ALPO Board possibilities for next year's annual meeting. Like last year's meeting, this year's meeting was held as a virtual conference through Zoom, with each attendee remotely participating using a personal computer or other mobile electronic device due to social restrictions posed by the Covid-19 pandemic. With the likelihood of easier mobility in the coming year, an in-person meeting may be feasible. This would be the first in-person meeting since meeting in Georgia in 2019. On the other hand, if restrictions are in place, considering the success of the past two virtual conferences and good attendance from them, a virtual conference wouldn't be a bad alternative. Still, an in-person meeting would be desirable, since direct contact allows for ample time to socialize and converse directly with other ALPO people.

Given these factors, Carl Hergenrother suggested a hybrid meeting, enjoying both advantages of a virtual and in-person conference. Tim Robertson thought a Zoom broadcast could be done from a remote location and not just as we have done before, with technical logistics being done from Tim's residence in California. Roger Venable pointed out that these virtual meetings are better for many since they eliminate the cost and time of travel for many.

Tim noted that next year, the ALPO will be having its 75th anniversary since its founding in 1947. It would be desirable to meet in-person, if possible. Albuquerque, New Mexico, would be a logical spot since the Astronomical League is having its meeting there and our founder Walter Haas initially lived in Albuquerque his first few years in New Mexico and operated the ALPO from that city in its early years. Due to the League's plans for having a program that doesn't include the ALPO in its presentation schedule, the ALPO opted out of the Albuquerque ALCon that was originally scheduled in 2020 and had been rescheduled now for 2022. Carl and Tim thought that Las Cruces would be a better alternative because of the ALPO's historical connection with the region, since Walter operated the ALPO from there for much of his life. We have had several great meetings over the years in 1968, 1993, 2011, 2015, and including our 50th anniversary meeting in 1997. All tThe annual meetings in Las Cruces, except for the 1997 meeting, were hosted by the local astronomy club in Las Cruces. Finding a host to coordinate the logistics would be essential. We do have a contact in Las Cruces in Walter's living daughter, Mary. Carl said that he would contact her to discuss possibilities about a Las Cruces meeting and what kind of support there might be in Las Cruces for that.

If a hybrid meeting was established, a primary concern would be how the costs would be shared with the attendees. Obviously, in-person attendees would support the meeting through registration

fees that cover the meeting room, technical support and other logistics. Would these costs be extended to members attending online? Would they be discounted in some way? Would enough members attend in-person if given an online alternative? Jerry Hubbell suggested that costs could be cut by having the meeting at a library or the local university that has audio/visual/ digital technical support with everyone attending having accommodations at a motel of their own choosing. Jerry suggested the costs could be made more acceptable for online attendees through incentives or promotions of one sort or another.

On the possibility that one type of meeting might be much preferred preferable over another, Ken suggested an email blast to poll the ALPO membership over this question. Considering that Las Cruces can be more a bit remote for some, how far would they be willing to travel to for an in-person convention?

Looking beyond next year, ALPO member John Nagle commented that the Astronomical League has tentatively scheduled to have its 2023 ALConON in Baton Rouge, Louisiana. Ken motioned to table consideration for meeting with the League in 2023 until it was certain that Baton Rouge would be the location for that year's ALConON. Other alternatives for a meeting site might arise as well, in the meantime.

Issue Three: ALPO Journal Status

(Introduced by Ken Poshedly)

Ken Poshedly reports that the Journal is doing well thanks in part to the excellent work of its diligent and industrious editor Shawn Dilles. For Ken's part, the layout and final production efforts with the Journal are continuing to be done by himself. Ken has wanted to defer this portion of the work to a paid contractor. Unfortunately, finding independent contractors at reasonable costs has been difficult. Sheridan, our printing company, has given Ken a referral to one individual that does that kind of work, and has worked with professional periodical editors and Sheridan to fulfill this vital role in the publication loop. Ken said that he would be looking into this avenue of relief. Thatwould facilitate pre-publication duties that complete the process of publication for each issue of the Journal in the coming months.

Issue Four: Status of ALPO YouTube Channel

(Introduced by Tim Robertson)

Tim Robertson talked about the purpose, potential and management of the ALPO YouTube Channel. Most are familiar with YouTube on the internet and its ability to provide a wide range of audio/video presentations. Channels are formed around content providers of which the ALPO is now one of these. Tim created the ALPO YouTube Channel in 2020 as a means of posting a variety of videos about the ALPO and as a vehicle for streaming live events such as our last two annual meetings that are also now on the channel as recorded presentations. Tim has given the ALPO YouTube Channel a great start. Tim's vision for the YouTube Channel would be to see it expand with other ALPO staff and members contributing videos regarding training in lunar and planetary observation techniques, informative videos about Solar System studies and live viewing through a telescope for events and demonstrations.

In contrast to the many other wonderful things Tim has created and been responsible for in the ALPO Outreach Section, Tim feels he is directly involved in too many areas of endeavor to give the YouTube channel the time and attention it deserves. Tim currently is the overall coordinator for the Outreach Section, and personally coordinates the ALPO Lunar and Planetary Training Program and the Observer's Notebook Podcasts. Tim is looking for someone that could manage the channel, and encourage, promote and support creative content. Tim would assist that person in getting acclimated to the YouTube environment. That person would coordinate the channel and be responsible for managing the creative content posted on the channel. Any interested ALPO members should contact Tim Robertson.

Issue Five: Status of Membership and Finances

(Introduced by Matthew Will)

The ALPO membership continues to rise, as it has over the past three years. As of this meeting the ALPO membership stands at 425 members. In terms of distribution, the number of members receiving the digital Journal appears to have increased to only 259 or approximately 61 percent of the membership compare to just under 60 percent a year ago. More of our newer members tend to purchase the digital ALPO memberships online. The ALPO has had an increase in membership because of a positive synergy from all of our sections. Yet, there could be other ways of improving our profile as a leading astronomical organization in Solar System astronomy and beyond. We have the capacity to build on that success provided that the right people are encouraged to participate, grow, and improve the ALPO. Perhaps, we need to review our impact to that community. Can our credibility or value be better appreciated? Can we make our presence more visible? In that regard, Board member Sanjay Limaye suggested that the ALPO consider posting an advertisement about the ALPO in Sky & Telescope. In the past, such an ad was prohibitive due to cost considerations. Even a quarter-page ad or smaller running for multiple issues would be quite costly. Matt Will commented that the ALPO has ran ads inviting readers to join the ALPO years ago in the Astronomical League's Reflector. The Reflector has a circulation of close to 20,000, but the ALPO didn't see any increase in its own membership. Sky & Telescope has a wider readership however. Ken Poshedly said that he would look into the possibility of running an ALPO advertisement in Sky & Telescope and report back to the Board.

The ALPO currently appears to be running a deficit with its finances. This is due in part to the increased size of the printed Journal. At the time of the Board meeting, tThe Springfield, Illinois, business account had $5,977.99 at the time of the Board meeting. The business account floats roughly between $3,000 to $6,000 between printings of the Journal. A cushion of $3,000 in the business account buffers as additional funds in case the ALPO is met with other one-time costs from time to time. Costs for Journal production could continue to be absorbed for the time being without going into debt; however, services from a contractor to handle layout operations (see Issue Three: Journal Status) could significantly increase preproduction costs for the Journal. The ALPO's funding is substantially supported through membership dues. Therefore, a dues increase would be inevitable. Typically, the ALPO increases dues every three or four years as costs increase not just for the printing and mailing of the Journal, but for other administrative expenses in operating the organization as well. A dues increase in January 2022 would be well-timed and consistent with the manner in which dues increases have appeared over the last 20 years. Ken could not give a definite timeline on when he might go about selecting a contractor to do the layouts for the Journal. Given the facts of the situation, the ALPO Board decided that the logical approach would be to defer a membership dues increase until the Publications Section has a contractor firmly in place, and only then to schedule a membership dues increase that would cover both preproduction and printing cost increases to bring our finances into stable order.

Issue Six: The ALPO Endowment

(Introduced by Matt Will)

The ALPO Endowment continues to grow but at a much slower rate. The Endowment is valued at $329,071.74. The funds from the Endowment are currently being invested in United States Treasury Bills with terms varying from 26 to 52 weeks and longer term TIPS (Treasury Inflation Protected Securities). A recent charitable bequest that will be incorporated into the Endowment in the near future should increase the value of the Endowment significantly, as past charitable bequests have, thanks to kind-hearted donors that share the ALPO's vision for a central office in the organization's future.

With a growing Endowment come growing responsibilities. Over the past two years, a structure has been set into place for better governing of the ALPO Endowment. With that, recruitment is taking place to fill seats for an ALPO Endowment Board of Trustees. The purpose of the Endowment Board of Trustees is to provide independent review and to advise on investing strategies for the Endowment's funds. The Treasurer is happy to report that we have more candidates than available slots for trustees. The ALPO Board Directors will select the candidates for the Board of Trustees per our Article 13 of our By-laws and Article VI of the Standing Rules. Hopefully, we can have the Trustees selected and serving by early September.

Issue Seven: ALPO Jupiter Section Coordinator

(Introduced by Ken Poshedly)

The position of Jupiter Coordinator has been vacant for the past year. Richard Schmude was coordinator for the two previous years before the vacancy and served as coordinator in earlier years. When not coordinator, he was an assistant coordinator, but always supported the Jupiter Section through his indefatigable efforts in producing the Jupiter apparition reports over the last quarter century! The coordinator's position has been one of principally administrating the Jupiter Section, which involves corresponding with observers, archiving observations, and writing interim section reports to the Journal every quarter, while Richard was responsible for analyzing observations and writing the apparition reports as assistant coordinator.

The search for a person to handle the Jupiter Section administrative duties has been difficult from the lack of responses to past inquiries targeted to Jupiter observers in the ALPO. After much discussion with the Board and ALPO members participating in discussion, Richard was agreeable to accept the additional responsibilities he once had as coordinator. Richard said, since he was probably going to resign from his ALPO Board seat in a year or two and would have more time to perform these additional functions, the ALPO Board unanimously agreed to reinstate Richard Schmude as the Coordinator of the Jupiter Section. Thank you, Richard!

Issue Eight: The Prospects for a Provisional Radio Astronomy

(Introduced by Carl Hergenrother)

A proposal was submitted by an ALPO member Steve Tzikas, who is also a member of the SARA (Society of Amateur Radio Astronomers) to create a provisional section for radio astronomy. Steve is also a member of SARA (Society of Amateur Radio Astronomers). Such a section could be authorized by the Executive Director without a bBoard vote and subject to a bBoard vote later on if the section proves viable and can exist as a permanent section. Ken Poshedly motioned that the issue be tabled for the time being since there were no expectations from Steve Tzikas that the section would be created any time soon. Matthew Will seconded the motion, and the motion carried unanimously.

Issue Nine: Staff Status

(Introduced by Carl Hergenrother)

Acting ALPO staff are eligible for permanent status contingent on a vote of the ALPO Board.

The usual probationary period for review before the Board decides whether or not to grant permanent status is usually two years. Acting ALPO staff are eligible for permanent status contingent on a vote by the ALPO Board.

After a discussion and review of the table, the Board deferred a decision on status as prescriptive of the policy to grant permanent status to acting staff after a two year interval if the Board is satisfied with the staff member's performance in that staff position.

Issue Ten: ALPO Website: Status, Updating, and Possible Redesign

(Introduced by Carl Hergenrother)

Table of ALPO Current Acting Staff Appointments

Staff Member	Section	Title	Date of Appointment
Pamela Shivak	Outreach Section Youth Program	Acting Coordinator	Apr 2020
Keith Spring	Eclipse Section	Acting Assistant Coordinator	Sept 2018
Keith Spring	Mercury and Venus Transits Section	Acting Assistant Coordinator	Sept 2018
David Teske	Lunar Topographic Studies Program	Acting Coordinator	July 2019
Shawn Dilles	Publications Section	Acting Assistant Coordinator (*Journal* Editor) *	July 2019

* Shawn Dilles was appointed by then outgoing Executive Director Richard Schmude as “acting” in the capacity of Journal editor according to the 2019 Board meeting minutes.

At last year's Board meeting, there was a discussion about improvements to the ALPO website, some of which involved updating content and while other proposals suggested improvement to the overall design of the webpages. The Board concluded that a committee should be formed to examine possible approaches toward making the ALPO website more user friendly at many levels. At the current meeting, Carl Hergenrother announced to the Board, the formation of that committee. It will be composed of the following ALPO staff and members which include Larry Owens and Jim Tomney of the Online Section, Tim Robertson of the Outreach Section, ALPO members Ron May and Matthew Benton, and Executive Director Carl Hergenrother, Larry Owens and Jim Tomney of the Online Section with Jim as committee chair. This committee will look at making the website more up-to-date in content and appearance as well as more dynamic and easier to use. Some Board members commented on the rather large costs for maintaining a website with preexisting, supporting software. Others thought that any costs for this project should be reasonable and hopefully in time for the 75th anniversary of the ALPO.

ISSUE ELEVEN: Commemoration of the ALPO 75th Anniversary and Possible Activities

Journal of the ALPO Editor Shawn Dilles has recently made suggestions regarding the observance of the ALPO's 75th anniversary year in 2022. He listed some proposals in a recent email to the ALPO Board given below:

1. A planning team can look into ideas for the ALPO 75th Anniversary Conference.

2. Develop a logo/seal to commemorate the event, perhaps to use on JALPO issues during that year? We could ask members to submit ideas and select a winning design.

3. Run articles in JALPO with a "Then and Now" theme for each section recalling the state of the art in the early years for equipment and also the 'issues of the day' compared with now.

4. Other historical articles could reflect on a range of topics, including the history of Pro-Am work, A Walter Haas profile, "Books by ALPO Members", "Solar System Objects named for ALPO members and others.

5. Tim could run a series of podcasts with the theme of 75 Years of ALPO with the goal of recruiting new members.

6. Members could submit notes on "What ALPO means to Me" and we can feature a few of our longest term members.

7. We can solicit letters of congratulations from the Astronomical League, BAA, RASC, IOTA, (NASA?), AAVSO etc.

For item number 2, Jerry Hubbell suggested that he could contribute the services of his daughter who so ably created the logo for the ALPO Exoplanets Section.

For item number 3, Carl Hergenrother agreed to offer to write "Then and Now"-themed articles for the Journal during the anniversary year.

For item number 5, Tim Robertson plans to focus on a number of podcasts relating to the history of the ALPO in the near future.

For item number 7, Shawn Dilles mentioned in his email that he could contribute to this.

Matt Will commented that he was issuing membership cards with a gold colored banner declaring the 75th anniversary of the ALPO in the coming year. Matt, as would many members for sure, be willing to contribute comments in the Journal about what the ALPO means to individual members on a personal level. The books by ALPO members that Matt Will maintains, are in serious need of updating, which Matt needs to do! All of these plans could dove-tail nicely with the annual meeting next summer with a little planning and foresight.

Issue Twelve: Lunar Nomenclature, Status Report – Naming of Craters or Lunar Features for Walter H. Haas, Donald C. Parker, Anton Rükl, Winifred S. Cameron and John Westfall

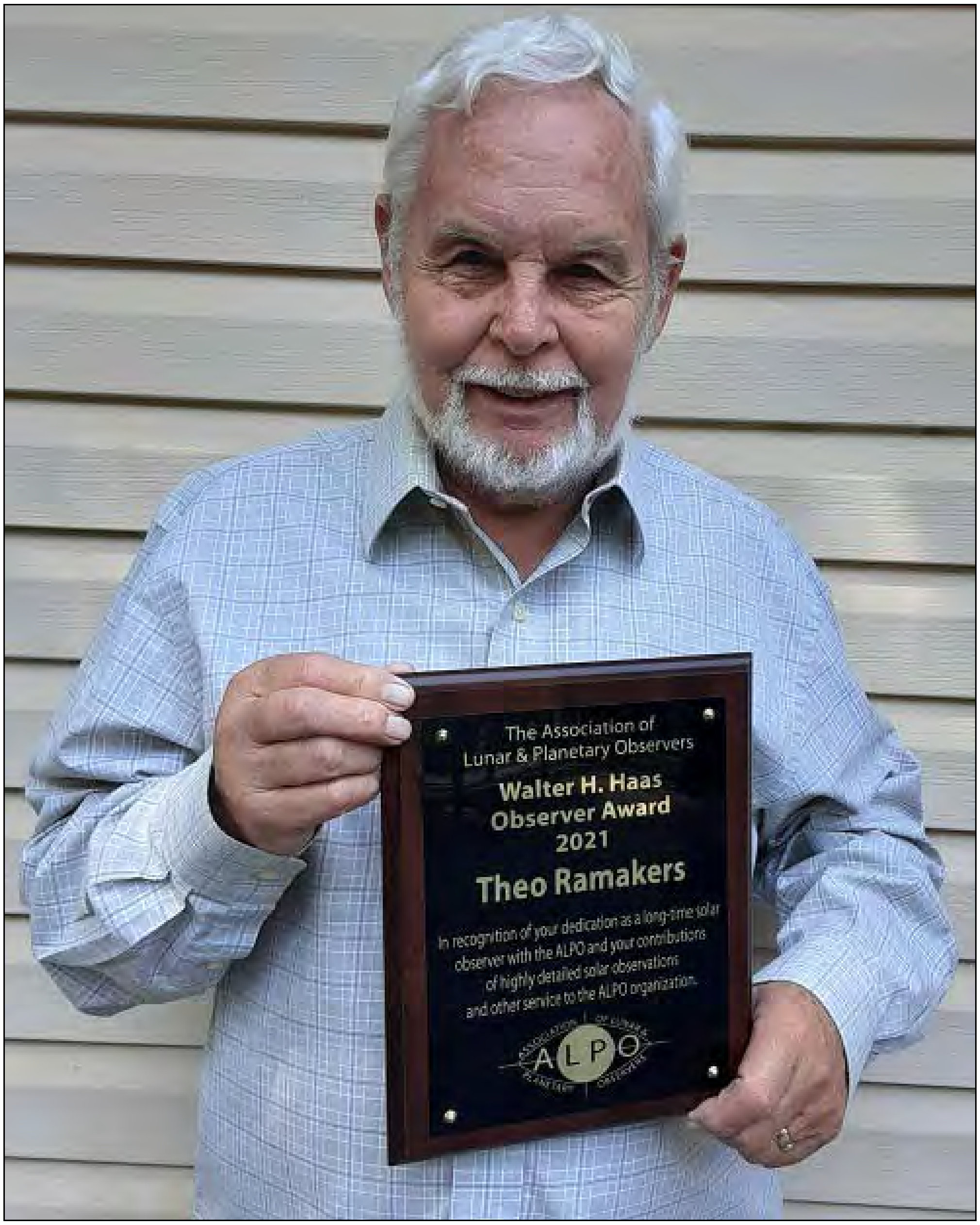
(Introduced by Matthew Will)

Matt Will put on the "contrite hat" and expressed his sincere apologies for not moving forward on this front. Other ALPO issues came to the forefront over the course of the year, which prevented him from making any real progress on this issue. More information about this issue can be read in last year's bBoard meeting minutes. While requirements and parameters discussed last year regarding the naming of lunar craters seem to be stifling for the deserving amateurs that have contributed greatly to the science of astronomy, there are nonetheless possibilities to see this type of commemoration done. It will take some effort and stick-to-itiveness to see this through to some conclusion, and hopefully, successfully

Issue Thirteen: Observer Award

(Introduced by Tim Robertson)

This year's Walter H. Haas Observer's Award recipient is ALPO member Theo Ramakers. Theo has been an ALPO member since 2008 and makes his home in Oxford, Georgia.



Theo Ramakers, winner of the 2021 Walter H. Haas Observer Award. (*Photo courtesy of Theo Ramakers*)

Theo is well-known for his observational work for the ALPO Solar Section and his past support of archival activities with the ALPO Galleries webpages on the ALPO website. Theo served as an assistant coordinator for the Online Section from March 2016 through March 2020 and was also an assistant coordinator for the ALPO Solar Section from September 2015 through March 2020. Theo has also contributed detailed analyses of solar activity for publication in the Journal of the ALPO and at annual meetings as well. Congratulations Theo!

As always, thanks are given to our fellow Board member Tim Robertson for continuing on as our chairman the Observer's Award Committee. Our thanks are also extended to the committee members that participated in the selection process. Thanks again Tim, for providing guidance and continuity to this important and time honored tradition of the ALPO!

Issue Fourteen: Election of Corporate Officers

In accordance with a long-standing agreement among the Board members, the rotation for the positions of executive director and associate executive director continues. Carl Hergenrother

will become our new executive director for the next two years and Ken Poshedly will be the

new associate executive director. Matthew Will shall continue as both secretary and treasurer.

This was done through unanimous approval by the Board for these proposed officers, serving for the next two years.

Membership in the Treasury Committee rotates as Board members enter and leave corporate officer positions in the organization. The Treasurer wishes to thank Ken Poshedly (who will become associate executive director) for having served on the Treasury Committee over the past two years. Tim Robertson and Richard Schumde serve on this committee along with Julius Benton; Julius is retiring from being executive director for the past two years. Current and future input from this committee will be welcome as the ALPO grows and decisions independent from the treasurer will be needed.

Adjournment

With no new business to conduct at this year's ALPO Board meeting, Tim Robertson made a motion to adjourn and Matt Will seconded. The motion passed with the Board members voting unanimously in the affirmative with the Board meeting adjourning at 6:32 pm PDT on Friday, August 13, 2021.

Book Review
Star Maps

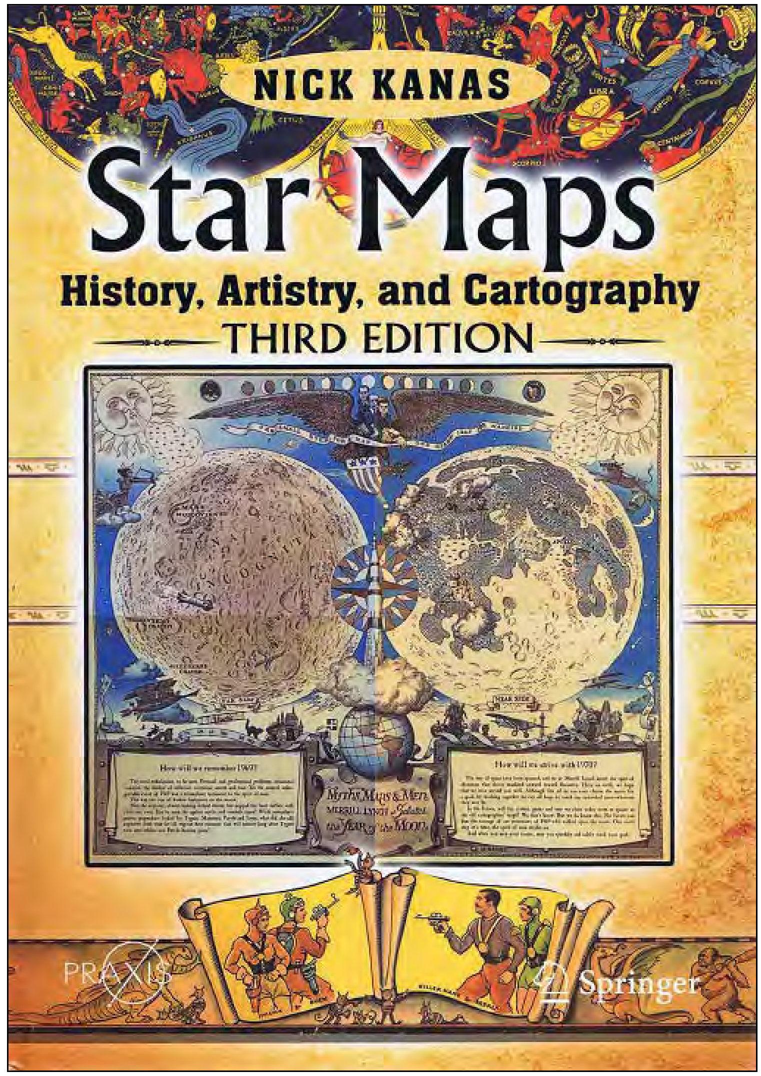
Review by Robert Garfinkle,
ragarf@earthlink.net

"Star Maps: History, Artistry, and Cartography", Third Edition by Nick Kanas (Springer Praxis Publishing), 2019. 563 pages, appendices, index, 226 illustrations, 24 x 17 cm. Price $54.00 [hardcover; ISBN 978-3-030-13612-3, eBook, 978-3-030-13613-0]

San Francisco Bay Area author Nick Kanas is an avid collector of celestial maps and charts. He has taken his many years of collecting expertise and condensed it into a marvelous book on this fascinating aspect of enjoying the night sky. This third edition of his book is greatly expanded in text and images of celestial maps. One vast improvement is that all of the figures are now placed within the text where the map is discussed. In the first edition, which was available only as a paperback, all of its color plates were lumped together in the middle of the book. Dr. Kanas has added 19 new color and black and white images of celestial maps from all ages.

The surviving celestial maps from Mesopotamia, Egypt, China, India and other ancient cultures influenced Greek, Roman, and Islamic skywatchers, who in turn produced their own representations of the night sky. Once knowledge of these earlier maps became known to Renaissance European cartographers, the art and craft of representing the night sky on paper reached a high point of refinement. Their maps have become highly prized collectors items, not only for showing the heavens, but for their artistry as well.

From the opening chapter devoted to explaining the difference between celestial and cosmological maps to the new last chapter covering celestial images in artistic paintings, you will find something fascinating on almost every page. The author describes the maps for each period and talks about how particular map styles were developed over the years and the relationships between them. Where a map or chart is illustrated, he discusses details shown on the map and gives you a good understanding of the map's place in celestial cartographic history. As you progress through the ages, you can see how one age influences the work of later eras. I found this to be a very fascinating aspect of this comprehensive work. I have read a number of books on the history of celestial cartography, but none with the depth and wealth of information on this important part of the history of astronomy.



The first appendix gives you tips on collecting celestial maps and what pitfalls to avoid. Appendix B lists celestial cartographers in alphabetical order and includes information on the works each individual produced. This is certainly a very handy part of this book. Appendix C consists of detailed indices of major constellation atlases from Johann Bayer's Uranometria of 1603 to Alessandro Piccolomini's De le Stelle Fisse, edition of 1579.

Dr. Kanas presents a vast and valuable body of knowledge on this subject and has done so in a lucid manner that I found very easy to follow and a real joy to read. Even though the small page-size of the book meant that images of the maps would be small, they are reproduced to such a fine point that details on all of them remain easily readable. I highly recommend this book to students of the history of astronomy or anyone interested in observing the night sky.

Papers & Presentations

Resources for the New Radio Astronomy Observer

By Stephen A. Tzikas,
ALPO Member
Tzikas@alum.rpi.edu

This is the second of two papers by ALPO member Stephen A. Tzikas regarding the formation of an ALPO Radio Astronomy Section.

Abstract

The student of radio astronomy will take some basic first steps. These involve accessing resources, participating in some learning experiences and applying the knowledge acquired to a growing loop of more challenging circumstances. This practical application of lessons learned and the sharing of them enlarges the platform for both developing amateurs and professionals. There are not enough volunteers to broaden the field of amateur radio astronomy to its full potential, though advances in technology are creating many new opportunities for citizen science. Amateurs contribute an important role to growing the field and will continue to do so for decades to come. Amateurs, as well as professional scientists and engineers, will have opportunities to cooperate and contribute in a parallel effort to fill the gaps that professional astronomers do not have the time to focus on.

Introduction

In this writer's previous paper on this topic (ALPO Journal 63-3, Summer 2021), I explored the steps necessary to create an organizational architecture of a an ALPO Radio Astronomy Section and the initial goals of such a group (Tzikas, 2021). This is quite a challenge. The first step for the student or amateur of radio astronomy is to realize the field is immense. Because of this, a viable group of radio observers in the ALPO may take years to form. Nonetheless, in this article I assume there may be a few ALPO members interested in exploring the idea and want to take some first steps, wherever that may lead. Like in any profession, increasing the focus in an area of interest becomes more and more narrow, while some competence is maintained for a wider context. In my own niche as a chemical engineer and chemist, I have a familiarity with the three other classic branches of engineering (mechanical, civil and electrical) as well as other main science disciplines (physics, biology and mathematics, the latter usually as computer science). So too, radio astronomy will bring many aspects of science and engineering to your doorstep. You will engage in astronomy, physics, computer science, electrical and mechanical engineering, chemistry (as spectroscopy) and biology (as SETI). If you think about it, being called an "amateur" is a sort of misnomer for people who already have a professional background in science and/or engineering. As a beginner, however, you might not realize what you don't know. A good practical step is to decide on an initial introductory learning experience.

The First Project

There is something for everyone in radio astronomy. While many people interested in radio astronomy are professionals in other scientific and engineering disciplines, no experience is necessary for beginners. If astronomy is your passion and you happen to know some electronics, you already have an advantage.

The most popular beginner radio telescopes are SuperSid (**Figure 1**) and Radio Jove (**Figure 2**). SuperSid follows solar flare activity, and Radio Jove observes Jupiter storms. SuperSid data is uploaded to a University of Stanford database, and Radio Jove data to a NASA database. Radio Jove is good for observers with a large back yard, as the dipole antenna for this kit is approximately 22 feet long. There is a large Radio Jove user group, and if the ALPO hosts an annual meeting at PARI (Pisgah Astronomical Research Institute) for instance, perhaps the ALPO can attract the Radio Jove crowd.

