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Journal of the Association of Lunar & Planetary Observers

The Strolling Astronomer

Volume 59, Number 1, Winter 2017

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Founded in 1947

The Super Full Moon of November

(see page 2 for details)

Journal of the Association of Lunar & Planetary Observers

The Strolling Astronomer

Volume 59, No.1, Winter 2017
This issue published in December 2016 for distribution in both portable document format (pdf) and hardcopy format.

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

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

For membership or general information about the ALPO, contact:

Matthew Will
ALPO Membership Secretary/Treasurer
P.O. Box 13456
Springfield, Illinois 62791-3456

E-mail to: matt.will@alpo-astronomy.org

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

Founded in 1947

Inside the ALPO

Papers & Presentations

ALPO Resources

Inside the ALPO
Member, section and activity news

Association of Lunar & Planetary Observers (ALPO)

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(See full listing in *ALPO Resources*)
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Comets Section: Carl Hergenrother
Meteors Section: Robert D. Lunsford
Meteorites Section: Dolores Hill
ALPO Online Section: Larry Owens
Computing Section: Larry Owens
Youth Section: Timothy J. Robertson

Point of View
Your ALPO!

By Matthew L. Will, membership secretary, the ALPO

For those of you that read the minutes of our Board meeting in the last issue of the Journal of the ALPO, you may have read about developments for expanding membership access to our quarterly Journal in both media (hard copy and digital). The move to do this was in the spirit of strengthening membership in our organization and making ALPO membership more appealing.

Also, the ALPO is focused on strengthening our own organizational structure, whether that is:

- Fortifying our own observing programs with capable and dedicated staff to manage these programs.
- Producing credible and respected literature such as with our Journal and other publications.
- Administering the mechanics of the internal workings of the ALPO.
- Projecting future needs, directions, and goals for the ALPO.

In short, the ALPO has a lot of moving parts!

As we celebrate our 70th anniversary next year, the success of the ALPO can be attributed to an engaged membership, responsive staff, sound finances, the use of modern technology and media, along with preserving our institutional history and having a vision for the future. I would briefly like to focus on our engaged membership.

The ALPO has been fortunate to have a membership that has taken great interest in the scientific debates on the pages of our Journal for the last 70 years. Moreover, ALPO members have also offered suggestions to me from time to time about our operations from the business end. The Membership Secretary has gotten some good ideas over the years. While some were impractical for various reasons, others were things that I had not thought of before. In short, change doesn't occur in a vacuum and your input as members is important in improving our organization.

My presentation on the history of the ALPO at the ALCon last summer demonstrated that. Many ALPO members over the years, whether they were on staff or just regular dues paying members, have made their mark with the ALPO with helpful insights and suggestions. So speak up! I can't say that every suggestion that I receive will be implemented due to factors or circumstances that might not be apparent at first blush. However, this is your ALPO and the dues that you pay support our organization and entitle you to some say in our operations. I eagerly, and cheerfully look forward to engaging with you!

Inside the ALPO
Member, section and activity news

News of General Interest

Our Cover

This month's cover image of the November "Super Full Moon", while not strictly scientific, does (at least technically) fall into the camp of "observational astronomy".

Taken from his observatory in Colfax, California, our cover features an image by Don Machholz that he took through his homemade 6" binoculars using a simple Nikon digital camera.

Don adds that, "The ridge (where the foreground trees are located) is 4,000 feet from my house."

On this page, we include a few other attempts to catch the experience.

- Says John Westfall (bottom of this column) from Antioch (near San Francisco), California USA: "The attached supermoon 450-mm telephoto image isn't what you asked for (no foreground object for comparison), but still may be of some interest because it was taken when the Moon was closest to me (periwestfall?) rather than to the center of the Earth: 2016 NOV 14, 07h49m UT. The line-of-sight distance was then 350,768 km, or 5,766 km less than the center-to-center distance at that moment, and 5,461 km closer than the closest center-to-center distance at 11:28 UT.

- Larry Owens (top of this page) from Alpharetta (near Atlanta),

Inside the ALPO
Member, section and activity news

Georgia USA, describes his effort as simply, "With a little fall color". (Top right)

- Rik Hill (beneath the Larry Owens image) from Tuscon, Arizona, USA, states, "Here ya go!" (Bottom right)

Special Announcement from the ALPO Venus Section

The ALPO Venus Section continues 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.

It should be emphasized that it is still not too late for those who want to send their digital images to the ALPO Venus Section and the VEX website to do so. Also needed are drawings of Venus in Integrated Light and with color filters of known transmission while the VEX mission was in progress. 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*.

Digital Journal of the ALPO Now Available to All ALPO Members

As per the unanimous vote by the ALPO board of directors at its August 13 meeting, those whose ALPO membership includes only the paper (hard copy) of our *Journal* will now be able to download the full-color digital version as well, complete with its electronic bookmarks and hyperlinks.

Thus, all members will now receive a formal email notification as the newest issue is made available. The email will include a hyperlink on which to click After clicking on the hyperlink, a"pop-up window" will appear. Simply provide the requested data as requested to begin the download.

Update: The ALPO Publications Section Gallery

By Ken Poshedly

This is to announce that the ALPO Publications Section Gallery has been updated to include all ALPO Journals from 2015 back to 2001 and various indexes to the Journals.

The pre-2001 Journals back to issue No. 1 (1947) and additional indexes will be posted in the coming weeks and months.

These Journals are available to all to access, with no password required to open them.

The ALPO Publications Section gallery replaces the old online repository where some Journals were still password-protected. That online location will be deleted.

The Journals for calendar year 2016 remain available only to ALPO members and will be posted to the new location as their individual one-year anniversaries of release are reached.

It was in 2001 that Ken Poshedly was named editor & publisher and began production of a redesigned ALPO journal on a quarterly (seasonal) production schedule. As a longtime professional publications editor, Ken already knew that previous editors/publishers John Westfall and ALPO founder Walter Haas did a most impressive job during their tenures and both deserve our appreciation.

The Journal redesign included producing an online (digital) version as well as retaining the hard copy version. In addition, the Journal was reorganized into three major chunks; first, "Inside the ALPO", where member, section and activity news is presented ahead of anything else, then the science papers (called "feature stories"), and finally "ALPO

Inside the ALPO
Member, section and activity news

Resources", a directory people, publications, etc., for getting in touch with anybody of importance in our organization.

Other changes included moving to an 8 1/2 x 11 inch page size with full-color graphics, hyperlinks and bookmarks throughout the pdf version. (Hyperlinks allow the reader to access external online sites as well as email various authors and other individuals while electronic bookmarks enable the reader to jump directly to specific locations within the Journal itself.)

Our latest change is in how the Journal is distributed; whereas an email had been distributed to those members whose memberships included the digital Journal and directed them to access a certain online location to download a password-protected pdf file, we now distribute a special announcement of the release of the digital version to all ALPO members, including those whose memberships include the hard copy version. That announcement includes a link which walks the ALPO member through the download process.

Besides the ALPO journals, the Publications Section Gallery also includes various observing forms and monographs, all of which will be upgraded as new versions are made available.

To begin your own exploration of the Publications Gallery:

1. Go to the ALPO home page at http://www.alpo-astronomy.org/, then click on the "ALPO Section Galleries" link at the top-right of the screen.

2. Click on the icon for the "Publications Section".

3. Click on the icon for the "Digital Journals of the ALPO."

4. Click on the icon for any of the various years.

Inside the ALPO
Member, section and activity news

5. Click on the icon for any of the Journals in the chosen year.

6. Click on the "Download document" link near the center of the screen.

Then either save the document to your own platform or just access the document without saving it. Saving the document to your own terminal allows you to access it at any time, even if online access is not available.

Call for Articles for Publication in This Journal

The ALPO appreciates articles for publication and encourages its membership to submit written works (with images, if possible).

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 regular addresses and e-mail address is in the ALPO Resources section of this Journal.

Online JALPO Passwords

Passwords for access to certain older online (pdf) issues of the JALPO can be obtained from this editor at *ken.poshedly@alpo-astronomy.org*

All online (pdf) issues of our Journal from JALPO43-1 (Winter 2001) through JALPO56-1 (Winter 2014) can be accessed at *http://www.alpo-astronomy.org/djalpo/*

ALPO Interest Section Reports

ALPO Online Section

Larry Owens, section coordinator
Larry.Owens@alpo-astronomy.org

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

To all section coordinators: If you need an ID for your section's blog, contact Larry Owens at *larry.owens@alpo-astronomy.org*

For details on all of the above, visit the ALPO home page online at *www.alpo-astronomy.org*

Computing Section

Larry Owens, section coordinator
Larry.Owens@alpo-astronomy.org

Important links:

- To subscribe to the ALPOCS yahoo e-mail list, *http://groups.yahoo.com/group/alpocs/*
- To post messages (either on the site or via your e-mail program), *alpocs@yahoogroups.com*
- To unsubscribe to the ALPOCS yahoo e-mail list, *alpocs-unsubscribe@yahoogroups.com*
- Visit the ALPO Computing Section online at *www.alpo-astronomy.org/computing*

Lunar & Planetary Training Program

Tim Robertson, section coordinator
cometman@cometman.net

The ALPO Lunar & Planetary Training Program is open to all members of the ALPO, the 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.

I, Tim Robertson, as program coordinator, heartily welcome you to the ALPO and our training program and look forward to hearing from you!

To began the first phase of training at the basic level, interested persons should contact me at the following address:

Timothy J. Robertson
ALPO Training Program
195 Tierra Rejada #148
Simi Valley, California 93065

Or send e-mail to me at: cometman@cometman.net

For more information about the ALPO Lunar & Planetary Training Program, go to: *www.cometman.net/alpo/*

Inside the ALPO
Member, section and activity news

ALPO Observing Section Reports

Mercury / Venus Transit Section

John Westfall, section coordinator
johnwestfall@comcast.net

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

Meteors Section

Robert Lundsford, section coordinator
lunro.imo.usa@cox.net

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 includes new meteorite approvals from August to November 5, 2016.

The ALPO Meteorite Section consults with members about meteorites to educate and promote research. ALPO members who collect meteorites are encouraged to report unusual features in their meteorite samples. For example, recently approved ungrouped chondrite NWA 10769 was purchased by Nicola Castellano and submitted to researchers for classification. While it displays a typical chondritic texture, it has other particularly interesting characteristics such as the abundance of mostly nickel-rich sulfides and no troilite (usually abundant in ordinary chondrites). Oxygen isotope plots are distinct from other chondrites, too, suggesting a different source reservoir of material in the protoplanetary disk (Moggi Cecchi et al. 2016, Meteoritical Bulletin No. 105 in preparation).

From August to November 5, 2016 there were 1509 newly approved and/or revised meteorites included in the official record of the Meteoritical Society's Nomenclature Committee. New classified falls include the 10 kg L5 Banma (China) meteorite on August 24, 2016 and the 8.938 kg Ejby H5/6 (Denmark) on Feb. 6, 2016. Banma fell as a single stone embedded in a small crater while the Ejby broke into many fragments on impact. Official information for Osceola (Florida, USA) and Kamargaon (India) were updated and corrected.

A wide range of meteorite types were reported, including one new acapulcoite, lodranite, ungrouped achondrites, 2 angrites; Martian and lunar meteorites. Additional interesting meteorite recoveries of note were the large 377 kg L4 chondrite Clarendon (c) from Texas ranging to the very small 80 mg L5 chondrite GRV 090554 from Antarctica.

Visit the ALPO Meteorites Section online at www.alpo-astronomy.org/meteorite/

Comets Section

Report by Carl Hergenrother, section coordinator
chergen@lpl.arizona.edu

Despite the lack of bright comets over the past few months, the ALPO Comets Section has been keeping busy. While no visual observations have been submitted since last summer, CCD observers have been submitting many images of fainter comets. Between August and November, images of comets 2P/Encke, 29P/Schwassmann-Wachmann, 53P/Van Biesbroeck, 56P/Slaughter-Burnham, 74P/Smirnova-Chernykh, 93P/Lovas, 174P/Echeclus, 226P/Pigott-LINEAR-Kowalski, C/2010 U3 (Boattini), C/2013 US10 (Catalina), C/2014 A4 (SONEAR), C/2014 V4 (Catalina), C/2015 V1 (PANSTARRS), C/2015 V2 (Johnson), C/2016 A8 (LINEAR) and C/2016 M1 (PANSTARRS) were contributed by Charles Bell, Denis Buczynski, Manos Kardasis, Gianluca Masi, Richard Owens and John Sabia. Also, Per-Jonny Bremseth of Norway has agreed to contribute his collection of comet drawings spanning back to C/1969 Y1 (Bennett). As of mid-November, over 2100 drawings, photographs, CCD images and spectra of 186 different comets have been placed in the Comets Gallery on the ALPO website.

The current drought of bright comets will definitely come to an end in 2017. The first three months of the year will see no less than five comets become targets for visual observers using small aperture equipment.

Inside the ALPO
Member, section and activity news

Included in this report are ephemerides for five comets discussed. These ephemerides are for five-day intervals and contain the comet's Right Ascension (R.A.), Declination (Decl.), heliocentric distance in au (r), geocentric distance in au (d), phase angle in degrees (Ph.A.), Elongation from the Sun in degrees (Elong), total V magnitude (m1), and maximum elevation in degrees at the start or end of astronomical twilight for latitude +40 north and -40 south (Max Elev).

- First up is 45P/Honda-Mrkos-Pajdusakova. Discovered in 1948, 2016 will be the 12th observed apparition for this comet as it rounds the Sun once every ~5.3 years. As January begins, 45P will be just past perihelion (December 31 at 0.53 au), bright at 6-7th magnitude, but poorly placed low in the evening sky. By the second week of January, it will be located too close to the Sun to be observed. That all changes in February, as P/H-M-P rockets out of the dawn and becomes well-placed for early risers in the morning sky. Peak brightness may be 5-6th magnitude as it passes 0.08 au from Earth on February 11.
- Also observable in February is comet 2P/Encke. 2017 will mark Encke's 63rd observed apparition since it was first seen in 1786 by Pierre Mechain. It was "discovered" three additional times, in 1795 by Caroline Herschel, in 1805 by Jean-Louis Pons and in 1818 by Pons again, before Johann Franz Encke recognized its periodic nature.

Ephemerides for Comets 2P/Encke, 41P/Tuttle-Giacobini-Kresak, 45P/Honda-Mrkos-Pajdusakova,C/2015 ER61 (PANSTARRS) and C/2015 V2 (Johnson)

Date	R.A.	Decl.	r	d	Ph.A	Elong	m1	Max	Elev
2P/Encke									
								40N	40S
2017 Jan 01	23 01.91	+04 07.5	1.393	1.421	40	68	12.8	45	7
2017 Jan 06	23 06.03	+04 19.3	1.322	1.414	41	64	12.5	43	4
2017 Jan 11	23 10.79	+04 35.7	1.249	1.401	43	60	12.3	40	1
2017 Jan 16	23 16.16	+04 56.4	1.173	1.381	44	56	12.0	37	-1
2017 Jan 21	23 22.11	+05 20.9	1.095	1.354	45	53	11.7	34	-3
2017 Jan 26	23 28.59	+05 48.3	1.014	1.319	47	49	11.4	31	-4
2017 Jan 31	23 35.57	+06 17.8	0.930	1.276	50	46	11.0	28	-6
2017 Feb 05	23 42.93	+06 47.7	0.843	1.223	53	43	10.5	26	-7
2017 Feb 10	23 50.49	+07 15.0	0.754	1.160	57	40	10.0	23	-8
2017 Feb 15	23 57.92	+07 34.6	0.662	1.085	63	36	9.4	19	-9
2017 Feb 20	00 04.47	+07 36.6	0.570	0.998	72	33	8.7	16	-10
2017 Feb 25	00 08.56	+07 00.9	0.480	0.898	86	28	7.8	11	-11
2017 Mar 02	00 06.78	+05 06.8	0.400	0.792	107	22	7.0	5	-12
2017 Mar 07	23 53.46	+00 51.1	0.346	0.698	141	12	6.3	-5	-14
2017 Mar 12	23 26.89	-05 47.1	0.340	0.655	173	2	6.1	-19	-15
2017 Mar 17	22 59.30	-11 55.5	0.384	0.684	135	15	6.6	-15	-1
2017 Mar 22	22 41.98	-15 34.4	0.460	0.754	107	26	7.4	-12	9
2017 Mar 27	22 34.33	-17 18.2	0.548	0.833	90	33	8.1	-10	16
2017 Apr 01	22 32.45	-18 00.0	0.641	0.907	78	38	8.8	-8	21
41P/Tuttle-Giacobini-Kresak									
								40N	40S
2017 Feb 05	09 20.04	+12 58.3	1.374	0.389	2	176	13.2	63	37
2017 Feb 10	09 19.52	+15 04.7	1.335	0.349	2	176	12.4	65	35
2017 Feb 15	09 19.07	+17 41.1	1.297	0.313	7	170	11.7	68	32
2017 Feb 20	09 19.02	+20 51.1	1.261	0.281	12	163	10.9	71	29
2017 Feb 25	09 19.82	+24 37.8	1.226	0.253	18	156	10.2	75	25
2017 Mar 02	09 22.12	+29 03.5	1.194	0.228	24	149	9.5	79	21
2017 Mar 07	09 26.87	+34 09.3	1.164	0.207	31	142	8.8	84	16
2017 Mar 12	09 35.37	+39 54.8	1.136	0.189	37	135	8.2	90	10
2017 Mar 17	09 49.66	+46 15.4	1.112	0.175	44	128	7.6	84	4
2017 Mar 22	10 13.12	+52 57.8	1.091	0.163	51	121	7.1	77	-3
2017 Mar 27	10 51.64	+59 32.1	1.073	0.155	57	115	6.7	70	-10
2017 Apr 01	11 53.84	+64 58.9	1.060	0.150	62	110	6.4	65	-15
45P/Honda-Mrkos-Pajdusakova									
								40N	40S
2017 Jan 01	20 59.18	-18 51.1	0.533	0.691	106	31	6.8	9	-1
2017 Jan 06	21 07.79	-17 30.0	0.547	0.585	120	28	6.5	7	-4
2017 Jan 11	21 11.56	-16 05.6	0.580	0.485	134	24	6.4	5	-7
2017 Jan 16	21 09.91	-14 32.5	0.628	0.394	147	19	6.4	1	-11
2017 Jan 21	21 02.14	-12 37.5	0.686	0.312	159	13	6.4	-3	-16
2017 Jan 26	20 46.47	-09 53.7	0.751	0.238	167	9	6.3	-9	-23
2017 Jan 31	20 17.97	-05 21.2	0.819	0.173	161	14	6.1	-2	-21
2017 Feb 05	19 22.34	+03 29.0	0.890	0.118	141	33	5.7	18	-11
2017 Feb 10	17 22.70	+20 11.3	0.962	0.086	104	70	5.4	56	5
2017 Feb 15	14 23.49	+32 00.9	1.034	0.097	59	115	6.1	82	17
2017 Feb 20	12 31.04	+31 01.6	1.105	0.143	33	142	7.3	81	19
2017 Feb 25	11 38.71	+28 17.5	1.176	0.201	20	155	8.4	78	22
2017 Mar 02	11 11.32	+26 07.7	1.246	0.267	15	160	9.3	76	24
2017 Mar 07	10 55.26	+24 28.5	1.315	0.337	14	160	10.1	74	26
2017 Mar 12	10 45.26	+23 09.0	1.382	0.410	15	157	10.8	73	27
2017 Mar 17	10 38.94	+22 02.0	1.449	0.488	17	153	11.4	72	28
2017 Mar 22	10 35.07	+21 03.0	1.514	0.569	19	149	12.0	71	29
2017 Mar 27	10 32.97	+20 09.4	1.578	0.654	21	144	12.5	70	30
2017 Apr 01	10 32.22	+19 19.3	1.641	0.743	22	140	13.0	69	31

Inside the ALPO
Member, section and activity news

Visual observers using large apertures will be able to spot Encke in January. Smaller aperture users will need to wait till early February when Encke becomes brighter than 11th magnitude. It is observable from the northern hemisphere in the evening sky till the end of February when it will have reached 7th magnitude. Southern hemisphere observers will be able to follow Encke starting in late March as it fades. Perihelion is on March 10 at 0.34 au.

- The spring's third bright comet was discovered by the Pan-STARRS1 telescope back in March of 2015. When first seen at a distance of 8.5 au from the Sun, observers didn't notice any cometary activity so the comet was originally designated as the asteroid 2015 ER61. Large telescope follow-up observations soon uncovered a faint coma and tail and the object was re-designated as C/2015 ER61 (PANSTARRS). A dynamically old comet (meaning it's been close to the Sun before), Comet PANSTARRS will reach perihelion on May 9 at 1.04 au from the Sun. At the start of 2017, it will be around 12th magnitude. It will brighten to magnitude 10 by mid-February and magnitude 8 by the end of March. An inclination of only 6 degrees will keep it close to the ecliptic for the entire apparition. Southern hemisphere observers will get a good view of the comet starting in January. While northern observers will be able to observe it throughout the summer, it will be located low morning sky the entire time.
- Our fourth comet of the quarter is long-period comet C/2015 V2 (Johnson). Discovered in November of 2015 by Jess Johnson of the Catalina Sky Survey, Comet Johnson is inbound to a June 12 perihelion at 1.64 au from the Sun and a close approach to Earth at 0.81 au on June 5. At that time, it may have brightened to 6th magnitude. The peak brightness is questionable as Comet Johnson is a dynamically new comet which are prone to underperforming near and after perihelion. As 2017 begins,

Ephemerides for Comets 2P/Encke, 41P/Tuttle-Giacobini-Kresak, 45P/Honda-Mrkos-Pajdusakova,C/2015 ER61 (PANSTARRS) and C/2015 V2 (Johnson) (Continued)

C/2015 ER61 (PANSTARRS)

Date	R.A.	Decl.	r	d	Ph.A	Elong	m1	Max	Elev
								40N	40S
2017 Jan 01	15 06.67	-19 50.3	2.229	2.716	19	50	12.2	20	14
2017 Jan 06	15 18.02	-20 28.5	2.169	2.611	21	53	11.9	20	17
2017 Jan 11	15 29.89	-21 5.1	2.110	2.507	22	55	11.7	20	21
2017 Jan 16	15 42.32	-21 39.7	2.051	2.403	23	57	11.5	21	24
2017 Jan 21	15 55.38	-22 11.9	1.991	2.300	25	59	11.3	21	27
2017 Jan 26	16 09.12	-22 41.1	1.932	2.198	26	61	11.1	20	30
2017 Jan 31	16 23.60	-23 6.6	1.873	2.099	27	63	10.8	20	33
2017 Feb 05	16 38.88	-23 27.7	1.814	2.001	29	64	10.6	20	36
2017 Feb 10	16 55.02	-23 43.4	1.755	1.906	30	66	10.3	20	38
2017 Feb 15	17 12.10	-23 52.7	1.697	1.815	32	67	10.1	19	40
2017 Feb 20	17 30.18	-23 54.1	1.639	1.727	34	68	9.8	19	42
2017 Feb 25	17 49.29	-23 46.4	1.582	1.644	35	68	9.6	18	44
2017 Mar 02	18 09.45	-23 28.0	1.526	1.565	37	69	9.3	18	45
2017 Mar 07	18 30.66	-22 57.1	1.472	1.492	39	69	9.0	17	45
2017 Mar 12	18 52.88	-22 12.3	1.418	1.426	40	69	8.8	16	46
2017 Mar 17	19 16.04	-21 11.9	1.367	1.366	42	68	8.5	16	46
2017 Mar 22	19 40.00	-19 55.1	1.317	1.314	44	67	8.3	15	45
2017 Mar 27	20 04.59	-18 21.3	1.270	1.270	46	66	8.1	14	44
2017 Apr 01	20 29.58	-16 30.9	1.226	1.234	47	65	7.8	14	43

C/2015 V2 (Johnson)

Date	R.A.	Decl.	r	d	Ph.A	Elong	m1	Max	Elev
								40N	40S
2017 Jan 01	14 33.10	+44 01.9	2.642	2.479	21	88	10.9	67	-20
2017 Jan 06	14 43.67	+44 02.2	2.596	2.406	22	89	10.7	68	-18
2017 Jan 11	14 54.05	+44 04.6	2.550	2.335	22	91	10.6	70	-16
2017 Jan 16	15 04.23	+44 09.0	2.505	2.265	23	92	10.5	72	-13
2017 Jan 21	15 14.16	+44 15.4	2.460	2.197	23	93	10.3	73	-11
2017 Jan 26	15 23.79	+44 23.9	2.415	2.130	23	94	10.2	74	-9
2017 Jan 31	15 33.06	+44 34.4	2.371	2.064	24	95	10.0	75	-7
2017 Feb 05	15 41.92	+44 46.8	2.327	2.000	24	96	9.9	77	-5
2017 Feb 10	15 50.32	+45 00.8	2.284	1.937	25	97	9.7	78	-3
2017 Feb 15	15 58.18	+45 16.4	2.241	1.874	25	98	9.6	79	-2
2017 Feb 20	16 05.46	+45 33.3	2.199	1.813	26	99	9.4	79	0
2017 Feb 25	16 12.05	+45 51.3	2.158	1.752	26	100	9.3	80	1
2017 Mar 02	16 17.87	+46 10.1	2.118	1.692	27	101	9.1	81	2
2017 Mar 07	16 22.84	+46 28.9	2.078	1.632	27	101	8.9	82	2
2017 Mar 12	16 26.85	+46 47.1	2.040	1.572	28	102	8.8	82	3
2017 Mar 17	16 29.82	+47 04.1	2.003	1.513	28	104	8.6	83	3
2017 Mar 22	16 31.63	+47 18.8	1.966	1.455	29	105	8.5	83	3
2017 Mar 27	16 32.15	+47 30.1	1.932	1.396	29	106	8.3	83	3
2017 Apr 01	16 31.28	+47 36.1	1.898	1.338	30	107	8.1	82	2

Inside the ALPO
Member, section and activity news

Johnson may be as bright as magnitude 11 and will continue to brighten to magnitude 10 by early February, magnitude 9 by early March and magnitude 8 by early April. It will be located at high declinations and well placed for northern observers through the summer.

- The last comet is 41P/Tuttle-Giacobini-Kresak. This comet was discovered on three separate occasions: in 1858 by Horace Tuttle, 1907 by Michel Giacobini and 1951 by Lubor Kresak. 2016 marks 41P's 11th observed apparition. Nominally, 41P should become brighter than 13th magnitude in early February, 10th magnitude in late February and 6th magnitude by late March. I say nominally because this comet is prone to outbursts. In 1973, T-G-K experienced two 10-magnitude outbursts. Smaller outbursts also occurred in 1995 and 2001. If T-G-K were to experience an outburst during this return, it could become a naked eye object. Perihelion is on April 13 at 1.05 au and close approach to Earth is on March 27 at 0.14 au.

As always, the ALPO Comets Section solicits comet observations of all kinds for these and all comets, past and present.

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*

Please consider reporting all your comets observations, past and present, to ALPO Comets Section Coordinator Carl Hergenrother at the email address listed at the beginning of this report.

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

Solar Section

Report by Rik Hill, section coordinator & science advisor
rhill@lpl.arizona.edu

The ALPO Solar Section has become rather stable in membership and our members persevere in monitoring what little solar activity there is in this sudden and early drop towards minimum. One new member has joined us since the last report, John O'Neal and the amount of submitted data at a high level. It is usual to get between 400-450 observations per 27.3 day rotation.

Theo has been publishing his overviews of the rotation just passed, on the ALPO website. These are helpful in giving the observers a brief idea for how the activity is proceeding without having to wait for the formal reports in the JALPO.

Pam Shivak continues to do regular postings of solar observations and news on Facebook. She also posts to the Facebook pages: SOLARACTIVITY, Solar Sidewalk Astronomers and Daystar on general solar topics.

Rick Gossett reports that all is well with our email list. There have been no hack attempts and all communications have been civil and on topic.

To join the Yahoo Solar ALPO e-mail list, please go to *https://groups.yahoo.com/neo/groups/Solar-Alpo/info*

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
frankj12@aol.com

Visit the ALPO Mercury Section online at *www.alpo-astronomy.org/mercury*

Venus Section

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

Venus is prominently appears in the western evening sky following sunset at apparent visual magnitude of -4.3 (as of early January 2017) as a slightly gibbous disk about 56.6% illuminated with an apparent diameter of about 21.9". During the current (2016-17 Eastern (Evening)) apparition, Venus is continues to pass through its waning phases (a progression from fully illuminated through crescent phases). Thus, observers witness the leading hemisphere of the planet at the time of sunset on Earth. Venus will attain Greatest Elongation East of 47° on January 12, 2017 and reach theoretical dichotomy (predicted half-phase) on January 14. The planet will portray its greatest brilliancy on

Inside the ALPO
Member, section and activity news

February 18 at apparent visual magnitude -4.8.

The accompanying Table of Geocentric Phenomena in Universal Time (UT) is presented for the convenience of observers for this apparition.

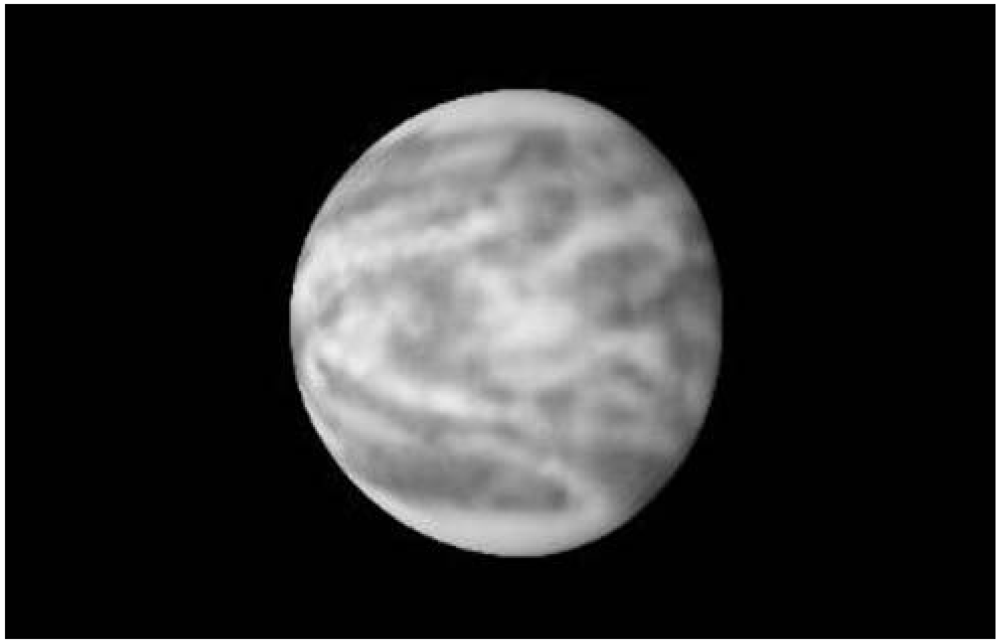
As of this report, the ALPO Venus Section has already started receiving numerous visual drawings and digital images from observers around the world, with reports of the usual atmospheric features in the form of radial, amorphous, irregular, and banded dusky markings at UV and near-IR wavelengths. Visual observers also reported analogous dusky features on the disk of the planet in integrated light (no filter) and with color filters. A report on the previous (2015-16 Western (Morning)) apparition will appear in this Journal at a later date.