Just like those topics of interest in the ALPO, SARA topics can be covered in extreme detail, making a person wonder how many years it will take to learn the subject. To a novice, I may seem ahead in knowledge, but there is a lot I don't know. As I learned more radio astronomy, I realized how much I didn't know and the enormous investment of time it would take to learn everything. Consequently, specialization is a good approach for those who have learned some basic concepts and have explored some basic radio telescope kits. In your specialization, join a radio astronomy organization. The SARA is a logical choice but not the only one. For $20, SARA's annual membership is worth it, especially for all the help one can receive in setting up their radio telescopes, to include the software issues. Many of my fellow SARA members are ham radio

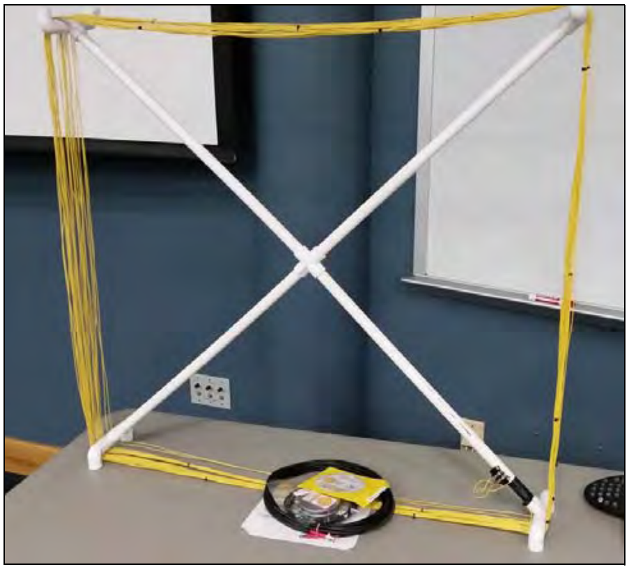


Figure 1 (left). This SuperSid loop antenna and receiver kit was given away as a door prize at the Society of Amateur Radio Astronomers (SARA) annual conference in July 2016. (Photo by Stephen Tzikas.)

Figure 2 (right). This Radio Jove dipole antenna was assembled at the July 2013 SARA annual conference at Greenbank, WV. (Photo by Stephen Tzikas)

operators and are members of the American Radio Relay League (ARRL). The ARRL specializes in radio technology, which is essential knowledge for radio astronomy. The ARRL administers the exams for FCC ham radio licenses, and there are three levels: Technician, General, and Extra. Even if you don't become a ham radio operator, taking these exams is very helpful for learning the basics of radio technology.

I also recommend completing the Astronomical League's Radio Astronomy Observation Award to the Gold Level. This program will provide a disciplined approach to radio astronomy and its link is found at: *https://www.astroleague.org/programs/radio-astronomy-observing-program* .

The two books shown in **Figure 3** should also prove to be most helpful.

Besides buying radio telescope kits, many SARA members build their own radio telescopes. They might make use of SDR (software- defined radio), Arduino, Raspberry Pi, and GNU Radio. Some use Astropy for visualizing their gathered raw data. They build or buy their antennas. Some find oversized radio telescope dishes given away by their owners to anyone willing to take the dish and haul it away.

Reducing Amateur-Professional Gaps

Another good idea is to read some professional journal articles. This can help add to the comparatively sparse literature in amateur radio astronomy by taking professional concepts and attempting to develop amateur equivalents. At the very least, this increases awareness of the gap that should be reduced between amateur and profession approaches. Over the years, I targeted journal articles of a particular interest. At one time, I was interested in learning about occultation of celestial radio sources by the Moon and planetary bodies. There are a few professional articles that are posted on the internet and provide the reader with awareness on the level of professional detail required. It will put your knowledge in perspective if your radio telescope is of sufficient size to detect the radio source. Radio occultations don't need to be difficult to observe. My own article, "X-Band Observations of the August 21, 2017 Partial Solar Eclipse," in the JALPO, 61-1-Winter 2019 issue, observed the occultation of the Sun by the Moon (Tzikas, 2019). I used the Skynet 20m radio dish to collect data for that article. I was able to put my simple observations into the context of more professional ones to reflect on whether there was something I could have done to make my observations better. See the sample list below of professional papers related to radio occultations for examples of some professional approaches:

1. *The Astrophysical Journal*, 146, 646T, 1966, Lunar Occultations of Five Radio Sources, J.H. Taylor, Jr., Harvard Radio Astronomy Station, Fort Davis, Texas, Received June 29, 1966.

2. *The Astrophysical Journal*, 423:L143-L146, 1994 March 10, The Spatial Size of the SiO Masers in R Leonis Derived from Lunar

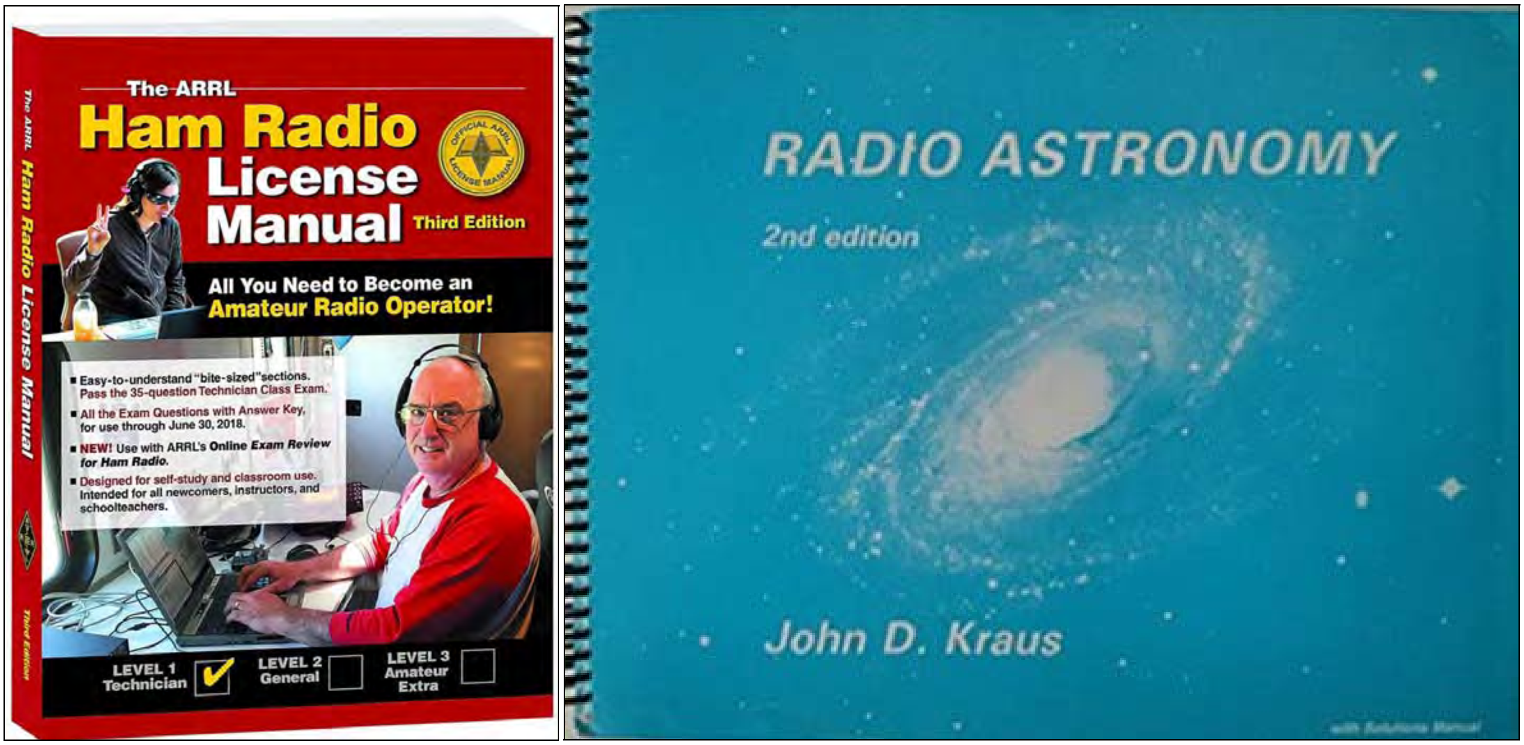


Figure 3. Two useful books: *The ARRL Ham Radio License Manual* will help prepare you for the Technician license exam. The ARRL offers many valuable books on radio technology. Also *Radio Astronomy 2nd Edition*, by John Daniel Kraus is considered the most authoritative source. Used copies are available through Amazon.com.

Occultations, J. Cernicharo, W. Brunswig, G. Paubert, and S. Liechti

3. *Research in Astronomy and Astrophysics,* 2012 Vol. 12 No. 9, 1297-1312, New Radio Observations of the Moon at L band, Xi-Zhen Zhang, Andrew Gray, Yan Su, Jun-Duo Li, Tom Landecker, Hong-bo Zhang, and Chun-Lai li.

4. *The Astrophysical Journal*, Volume 148, June 1967, Lunar Occultation Studies of Five Weak Radio Sources of Small Angular Size, C. Hazard, S. Gulkis, and A.D. Bray.

5. *Australian Journal of Physics*, 1966, 19, 409-19, The Lunar Occultation of the Crab Nebula Observed at Parkes on June 21, 1963, By R.D. Davies, F.F. Gardner, C. Hazard, and M.B. Mackey

6. *The Astrophysical Journal*, Vol. 151, January 1968, Models of Nine Radio Sources from Lunar Occultation Observations, J.H. Taylor and M.L. De Jong

7. *Soviet Astronomy – AJ*, Vol. 10, No. 1, July-August, 1966, Radio-Brightness Distribution of the Crab Nebula at Meter Wavelengths from Observations of the Lunar Occultation on August 4, 1964, V.S. Artyukh, V.V. Vitkevich, V.I. Vlasov, G.A. Kafarov, and L.I. Matveenko

8. *The Astrophysical Journal*, Vol 160, April 1970, Additional Occultation Studies of Weak Radio Sources at Arecibo Observatory: List 4, Kenneth R. Lang, J. Sutton, C. Hazard, and S. Gulkis

9. *B.A.N.* (Astronomical Institutes of the Netherlands), 478, Leiden, Observations of Two Occultations of the Crab Nebula by the Moon, at 400 Mc/s, By C.L. Seeger and G. Westerhout

10. *The Astrophysical Journal*, Vol. 157, September 1969, Arecibo Occultation Studies: List 3, S. Gulkis, J. Sutton, and C. Hazard, Cornell-Sydney University Astronomy Center

11. *Monthly Notices of the Royal Astronomical Society*, Vol. 124, 1962. The Method of Lunar Occultations and its Application to a Survey of the Radio Source 3C212, C. Hazard.

12. *Monthly Notices of the Royal Astronomical Society* (1972) 158, 431-462. A Study of the Lunar Occultations of Eleven Radio Sources, A.G. Lyne

The Skynet 20m radio telescope is capable of observing very weak radio sources. It is a publicly available remote telescope used by many amateur organizations and universities for educational purposes. Nonetheless, it is a powerful instrument and the quality of the work that can be performed on this telescope is illustrated in two of Dr. Dan Reichart's articles:

- "The fading of Cassiopeia A, and improved models for the absolute spectrum of primary radio calibration sources", *MNRAS* (*Monthly Notices of the Royal Astro. Soc.)* 469, 1299 – 1313 (2017) doi:10.1093/mnras/stx810 Advance Access publication 2017 April 3: *http://www.gb.nrao.edu/20m/projdocs20m/FadingofCassA_MN469p1299_2017.pdf*
- "Skynet Algorithm for Single-dish Radio Mapping. I: Contaminant-cleaning, Mapping, and Photometering Small-scale Structures", *The Astrophysical Journal Supplement Series*, 240:12 (50pp), 2019 January https://doi.org/10.3847/1538-4365/aad7c1 © 2019. The American Astronomical Society.

I've used such articles as a basis to develop amateur skills not requiring an extensive statistical analysis to determine accurate flux densities.

Education

To develop radio astronomy skills, one can take a university course or workshop. Coursera has an online radio astronomy course, and the annual Chautauqua course in radio astronomy occurs at Green Bank Observatory, WV (GBO). The annual SARA conference is a must-do experience for anyone serious about radio astronomy. While SARA also has a spring conference, the summer event occurs at the GBO campus and allows members use of the 40-foot radio telescope and the 20-meter radio telescope. There are displays of member radio telescopes on the lawn each evening. That's in addition to the presentations, campus tours, lively Drake Lounge social interaction, and many other pleasant experiences. There is always a crowd of first-time attendees who are new to radio astronomy. The first day is dedicated to introductory radio astronomy lectures.

Radio astronomers do not have their own professional organization, but the American Institute of Physics (AIP), the American Physical Society (APS), the Institute of Physics (IOP), the American Astronomical Society (AAS), and the Institute of Electrical and Electronic Engineers (IEEE) are where professional radio astronomers enquire to publish their research.

Collaborations for New Observing Forms

There is a need to collaborate and create new tools for amateur radio astronomers. For example, partnering on the creation of amateur radio astronomy databases is a great way to learn. So too is the visualization and development of new opportunities for amateur radio astronomers. In 2016, a few SARA members, including myself, developed a solar system database template intended as a guide for amateur radio astronomers. These are the sorts of projects where organizations such as the ALPO could contribute, similar to how it created the planetary observation forms. The solar system database template was intended for the consideration of what data can be collected, assuming one wants to start a database for a specific instrument or observation target. Such a template can be made available for all amateur members to upload their data. Observers would be able to see if they are getting a proper signal by comparing to what others gathered using a similar instrument. Like the optical observation forms, it helps get the observers thinking about the measurements to note and record. While such templates are posted on the SARA website, they are living documents intended for further refinement as volunteers come forward. Could the members of the ALPO help with this, or even create their own better template? Of course, this assumes they learn some basic skills and commit time to the project. The caption of the Solar System database template shows how it can be developed. The template is a start, but it is not finished. SARA members have offered many comments on how to improve the template further. I welcome volunteers and partners to follow-up on its collected commentary for further improvements. Are you a self-starter and interested in this? If so, please contact me.

My Own Journey

One of the best ways to learn a new subject is to volunteer to work on a project, and I have already suggested one with the solar system database template development. There are many more. When I first joined SARA, they had a good website but it wasn't organized like the ALPO with sections, which is standard practice in professional organizations whether they are called sections, divisions or something else. I proposed to SARA management that such sections should be added to the SARA website. I was then given permission to work on this as a project and today, one will find such sections on the SARA website. Since I was new to radio astronomy, organizing materials into sections was a natural learning experience for me and I was pleased to share this organization and overview of radio astronomy with SARA. The purpose of SARA Sections included:

- Organizing SARA like other national amateur (e.g., AAVSO, ALPO) and professional organizations.
- Making sections conducive to volunteering; database collection; strategic planning; posting of observation protocols and member interests.
- Helping maintain consistency and thoroughness throughout the SARA website.
- Allowing more member empowerment to create SARA's future.

A Solar System Section Database Template

(*Courtesy of the Society of Amateur Radio Astronomers*)

Observing Specifications

Object observed
Date and UT
Latitude/ Longitude (of the observer)
Frequency/ Frequency Range
Check all that Apply:
___ Thermal
___ Continuum Spectrum
___ Absorption Spectrum
___ Emission Spectrum
___ Non-Thermal Synchrotron

Type of Radio Object Specifics

RA and Declination:
___ Sun
___ Solar flare observations at VLF and decametric frequencies
___ Moon
___ Planet
___ Jupiter observations at decametric frequencies
___ Asteroid
___ Meteor
___ Comet

Telescope Specifications

System specifications
Antenna tracking & Phase tracking programs
Antenna Specifications and Type
___ Monopole
___ Dipole
___ Dish
___ Helix
___ Yagi
___ IBT
___ SDR
LNA Specifications
System Temperature
Online System (e.g. Skynet)
Software Specifications and Output
___ FFT
___ Waterfall plot
___ Doppler shift
Type of Receiver list
___ Ettus
___ Spectracyber
___ Rtl-SDR
___ RASDR2
___ Radio Jove
___ SuperSid

Experience Level Specifications

- Price of System Setup (if purchased new)
- Ease of System Setup
- Ease of Software Configuration
- Subject Matter Expert(s)

A Solar System Section Database Template (Continued)

Methodology

___ Simple observation
___ Molecular Spectroscopy
___ Occultation
___ Interferometry
___ Imaging
___ Radiometry and Magnetometry
___ Polarimetry

Considerations
• Type of Analysis Completed
• Calibration Source and Minimum Resolution (at specified wavelength)

Recorded Output

Source structure:
___ Complex
___ Double
___ Single

Considerations
• Raw Data Table
• Flux and Flux Density
• Angular Size
• Gain
• Interference Sources

In my last ALPO article (Tzikas 2021), I took this approach to list a series of bulleted items that would form an outline for an ALPO Radio Astronomy Section. Those bullets highlight appropriate targets for this ALPO section mission and goals. For the interested ALPO member, that outline can be a basis of their observing programs. These work best with a lead person who can help the observers get to the point where they can independently provide constantly good and useful data. As noted, there are basic radio astronomy telescopes for purchase to start anyone in an aspect of radio astronomy. There are also plenty of engineering enthusiasts who enjoy building their own radio telescopes. With such tools as the remote 20m radio telescope, the experienced observer has powerful tools. The Skynet 20m dish is not the only instrument of professional quality. Once a person starts gathering knowledge, there are other opportunities if one knows where to look. Often these are smaller organizations and universities with instruments that welcome volunteers to help develop their organizational capabilities. These places may have acquired their access to certain facilities, for example through military decommissioning, but that doesn't mean the organization has all the required skills to operate it at its full performance level.

I think the ALPO will be lucky to get several immediate active volunteers. But if at least some rudimentary structure is in place, I think it helps the occasional enthusiastic new member who decides that radio astronomy is his or her passion and develops something further. Over the years these "seeds" grow, though that might not be apparent from a daily perspective.

I've taken an interest to the GBO 20m remote radio dish - a professional radio telescope (**cover of this Journal**). My main focus is to learn one aspect of it annually. That is all I have time for at the moment. This year, I am looking at the use of the 20m to observe astronomical masers (**Figure 4**). Last year, it was pulsars. The year before that, it was variable radio sources such as Cas A.

Resources

This article serves as a basis for ALPO members to learn basic radio astronomy on their own. They'll need to be persistent, as there is no "help desk" when it comes to radio astronomy. The closest thing to that is the SARA email forum, where some very smart SARA members like to do that type of mentoring.

If radio astronomy does capture your interest, it will offer you many interesting challenges, including many at a more advanced undergraduate and graduate level of university expertise. One might not be performing at a professional research level, but it could very much require a university education depending on what one decides to pursue. Let's

Figure 4. The author inside the GBO 40-foot radio telescope control room on July 14, 2013. (Photo by Stephen Tzikas.)

start though with some simple basic first steps:

1. Sign up on the SARA Listserv: One does not need to be a SARA member to sign up. This email forum will give anyone a feel for the breadth and complexity of radio astronomy conversation.

2. Browse the SARA website: Review the Solar System section, among other sections to see all six topic areas of radio astronomy. Browse the Beginner's Tab under the SARA Section Introduction page, as well as the Education link on the top ribbon of the SARA page.

3. Attend a SARA Conference. The Eastern Conference has demonstrations on the lawn. One also has access to the GBO on-site, 40-foot radio telescope and the 20m radio telescope.

4. Get practice for building your own radio instrumentation. If you never soldered before, try practicing on some low-cost educational kits available for sale on the internet.

5. Become a Volunteer: It's up to an individual to make an observing idea grow by cooperating with other like-mind radio observers. Get involved, share your knowledge, learn and work with others. If you have something valuable to share, create an observing guide. They are greatly needed. Help develop and update data collection templates and programming.

6. Start Observing: Purchase a low-cost INSPIRE radio receiver kit, a Super-SID, or a Radio Jove. Visit the live radio meteors web page.

7. Acquire Basic Radio Electronic Skills: Attend an ARRL meeting. Local radio technology clubs exist in nearly every county.

Create Projects

Once you have gained some experience and selected an area of particular interest for detailed research and observation, what you learn will help others build the amateur field. Consider writing articles, making a presentation, or mentoring someone on what you have found. I say this because there are not a lot of instructional materials for amateurs once the basic kits are mastered. My personal interest in the 20m radio dish led me to create new observational projects for it annually when I demonstrate its capabilities at the Eastern SARA conference. These projects are ongoing as I delve deeper into them and consult professional literature on observational nuances. These observations include the variability of some radio sources with time, taking a flux density measurement, masers, pulsars, manipulating raw observational data, and observing other analytical nuances. I post these educational project updates on SARA's Analytical Section web-page. Creating projects is a common theme among amateur radio astronomers and students. Amateurs frequently build their own radio telescopes because advanced kits usually do not exist.

Grants

Amateur projects can also demonstrate that by using new, low-cost technologies or materials through small student grants, they can be assembled into instrumentation to observe phenomena that until a few decades ago was only available through professional instruments. If you are a student or teacher, you can take advantage of SARA's Student and Teacher Grant Program. This program provides kits and/or funding for radio telescope projects, of which some past projects at universities had been quite elaborate involving multiple students. Funding provided is typically up to $500, but can go higher based on a project's sophistication.

An Active Forefront

As I conclude, remember that radio astronomy is a 24/7 adventure under any weather conditions. It can be a simple enjoyment, or as challenging as you wish to make it. I would expect that if a radio astronomy section in the ALPO develops, that at some future date it could help set new limits of amateur solar system radio astronomy observing.

References

Tzikas, Stephen (2019). "X-Band Observations of the August 21, 2017 Partial Solar Eclipse", *Journal of the Assn. of Lunar & Planetary Observers*, Vol. 61, No. 1 pp. 33-34.

Tzikas, Stephen (2021). "On Establishing an ALPO Radio Astronomy Section", *Journal of the Assn. of Lunar & Planetary Observers*, Vol. 63, No. 3 pp. 32-33..

Papers & Presentations:

A Report on Carrington Rotations 2238 and 2241 (2020 11 28.6139 to 2021 03 17.9403 UT)

By Richard (Rik) Hill,
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ALPO Solar Section
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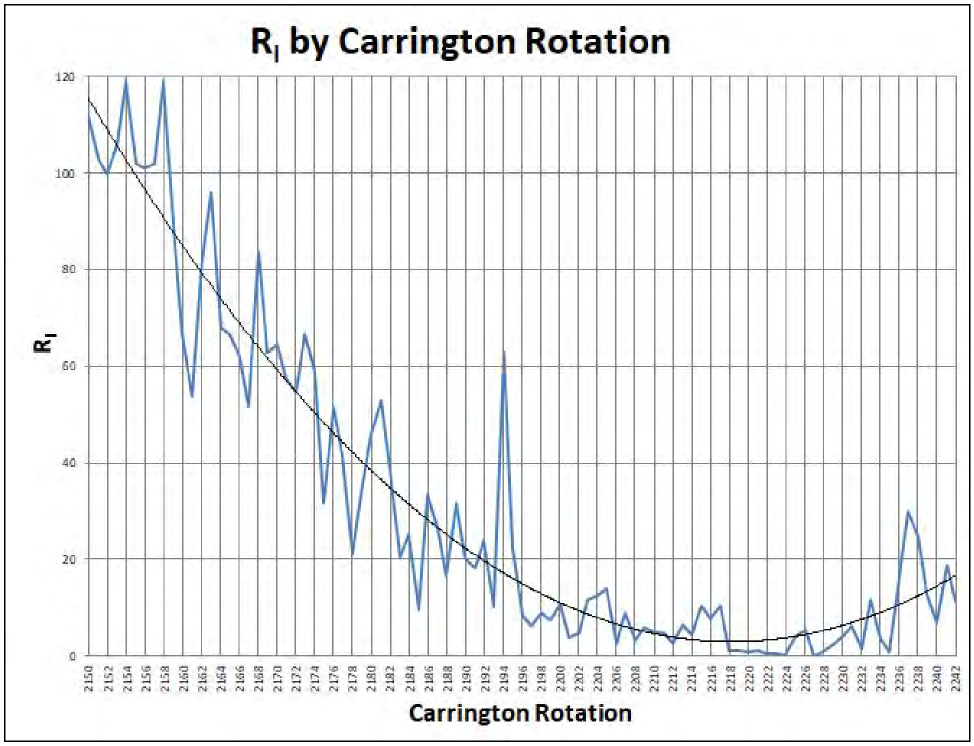
To our hard-copy readers: This paper can be viewed in full-color in the online (pdf) version of this Journal.

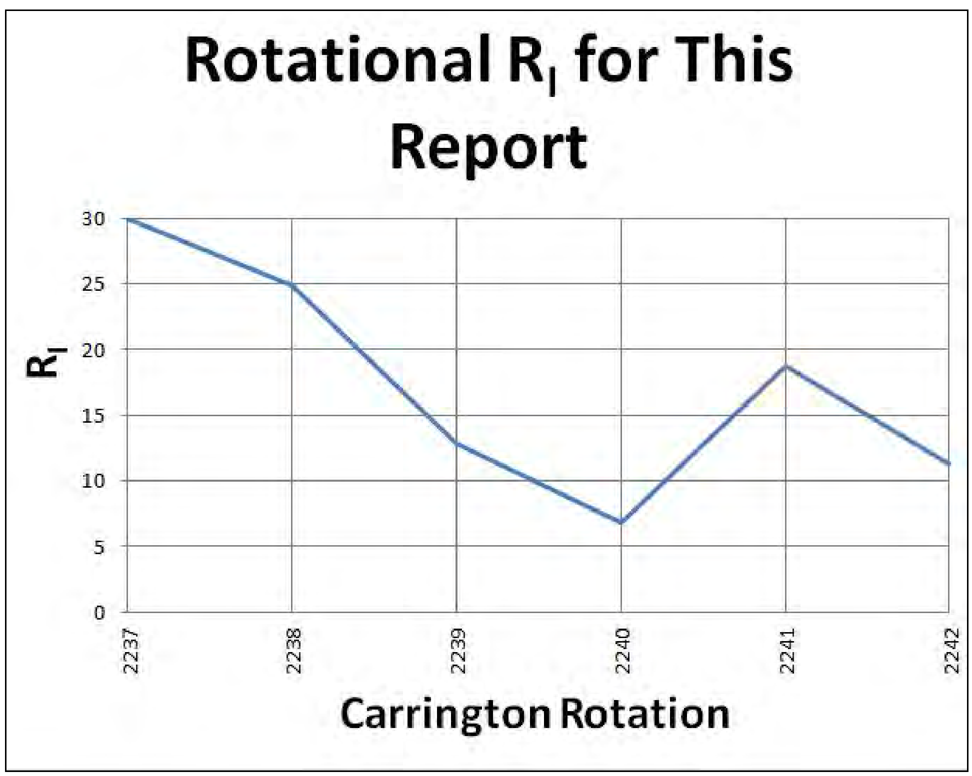
Overview

Solar activity for this reporting period ranged from low to very low, with the most active rotation being the first one, CR 2238, with an average R_I of 24.9 (daily high R_I of 94 on 11/29, the day after the high for the previous reporting period) and 30 days of no spots. The largest region was AR 2786, which with nearby AR 2785 made for the best observing of this reporting period. No naked-eye spots or groups were reported, though AR 2786 attained an area of 1,000 mils on 11/25, which would have been sufficient for a sharp-eyed observer to detect through a solar filter alone.

The rest of the period was rather lackluster with no regions exceeding 220 mils. CRs 2237-2238 created a spike in the long-term plot, making a lot of observers excited about a fast return to strong activity. But activity fell back to low levels and it's beginning to look like the slower rise prediction to the next maximum is most likely at this time.

Observers contributing to this report, their modes of observing and equipment are summarized in the accompanying table. It will be used as a reference throughout this report rather than repeating this information on every image or mention.





Terms and Abbreviations

Readers are encouraged to return here as needed for definitions of any unfamiliar terms and abbreviations.

AR = Active Regions, that is, areas which include all activity in all wavelengths for that area of the Sun as designated by NOAA; only the last four digits of the full identification number is used here.

CaK = Calcium K-line observations.

CM = Central Meridian of the visible disk.

CR = Carrington Rotations.

faculae = bright regions of the Sun's photosphere seen most easily near the Sun's edge.

groups = visible light or "white light" sunspots associated with an Active Region.

H-a = hydrogen-alpha observations.

"leader" and "follower" = "east" and "west" on the Sun; using the "right-hand rule" where, using your right hand, your thumb pointing up is the North Pole and the rotation follows the curl of your fingers. Orientation of all images is with north up and celestial west to the right.

mils = abbreviation for "millionths of the Sun's visible disk".

Na-D = Sodium-D observations.

Naked-eye sunspots = those spots visible on the Sun without amplification but through proper and safe solar filtration; never look at the Sun, however briefly, without such filtration even at sunrise/sunset.

NOAA = National Oceanic and Atmospheric Administration.

N, S, E and W = north, south, east, west.

plage = a luminous area in the Sun's chromosphere that appears in the vicinity of an active region.

W-L = abbreviation for "white light observations".

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Statistics compiled by this author have their origin in the finalized daily International Sunspot Number data published by the World Data Center - Solar Index and Long Term Solar Observations (WDC-SILSO) at the Royal Observatory of Belgium. All times used here are Coordinated Universal Time and dates are reckoned from that and will be expressed numerically with month/day (for example, "9/6" and "10/23"). Carrington Rotation commencement dates are obtained from the table listed on the ALPO Solar Section web page at:

http://www.alpo-astronomy.org/solarblog/?page_id=3423

Areas of regions and groups are expressed in the standard units of millionths of the solar disk, with a naked-eye spot generally being about 900-1,000 millionths for the average observer. The McIntosh Sunspot Classification used here is the one defined by Patrick McIntosh formerly of NOAA (McIntosh 1981, 1989) and detailed in an article in the Journal of the ALPO, Volume 33 (Hill 1989). This description is also included in an online article on white-light flare observation located at:

http://www.alpo-astronomy.org/solarblog/?page_id=200

This will be referred to as the McIntosh Class. The magnetic class of regions is assigned by NOAA and will be entered parenthetically after the McIntosh Class unless specifically referred to as "mag. class".

Lastly, due to the constraints of publishing, most of the images in this report have been cropped, reduced or otherwise edited. The reader is advised that all images in this report, and a hundred times more, can be viewed at full resolution in the ALPO Solar Archives. The archives can be accessed by going to www.alpo-astronomy.org, then clicking on the ALPO Section Galleries link near the top-right corner of the page, then clicking on "Solar Observations Archive". You can also access the archives directly through this link: http://alpo-astronomy.org/gallery3/index.php/Solar-Observations-Archive .