For the 2016-17 Eastern (Evening) Apparition, with Venus reaching a maximum angular distance from the Sun of 47°, the effects arising from the excessive brilliance of the disk at that time is troublesome when observing Venus against a dark sky, Well in advance of and following greatest elongation, Venus is frequently low in the western sky where atmospheric differential refraction and prismatic dispersion produce poor seeing conditions. So, at such times, many observers have adopted a practice of viewing Venus only when it has attained an altitude of about 20° or more above the horizon, which is not always possible.

Consequently, although it may seem difficult locate Venus during daylight, the planet is comparatively bright, and in practice and assuming a clear sky, observers can usually find the planet if they know exactly where to look. Also, if the planet is view under darkened sky conditions, the presence of a slight haze or high cloud often stabilizes and reduces glare conditions while improving definition.

Readers of this Journal are likely acquainted with our on-going collaboration with professional astronomers as exemplified by our sharing of visual observations and digital images at various wavelengths during ESA's Venus Express (VEX) mission that began in 2006 and concluded in 2015. It was a tremendously successful Pro-Am effort involving ALPO Venus observers around the globe.

It should be noted that it is still not too late for those who want to send their images to the ALPO Venus



Michel Legrand of La Baule-Escoublac, France, contributed this excellent drawing of Venus at 17:48 UT on August 25, 2016 using a W80A light blue filter with a 41.0 cm (16.1 in.) Newtonian at 366X. S = 6.0, Tr = 4.0. Amorphous, irregular, and banded dusky markings are depicted in this sketch, along with both cusp caps and cusp bands. The apparent diameter of Venus is 10.8", phase (k) 0.927 (92.7% illuminated), and visual magnitude -3.7. South is at top of image.

Geocentric Phenomena of the 2016-17 Eastern (Evening) Apparition of Venus in Universal Time (UT)

Superior Conjunction	2016	Jun 06 (angular diameter = 9.7 arc-seconds)
Greatest Elongation (East)	2017	Jan 12 (47°)
Predicted Dichotomy		Jan 14.56^{d} (exactly half-phase predicted)
Greatest Illuminated Extent		Feb 18 (m_v = –4.8)
Inferior Conjunction		Mar 25 (angular diameter = 59.8 arc-seconds)

Inside the ALPO
Member, section and activity news

Section and the VEX website (see below). These observations remain 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 at:

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

A follow-up on the Pro-Am effort is underway with Japan's (JAXA) Akatsuki mission that was to start full-scale observations this past in April, and more will be announced about this endeavor soon in this *Journal*.

The observation programs of the ALPO Venus Section are listed on the Venus page of the ALPO website at *http://www.alpo-astronomy.org/venus* as well as in considerable detail in the author's *ALPO Venus Handbook* available from the ALPO Venus Section as a pdf file.

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 visual drawings of the planet. Regular imaging of Venus in both UV, 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 (for example, 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 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 may be included within this issue of your Journal; it is also located online at:

http://www.alpo-astronomy.org/gallery/main.php?g2_view=core.DownloadItem&g2_itemId=85642

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 plane as a cooperative simultaneous observing endeavor with visual observers. Also, observers should undertake imaging of the planet at near-IR wavelengths (for example, 1000nm), 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 challenges ahead.

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 Wayne Bailey, program coordinator
wayne.bailey@alpo-astronomy.org

The ALPO Lunar Topographical Studies Section (ALPO LTSS) received a total of 131 new observations from 16 observers during the July-September quarter. Eleven contributed articles were published in addition to numerous commentaries on images submitted. The *Focus-On* series continued, under Jerry Hubbell, with an article on Montes Apenninus & Palus Putredinis. Upcoming *Focus-On* subjects include the Schiller-Zucchius Basin, Montes Taurus & the Taurus-Littrow Valley and Rupes Recta.

Since our last section report, we have lost two well-known lunar figures, Peter Grego and Ewen Whitaker

Peter Grego was a long time contributor of lunar drawings. In addition to his drawings, which were created on a PDA and had an almost photographic appearance, he also contributed a short tutorial on lunar drawing to the April 2009 issue of *The Lunar Observer*. Peter was very active in British amateur astronomy. He was a prolific author, best known among lunar enthusiasts for *The Moon and How to Observe It*. His sketches for the TLO were always accompanied by insightful commentary. He will be missed. A memorial article is in the September issue of *The Lunar Observer*.

Ewen Whitaker was best known for his work on lunar cartography and

Inside the ALPO
Member, section and activity news

Lunar Calendar for January thru March 2017

2017	Date	UT	Event
Jan	02	09:20	Moon-Venus: 2° S
	03	06:47	Moon-Mars: 0.3° S
	05	19:47	First Quarter
	09	14:07	Moon-Aldebaran: 0.4° S
	10	06:07	Moon Perigee: 363200 km
	11	09:32	Moon Extreme North Dec.: 18.9° N
	12	11:34	Full Moon
	15	04:07	Moon-Regulus: 0.9° N
	19	05:26	Moon-Jupiter: 3° S
	19	22:14	Last Quarter
	22	00:14	Moon Apogee: 404900 km
	24	10:37	Moon-Saturn: 4° S
	25	11:59	Moon Extreme South Dec.: 18.9° S
	26	00:46	Moon-Mercury: 4° S
	28	00:07	New Moon
	31	14:34	Moon-Venus: 4.2° N
Feb	01	01:09	Moon-Mars: 2.4° N
	04	04:19	First Quarter
	05	21:14	Moon-Aldebaran: 0.2° S
	06	13:59	Moon Perigee: 368800 km
	07	18:34	Moon Extreme North Dec.: 18.9° N
	11	00:33	Full Moon
	11	00:45	Pen. Lunar Eclipse
	11	14:04	Moon-Regulus: 0.8° N
	15	14:55	Moon-Jupiter: 2.9° S
	18	19:33	Last Quarter
	18	21:14	Moon Apogee: 404400 km
	20	23:44	Moon-Saturn: 3.9° S
	21	20:50	Moon Extreme South Dec.: 18.8° S
	26	14:58	New Moon
Mar	01	18:58	Moon-Mars: 4.4° N
	03	07:24	Moon Perigee: 369100 km
	05	02:38	Moon-Aldebaran: 0.2° S
	05	11:32	First Quarter
	07	00:43	Moon Extreme North Dec.: 18.9° N
	10	22:20	Moon-Regulus: 0.9° N
	12	14:54	Full Moon
	14	20:04	Moon-Jupiter: 2.7° S
	18	17:25	Moon Apogee: 404700 km
	20	10:49	Moon-Saturn: 3.8° S
	20	15:58	Last Quarter
	21	05:22	Moon Extreme South Dec.: 18.9° S
	28	02:57	New Moon
	30	12:39	Moon Perigee: 363900 km

Table courtesy of William Dembowski and NASA's SkyCalc Sky Events Calendar

nomenclature. Starting as an amateur astronomer in Great Britain, he was hired by the Royal Greenwich Observatory, then moved to the U.S. to work with Gerard Kuiper at Yerkes and McDonald Observatories, and finally at the University of Arizona's Lunar and Planetary Laboratory. He was a major contributor to the series of lunar atlases produced by Kuiper's team, and to the IAU's standardization of lunar nomenclature. He was always willing to help amateurs and will be missed. A memorial article is in the November issue of *The Lunar Observer.*

We are currently considering whether to make any changes to the Lunar Topographic Studies/Selected Areas programs. Anyone with suggestions for additional programs, changes to existing programs, or suggested eliminations is welcome to send them to me at the e-mail above.

All electronic submissions should now be sent to both me and Assistant Coordinator Jerry Hubbell (*jerry.hubbell@alpo-astronomy.org*). Hard copy submissions should continue to be mailed to me.

Visit the following online web site for more info *moon.scopesandscapes.com* (including current and archived issues of *The Lunar Observer*).

Lunar Meteoritic Impacts

Brian Cudnik,
program coordinator
cudnik@sbcglobal.net

Please visit the ALPO Lunar Meteoritic Impact Search site online

Inside the ALPO
Member, section and activity news

at www.alpo-astronomy.org/lunar/lunimpacts.htm.

Lunar Transient Phenomena

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

Five LTP were reported during 2016, but only two survived our vetting process and made it onto the LTP database, albeit at the lowest weightings; both concern the crater Herodotus:

- Herodotus: 2016 Jun 17 UT 05:00 Alberto Anunziato (Argentina, AEA) observed a very tiny light spot on the southern edge of where the shadow from topographic relief to the south of Vallis Schroteri merges onto the floor of Herodotus. There should be no light spot here. The ALPO/BAA weight=1, as the scope was a small aperture 4" Meade.
- Herodotus: 2016 Jul 17 UT 03:49 Paul Zeller (Indianapolis, IN, ALPO) imaged a pseudo peak effect, with a hint of shadow, near the center of the floor of the crater, however image sharpness and image noise makes this uncertain, and 79 minute later, a sharper monochrome image by Marcello Gundlach (Bolivia, IACCB), revealed nothing unusual. The ALPO/BAA weight=1.

If anybody was imaging the Aristarchus area on the above two dates, we would be very grateful if you could please email your images in, so that we can check up on these appearances of Herodotus.

We welcome new observers, whether they are experienced visual observers, or high resolution lunar imagers, in order to solve some past historical lunar observational puzzles.

A list of dates and UTs to observe repeat illumination events can be found on: http://users.aber.ac.uk/atc/lunar_schedule.htm, and LTP observational alerts are given on this Twitter page: https://twitter.com/lunarnaut

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

Mars Section

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

Mars is still south of the celestial equator, but will gradually acquire a more northerly declination as it proceeds along the ecliptic in the next few months. It will cross the celestial equator into the northern sky on January 29th. However, its angular diameter will then be only 5.1 arc seconds, so it will be difficult to observe fine detail in the albedo features. Its solar elongation in the evening sky is gradually decreasing, and will be only 51 degrees on January 29th -- so plan on observing it soon after sundown.

As you read this, the Martian southern summer is beginning, and the season of very large dust storms is upon us. Of the 9 planet-encircling dust storms that were observed before 1999, the mean season of onset was L_S 254, with the earliest onset being L_S 204 (early southern spring) and the latest onset at L_S 312 (the middle of southern summer). Watching the spread of such a storm from night to night is fascinating, and may be a once-in-a-lifetime experience that you do not want to miss. The South Polar Cap is shrinking, and you can monitor its changes. The far northern features are now poorly seen, as the South Pole is tilted toward Earth.

Please join us on the Yahoo Mars observers' message list at https://groups.yahoo.com/neo/groups/marsobservers/info . When you make an observation, please either share it with the group by posting it in the photos section of the Yahoo list, or send it directly to me at rjvmd@hughes.net .

Visit the ALPO Mars Section online and explore the Mars Section's recent observations: www.alpo-astronomy.org/mars

Minor Planets Section

Frederick Pilcher, section coordinator
pilcher35@gmail.com

Some of the highlights published in the *Minor Planet Bulletin*, Volume 44, No. 4, 2016 October-December, are presented. These represent the recent achievements of the ALPO Minor Planets Section.

The *Minor Planet Bulletin* continues to grow. The four issues for calendar 2016 have a larger total number of pages, 336, and larger total number of asteroids, 720, than in any previous year. This achievement was possible only because the number of

Inside the ALPO
Member, section and activity news

participating competent observers is also increasing. This writer especially thanks the new lightcurve observers for entering the field.

Alberto Carbognani describes how to find accurate color indices B-V and V-R and applies his method to find for the Earth approacher (214088) 2004 JN13 numerical values of B-V=0.88 and V-R=0.48, typical of taxonomic class S.

Brian Warner, a veteran observer of rotational properties of close approaching asteroids, has found evidence for satellites of several of them. Three of these have a primary with very long rotation period and secondary with short rotation period: (215442) 2002 MQ3, primary period 473 hours, secondary period 2.6491 hours; 2009 EC, primary period 48.7 hours, secondary period 3.261 hours; 2016 BU13, primary period 39.5 hours, secondary period 2.4500 hours. Two others have the more commonly encountered primary with short rotation period and secondary with long rotation period tidally locked to the orbital revolution period (like the Earth-Moon system). These are (10150) 1994 PN, primary period 2.965 hours, secondary period 10.55 hours; and (154244) 2002 KL6 primary period 4.6087 hours, secondary period 24.05 hours. A third object, (54697) 2001 FA, has primary rotation period 2.7075 hours, secondary period of revolution 16.264 hours, with a very uncertain hint of secondary rotation period 2.1239 hours that needs future confirmation. (This is not analogous to Earth and Moon, but may be an instrumental artifact.)

Asteroids smaller than 300 meters often have superfast rotations. Brian Warner has found three of these objects with rotation period and diameter respectively: 2016 GS2, 0.0182725 hours, 75 meters; 2016 HO, 0.7512 hours, 26 meters; 2016 JP17, 0.070176 hours, 70 meters.

Alessandro Marchini and eight collaborators have discovered that 2242 Balaton is a binary and obtained especially well defined lightcurves. With a dual period search program that separates primary and secondary periods, they find that the primary rotation period is 2.7979 hours with the usual bimodal lightcurve of amplitude 0.20 magnitudes, and the secondary lightcurve shows dips of about 0.10 magnitudes during transits of and occultations by the primary, analogous to a partially eclipsing binary star, and defining a period of revolution 12.96 hours and likely tidally locked rotation of the secondary. A ratio of diameters ≥0.25 is inferred.

Binary properties of several other asteroids were observed again: 1727 Mette, 1866 Sisyphus, 2047 Smetana, 5899 Jedicke, (18990) 2000 EV26.

Two slow rotators were found to be tumbling (simultaneous rotation about two different axes with different periods that produces nonrepeating lightcurves): (331471) 1984 QY1 and (388945) 2008 TZ3.

In addition to asteroids specifically identified above, lightcurves with derived rotation periods are published for 143 other asteroids as listed below: 50, 58, 124, 238, 307, 339, 381, 465, 481, 503, 507, 512, 537, 569, 585, 857, 884, 895, 1005, 1085, 1108, 1145, 1259, 1263, 1271, 1305, 1311, 1320, 1363, 1454, 1480, 1583, 1597, 1603, 1647, 1714, 1715, 1791, 1859, 1911, 2049, 2087, 2146, 2179, 2241, 2260, 2312, 2346, 2408, 2491, 2656, 2660, 2828, 2854, 2904, 3002, 3063, 3103, 3177, 3223, 3228, 3606, 3669, 3709, 3754, 3793, 3812, 3829, 3840, 3861, 4060, 4063, 4068, 4145, 4170, 4489, 4542, 4587, 4640, 4708, 4764, 4833, 4834, 4919, 4931, 4962, 5012, 5027, 5232, 5264, 5284, 5318, 5836, 5863, 6173, 6310, 6556, 7016, 7543, 7660, 8013, 8045, 9083, 9400, 9414, 10259, 11395, 12551, 13388, 15436, 15440, 15502, 15535, 16233, 18060, 24403, 29470, 31013, 35396, 39810, 68346, 78857, 85628, 93768, 137170, 138325, 141354, 153652, 154555, 162463, 436775, 441987, 464798, 2002 CX58, 2002 LY1, 2003 KO2, 2009 DL46, 2016 BX14, 2016 FE1, 2016 FY3, 2016 JC6, 2016 LG.

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 lightcurve 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 realize. Observations of asteroids at multiple oppositions widely spaced around the sky are necessary to find

Inside the ALPO
Member, section and activity news

axes of rotation and highly accurate sidereal periods.

The *Minor Planet Bulletin* is a refereed publication and that it is available online at *http://www.minorplanet.info/mpbdownloads.html*.

Annual voluntary contributions of $5 or more in support of the publication are welcome.

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

Jupiter Section

Report by Ed Grafton, section coordinator
ed@egrafton.com

After reaching solar conjunction on September 26, 2016, Jupiter emerged from the solar glare revealing that an NTB disturbance had begun in October. Glenn Orton (NASA) working at the NASA 3-meter Infrared Telescope Facility at the Mauna Kea Observatory in Hawaii first alerted the astronomical community of the outbreak with this image on October 19, 2016.

http://egrafton.com/NASA_glenn_orton.jpg

Just three days later, Thomas Ashcraft captured the NTB outbreak with a C14 SC from New Mexico.

Figure 1. Image by Thomas Ashcraft on October 22nd 2016 showing the NTB outbreak.

NTB outbreaks have been occurring at about five-year intervals, the last occurring in 2012. The NTB outbreak bright spots were reported by John Rogers of the BAA to have a drift rate of about -13 deg/day in System III.

Richard Schmude, Jr. has completed writing the 2013-2014 Jupiter apparition report and submitted it to the JALPO for publication. [Editor's Note: This report has been received and is in process to be published in the first available JALPO, possibly JALPO59-2.]

Richard anticipates beginning work on the 2014-2015 Jupiter report in 2017

John Westfall has prepared predictions of Galilean satellite events for the current (2016/17) apparition to aid in satellite timing event data collection and observations.

http://www.alpo-astronomy.org/jupiterblog/wp-content/uploads/2016/10/GalEcl_2016-17.pdf

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

Galilean Satellite Eclipse Timing Program

Report by John Westfall, program coordinator
johnwestfall@comcast.net

Contact John Westfall via e-mail at *johnwestfall@comcast.net* or via postal mail at 5061 Carbondale Way, Antioch, CA 94531 USA to obtain an observer's kit, also available on

Jupiter as imaged by Thomas Ashcraft showing the NTB disturbance. See text and image for details.

Inside the ALPO
Member, section and activity news

the Jupiter Section page of the ALPO website.

Saturn Section

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

The 2015-16 apparition of Saturn came to a close as the planet entered conjunction with the Sun on December 10, 2016. The planet will not become visible to any reasonable advantage before sunrise until late February 2017 as the 2016-17 apparition gets underway. Opposition will occur on June 15, 2017, affording the best opportunities to view and image the planet most of the night despite its southerly declination of about -22° for northern hemisphere observers.

The accompanying Table of Geocentric Phenomena for the 2016-17 Apparition in Universal Time (UT) is presented for the convenience of observers.

As of this writing, the ALPO Saturn Section has amassed well over 400 observations in the form of digital images, visual drawings, and visual numerical relative intensity estimates. Because observations are continuing to arrive, many more observations will be added to the total received before this report appears in a future issue of this Journal. Reports have been received of occasional white spots in the northern and southern halves of the Equatorial Zone (denoted as EZn and EZs, respectively), as well as small white spots imaged in:

- The North Temperate Zone (NTeZ) at approximate saturnigraphic latitude +44°.
- The North Tropical Zone (NTrZ) near saturnigraphic latitude +30°.
- The North Equatorial Belt Zone (NEBZ) at about saturnigraphic latitude +24°.
- Dark spots have also been imaged in: The Equatorial Band (EB) at saturnigraphic latitudes 0°.
- The North North Temperate Zone (NNTeZ) at approximately saturnigraphic latitude +59.2°.
- The North North North Temperate Belt (NNBTeB) at about saturnigraphic latitude +63°.

With the rings having been tilted about +26° toward Earth during 2015-16, observers experienced near-optimum views of the northern hemisphere of the globe and north face of the rings during the apparition. These circumstances will be even more favorable in 2016-17 as the inclination of the rings to our line of sight will reach a maximum of +27° by mid-October 2017. It will be curious to see how discrete activity seen or imaged on Saturn during 2015-16 carries over into the 2016-17 observing season as well as what new atmospheric phenomena might emerge.

More on Saturn: A Special Saturn Cassini Mission Pro-Am Note

Pro-Am cooperation with the ongoing *Cassini* mission continues during the 2016-17 apparition. Saturn observers worldwide are alerted, however, that NASA's unprecedented close-range surveillance of the planet by the *Cassini* spacecraft for nearly 13 years, which started back on April 1, 2004, will enter the final year of its epic voyage during the 2016-17 apparition. The spacecraft is expected to conclude its remarkable odyssey on September 15, 2017,

Geocentric Phenomena for the 2016-17 Apparition of Saturn in Universal Time (UT)

Conjunction	2016 Dec 10^d UT
Opposition	2017 Jun 15^d
Conjunction	2017 Dec 21^d
Opposition Data:	
Equatorial Diameter Globe	18.3 arc-seconds
Polar Diameter Globe	16.3 arc-seconds
Major Axis of Rings	41.5 arc-seconds
Minor Axis of Rings	18.5 arc-seconds
Visual Magnitude (m_v)	0.0
B =	+26.5°
Declination	-22.0°
Constellation	Ophiuchus

Inside the ALPO
Member, section and activity news

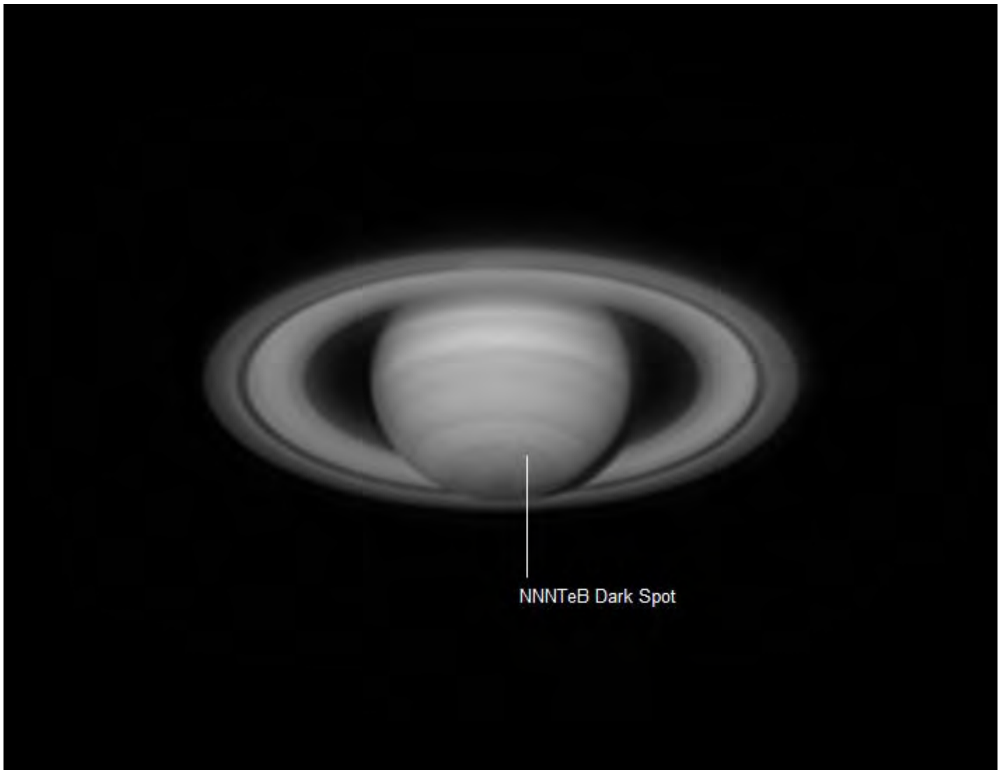


Image of Saturn taken at red wavelengths on August 14, 2016 at 11:05 UT by Trevor Barry of Broken Hill, Australia using a 40.8 cm (16.0 in.) Newtonian. There is a slightly elongated dark spot in the NNNTeB approaching the CM at measured saturnigraphic latitude +63.6° surrounded by a lighter "collar" and presumably the same long-lived feature imaged frequently by observers in the immediately preceding apparition. Numerous other belts and zones are seen on the globe, as well as Cassini's division (A0 or B10) clearly running all the way around the circumference of the rings (except where the globe blocks our view of the rings). Also visible is Encke's "complex" (A5) and other "intensity minima" at the ring ansae. The dark shadow of the globe on the rings is situated toward the West (right) in this image which was taken after opposition. Seeing was slightly above average (S=5.5) with good sky transparency (no numerical rating was given). The apparent diameter of Saturn's globe was 17.1", with a ring tilt of +26.0°. CMI = 150.4°, CMII = 170.0°, CMIII = 343.3°. S is at the top of the image.

when it plunges into Saturn's atmosphere.

But between now and then, *Cassini* will complete a remarkable two-part endeavor. The first phase involves weekly orbital passages of the spacecraft within 7,800 km of the center of Saturn's narrow-braided F-ring that started in November 2016, with mission scientists hoping to capture high-resolution images of small satellites and study other structures within the ring for the first time since an initial close fly-by back in 2004.

The second phase is being dubbed the "Grand Finale" that involves a gravity assist by a close flyby of Titan to reconfigure the orbital path of *Cassini* and allow it to make over 20 passages through the gap that is only 2,400 km wide between Saturn and the inner edge of the ring system starting April 27, 2017.

The objective of this phase is to analyze fine dust particles in the rings and sample outer regions of the atmosphere of Saturn, while also imaging the planet's atmosphere closer than in the past, mapping the planetary magnetic and gravitational field, gaining greater knowledge of Saturn's internal structure and rotational dynamics, and acquiring a keener understanding perhaps of the mass of the ring system.

ALPO Saturn observers who have been participating already in our on-going Pro-Am activities, as well as anyone else who wants to join us in our continuing efforts, are highly encouraged to continue to submit systematic observations and digital images of the planet at various wavelengths throughout the 2016-17 apparition. The spacecraft will very likely return some spectacular images of Saturn's northern hemisphere and any discrete phenomena before the two aforementioned plunges into the rings and ultimately into the atmosphere of Saturn in mid-September 2017.

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.

Inside the ALPO
Member, section and activity news

Observers are urged to pursue digital imaging of Saturn at the same time that others are imaging or visually monitoring the planet (that is, simultaneous observations). Also, while regular imaging of the Saturn is very important, far too many experienced observers neglect making visual numerical relative intensity estimates, which are badly needed for a continuing comparative analysis of belt, zone, and ring component brightness variations over time.

The ALPO Saturn Section thanks all observers for their dedication and perseverance in regularly submitting so many excellent reports and images. *Cassini* mission scientists, as well as other professional specialists, continue to request drawings, digital images, and supporting data from amateur observers around the globe in an active 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

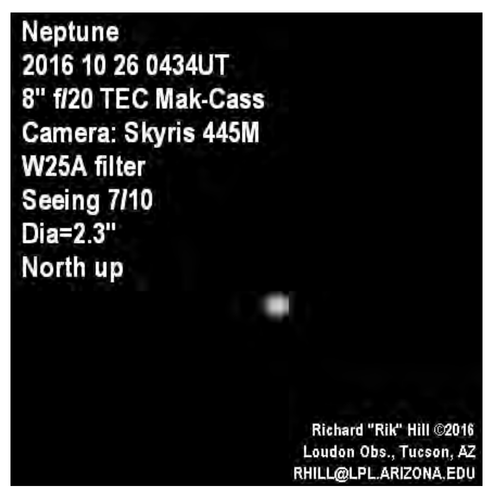
The planets Uranus and Neptune will be visible in the early evening during January. Both planets will be in the west. Since the Sun sets so early the best time to view them would be in the early evening. Pluto will be too close to the Sun to observe in January but by March may be visible before morning twilight. [Editor's Note: *skyandtelescope.com* is a great source to find specific locations of sky objects.]

Marc Delcroix, Frank Melillo, Christophe Pellier and Anthony Wesley have submitted images to the writer. Albedo features are visible in many of these. In addition, the writer has collected a few U and V filter measurements of Uranus.

The 2015-2016 remote planets report has been submitted to the editor and will hopefully appear in this journal in 2017. [Editor's Note: This report has been received and is in process to be published in the first available JALPO.]

To repeat what I said in my last section report, I have also started archiving images of the remote

Above, Uranus as imaged by Frank Melillo. See image for details.
Below, Uranus and Neptune as imaged by Rik Hill.



Inside the ALPO
Member, section and activity news

planets. To make the process as fast as possible, I am requesting that Uranus images be named as follows: UYYYY-MM-DD-TTTT.T where:

- YYYY stands for the year
- MM stands for the numerical month
- DD stands for the date
- TTTT.T stands for the Universal Time.

Please be sure to place a "U" at the front for Uranus, an "N" for Neptune, and the letter "P" for Pluto" images.

Finally, a reminder that the book *Uranus, Neptune and Pluto and How to Observe Them*, which was authored by this coordinator, 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*) to order a copy.

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

Obituary: Winifred Sawtell Cameron, 1918–2016

By John Westfall

Lunar scientist Winifred Sawtell Cameron passed away on March 29, 2016, and is survived by two daughters and seven grandchildren.

After receiving her Master's degree in astronomy at Indiana University, Wini went on to work for the U.S. Naval Observatory in 1952 and then traveled with her astronomer husband, Robert Curry Cameron (1925-1972) to Johannesburg, South Africa, in order to build and operate a station to track the Explorer I satellite.

In 1959 she joined NASA as one of their first three female astronomers. Within NASA's Manned Space Flight program, Wini was the astronomer on duty for John Glenn's and Scott Carpenter's Mercury flights and then participated in the selection of the Apollo landing sites. She was a member of the IAU Division II Planetary Systems Sciences until 2012, and of its Commission 16 Physical Studies of Planets & Satellites until 2015.

Wini's specialty was the Moon, in particular lunar transient phenomena. She became a recognized authority in LTP, publishing numerous articles, including two in *Sky & Telescope* and nine in the *JALPO*. Her definitive historical catalog of the reported phenomena (*Lunar Transient Phenomena Catalog*, NSSDC/WDC-A-R&S 78-03) was published by NASA in 1978.

In the ALPO, she served as our Lunar Transient Phenomena Recorder for over two decades (1971-1994). She also arranged for NASA to donate to the ALPO a set of approximately 2,650 photographic prints from the 1966-67 Lunar Orbiter Missions (all the high-resolution frames from Mission II and all the medium- and high-resolution frames from Missions III, IV and V).

Winifred Cameron, 1918 - 2016

While employed by NASA, Wini and her husband lived in Silver Spring, Maryland. In 1985, she moved to Sedona, Arizona, and then to Lehigh Acres, Florida, in 2010. The minor planet (1575) Winifred commemorates her.

On the following pages are listings of those who have gone above the call of duty and have made financial contributions to the ALPO in excess of their annual dues.

With the end of the year fast approaching, we ask that you also consider making a tax-deductible donation to the Assn of Lunar & Planetary Observers.