Table of Contributors to This Report

Observer	Location	Telescope (aperture, type)	Camera	Mode	Format
Paul Andrew	Dover, Kent, UK	152mm, RFR	ZWO ASI 290	H-a	digital images
Tony Broxton	Launceston, Cornwall, UK	127mm, SCT	N/A	W-L	drawings
Vlamir da Silva	Sao Palo, Brazil	40 mm, PST	DMK21AU04.AS	H-a	digital images
Howard Eskildsen	Ocala, FL, USA	80mm, RFR	DMK41AF02	W-L wedge	
Guilherme Grassmann	Curitiba, Brazil	60mm, RFR	Lumenera Skynyx 2.0	H-a	
Richard Hill	Tucson, AZ, USA	90mm, MCT	Skyris 445m	W-L	
Monty Leventhal	Sydney, New South Wales, Australia	250mm, SCT	Canon Rebel T3i EOS 600D	W-L/H-a	drawings
				H-a	digital images
Frank Mellilo	Holtsville, NY, USA	200mm, SCT	DMK21AU03AS	H-a	
Luigi Morrone	Agerola, Italy	355mm SCT	Fornax52	W-L	
John O'Neal	Statesville, NC, USA	152mm, RFR	ZWO AS174MM	Na-D	
		60mm, RFR	ZWO AS174MM	H-a	
		100mm, RFR	ZWO AS174MM	CaK	
Theo Ramakers	Oxford, GA, USA	80mm, RFR	ZWO ASI174MM	H-a	
		279mm, SCT	DMK41AU02AS	W-L	
		40mm, H-a PST	DMK21AU03AS	H-a	
		40mm, CaK PST	DMK21AU03AS	CaK	
Randy Shivak	Prescott, AZ, USA	152mm, RFR	ZWO-ASI174	H-a	
Randy Tatum	Bon Air, VA, USA	180mm, RFR	DFK31AU	W-L-pentaprism	
David Teske	Louisville, MS, USA	60mm, RFR	N/A	W-L/H-a	drawings
		100mm, RFR	ZWO-ASI120mm	H-a	digital images
David Tyler	Buckinghamshire, UK	178mm, RFR	ZWO ASI 120	W-L	
Geert Vandenbulcke	Koksijde, Belgium	80mm, RFR	ZWO ASI 290	H-a	
Christian Viladrich	Nattages, France	300mm, RFN	Basler 1920-155	W-L	

Telescope types: Refractor (RFR), Newtonian Reflector (RFN), Cassegrain (Cass), Schmidt Cassegran (SCT), Maksutov-Cassegrain (MCT), PST (Personal Solar Telescope)=RFR

Carrington Rotation 2238

Dates: 2020 11 28.6139 to 2020 12 25.9375

Avg. R_I = 24.9
High R_I = 94 (11/29)
Low R_I = 0 (12/19 & 12/20)
(see plot on next page)

While activity was low for this rotation, combined with the previous rotation, the numbers were higher than any rotations since CR 2196 back in October 2017. Nine regions were designated during the course of this rotation.

As AR 2783 of the previous rotation (Hsx of 70mils) was reaching its peak on the CM on 11/22, AR 2785 was coming onto the disk also an Hsx group of 60mils (mag-class Alpha). On 11/23, it was 120mils (Cso) followed by AR 2786 also 120mils (Hsx). Their relative positions are well-shown in an Eskildsen W-L image at 16:08 UT (**Figure 1).**

At this point, AR 2785 stalled at 140mils (Hsx) while AR 2786 grew on 11/24 to 380mils (Cko, mag-class Beta), as shown by Ramakers in the W-L, H-a and Cak montage image at 14:57, 15:07 and 15:16 UT respectively (**Figure 2**). This region tripled in area on 11/25 to 1,000mils with no change in classes. Ramakers reported th**at no spot group of this size has been observed since 9/8-9/9 2017!** Though there were no reports of AR 2786 as a naked-eye spot (using proper filtration), it was certainly big enough to be detected. Grassmann followed its evolution from 11/23 thru 12/03 in a great series of daily CaK images (**Figure 3**).

On 11/26, the area of AR 2786 decreased to 840mils but the class increased in complexity to Fko (mag-class Beta-Gamma), still a true flare producer as imaged by Eskildsen in the W-L and H-a montage at 16:31 UT and 16:24 UT respectively (**Figure 4**). Then, on 11/27, it decreased further to 800mils with no change in class. Ramakers took a nice high-resolution W-L image at 14:53 UT (**Figure**

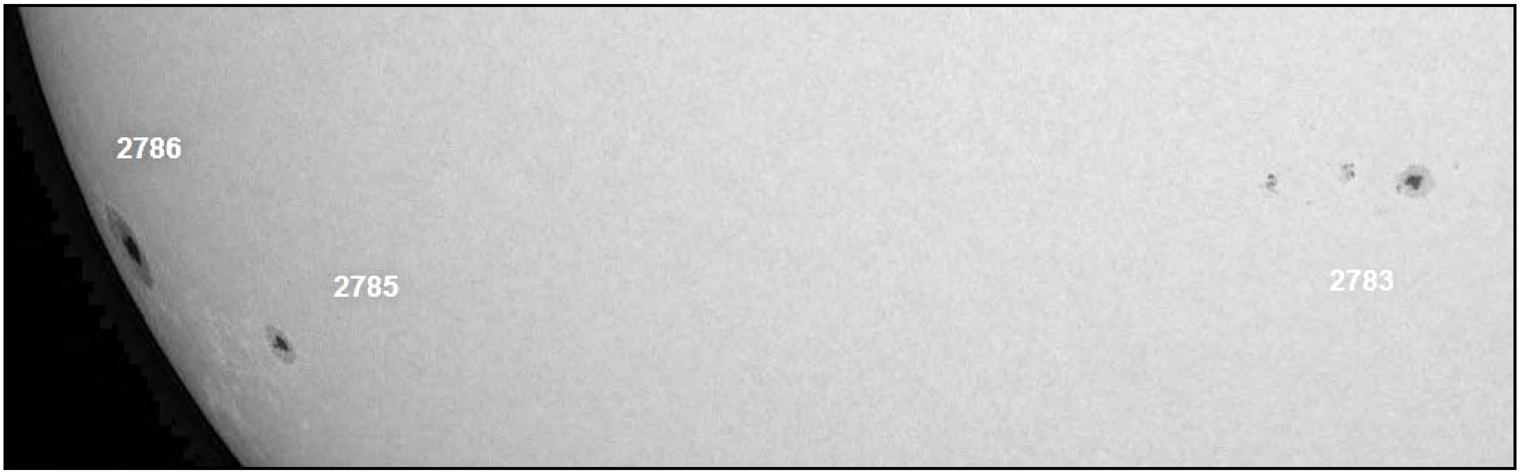


Figure 1 (above). Eskildsen W-L image on 11/23 at 16:08 UT showing ARs 2783, 2785, 2786.

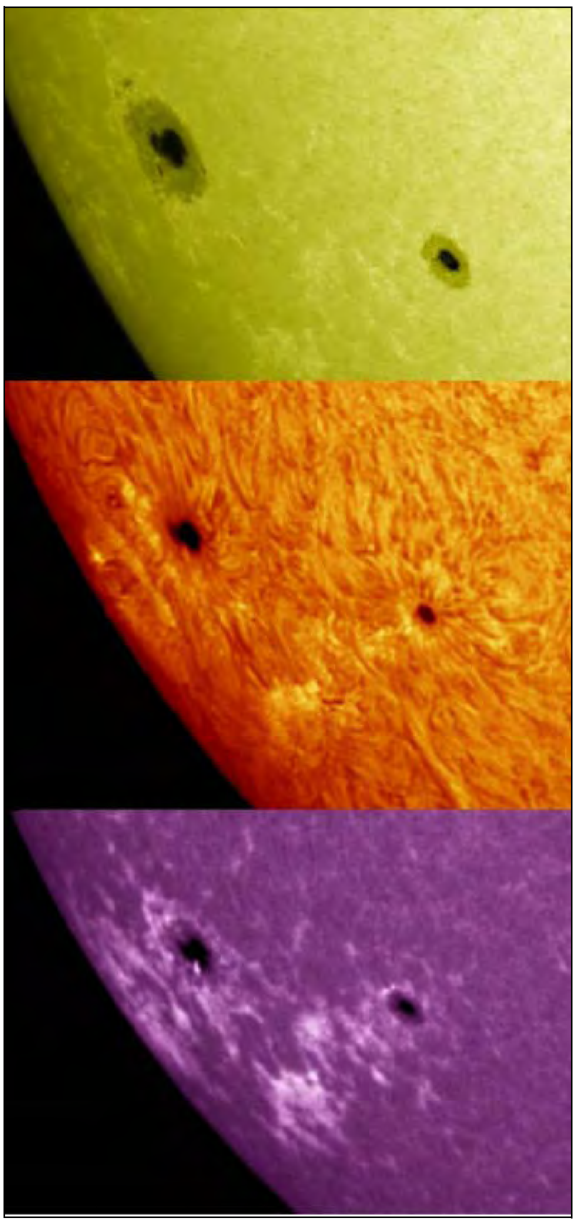


Figure 2 (left). A montage of Ramakers images of ARs 2785 and 2786 taken on 11/24 in W-L, H-a and Cak (top to bottom) at 14:57 UT, 15:07 UT and 15:16 UT, respectively.

Figure 3 (above). A series of Grassmann CaK images that followed the evolution of AR 2786 from 11/23-12/03.

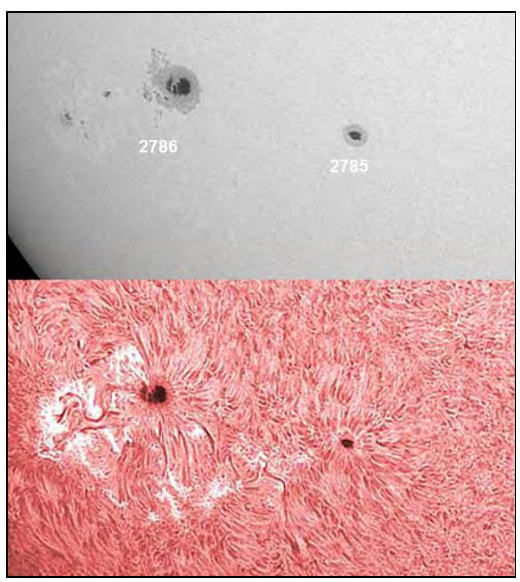


Figure 4 (left). A two-pane view on 11/26 of ARs 2785 and 2786 by Eskildsen in W-L and H-a at 16:31 UT and 16:24 UT, respectively.

5) and Viladrich captured a sub-arc-second H-a image at 12:32 UT (**Figure 6**).

This continued on 11/28 with area of 780mils, but still no change in class as activity moved into CR 2238. Captured in a 26-image H-a sequence by Da Silva was a bright region that was the site of the flaring. Unfortunately, he imaged it at 13:36 UT (**Figure 7**), which was between the two periods of active flaring.

AR 2786 decreased further on 11/30 with a reduction in class to Cki (mag-class Beta). Things were devolving rapidly now with the area being only 430mils and class Cko on 12/1. There were a number of "energetic events" from 12/1 thru 12/5, some due to AR 2786, but none were caught by our observers.

Carrington Rotation 2239

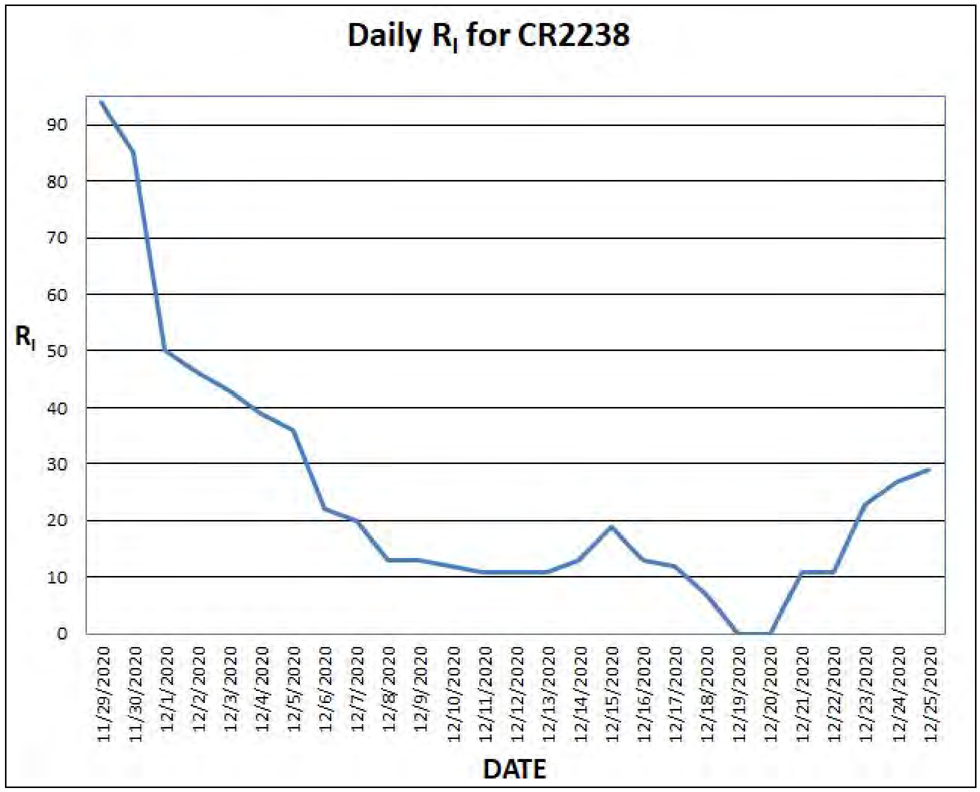
Dates: 2020 12 25.9375 to 2021 01 22.2750

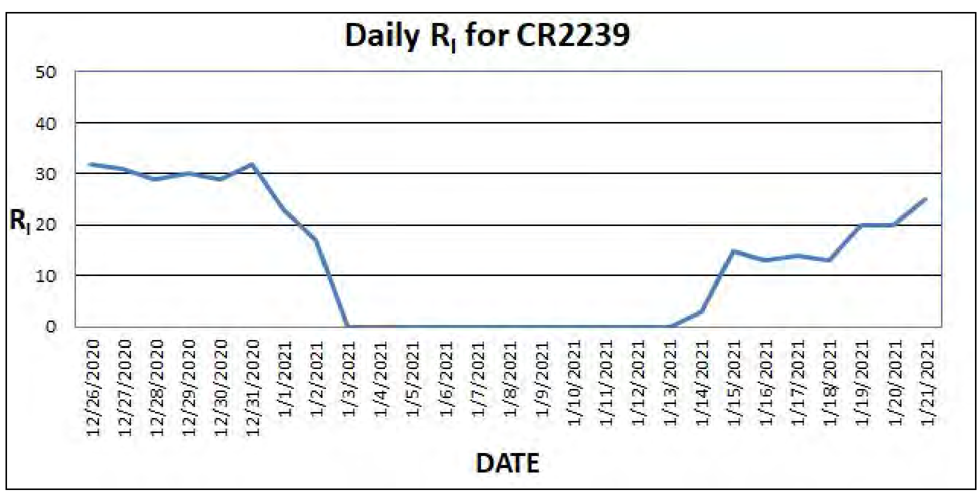
Avg. R_I = 12.8
High R_I = 32 (12/26 & 12/31)
Low R_I = 0 (11 days)

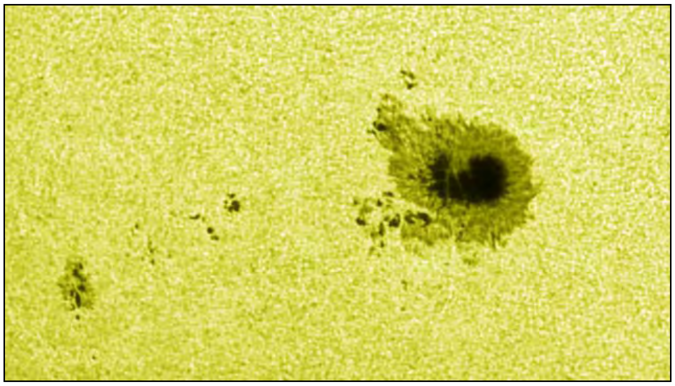
The activity level dropped back down to very low again, with an average R_I of 12.8, 11 days of zero spots and only four regions designated. The rotation opened with ARs 2794 and 2795 on the disk, both small and not terribly active with the former getting to 220 mils and Hsx during its entire passage across the disk and the latter peaking at 200 mils, Dao. Only two other active regions were designated in this rotation, ARs 2796 and 2797. These ARs were even less impressive.

AR 2794 came on in the previous rotation as an Hsx group of 120 mils on 12/20 (mag. class Alpha) and stayed that way, that is, a round spot with a radially symmetrical penumbra between 120 and 200 mils in size. Grassmann got the first good look at it in a CaK image on 12/21 at 22:38 UT (**Figure 8**). It was followed on 12/23, by about 30 degrees in longitude, by AR 2795 which formed on the disk as a 40-mils Cro group. It jumped to a Dao group of 200 mils the next day and spent the rest of its time on the disk slowly breaking down. Even so, it was producing some flares like two B1 flares seen on 12/31. The peak of these groups is well-shown in a three-pane assembly of Eskildsen images on 12/26: W-L at 16:37 UT, H-a at 16:33 UT and Cak at 16:35 UT (**Figure 9**). It was captured again on 12/27 in a W-L Broxton drawing at 10:25 UT (**Figure 10**).

AR 2797 was first noted by Teske on 1/14 at 17:19 UT in W-L/H-a drawing as faculae on the limb. It was officially designated AR 2797 the next day. By 1/18, it was Cao of 120 mils (mag-class Beta). It stayed that way the next day, but on 1/20 had decreased to 60 mils with classes remaining the same. All three of these days are well-shown in the three-pane Ramakers' W-L montage (**Figure 11**). The class was officially reduced to Hax on 1/21, with an area of 70 mils (mag. class still Beta) as seen in a Grassmann CaK image at 11:09 UT (**Figure 12**). It crossed the meridian on 1/23, still Hax but now was only 50 mils and a mag. class of Alpha. It continued to shrink in size until it was gone by 1/28. Teske was the last to record this region in one of his W-L/H-a drawings at 22:02 UT on 1/27.







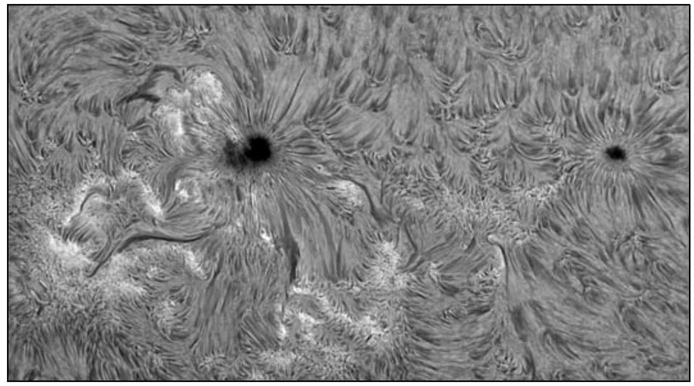
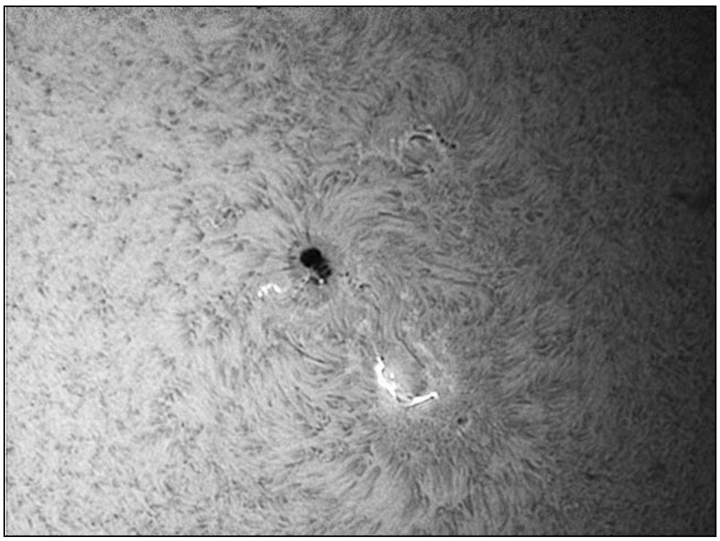


Figure 5 (above left). A Ramakers high-resolution W-L image of AR 2786 on 11/27 at 14:53 UT.

Figure 6 (above right). A Viladrich sub-arc-second H-a image of ARs 2785 and 2786 on 11/27 at 12:32 UT.



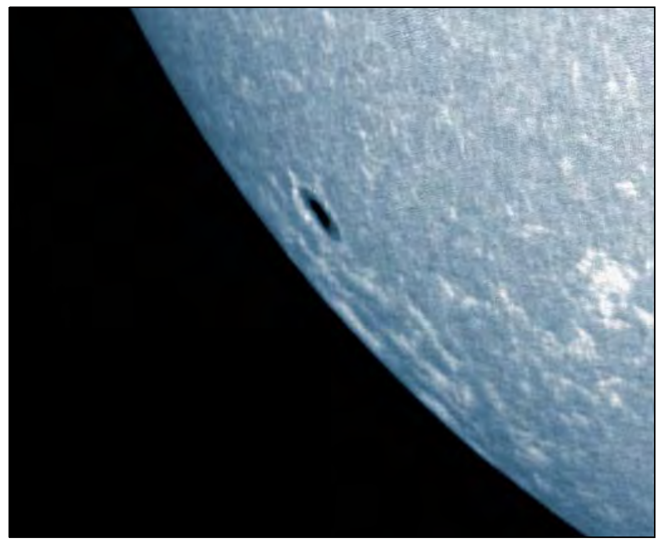
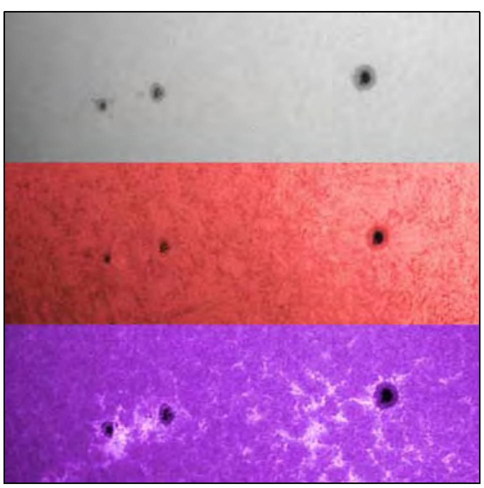


Figure 7 (above left). A region that was flaring shown here between flares by Da Silva on 11/28 at 13:36 UT.

Figure 8 (above right). Grassmann got the first good look AR 2794 in CaK image on 12/21 at 22:38 UT.



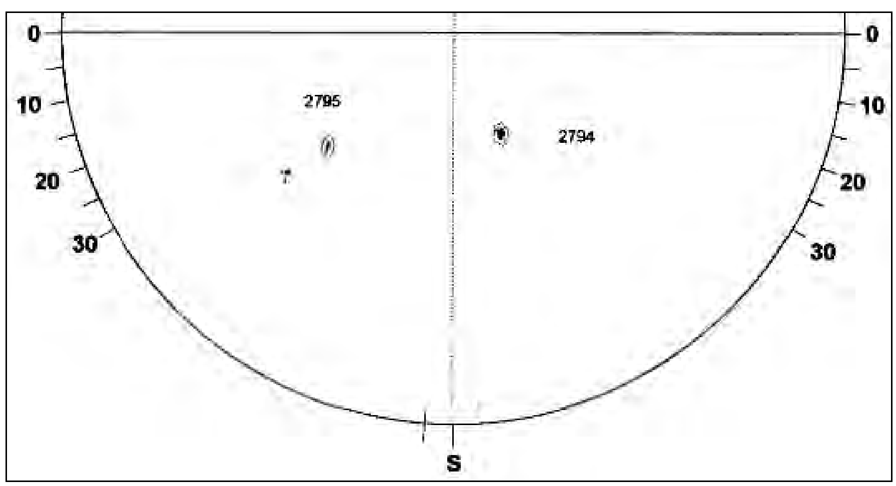
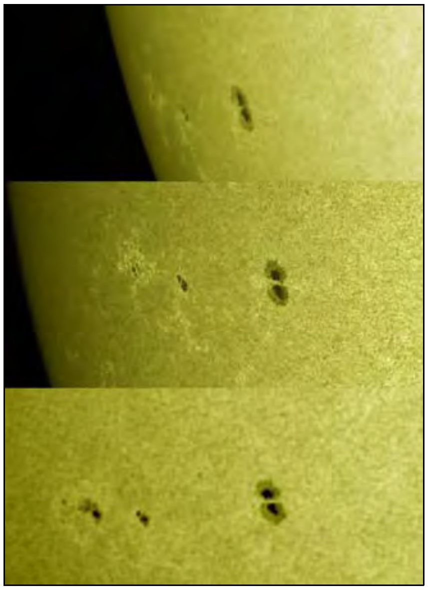


Figure 9 (above left). Three-pane assemblage of AR 2794 and 2795 by Eskildsen on 12/26 (top to bottom) W-L at 16:37 UT, H-a at 16:33 UT and Cak at 16:35 UT.

Figure 10 (above right). Broxton drawing of the southern hemisphere of the solar disk on 12/27 at 10:25 UT showing AR 2794 and 2795.



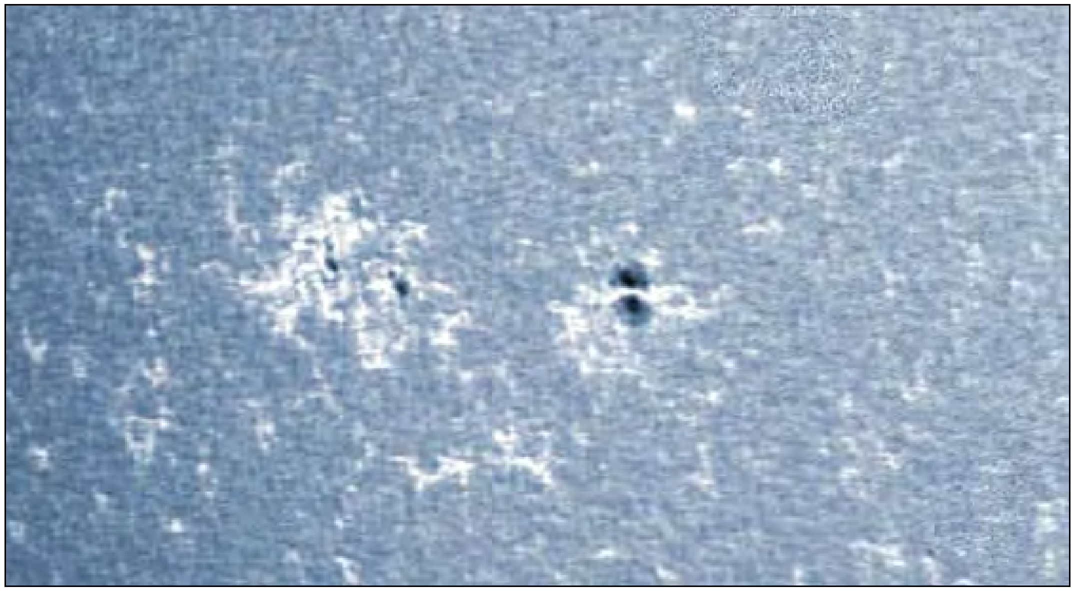
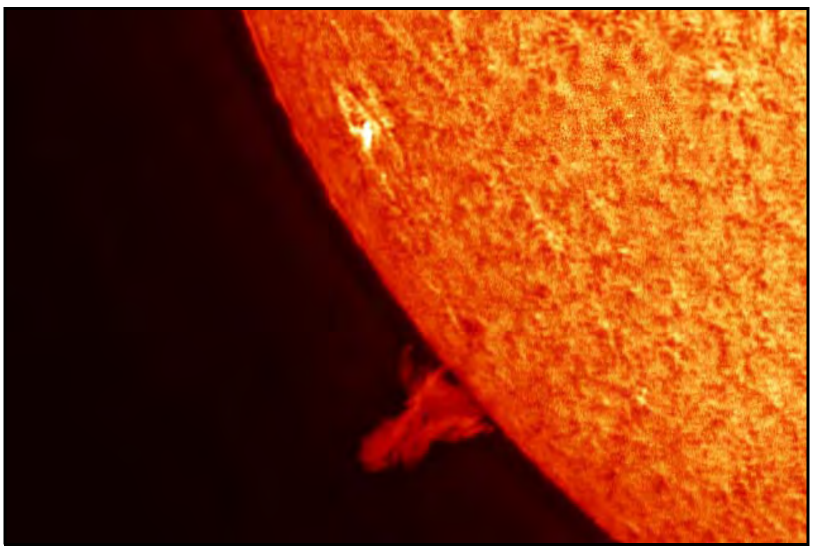


Figure 11 (above left). AR 2797 in a three-pane Ramakers W-L montage from top to bottom, on 1/18 at 15:08 UT, 1/19 at 15:13 UT, and 1/20 at 15:56 UT.

Figure 12 (above right). Grassmann CaK image of AR 2797 on 1/21 at 11:09 UT.



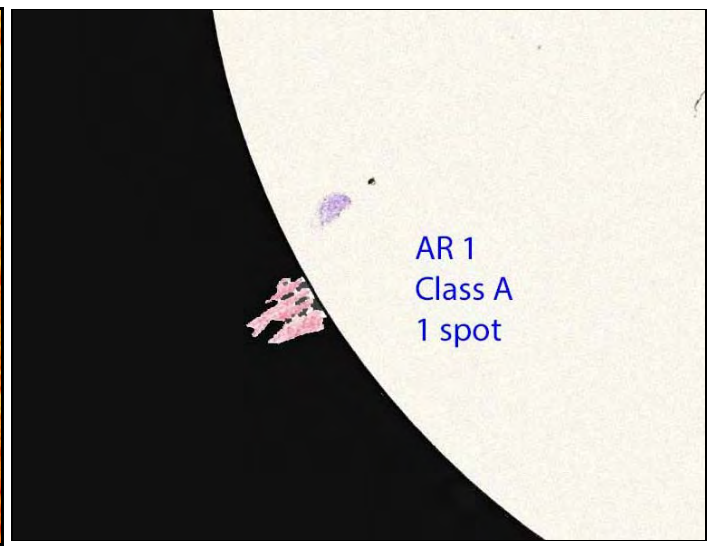


Figure 13 (above left). Ramakers image of a nice prominence next to a small undesignated active region, on 2/8 at 14:52 UT.

Figure 14 (above right). Teske W-L/H-a drawing of a prominence at the same location as Fig. 13 on 2/10 at 19:32 UT.