For more information, please contact Matt Will, P.O. Box 13456, Springfield, IL 62791-3456; email to *matt.will@alpo-astronomy.org*

Inside the ALPO
Member, section and activity news

Membership Report: Sponsors, Sustaining Members and Newest Members

by Matthew L. Will, ALPO Membership Secretary/Treasurer

Contributors and Newest Members

The ALPO wishes to thank the following members listed below for voluntarily paying higher dues. The extra income helps in maintaining the quality of the ALPO Journal while also strengthening our endowment. Thank you! As of November 20, 2016:

Patrons, Benefactors, Providers, Funders and Universal Members — $250 or More Per Membership

Member	City	State
Wayne Bailey	Sewell	NJ
Mike Hood	Kathleen	GA
Gerald Hubbell	Locust Grove	VA
Gordon Lamb	Pendleton	KY
Gregory Macievic	Camden	OH
Thomas R Williams	Houston	TX

SPONSORS - $150 per membership

<table>
<tr><th>Member</th><th>City</th><th>State</th><th>Country</th></tr>
<tr><td>Brian Combs</td><td>Macon</td><td>GA</td><td rowspan="10">USA</td></tr>
<tr><td>Jack Davis</td><td>Bowie</td><td>MD</td></tr>
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<tr><td>Detlev Niechoy</td><td>Goettingen</td><td></td><td>Germany</td></tr>
<tr><td>Roy Parish</td><td>Shreveport</td><td>LA</td><td rowspan="8">USA</td></tr>
<tr><td>Patrick J Peak</td><td>Louisville</td><td>KY</td></tr>
<tr><td>Stephen Sands</td><td>Alton</td><td>IL</td></tr>
<tr><td>Berton & Janet Stevens</td><td>Las Cruces</td><td>NM</td></tr>
<tr><td>Roger Venable</td><td>Chester</td><td>GA</td></tr>
<tr><td>Gus Waffen</td><td>North Royalton</td><td>OH</td></tr>
<tr><td>Gary K Walker, Md</td><td>Macon</td><td>GA</td></tr>
<tr><td>Christopher Will</td><td>Springfield</td><td>IL</td></tr>
</table>

A special thank you to John and Elizabeth Westfall, for generous support of to the ALPO in providing contributions that cover recordkeeping expenses. The ALPO is also grateful for a generous separate contribution of $200 from ALPO Patron member Gordon Lamb, from earlier this year.

Inside the ALPO
Member, section and activity news

SUSTAINING MEMBERS - $75 per membership

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William Dembowski	Windber	PA	
T Wesley Erickson	Warner Springs	CA	
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Steven Siedentop	Grayson	GA	

Founded in 1947

Inside the ALPO
Member, section and activity news

NEWEST MEMBERS

The ALPO would like to wish a warm welcome to those who recently became members. Below are persons that have become new members from December 9, 2015 through November 20, 2016: where they are from and their interest in lunar and planetary astronomy. The legend for the interest codes are located at the bottom of the page. Welcome aboard!

Members	City	State	Country	Interest
Robert Antol	Poughquag	NY		
Miguel Araujo	Evora,		PORTUGAL	
Karl S Baltz	Spring	TX		
John Charles Bell	Vicksburg	MS		
George Bertalan	Fairview Park	OH		
Thomas Bibb	Charlestown	IN		
Jean-Francois Coliac			FRANCE	
Phillip Cowell	Johnson City	NY		
Douglas Criner	Princeton	IL		2356HS
Mitchell Criswell	Pearce	AZ		CMOX
Frank Dempsey	Locust Hill	ON	CANADA	
William Eareckson	Aurora	CO		
Agapios Elia	Nicosia		CYPRUS	
Darren Erickson	Bloomington	IL		
Brian Ford	Columbia	SC		
Corban Octavian Gabriel	Bucharest		ROMAMIA	0
Bob & Claire Gadbois	Chicago	IL		
Mike Hale	Fayetteville	AR		
William Hrudey	West Bay		CAYMAN ISLANDS	
Dave Jester	Ridgecrest	CA		
Roger Jones	Coedygo, Oswestry		UNITED KINGDOM	
Jim Kloeppel	Urbana	IL		
Kenneth Magar	Franklin	IN		
Troy Mc Curry	Washington	DC		
Michael G Miller	Comfort	TX		45AD
Kelley Nebosky	Fort Wayne	IN		456789ACS
Van Han Nguyen	Aubervilliers		FRANCE	
John O'Neal	Statesville	NC		
Robert Reeves	San Antonio	TX		
Thomas Riesterer	Chicago	IL		
Chris Schur	Payson	AZ		
Chris Shaw	Te Anau		NEW ZEALAND	
Pamela Shivak	Prescott Valley	AZ		
Jeffery Joel Smith	Clarksburg	MD		
Andrew M Sorenson	Jefferson	IA		2456X
Allan Staib	Peel	AR		
David Stephens	Little Rock	AK		
Gary Varney	Pembroke Pines	FL		
Dan Ward	Oakton	VA		
Carl Wenning	Normal	IL		
Ademir Xavier	Capinas	SP	BRAZIL	

Inside the ALPO
Member, section and activity news

New Member Interest Codes

0 = Sun	6 = Saturn	D = CCD Imaging	P = Photography
1 = Mercury	7 = Uranus	E = Eclipses	R = Radio Astronomy
2 = Venus	8 = Neptune	H = History	S = Astronomical Software
3 = Moon	9 = Pluto	I = Instruments	T = Tutoring
4 = Mars	A = Asteroids	M = Meteors	V = Videography
5 = Jupiter	C = Comets	O = Meteorites	X = Visual Drawing

Haas & Parker Donations Update

The ALPO has received more donations from earlier in 2016, in the names of our late founder Walter H. Haas and late ALPO Board Member Donald C. Parker.

- John Centala - $500 in the name of Walter H. Haas and $500 in the name of Donald C. Parker.
- Gary K. Walker - $150 in the name of Donald C. Parker

The new total for contributions in Walter Haas' name is $4330 and in Don Parker's name, $3675 collected since both passed away in 2015.

The ALPO wishes to thank all who have contributed funds in the names of both Walter H. Haas and Donald C. Parker. Donation in the ALPO in their names are still being accepted. There are two ways to contribute:

Send your check or money order made payable to the ALPO to, ALPO, P.O. Box 13456, Springfield, IL 62791-3456

Donate by credit card on the Astronomical League online store at the URL: *https://store.astroleague.org/index.php?main_page=product_info&cPath=10&products_id=50&zenid=g29852ugiccivalvfgkjc5i185*

If paying by check, please write on the check's memo line "in memory of Walter Haas" or "in memory of Don Parker." If paying online, there should be an option for "special instructions" where one can state that the donation is in the memory or Walter Haas or Don Parker.

Feature Story: ALPO Solar Section

A Report on Carrington Rotations 2178 and 2179 (2016-06-06 to 2016-07-31)

By Richard (Rik) Hill, Coordinator & Scientific Advisor, ALPO Solar Section
rhill@lpl.arizona.edu

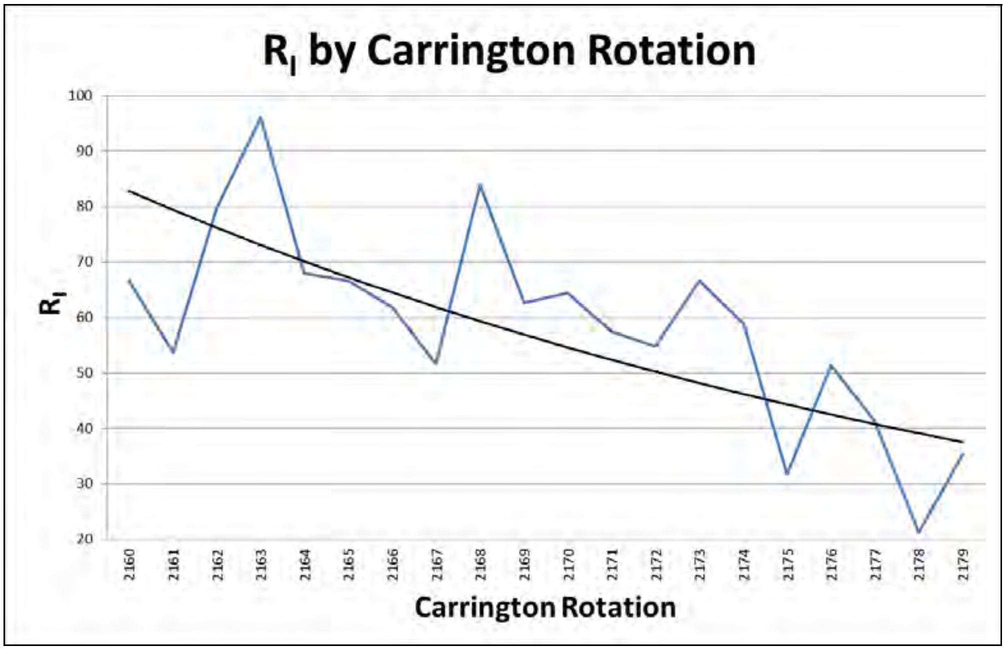
Overview

Solar activity generally continued to decrease and still headed towards minimum (predicted for 2020-21). As Plot 1 shows, with a linear least squares trend-line superimposed, the maximum daily sunspot number (RI) never rose even to 70, with the high for this report being 69 on 7/15. In the two rotations covered in this report, there were 12 spotless days. The average sunspot number for this reporting period was 28.4, a dramatic decrease from the 45.9 of the previous reporting period, or 61.2 in the report before that.

One new observer was added during this period, O'Neal, and the ALPO Solar Section took in over 442 observations on average per rotation. This is remarkable, considering the low level of activity and speaks well to the perseverance and dedication of our observers! However, this amount of data and number of observers makes it difficult to mention all of the observers individually and show all their work. Let it be known that we are grateful to all on the Observers List included in this paper and have the highest regard for their excellent work.

Terms and Abbreviations Used In This Report

As with previous reports, the ALPO Solar Section will be referred to as "the Section". Carrington Rotations will be called "CRs; similarly, Active Regions will be called "ARs" using only the last 4 digits of the full number. The term "Groups" refers to the visible light or "white light" sunspots, while "Region" or "Active Region"applies to all phenomena, in all wavelengths, associated with the particular sunspot group. Statistics used in this report are compiled by the World Data Center – Solar Index and Long Term Solar Observations (WDC-SILSO) at the Royal Observatory of Belgium which is responsible for the daily International Sunspot Number used here. All times are Coordinated Universal Time and dates are reckoned from that. Dates will be expressed numerically with month/day such as "9/6" or "10/23".



The terms "leader" and "follower" are used here instead of east or west on the Sun to avoid confusion. "W-L" is the abbreviation to indicate White-Light observations while Hydrogen-Alpha is "H-a" and Calcium K-line is "CaK". An important point here that needs repeating is "naked eye" means the ability to see a feature on the Sun through proper and safe solar filtration, with no other optical aid. You should never look at the Sun, however briefly, without proper filtration even without optical magnification. Orientation of images shown here will be north up and celestial west at the right (northern hemisphere chauvinism).

Areas of regions and groups are expressed in the standard measurement of millionths of the solar disk, with a naked eye spot generally being about 900-1,000 millionths for the average observer. Modified Zurich Sunspot classifications used here are the ones defined by Patrick McIntosh of NOAA (McIntosh 1981, 1989) and detailed in an article in the JALPO 33 (Hill 1989). This classification system is also detailed by the author on the Section website at : http://www.alpo-astronomy.org/solar/W-Lft.html in an article on white light flare observation. Lastly, the magnetic class of regions is as assigned by NOAA and will be abbreviated "mag-class".

Observers contributing to this report and their modes of observing are summarized in Table 1. It will be used as a reference throughout this report rather than repeating this information on every image or mention.

Table 1. Contributors to This Report

Observer	Location	Telescope (aperture, type)	Camera	Mode	Format
Michael Borman	Evansville, IN	102mm, RFR 90mm, RFR 102mm, RFR	Point Grey GS3	W-L H-a CaK	digital images
Richard Bosman	Enschede, Netherlands	110mm, RFR 355mm, SCT	Basler Ace 1280	H-a W-L	digital images
Tony Broxton	Cornwall, UK	127mm, SCT	N/A	W-L	drawings
Gabriel Corban	Bucharest, Romania	120mm, RFL-N	Point Grey GS3-U3	H-a W-L	digital images
Franky Dubois	West-Vlaanderen, Belgium	125mm, RFR	N/A	visual sunspot reports	—
Howard Eskildsen	Ocala, FL	80mm, RFR	DMK41AF02	W-L wedge CaK	digital images
Joe Gianninoto	Tucson, AZ	115mm, RFR 80mm, RFR	N/A	W-L H-a	drawings
Guilherme Grassmann	Curitiba, Brazil	60mm, RFR	Lumenera Skynyx 2.0	H-a	digital images
Richard Hill	Tucson, AZ	90mm, MCT 120mm, SCT	Skyris 445m	W-L	digital images
Bill Hrudey	Grand Cayman	200mm, RFL-N 60mm, RFR	ASI174MM	W-L H-a	digital images
David Jackson	Reynoldsburg, OH	124mm, SCT	N/A	W-L	digital images
Jamey Jenkins	Homer, IL	102mm, RFR 125mm, RFR	DMK41AF02	W-L CaK	digital images
Pete Lawrence	Selsey, UK	102.5mm, RFR	ZWO ASI174MM	H-a	digital images
Monty Leventhal	Sydney, Australia	250mm, SCT	N/A Canon-Rebel	W-L/H-a H-a	drawings digital images
Efrain Morales	Aguadilla, Puerto Rico	50mm, RFR	Point Grey Flea 3	H-a	digital images
German Morales C.	Bolivia	200mm, SCT	N/A	visual sunspot reports	—
John O'Neal	Statesville, NC	102mm, RFR	ZWO ASI174MM	H-a, CaK, CaH, Na	digital images
Theo Ramakers	Oxford, GA	80mm, RFR 11" SCT 40mm, H-a PST 40mm, CaK PST	ZWO ASI174MM DMK41AU02AS DMK21AU03AS DMK21AU03AS	H-a W-L H-a Cak	digital images
Ryc Rienks	Baker City, OR	203mm, SCT 40mm, H-a PST	N/A	W-L H-a	drawings
Chris Schur	Payson, AZ	152mm, RFR 100mm, RFR	DMK51	CaK W-L (CaK-off-band continuum) H-a	digital images
Avani Soares	Canoas, Brazil	120mm, RFR	ZWO-ASI 224	W-L	digital images
Randy Tatum	Bon Air, VA	180mm, RFR	DFK31AU	W-L-pentaprism	digital images
David Teske	Starkville, MS	60mm, RFR	N/A Malincam	W-L, H-a W-L	digital images
David Tyler	Buckinghamshire, UK	178mm, RFR 90mm, RFR	ZWO	W-L H-a	digital images
NOTE: Telescope types: Refractor (RFR), Newtonian Reflector (RFN), Schmidt Cassegrain (SCT), Maksutov-Cassegrain (MCT), Cassegrain (Cass)					

References:

Hill, R.E., (1989) "A Three-Dimensional Sunspot Classification System" Journal of the Assn of Lunar & Planetary Observers, Vol. 33, p. 10. *http://articles.adsabs.harvard.edu/cgi-bin/nph-iarticle_query?1989JALPO..33...10H&data_type=PDF_HIGH&whole_paper=YES&type=PRINTER&filetype=.pdf*

Livingston, W., Penn, M.; (2008) "Sunspots may vanish by 2015." *https://wattsupwiththat.files.wordpress.com/2008/06/livingston-penn_sunspots2.pdf*

McIntosh, Patrick S., (1989) "The Classification of Sunspot Groups" Solar Physics, Vol. 125, Feb. 1990, pp. 251-267.

McIntosh, Patrick S., (1981) The Physics Of Sunspots Sacramento Peak National Observatory, Sunspot, NM; L.E. Cram and J.H.Thomas (eds.), p.7.

Further references used in the preparation of this report:

Solar Map of Active Regions *https://www.raben.com/maps/date*

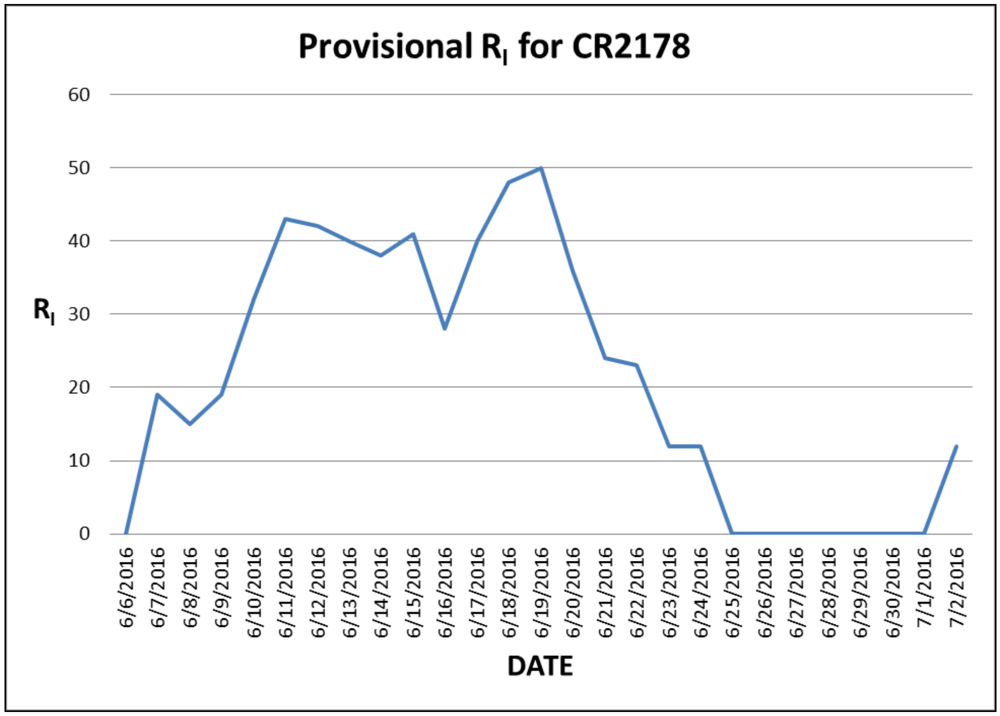
SILSO World Data Center *http://sidc.be/silso/home*

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/*

Carrington Rotation 2178

Dates: 2016 06 06.2479 to 2016 07 03.4444
Avg. R_I = 21.3
High R_I = 50 (6/19)
Low R_I = 0 (eight days)



This rotation was characterized by low activity with no naked eye spots. There were eight days of zero sunspot count. The highlighted region, AR2552, was not numerically the largest; instead, that was AR2553, which was Hsx (1 spot) when it came on the disk and Hhx when it left (still 1 spot) and rose to a maximum of 330 millionths of the disk.

This may well have been the second reappearance of AR2533 as demonstrated by Tyler in his three-pane image showing this spot (Fig. 1) This would not be unusual for H-class spots, as they can often persist for multiple rotations. The former region formed on the disk past the central meridian was smaller (around 150 millionths at best), getting to a D-class group, but had many small spots and was the major flare producer for this rotation.

Gianninoto, Leventhal and Ramakers were the first to report this region on 6/7. Ramakers shows a disturbance with one or two spots in both H-a and CaK while drawings of the other two observers show several small spots, with Leventhal classing the region as Axx in contrast to the published class of Bxo with an area of 10 millionths and mag-class of beta. Already it was producing roughly one flare every two hours! Ramakers did two fine images in w-l (12:42 UT) and H-a (12:48 UT) on 6/8 that show unusual structure to the group. The leader was a triangular spot of three or four umbrae in a rather chaotic penumbra. It was followed a little to the south by a ring of tiny umbrae and pores with a larger umbra contained. The whole region was hot in H-a, but the

Figure 1. White-light images of AR2533, AR2546, AR2553 illustrating the possibility that these may all be different passages of the same region renumbered in each rotation. Images by Dave Tyler using equipment specified in Table 1.

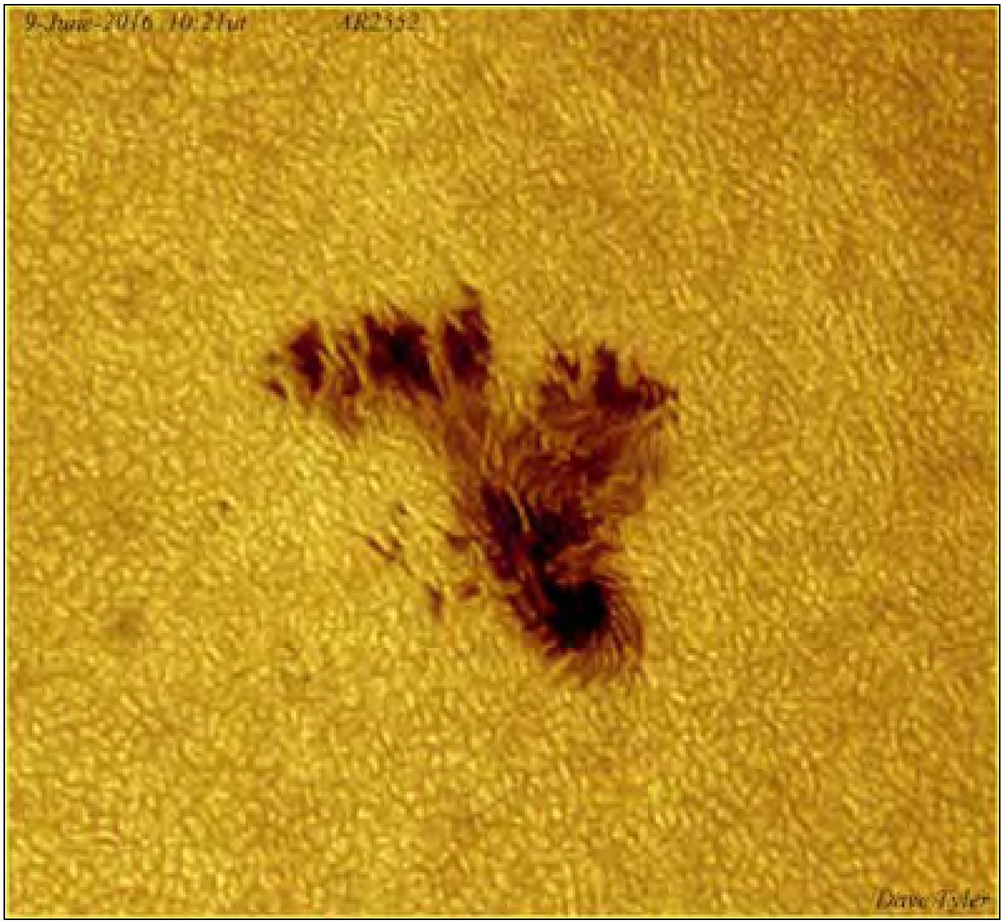


Figure 2. White-Light image of AR2552 by Tyler on 6/9 at 10:21 UT using his w-l equipment noted in Table 1.

flare production was probably in the follower. The area, mag-class and rate of flare production were unchanged.

To the north of the group were a few more pores. The next day, 6/9, we have a spectacular w-l image by Tyler that shows this sunspot group in great detail (Fig. 2). The follower spots were eithe or had merged with the leader spot into a single complicated spot. The main umbral mass was enclosed within disorganized penumbra. To the north end of this mass, three umbrae, oriented east-west, perpendicular to the southern portion, were in fragmentary penumbra. The two hours between a Tyler w-l image (10:12 UT) and a Ramakers image show rapid internal movements and a change taking place in this small group. A Ramakers H-a image, just after a flare ended at 12:15 UT shows the site for flaring was in the north portion of the spot. On 6/10, the area shot up to 140 millionths as the region spread out to the north as well-shown in another Tyler w-l image at 11:49 UT and a Ramakers w-l image at 13:55 UT. The mag-class was now listed as beta-delta and flare production was slightly increased. Leventhal classed it as McIntoshclass Csi in contrast to the NOAA class of Dao. This could simply be due to the time difference between the observations. The next day, 6/11, observations by Grassmann and Ramakers showed AR2552 to be reduced in area with several umbrae separated and following (Fig. 3). Officially the area was now 60 millionths, but the mag-class was the same. Flare production had decreased by about a third. Gianninoto got the last close-up look at this region as it was on the limb. He counted seven spots in the w-l group with a class of Dai, and was the only observer to show the prominences associated with this region (Fig. 4).

Carrington Rotation 2179

Dates: 2016 07 03.4444 to 2016 07 30.6521
Avg. R_I = 35.53
High R_I = 69 (7/15)
Low R_I = 0 (four days)

This rotation showed a slight increase in activity over the previous rotation, mostly due to the regions AR2565, 2566 and 2567, which are the highlights of this rotation.

AR2565 was first observed on the limb by ALPOSS observers on 7/11. There were three other small regions on the Sun at the time and its appearance went largely unnoticed. At that time, it looked to be a single large spot with a small associated prominence as noted in drawings by Gianninoto, Grassmann and Rienks. Observers classed it as Hhx or Hsx -- in agreement with the NOAA classification of Hsx and area of 120 millionths. But an indication of a more complex region were the dozen flares that it had already produced. In H-a images, Ramakers captured a bright but small plage following the large sunspot. On 7/12, this was seen in better detail in a Ramakers image (Fig. 5) and confirmed in a Gianninoto drawing as a hot spot that was likely the site of solar flaring. Flare production had fallen off to about half of what it was previously, but it was still the strongest on the solar disk. In CaK (Ramakers), the following plage was much larger with another extensive plage region to the north of AR2565. The w-l appearance (Grassmann, Teske & Ramakers) showed the one large spot

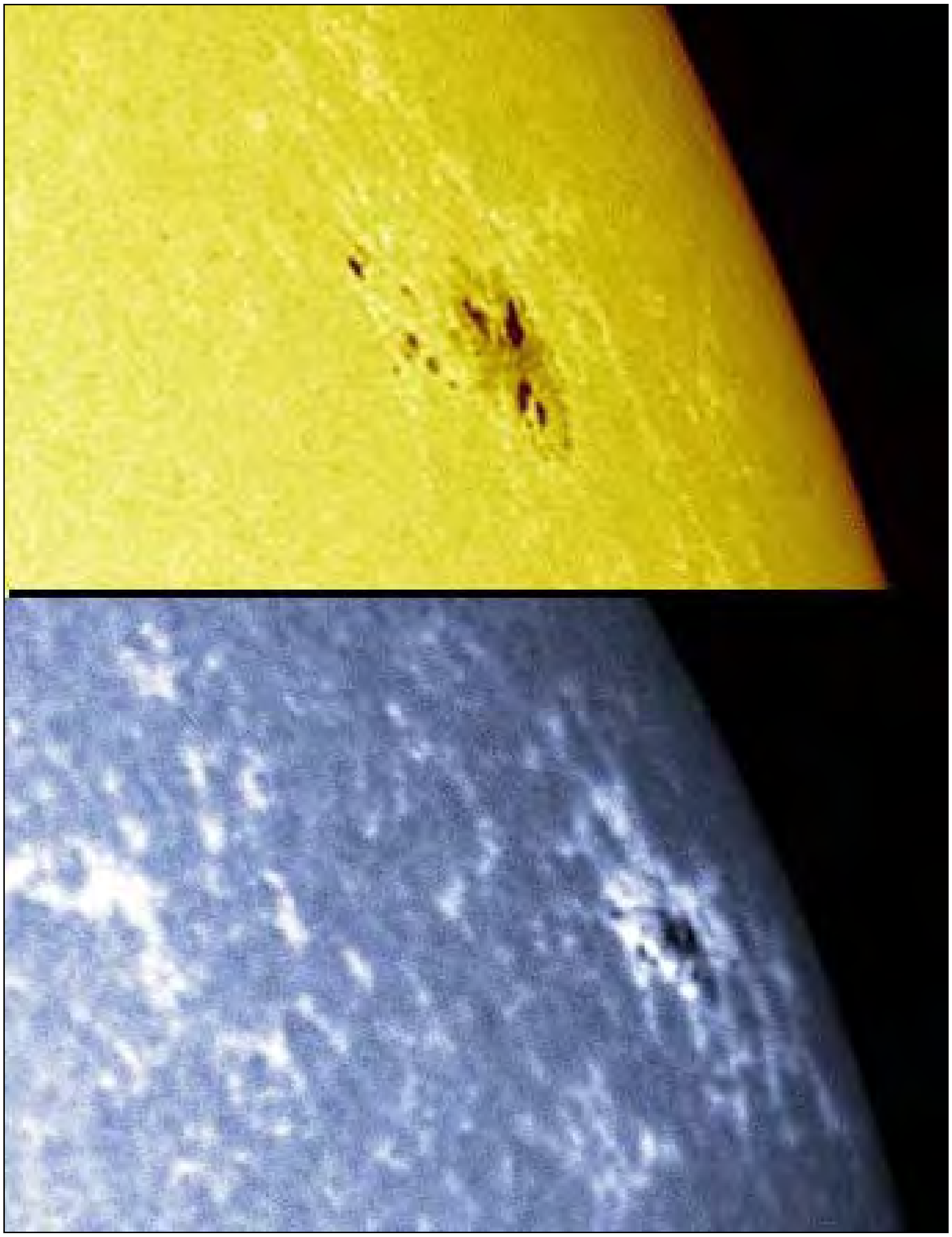


Figure 3. Two views of AR2552 on 6/11. The upper is a white-light (540nm) image by Ramakers at 12:57 UT. Below is a CaK image by Grassmann at 10:47 UT. Instrumental details can be found Table 1.

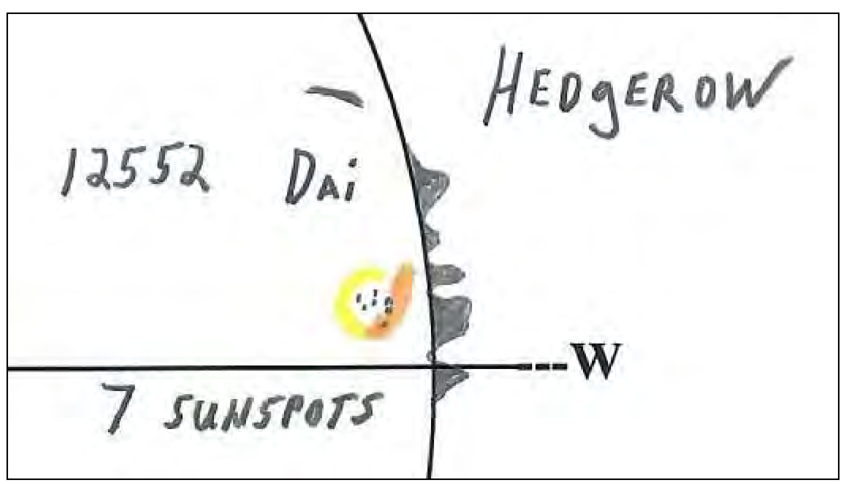
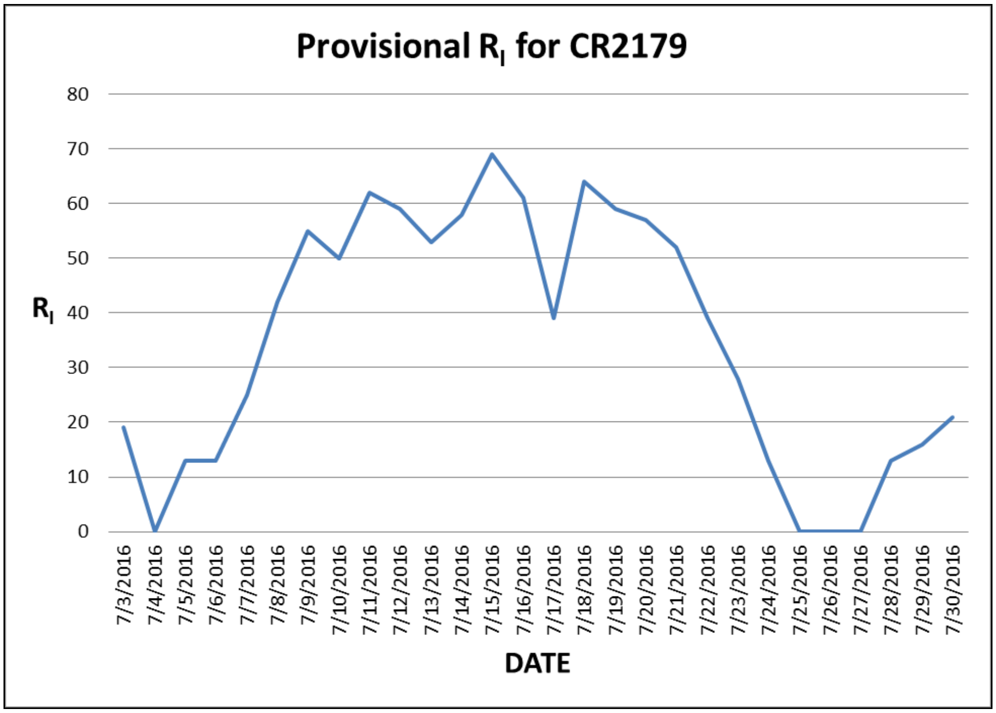


Figure 4. A combined white-light and H-alpha drawing of AR2552 by Ginninoto at 14:10 UT on 6/11. Note the limb prominences. Details on his equipment can be found in Table 1.

with symmetrical penumbra containing four umbrae and a few tiny umbrae around and following with the area unchanged. The site of the following plage was seen as bright faculae. Gianninoto put a class estimate for the group at Hsx and Rienks as Hax, which agreed well with the NOAA estimate of Hsx. Things were remarkably unchanged on 7/13 and we got a nice sub-arc-second look at the large spot in a Tyler image (Fig. 6). One thing just barely shown in the Tyler image but much better seen in a Ramakers image a few hours later is the small cluster of umbrae that had formed following the big spot and a little south. By 7/14, several of the larger spots in this cluster had begun to develop their own penumbra. This had earned the group a new classification of Cao, though the mag-class remained "beta" with similar flare production (about 1 every 4 hours). This cluster of spots had almost doubled the area of the group to 220 millionths.

Early on 7/15, the cluster rapidly broke down while another, larger cluster very rapidly formed about three times farther out from the large spot, still following. This was a new group designated AR2567 late on this date which was classed as Dac with a mag-class of beta-gamma-delta, a very exclusive fraternity! No one showed any transition of the following spots into this new region, so it must be assumed that one broke down and the other, with a distinctly separate magnetic identity, rapidly formed between 22:30 UT on 7/14 and 12:29 UT on 7/15. On this latter date, Ramakers began a seven-day sequence that documented the life of this region very well (Fig. 7). In the Ramakers image at 13:40 UT on 7/15, AR2567 shows a lot of signs of violent activity (shattered penumbrae, etc.) with around 75-80 flares on its first full day! This eclipsed AR2565 by about a factor of 10, which



was still just a fairly round spot of H-class. Above AR2565 was a lone sunspot. This was designated AR2566 and was destined to be utterly

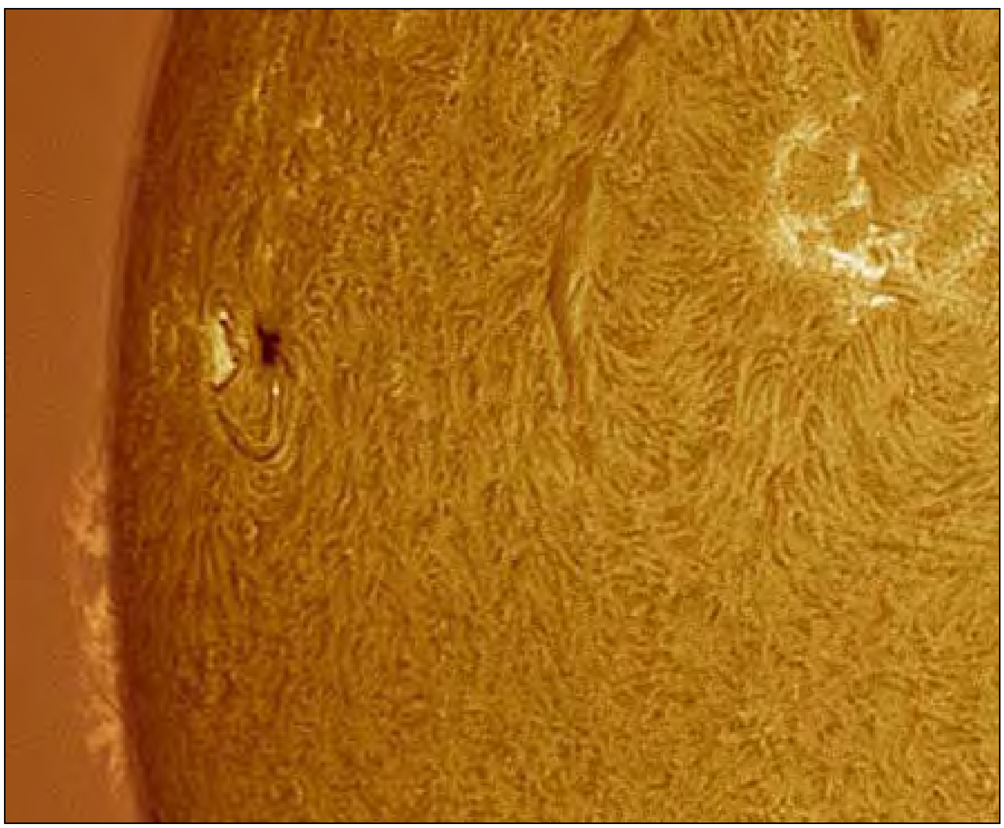


Figure 5. An H-alpha image of AR2562 by Ramakers at 14:07 UT on 7/12 as it comes on the disk. Prominences on the limb are from AR2565 just starting to make an appearance. Instrumental information is found on Table 1.

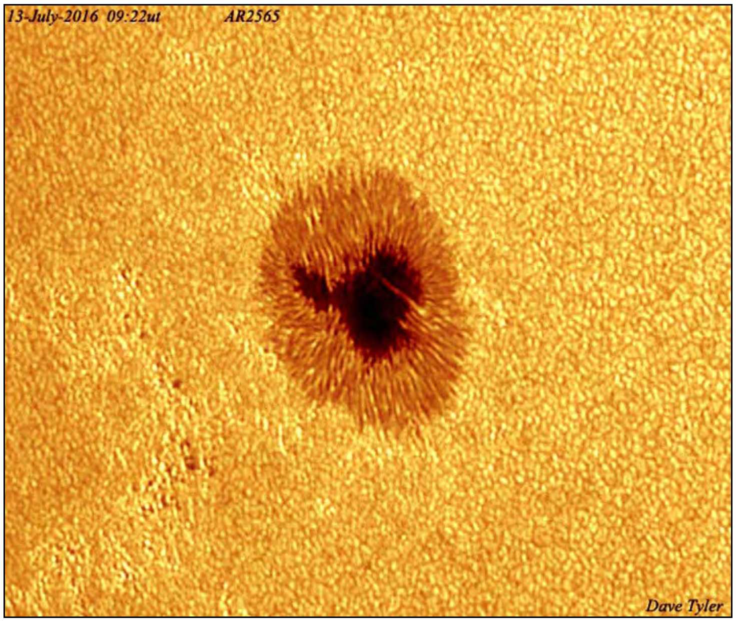


Figure 6. An excellent view of AR2565 on 7/13 by Tyler at 09:22 UT. Equipment used are in Table 1.

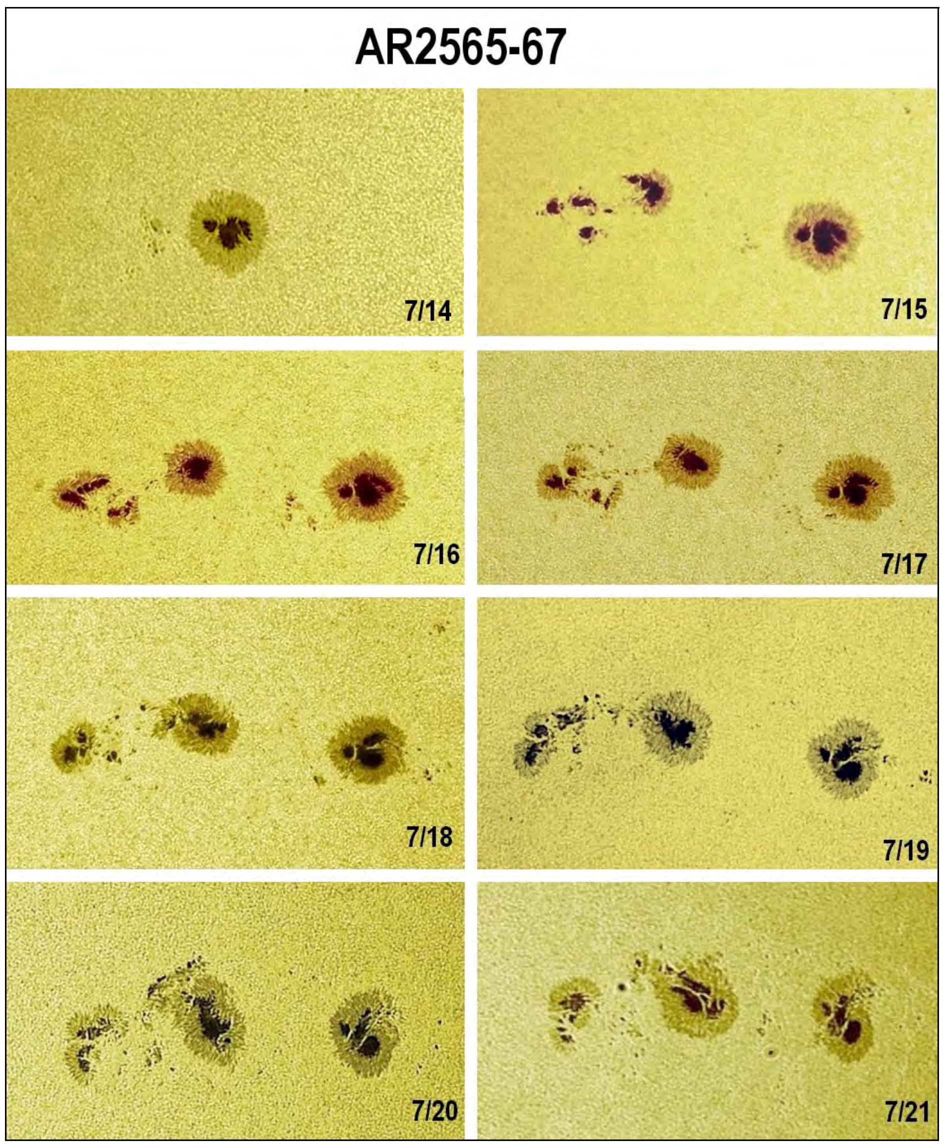


Figure 7. An eight-day, white-light montage by Ramakers showing the development of AR2565 and AR2567. Image times are: 7/14 13:10 UT, 7/15 13:40 UT, 7/16 14:08 UT, 7/17 12:22 UT, 7/18 12:41 UT, 7/19 15:11 UT, 7/20 14:29 UT and 7/21 14:07 UT. His telescope/camera information can be found in Table 1.

unremarkable. These events were corroborated by numerous observers on this date (Grassmann, Gianninoto, Levinthal, Reinks, Teske, Tyler). AR2567 developed further by 7/16 to Dsc class with 200 millionths area. All follower spots now had penumbrae on the outer edges from the center of the group, indicative of flare production in the middle, and a leader spot that had become even more circular than AR2565! This latter group had a collection of sizable umbrae contained in a round, radially symmetric penumbra. Between the larger collection of umbrae and one that had become separated was a hot light bridge, a good site for flares. The following collection of tiny umbrae and pores had once again reformed, following the leader closely. The area was still 320 millionths and the class was back up to Dho. In addition to the Ramakers montage, Tyler did an exquisite H-a and w-l pair of images that the author has put together here to show just where some of the flare activity is occurring. Tyler shows excellent sub-arc-second detail in w-l at 11:03 UT with a corresponding H-a image at 11:28 UT, which also includes an inset of a drawing by Teske on the same day at 15:48 UT (Fig. 8).

The next day, 7/17, flare production decreased a bit in AR2567 which was now a mag-class of beta-gamma and a McIntosh class of Dhi with an area of 330 millionths. The follower spots moved away from the leader and were coalescing. An interesting trail of small umbrae and pores connected the leader and follower. AR2565 was now Cko, with an area of 350 millionths with the small follower spots mostly just pores again. It's odd that the area should be slightly larger because the follower spots were gone and the main spot looked about 10% smaller than the day before. The follower spots in AR2567 had largely coalesced by 7/18 with a few naked umbrae and penumbral bits between the leader and follower. The leader spot was showing signs of disruption on the following side. These things indicated that flares were probably in this area. A Schur h-a image on 7/18 shows not only this hot spot, but another between the two ARs. Other parameters of these two regions were largely unchanged from the previous day (Fig. 9).

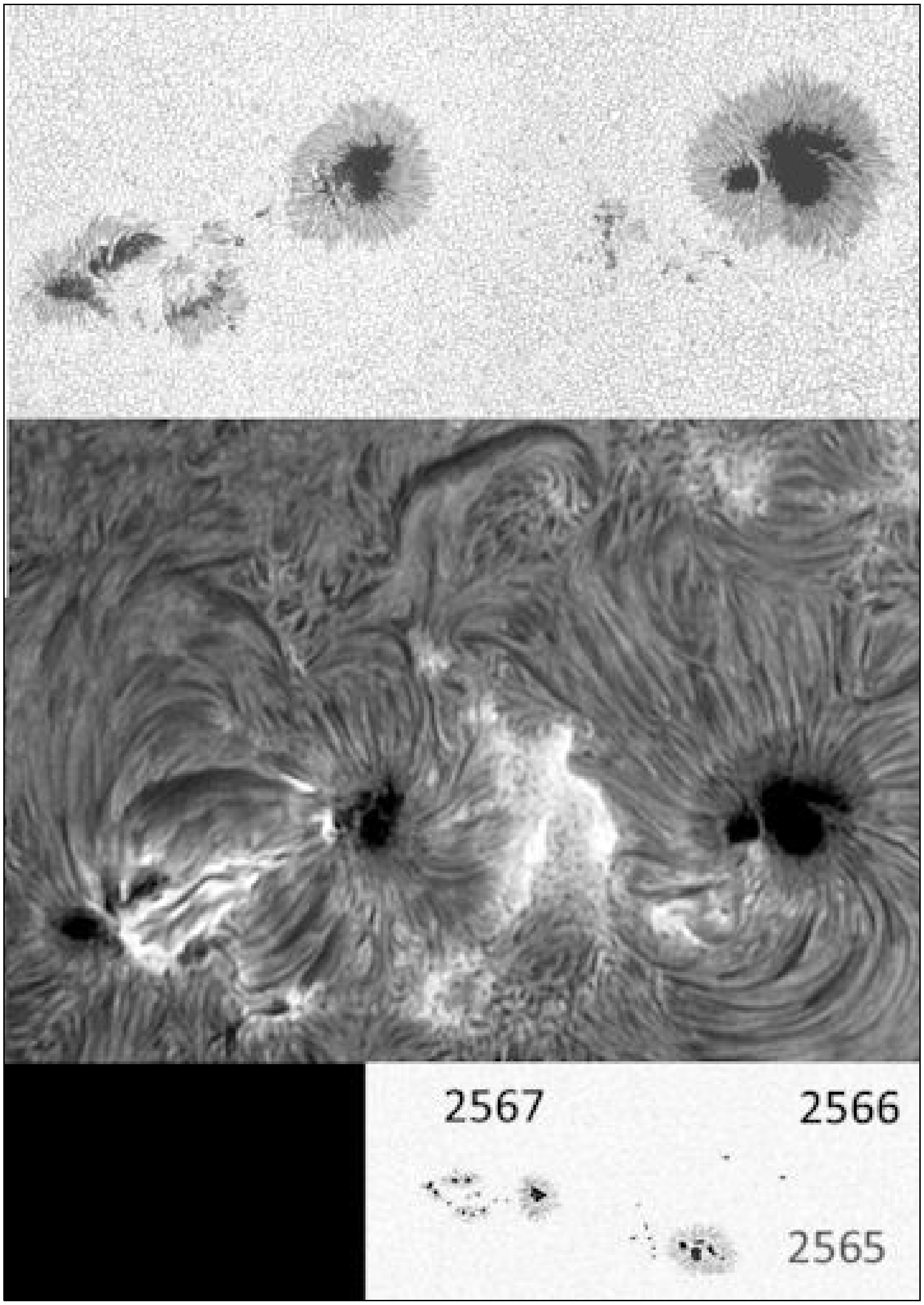


Figure 8. Three views of AR2565 and 2567 on 7/16. The upper one is a white light image by Tyler at 11:03 UT. The middle image is an H-alpha image by Tyler at 11:28 UT and the bottom inset is a drawing by Teske at 14:35 UT. Further instrumental information is in Table1.

In AR2567 on 7/19, things were more active, as the leader was now larger and the follower had increased in area with light bridges cutting the larger spot into three pieces with a scattering of umbrae and detached penumbra between the leader and follower. The class was listed as Dki with the mag-class being beta-gamma, down from previous days. Flare production had dropped by another 20% to about 50 in the previous 48 hours, but still an impressive average of 1 per hour. A blue-shifted H-a image by O'Neil (Fig. 10) shows very interesting fibril structures stretching across the region from the leading side of the leader spot to the leading edge of the follower. It also shows some interesting bright spots around AR2565.

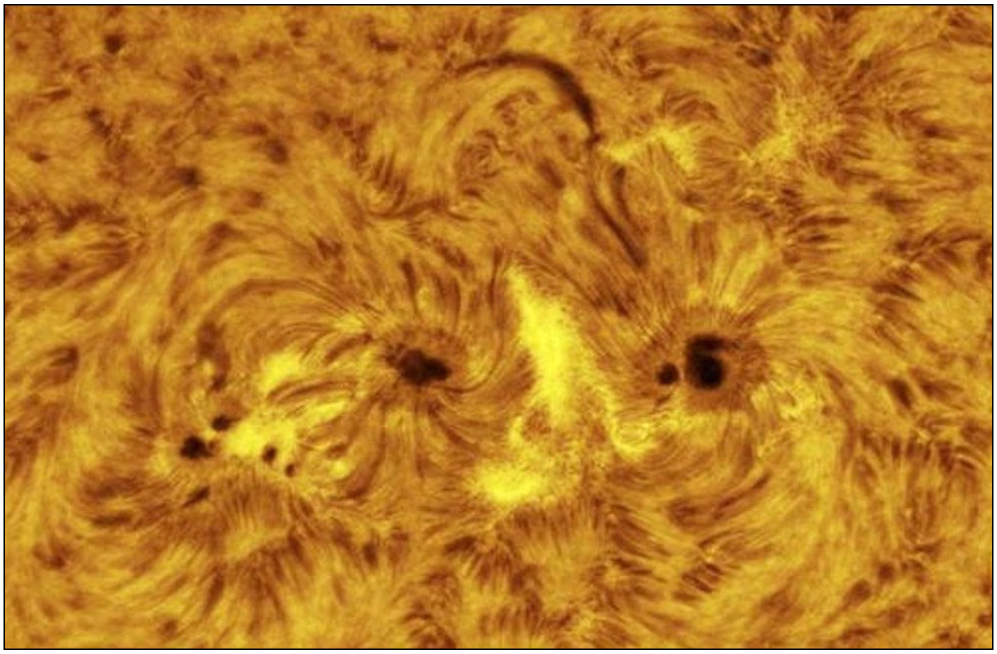


Figure 9. A Ramakers H-a image of AR2565-67 on 7/17 at 15:16 UT. See Table 1 for additional instrumental details.

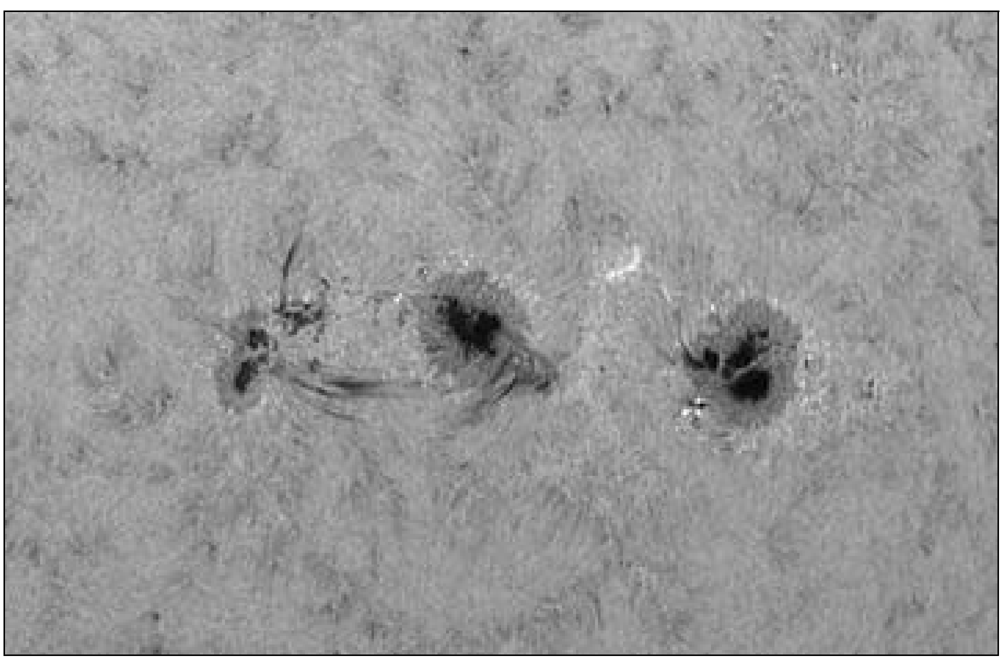


Figure 10. A blue-shifted H-alpha image of AR2565-67 on 7/19 at 13:48 UT. Note the filaments that reach completely across AR2567 and the interesting bright points around AR2565. More instrument and camera details are on Table 1.

The next day, 7/20, saw AR2565 continuing a process of decay, where the former umbra was divided into three pieces by thin light bridges and the leading penumbra was quite disturbed. AR2567 had a leader spot with a large north-south elongated umbra surrounded by penumbra that was disturbed on the north and south ends. The follower spot of this group consisted of between six and eightumbrae, in two separate masses arranged north-south, with penumbra only on the following sides. Again the classes and area for the former region were unchanged, but the latter had increased in area to 510 millionths with a w-l class of Dki and a mag-class reduced to just beta. This would be maximum development for this region. Grassmann got a good CaK image at 08:53 UT of these regions showing hot spots between the leader and follower in AR2567 and another north-south elongated hotspot between the two regions (Fig. 11). Things showed dissolution in both regions on 7/21. In AR2565, the northern end of the group was now broken penumbra with a scattering of tiny umbrae and pores mixed in. The two northern umbrae were smaller and the middle one crossed by several small light bridges. The class was Hkx with an area of 250 millionths and mag-class was listed as alpha with only one flare in 48 hours. Similarly, AR2567 displayed the signs of break up. The leader spot umbra was crossed by no less than four light bridges and its northern end was broken up similar to the previous group. The follower spot had one larger spot (the northern one) while the southern one that was formerly the larger was now much reduced in size as seen in a Tyler

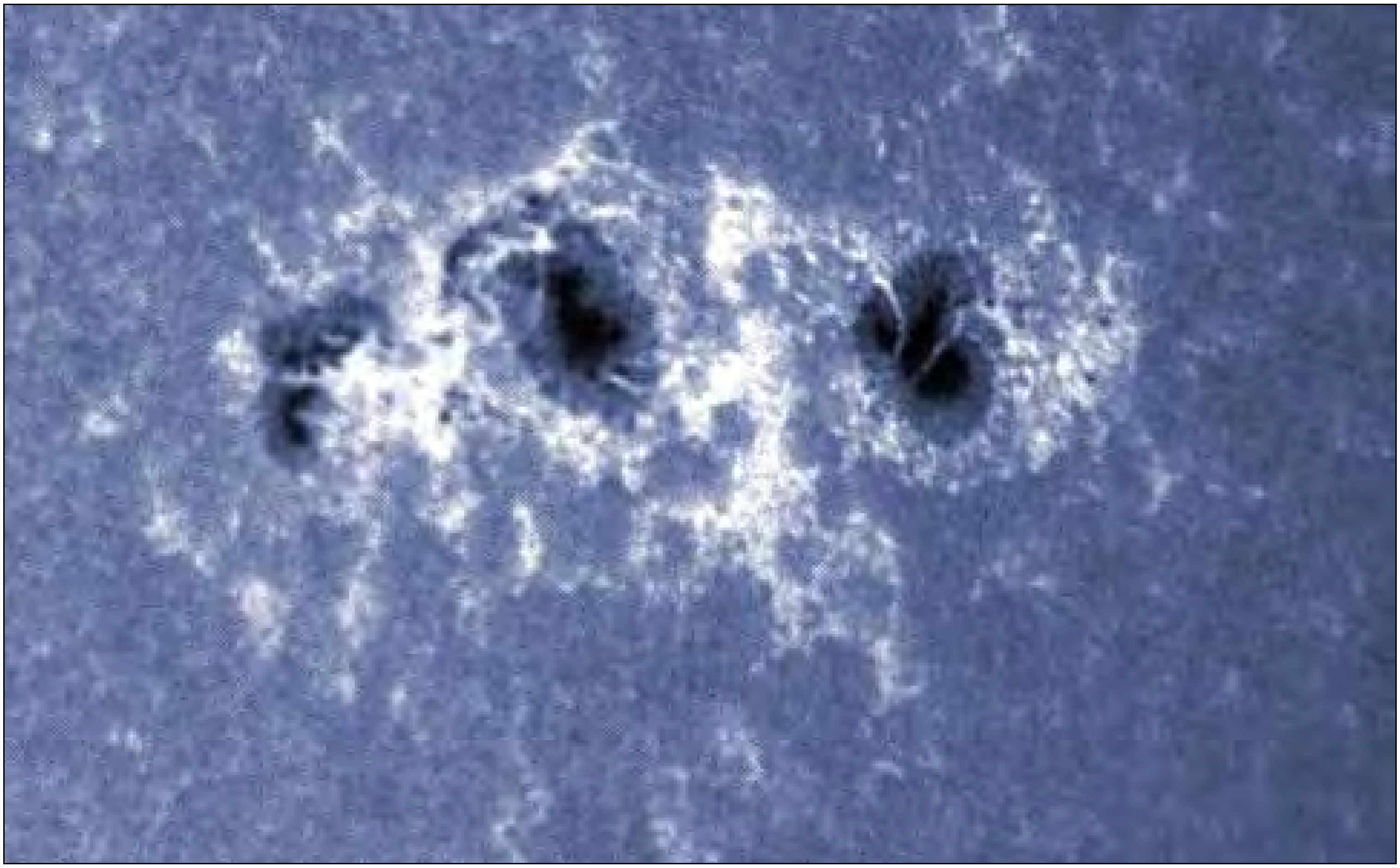


Figure 11. An excellent CaK image of AR2565-67 by Grassmann on 7/20 at 08:53 UT. Instrumental details are in Table 1.

Figure 12. Another arc-second image of AR2565-67 by Tyler on 7/21 at 09:51 UT. Equipment used is listed in Table 1.

w-l image taken at 09:31 UT (Fig. 12). The area and classes were reduced to Dki and beta-gamma again with an area of 380 millionths. This region was still producing an average of one flare per hour.

Things remained much the same as these regions approached the limb. AR2565 stayed at Hkx with an area of 250 millionths for the rest of its time on the disk. AR2567 kept breaking down until it was Dao at 210 millionths as it left the disk on 7/24. One beautiful high resolution CaK view of these regions on 7/23 (the last day they were both on the disk) was had by Eskildsen at 12:38 UT (Fig.13); it shows the regions much reduced in area with one small flare in progress. Tyler the regions on the limb just a few hours earlier in w-l (Fig.14). Note the extensive faculae and the Wilson Effect nicely demonstrated in this last w-l view.

Conclusion

As can be seen, activity is still decreasing though there is still the occasional interesting region. AR2567 at its peak was less than half the area of the best regions only a year ago. But it demonstrates that it is nevertheless important for vigilant monitoring of solar activity on this most dynamic of bodies. Use what equipment you have and observe in whatever mode is convenient for you. We have four observers who, as seen in this report, do drawings. All observations are useful and helpful. Further, observers are encouraged to consider doing as was done for the Ramakers observations by compiling, in one image, a time sequence of one or two regions. It makes it much easier to note changes and see predictive behavior that might have otherwise been missed.

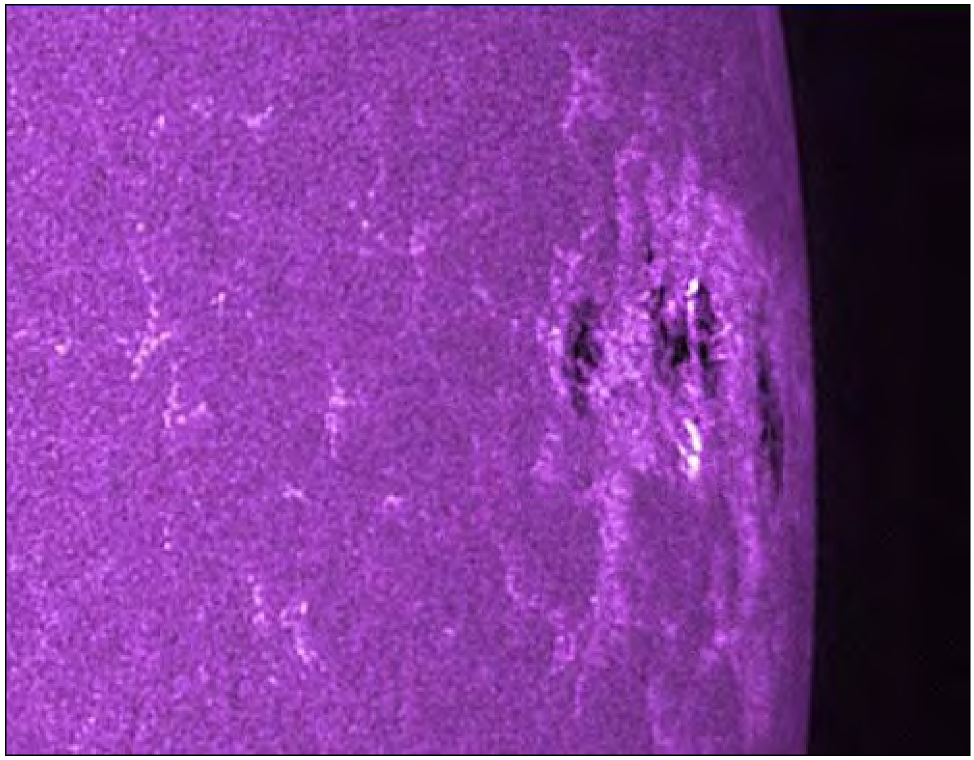


Figure 13. A breathtaking last look at AR2565-67 in a CaK image by Eskildsen on 7/23 at 12:38UT. See Table 1 for his instrumentation.