Carrington Rotation 2240

Dates: 2021 01 22.2750 to 2021 02 18.6153

Avg. R_I = 6.79
High R_I = 35
Low R_I = 0 (16 days)
(see plot on next page)

The *very* low activity for this rotation marks the low point for this reporting period. Only four small active regions were designated during this rotation, all in the northern hemisphere, none of which exceeded 50 mils. Most of the activity was at the very beginning of the rotation with final days of AR 2797 covered in the previous rotation.

One highlight for this rotation is seen on a nice image that Ramakers acquired on 2/8 at 14:52 UT of a prominence next to a small undesignated active region (**Figure 13**). Teske showed a prominence at the same location on 2/10 at 19:32 UT in one of his W-L/H-a drawings (**Figure 14**). This activity faded fairly quickly after that.

Carrington Rotation 2241

Dates: 2021 02 18.6153 to 2021 03 17.9403

Avg. R_I = 30
High R_I = 84 (11/28)
Low R_I = 0 (11/16)
(see plot on next page)

Activity increased but was still low to very low for this rotation. There were eight regions designated but only one of which, AR 2804, grew to more than 100 mils, but not as high as 200 mils

AR 2804 formed on the disk on 2/22 and is shown in a fine three-pane view on 2/24 by Ramakers: (top) W-L at 14:20 UT, (middle) H-a at 14:28 UT and (bottom) CaK at 14:37 UT (**Figure 15**). At this time, it had rapidly developed into a Dai group of 120 mils area (mag. class Beta). In the top pane we can see over half a dozen umbral spots with rudimentary penumbra, typical of a growing new group. But in the H-a view, we can see strong activity between the leader and follower spots. This is also seen to some degree in the CaK view with a small plage tight about the leader spots.

Several days later, on 2/26, the region was Dsi of 170mils (Beta) when a two-pane image by Hill W-L at 20:01 UT (left) and Grassmann H-a at 18:37 UT (right) show the leader now fully developed with a large umbra surrounded by a radially symmetric penumbra (**Figure 16**). In H-a, we see the activity still confined between the leader and follower as the region approaches the limb.

Maximum development occurred on 2/27 when the region attained 190 mils as a Dso (mag. class Beta). A combined Vandenbulke W-L at 12:40 UT (left) and Grassmann CaK at 11:47 UT (right) image serves to show that little had changed from the previous day, but the activity had now migrated to a region around the follower spots (**Figure 17**). This was the last good view we had of this region as it went around the limb a day later.

Before leaving this rotation, we have a treat from Shivak on the last day of the rotation. He submitted two views of one prominence separated in time by just under 20 minutes on 3/16 (**Figure 18**). The upper pane is at 13:37 UT and the lower at 13:52 UT. It's fascinating to see the small delicate changes that took place in this time interval. I would encourage him to make movies of these with his excellent equipment!

Conclusion

Cycle 25 is going well but is not yet strong. Of the three models that predict the rate of rise in activity, the lower-slower rise prediction seems to be the one that is happening. It is good to see more activity now than two years ago and we hope this will continue, however, NASA has recently announced that Cycle 25 is expected to be the weakest solar cycle in 200 years!

Observers reading this report are strongly encouraged to submit their images and drawings to the ALPO Solar Section at: *solar@alpo-astronomy.org* using the image naming format described at: *http://www.alpo-astronomy.org/alpo/?page_id=952* By doing so, you will see your own efforts highlighted in future reports. And never assume your results are less than useful. You may well have been the only person to have recorded some feature or event on our dynamic Sun!

For more information go to: *http://www.alpo-astronomy.org/member/ALPO_Standard_Memberships.html*

Acknowledgement

The author wishes to recognize and express gratitude to Assistant Coordinator Kim Hay for the well-done rotation reports posted on the website and which were used in the preparation of this report.

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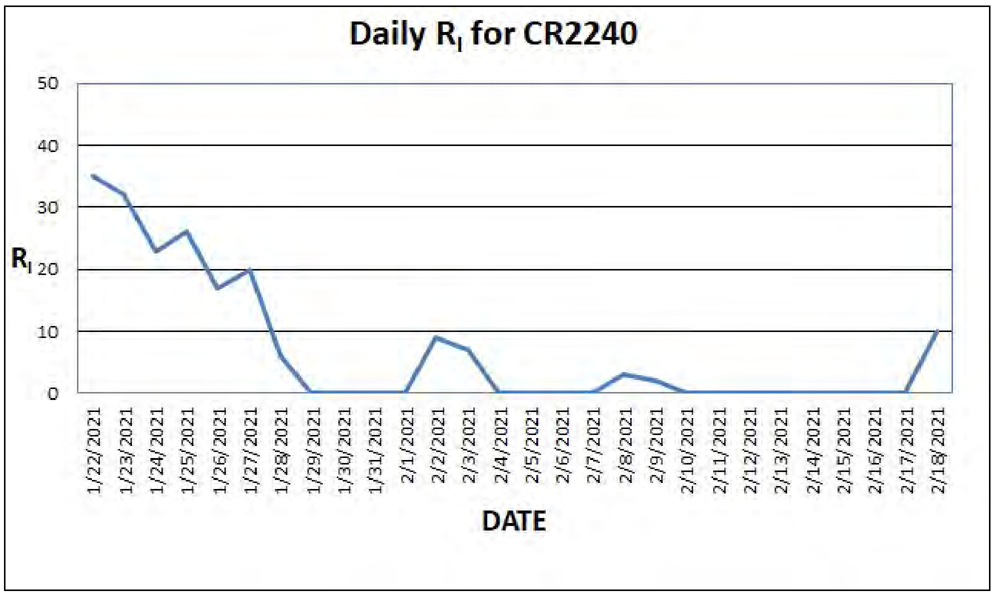

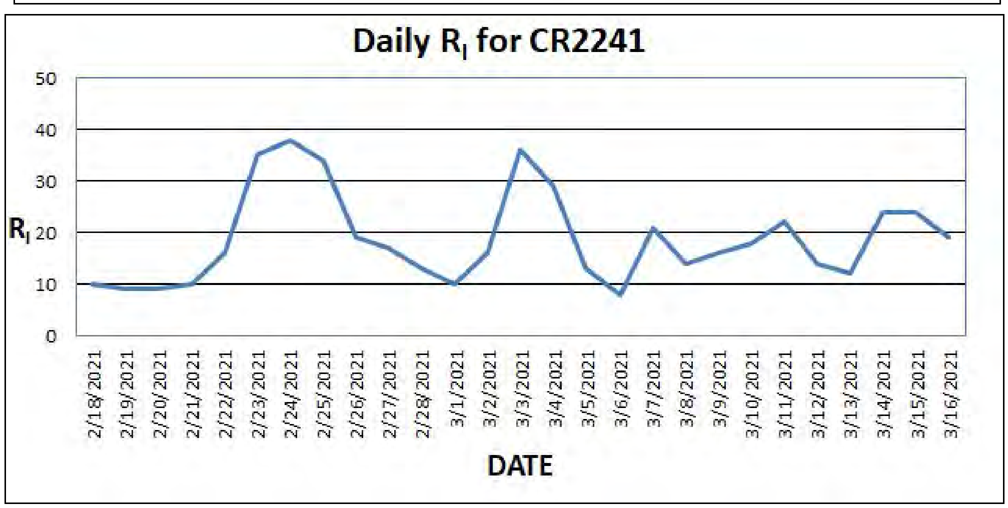

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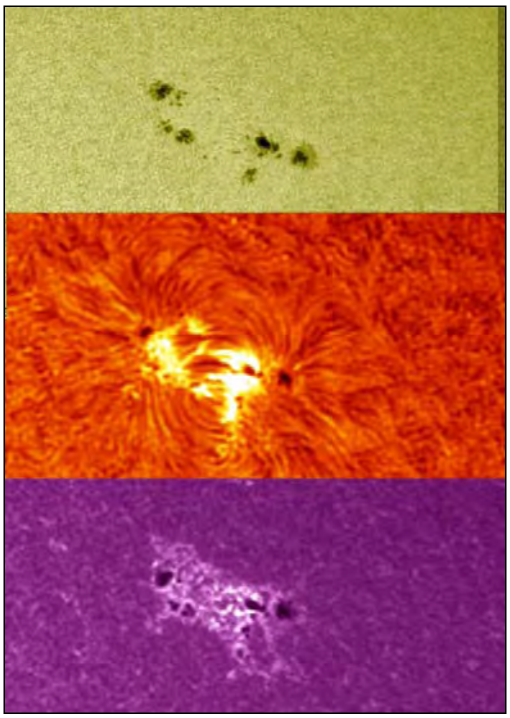
SILSO World Data Center *http://sidc.be/silso/home*

SILSO Sunspot Number *http://www.sidc.be/silso/datafiles*

The Mass Time-of-Flight spectrometer (MTOF) and the solar wind Proton Monitor (PM) Data by Carrington Rotation. *http://umtof.umd.edu/pm/crn/*



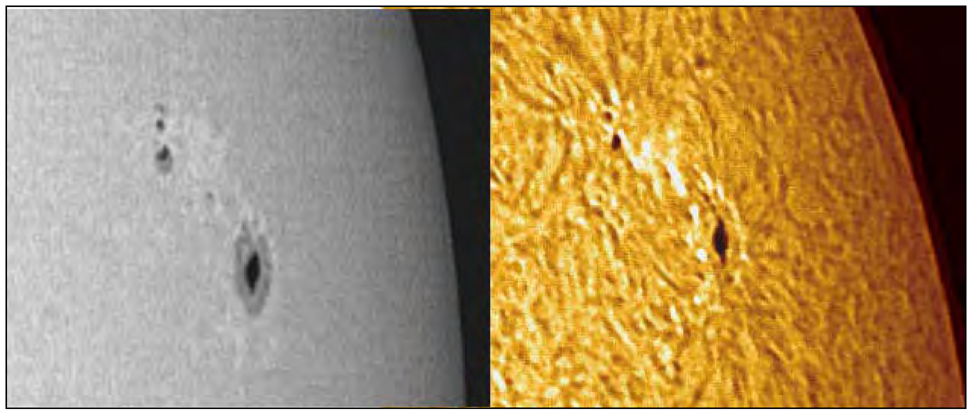
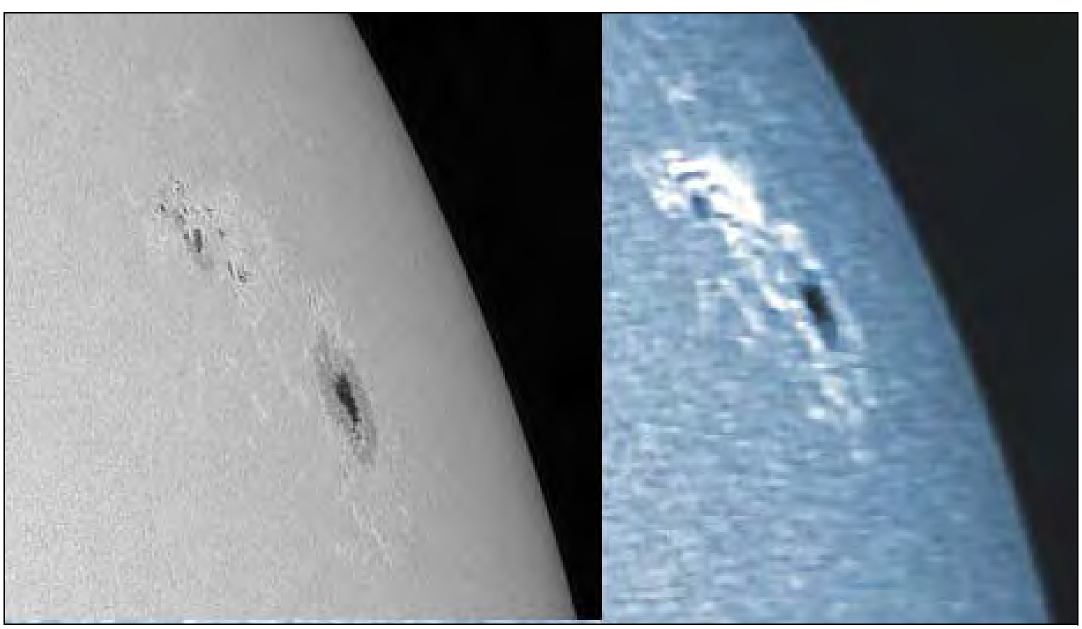


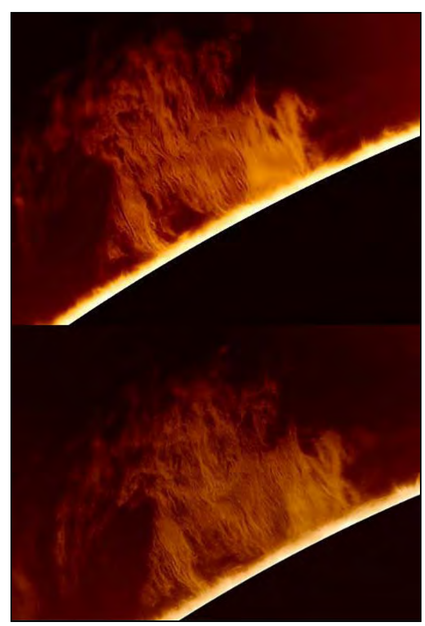
Figure 15 (left). A three-pane view on 2/24 by Ramakers: (top) W-L at 14:20 UT, (middle) H-a at 14:28 UT, and (bottom) CaK at 14:37 UT.

Figure 16 (above). A two-pane image by Hill in W-L at 20:01 UT (left) and Grassmann H-a at 18:37 UT (right) on 2/26.

Figure 17 (below left). A two-pane image by Vandenbulke W-L at 12:40 UT (left) and Grassmann CaK at 11:47 UT (right) on 2/27.

Figure 18 (below right). Shivak prominence montage on 3/16. The upper pane is at 13:37 UT and the lower at 13:52 UT.





Papers & Presentations

ALPO Observations of Venus During the 2017-2018 Western (Morning) Apparition

By Julius L. Benton, Jr., coordinator, ALPO Venus Section
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To our hard-copy readers: This paper can be viewed in full-color in the online (pdf) version of this Journal.

Abstract

Nine observers from the United States, France, Germany, Italy, Spain and the United Kingdom contributed digital images and visual observations (drawings and descriptive reports) to the ALPO Venus Section during the 2017-18 Western (Morning) Apparition, which was considered to be one of the more poorly observed apparitions in recent years. This report summarizes the results of the small sample of 117 total observations. Types of telescopes and accessories used in making the observations, as well as sources of data, are discussed. Comparative studies take into account observers, instruments, visual and photographic results. The report includes illustrations and a statistical analysis of the long-established categories of features in the atmosphere of Venus, including cusps, cusp-caps, and cusp-bands, seen or suspected at visual wavelengths in integrated light and with color filters, as well as digital images captured at visual, ultraviolet (UV) and infrared (IR) wavelengths. Terminator irregularities and the apparent phase phenomena, as well as results from continued monitoring of the dark hemisphere of Venus for the enigmatic Ashen Light are discussed.

Introduction

The ALPO Venus Section received only 117 observations for the 2017-18 Western (Morning) Apparition, comprised of visual drawings, descriptive reports and digital images from just nine observers residing in the United States, France, Germany, Italy, Spain and the United Kingdom. Geocentric phenomena in Universal Time (UT) for this observing season are given in *Table 1*, while *Figure 1* shows the distribution of observations by month during the apparition. *Table 2* gives the location where observations were made, the number of observations submitted and the telescopes utilized. Observational coverage of Venus during this apparition was considered poor in comparison with several recent observing seasons. The observational reports upon which this report is based covered the period from March 26 through November 3, 2017, with 63.2% of the total contributions received during June through August 2017. There was an obvious scarcity in observational coverage for the period between the middle of November 2017 and Superior Conjunction on January 9, 2018; several individuals commented that unusually cloudy weather and poor seeing conditions contributed to the lapse in observational coverage during that time frame.

For the 2017-18 Western (Morning) Apparition of Venus, observers witnessed the trailing hemisphere of Venus at the time of sunrise on Earth (a progression from crescent through gibbous phases) as the planet passed through greatest

Terminology: Western vs Eastern

"Western" apparitions are those when an "inferior" planet (Mercury or Venus, whose orbits lie inside the Earth's orbit around the Sun) is **west of the Sun**, as seen in our morning sky before sunrise.

"Eastern" apparitions are those when that planet is **east of the Sun,** as seen in our sky after sunset.

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:

Estimated magnitude of the faintest star observable near Venus, allowing for daylight or twilight

IAU directions are used in all instances.

brilliancy (–4.8m_v), dichotomy, and maximum western elongation from the Sun (46.0°). Observers are encouraged to carry out systematic observations of Venus when seeing conditions permit from conjunction to conjunction; the ALPO Venus Section is fortunate to have a team of dedicated observers who have tried very hard to do that each observing season.

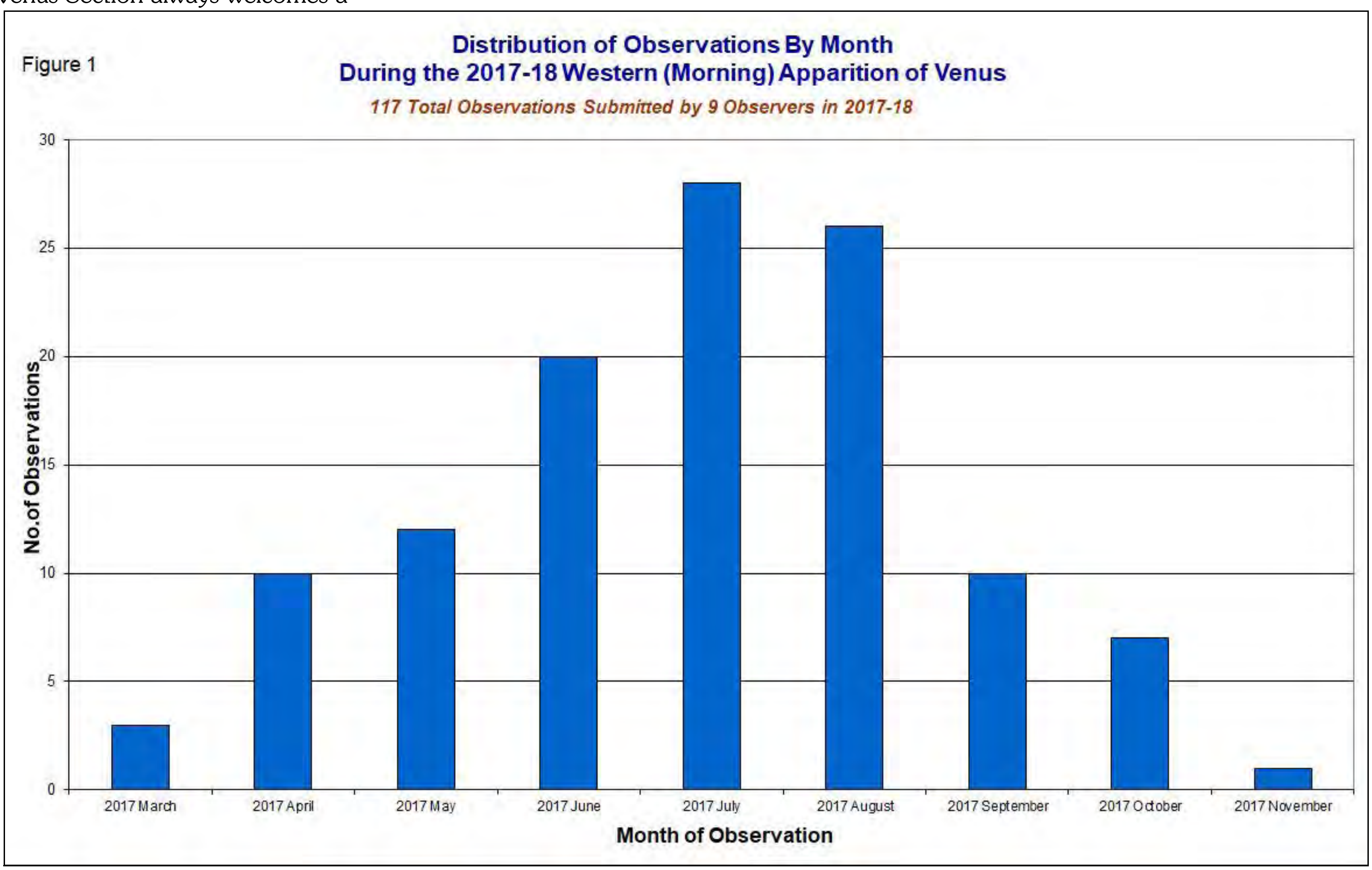
Figure 2 shows the distribution of observers and contributed observations by nation of origin for this apparition, where it can be seen that 33.3% of the participants in our programs were located in the United States, and that their observations accounted for 25.6% of the total submitted. Continuing international cooperation took place during this observing season, whereby 66.7% of the observers resided outside the United States and contributed 74.4% of the overall observations. The ALPO Venus Section always welcomes a widening global team of observers in the future.

The types of telescopes used to observe and image Venus are shown in *Figure 3*.

Apertures less than 15.2 cm (6.0 in.) accounted for 32.5% of all observations in 2017-18, with the remaining percentage (67.5%) were made with instruments ranging from 15.2 cm (6.0

Table 1. Geocentric Phenomena in Universal Time (UT) for the 2017-18 Western (Morning) Apparition of Venus

Inferior Conjunction	2017 Mar 25^d 10^h UT
Initial Observation	Mar 26^d 11 ^{h} 20^m UT
Greatest Illuminated Extent	Apr 30^d $04^h 00^m$ UT (m_v = –4.8)
Greatest Elongation West	Jun 03^d 13^h 00^m UT (47.0°)
Dichotomy (predicted)	Jun 04.26^d
Final Observation	Nov 23^d 12^h 19^m UT
Superior Conjunction	2018 Jan 09^d 10^h 00^m UT
Apparent Diameter (observed range): 59.8″ (2017 Mar 26) ↔ 10.1″ (2017 Nov 23)	
Phase Coefficient, ***k*** (observed range): 0.010 (2017 Mar 26) ↔ 0.982 (2017 Nov 23)	



in.) to 106.0 cm (42.4 in.). During this observing season, the frequency of use of classical designs (refractors, Cassegrains, and Newtonians) was 40.2%, while utilization of catadioptrics (Schmidt-Cassegrains, Dall-Kirkhams and Maksutov Cassegrains) was 59.8%. Essentially all visual and digital observations were performed under twilight or daylight conditions, generally because most experienced Venus observers recognize that viewing during twilight or even in full daylight substantially reduces the excessive glare associated with the planet. Also, doing visual work or imaging Venus when it is higher in the sky markedly cuts down on the detrimental effects of atmospheric dispersion and image distortion prevalent near the horizon.

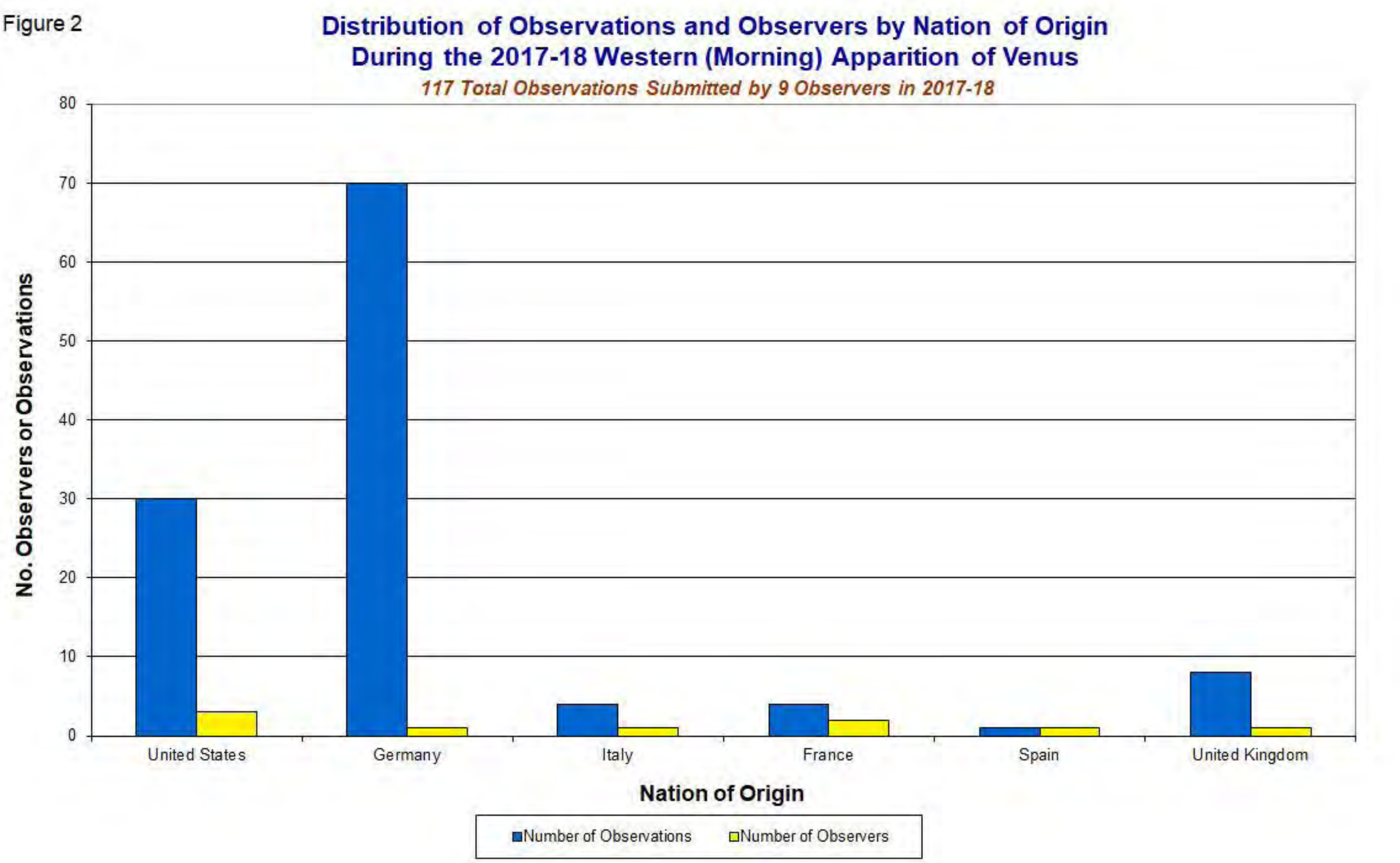
Despite the small number of observers and observations for 2017-18, the writer sincerely appreciates the reports that were contributed in the form of drawings in integrated light (no filter) and color filters, descriptive reports and digital images of Venus during the observing season. Readers who want to follow Venus in coming apparitions are urged to join the ALPO and start participating in our observational studies. The significant brightness of Venus makes it an easy object to find. Around the dates of greatest elongation from the Sun, the planet can be as much as 15 times brighter than Sirius and can even cast shadows when viewed from a dark, moonless observing site. Getting started in the Venus Section observing programs requires only minimal aperture, ranging from 7.5 cm (3.0 in.) for refractors to 15.2 cm (6.0 in.) reflectors.

Observations of Atmospheric Details on Venus

The methods and techniques for visual studies of the especially faint, elusive "markings" in the atmosphere of Venus are described in detail in *The Venus Handbook*, available from the ALPO Venus Section coordinator or downloaded as a pdf file from the ALPO website at *http://alpo-astronomy.org/gallery3/index.php/Publications-Section/ALPO-Monographs/ALPO-Monograph-15-Venus-Handbook-Revised-Edition-2016*. Readers who maintain archives of earlier issues of this Journal may also find it useful to consult previous apparition reports for a historical account of ALPO studies of Venus (Benton, 2011-20).

Most of the drawings and digital images used for this analytical report were made at visual wavelengths, but several observers routinely imaged Venus in infrared (IR) and ultraviolet (UV) wavelengths. Some examples of submitted observations in the form of drawings and images accompany this report to help readers interpret the level

Figure 2



and types of atmospheric activity reported on Venus during this apparition.

Represented in the photo-visual data for this apparition were all of the long-established categories of dusky and bright markings in the atmosphere of Venus, including a small fraction of radial dusky features. *Figure 4* shows the frequency of readily identifiable forms of markings seen or suspected on Venus. Most observations referenced more than one category of marking or feature, so totals exceeding 100% are not unusual. At least some level of subjectivity is inevitable when visual observers attempt to describe, or accurately represent on drawings, the variety of highly elusive atmospheric features on Venus, and this natural bias had some effect on the data represented in *Figure 4*. It is assumed, however, that conclusions discussed in this report are, at the very minimum, sensible interpretations.

The dusky markings of Venus' atmosphere are always troublesome to detect using unfiltered visible light, and this well-known characteristic of the planet is generally independent of the experience of the observer. When color filters and variable-density polarizers are utilized as a routine practice, however, views of cloud phenomena on Venus at visual wavelengths are often measurably improved. Without neglecting vital routine visual work, the ALPO Venus Section urges observers to try their hand at digital imaging of Venus at UV and IR wavelengths. The morphology of features captured at UV and IR wavelengths is frequently quite different from what is seen at visual regions of the spectrum, particularly atmospheric radial dusky patterns (in the UV) and the appearance of the dark hemisphere (in IR). Similarities do occasionally occur, though, between images taken at UV wavelengths and drawings made with blue and violet filters. The more of these that the ALPO Venus Section receives during an observing season, the more interesting are the comparisons of what can or cannot be detected visually versus what is captured by digital imagers at different wavelengths.