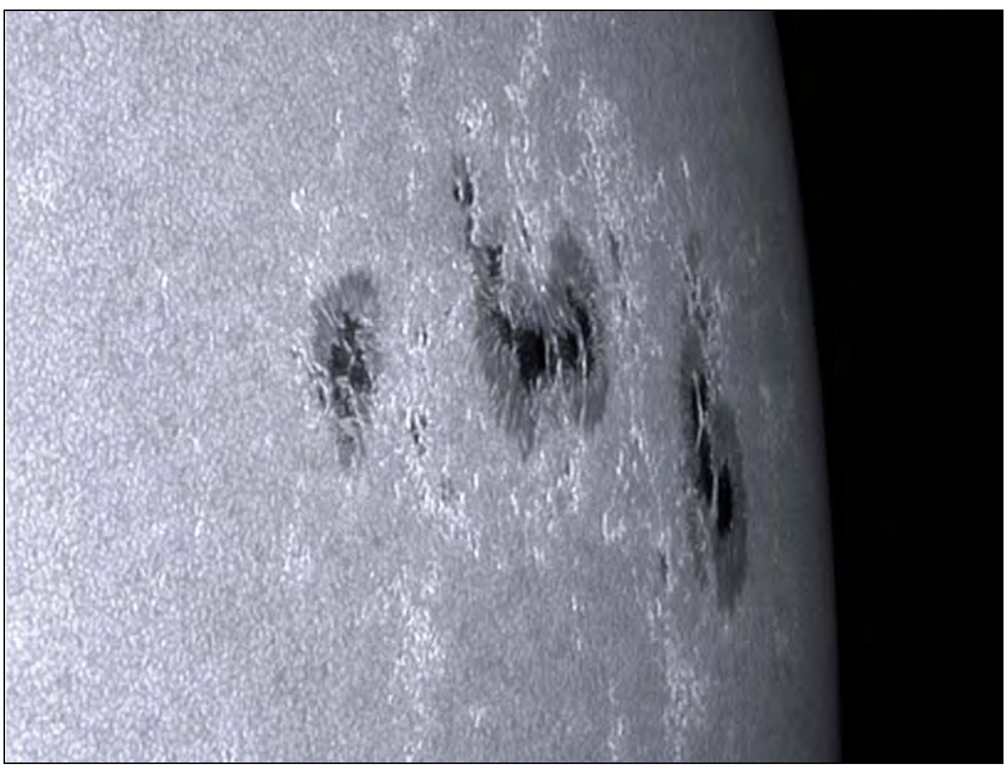


Figure 14. A last white-light look at AR2565-67 on the limb by Tyler on 7/23 at 09:01 UT.

Feature Story: Venus

ALPO Observations of Venus During the 2012-2013 Western (Morning) Apparition

By Julius L. Benton, Jr., coordinator
ALPO Venus Section
jlbaina@msn.com

An ALPO Venus Section Observing Report Form is located at the end of this report.

Abstract

Twelve observers from the United States, Japan, France, Germany, Italy, and Sweden contributed digital images and visual observations (drawings and descriptive reports) to the ALPO Venus Section during the 2012-13 Western (Morning) Apparition. This report summarizes the results of the 150 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 150 observations for the 2012-13 Western (Morning) Apparition, comprised of visual drawings, descriptive reports, and digital images from 12 observers residing in the United States, Japan, France, Germany, Italy, and Sweden. 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 about half as strong compared with the immediately preceding 2011-12 Eastern (Evening) Apparition, but a few individuals began monitoring the planet early on. For instance, Detlev Niechoy sketched the crescent Venus at 11:39 UT on June 9, 2012, roughly 3½ days following Inferior Conjunction on June 6, 2012 [*Refer to Illustration No. 001*], and Christian Viladrich contributed a beautiful image of the crescent Venus on June 23, 2012 at 09:44 UT [*Refer to Illustration No. 002*]. The observational reports upon which this report is based spanned the period starting June 9, 2012 through January 12, 2013, with 92.7% of the total contributions for July through November 2012. For the 2012-13 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 brilliancy

All Readers

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

Online Features

Left-click your mouse on:

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

Observing Scales

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

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

Scale of Transparency Conditions:
Estimated magnitude of the faintest star observable near Venus, allowing for daylight or twilight

IAU directions are used in all instances.

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.

(–4.6mv), dichotomy, and maximum western elongation from the Sun (46.0°). Observers are urged to try to carry out systematic observations of Venus when seeing conditions permit from conjunction to conjunction, and the ALPO Venus Section is quite fortunate to have a growing team of persistent, dedicated observers who have tried very hard to do that in recent observing seasons.

Table 1: Geocentric Phenomena in Universal Time (UT) for the 2012-2013 Western (Morning) Apparition of Venus

Superior Conjunction	2012 Jun 06^{d} 01^{h} UT
Initial Observation	Jun 09 11:08
Greatest Illuminated Extent	Jul 12 16:00 (m_v = –4.6)
Dichotomy (predicted)	Aug 08 04:19:19 (15.18^{d})
Greatest Elongation West	Aug 08 16:00 (47.0˚)
Final Observation	2013 Jan 12 12:12
Superior Conjunction	Mar 28 17
Apparent Diameter (observed range):	57.9″ (2012 Jun 09) ↔ 10.6″ (2013 Jan 12)
Phase Coefficient, ***k*** (observed range):	0.004 (2012 Jun 09) ↔ 0.953 (2013 Jan 12)

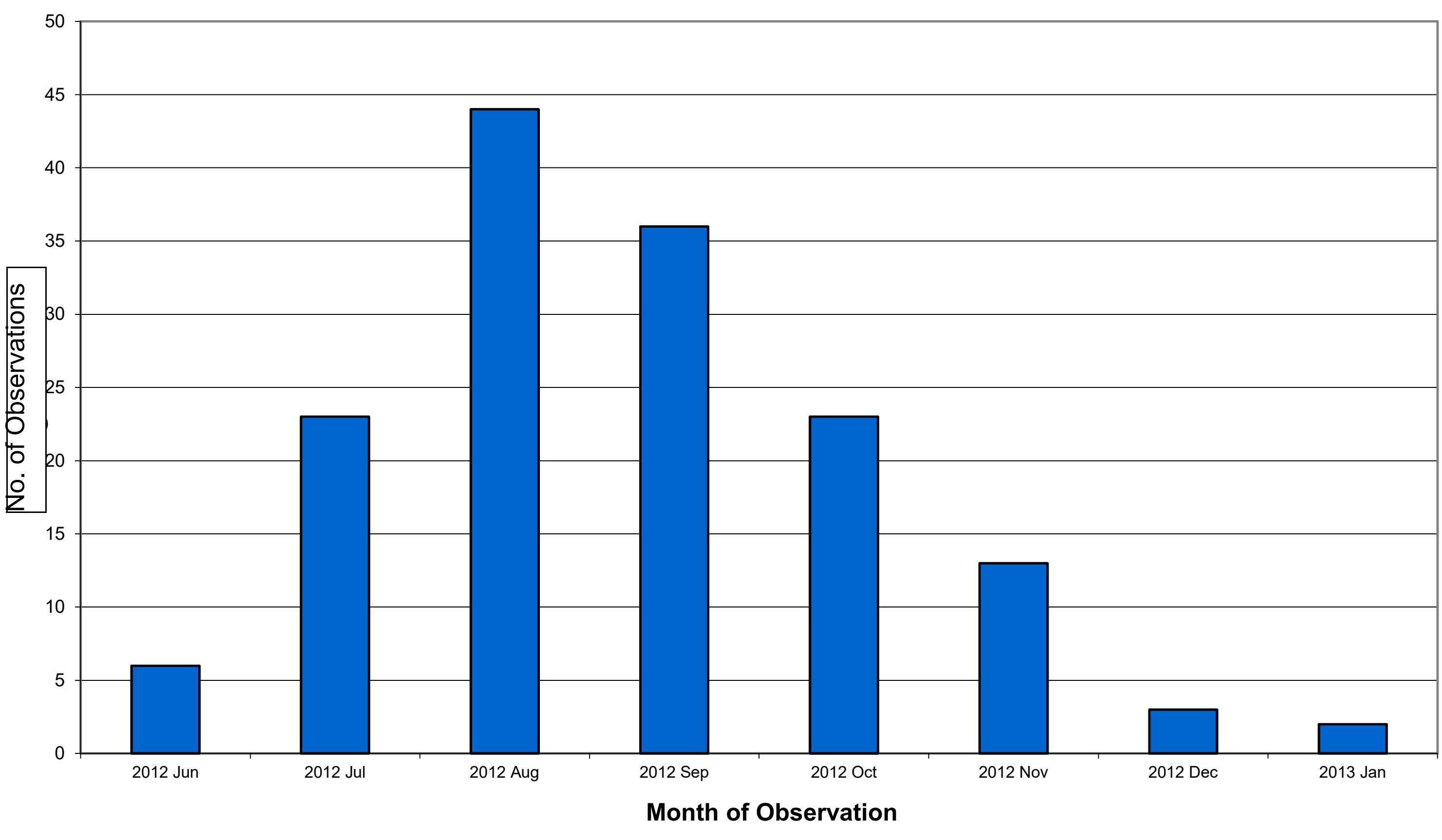
Figure 2 shows the distribution of observers and contributed observations by nation of origin for this apparition, where it can be seen that 58.3% of the participants in our programs were located in the United States, and they accounted for 27.3% of the total observations. Regular international cooperation took place during this observing season, whereby 41.7% of the observers resided outside the United States and contributed 72.7% 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 11.3% of all observations in 2012-13, with the majority (88.7%) made with instruments ranging from 15.2 cm (6.0 in.) to 100.0 cm (394 in.).

Figure 1

Distribution of Observations By Month During the 2012-13 Western (Morning) Apparition of Venus

150 Total Observations Submitted By 12 Observers in 2012-13



During the observing season the frequency of use of classical designs (refractors) was only 8.7%, while utilization of catadioptrics (Schmidt Cassegrain and Maksutov Cassegrain) was 91.3%. All visual and digital observations were performed under twilight or daylight conditions, generally because more experienced Venus observers recognize that viewing during twilight or 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.

The writer expresses his gratitude to the 12 observers who made this report possible by regularly sending in their drawings, descriptive reports, and digital images of Venus in 2012-13. Readers who want to follow Venus in upcoming apparitions are urged to join the ALPO and start participating in our observational studies. There is no doubt that the brightness of Venus makes it an easy object easy to find, and around the dates of greatest elongation from the Sun, it 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 programs requires only minimal aperture, ranging from 7.5 cm (3.0 in.) for refractors to 15.2 cm (6.0 in.) reflectors.

Table 2: ALPO Observing Participants in the 2012-13 Western (Morning) Apparition of Venus

Observer & Observing Site	No. of Observations	Telescope(s) Used*
Benton, Julius L. - Wilmington Island, GA	15	9.0 cm (3.5 in.) MAK
Graham, Frances - East Pittsburgh, PA	1 4	6.0 cm (2.4 in.) REF 16.0 cm (6.3 in.) REF
Hill, Rik - Tucson, AZ	1	9.0 cm (3.5 in.) MAK
Ikemura, Toshihiko - Osaka, Japan	1	38.0 cm (15.0 in.) NEW
Jakiel, Richard - Lithia Springs, GA	1	30.5 cm (12.0 in.) SCT
Lindberg, H.G. - Skultuna, Sweden	25	18.0 cm (7.1 in.) MAK
Mattei, Michael - Littleton, MA	3	35.6 cm (14.0 in.) SCT
Maxson, Paul - Phoenix, AZ	11	35.6 cm (14.0 in.) SCT
Melillo, Frank J. - Holtsville, NY	5	25.4 cm (10.0 in.) SCT
Niechoy, Detlev - Göttingen, Germany	73	20.3 cm (8.0 in.) SCT
Pellier, Christophe - Bruz, France	5	25.4 cm (10.0 in.) NEW
Viladrich, Christian - Paris, France	1 3 1	15.2 cm (6.0 in.) REF 35.6 cm (14.0 in.) SCT 100.0 cm (39.4 in.) CAS
Total No. of Observers	**12**	
Total No. of Observations	**150**	

*REF = Refractor, SCT = Schmidt-Cassegrain, MAK = Maksutov, CAS = Cassegrain

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 in printed (hard copy) or *.pdf (digital) format. 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.

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 and types of atmospheric activity reported on Venus 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, described in the literature cited earlier in this report. *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 normal visual observing methods, 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.

Figure 4 illustrates that the dazzlingly bright disc of Venus was considered as being completely devoid of atmospheric features in only 14.1% of the observations submitted this apparition. When dusky features were seen, suspected or imaged on the brilliant disc of Venus, the highest percentage was Banded Dusky Markings" (76.3%), followed by "Amorphous Dusky Markings" (66.7%), "Irregular Dusky Markings" (51.1%) [Refer to Illustrations No. 003 thru 011], and "Radial Dusky Markings" (14.8%) [Refer to Illustration No. 012 and 013], whereby the latter are normally only revealed in UV images along with the characteristic "Y- shaped" cloud features in the atmosphere of Venus.

Terminator shading was reported in 94.1% 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 many UV images [*Refer to Illustrations No. 014 thru 016]*.

Figure 2

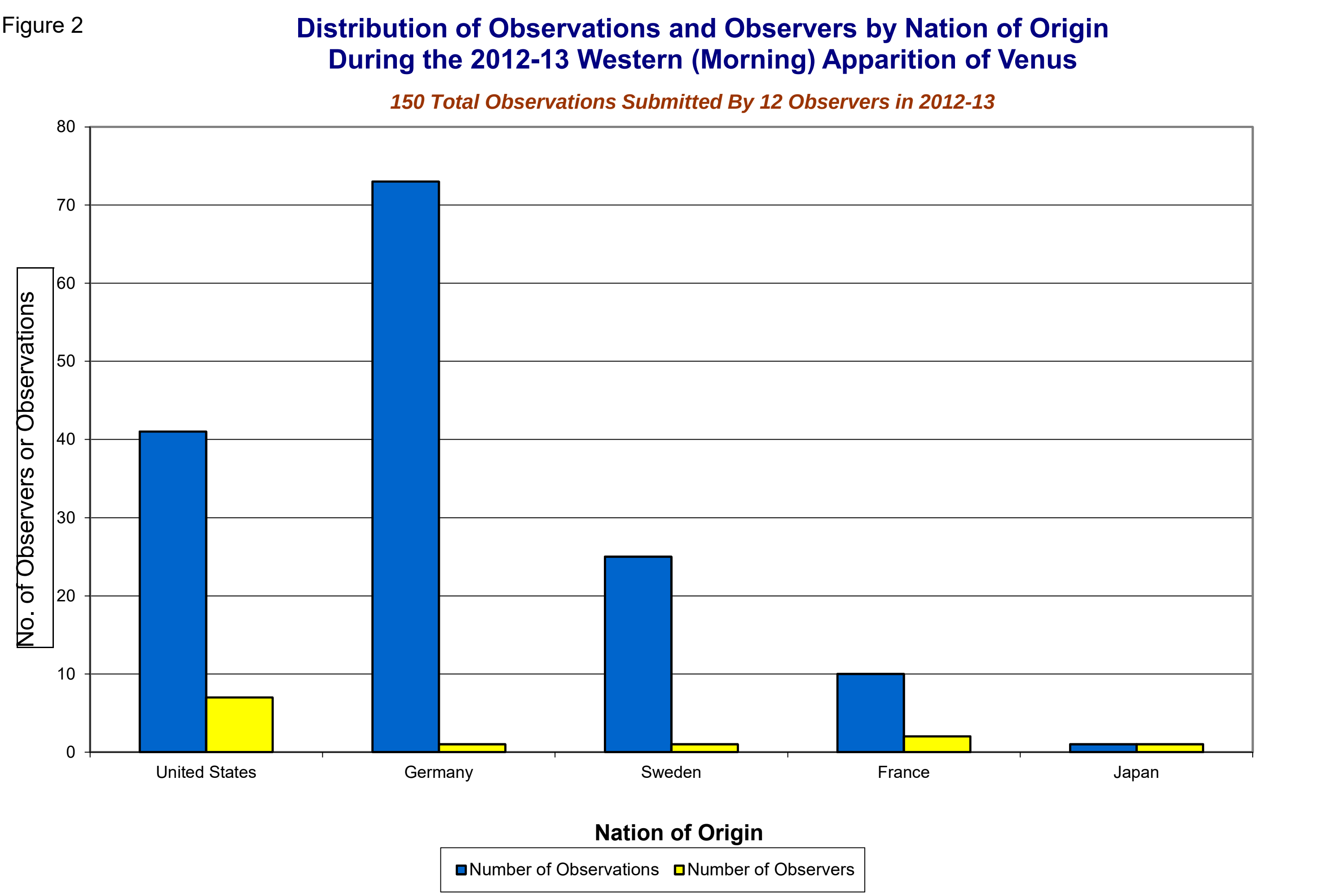


Figure 3

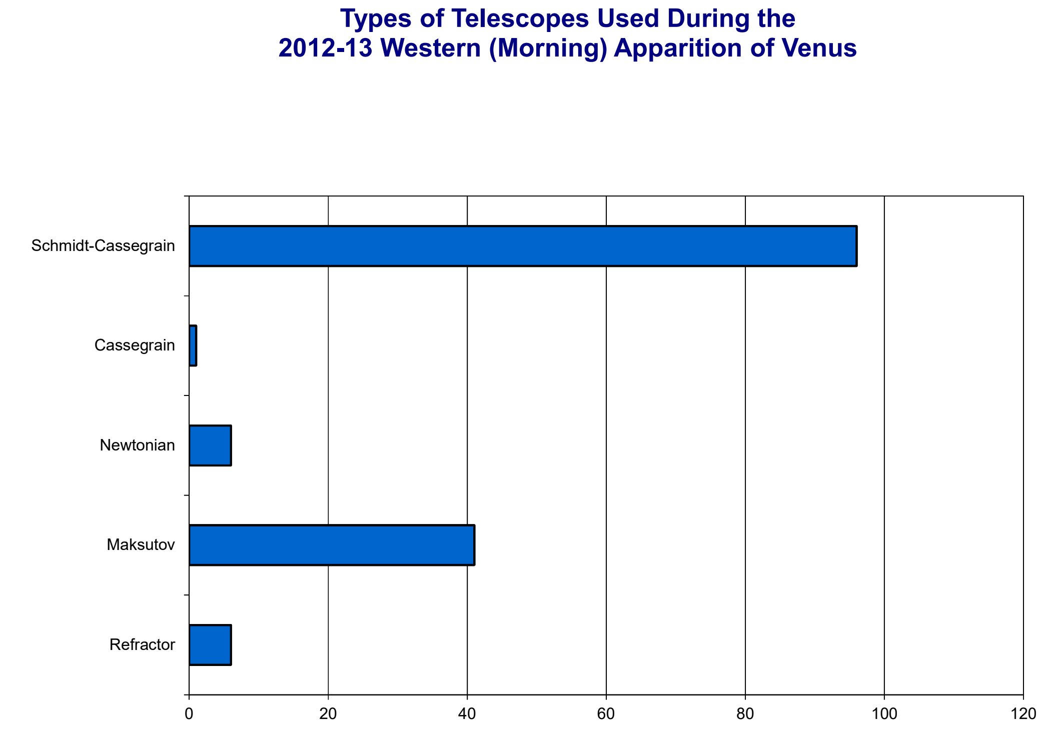


Figure 4

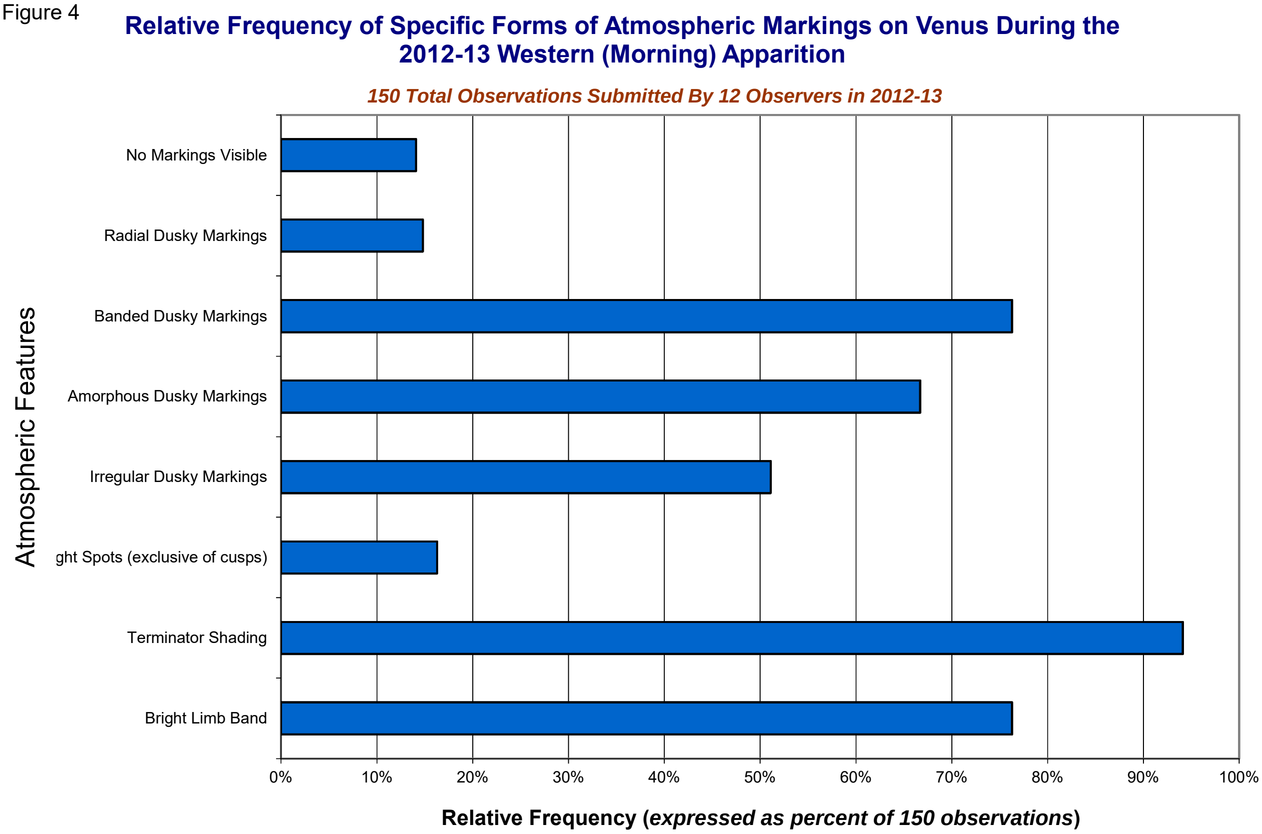
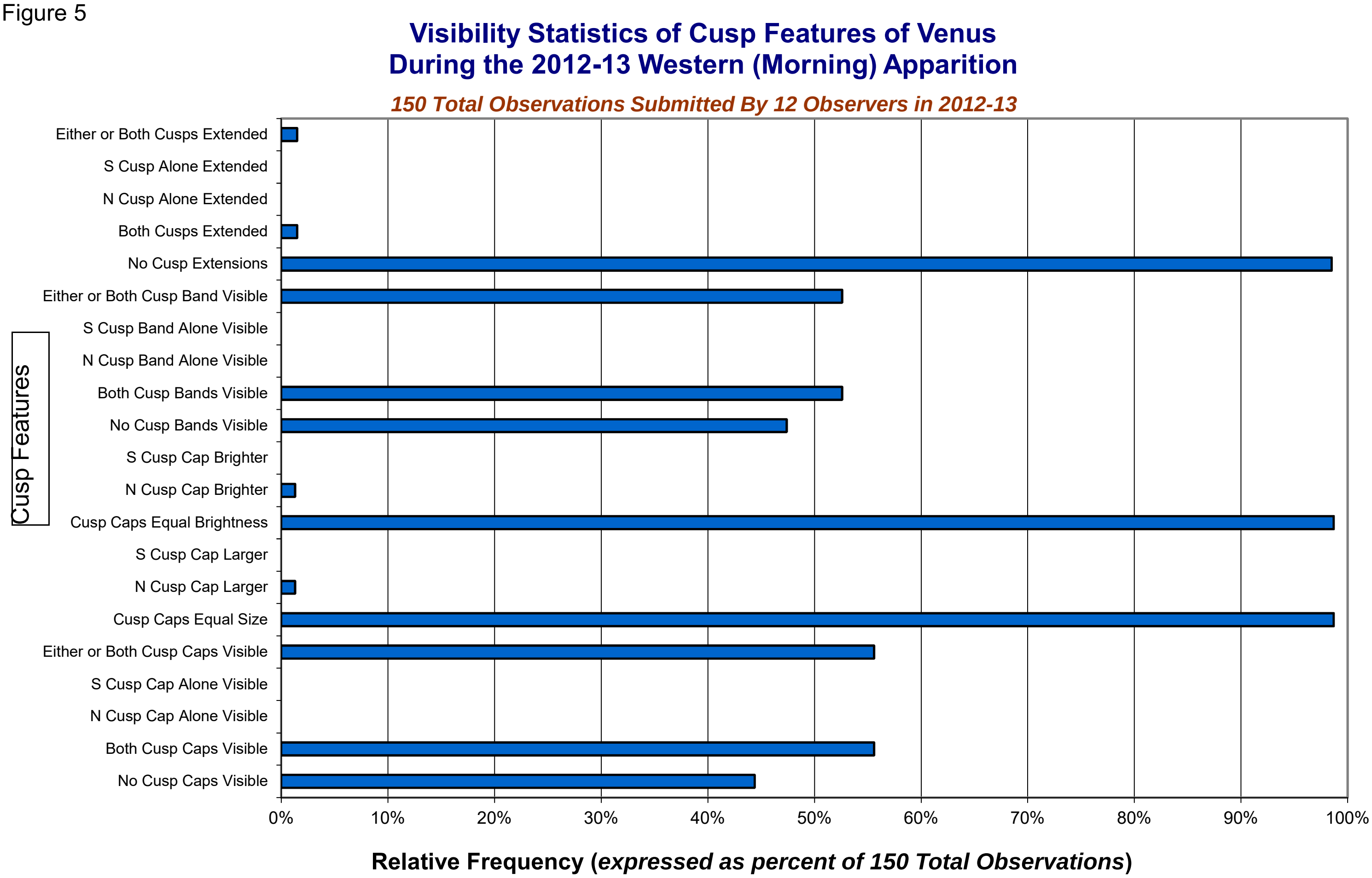


Figure 5



The mean numerical relative intensity for all of the dusky features on Venus this apparition averaged about 8.8. 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 ~3.6 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 16.3% of the submitted observations and images. As a normal practice, when visual observers detect such bright areas, it is standard practice to denote them on drawings by using dotted lines to surround them [*Refer to Illustrations No. 017 thru 020*].

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.

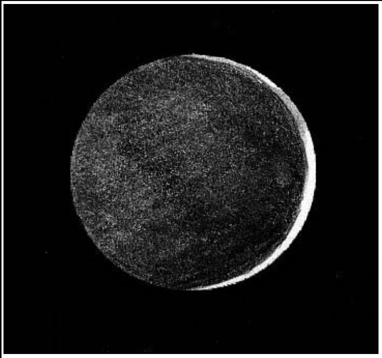
The Bright Limb Band

Figure 4 illustrates that a little over two-thirds of the submitted observations (76.3%) 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 69.9% of the time, and interrupted or only marginally visible along the limb of Venus in 30.1% of the positive reports. The bright limb band was more likely to be incomplete in UV images than those captured in the visible spectrum as well as submitted drawings. The mean numerical intensity of the Bright Limb Band was 9.8, seemingly a bit more obvious when color filters or variable-density polarizers were used. This very bright feature, usually reported by visual observers this apparition [*Refer to Illustration No. 021*], was also seen on a fairly large number of digital images of Venus received [*Refer to Illustration No. 007*].

***General Caption Note for Illustrations 1-27**. 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.*

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 64.4% 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 occasionally take the form of bulges, while darker markings may appear as wispy hollows [Refer to Illustration No. 022 and 023].



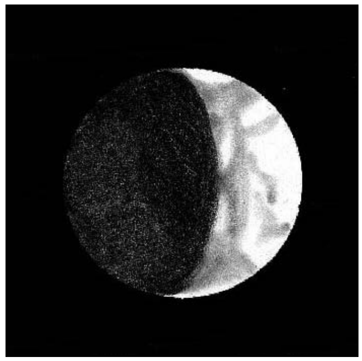



Illustration 001 (top left) 2012 June 09 11:39 UT. Drawing by Detlev Niechoy. 20.3 cm (8.0 in.) SCT at 136X and UG3 filter. Seeing 3.0 (interpolated), Transparency (not specified). Phase (k) = 0.004, Apparent Diameter = 57.9”. Drawing shows very thin crescent of Venus approximately 3½ days after Inferior Conjunction. S is at the top of the image.

Illustration 002 (top second) 2012 June 23 09:44 UT. Digital image by Christian Viladrich. 15.2 cm (6.0 in.) REF using Schuller UV filter. Seeing (not specified), Transparency (not specified). Phase (k) = 0.094, Apparent Diameter = 50.6”. UV image depicts the brilliant crescent of Venus showing no cusp extensions. S is at the top of the image.

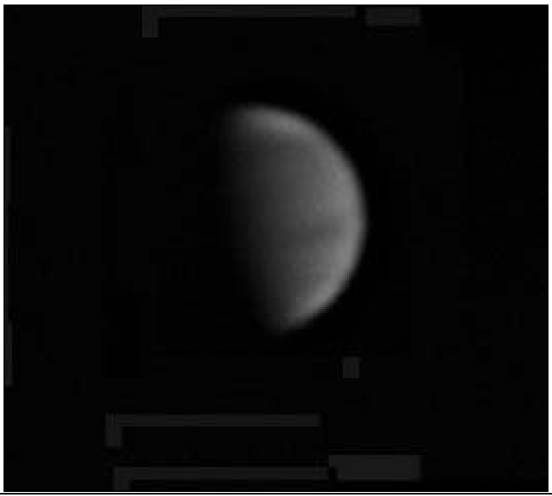
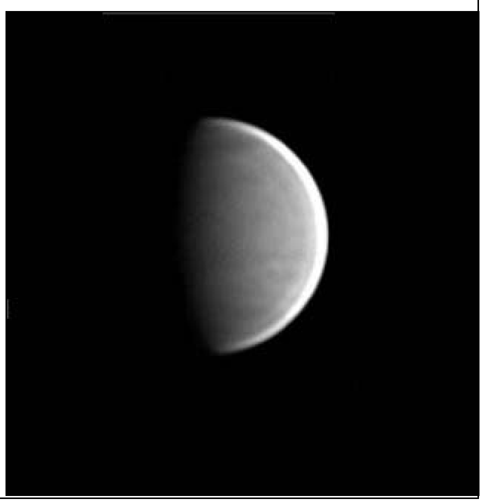
Illustration 003 (top third) 2012 July 25 05:48 UT. Drawing by Detlev Niechoy. 20.3 cm (8.0 in.) SCT at 225X and W25 filter. Seeing 3.0 (interpolated), Transparency (not specified). Phase (k) = 0.369, Apparent Diameter = 31.0”. Amorphous and irregular dusky markings are represented in this drawing along with the slightly larger and brighter S cusp cap; both cusp bands are seen. S is at the top of the image.

Illustration 004 (top right) 2012 August 07 09:40 UT. Drawing by Frances Graham. 16.0 cm (6.3 in.) REF at 400X and W47 filter. Seeing 5.0 (interpolated), Transparency (described as good but not numerically rated). Phase (k) = 0.455, Apparent Diameter = 26.1”. Banded dusky markings are illustrated in this drawing. S is at the top of the image.

Illustration 005 (bottom left) 2012 August 20 07:40 UT. Digital image by Christian Viladrich. 35.6 cm (14.0 in.) SCT using Schuller UV filter. Seeing (not specified), Transparency (not specified). Phase (k) = 0.527, Apparent Diameter = 22.5”. Banded and amorphous dusky markings are seen in this excellent image. S is at the top of the image.

Illustration 006 (bottom center) 2012 September 09 06:15 UT. Digital image by H.G. Lindberg. 18.0 cm (7.1 in.) MAK at 365nm UV. Seeing (not specified), Transparency (not specified). Phase (k) = 0.622, Apparent Diameter = 18.7”. Banded dusky markings are apparent along with N and S cusp caps and cusp bands. S is at the top of the image.

Illustration 007 (bottom right) 2012 September 14 06:28 UT. Digital Image by Christophe Pellier. 25.4 cm (10.0 in.) NEW at 800nm IR Seeing (not specified), Transparency (not specified). Phase (k) = 0.643, Apparent Diameter = 18.0”. Banded and amorphous dusky markings, as well as the bright limb band from cusp to cusp, are visible in this superb image taken in the IR. S is at the top of the image.

Cusps, Cusp-Caps, and Cusp-Bands

When the phase coefficient, k, is between 0.1 and 0.8 (that is, the fraction of the disc that is illuminated), 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 98.7% of the time and in brightness in 98.7% of the observations. So, there were minimal instances when the southern and northern cusp-caps were larger and brighter than each other. Both cusp-caps were visible in 55.6% 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 52.6% of the observations when cusp-caps were visible. When seen, the cusp-bands displayed a mean relative intensity of about 7.8 (see *Figure 5*) [*Refer to Illustration No. 024*].

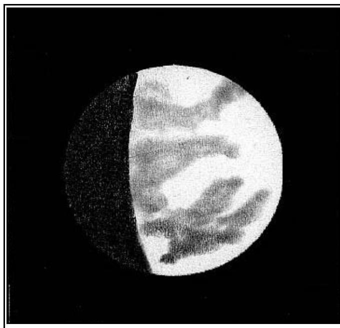
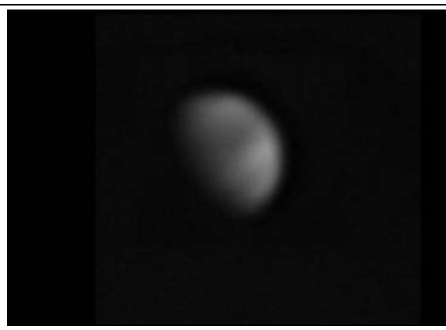
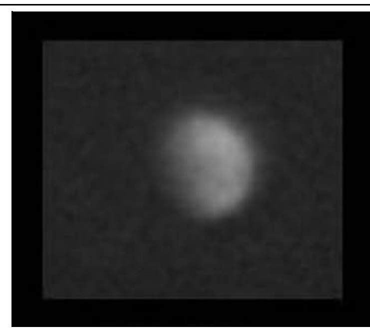
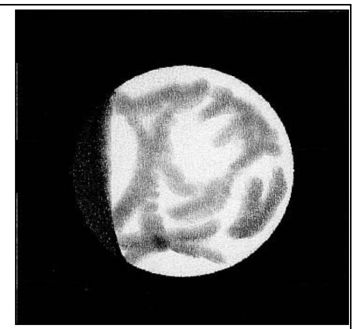
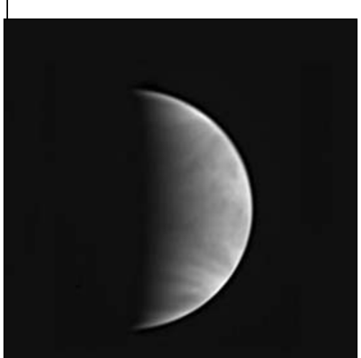
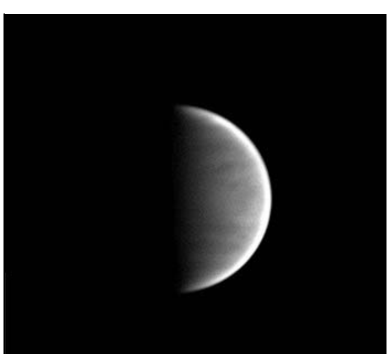
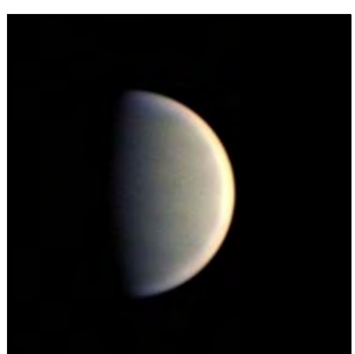
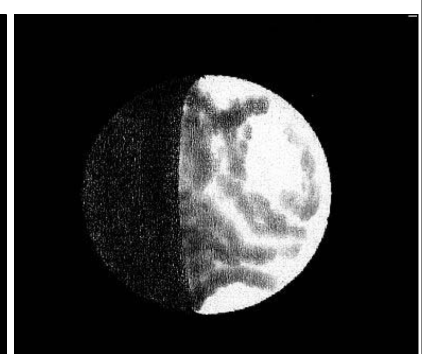





Illustration 008 (top left) 2012 October 02 04:28 UT. Drawing by Detlev Niechoy. 20.3 cm (8.0 in.) SCT at 162X in Integrated Light (no filter). Seeing 3.0 (interpolated), Transparency (not specified). Phase (k) = 0.712, Apparent Diameter = 15.8”. Amorphous and irregular dusky markings appear in this sketch. S is at the top of the image.
Illustration 009 (top second) 2012 October 16 06:25 UT. Digital image by H.G. Lindberg. 18.0 cm (7.1 in.) MAK at 365nm UV. Seeing (not specified), Transparency (not specified). Phase (k) = 0.760, Apparent Diameter = 14.5”. Banded dusky markings can be seen across the gibbous disk of Venus. S is at the top of the image.
Illustration 010 (top third) 2012 November 11 14:19 UT. Digital image by Frank Melillo. 25.4 cm (10.0 in.) SCT using Schott UG-1 UV filter. Seeing = 7.0, Transparency (not specified). Phase (k) = 0.836, Apparent Diameter = 12.8”. Amorphous dusky features are detected in this UV image. S is at the top of the image.
Illustration 011 (top right) 2012 November 14 06:17 UT. Drawing by Detlev Niechoy. 20.3 cm (8.0 in.) SCT at 225X and W15 filter. Seeing 3.5 (interpolated), Transparency (not specified). Phase (k) = 0.843, Apparent Diameter = 12.6”. Irregular dusky markings are apparent across the disk of Venus. S is at the top of the image.
Illustration 012 (bottom left) 2012 August 08 05:41 UT. Digital image by Christian Viladrich. 100.0 cm (39.4 in.) CAS at Pic du Midi Observatory at 325-281nm UV. Seeing (not specified), Transparency (not specified). Phase (k) = 0.460, Apparent Diameter = 25.8”. Radial dusky markings and characteristic “Y- shaped” cloud features among other atmosphere details of Venus are seen in this exquisite image with a very large aperture telescope. S is at the top of the image.
Illustration 013 (bottom second) 2012 August 18 05:39 UT. Digital Image by Christophe Pellier. 25.4 cm (10.0 in.) NEW with violet 400nm (W47) filter. Seeing (not specified), Transparency (not specified). Phase (k) = 0.517, Apparent Diameter = 23.0”. Radial dusky markings and banded dusky markings are shown in this image along with the bright limb band. S is at the top of the image.
Illustration 014 (bottom third) 2012 September 06 06:21 UT. Digital Image by Christophe Pellier. 25.4 cm (10.0 in.) NEW with RGB filters. Seeing (not specified), Transparency (not specified). Phase (k) = 0.609, Apparent Diameter = 19.2”. Banded dusky markings and their merger with the terminator shading from cusp to cusp are visible. S is at the top of the image.
Illustration 015 (bottom right) 2012 September 10 05:00 UT. Drawing by Detlev Niechoy. 20.3 cm (8.0 in.) SCT at 82X in Integrated Light (no filter). Seeing 2.5 (interpolated), Transparency (not specified). Phase (k) = 0.626, Apparent Diameter = 18.6”. Irregular dusky markings, the bright limb band from cusp to cusp, and both cusp caps and cusp bands are seen I this drawing. S is at the top of the image.

Cusp Extensions

In 98.5% of the submitted visual observations during the apparition, cusp extensions were not reported in integrated light or with color filters beyond the 180° expected from simple geometry (see *Figure 5*). While Venus was passing through its crescent phases following inferior conjunction on June 6, 2012, rare instances of cusp extensions were detected from time to time, ranging from 2° to 10°, but not particularly noticeable on any contributed drawings and rather vague in images submitted. Experience has shown that 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 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. The predicted half-phase occurs when k = 0.500, and the phase angle, i, between the Sun and the Earth as seen from Venus equals 90°. Although theoretical dichotomy occurred on August 15.18d, visual dichotomy estimates were not submitted during this apparition.

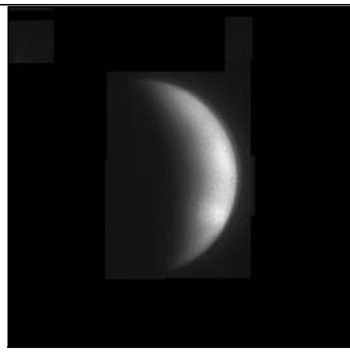
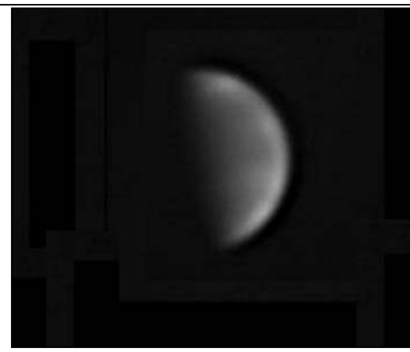
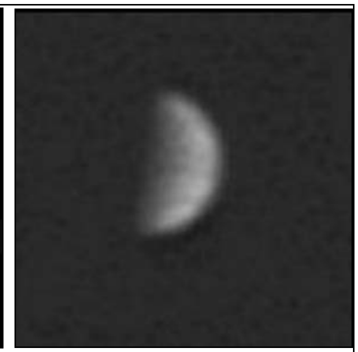
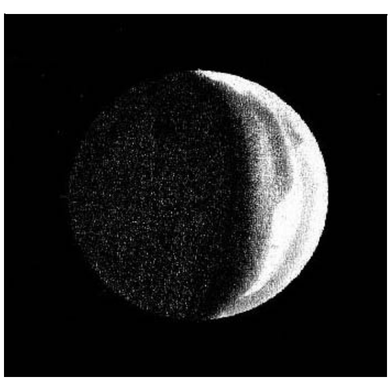
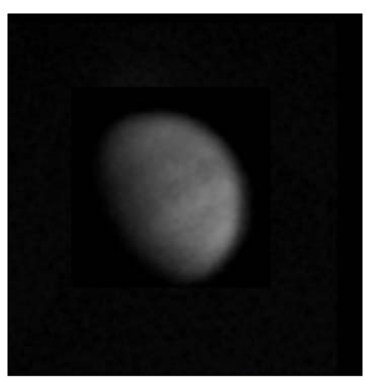
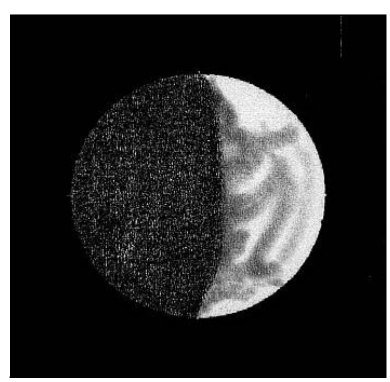





Illustration 016 (top left) 2012 September 05 06:14 UT. Digital image by H.G. Lindberg. 18.0 cm (7.1 in.) MAK at 365nm UV. Seeing (not specified), Transparency (not specified). Phase (k) = 0.604, Apparent Diameter = 19.4”. The discontinuous bright limb band and banded dusky markings can be seen across the slightly gibbous disk of Venus. S is at the top of the image.
Illustration 017 (top second left) 2012 July 25 14:08. Digital Image by Paul Maxson. 35.6 cm (14.0 in.) SCT with UV filter. Seeing (not specified), Transparency (not specified). Phase (k) = 0.372, Apparent Diameter = 30.8”. Bright spots exclusive of the cusps are captured in this image. S is at the top of the image.
Illustration 018 (top third left) 2012 August 28 06:14 UT. Digital image by H.G. Lindberg. 18.0 cm (7.1 in.) MAK at 365nm UV. Seeing (not specified), Transparency (not specified). Phase (k) = 0.567, Apparent Diameter = 20.8”. Bright spots are possibly present in this image. S is at the top of the image.
Illustration 019 (top right) 2012 August 26 14:05 UT. Digital image by Frank Melillo. 25.4 cm (10.0 in.) SCT using Schott UG-1 UV filter. Seeing = 7.0, Transparency (not specified). Phase (k) = 0.559, Apparent Diameter = 21.2”. Amorphous dusky features are detected in this UV image. S is at the top of the image. Bright spots seem to be visible in this UV image. S is at the top of the image.
Illustration 020 (bottom left) 2012 August 19 19:53 UT. Digital image by Toshihiko Ikemura. 38.0 cm (15.0 in.) NEW using Astrodon UV filter. Seeing (not specified), Transparency (not specified). Phase (k) = 0.525, Apparent Diameter = 22.7”. Banded dusky markings along with possible bright spot(s) toward bottom of image. S is at the top of the image.
Illustration 021 (bottom second left) 2012 July 26 05:15 UT. Drawing by Detlev Niechoy. 20.3 cm (8.0 in.) SCT at 225X using W15 filter. Seeing 3.0 (interpolated), Transparency (not specified). Phase (k) = 0.376, Apparent Diameter = 30.6”. Bright limb band is shown cusp to cusp in this drawing. S is at the top of the image.
Illustration 022 (bottom third left) 2012 November 06 07:44 UT. Digital image by H.G. Lindberg. 18.0 cm (7.1 in.) MAK at 365nm UV. Seeing (not specified), Transparency (not specified). Phase (k) = 0.822, Apparent Diameter = 13.1”. Banded dusky markings and an irregular terminator is visible where dusky marking merge with the shaded terminator. S is at the top of the image.
Illustration 023 (bottom right) 2012 August 03 03:42 UT. Drawing by Detlev Niechoy. 20.3 cm (8.0 in.) SCT at 82X in Integrated Light (no filter). Seeing 2.0 (interpolated), Transparency (not specified). Phase (k) = 0.429, Apparent Diameter = 27.5”. In addition to the banded and irregular dusky markings, the shaded terminator is irregular from north to south in this drawing. S is at the top of the image.

Ashen Light Observations and Dark Hemisphere Phenomena

The Ashen Light, reported the first time by G. 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 continues to receive reports 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 could simultaneously confirm visual impressions of any suspected Ashen Light on the same date and at the same time. Moreover, Venus observers who are routinely doing digital imaging can hopefully capture and document any illumination that may be present on the planet monitor the dark side of Venus, ideally as part of a cooperative simultaneous observing endeavor with visual observers.

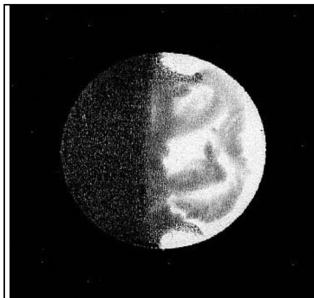
In 2012-13, there were no digital images submitted that suggested the presence of the Ashen Light, but one seasoned visual observer, Detlev Niechoy, suspected the Ashen Light using a W15 (deep yellow) filter on July 24, 2012 at 05:00 UT [*Refer to Illustration No. 025*].

Since the instrumentation and methodology are not really complicated, the ALPO Venus Section also urges observers to pursue 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 the IR. In the only such observation this apparition, Frank Melillo submitted a 1000nm IR image of the crescent of Venus on July 01, 2012 at 09:00 UT just barely showing the dark hemisphere [*Refer to Illustration No. 026*].

There were no instances when the dark hemisphere of Venus allegedly appeared darker than the background sky during the 2010-11 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 not unusual for two observers looking at Venus at the same time



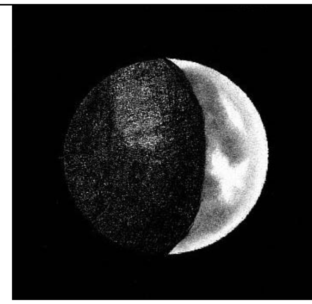


Illustration 024 (top left) 2012 August 27 04:15 UT. Drawing by Detlev Niechoy. 20.3 cm (8.0 in.) SCT at 82X in Integrated Light (no filter). Seeing 2.0 (interpolated), Transparency (not specified). Phase (k) = 0.562, Apparent Diameter = 21.0”. In addition to the banded, amorphous, and irregular dusky markings, the shaded terminator is visible with the bright limb band and both cusp caps (equally bright) and dusky cusp bands. S is at the top of the image.

Illustration 025 (top middle) 2012 July 24 05:00 UT. Drawing by Detlev Niechoy. 20.3 cm (8.0 in.) SCT at 290X with W15 filter. Seeing 3.0 (interpolated), Transparency (not specified). Phase (k) = 0.362, Apparent Diameter = 31.4”. The Ashen Light is suspected within the dark hemisphere of Venus, while the shaded terminator appears slightly deformed by adjacent amorphous dusky markings. There were not corroborating observations of the Ashen Light on this date by other observers. S is at the top of the image.

Illustration 026 (top right) 2012 July 01 09:00 UT. Digital image by Frank Melillo. 25.4 cm (10.0 in.) SCT using 1000nm IR filter. Seeing = 7.0, Transparency (not specified). Phase (k) = 0.168, Apparent Diameter = 44.8”. The near-IR thermal emission of the dark side of Venus is captured in this image. S is at the top of the image.

Illustration 027 2012 August 13 20:45 UT. Digital Image of Venus captured by Rik Hill. 9.0 cm (3.5 in.) MAK in Integrated Light (no filter). Seeing = 3.5, Transparency (full daylight). Phase (k) = 0.490, Apparent Diameter = 24.3”. The daylight occultation of Venus by the thin crescent moon in 110°F weather.

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 only 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 would 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.

A Daylight Lunar Occultation of Venus

On August 13, 2012, North American observers, who were blessed with clear skies, were able to witness a rare daytime occultation of Venus by the very thin waning crescent Moon. The only observation of this event was submitted by Rik Hill observing from a favorable location in Arizona in 110°F weather at 20:45 UT on August 13 [*Refer to Illustration No. 027*]. This task was made more difficult due to the challenge of locating the dim crescent moon in a bright daylight sky.

Amateur-Professional Cooperative Programs

The ALPO Venus Section continues to routinely share visual observations and digital images at various wavelengths with the professional community. As readers will recall, the European Space Agency's (ESA) 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. It should be emphasized that it is still not too late for those who want to send their digital images to the ALPO Venus Section and the VEX website (see below) to do so. Sought after also are drawings of Venus in Integrated Light and with color filters of known transmission while the VEX mission was in progress. 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.

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

As of this writing, there are tentative plans for an ALPO Pro-Am cooperative with Japan's (JAXA) Akatsuki mission that was to start full-scale observations in April 2016. There will be more news forthcoming on this potential endeavor in later updates in this Journal.

Conclusions

Analysis of ALPO observations of Venus during the 2012-13 Western (Morning) Apparition showed that vague shadings on the disc of the planet were periodically apparent to visual observers who utilized standardized filter techniques to help reveal the notoriously 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 future Pro-Am collaboration exists as initial plans are formulated for supporting the Japanese (JAXA) Akatsuki mission commencing in 2016.

Active international cooperation by individuals making regular systematic, simultaneous observations of Venus remain our main objective, and the ALPO Venus Section encourages interested readers to join us in our many projects and challenges in the coming years.

References

Benton, Julius L., Jr., (2002). An Introduction to Observing Venus. Savannah, GA: Review Publishing Co. Available from the author at *jlbaina@msn.com*

--------------, (2011), "ALPO Observations of Venus During the 2007-08 Western (Morning) Apparition of Venus." Journal of the Assn of Lunar & Planetary Observers, Vol. 53, No. 1 (Winter), pp. 27-39. *http://www.alpo-astronomy.org/gallery/main.php?g2_view=core.DownloadItem&g2_itemId=92743*

-------------, (2014), "ALPO Observations of Venus During the 2009-10 Western (Morning) Apparition of Venus." Journal of the Assn of Lunar & Planetary Observers, Vol. 56, No. 3 (Summer), pp. 19-33. *http://www.alpo-astronomy.org/gallery/main.php?g2_view=core.DownloadItem&g2_itemId=92688&g2_GALLERYSID=16f5f32393426335eb2914b275387b99*

de Pater, Imke and Lissauer, Jack J., (2013). Fundamental Planetary Science. New York: Cambridge University Press. *http://www.amazon.com/Fundamental -Planetary-Science-Chemistry-Habitability/dp/052161855X*

Hunten, D.M., et al, eds. (1983). Venus. Tucson: University of Arizona Press. *http://www.uapress.arizona.edu/BOOKS/bid222.htm*

United States Naval Observatory. The Astronomical Almanac. Washington: U.S. Government Printing Office. (Annual Publication; the 2012 and 2013 editions, which were published in 2011 and 2012, respectively, were used for this report.

Association of Lunar and Planetary Observers (A.L.P.O.): Venus Section

A.L.P.O. Visual Observation of Venus

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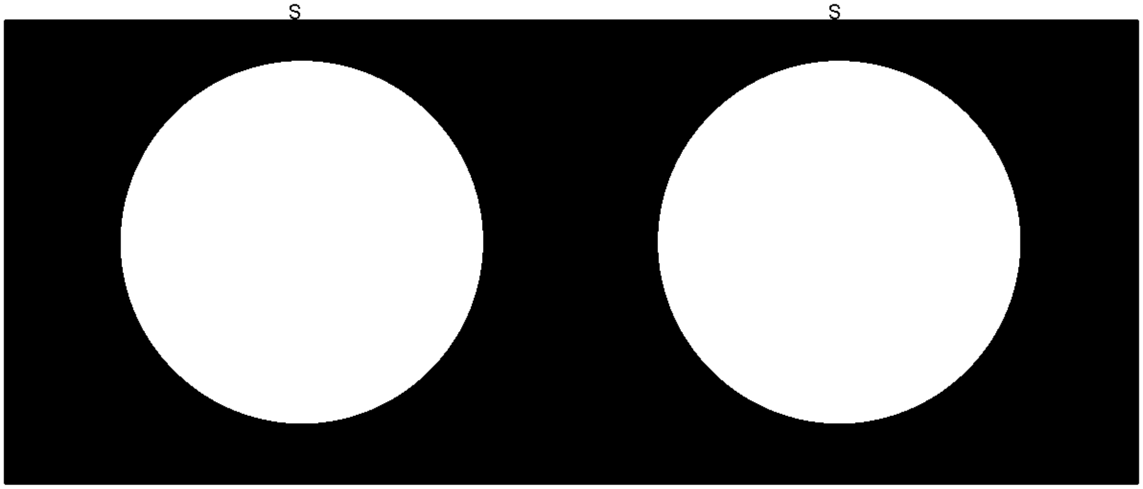


N (*all coordinates are IAU*) N

Observer________________________________Location____
UT Date _____________ UT Start _______________ UT End _______________ D = __________″ k_m = __________ k_c = ___________
m_v = ___________ Instrument ____ Magnification(s) _____________ x_{min} _____________ x_{max}
Filter(s) IL(none) __________ f_1 __________ f_2 __________ f_3 ____________ Seeing ______________ Transparency _______________

Sky Illumination (*check one*): [ ] Daylight [ ] Twilight [ ] Moonlight [ ] Dark Sky

Dark Hemisphere (*check one*):
[ ] No dark hemisphere illumination
[ ] Dark hemisphere illumination suspected
[ ] Dark hemisphere illumination
[ ] Dark hemisphere darker than sky

Bright Limb Band (*check one*):
[ ] Limb Band not visible
[ ] Limb Band visible (complete cusp to cusp)
[ ] Limb Band visible (incomplete cusp to cusp)

Terminator (*check one*):
[ ] Terminator geometrically regular (no deformations visible)
[ ] Terminator geometrically irregular (deformations visible)

Terminator Shading (*check one*):
[ ] Terminator shading not visible
[ ] Terminator shading visible

Atmospheric Features (*check, as applicable*):
[ ] No markings seen or suspected
[ ] Radial dusky markings visible
[ ] Amorphous dusky markings visible
[ ] Banded dusky markings visible
[ ] Irregular dusky markings visible
[ ] Bright spots or regions visible (exclusive of cusp regions)

Cusp-Caps and Cusp-Bands (*check, as applicable*):
[ ] Neither N or S Cusp-Cap visible
[ ] N and S Cusp-Caps both visible
[ ] N Cusp-Cap alone visible
[ ] S Cusp-Cap alone visible
[ ] N and S Cusp-Caps equally bright
[ ] N and S Cusp-Caps equal size
[ ] N Cusp-Cap brighter
[ ] N Cusp-Cap larger
[ ] S Cusp-Cap brighter
[ ] S Cusp-Cap larger
[ ] Neither N or S Cusp-Band visible
[ ] N and S Cusp-Bands both visible
[ ] N Cusp-Band alone visible
[ ] S Cusp-Band alone visible

Cusp Extensions (*check, as applicable*):
[ ] No Cusp extensions visible
[ ] N Cusp extended (angle = _____°)
[ ] S Cusp extended (angle = _____°)

Conspicuousness of Atmospheric Features (*check one*):
[ ] 0.0 (nothing seen or suspected)
[ ] 3.0 (indefinite, vague detail)
[ ] 5.0 (suspected detail, but indefinite)
[ ] 7.0 (detail strongly suspected)
[ ] 10.0 (detail definitely visible)

IMPORTANT: Depict morphology of atmospheric detail, as well as the intensity of features, on the appropriate blanks at the tope of this form. Attach to this form all supporting descriptive information, and please do not write on the back of this sheet. The intensity scale is the *Standard A.L.P.O. Intensity Scale*, where 0.0 = completely black ⇔ 10.0 = very brightest features, and intermediate values are assigned along the scale to account for observed intensity of features.

Feature Story

People on the Moon: Women

By Wayne Bailey, Coordinator, ALPO Lunar Topographic Studies Progam
wayne.bailey@alpo-astronomy.org

Online Readers

Left-click your mouse on the e-mail address in blue text to contact the author of this article and any of the additional information sources in blue text at the end of this paper for more information.

Introduction

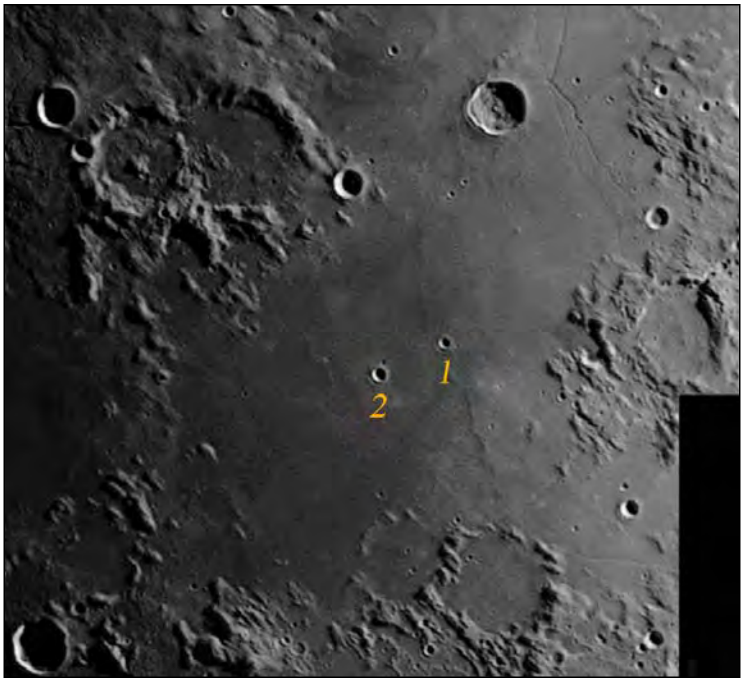
This is the second of a series of occasional articles on people represented by named features on the Moon. The previous article (JALPO 58-3, Summer 2016, pg 57) concerned the crater named for Sir James South. This article, however, covers a range of features, those memorializing women **(Table 1)**, rather than a single feature. Possibly due to the historical tendency to overlook the contributions of women in the sciences, the number of features included is manageable. Also, partly because this is a journal for observers, and partly to reduce the length, I've limited the discussion of features on the far side to a brief, tabular listing.

Most of the women on this list lived at least part of their lives during the 19th century, although the 3rd, 4th, 18th, and 20th centuries are also represented. The most recent additions are located on the far side, as would be expected, since near-side features were already named. Those on the far side include all who were born in the 20th century, but also include several whose lives ended prior to 1900.

Observing/sketching/imaging all 13 near-side craters would be an interesting observing project. A much more challenging project would include the three additional craters located in the libration zone. Nöther (Noether) will be the most difficult to spot since it is at the outer edge of the libration zone, making it inaccessible except during the most favorable librations. All of the libration zone craters are large so they should be identifiable. All craters mentioned here are marked on **Figure 1** with numbers that correspond to the numbered entries below. Rukl's Atlas of the Moon labels all 16 accessible craters. Two useful resources which have the capability to locate and display labeled images of lunar features are the following:

- IAU/USGS/NASA Gazetteer of Planetary Nomenclature (*https://planetarynames.wr.usgs.gov/Page/MOON/target*)
- Lunar Reconnaissance Orbiter Camera website *(http://lroc.sese.asu.edu/*)

Figure 1. Location of near side craters. Legend: 1. Blagg, 2. Bruce, 3. Catharina, 4. Clerke, 5. C. Herschel, 6. Hypatia, 7. Jenkins, 8. Lepaute, 9. Maury, 10. Mitchell, 11. Proctor, 12. Sheepshanks, 13. Somerville, 14. Maunder, 15. Nöther, 16. Sklodowska.