Table 2. ALPO Observing Participants in the 2017-18 Western (Morning) Apparition of Venus

Observer and Observing Site	No. Obs.	Telescope(s) Used*
Abel, Paul G.; Leicester, UK	8	20.3 cm (8.0 in.) NEW
Benton, Julius L.; Wilmington Island, GA	3 1 2 1	8.0 cm (3.1 in.) REF 9.0 cm (3.5 in.) MAK 10.2 cm (4.0 in.) MAK 15.0 cm (5.9 in.) MAK
Braga, Raffaello; Milano, Italy	4	21.0 cm (8.3 in.) DAL
Delcroix, Marc; Tournefeuille, France	1	106.0 cm (42.4 in.) CAS
Gallardo, Antonio; Maoron de la Frontera, Spain	1	28.0 cm (11.0 in.) SCT
Legrande, Michel; Le Baule, France	3	41.0 cm (16.0 in.) NEW
Melillo, Frank J.; Holtsville, NY	22	25.4 cm (10.0 in.) SCT
Niechoy, Detlev; Göttingen, Germany	31 39	10.2 cm (4.0 in.) REF 20.3 cm (8.0 in). SCT
Tatum, Randy; Henrico, VA	1	30.5 cm (12.0 in.) SCT
Total No. of Observers	**9**	
Total No. of Observations	**117**	

*REF = Refractor, SCT = Schmidt Cassegrain, MAK = Maksutov, NEW = Newtonian, DAL = Dall-Kirkham, CAS = Cassegrain

Figure 4 illustrates the relative frequency of atmospheric markings reported in visual observations and digital images during the 2017-18 Western (Morning) Apparition. The highest percentage fall into the following categories:

- "Banded Dusky Markings" (79.5%)
- "Amorphous Dusky Markings" (52.1%)
- "Irregular Dusky Markings" (49.6%) [Refer to Illustrations No. 001 thru 011]
- "Radial Dusky Markings" (12.0%) [Refer to Illustrations No. 006, 007, and 012 thru 016]

The latter are normally only revealed in UV images along with the characteristic horizontal V, Y, or ψ (psi)-shaped dusky cloud features in the atmosphere of Venus.

Terminator shading was reported in 97.4% of the observations, as shown in *Figure 4*. Terminator shading normally extended from one cusp of Venus to the other, and the dusky shading was progressively lighter in tone (higher intensity) from the region of the terminator toward the bright planetary limb. Many observers described this upward gradation in brightness as ending in the Bright Limb Band. A considerable number of images at visual wavelengths showed terminator shading, but it was most obvious on several UV images [*Refer to Illustrations 003 thru 006, and 015 thru 017*].

The mean numerical relative intensity for all of the dusky features on Venus this apparition averaged about 8.9. The ALPO Scale of Conspicuousness (a numerical sequence from 0.0 for "definitely not seen" up to 10.0 for "definitely seen") was used regularly, and the dusky markings in *Figure 4* had a mean conspicuousness of ~ 4.5 throughout the apparition, suggesting that the atmospheric features on Venus were within the range from very indistinct impressions to fairly strong indications of their actual presence.

Figure 4 also shows that "Bright Spots or Regions," exclusive of the cusps, were seen or suspected in 12.0% of the submitted observations [*Refer to Illustrations 018 and 019*]. As a customary practice, when visual observers detect such bright areas, it is standard procedure to denote them on drawings by using dotted lines to surround them.

During this apparition, observers regularly used color filter techniques when viewing Venus, and when results were compared with studies in Integrated Light, it was evident that color filters and variable-density polarizers improved the visibility of otherwise indefinite atmospheric markings on Venus.

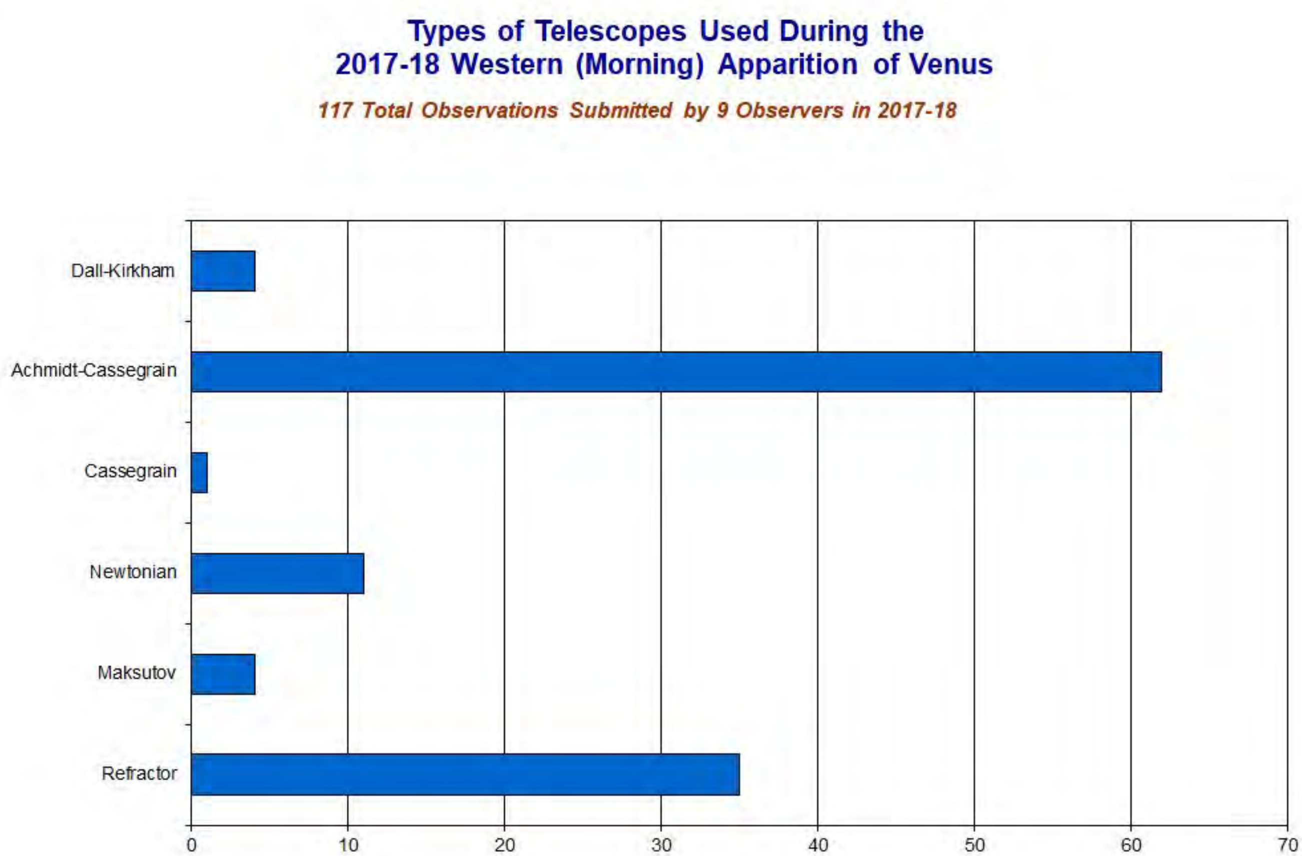
The Bright Limb Band

Figure 4 illustrates that a little over one-third of the submitted observations (37.1%) this apparition referred to a conspicuous "Bright Limb Band" on the illuminated hemisphere of Venus. When the Bright Limb Band was visible or imaged, it appeared as a continuous, brilliant arc running from cusp to cusp only 41.5% of the time, while it was interrupted or only marginally visible as complete along the limb of Venus in 58.5% of the positive reports. The Bright Limb Band was more likely to be incomplete in UV images than those captured at visual wavelengths or in submitted drawings. The mean numerical intensity of the Bright Limb Band was 9.7, perhaps slightly more noticeable with color filters or variable density polarizers. This very bright feature, usually reported by visual observers this apparition [*Refer to Illustrations 002 and 004*], was also seen on many of the digital images of Venus received [*Refer to Illustration 006*].

Terminator Irregularities

The terminator is the geometric curve that separates the brilliant sunlit and dark hemispheres of Venus. A deformed or asymmetric terminator was reported in

Figure 3



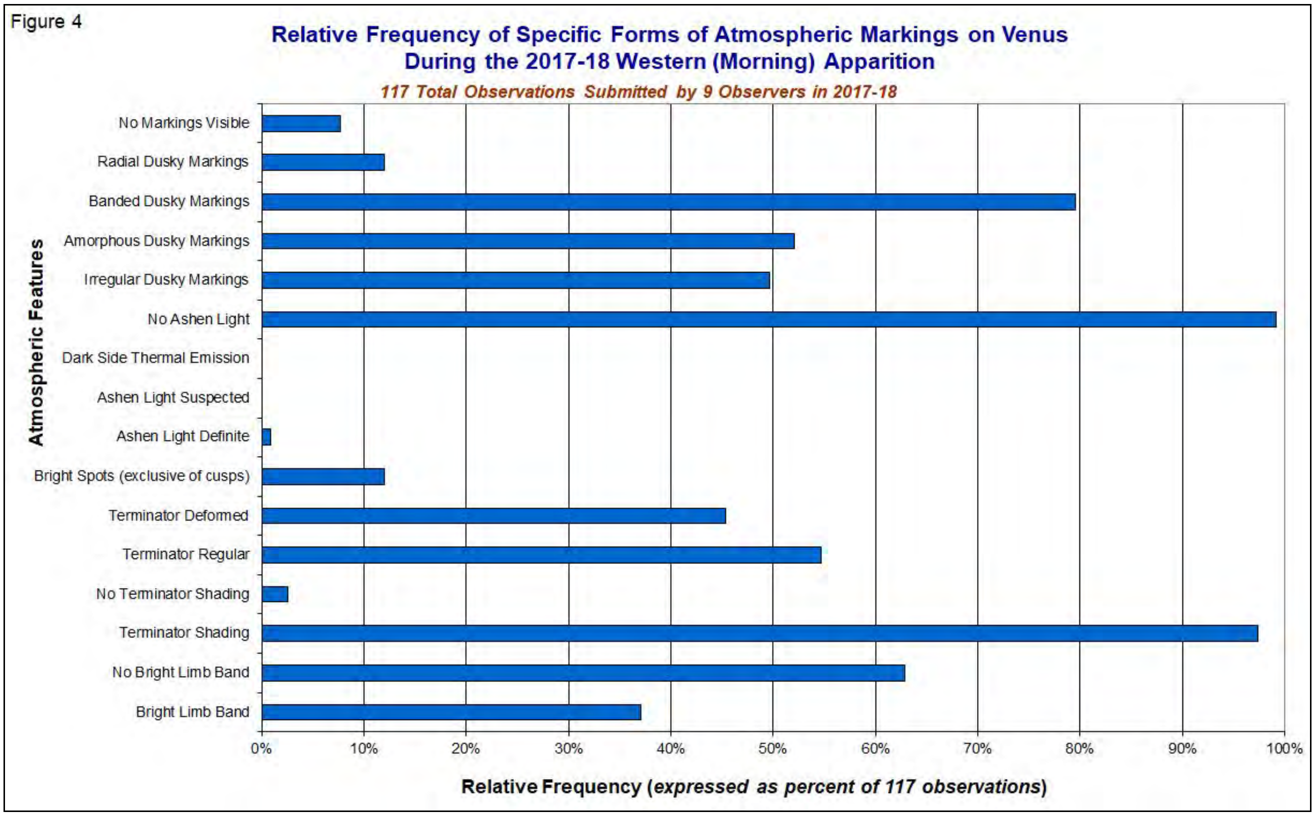


Figure 4
Relative Frequency of Specific Forms of Atmospheric Markings on Venus
During the 2017-18 Western (Morning) Apparition
117 Total Observations Submitted by 9 Observers in 2017-18
Atmospheric Features
No Markings Visible
Radial Dusky Markings
Banded Dusky Markings
Amorphous Dusky Markings
Irregular Dusky Markings
No Ashen Light
Dark Side Thermal Emission
Ashen Light Suspected
Ashen Light Definite
Bright Spots (exclusive of cusps)
Terminator Deformed
Terminator Regular
No Terminator Shading
Terminator Shading
No Bright Limb Band
Bright Limb Band
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Relative Frequency (expressed as percent of 117 observations)

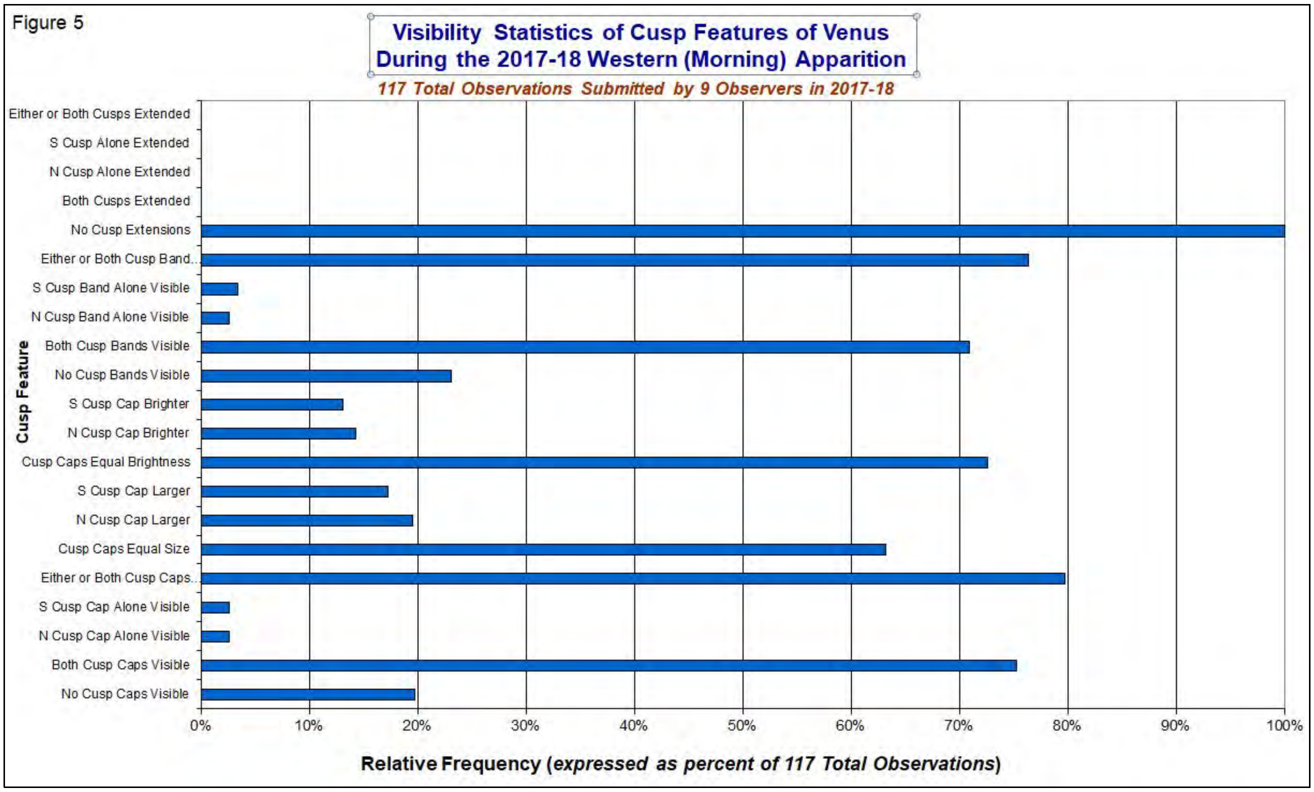


Figure 5
Visibility Statistics of Cusp Features of Venus
During the 2017-18 Western (Morning) Apparition
117 Total Observations Submitted by 9 Observers in 2017-18
Cusp Feature
Either or Both Cusps Extended
S Cusp Alone Extended
N Cusp Alone Extended
Both Cusps Extended
No Cusp Extensions
Either or Both Cusp Band...
S Cusp Band Alone Visible
N Cusp Band Alone Visible
Both Cusp Bands Visible
No Cusp Bands Visible
S Cusp Cap Brighter
N Cusp Cap Brighter
Cusp Caps Equal Brightness
S Cusp Cap Larger
N Cusp Cap Larger
Cusp Caps Equal Size
Either or Both Cusp Caps...
S Cusp Cap Alone Visible
N Cusp Cap Alone Visible
Both Cusp Caps Visible
No Cusp Caps Visible
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Relative Frequency (expressed as percent of 117 Total Observations)

45.3% of the observations. Amorphous, banded and irregular dusky atmospheric markings often seemed to merge with the terminator shading, possibly contributing to some of the reported incidences of irregularities. Filter techniques usually improved the visibility of terminator asymmetries and associated dusky atmospheric features. Bright features adjacent to the terminator can sometimes appear as “bulges”, while darker markings may look like wispy hollows [*Refer to Illustrations 005, 008, 009, 020 and 021*].

Cusps, Cusp-Caps and Cusp-Bands

When the fraction of the disc that is illuminated (*known as the phase coefficient*, ***k***) is between 0.1 and 0.8, atmospheric features on Venus with the greatest contrast and overall prominence are consistently sighted at or near the planet's cusps, bordered sometimes by dusky cusp-bands. *Figure 5* shows the visibility statistics for Venusian cusp features for this apparition.

When the northern and southern cusp-caps of Venus were reported this observing season, *Figure 5* graphically shows that these features were equal in size 63.2% of the time and of equal brightness 72.6% of the time. So, there were minimal instances when the southern and northern cusp-caps were larger and/or brighter than each other. Both cusp-caps were visible in 75.2% of the observational reports, and their mean relative intensity averaged 9.8 during the observing season. Dusky cusp-bands were detected flanking the bright cusp-caps in 70.9% of the observations when cusp-caps were visible, and when visible, the cusp-bands displayed a mean relative intensity of about 7.5 (see *Figure 5*) [*Refer to Illustrations 004, 019, 022 and 023*].

Cusp Extensions

No obvious cusp extensions were reported in integrated light or with color filters beyond the 180° expected from simple geometry (*Figure 5*). Cusp extensions are notoriously hard to image because the sunlit regions of Venus are overwhelmingly brighter than faint cusp extensions, but observers are still encouraged to try to record these

General Caption Note for Illustrations 1 thru 24. REF = Refractor, SCT = Schmidt-Cassegrain, CAS = Cassegrain, MAK = Maksutov, NEW = Newtonian; UV = Ultra Violet light; Seeing on the Standard ALPO Scale (from 0 = worst to 10 = perfect); Transparency = the limiting naked-eye stellar magnitude. All illustrations numbered from left to right.




Illustration 001. 2017 Apr 21, 10:41 UT. Drawing by Michel Legrand. 41.0 cm (16.0 in.) NEW in Integrated light (no filter). Seeing not specified), Transparency (not specified). Phase (k) = 0.185, Apparent Diameter = 44.6". Drawing shows crescent of Venus with amorphous and irregular dusky markings. S is at the top of the drawing.

Illustration 002. 2017 April 25, 09:34 UT Drawing by Paul G. Abel. 20.3 cm (8.0 in.) NEW at 67X in IL (Integrated Light) and W47 (violet) filter. Seeing 4.0 (interpolated), Transparency rated as “good”. Phase (k) = 0.0.221, Apparent Diameter = 41.8". Amorphous and, banded dusky markings present in this very nice drawing, along with terminator shading and the bright limb band running from cusp to cusp. S is at the top of the drawing.

Illustration 003. 2017 May 14, 10:31 UT Drawing by Paul G. Abel. 20.3 cm (8.0 in.) NEW at 67X in IL (Integrated Light) and W47 (violet) filter. Seeing 4.0 (interpolated), Transparency rated as “good”. Phase (k) = 0.372 Apparent Diameter = 31.1". Banded and irregular dusky markings are visible along with terminator shading. S is at the top of the drawing.

Illustration 004. 2017 May 22, 10:34 UT Drawing by Paul G. Abel. 20.3 cm (8.0 in.) NEW at 67X and 111X in IL (Integrated Light) and W47 (violet) filter. Seeing 4.0 (interpolated), Transparency (not specified. Phase (k) = 0.0.425 Apparent Diameter = 27.9". Banded and irregular dusky markings are noticed blending in with shading along the terminator; both cusp caps appear equally bright and of equal size, plus bordering dusky cusp bands. The bright limb band is also visible. S is at the top of the drawing.

features using digital imagers in upcoming apparitions.

Estimates of Dichotomy

A discrepancy between predicted and observed dates of dichotomy (half-phase) is often referred to as the "Schröter Effect" on Venus and is so-named for Johann Hieronymus Schröter who was the first to notice this anomaly. The predicted half-phase occurs when $\boldsymbol{k}$ = 0.500, and the phase angle, $\boldsymbol{i}$, between the Sun and the Earth as seen from Venus equals 90°. Although theoretical dichotomy occurred on June 4.26^{d}, 2017 visual dichotomy estimates were not received this apparition.

Ashen Light Observations and Dark Hemisphere Phenomena

The Ashen Light, reported the first time by Giovanni Riccioli in 1643, is an extremely elusive, faint illumination of Venus' dark hemisphere. Some observers describe the Ashen Light as resembling Earthshine on the dark portion of the Moon, but the origin of the latter is clearly not the same. It is natural to presuppose that Venus should ideally be viewed against a totally dark sky for the Ashen Light to be detectable, but such circumstances occur only when the planet is very low in the sky where poor seeing adversely affects viewing. The substantial glare from Venus in contrast with the surrounding dark sky is a further complication. Nevertheless, the ALPO Venus Section receives reports during nearly every apparition from experienced visual observers, viewing the planet in twilight, who are absolutely convinced they have seen the Ashen Light, and so the controversy continues. It would be immensely valuable if two or more observers making simultaneous observations (same time and date) could report visual impressions of any suspected Ashen Light. Moreover, Venus observers who are routinely capturing digital images of Venus can hopefully capture and document any illumination that may be present on the dark side of Venus, ideally as part of a cooperative simultaneous observing endeavor with visual observers.

In 2017-18, there were no digital images submitted that suggested the presence of the Ashen Light, but Detlev Niechoy strongly suspected the Ashen Light in integrated light (no filter) in his rather interesting drawing on March 28, 2017, at 10:40 UT [*Refer to Illustration 024*]. Overall, the Ashen Light was not present in 99.1% of the observations (also see *Figure 4*).

The ALPO Venus Section encouraged observers to conduct systematic imaging of the planet in the near-IR. At these wavelengths the hot surface of the planet becomes quite apparent and occasionally mottling shows up in such images, which are attributed to the presence of cooler, dark, higher-elevation terrain and warmer, bright, lower surface areas in

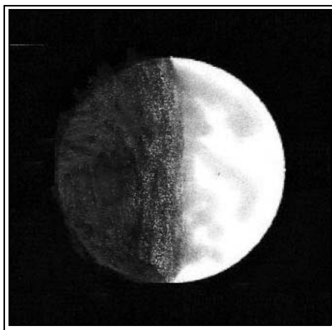
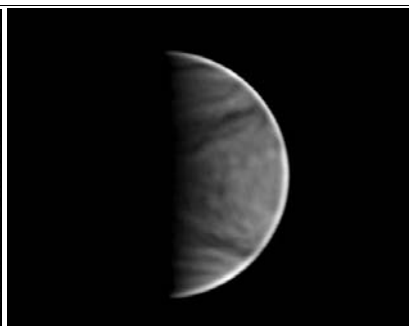
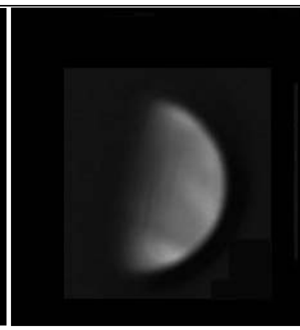
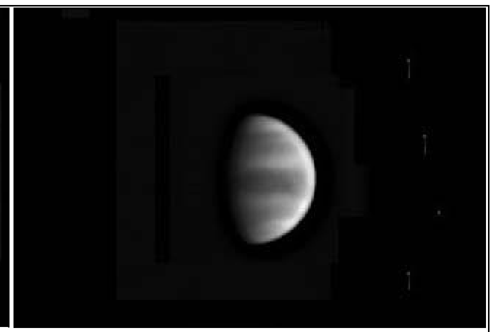





Illustration 005. 2017 May 31, 03:16 UT. Drawing by Detlev Niechoy. 20.3 cm (8.0 in.) SCT at 225X in IL (Integrated Light). Seeing 3.0, Transparency (not specified). Phase (k) = 0.477, Apparent Diameter = 25.0". Amorphous and irregular marking, as well as the northern most cusp cap and cusp band is shown. The terminator is somewhat irregular from cusp to cusp. S is at the top of the drawing.

Illustration 006. 2017 June 11, 04:21 UT. UV image by Marc Delcroix. 106.0 cm (42.1 in.) CAS at Pic du Midi Observatory. Seeing (rated as "good"), Transparency (not specified). Phase (k) = 0.536, Apparent Diameter = 22.1". Along with terminator shading, banded dusky markings are clearly visible in this image as well, plus both cusp caps and cusp bands as well as a portion of the bright limb band toward the with the characteristic V, Y, or ψ (psi)-shaped dusky cloud features in the atmosphere of Venus. The bright limb band is continuous along the limb from cusp to cusp. S is at the top of the image.

Illustration 007. 2017 June 25, 13:05 UT. UV image by Frank Melillo. 25.4cm (10.0 in.) SCT. Seeing = 6.0, Transparency (not specified). Phase (k) = 0.604, Apparent Diameter = 19.2". Along with terminator shading amorphous dusky markings and possibly V, Y, or ψ (psi) shaped dusky cloud features are noted. S is at the top of the image.

Illustration 008. 2017 July 22, 06:20 UT. UV image by Antonio Gallardo. 28.0 cm (11.0 in.) SCT. Seeing (not specified), Transparency (not specified). Phase (k) = 0.710, Apparent Diameter = 15.6". Banded dusky markings are depicted, plus an interesting dusky band running across the disk from limb to terminator is rather conspicuous; the terminator is irregular as well because of the banded dusky features. (Compare this image (by Gallardo) with a near-simultaneous observation with the UV image by Frank Melillo in Illustration 009 on next page.) S is at the top of the image.

the IR. There were no IR images submitted during the 2017-18 apparition of the dark hemisphere. There were several suspected instances during crescentic phases when the dark hemisphere of Venus allegedly appeared *darker* than the background sky during the 2017-18 Western (Morning) Apparition, a phenomenon that is probably nothing more than a spurious contrast effect.

Simultaneous Observations

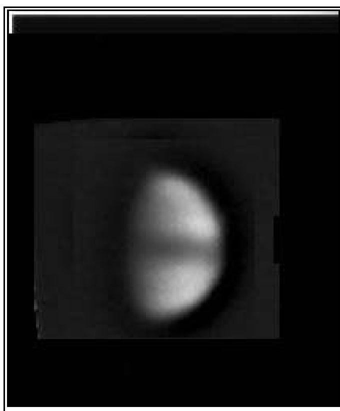
The atmospheric features and phenomena of Venus are elusive, and it is not unusual for two observers looking at Venus at the same time to derive somewhat different impressions of what is seen. Our challenge is to establish which features are real on any given date of observation, and the best way to build confidence in any database is to increase observational coverage on the same date and at the same time. Therefore, the ideal scenario would be to have simultaneous observational coverage throughout any apparition. Simultaneous observations are defined as independent, systematic and standardized studies of Venus carried out by a large group of observers using the same techniques, similar equipment and identical observing forms to record what is seen. While this standardized approach emphasizes a thorough visual coverage of Venus, it is also intended to stimulate routine digital imaging of the planet at visual and various other wavelengths, such as infrared and ultraviolet. By these exhaustive efforts, we hope to be able to at least partially answer some of the questions that persist about the existence and patterns of atmospheric phenomena on Venus.

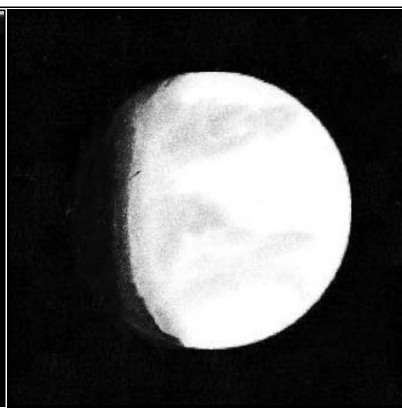
Amateur-Professional Cooperative Programs

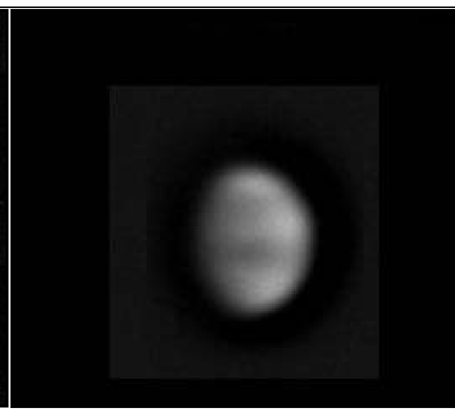
The ALPO Venus Section continued to routinely share visual observations and digital images at various wavelengths with the professional community. As readers will recall, the European Space Agency's Venus Express (VEX) mission that started systematically monitoring Venus at UV, visible (IL) and IR wavelengths back in May 2006, ended its highly successful campaign early in 2015 as it made its final descent into the atmosphere of the planet. It was a tremendously successful Pro-Am collaborative effort involving ALPO Venus observers around the globe, and those who actively participated are commended for their perseverance and dedication. These collective data are important for further study and will continue to be analyzed for several years to come as a result of this endeavor. The VEX website is:

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

A follow-on Pro-Am effort is now underway with Japan's (JAXA) *Akatsuki* mission that began full-scale observations back in April 2016. The initial mission was successfully completed in 2018, and has been extended until the end of 2020. The website for *Akatsuki* mission is







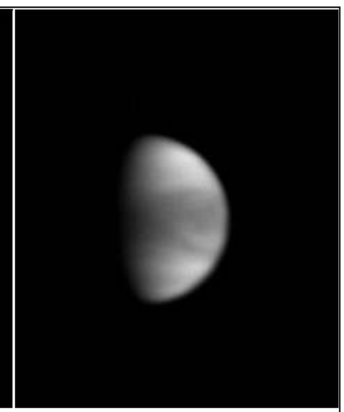


Illustration 009. 2017 July 22, 13:15 UT. UV image by Frank Melillo. 25.4cm (10.0 in.) SCT. Seeing = 6.0, Transparency (not specified). Phase (k) = 0.711, Apparent Diameter = 15.6". Banded dusky markings are obvious, plus an interesting dark band running across the disk from limb to terminator prominent; the terminator is irregular as well because of the banded dusky features. (Compare this image with a near simultaneous observation with the UV image by Antonio Gallardo in Illustration 008). S is at the top of the image.

Illustration 010. 2017 August 28, 12:59 UT. Drawing by Detlev Niechoy. 20.3 cm (8.0 in.) SCT at 225X in Integrated Light (no filter) and a W25 (red) filter. Seeing 4.0 (interpolated), Transparency (not specified). Phase (k) = 0.828, Apparent Diameter = 12.7". Drawing depicts amorphous dusky and irregular markings on the gibbous disk of Venus. S is at the top of the drawing.