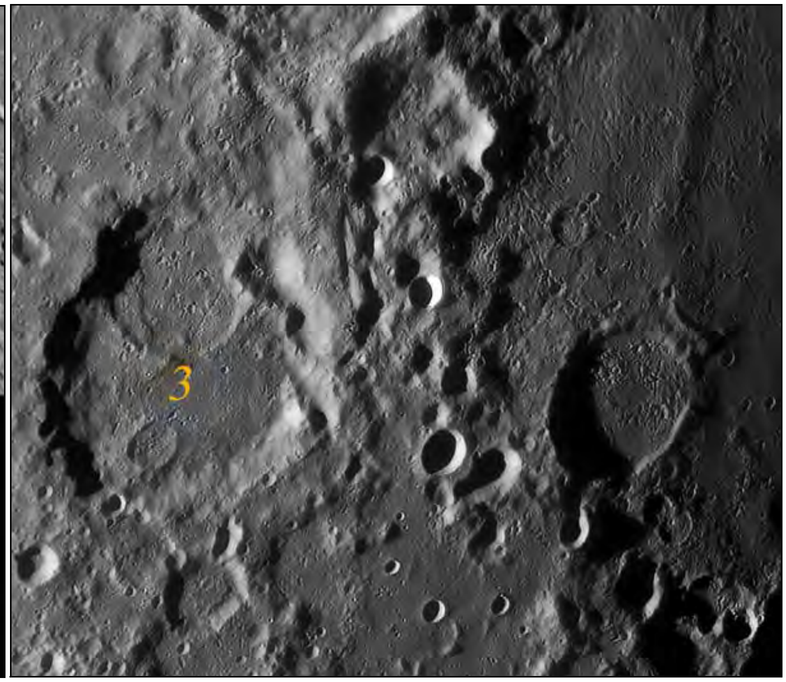


Figure 2 (at left). Blagg & Bruce. Image by Rik Hill, Tucson, AZ USA. March 17, 2015 02:08 UT.
Figure 3 (at right). Catharina. Image by Paolo R. Lazzarotti, Maaciano (GR), Tuscany, Italy. September 17, 2011 04:20 UT.

These can be very helpful for identifying small features, particularly in crowded areas.

Women on the Near Side

1. Blagg, Mary Adela (1858-1944) 1.3N, 1.5E, 5 km

In 1935, British amateur astronomer Blagg and Karl Müller published the first attempt to standardize lunar nomenclature in the 20th Century, “Named Lunar Formations” for the Lunar Commission of the International Astronomical Union. Although Blagg was interested in science and mathematics from a young age, University Extension Lectures by John Herschel's grandson kindled her serious interest in astronomy. She was also interested in variable stars and co-authored with Herbert Turner a series of papers in the Monthly Notices of the Royal Astronomical Society analyzing Joseph Baxendall's observations.

Crater Blagg **(Fig. 2)** is a small, simple crater near the center of Sinus Medii, southwest of Triesnecker and east of Bruce. A small pit is just east of Blagg, and there are low N-S ridges in the vicinity.

2. Bruce, Catherine Wolfe (1816-1900) 1.1N, 0.4E, 7 km

Bruce was an American philanthropist who became interested in astronomy late in life. She donated funds to various astronomers and observatories. Among her bequests, the most widely known may be the Bruce Photographic Telescope which she funded for Harvard College Observatory, and the Bruce Medal awarded by the Astronomical Society of the Pacific. The telescope was in use from 1893 until 1950 initially at Harvard in Cambridge, then Arequipa, Peru, and finally Bloemfontein, South Africa. The Bruce Medal has been awarded annually since 1898 for a lifetime of outstanding research in astronomy.

Crater Bruce **(Fig. 2)** is another small, simple crater. Slightly larger than the adjacent Blagg, it's located on a smooth area of Sinus Medii between two low ridges. There's a small pit just to its north.

3. Catharina - St Catherine of Alexandria (? - c. 307) 18.0S, 23.6E, 100 km

St. Catherine was a theologian, philosopher and Christian martyr. She converted 50 pagan philosophers to Christianity in a debate, along with 200 soldiers. As a result, they were all executed. She is the patron saint of philosophers and students.

This large, complex crater **(Fig. 3)** is easily recognized as the southernmost of the three large craters that border the northwest edge of Mare Nectaris, Theophilus, Cyrillus and Catharina. It's heavily degraded, with several medium size craters superimposed, most notably Catharina P interrupting the north wall. A multitude of small craters pepper the floors and walls. A rille crosses the southeastern floor of P. Just north of P, a small crater perches on a domelike hill. Catharina is inside the Nectaris Basin but outside of the flooded Mare Nectaris. The basin's outer ring includes the Altai Scarp (Rupes Altai) to the west and south.

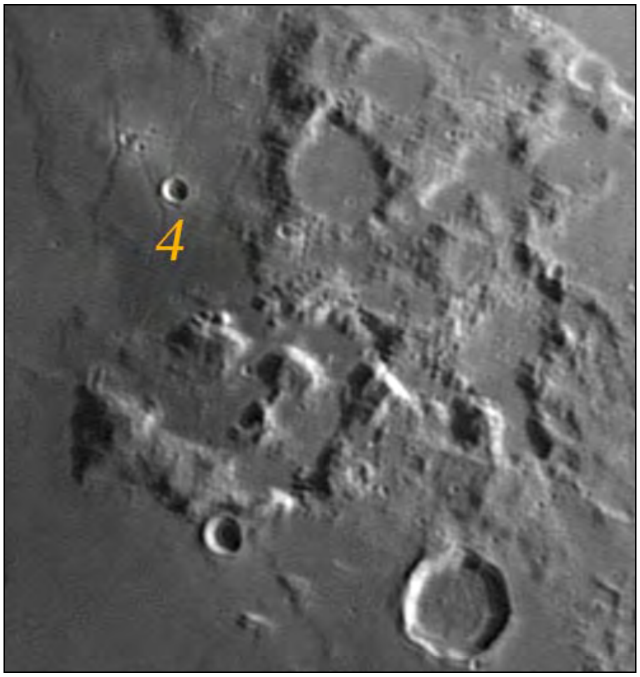


Figure 4 (left). Clerke. Image by Rik Hill, Tucson, AZ USA. March 15, 2016 01:48 UT.
Figure 5 (right). C. Herschel. Image by Maurice Collins, Palmerston North, New Zealand. August 26, 2015 07:35 UT.

4. Clerke, Agnes Mary (1842-1907) 21.7N, 29.8E, 6 km

Clerke was a British astronomer who wrote articles for the Edinburgh Review, the Encyclopedia Britannica, Nature, and The Observatory. She also wrote several books on the history of astronomy, including "A Popular History of Astronomy During the Nineteenth Century", as well as popular books on astronomical topics. Her understanding of the subject and clarity of writing generated significant questions for further research in astronomy and astrophysics. She was home-schooled, which produced a level of academic achievement that was unusual for women at the time. Her only experience as an observational astronomer occurred in 1888 when she spent three months at the Royal Observatory, Cape of Good Hope, Africa, at the invitation of its director, David Gill. Many of her articles were published anonymously, hence not always recognized.

Crater Clerke **(Fig. 4)** is a small, simple crater on the southeastern edge of Mare Serenitatis, west of the teardrop-shaped crater Littrow. The Apollo 17 landing site is nearby. Several rilles and ridges pass nearby

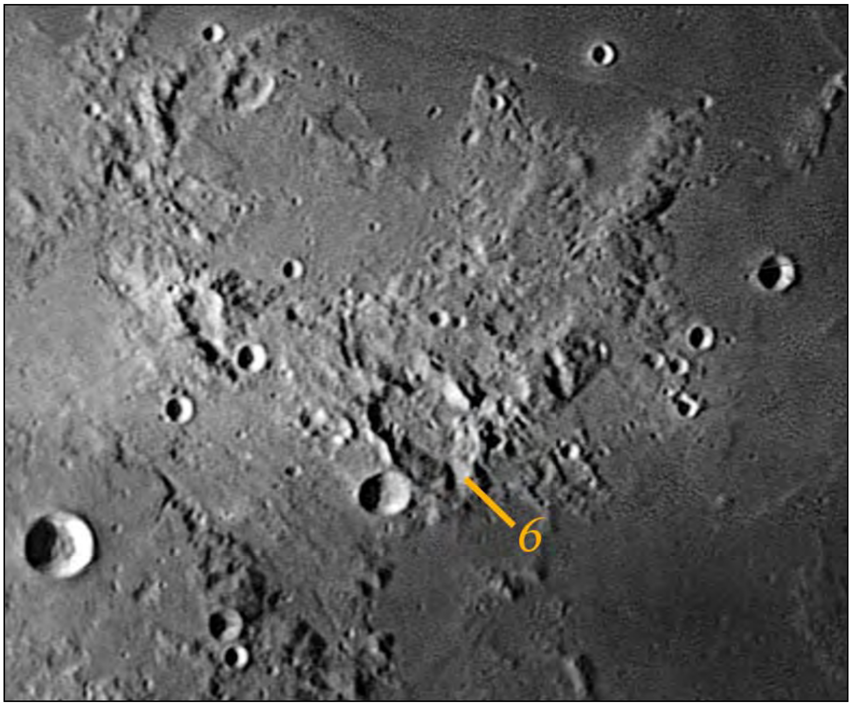
5. Herschel, Caroline Lucretia (1750-1848) 34.5N, 31.2W, 13 km

Caroline Herschel was a trained concert singer, but followed her older brother William into the field of astronomy. She specialized in searching for comets, of which she discovered eight. She also assisted her brother with his observing programs, identifying three new nebulae. Caroline learned how to grind and polish mirrors and build telescopes, creating with her brother, the most powerful telescopes in the world at the time. In 1787, King George III awarded Caroline a pension of £150 as her brother's assistant, making her the first female paid professional astronomer. In addition to her own observational programs and assisting William with observing, she prepared drafts of his papers for the Philosophical Transactions. She published an updated and corrected edition of Flamseed's star catalog. After William's death, she completed the catalog of nebulae and star clusters that he had observed, a work that earned her the 1828 Gold Medal of the Astronomical Society of London (now the Royal Astronomical Society). In 1847, William's son John completed the southern extension of this catalog. Caroline was elected an honorary member of the Royal Astronomical Society in 1835 at the same time as Mary Somerville.

C. Herschel **(Fig. 5)** is a small, flat-floored crater which is easily located on western Mare Imbrium. The crater is large enough to see some detail. It is situated on a low ridge that extends from Sinus Iridum to a little southwest of C. Herschel.

6. Hypatia (c. 370-415) 4.3S, 22.6E, 40 km

Hypatia was a mathematician and philosopher in Alexandria, possibly the earliest recognized woman scholar. She was the daughter of the mathematician Theon, who raised her more in the role of a son than in the traditional woman's role of the day. She is remembered for her love of learning and quality of her mathematics and astronomy teaching. She was head of the Alexandrine Neoplatonic School, and may have



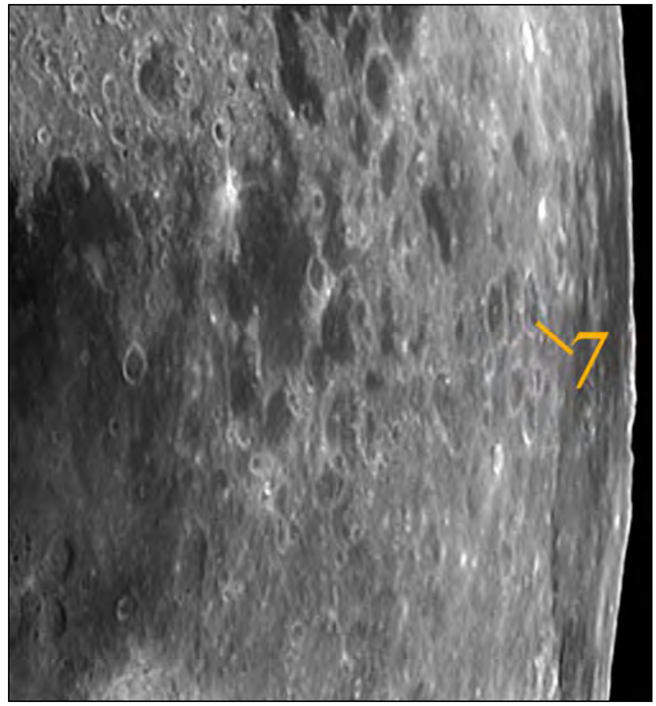


Figure 6 (left). Hypatia. Image by Rik Hill, Tucson, AZ USA. October 3, 2015 09:17 UT.
Figure 7 (right). Jenkins. Image by Alexander Vandenbohede, Brugge, Belgium. December 28, 2014 20:15 UT.

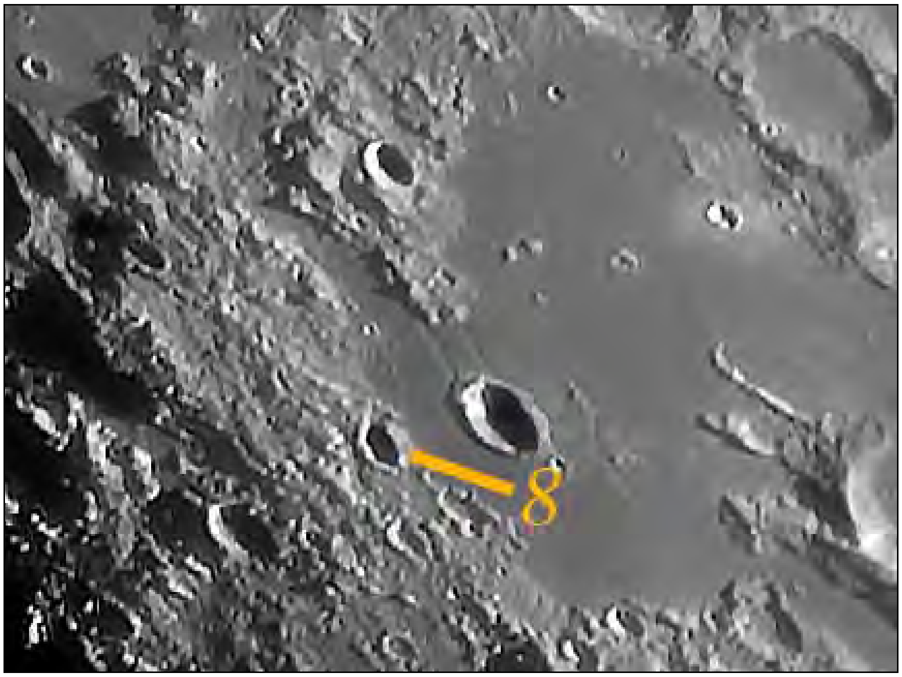
written commentaries on the Arithmetica of Diophantius, of Alexandria, the Conics of Apollonius, and the astronomical works of Ptolemy, none of which survive today. As a pagan, she was slashed and stoned to death and her dismembered body scattered in Alexandria by Christian zealots, who blamed her charisma and excellent teaching for preventing the Roman Prefect Orestes from accepting the "true faith." Her death is considered by some to mark the end of the classical world.

Hypatia **(Fig. 6)** is a very irregularly shaped crater on the northwest shore of Sinus Asperitatis. A small, well-defined crater, Hypatia A, is on the outer southwest wall. Hypatia has considerable internal structure, including superimposed, degraded craters, small pits and ridges. The area around Hypatia is also complex, with crater chains and valleys. In particular, note the intersecting valleys just northwest, and the parallel gouges just southeast of Hypatia. Also, the banded crater Torricelli C on the mare near the right edge of Fig. 6, and the unnamed crater just east of Hypatia D & DA which appears fluted due to several small craters on its rim. It's difficult to decide whether Hypatia is an old crater that has been highly modified by subsequent impacts, a fortuitous combination of several craters, or just an oddly shaped gap between the surrounding peaks.

7. Jenkins, Louise Freeland (1888-1970) 0.3N, 78.1E, 38 km

Jenkins was an American astronomer who held several positions during her career. At Mt. Holyoke College, she served as an assistant astronomer at the observatory (1911-1915), and astronomy instructor (1915-1920). She was also chief of computation at the Allegheny Observatory (1913-1915). She then spent 12 years as a Baptist missionary in Japan, before returning to the U.S. and taking up a position as a staff member at Yale University Observatory (1932-1958), continuing as a volunteer into 1968. She was co-editor of the Astronomical Journal (1942-1958), co-author of the General Catalog of Stellar Parallaxes, edited the 3rd edition of the Yale Bright Star Catalog, and produced a catalog of stars within 10 parsecs of the Sun. Throughout her career, she studied variable stars and was the first woman to observe them from Japan.

Crater Jenkins **(Fig. 7)** is a moderate-size crater found between Mare Spumens and Mare Smythii, near the eastern limb. Because it is close to the limb, libration has a significant effect on observations. The small bright ray crater Petit on the northwest shore of Mare Spumens and the small bright crater Schubert A to its north help to locate Jenkins. Jenkins is the easternmost of three overlapping, similar size craters, Nobili, Schubert X and Jenkins. Nobili, on the west, noticeably overlies Schubert X. Jenkins only slightly impinges on Schubert X's east wall. Schubert J appears to slightly impinge on Jenkins southeast rim. Small craters on the rim appear as bright spots in high-Sun images. The floor is flat with few features.



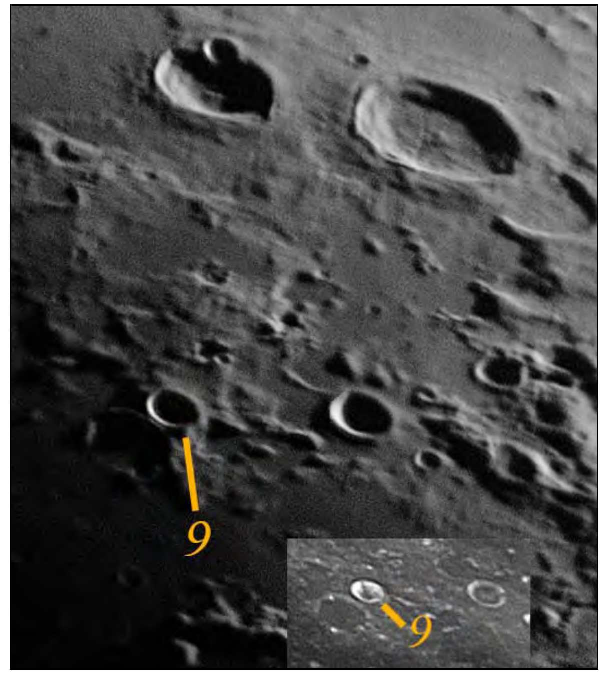


Figure 8 (left). Lepaute. Image by Howard Eskildsen, Ocala, Florida USA. February 18, 2016 23:46 UT.
Figure 9 (right). Maury. Image by Rik Hill, Tucson, AZ USA. July 21, 2015 02:58 UT. Inset by: Howard Eskildsen, Ocala, Florida USA. September 13, 2008 01:51 UT.

8. Lepaute, Nicole Reine Étable de la Brière (1723-1788) 33.3S, 33.6W, 16 km

A French astronomer, whose husband was royal clockmaker to Louis XV, Lepaute assisted Lalande in producing ephemerides for the annual Connaissance des temps. She also performed the calculations for Lalande and Clairaut which accounted for the gravitational effect of Jupiter and Saturn on the date of Comet Halley's return for its 1759 apparition. For the annular solar eclipse of 1764, she calculated the time and percentage of eclipse for all of Europe, publishing a map and tables. In his "History of Astronomy", Lalande paid tribute to her work, an unusual recognition for women in science in the 18th century.

Crater Lepaute **(Fig. 8)** is nicely placed for convenient observation on the western shore of Palus Epicardium, southeast of Mare Humorum. It's a small crater but large enough to discern some detail in its interior. The rille systems on Palus Epicardium are a stronger attraction to this area however.

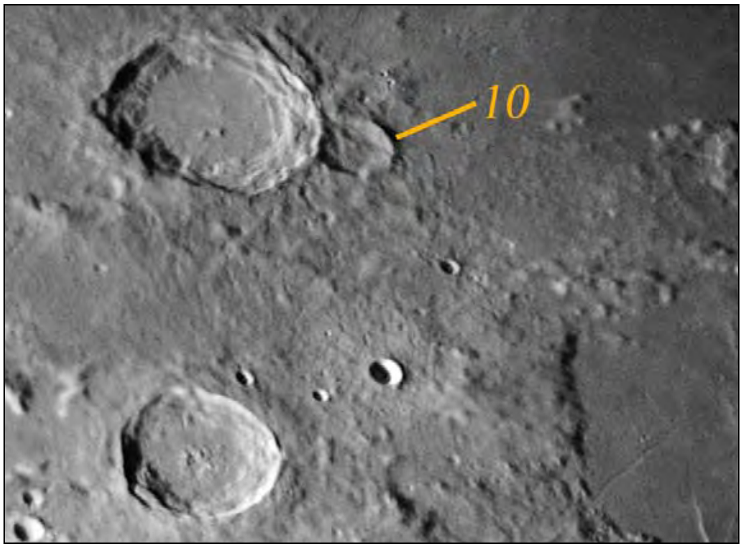
9. Maury, Antonia Caetana de Paiva Pereira (1866-1952) 37.1N, 39.6E, 17 km

Antonia Maury worked at the Harvard College Observatory as an astronomer after graduating from Vassar College in 1887 where she was one of the last students of Maria Mitchell. She participated in the spectral classification of northern hemisphere stars that resulted in the Henry Draper Catalog. Hired to classify stars on Edward Pickering's system, she instead created her own system, whose finer details Pickering regarded as useless. She recognized that the alphabetical classification system could be rearranged to represent the temperature of the star, created finer subdivisions and discovered the signatures of supergiants. It wasn't until 1907 that Ejnar Hertzsprung recognized that her system allowed stars to be grouped by temperature and luminosity (what is now known as the Hertzsprung - Russell diagram). In 1889, Pickering discovered the first spectroscopic binary, Mizar, and Maury discovered the second, beta Auriga. She was the first to measure their orbital periods. Her employment at Harvard ended in 1892, but she continued to analyze spectra as a guest until 1935, including an extensive analysis of the peculiar eclipsing binary, beta Lyrae. She lectured at several colleges, served as director of the Draper Park Museum, and was a recognized ornithologist and naturalist. She received the Annie J. Cannon Prize (named for her co-worker at Harvard) of the American Astronomical Society in 1943, the only major recognition she received. The crater Maury's name represents both her and American Oceanographer Matthew F. Maury.

Maury **(Fig. 9)** is a small crater on the eastern shore of Lacus Somniarum, northeast of Posidonius and south of the Atlas Hercules pair. It's easy to identify, conveniently placed for observing, and probably best known as a banded crater. The inset in Fig. 9 shows the bands that are visible when the Sun is high in Maury's sky.

10. Mitchell, Maria (1818-1889) 49.8N, 20.2E, 30 km

Maria Mitchell was the first American female astronomer and the first woman



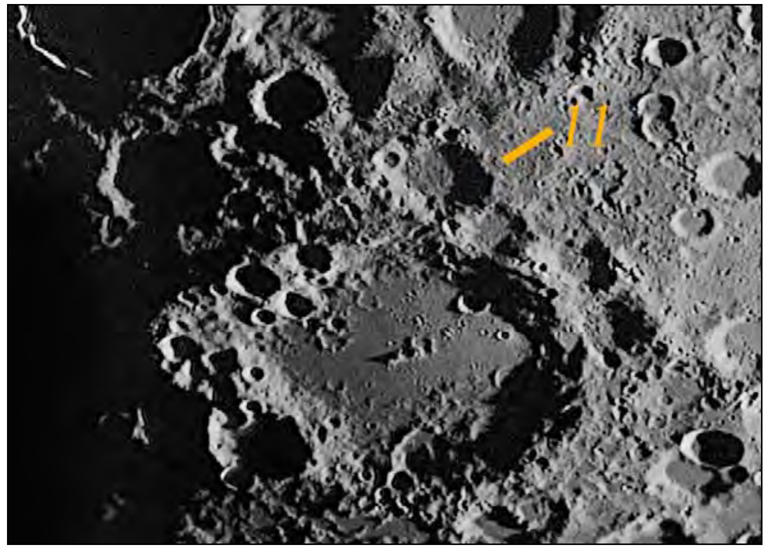


Figure 10 (left). Mitchell. Image by Rik Hill, Tucson, AZ USA. October 3, 2015 08:08 UT.
Figure 11 (right). Proctor. Image by Rik Hill, Tucson, AZ USA. July 13, 2016 03:34 UT.

elected to the American Academy of Arts and Sciences. She was born on Nantucket Island, Massachusetts. Her interest in astronomy was triggered by the return of Halley's Comet in 1835. She began by observing with her father, helping him with his observations and computations. Her father was a well-known astronomer who calibrated chronometers for merchant vessels and whaling ships on Nantucket. Besides timekeeping, they observed solar system objects and searched for comets, resulting in several independent discoveries. The king of Denmark awarded her a medal for discovering Comet C/1847 T1 (Mitchell) and calculating its hyperbolic orbit. She had been working as a teacher and librarian, but the fame resulting from the discovery and award led to a position as a computer for the American Ephemeris and Nautical Almanac, providing her with income that allowed her to travel throughout the U.S. and later throughout Europe. Her observatory on Nantucket Island housed a 5-inch Alvan Clark refractor. In 1865, she became the first professor of astronomy at Vassar College. The college observatory housed a 12-i-inch refractor which Mitchell and her students used for visual measurements of double stars and planets. Many of her students went on to work as computers at Harvard, Lick, and Mount Wilson Observatories. In 1888, she retired from Vassar and returned to Nantucket.

Mitchell **(Fig. 10)** is a moderate-size crater that is very easy to identify, since it is adjacent to the east wall of well-known and often-viewed Aristoteles. Aristoteles slightly overlies the west wall of Mitchell and Mitchell appears more eroded than Aristoteles, which indicates that Mitchell is the older of the two. Details in the eastern portion of Mitchell appear smoother than the western third. My impression is that the formation of Aristoteles simply buried Mitchell's west wall under its outer wall and covered the rest of the crater under a coating of fine debris.

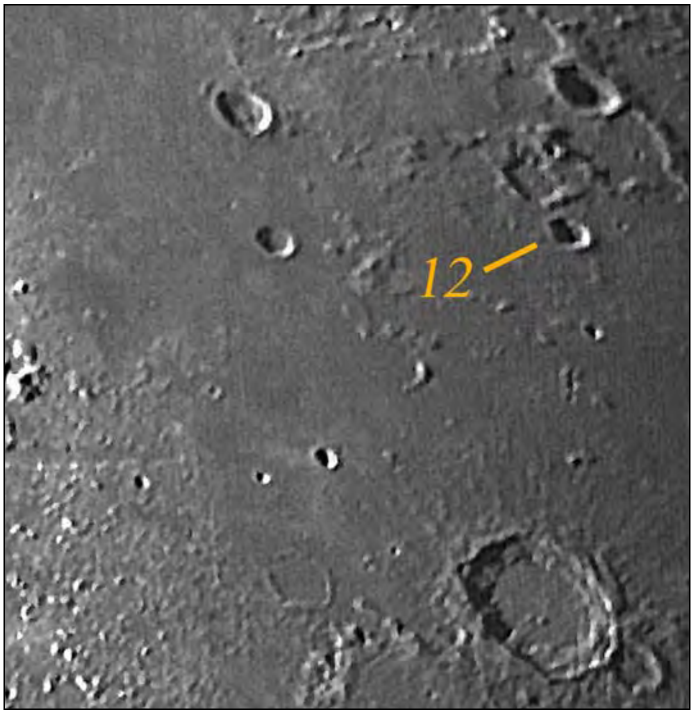
11. Proctor, Mary (1862-1957) 46.4S, 5.1W, 52 km

Born in Ireland and daughter of the astronomer Richard Proctor, Mary is known for writing popular articles and books on astronomy. The family emigrated to the United States in 1881 and settled in St. Joseph, Missouri. She assisted with the journal Knowledge which her father had founded and wrote several articles on comparative mythology and astronomy. She worked at the 1893 World Colombian Exhibition in Chicago, delivering children's lectures which were also popular with adults. Many of her books and articles were aimed at children, and she became known as the Children's Astronomer.

Proctor **(Fig. 11)** is a medium-size crater in the southern lunar highlands. The southern highlands are a complicated area to navigate, particularly in the southeastern sector, but Proctor is not difficult to identify since it is adjacent to the north wall of the large crater Maginus, which in turn is between easily identified Tycho and Clavius. In Fig. 11, Tycho is the large shadowed crater on the upper left edge. Proctor is heavily eroded and peppered with small craters. Nearby Heraclitus is oddly rectangular and linear structures are obvious in the region southeast of Maginus. Linear structures are, in fact, abundant throughout this area once you start looking for them, including the walls of Proctor and Maginus.

12. Sheepshanks, Anne (1789-1876) 59.2N, 16.9E, 25 km

Philanthropist Anne Sheepshanks was the sister of British astronomer Richard Sheepshanks. In 1857, she donated her brother's extensive collection of astronomical instruments to the Royal Astronomical Society. She also endowed the Sheepshanks Exhibition at Cambridge and donated funds for the advancement of astronomy and related



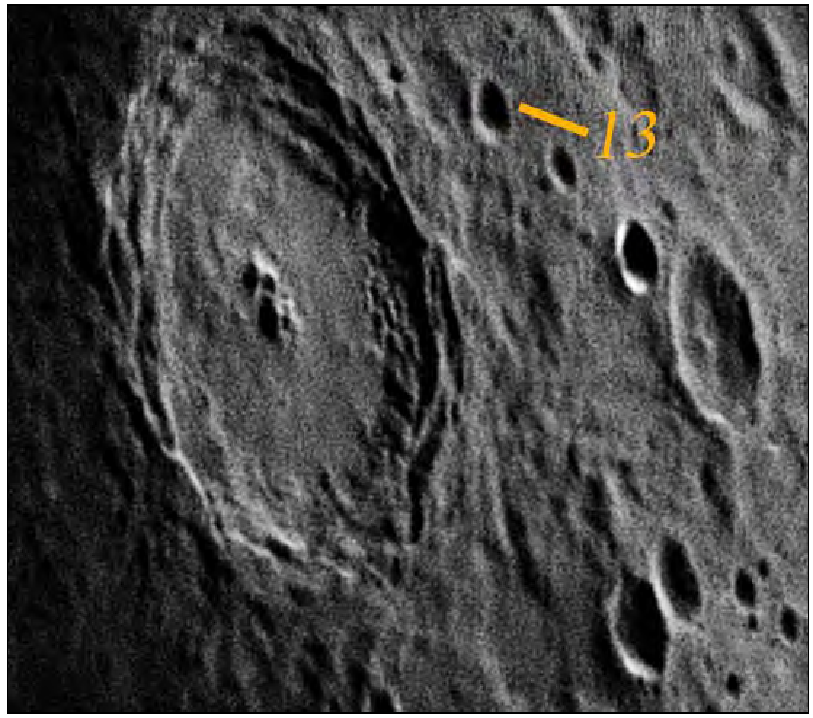


Figure 12 (left). Sheepshanks. Image by Jay Albert, Lake Worth, FL USA. September 3, 2015 06:19 UT.
Figure 13. (right) Somerville. Image by Rik Hill, Tucson, AZ USA. July 09, 2016 03:21 UT.

sciences and for a new transit instrument at Cambridge Observatory. She was elected an honorary member of the Royal Astronomical Society in 1862.