Illustration 011. 2017 September 4, 14:00 UT. UV image by Frank Melillo. 25.4cm (10.0 in.) SCT. Seeing = 4.0, Transparency (not specified). Phase (k) = 0.847, Apparent Diameter = 12.3". Banded dusky markings easily seen on this image. S is at the top of the image.

Illustration 012. 2017 July 18, 03:31 UT. UV image by Raffaello Braga. 21.0 cm (8.3 in.) DAL with W47 (violet) filter. Seeing (not specified), Transparency (not specified). Phase (k) = 0.0.695, Apparent Diameter = 16.0". Banded and radial dusky markings are visible in this image including V, Y, or ψ (psi) shaped dusky cloud features. S is at the top of the image.

"live"; interested and adequately equipped ALPO observers can register and start submitting images at any time. More information will continue to be provided on the progress of the mission in forthcoming reports in this Journal. It is extremely important that all observers participating in the programs of the ALPO Venus Section always first send their observations to the ALPO Venus Section at the same time submittals are contributed to the *Akatsuki* mission. This will enable full coordination and collaboration between the ALPO Venus Section and the *Akatsuki* team in collection and analysis of all observations whether they are submitted to the *Akatsuki* team or not. If there are any questions, please do not hesitate to contact the ALPO Venus Section for guidance and assistance. Those wishing to register to participate in the coordinated observing effort between the ALPO and Japan's (JAXA) *Akatsuki* mission should utilize this link:

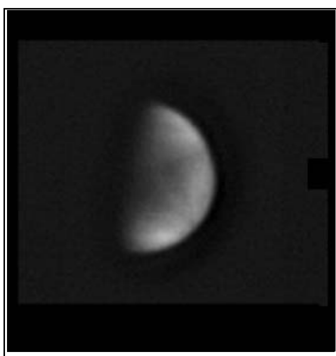
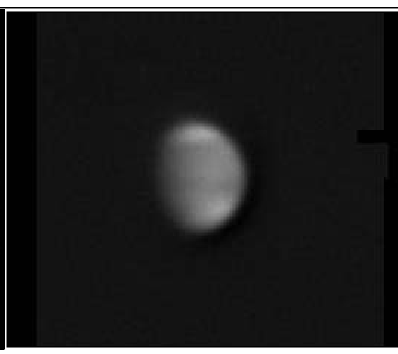
https://akatsuki.matsue-ct.jp/

Conclusions

Analysis of minimal collection of ALPO observations of Venus during the 2017-18 Western (Morning) Apparition revealed that vague shadings on the disc of the planet were occasionally apparent to visual observers who utilized standardized filter techniques to help show the extremely elusive atmospheric features. Indeed, it is often very difficult to be sure visually what is real and what is merely illusory at visual wavelengths in the atmosphere of Venus. Increased confidence in visual results is improving as more and more program participants are attempting simultaneous observations. Readers and potential observers should realize that well-executed drawings of Venus are still a vital part of our overall program as we strive to improve the opportunity for confirmation of highly elusive atmospheric phenomena, to introduce more objectivity, and to standardize observational techniques and methodology. It is especially good to see that to a greater extent, Venus observers are contributing digital images of the planet at visual, near-UV and near-IR wavelengths. It is also meaningful when several observers working independently, with some using visual methods at the same time others are employing digital imaging, to produce comparable results. For example, atmospheric banded features and radial ("spoke") patterns depicted on drawings often look strikingly similar to those captured with digital imagers at the same date and time.

Many of our best UV images have been sought after by the professional community, and cooperative involvement of amateurs and professionals on common projects took another step forward with the establishment of the Venus Amateur Observing Project (VAOP) in 2006 coincident with the Venus Express (VEX) mission, which continued until 2015. The opportunity for Pro-Am collaboration continues with support for the ongoing Japanese (JAXA) *Akatsuki* mission.

Active international cooperation by individuals making regular systematic, simultaneous observations of Venus

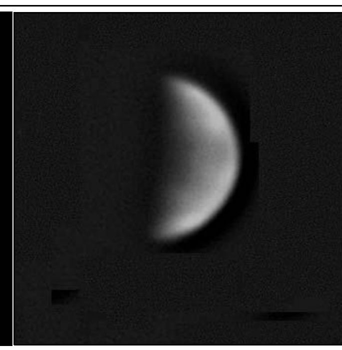


Illustration 013. 2017 July 03, 13:15 UT. UV image by Frank Melillo. 25.4cm (10.0 in.) SCT. Seeing = 7.0, Transparency (not specified). Phase (k) = 0.638, Apparent Diameter = 17.9". V, Y, or ψ (psi) shaped dusky cloud features are easily seen in this image in good seeing. S is at the top of the image.

Illustration 014. 2017 August 24, 13:15 UT. UV image by Frank Melillo. 25.4cm (10.0 in.) SCT. Seeing = 5.0, Transparency (not specified). Phase (k) = 0.15, Apparent Diameter = 13.8". V, Y, or ψ (psi) shaped dusky cloud features are just barely perceptible in this image. S is at the top of the image.

Illustration 015. 2017 September 09, 13:35 UT. UV image by Frank Melillo. 25.4cm (10.0 in.) SCT. Seeing = 5.0, Transparency (not specified). Phase (k) = 0.859, Apparent Diameter = 12.1". The V, Y, or ψ (psi) shaped dusky cloud features are present in this image despite poor seeing conditions; terminator shading is noticeable as well. S is at the top of the image.

Illustration 016. 2017 June 04, 13:55 UT. UV image by Frank Melillo. 25.4cm (10.0 in.) SCT. Seeing = 5.0, Transparency (not specified). Phase (k) = 0.502, Apparent Diameter = 13.7". Terminator shading and adjacent V, Y, or ψ (psi) shaped dusky cloud features are quite apparent in mediocre seeing. S is at the top of the image.

remains our main objective, and the ALPO Venus Section encourages interested readers to join us in our many projects and challenges in the coming years.

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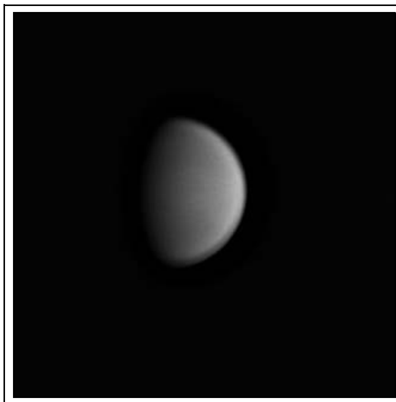
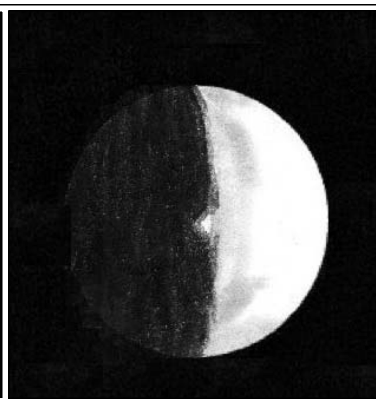

Illustration 017. 2017 August 01, 10:24 UT. UV image by Randy Tatum. 30.5 cm (12.0 in.) SCT. Seeing = 6.5, Transparency = 4.0. Phase (k) = 0.745, Apparent Diameter = 14.6". Amorphous dusky features show an evident dusky gradation as they blend in with the terminator shading. S is at the top of the image.

Illustration 018. 2017 May 17, 10:13 UT. Drawing by Detlev Niechoy. 20.3 cm (8.0 in.) SCT at 225X in Integrated Light (no filter). Seeing 4.0 (interpolated), Transparency (not specified). Phase (k) = 0.393, Apparent Diameter = 29.8". Drawing shows a mall bright spot on the disk of Venus situated midway between cusps along the terminator. Irregular dusky markings are also present. S is at the top of the drawing.

Illustration 019. 2017 June 04, 09:43 UT. Drawing by Paul G. Abel. 20.3 cm (8.0 in.) NEW at 67X and 111X in IL (Integrated Light). Seeing 4.0 (interpolated), Transparency (not specified. Phase (k) = 0.501 Apparent Diameter = 23.8". Banded dusky markings are apparent as well as a bright oval located toward the southern cusp of Venus just below the northern-most edge of the southern cusp band; the southern cusp cap is obviously a bit larger and brighter than the northern cusp cap that is also bordered by a narrow cusp band. S is at the top of the drawing.

Illustration 020. 2017 April 28, 09:27 UT. Drawing by Detlev Niechoy. 20.3 cm (8.0 in.) SCT at 225X in Integrated Light (no filter) and a W25 (red) filter. Seeing 3.0 (interpolated), Transparency (not specified). Phase (k) = 0.247, Apparent Diameter = 39.8". Notice the irregularities along the terminator in this drawing as well as irregular dusky markings. S is at the top of the drawing.

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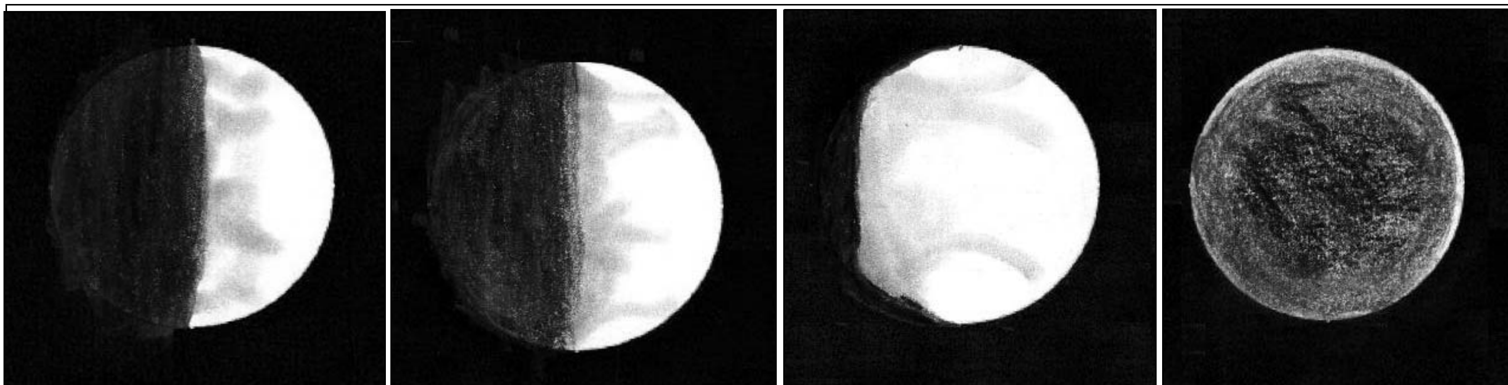

Illustration 021. 2017 June 09, 03:07 UT. Drawing by Detlev Niechoy. 20.3 cm (8.0 in.) SCT at 225X in Integrated Light (no filter). Seeing 3.0 (interpolated), Transparency (not specified). Phase (k) = 0.526, Apparent Diameter = 22.6". Terminator is deformed along its extent from cusp to cusp. Banded dusky markings are also easily seen. S is at the top of the drawing.

Illustration 022. 2017 May 30, 03:30 UT. Drawing by Detlev Niechoy. 20.3 cm (8.0 in.) SCT at 82X in Integrated Light (no filter) and W25 (red) filter. Seeing 3.0 (interpolated), Transparency (not specified). Phase (k) = 0.472, Apparent Diameter = 25.3". In addition to banded dusky markings, both cusp caps (nearly equal in size and brightness) and both cusp bands are clearly visible. S is at the top of the drawing.

Illustration 023. 2017 August 15, 02:50 UT. Drawing by Detlev Niechoy. 20.3 cm (8.0 in.) SCT at 82X in Integrated Light (no filter). Seeing 3.0 (interpolated), Transparency (not specified). Phase (k) = 0.789, Apparent Diameter = 13.6". Irregular dusky markings are present as well as both cusp caps and cusp bands; the northern cusp cap is considerably larger and more prominent than its smaller less conspicuous southern counterpart. S is at the top of the drawing.

Illustration 024. 2017 March 28, 10:40 UT. Drawing by Detlev Niechoy. 20.3 cm (8.0 in.) SCT at 82X in Integrated Light (no filter). Seeing 3.0 (interpolated), Transparency (not specified). Phase (k) = 0.013, Apparent Diameter = 59.5". The elusive Ashen Light is strongly suspected. S is at the top of the drawing.

Papers & Presentations

ALPO Observations of Jupiter During the 2018-2019 Apparition

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To our hard-copy readers: This paper can be viewed in full-color in the online (pdf) version of this Journal.

Abstract

A total of 54 observers submitted Jupiter observations during the apparition. Three highlights discussed include the generation of reddish areas (flakes or blades) by the Great Red Spot (GRS), the continued coloration of the Equatorial Zone (EZ) and the outpouring of several white ovals following the South Equatorial Belt-southern edge (SEBs) -Jetstream (or SEBs-Jet) current into the GRS area. Drift rates of features in eight currents along with whole-disk J and H filter brightness measurements are also reported.

Introduction

The characteristics of Jupiter for the 2018-2019 apparition are given in *Table 1*. Those who submitted observations are included in *Table 2*. There were 1,523 images in the 2018-2019 Jupiter folder as of May 5, 2020. They may be examined by clicking on "ALPO Section Galleries" and then "Jupiter Images and Observations" and then "Apparition 2019", or by using this link:

http://www.alpo-astronomy.org/gallery3/index.php/Jupiter-Images-and-Observations/Apparition-2019.

This paper follows certain conventions.

- The planetographic (or zenographic) latitude is always used.
- Latitudes and longitudes were measured from images using WinJUPOS (Hahn, 2019).
- West refers to the direction of increasing longitude.
- The three longitude systems are described in (Rogers, 1995). The Greek letter λ, followed by a subscript Roman numeral describes the longitude system and value. For example, λ_{II} = 57° W means a System II longitude of 57° W.
- All dates and times are in Universal Time (UT).
- Unless stated otherwise, all data are based on visible or near infrared (wavelengths up to 1.0 micrometer) light images.

Table 1. Characteristics of the 2018-2019 Apparition of Jupiter[a]

First conjunction date	Nov. 26, 2018
Opposition date	Jun. 10, 2019
Second conjunction date	Dec. 27, 2019
Brightness at opposition (stellar magnitudes)	-2.6
Equatorial angular diameter at opposition	46.0 arc-seconds
Right Ascension at opposition	17h 13m
Declination at opposition	22.4° S
[a] Data are from Edgar (2017, 2018)	

All Readers

Your comments, questions, etc., about this report are appreciated. Please send them to: *ken.poshedly@alpo-astronomy.org* 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 Jupiter when allowing for moonlight and twilight

Table 2. Individuals Submitting Observations During the 2018-2019 Apparition of Jupiter

Name, Location (Type Of Observation)*	Name, Location (Type Of Observation)	Name, Location (Type Of Observation)
O. Alvarado, Venezuela (I)	C. Go, Philippines (I)	C. Pellier, France (I)
J. Alvarez, USA (DN)	L. Goncalves, Brazil (I)	J. Phillips, USA (I)
D. Baratoux, France (I)	J. Guerrero, Venezuela (I)	P. Plante, USA (I)
T. Barry, Australia (I)	R. Hill, USA (I)	Z. Pujic, Australia (I)
I. Bouhras, Greece (I)	M. Hood, USA (I)	T. Ramakers, USA (V)
R. Bidshari, United Arab Emirates (I)	Hubble Space Telescope Team, USA (I)	A. Reyes, Venezuela (I)
D. Breit, USA (I)	R. Jimenez, Venezuela (I)	J. Rogers, UK (R)
J. Carels, Belgium (I)	M. Kardasis, Greece (I)	R. Schmude, Jr., USA (PP)
F. Carvalho, Brazil (I)	C. López, Venezuela (I)	M. Sweetman, USA (D, DN, I)
G. Carvalho, Brazil (I)	L. Magalhaes, Brazil (I)	S. Sylla, France (I)
E. Chappel, USA (I)	P. Maxson, USA (I)	R. Taggart, USA (I)
F. Colas, France (I)	F. Melillo, USA (I)	J. Tomney, USA (I)
M. Collins, New Zealand (I)	J. Melka, USA (I)	C. Triana, Columbia (I)
B. Combs, USA (I)	S. Mizamoto, (DN)	R. Verdier, Argentina (I)
B. Cudnik, USA (D, TT)	E. Morales-Rivera, USA (I)	G. Walker, USA (I)
V. da Silva, Jr., Brazil (I)	L. Morrone, Italy (I)	A. Wesley, Australia (I)
M. Delcroix, France (I)	A. Pace, Malta (I)	J. Willinghan, USA (I)
C. Foster, South Africa (I)	D. Peach, UK (I)	L. Yasutake, Argentina (I)
*Key: D = drawing, DN = descriptive notes, I = image, PP = photoelectric photometry, R = reports, TT = transit time, V = video		

- All methane band images are made in light with a wavelength near 0.89 µm.
- In all cases, the drift rate is for the center of the feature.
- All dates, except where noted, are for the current apparition and, hence, years are not included.
- Normal belt abbreviations are used such as NEB = North Equatorial Belt (see *Table 3*). The north and south edges of a belt will have an "n" or "s" following the abbreviation. For example the north edge of the NEB is the "NEBn".
- Statistical T-tests are made at the 95% confidence level (Larson and Farber, 2006). The previous apparition is described in (Schmude, 2021).

Disk Appearance

Figure 1 illustrates the visible-light appearance of Jupiter during 2018-2019. *Figure 2* shows Jupiter's appearance in different wavelengths of light.

Cudnik and Sweetman submitted light intensity estimates and many of these were examined. These were made on the scale of 0 = black to 10 = white. Mean light intensities and standard deviations are summarized in *Table 4*. Statistically significant changes since May 2018, include the brightening of the SEB and NTrZ, and the darkening of the NEB, EZn and EZs.

Table 5 summarizes belt latitudes measured in visible light. Statistically, significant changes include the northward shift of the SEBn, NTBs, NTBn and NNTBs.

Table 6 summarizes belt latitudes measured in methane band light. Statistically significant changes include the northward shift of the NEBs, NTBn and NNTBn, and the southward shift of the NTBs. Interestingly, the NTBs shifted in opposite directions in visible and methane band light. It will be interesting to see what happens in 2020.

Region I: The Great Red Spot (GRS)

Figure 3 shows GRS activity during May and Figure 4 shows the appearance of the GRS throughout the apparition. *Figure 5* shows a Juno image of the GRS during perijove 18.

The general appearance of the GRS is similar to the previous apparition. It has a strong red color and is dark in blue and ultraviolet light (*figures 1 and 2*). Its mean light intensity is 3.8, which is nearly the same as in the previous apparition.

Table 3. Names and Abbreviations of Belts and Zones on Jupiter

Belt and Zone Name	Abbreviated Form	Current Name	Abbreviated Form
South Polar Region	SPR	South Polar Current	SPC
South Polar Belt	SPB	South South South South Temperate Current	S^4TC
South South South Temperate Zone	S^3TZ	South South South Temperate Current	S^3TC
South South Temperate Belt	SSTB	South South South Temperate Current jetstream	S^3TC jetstream
South Temperate Zone	STZ	South South Temperate Current	SSTC
South Temperate Belt	STB	South Temperate Current	STC
South Tropical Zone	STrZ	South Temperate Belt North jetstream	STBn jetstream
South Equatorial Belt	SEB	South Tropical Current	STrC
South Equatorial Belt Zone	SEBZ	South Equatorial Belt Current, barges	SEBC, barges
Equatorial Zone	EZ	South Equatorial Belt revival	SEB revival
Equatorial Band	EB	North Equatorial Current	NEC
North Equatorial Belt	NEB	North Intermediate Current	NIC
North Tropical Zone	NTrZ	North Tropical Current, barges	NTrC, barges
North Temperate Belt	NTB	North Tropical Current	NTrC
North Temperate Zone	NTZ	North Temperate Current B	NTC-B
North North Temperate Belt	NNTB	North Temperate Current	NTC
North North Temperate Zone	NNTZ	North North Temperate Current Jetstream	NNTC jetstream
North North North Temperate Belt	N^3TB	North North Temperate Current	NNTC
North North North Temperate Zone	N^3TZ	North North North Temperate Current	N^3TC
North Polar Region	NPR	North North North North Temperate Current	N^4TC
Great Red Spot	GRS	North Polar Current	NPC

[a] The word “Jet” replaces the word “Jetstream” in some cases.

Table 4. Mean Visible Light Intensities of Jovian Features for the 2018-2019 Apparition

Feature	Intensity	Standard Deviation	Number
NPR	6.1	0.30	43
NTB[a]	5.6	0.83	41
NTrZ	8.1	0.50	44
NEB	3.1	0.32	44
EZn	6.6	0.68	39
EB	6.6	0.66	27
EZs	6.8	0.98	39
SEB	4.8	0.72	38
STrZ	9.4	0.71	42
GRS	3.8	0.57	16
STB	6.2	1.10	7
SPR	5.9	0.39	44

Table 5. Planetographic Latitudes of Belts on Jupiter Based on Images Made in Visible Wavelengths in June 2019[a]

Feature	South Edge	North Edge
South Polar Belt (SPB)	67.1° S (2.0°, 18)	63.8° S (1.5°, 18)
South Equatorial Belt (SEB)	20.0° S (1.0°, 17)	7.7° S (0.5°, 18)
North Equatorial Belt (NEB)	8.9° N (0.9°, 18)	17.6° N (1.0°, 18)
North Temperate Belt (NTB)	27.6° N (1.3°, 18)	31.6° N (1.5°, 18)
North North Temperate Belt (NNTB)	35.7° N (1.4°, 16)	39.0° N (1.2°, 16)

[a] Standard deviations are in parentheses followed by the number of measurements.

Table 6. Planetographic Latitudes of Belts on Jupiter Based on Methane-Band Images Made at a Wavelength Near 0.889 m in June 2019[a]

Feature	South Edge	North Edge
South Polar Cap (SPCn)	–	67.2° S (1.2°, 18)
South Equatorial Belt	19.5° S (0.7°, 17)	6.7° S (2.5°, 17)
North Equatorial Belt	11.3° N (1.3°, 17)	18.4° N (0.8°, 18)
North Temperate Belt	23.4° N (0.6°, 18)	31.3° N (0.9°, 18)
North North Temperate Belt	35.0° N (1.0°, 18)	39.5° N (0.9°, 18)

[a] Standard deviations are in parentheses followed by the number of measurements.

A plot of the System II longitude of the GRS versus time is shown in *Figure 6* (top). Its mean System II drift rate is 2.0 degrees/30 days. This is higher than the mean rate for 1990-2015, 0.98 degrees/30 days (Schmude 2019). The mean latitude of the GRS is 22.8° S with a standard deviation of 0.44°. This is based on 75 measurements.

The most significant GRS development is the release of reddish sections called “flakes” or “blades.” This occurred during much of 2019. Rogers (2019a-h, 2020) describes several flaking events. *Figure 3* illustrates two of these; the first one started on May 15 (*figures 3A-3F*) and the second one started around May 26 (*figures 3K-3L*). The flakes have the same colors as the GRS in blue and integrated light and are bright in methane-band light. What triggered these events? Foster et al. (2019) reports that flaking events often occurred a few days after an oval following the SEBs-Jet current entered the Red Spot Hollow. *Figures 3S-3V* show one of these ovals. They suggest the GRS may be more prone to disruption from these ovals because of its smaller size. Two ovals in the SEBs-Jet had System II drift rates of 102° and 88°/30 days (*see Table 7*). This is within the range of the SEBs-Jet current (Rogers, 1995).

The GRS underwent other changes during the flaking events. For example, its latitude shifted from 23° S in early May to 22° S four weeks later. It also shrunk. Rogers (2019g) reports it had an east-west (EW) length of 12° of longitude in July. The writer measured both the EW and north-south (NS) dimensions of the GRS in degrees of longitude and latitude, respectively. The mean EW and NS dimensions for the GRS from Feb. 18 to May 12 are 14.1° and 10.1°, respectively. The corresponding values for Jun. 25 to Sep. 28 are 13.0° and 9.3°. There is a statistically significant difference in both dimensions between these intervals. The GRS EW length returned to 14° in Oct. (Rogers, 2019h). Other GRS changes include the presence of a white oval (*Figure 3E*), a change in shape of the central dark bar (*figures 3H and 3J*), a change in the dark border (*figures 3A, 3E, 3F and 3G*), the development of a dark spiral pattern (*Figure 3K*) and a change in the orientation of its major axis (*figures 3L and 3M*). Most of these irregularities occurred in the previous apparition (Schmude 2021).

The mean GRS position between May 27 and June 25 is λ_{II} = 311.0° W with a standard deviation of 1.0°. This is based on 25 measurements. This is 18 degrees farther west than the predicted position based on the model in Schmude (2016).

Table 7. System II Drift Rates and Wind Speeds of a Few White Ovals And the GRS on Jupiter During the 2018-2019 Apparition

Feature Name	Drift Rate (Deg./30 Days)	Latitude	Current[a]	Wind Speed[b] (M/s)
A1	–27	60.5° S	SPC	4.6
A2	–18	50.8° S	SSSTC	3.2
B1	–31	41.2° S	SSTC	8.7
B2	–29	41.0° S	SSTC	7.9
B3	–27	41.0° S	SSTC	7.1
B4	–31	41.2° S	SSTC	8.5
B5	–31	41.1° S	SSTC	8.5
B6	–27	41.2° S	SSTC	7.3
B7	–28	41.3° S	SSTC	7.3
B8	–28	41.3° S	SSTC	7.5
Oval BA	–14	33.9° S	STC	2.4
C1	–13	33.7° S	STC	2.0
GRS	2.0	22.8° S	STrC	–4.5
S1[c]	102	20.9° S	SEBs-Jet	–49.7
S2[d]	88	20.4° S	SEBs-Jet	–43.6
H1	–81	34.9° N	NNTC-Jet	29.6
H2	–79	35.1° N	NNTC-Jet	28.6
H3	–84	35.4° N	NNTC-Jet	30.3
H4	–83	35.2° N	NNTC-Jet	29.9
H5	–82	35.4° N	NNTC-Jet	29.6
H6	–83	35.3° N	NNTC-Jet	30.2
H7	–83	35.3° N	NNTC-Jet	30.0
H8	–82	35.1° N	NNTC-Jet	29.8
G1	–7	41.3° N	NNTC	–0.2

[a] from Rogers (1990). [b]relative to System III. [c]for the spot imaged on Mar. 7-22. [d] for the spot imaged on May 12-22.

Region II: South Polar Region (SPR) to the South Tropical Zone (STrZ)

Figures 1 and 2 show the appearance of the SPR in several wavelengths. The SPR followed a similar trend as in the previous apparition. It was dark in short wavelengths (blue and ultraviolet), but bright in methane band light. In visible wavelengths, one belt (the SPB) is visible. Its mean latitudes are summarized in *Table 5*. Sweetman may have drawn it on Jun. 8 and 13.

On many occasions between May 26 and Sep. 30, Sweetman drew one or more large bright areas centered at 49° S. These are too large to be ovals and are instead believed to be portions of the SSSTZ. F*igures 1E, 1H, 1I and 1K* show the SSSTZ.

Table 7 lists the drift rates, latitudes and wind speeds of several features. Two white ovals (A1 and A2) had latitudes consistent with the SPC and the SSSTC. Their System II longitudes are shown in *Figure 7*. Oval A1 appears to show an oscillation in longitude with a period of ~80 days with an amplitude near four degrees. This is also consistent with the description given by Rogers (2019h) for an oval in the “S4 domain”.

Figure 8 shows the System II longitudes for eight white ovals following the SSTC and *Table 7* lists their drift rates. The mean System II drift rate is -29°/30 days. This is a little more than one standard deviation from the mean value for 1990-2015 (Schmude 2019).

The mean latitudes of the STB (Rogers, 1995) served as guides in identifying the

STB in 2019. *Figure 1C* illustrates the situation. Essentially, there was a dark segment following Oval BA (thick arrow) followed by a gap and a thin dark strip (thin arrow) farther south. The dark segment closest to Oval BA is close to the latitudes of the STB with mean southern and northern borders of 32.6° S and 29.5° S. Its mean lengths, in degrees of longitude, are 22°, 22° and 38° for Mar. 10-19, Jun. 4-28 and Sep. 8-29, respectively.

Figure 6 shows the System II longitude versus time graphs for Oval BA and white oval, C1, which both follow the STC. The drift rate of Oval BA is -14°/30 days, which is consistent with what it was in late 2018 (Schmude, 2021). The mean latitude of Oval BA is 33.9° S with a standard deviation of 0.70°. This is based on 42 measurements.

The brightness and appearance of Oval BA changed in different wavelengths. It continued to be bright in methane band and visible light. It blended in with the STB in UV light (*see Figure 2I (arrow)*). This is different from the GRS, which is very dark in UV light (*see Figure 2L*). A faint darker ring was imaged inside Oval BA. Based on a June 26 Hubble Space Telescope image, the mean EW outer and inner ring dimensions are 5.0° and 3.8° of longitude; the mean NS outer and inner ring dimensions are 4.2° and 3.1° of latitude. Therefore, this ring is thinner than in the previous apparition (Schmude, 2020b).

The narrow STropB developed during the apparition. *Figures 1D, 1F and 1H* show it in visible light. *Figures 2D, 2F, 2H, 2J – 2L* show it in other wavelengths. It is centered at 25.8° S. It is not present in a Jan. 25 image made by C. Foster but shows up as a stub in a Feb. 6 image at the preceding edge of the GRS. It maintained an EW length of 5°-10° for the next few weeks. On Mar. 24, and Apr. 7 it had reached respective lengths of 20° and 36°. It covered all longitudes in a June 14 image by C. Foster.

Region III: South Equatorial Belt (SEB)

Figures 1 and 2 show the appearance of the SEB. Longtime visual observers, M. Sweetman, B. Cudnik and P. Plante drew the SEB with dark thin strips at the northern and southern edges separated by a zone. The development of this zone is probably why the SEB had a statistically significant brightening compared to the previous apparition (Schmude 2021).

Region IV: Equatorial Zone (EZ)

Figure 2 shows the EZ in different wavelengths of light. It is bright in both methane-band and near-infrared light, but is dark in blue and ultraviolet light. This is consistent with its orange color

Table 8: Brightness Measurements of Jupiter Made During the 2018-2019 Apparition

Date 2019	α (degrees)	Measured Magnitude	Comp. Star	Date 2019	α (degrees)	Measured Magnitude	Comp. Star
Jan. 11.476	6.4	H = –1.67	α-Lyr	Apr. 30.332	7.6	H = –2.19	α-Lyr
Jan. 11.494	6.4	J = –2.13	"	Apr. 30.349	7.6	J = –2.71	"
Feb. 25.471	10.3	H = –1.76	"	May 24.210	3.5	H = –2.28	"
Feb. 25.486	10.3	J = –2.29	"	May 24.220	3.5	J = –2.90	"
Mar. 7.455	10.7	H = –1.81	"	May 25.256	3.3	H = –2.34	"
Mar. 7.466	10.7	J = –2.37	"	May 25.271	3.3	J = –2.87	"
Mar. 20.408	10.7	H = –1.92	"	May 29.211	2.6	H = –2.36	"
Mar. 20.423	10.7	J = –2.47	"	May 29.226	2.6	J = –2.85	"
Apr. 3.373	10.2	H = –2.02	"	Jun. 14.094	0.7	H = –2.39	"
Apr. 3.390	10.2	J = –2.59	"	Jun. 14.103	0.7	J = –2.85	"

α Ephemeris data from JPL Horizons at: https://ssd.jpl.nasa.gov/horizons.cgi#top

Table 9. Summary of Possible Impact Events on Jupiter Since 2009

Date	Estimated Brightness (Magnitudes)	Estimated Diameter of Object (M)	Location (System III Longitude)	Person(s) Making Image(s)	Source
Jul. 9, 2009	--	~500	57.9° S, 180° W	A. Wesley & others	Hueso et al. (2013)
Jun. 3, 2010	~6	5-20	16.5° S, 159° W	A. Wesley, & C. Go	Hueso et al. (2013)
Aug. 20, 2010	~6	5-20	21.5° N, 337 W	M. Tachikawa, K. Aoki & M Ichimaru	Hueso et al. (2013)
Sep. 10, 2012	~6	5-20	0.7° N, 265 W	G. Hall & D. Peterson	Hueso et al. (2013)
Mar. 17, 2016	~4.3	~14	11° N, 303° W	G. Kernbauer & J. McKeon	Schmude (2020a)
May 26, 2017	~5	~12	51° N, 301° W	T. Riesslere, S. Pedranghelu & a third visual observer	ALPO Japan Latest website
Aug. 7, 2019	~5	~12	19° S, 14° W	E. Chappel	ALPO website

(Rogers, 2019c). It is brightest at its southern edge (*see figures 1A-1C* and *1F*). Sweetman reports it being bright at its southern edge on three occasions between Jun. 23 and Jul. 20.

Region V: North Equatorial Belt (NEB)

Figures 1 and 2 show the general appearance of the NEB. Its mean borders for 1995-2017 are 7.3° (0.7°) and 18.9° N (1.9°) where standard deviations are in parentheses (Schmude, 2020a). Therefore, the NEBs in 2019 is farther north than the mean value (*see Table 5*). Its width is only 8.7° of latitude, which is lower than the mean of 11.6°. There are several bays in the NEBn. One large bay, imaged by A. Wesley on Jun. 12.7, has a peak-to-valley latitude difference of 3.8°.

The NEB has a mean light intensity value of 3.1. This is a statistically significant drop compared to the previous apparition. The darkening is also consistent with Sweetman's comments. For example, on May 25 and Jun. 5, he states the NEB is not wide but is very dark. On Sep. 12, he states the NEB has a brown color. Although the NEB is the darkest feature in integrated light (*see Table 4*), the GRS and parts of the SEB are darkest in blue light (*see Figure 2J*).

Region VI: North Tropical Zone (NTrZ) to the North Polar Region (NPR)

The NTrZ and NTB changed. The NTrZ is wider and brighter compared to 2018 (Schmude, 2021). This may be due to the fading of the southern portion of the NTB. Its northern portion varies in darkness with longitude (*see Figures 1A and 1B*). Sweetman describes the NTB as being a thick belt that is not distinct on May 26, but thin on Jun. 19.

Figure 9 shows the System II longitudes of eight small dark spots that follow the NNTC-Jet current. The mean System II drift rate is -82°/30 days and is close to the mean value for this current (Rogers, 1995), (Schmude, 2019).

The NNTB often had a grayish color and an irregular border in Red-Green-Blue (RGB) images. It underwent a statistically significant shift northward compared to the previous apparition. *Figure 7* shows the longitude-versus-time graph for a white oval, G1. Its mean drift rate and latitude are consistent with the NNTC.

The NPR displayed color characteristics similar to those in the previous apparition (Schmude, 2021). It is not as dark as the SPR in blue and ultraviolet light, but is darker than the SPR in methane band light (*see Figure 2*). It is 0.15 light intensity units brighter than the SPR based on visible light intensity estimates.

Photoelectric Photometry

The writer measured the near-infrared brightness of Jupiter using an SSP-4 photometer along with filters transformed to the J and H system (Henden, 2002). Extinction and transformation corrections were made in a similar manner as described in Hall & Genet (1988), (Schmude, 2017). Mean reduced magnitudes (Shepard, 2017) are $J(1, \alpha) = -9.66$ and $H(1, \alpha) = -9.13$. These values are a few percent brighter than those in previous apparitions (Schmude, 2021). There is a statistically significant difference for the J(1, a) values but not for the H(1, a) values.

Possible Jupiter Impact

E. Chappel submitted a red-filter image showing a flash on Jupiter. It was made on Aug. 7 at 4:07.5 UT. There are no other known images showing this flash. If this is an impact, the estimated size of the object is 12 m using an estimated brightness of magnitude 5 and the procedure described elsewhere (Schmude, 2020). This writer used WinJupos to measure its location and used this information to look for a dark spot on images made a few minutes after impact (by E. Chappel) and 40 hours after impact (by C. Foster). In this writer's analysis, the size of the "cross-wire" (tiny "+" mark) was adjusted to the smallest setting and it was then placed at the location of the flash and the brightness adjusted to different shades of gray. At one gray level, the mark blended in with the SEB and was invisible. The writer focused on the spot while changing the brightness of the "cross-wire". Images made a few minutes after impact did not show a dark pixel. An RGB image made by C. Foster on Aug. 8 at 20:38.2 UT shows a darker pixel (~500 km across) near the impact area, but the corresponding methane band image, shows no irregularities. Therefore, the resulting impact area is no larger than 500 km across.

Table 9 summarizes the known Jupiter impacts since 2009. The large impact in 2009 was caused by an object with an estimated size of 500 m and caused a dark spot almost 10,000 times this size (Hueso et. al, 2013). Therefore, if one scales down the estimated size of the Aug 7 object, the resulting impact area would be ~120 km.

Satellites

Several interesting images of Jupiter's satellites were acquired during this apparition. F*igure 4M* shows a grazing transit of Callisto across Jupiter's NPR. According to *WinJUPOS*, Callisto and the NPR are in their predicted position to within 700 km. Several individuals imaged Ganymede transiting the NPR of Jupiter. In RGB and near-infrared images, Ganymede is brighter than the NPR during May – Aug.; however it blended in with the NPR in an ultraviolet image recorded by M. Kardasis on Jul. 17. At that time, it was centered at 51° N. V. da Silva, Jr. made a sequence of four images on Jul. 9 between 21:43 and 22:27 UT showing a transit of Europa at 32° N. Europa was much brighter than the NTZ when 36° from the

Central Meridian (CM) but blended in with it at the CM.

Acknowledgements

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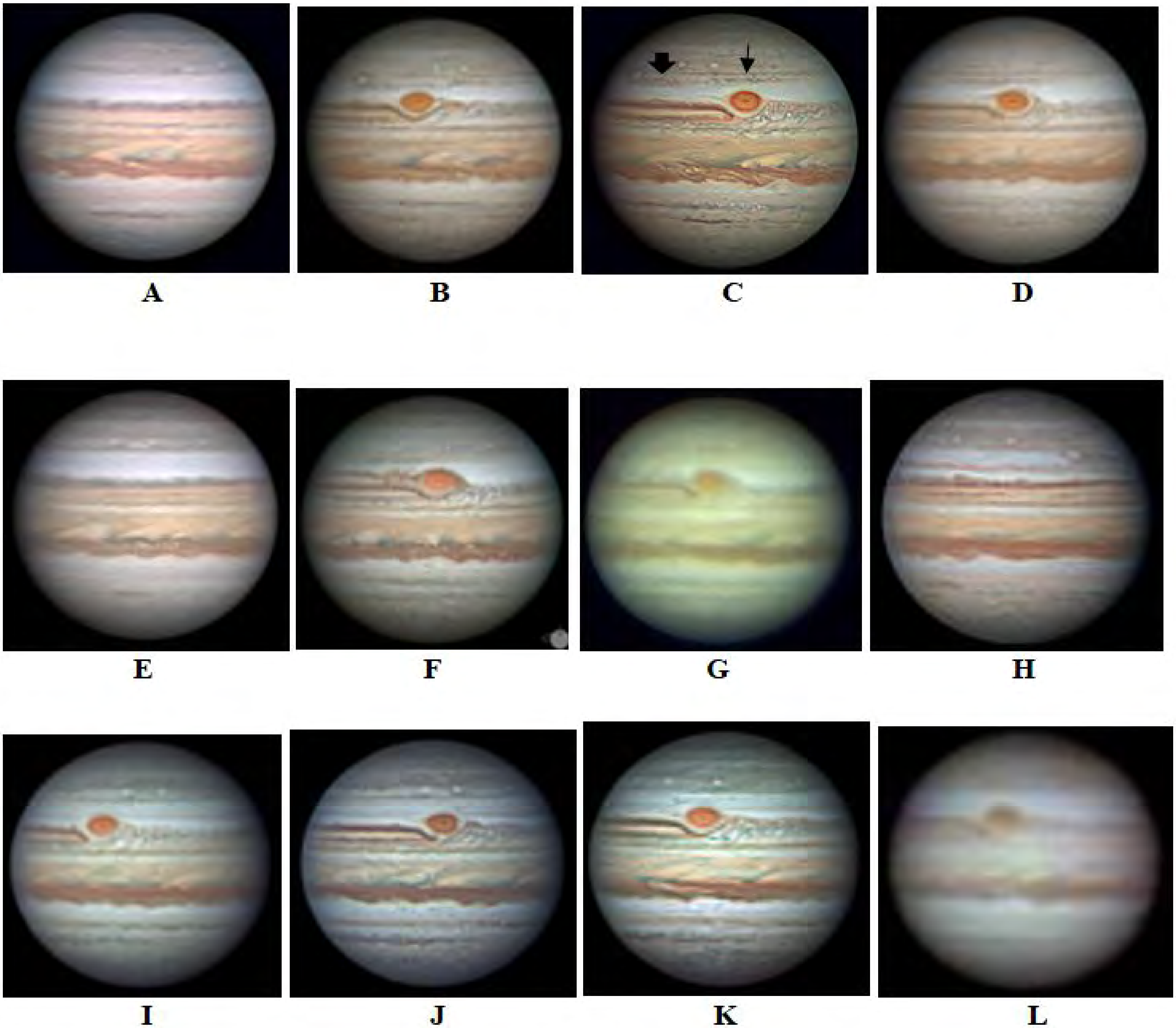


Figure 1: Images of Jupiter in integrated light. In all cases south is at the top. **A**: Jan. 21 (3:13 UT) by C. Foster; **B**: Feb. 2 (10:07.1 UT) by D. Peach and the Chiliscope Team; **C**: Mar. 14 (2:52 UT) by C. Foster; **D**: Apr. 13 (7:57 UT) by D. Peach; **E**: May 5 (10:31 UT) by P. Maxson; **F**: May 27 (14:03.1 UT) by A. Wesley; **G**: July 4 (5:38 UT) by R. Hill; **H**: Aug. 10 (16:25.1 UT) by C. Foster; **I**: Sep. 16 (7:24.4 UT) by A. Wesley; **J**: Oct. 5 (7:35.4 UT) by A. Wesley; **K**: Nov. 10 (7:59.3 UT) by A. Wesley; **L**: Dec. 2 (16:19 UT) by C. Foster.

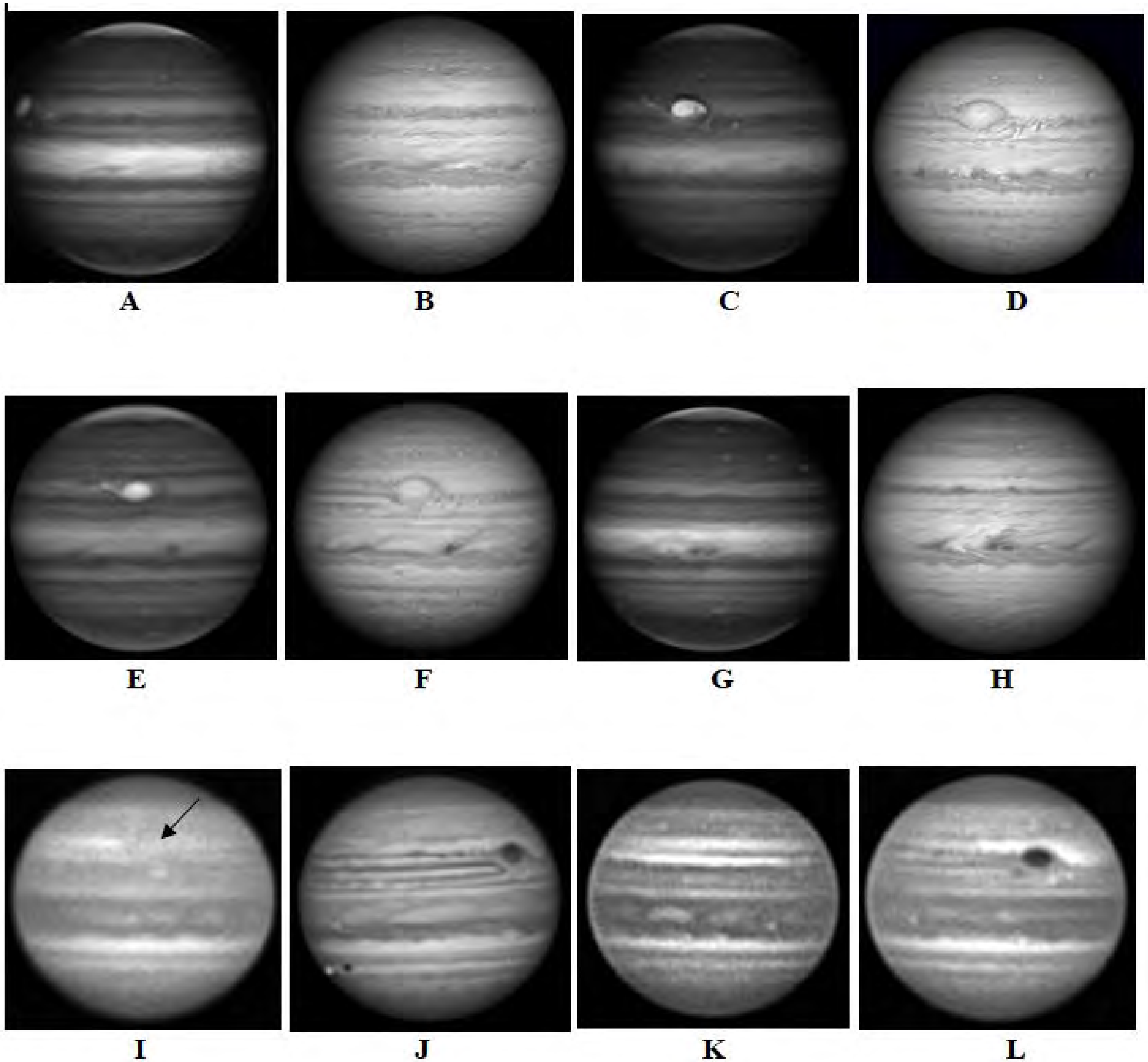


Figure 2. Images of Jupiter in multiple wavelengths. The first four images are methane-band and near-infrared light pairs and the last four images are individual blue and ultraviolet images. South is at the top in all images. **A**: Apr. 13 (19:36 UT) by C. Go (methane-band); **B**: April 13 (20:01 UT) near-infrared; **C**: May 28 (0:33 UT) by C. Foster (methane-band); **D**: May 28 (0:20.9 UT) by C. Foster; near-infrared; **E**: Jun. 3 (4:59 UT) by E. Morales-Rivera (methane-band); **F**: Jun 3 (5:05 UT) by E. Morales-Rivera (near-infrared); **G**: Jul. 18 (11:57 UT) by C. Go (methane-band); **H**: Jul. 18 (11:51 UT) by C. Go. (near-infrared) **I**: Jun. 4 (8:11 UT by P. Maxson (ultraviolet); **J**: Jun 15 (3:35 UT) by E. Morales-Rivera (blue); **K**: Jun. 18 (7:22 UT) by P. Maxson (ultraviolet); **L**: Jun 24 (6:48 UT) by P. Maxson (ultraviolet)

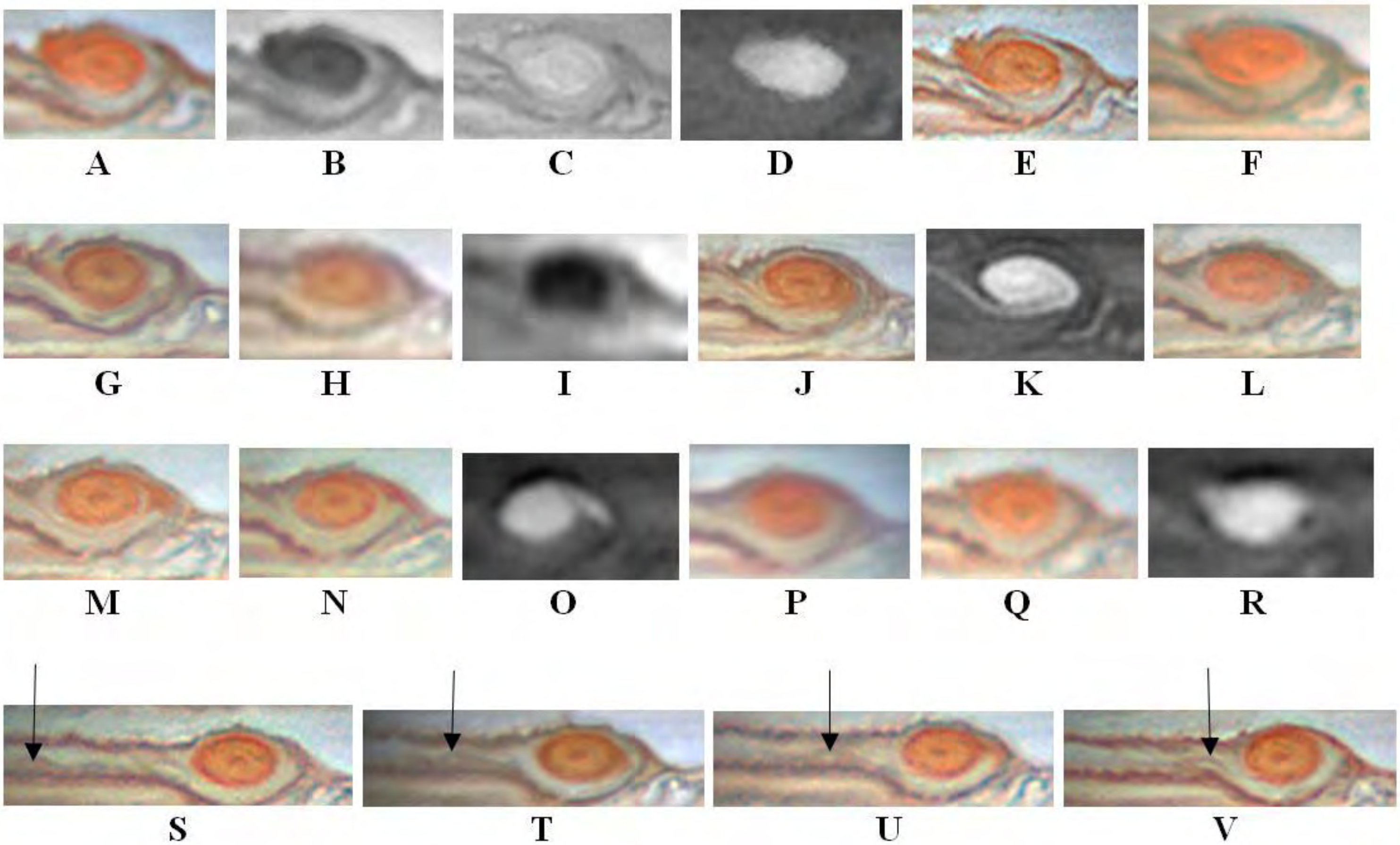


Figure 3. Images of the GRS during late May showing flaking events along with four images of an approaching oval (S2) following the SEBs Jet. South is at the top in all images. **A**: May 22 (14:37.4 UT) by A. Wesley (IR-G-B); **B**: May 22 (14:41.4 UT) by A. Wesley (blue); **C**: May 22 (14:29.9 UT) by A. Wesley (IR > 750 nm); **D**: May 22 (14:49.8 UT) by A. Wesley (889 nm/18 nm); **E**: May 23 (11:05.6 UT) by A. Wesley (RGB); **F**: May 23 (0:19.9 UT) by C. Foster (RGB); **G**: May 24 (16:18.2 UT) by A. Wesley; **H**: May 26 (8:41 UT) by P. Maxson (RGB); **I**: May 26 (9:06 UT) by P. Maxson (UV); **J**: May 26 (17:54 UT) by C. Go; **K**: May 26 (18:12 UT) by C. Go (methane band); **L**: May 27 (14:03.1 UT) by A. Wesley (IR-G-B); **M**: May 28 (0:15.5 UT) by C. Foster; **N**: May 28 (20:11.3 UT) by C. Foster (RGB); **O**: May 28 (20:31.5 UT) by C. Foster (methane band); **P**: May 29 (5:01 UT) by B. Combs (RGB); **Q**: May 30 (21:06.6 UT) by C. Foster (RGB); **R**: May 30 (21:39.2 UT) by C. Foster (methane band); **S**: May 13 (2:39.2 UT) by C. Foster; **T**: May 17 (16:08.9 UT) by A. Wesley; **U**: May 18 (21:38.6 UT) by C. Foster; **V**: May 20 (23:16.1 UT) by C. Foster.

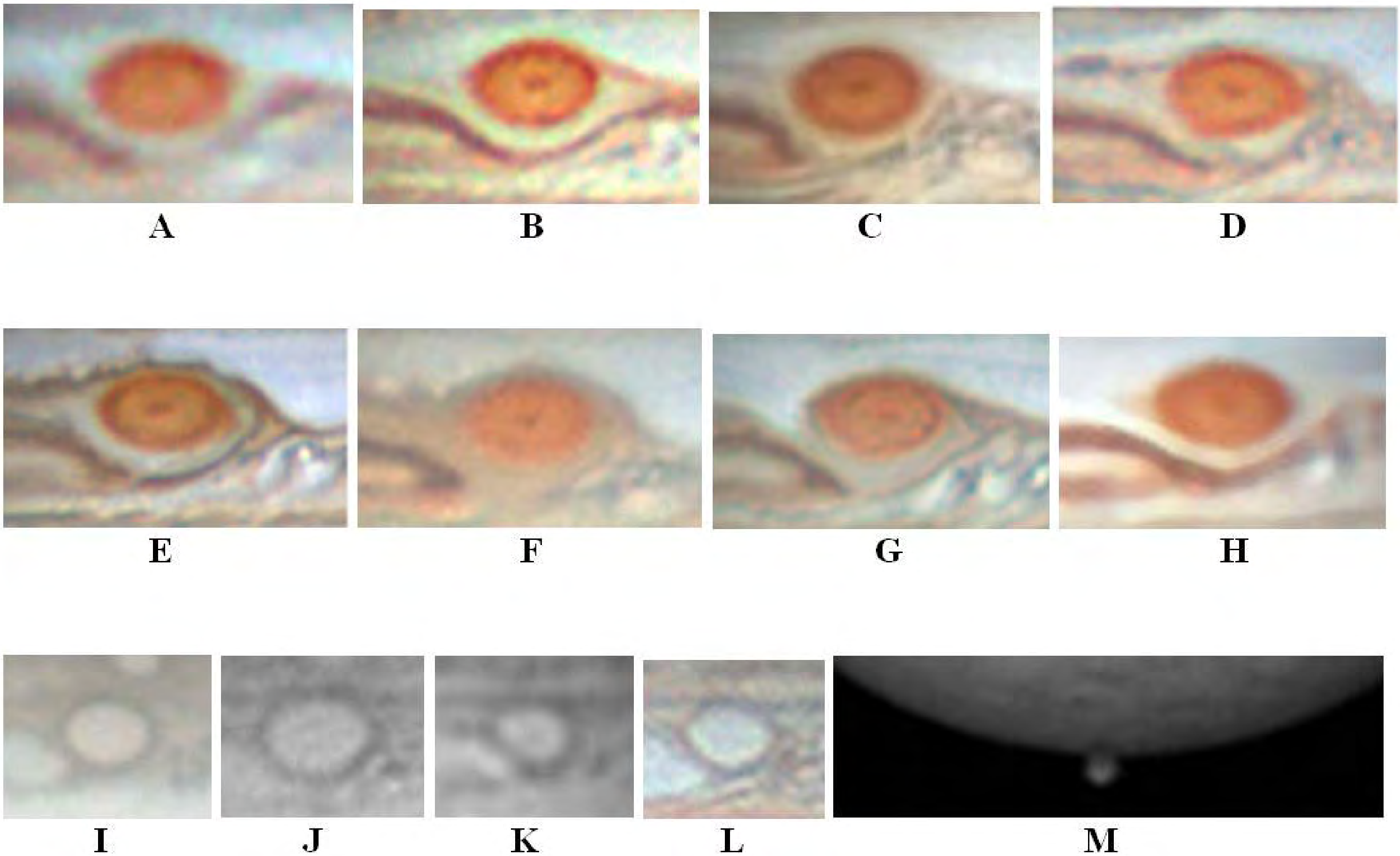


Figure 4. Images of the GRS (**A-H**), Oval BA (**I-L**) and a partial transit of Callisto (**M**). In all cases, south is at the top. **A**: Jan. 18 (2:50 UT) by C. Foster; **B**: Feb. 18 (3:39.5 UT) by C. Foster; **C**: Mar. 17 (20:53 UT) by C. Go; **D**: Apr. 17 (1:05.2 UT) by C. Foster; **E**: May 17 (16:08.9 UT) by A. Wesely; **F**: June 21 (0:04.8 UT) by C. Foster; **G**: July 12 (12:30.5 UT) by A. Wesley; **H**: Aug. 17 (1:35.5 UT) by M. Hood; **I**: Apr. 17 (8:55.7 UT) by D. Peach (visible light); **J**: Jun. 5 (23:32.1 UT) by C. Foster (near infrared light); **K**: July 25 (3:18 UT) by P. Maxson (near-infrared light); **L**: Aug. 3 (16:24.3 UT) by C. Foster (integrated light); **M**: Oct. 31 (17:03 UT) by C. Foster (Note the grazing transit of Callisto).

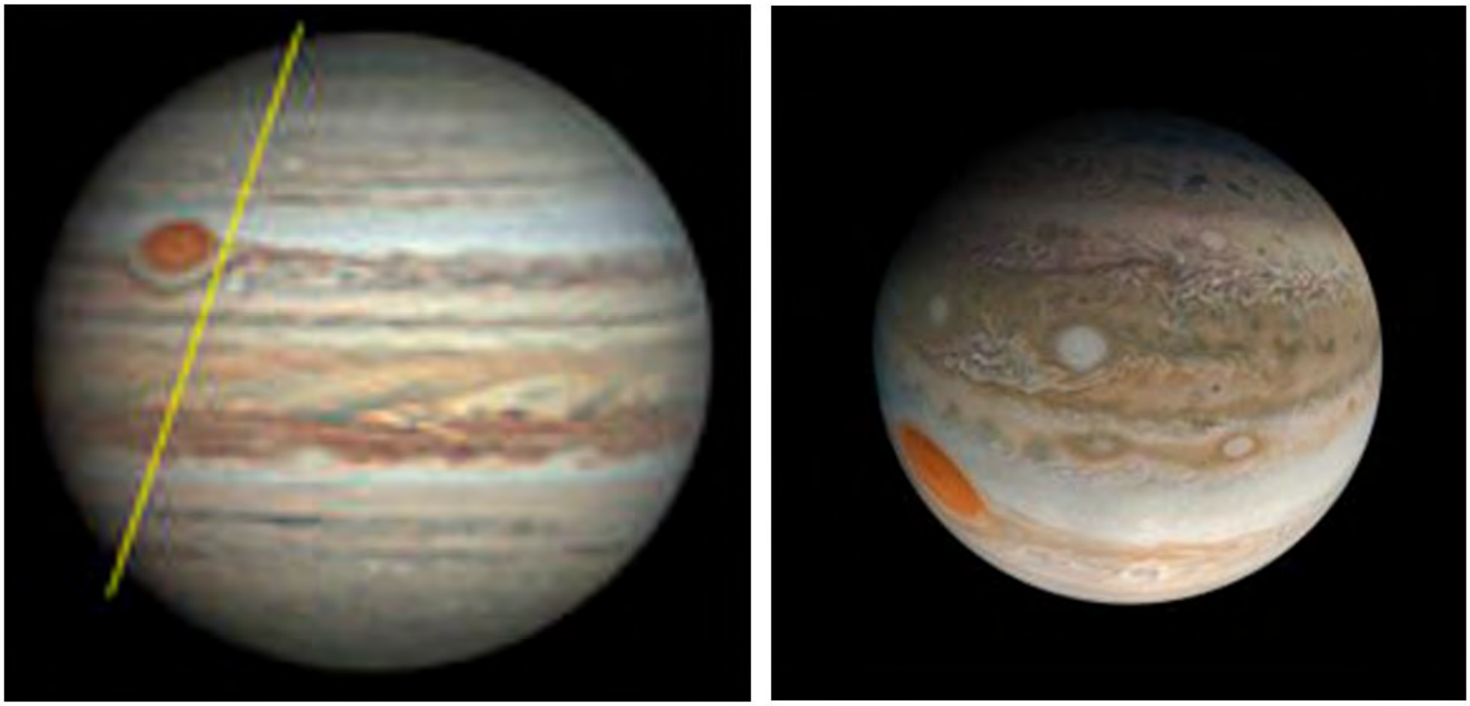
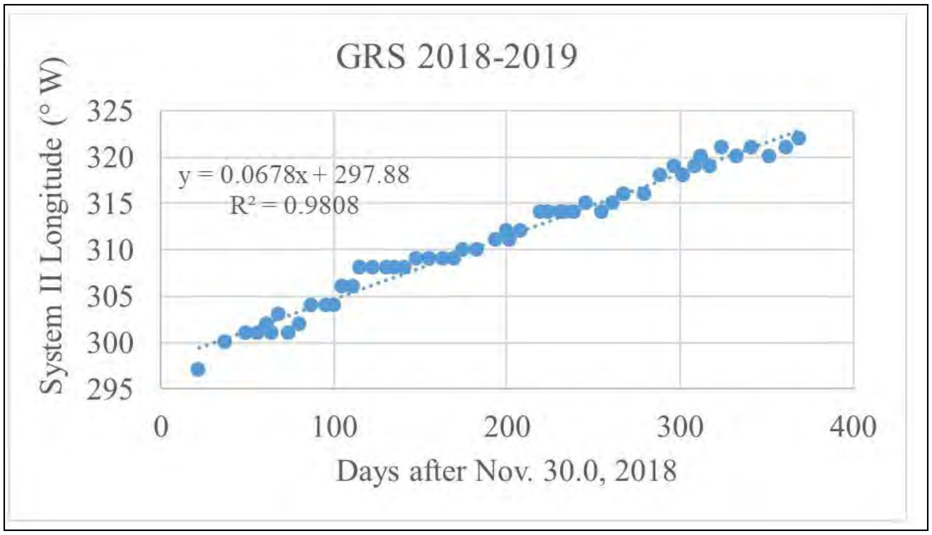
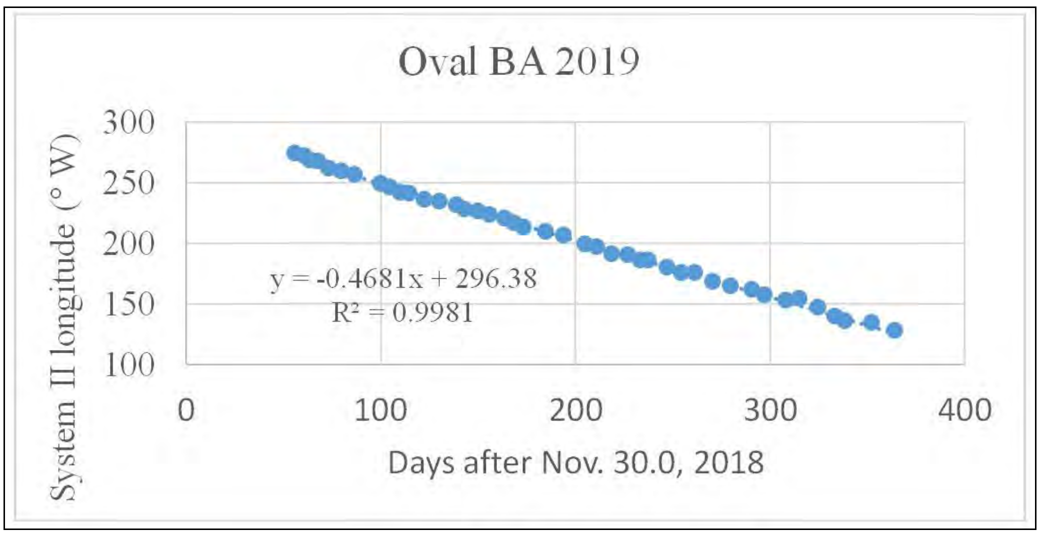


Figure 5. An Earth-based image of Jupiter made on Feb. 9 by C. Foster on the left and an image made by the Juno spacecraft three days later over the same region (perijove 18). The yellow line in the left image shows the approximate path of the Juno spacecraft. The image on the right shows the GRS (large red oval) and a large white oval near the center that is oval B2. *Credits: Clyde Foster (left image) and NASA/JPL-Caltech/SwRI/MSSS and Kevin M. Gill (image on right).*





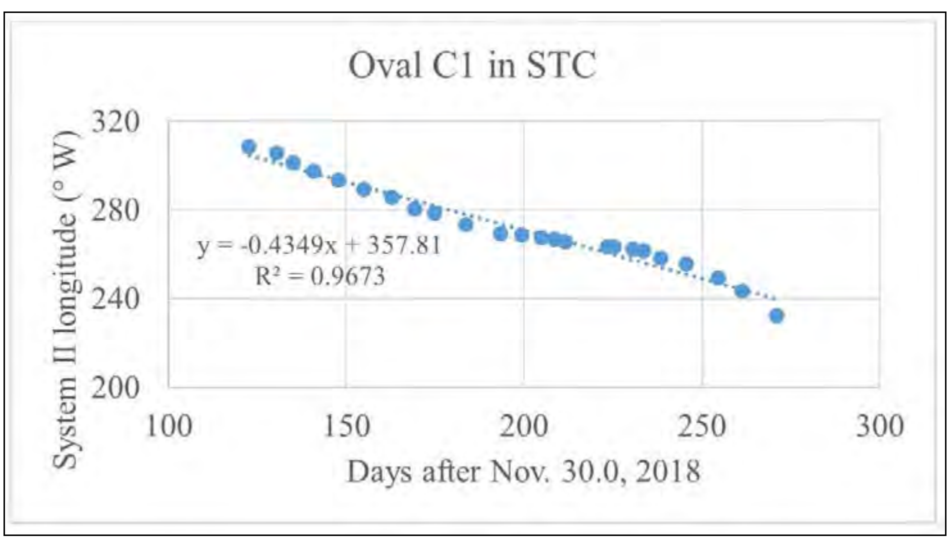


Figure 6. Graphs of the System II longitude versus time for the GRS, Oval BA and white oval C1 which is in the STC. In the equations, y represents the System II longitude and x represents the days after Nov. 30.0, 2018.

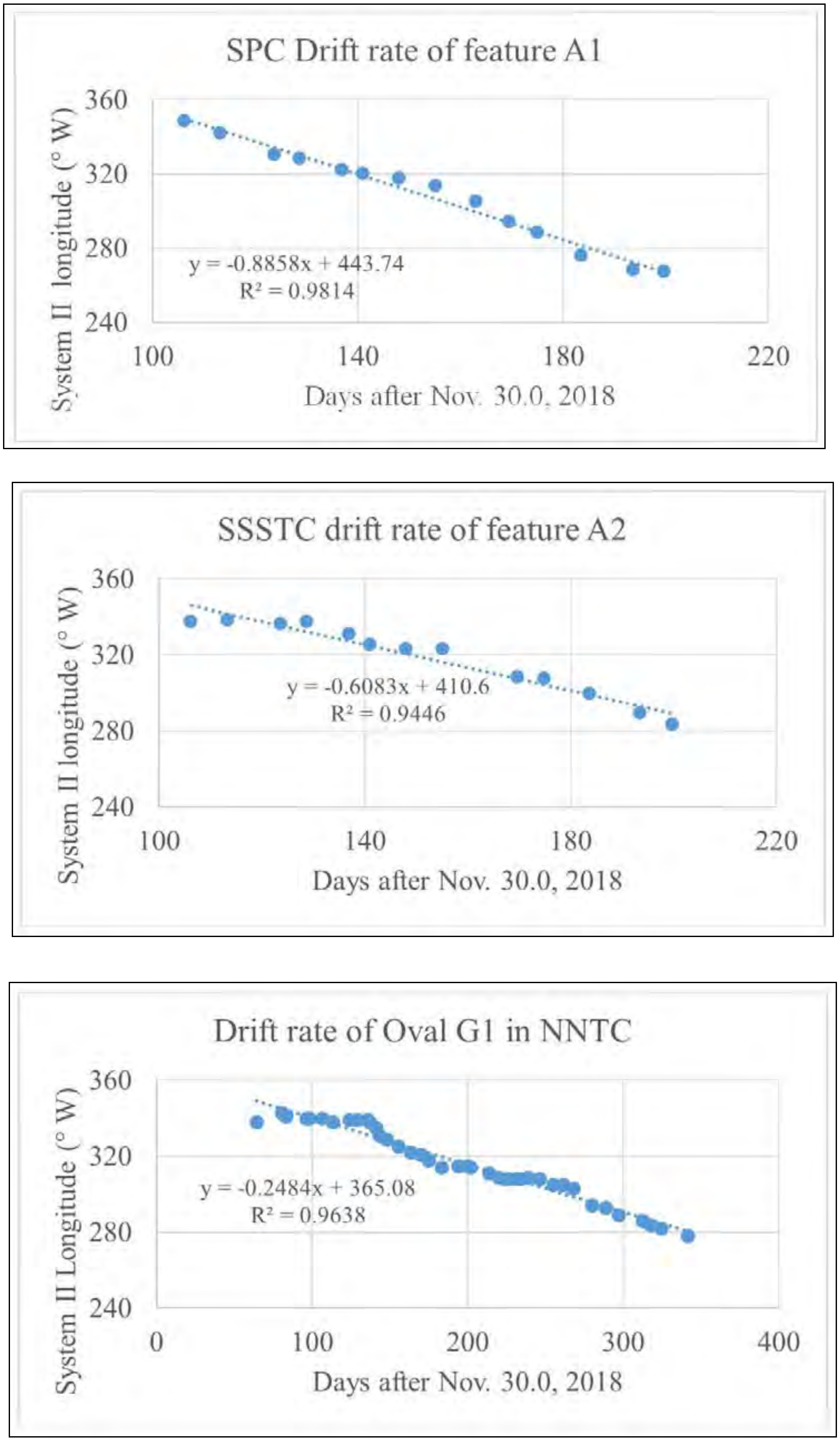


Figure 7. Graphs of System II longitudes versus time for white ovals A1 (south polar current), A2 (SSSTC) and G1 (NNTC). In the equations, y represents the System II longitude and x represents the days after Nov. 30.0, 2018.

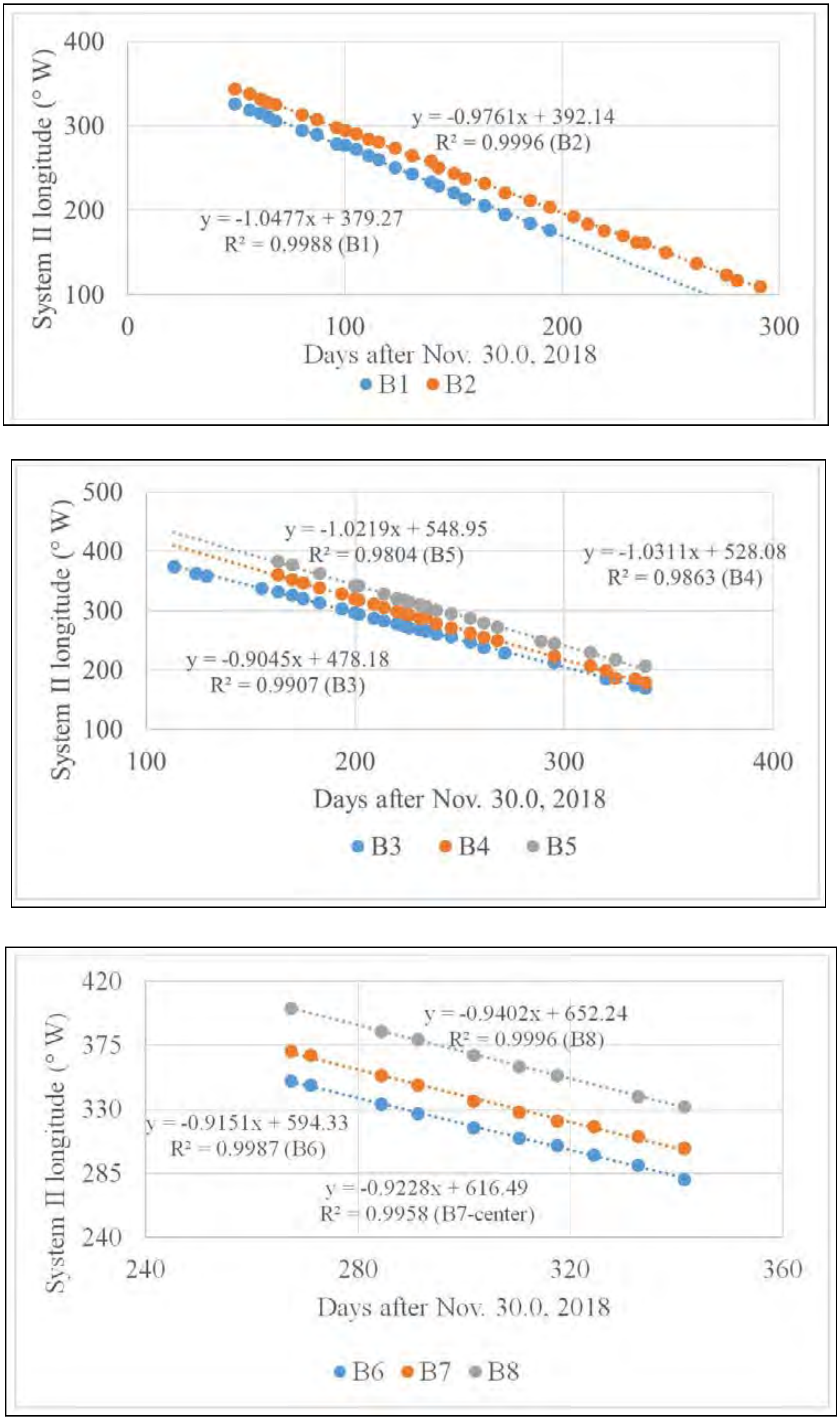


Figure 8. Graphs of System II longitudes versus time for white ovals B1 through B8, which follow the SSTC. In the equations, y represents the System II longitude and x represents the days after Nov. 30.0, 2018.

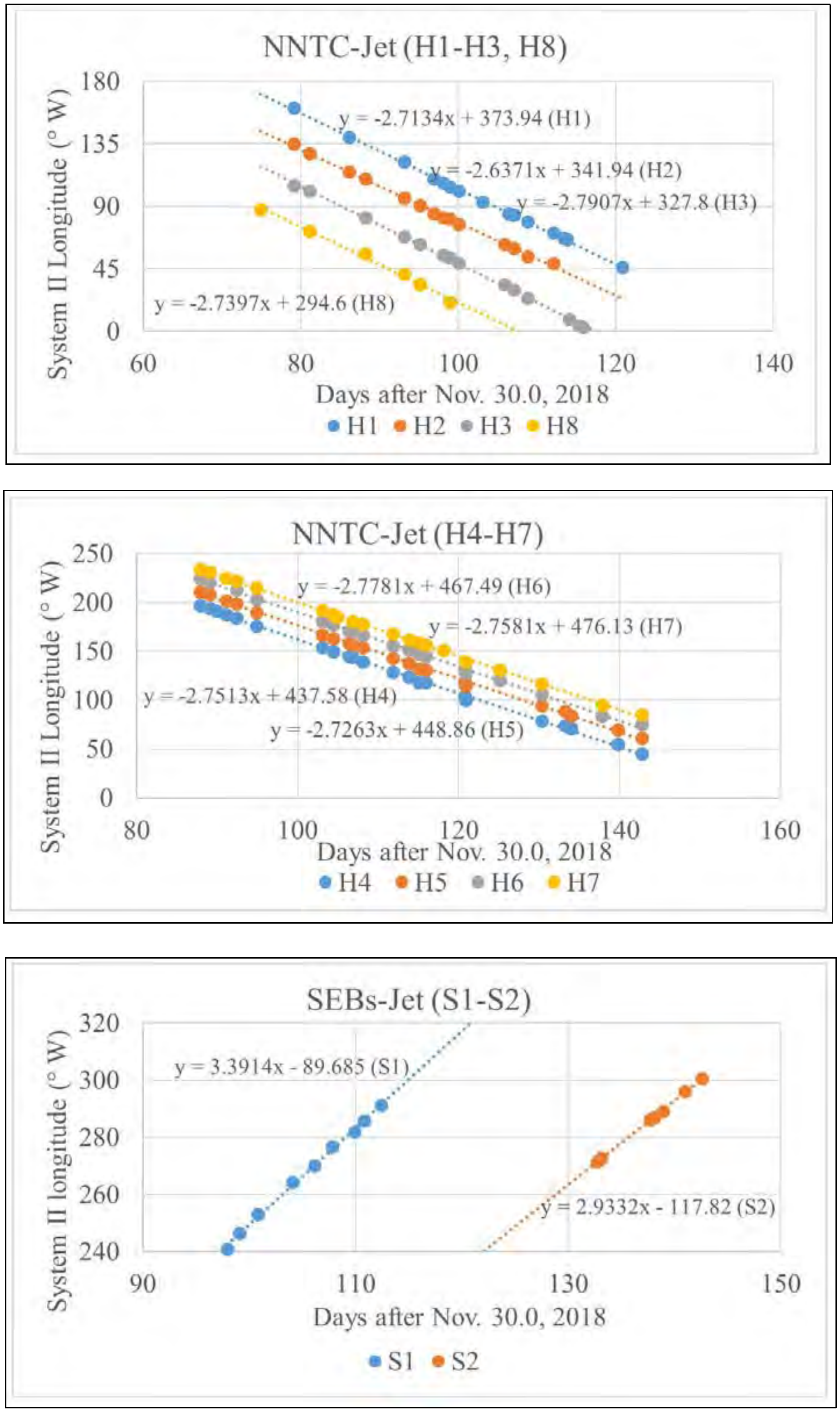


Figure 9. Graphs of System II longitudes versus time for dark spots H1-H8, which follow the NNTC-Jet. The bottom graph shows two retrograding white spots on the SEBs. In the equations, y represents the System II longitude and x represents the days after Nov. 30.0, 2018.

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- Coordinator; Timothy J. Robertson, 195 Tierra Rejada Rd., #148, Simi Valley, CA 93065; *cometman@cometman.net*

Youth Activities Program

http://www.cometman.net/youth/

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Mercury/Venus Transit Section

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Mercury Section

http://www.alpo-astronomy.org/Mercury

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Venus Section

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Lunar Section

Lunar Topographical Studies Program

http://moon.scopesandscapes.com/ALPO_Lunar_Program.htm

Lunar Selected Areas Program

http://moon.scopesandscapes.com/alpo-sap.html

Lunar Banded Craters Program

http://moon.scopesandscapes.com/alpo-bcp.htm

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Lunar Meteoritic Impacts Search Program

http://www.alpo-astronomy.org/lunar/lunimpacts.htm

- Coordinator; Brian Cudnik, 11851 Leaf Oak Drive, Houston, TX 77065; cudnik@sbcglobal.net

Lunar Transient Phenomena Program

http://www.alpo-astronomy.org/lunar/LTP.html; also http://www.LTPresearch.org

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Minor Planets Section

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- Scientific Advisor; Dr. Petr Pravec, Ondrejov Observatory, Astronomical Institute, Academy of Sciences, Cz-25 165 Ondrejov, Czech Republic; ppravec@asu.cas.cz
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Jupiter Section

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- Assistant Coordinator, Jupiter Section email discussion list; Craig MacDougal, 821 Settlers Road, Tampa, FL 33613; macdouc@verizon.net

Saturn Section

http://www.alpo-astronomy.org/saturn

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Remote Planets Section

http://www.alpo-astronomy.org/remote

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Exoplanets Section

http://www.alpo-astronomy.org/saturn

- Acting Coordinator; Jerry Hubbell, 406 Yorktown Blvd, Locust Grove, VA 22508; jerry.hubbell@alpo-astronomy.org

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ALPO Publications

The Monograph Series

http://www.alpo-astronomy.org/publications/Monographs page.html

Publications too lengthy for publication in *The Strolling Astronomer*. All are available ONLY online as a pdf files. NONE are available any longer in hard copy format. There is NO CHARGE for any of the ALPO monographs.

- **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. File size approx. 5.2 mb.

- **Monograph No. 2**. *Proceedings of the 44th Convention of the Association of Lunar and Planetary Observers. Greenville, South Carolina, June 15-18, 1994. 52* pages. File size approx. 6.0 mb.

- **Monograph No. 3**. *H.P. Wilkins 300-inch Moon Map.* 3rd Edition (1951). Available as one comprehensive file (approx. 48 megabytes) or five section files (Part 1, 11.6 megabytes; Part 2, 11.7 megabytes; Part 3, 10.2 megabytes; Part 4, 7.8 megabytes; Part 5, 6.5 mb)

- **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

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States, Canada, and Mexico. File size approx. 2.6 mb.

- **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. File size approx. 2.6 mb.

- **Monograph No. *6.*** *Proceedings of the 47th Convention of the Association of Lunar and Planetary Observers, Tucson, Arizona, October 19-21, 1996.20* pages. File size approx. 2.6 mb.

- **Monograph No. 7.** *Proceedings of the 48th Convention of the Association of Lunar and Planetary Observers. Las Cruces, New Mexico, June 25-29, 1997.76* pages. File size approx. 2.6 mb.

- **Monograph No. 8**. *Proceedings of the 49th Convention of the Association of Lunar and Planetary Observers. Atlanta, Georgia, July 9-11,1998.122* pages. File size approx. 2.6 mb.

- **Monograph Number 9**. *Does Anything Ever Happen on the Moon?* By Walter H. Haas. Reprint of 1942 article. 54 pages. File size approx. 2.6 mb.

- **Monograph No. 10.** *Observing and Understanding Uranus, Neptune and Pluto*. By Richard W. Schmude, Jr. 31 pages. File size approx. 2.6 mb.

- **Monograph No. 11**. *The Charte des Gebirge des Mondes* (Chart of the Mountains of the Moon) by J. F. Julius Schmidt, this monograph edited by John Westfall. Nine files including an accompanying guidebook in German. Note files sizes:
  Schmidt0001.pdf, approx. 20.1 mb;
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  Schmidt2022.pdf, approx. 21.1 mb;
  Schmidt2325.pdf, approx. 22.9 mb;
  SchmidtGuide.pdf,approx. 10.2 mb

- **Monograph No. 12.** *Solar Activity from 2014 through 2016* (subtitled *An unorthodox analysis of solar activity during three years, on the way to solar minimum*) by Theo Ramakers. Documents the research done to evaluate the relationship between the Wolf number indicator used to identify solar activity in many amateur solar reports and the size of the areas which Active Regions occupy during times of high solar energy."

- **Monograph No. 13.** *A Manual for Observing the Moon: The ALPO Lunar Selected Areas Program* by Dr. Julius Benton. Second update to original 1994 edition. Intended for serious enthusiasts who want to seriously contribute to lunar science through participation in the specialized efforts of the ALPO Lunar Selected Areas Program (which now includes the Dark Haloed Craters Program (DHCP) and the Bright and Banded Craters Program (BBCP). The handbook includes fundamental methods and techniques for conducting systematic observations of specific types of lunar features, including remarks on the lasting value of current lunar visual observations by amateur astronomers with Earth-based telescopes.

- **Monograph No. 14.** *Theory and Methods for Visual Observations of Saturn* by Dr. Julius Benton. Intended for the individual who seeks to gain an understanding of the observational theory and methodology involved in pursuing a worthwhile program of observing Saturn, its ring system, and accompanying satellites. The methods and techniques presented will hopefully be instructive and helpful to the observer who wishes to produce the most useful and reliable data possible for analysis, whether one is conducting a purely visual program or utilizing digital imagers to capture images of Saturn at various wavelengths.

- **Monograph No. 15.** *A Guide for Visual Observations of the Planet Venus* by Dr. Julius Benton. Update to the original 2016 edition. Intended for the individual who seeks to gain an understanding of the observational theory and methodology involved in pursuing a worthwhile program of observing the planet Venus. This small (65-page) handbook has been written for the amateur astronomer who wants to pursue an organized program of systematic visual observations of this planet, a beautiful but exceedingly difficult object to observe.

ALPO Observing Section Publications

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

- **Solar:** *Guidelines for the Observation of White Light Solar Phenomena*, *Guidelines for the Observing Monochromatic Solar Phenomena* plus various drawing and report forms available for free as pdf file downloads at *http://www.alpo-astronomy.org solarblog*.

- **Lunar & Planetary Training Section:** *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. Available as pdf file via e-mail or send check or money order payable to Timothy J. Robertson, 195 Tierra Rejada Rd., #148, Simi Valley, CA 93065; e-mail *cometman@cometman.net*.

- **Lunar:** (1) *The ALPO Lunar Selected Areas Program Handbook* (hardcopy, $17.50). Includes full set of observing forms. (2) *Observing forms*: Send a SASE for a hardcopy of forms. Both the Handbook and individual observing forms are available for download (as pdf files) at *moon.scopesandscapes.com/ alpo-sap.html*. Use of observing forms will ensure that all requested information is included with observations, but are not required. Various lists and forms related to other Lunar section programs are also available at *moon.scopesandscapes.com*. 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

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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://moon.scopesandscapes.com/tlo.pdf* or send SASE to: Wayne Bailey, 17 Autumn Lane, Sewell, NJ 08080.

- **Venus (Benton):** Introductory information for observing Venus, the comprehensive *ALPO Venus Handbook*, as well as all observing forms and ephemerides, can be conveniently downloaded as pdf files at no cost to ALPO members and individuals interested in observing Venus as part of our regular programs at *http://www.alpo-astronomy.org/venus*.

- **Mars:** Free resources are on the ALPO website at *www.alpo-astronomy.org* . Click on "Mars Section" in the left column; then on the resulting webpage, look for links to resources in the right column including "Mars Observing Form", and "Mars Links". Under "Mars Links", click on "Mars Observers Cafe", and follow those links to The New "Internet Mars Observer's Handbook."

- **Minor Planets (Frederick Pilcher):** *The Minor Planet Bulletin*. Published quarterly and freely available at *http://www.mpbulletin.org*, this publication is **the** journal for almost all amateurs and even some professionals for publishing asteroid photometry results, including lightcurves, H-G parameters, color indexes, and shape/spin axis models. It is considered a refereed journal by the SAO/NASA ADS. All MPB papers are indexed in the ADS. While print subscriptions are no longer available to individuals, institutions (e.g., college libraries) can still obtain print copies via a special subscription. See details in MPB 37-4 or contact the editor, Richard Binzel. Annual voluntary contributions of $5 or more in support of the publication are welcome.
- Please send a check, drawn on a U.S. bank and payable in U.S. funds, to
  Minor Planet Bulletin
  c/o Melissa Hayes-Gehrke
  UMD Astronomy Department
  1113 PSC Bldg 415
  College Park, MD 20742

- **Jupiter:** *(1) Jupiter Observer's Handbook*, from the Astronomical League Sales, temporarily out of stock. *(2) ALPO_Jupiter*, the ALPO Jupiter Section e-mail network; to join, send a blank e-mail to *ALPO_Jupiter-subscribe@yahoogroups.com* (3) *Jupiter Observer's Startup Kit*, $3 from Richard Schmude, Jupiter Section Coordinator.

- **Saturn (Benton):** Introductory information for observing Saturn, including all observing forms and ephemerides, can be conveniently downloaded as pdf files at no cost to ALPO members and individuals interested in observing Saturn as part of our regular programs at *http://www.alpo-astronomy.org/saturn*. The former *ALPO Saturn Handbook* was replaced in 2006 by *Saturn and How to Observe It* (authored by Julius L. Benton) and it can be obtained from book sellers such as *Amazon.com*.

- **Meteors:** (1) *The ALPO Guide to Watching Meteors* (pamphlet). $3 per copy (postage & handling); check/money order to Astronomical League Sales, 9201 Ward Parkway, Suite 100, Kansas City, MO 64114; phone 816-DEEP-SKY (816-333-7759); e-mail *leaguesales@astroleague.org*. (2) *The ALPO Meteors Section Newsletter*, free (except postage), published quarterly (March, June, September and December). Send stamps, check or money order for first class postage to cover desired number of issues to Robert D. Lunsford, 14884 Quail Valley Way, El Cajon, CA 92021-2227.

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THE ASSOCIATION
OF LUNAR & PLANETARY OBSERVERS (ALPO)

The Association of Lunar & Planetary Observers (ALPO) was founded by Walter H. Haas in 1947 and incorporated in 1990 as a medium for advancing and conducting astronomical work by both professional and amateur astronomers who share an interest in Solar System observations. We welcome and provide services for all individuals interested in lunar and planetary astronomy. For the novice observer, the ALPO is a place to learn and to enhance observational techniques. For the advanced amateur astronomer, it is a place where one's work will count and be used for future research purposes. For the professional astronomer, it is a resource where group studies or systematic observing patrols add to the advancement of astronomy.

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

We have "sections" for the observation of all the types of bodies found in our Solar System. Section coordinators collect and study submitted observations, correspond with observers, encourage beginners, and contribute reports to our quarterly Journal at appropriate intervals. Each section coordinator can supply observing forms and other instructional material to assist in your telescopic work. You are encouraged to correspond with the coordinators in whose projects you are interested. Coordinators can be contacted either via e-mail (available on our website) or at their postal mail addresses listed in our Journal. Members and all interested persons are encouraged to visit our website at *http://www.alpo-astronomy.org*. Our activities are on a volunteer basis, and each member can do as much or as little as he or she wishes. Of course, the ALPO gains in stature and in importance in proportion to how much and also how well each member contributes through his or her participation.

Our work is coordinated by means of our quarterly periodical, the *Journal of the Assn. of Lunar & Planetary Observers* (known also as *The Strolling Astronomer*). Membership dues include a subscription to our Journal. Two versions of our Journal are distributed — a hardcopy (paper) version and an online (digital) version in portable document format (pdf) at considerably reduced cost.

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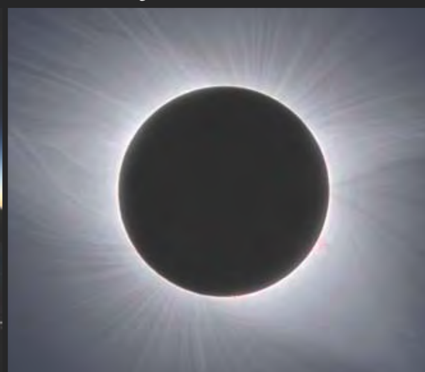

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