Sheepshanks (Fig. 12) is a moderate-size crater near the northern edge of Mare Frigoris, north of Aristoteles. Some terracing is visible on its inner walls. This area of Mare Frigoris is not as bland as other maria, small craters and hills dot the surface. Rima Sheepshanks also extends eastward across the mare from southeast of the crater.

13. Somerville, Mary Fairfax Grieg (1780-1872) 8.3S, 64.9E, 15 km

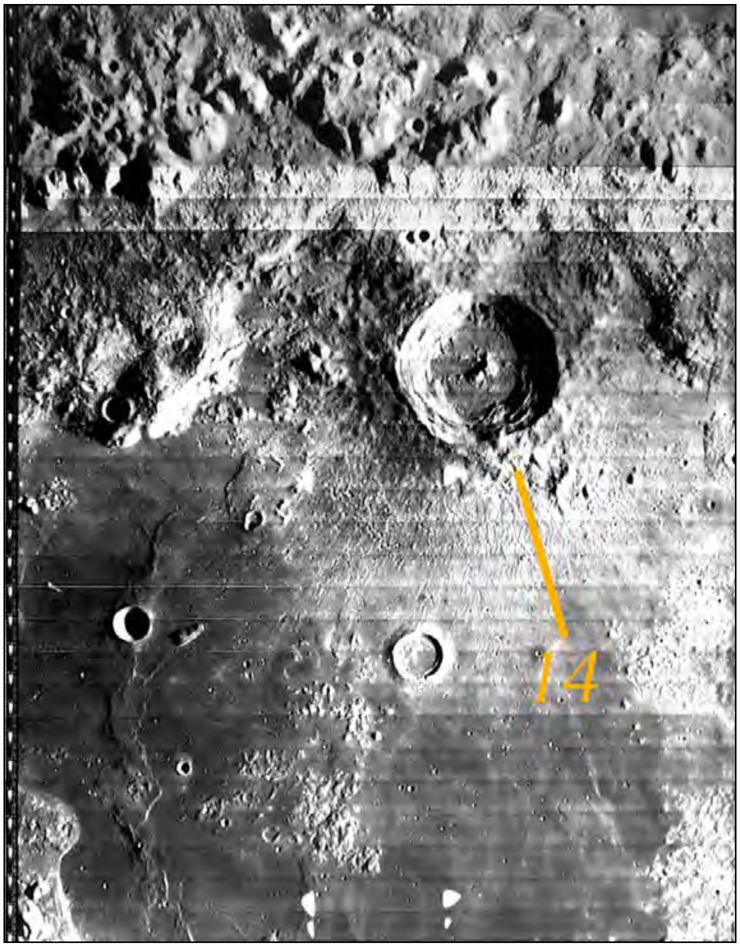
Scottish physicist and mathematician Mary Somerville was self-educated and developed her international reputation on her own, without working with a father, husband or brother. She performed experiments on magnetism, resulting in the first paper by a woman (excepting Caroline Herschel's observations) presented to and published by the Royal Society. She also translated, provided commentary on, and filled in the mathematical development in Laplace's "Celestial Mechanics". The 1836 edition of her book "The Connection of the Physical Sciences" contained a discussion of the problems with the orbits of the outer planets which suggested that the discrepancies may reveal the existence, mass and orbit of a body beyond Uranus. John Adams said that this passage inspired him to begin the calculations that led to the discovery of Neptune. Somerville was elected an honorary member of the Royal Astronomical Society in 1835, simultaneously with Caroline Herschel. She supported women's education and suffrage. The first signature on John Stuart Mills' petition to parliament for the right of women to vote is hers.

Somerville **(Fig. 13)** is a small, mostly featureless crater east of Langrenus. A highly eroded, shallow dish, Langrenus H is tangent to its northwest wall, and a distinct, flat-bottomed cone crater, Langrenus M lies to its southeast, next to Barkla.

Women in the Libration Zone

14. Maunder, Annie Scott Dill Russell (1868-1947) 14.6S, 93.8W, 55 km

Annie Russell was the daughter of a Presbyterian minister. Raised in Ireland, she attended the Ladies Collegiate School, Belfast, the premier girls' secondary school in Ireland. Deciding not to pursue an Irish University degree, she instead took the Girton College open entrance exam. Upon graduation, she won the Senior Optime in mathematics, the highest honor available to a woman in the mathematical tripos. At the time, women were allowed to sit for the Cambridge tripos exam, but could not be awarded a university degree. She taught college mathematics until learning of an opening for a "lady computer" at the Royal Greenwich Observatory, which she accepted at much lower pay than her teaching position. There, while measuring daily solar photos, she met solar astronomer E.W. Maunder. In 1890, she helped establish the British Astronomical Association (BAA). She was the first editor of the BAA journal (1894-1896) and resumed the editorship



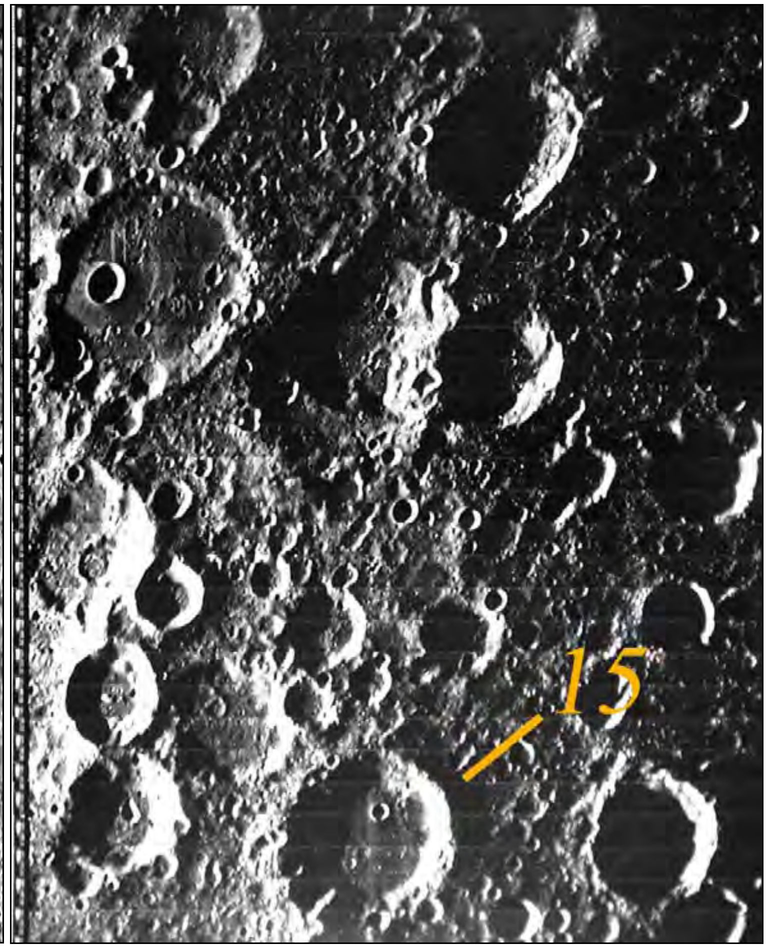


Figure 14 (left). Maunder. Source: Digital Lunar Orbiter Atlas of the Moon. LPI/USRA/NASA, Houston, TX, USA. Image #: iv-195-h2 . http://www.lpi.usra.edu/resources/lunar_orbiter/

Figure 15 (right). Nöther. Source: Digital Lunar Orbiter Atlas of the Moon. LPI/USRA/NASA, Houston, TX, USA. Image #: v-006-h3 . http://www.lpi.usra.edu/resources/lunar_orbiter/

later (1917-1930). She married Maunder in 1895 and, although she had to relinquish her paid position as his assistant, continued to work with him on solar studies. Her work included studies of sunspot distributions and eclipse photography of the corona. She also performed a photographic study of the Milky Way. Throughout her career, she continued to work with the BAA, encouraging other women and amateur astronomers. The crater Maunder is named for both Annie and her husband Edward Walter.

Maunder **(Fig. 14)** lies on the northern boundary of Mare Orientale, visible only when libration favors the west limb by more than 4 degrees. It's a moderately large crater, with a central peak and terraced walls. Maunder is the most accessible of the three craters in the libration zone.

15. Nöther, Amalie Emmy (1882-1935) 66.6N, 113.5W, 67 km

Nöther was a German mathematician who specialized in abstract algebra. She originally intended to teach French and English, but instead studied mathematics at the University of Erlangen where her father taught. After completing her dissertation in 1907, she spent seven years in an unpaid position at the Mathematical Institute of Erlangen until David Hilbert and Felix Klein invited her to join the mathematics department at the University of Göttingen. However, because of faculty bias against women, and despite Hilbert's indignant protests, she remained in unpaid positions until 1923. Her lectures were listed in Hilbert's name with her assisting. In 1933, she emigrated to the United States when the Nazi government dismissed Jews from university positions, and accepted a position at Bryn Mawr College. She has been described as the most important woman in the history of mathematics. The Nöther theorem in physics shows that conservation laws are a result of symmetry.

Nöther **(Fig. 15)** is a moderately large crater located at the extreme limit of libration on the northwest limb, in a densely cratered area. Because of the libration requirement, opportunities to observe it are extremely limited. Even identifying it will be a challenge.

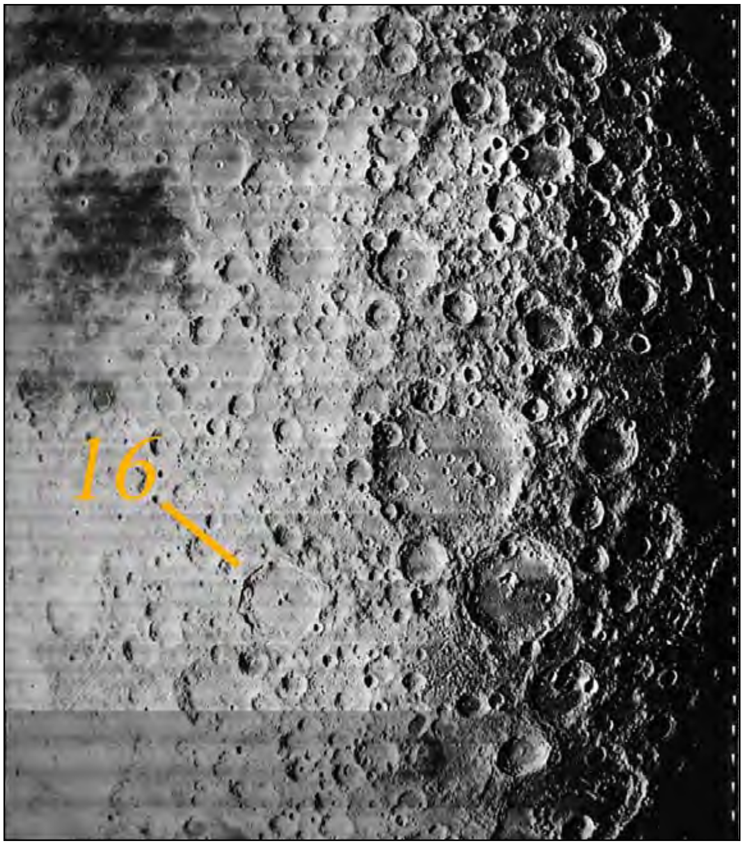


Figure 16. Sklodowska. Source: Digital Lunar Orbiter Atlas of the Moon. LPI/ USRA/NASA, Houston, TX, USA. Image #: ii-196-m. http:// www.lpi.usra.edu /resources/ lunar_orbiter/

16. Sklodowska, Maria Salomea (1867-1934) 18.2S, 95.5 E, 127 km

Maria Sklodowska, a Polish physicist, chemist and Nobel laureate, is probably better known to most as Madame Curie (Marie Sklodowska-Curie). She was educated at the Sorbonne in Paris, obtaining degrees in mathematics and physics. She was interested in the newly discovered Roentgen rays and radiation from uranium. She married Pierre Curie in 1895 and they continued investigating uranium's radiation together (Marie coined the term “radioactive”). To advance their investigations, Marie invented instruments to quantitatively measure radiation. In 1898, they showed that another radioactive element must also be present in the uranium ore, which they named Polonium in honor of Marie's homeland, and also detected the presence of a third radioactive element which they named Radium. Four years later, Marie had isolated enough radium to determine its atomic weight. Marie received a Doctor of Science degree in 1903. Also in 1903, Marie and Pierre Curie and Henri Becquerel shared the Nobel Prize for Physics for their discovery of radioactivity. After Pierre's accidental death in 1906, Marie assumed the chair of physics at the Sorbonne. In 191, she received the Nobel Prize for Chemistry for the discovery of radium and polonium, making her the first scientist to win the Nobel Prize twice. She also received the Davy medal of the Royal Society in 1903 and 1921. Her death from leukemia was probably caused by radiation exposure throughout her life.

Crater Sklodowska **(Fig. 16)** is located in the eastern libration zone, midway between, and east of Mare Smythii and Mare Australe. This is a large crater with a central peak complex and terraced inner walls.

Additional Reading

International Astronomical Union (IAU) Working Group for Planetary System Nomenclature (WGPSN). Gazetteer of Planetary Nomenclature. http:// planetarynames.wr.usgs.gov/

Gillis, J.J. ed.. Digital Lunar Orbiter Photographic Atlas of the Moon. LPI Contribution #1205. Lunar & Planetary Institute/USRA, Houston, TX http:/ www.lpi.usra.edu/resources/ lunar_orbiter/

Cocks, E.E. & J.C. Cocks. 1995. Who's who on the Moon: A Biographical Dictionary of Lunar Nomenclature. Tudor Publ. Inc., Greensboro. (ISBN:0-936389-27-3).

Dreyer, J.L.E. & H.H. Turner (eds.). 1923. History of the Royal Astronomical Society 1820-1920. Royal Astronomical Society, London. (Reprint, 1987, Blackwell Scientific, Oxford. (ISBN 0-632-02173-X).

Evershed, Mrs. John. 1938. Memoirs of the Britsh Astronomical Association Vol. 34, Pt 1. “Who's Who in the Moon”.

Hockey, Thomas (ed. In chief). 2007. Biographical Encyclopedia of Astronomers. Springer Science+Business Media¸LLC, New York. (ISBN: 978-0-387-35133-9)

Rukl, Antonin. 2004. Atlas of the Moon, revised updated edition, ed. Gary Seronik, Sky Publishing Corp., Cambridge. (ISBN: 1-931559-07-4)

— Wikipedia. “Emmy Noether”. https:// en.wikipedia.org/wiki/Emmy_Noether (retrieved Aug. 15, 2016).

Taylor, M. 1998. Agnes Scott College. “Emmy Noether”. https:// www.agnesscott.edu/lriddle/women/ noether.htm (retrieved Aug. 15, 2016).

"Marie Curie - Biographical". *Nobelprize.org.* Nobel Media AB 2014. Web. http://www.nobelprize.org/ nobel_prizes/chemistry/laureates/1911/ marie-curie-bio.html (retrieved Aug. 15, 2016).

Table 1. Women on the Moon

Name	Birth-Death	Crater Name	Location
Blagg, Mary Adela	1858-1944	Blagg	Near side
Bruce, Catherine Wolfe	1816-1900	Bruce	Near side
Catharina	?-307	Catharina	Near side
Clerke, Agnes Mary	1842-1907	Clerke	Near side
Herschel, Caroline Lucretia	1750-1848	C. Herschel	Near side
Hypatia	370-450	Hypatia	Near side
Jenkins, Louise Freeland	1888-1970	Jenkins	Near side
Lepaute, Nicole Reine Étable de la Brière	1723-1788	Lepaute	Near side
Maury, Antonia Caetana de Paiva Pereira	1866-1952	Maury	Near side
Mitchell, Maria	1818-1889	Mitchell	Near side
Proctor, Mary	1862-1957	Proctor	Near side
Sheepshanks, Anne	1789-1876	Sheepshanks	Near side
Somerville, Mary Fairfax Grieg	1780-1872	Somerville	Near side
Maunder, Annie Scott Dill Russell	1868-1947	Maunder	Libration zone
Nöther, Amalie Emmy	1882-1935	Nöther (Noether)	Libration zone
Sklodowska, Maria Salomea	1867-1934	Sklodowska	Libration zone
Bok, Priscilla Fairfield	1896-1975	Bok	Far side
Cannon, Annie Jump	1863-1941	Cannon	Far side
Cori, Gerty Theresa Radnitz	1896-1957	Cori	Far side
Fleming, Williamina Paton	1857-1911	Fleming	Far side
Kovalevskaya, Sofia Vasilyevna	1850-1891	Kovalevskaya	Far side
Leavitt, Henrietta Swan	1868-1921	Leavitt	Far side
McAuliffe, Sharon Christa Corrigan	1948-1986	McAuliffe	Far side
Meitner, Lise	1878-1968	Meitner	Far side
Resnik, Judith Arlene	1949-1986	Resnik	Far side
Tereshkova, Valentina Vladimirovna Nikolaeva	1937-	Tereshkova	Far side

Feature Story

ALPO Observations of Mars During the 2005 Apparition

By Richard W. Schmude, Jr., Assistant Coordinator, ALPO Mars Section (photometry and polarimetry)
schmude@gordonstate.edu

Abstract

This report summarizes observations of Mars made during the 2005 apparition. Olympus Mons grew very bright in early November. It is concluded that this brightening is caused by the low solar phase angle along with other factors. Maps of the SPC for 2005 and 2003 are presented. Dust storms in August and late October were imaged. The October dust storm caused many of the clouds, including the North Polar Hood (NPH) and South Polar Hood (SPH), to fade. The SPH started to develop in late August 2005 at L_S = 274°. Parts of the hood appeared in September and the first part of October. It grew thicker in December (L_S = 336°). Clouds were imaged in Tharsis, Edom, Libya and Argyre. The larger Martian moon, Phobos, was imaged and it reached greatest eastern elongation at the predicted times.

Introduction

The planet Mars was in a favorable location for observers at north temperate latitudes in late 2005. Its southern hemisphere was tipped towards the Earth during that time and was experiencing late spring and summer. McKim (2011a, b) gives a good summary of the apparition. Mallama (2007) and Schmude (2009) summarize brightness and polarization measurements of the planet during the 2005 apparition. This report summarizes images of that planet recorded mostly by amateurs. Topics covered include: the surface, SPC, dust storms condensate clouds and Mars' largest moon, Phobos. Figures 1 – 4 show images of Mars made in 2005 and early 2006. Important trends include the brightening of Olympus Mons near opposition (Figures 1I, 2F and 2G), the shrinking of the SPC (Figures 1A – 1H, 2A, 2B and 4) and the development of dust storms (Figure 3).

In this paper, certain conventions are followed. Unless stated otherwise, south will be near the top. The areocentric longitude (L_s) defines the season on Mars. The beginning of southern autumn, winter, spring and summer are at L_s 0°, 90°, 180° and 270°, respectively. All longitudes are measured westwards. Abbreviations are introduced and then used afterwards. Specific images cited in this report may be found at the ALPO Japan Latest website at: *alpo-j.asahikawa-med.ac.jp/Latest/Mars.htm*. All latitude and longitude coordinates not cited in other sources were measured by the writer using WinJupos. Areas were computed assuming an elliptical or circular shape and using the areas for a circle or ellipse.

The characteristics of the 2005 apparition are summarized in Table 1. Table 2 lists the individuals who submitted observations during this apparition.

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).

Table 1: Characteristics of Mars During Its 2005 Apparition[a]

First conjunction date	September 15, 2004
Opposition date	November 7, 2005
Second conjunction date	October 23, 2006
Angular diameter (opposition)	20.0 arc-seconds
Brightness (magnitudes)	-2.3
Right Ascension (opposition)	2h 51m
Declination (opposition)	+15.9°
Sub-Earth latitude	15.8° S
Areocentric longitude - L_S (opposition)	320°

[a] The Astronomical Almanac for the years 2004, 2005 and 2006.

Methods and Materials

The software package "WinJupos" was used in measuring the positions of features on an image. Essentially, an image is given the name YYYY-MM-DD-TTTT.T-other optional information. The YYYY is the four-digit year on the Gregorian Calendar, the MM is the month starting with January (01), DD is the date, the TTTT.T is the universal time rounded to the nearest 0.1 minutes and the other information is optional; it is anything which will help identify the image. For example, if the writer records

Table 2: List of Contributors to this Mars Apparition Report (along with their country, telescope aperture in meters and the type of telescope* used)

Acquarone F., Italy, .24 SC	Fattinnanzi C., Italy, .25 RL	Llewellyn D., USA, .50	Rizzato G., Italy, .28 SC
Adachi M., Japan, 0.31 RL	Fell D., Canada, .15 RR	Licchelli D., Italy, .26 DK	Robbins S. .15 RR
Adalaar J., Netherlands, several	Fisher J., .25 RL	Lomeli E., USA, .23 SC, .10 RR	Roel E., Mexico, .25 M
Agaus J.	Friedman A., USA, .25 MC	Looby M., USA .20 MN	Rosolina M., .20 SC
Allen E., USA, .20 SC	Fukui H., Japan, .25 DK	Lunsford R., .24 SC	Russo V., Italy, .23, .24 SC
Akutsu H., Japan, 0.28 RL	Gamble K.	Manner M., USA, .15 RR	Sabia J., .24 RR
Amadori V., Italy, 0.20 RL	Garofalo R., Italy	Matsumoto H., Japan, .30, .31 RL	Sanchez J., Spain, .20 SC
Anderson D., USA, 0.33	Gasparri D., Italy, .23 SC	Matsumoto N., Japan. .40 RL	Santacana G., USA.13 RR
Arai M., Japan, 0.28 RL	Gentry C., USA	Maxson P., USA	Santos E.
Arbuckle S. 0.18 MC	Go C., Philippines, .20 SC	McCullough J., USA, .36 SC	Schaeffer G., USA, .50 Obsesson
Arditti D., UK, 0.25 DK	Gorczynski P., USA, .18 MC	McKim R., UK	Schmidt M., USA, .36 SC
Baldoni P., Italy, 0.26 RL	Gorerstein I.	Meeckers O., Belgium .36 SC	Schmude R. Jr., USA, .12 RR
Ball A., 0.20 SC	Grafton E., USA, .36 SC	Meier R, Canada, .36 SC	Schulz R., Austria, .32 RL
Barton T., USA, 0.15 m RR	Grassmann G., Brazil, .25 SC	Melillo F., USA, .20 SC	Seip S.
Barucco D., Italy, 0.25 RL	Hähnel J., Germany, ..06 RR	Melka J., USA, .30 RL	Sharp I., UK, .20 & .38 RL
B[ee] R., USA, 0.13	Hansen J., USA, .28 SC	Mishina T., .20 RL	Sharp T., UK, .20 RL
Bell C., USA, 0.30 SC	Hansen K., USA, .28 SC	Mobberley M., UK, .25 RL	Sheff J., .23 RR
Bihel D., France, 0.6 C	Hatanaka A., Japan, .40 & .45 C	Montes M.	Sherrod C., USA, .41 SC
Biver N., France, 0.26 RL	Hayashi T., Japan, .36 SC	Moore D., USA, .25 RL	Sonka A., Romania, .23 SC
Bolzoni S., Italy, 0.20 SC	Heffner R., Japan, .28 SC	Moore J., UK, .18 MN	Sorenson J., Denmark
Bosman R., Neth., 0.28 SC	Hernandez C., USA, .23 MC	Morita M., Japan, .20 RL	Strikis J.D. .15 RR
Botallo D., Italy, 0.25 MG	Higgins Wl, USA, .46 SC	Nakai K., .25 SC	Suzuki T., Japan.18 MC
Brandt J. D. R. Neth., 0.20 RL	Hill R., USA, .36 SC	Nakamura J., Japan, .16 RL	Takimoto I., Japan, .31 RL
Budine P., USA, 0.15 M	Hinkle R., .25 SC	Nakanishi H, .30 RL	Takimoto K., Japan .15 RL
Bunge B., USA, 0.11, 0.43 RL	Hoehne B, .46 RL	Nam K.H., Korea, .20 SC	Talley M., Thailand, Mewlon
Cancelli S., Canada, 0.20 SC	HST Team	Neichi M., Japan, .25 RL	Tändler U., Germany, .13 RR
Carvalho F., Brazil, 0.25 RL	Hsuan-Hsiao C., Taiwan, .30 SC	Ng E., HK, China, .25 RL	Tasaka I., Japan, .73 C
Casquinha P., Portugal, .25 RL	Hunter D., UK, .25 RL	Niikawa M., Japan, .28 SC	Tasselli A., UK
Cellini C., Italy, 0.30 SC	Ikemura T., Japan, .31 RL	Nishina A., Japan, .30 C	Taylor M., .20
Chang D., Hong Kong (HK),, China, .20 & .25 SC	Jakiel R., USA, .28 SC	Nonoguchi T., Japan, .11 RR	Teichert G., France
Chaves R., USA, 0.25 MK	Jefferson J., UK, .13 MC	Nunes R., Portugal, .20 SC	Teodorescu M., Romania, .11 RL, .23 SC
Chavez R., USA, 0.25 MC	Joehue B., .46 m	Numazawa S., Japan, .28 RL	Tomita Y., Japan, .26 RL
Chasiotis E., Greece, .13 MC	Jones A., .25 SC	Okamoto Y., Japan, .20 SC	Trapani D., USA, .36 SC
Chester G., USA, .20 SC	Jones J., USA, .18 RR	Okuda K., Japan, .25 RL	Turner B., Australia, .25 RL
Colville B., Canada, .30 SC	Jones M., USA, .18 RR	Olivetti T., Thailand .18 MC, MN	Uri G., Italy, .40 RL
Comolli L, Italy, .31 RL	Ju K., Korea, .20 SC	Ota S., Japan, .20 RL	Valimberti M., Australia, .36 SC
Cook C., USA .23 SC	Kanno S, Japan, .25 RL	Owens L., USA, .36 SC	Vandebergh, R., Neth. .25 RL
Corrao F., Italy, .28 SC	Kazemoto A, Japan, .31 RL	Parker D.C., USA, .41 RL	Vandenbulcke G, Belgium, .28 SC
Crandall E., USA, .11 APO	Ki K., Korea, .20 SC	Parker T., USA, .31 SC	Viegas, N.
Daversin B., Fran., .20 MC, .6 C	King B., .25 RL	Peach D., UK, .24 SC	Wada S., Japan.15 RR
Davidson J., Brazil, .20 SC	Kirchhoff J., USA, .24 SC	Pellier C., France, .36 SC	Waddington B., USA, .25 SC
Davidson J. Saudi Arabia, .13 SC	Koishikawa M., Japan, .26 RL	Pettenpaul O., .23 SC	Walker S., USA, .13 & .18 MN
DeFreitas A., .20 SC	Kolovos D, Greece, .28 SC	Phillips J., USA, .25 Apochramat	Warren J., USA, .20 SC
Delcroix M., France, .25 SC	Kondou H., .13 RR & .15 MN	Porredon F., Spain, .20 SC	Weigand M., Germany, .28 SC
Dench D., .30 SC	Kristensen M., .32 RL	Portero J., Spain, .20 SC	Yoneyama S., 0.20 RL
Dickinson B., USA.20 SC	Kumamori T., Japan, .20 DK .6 C	Porteus M., USA, .1 RR .25 RL	Yunoki K., Japan, .20 RL
Dierick D., .23 SC	Labrevoir O., France, .6 C	Pujic Z., Australia, .31 RL	Zannelli C., Italy, .18 MN, .24 SC
Dittié, G. processed an image	Lau C., HK, China, .35 SC	Pulley H.	Zannotti F., Italy, .24 SC
Einaga H., Japan, .25 RL	Lawrence P., UK, .25 SC	Quin K., USA, .20 SC	
Evans C., UK, several	Lazzarotti P., Italy, .25 RL	Rivas D., Peru, .20 SC	
Fabian K., USA, .13 RR, .20 SC	Lecci V., Italy, .20 RL	Rivera-Morales E., USA .25 SC	

*C = Cassegrain; DK = Dall-Kirkham, M = Maksutov, MC = Maksutov-Cassegrain, MG = MAksutov-Gregory; MN = Makuutov-Newtonian; RL = Reflector, RR = refractor, SC = Schmidt-Cassegrain and SN = Schmidt-Newtonian an image on June 8, 2005, at 00:30:30 UT, the name would be 2005-06-08-0030.5-Schmude. Once an image is loaded into the software, a grid appears. The grid was oriented with respect to albedo features like the northern tip of Margaritifer Sinus. If a known albedo feature did not match its position to within a few degrees, the image was rejected.

The Surface

Region I: 250° W - 10° W

Figures 1F, 1H, 1J, 4C and 4D show the main features in this region. A bright spot surrounded by a dark, circular ring was at the southern edge of Hellas. See Figures 1F and 4D (arrow). Measurements made on an August 15, 2005, image show that it is centered at 56° S, 292° W and has a radius of 200 km. It is near Amphitrites Patera (59.0° S, 298.9° W), which is a “shallow, circular caldera-like structure” (Carr, 2006, 69). The circular ring may have also been imaged on October 11, 1941 (Slipher, 1962, plate XIV) and October 17, 1941 (Slipher, 1962, Plate IX). It was also imaged by Stephen Larson and Gary Rosenbaum in 1988 (McKim, 1991, p. 264).

Hellas is the lowest point on Mars. During the summer, it is usually bright with faint albedo markings. In the winter, it becomes very bright - probably because of CO_2 frost and/or clouds. One question is does the albedo control where winter frost and/or clouds develop? To answer this question, the writer measured the northern boundary of Hellas. Essentially, the northern boundary Hellas area extends to 30° S at 293° W. This is near the frost/cloud limit of Hellas in early 2014 at 293° W (Schmude, 2014, 114).

Region II: 10° W - 130° W

Figures 1G, 1I, 2B, 2F, 3A and 3B show the general appearance of this region. There was a small bright area to the south of Solis Lacus. See Figure 1I (arrow). The writer carried out measurements of it. It was approximately circular with a radius of 100 km. It was centered at 41° S, 94° W. This is at the southern boundary of Warrego Vallis (Carr, 2006, xi). On the geological map, it corresponds to "eNh" which is described as “early Noachian highland unit” (Tanaka et al., 2014). It is also visible in images recorded by Stephen Larson and Gary Rosenbaum in 1988 (McKim, 1991, p. 264).

Ascreus Mons was visible as a bright spot near opposition. It had a nearly circular shape and was centered close to the caldera (Carr, 2006, p. 6). See Table 3. The other two large Tharsis volcanoes (Pavonis Mons and Arsia Mons) were not imaged as bright spots. These two are not visible on Hatanaka's November 1 image at 15:40:44 UT, even though they were near the morning limb and, hence, should have been free of clouds. Low contrast may be the cause. An August 27, 2003 HST image shows large bright orange areas near Arsia and Pavonis Mons. Therefore, nearby bright areas may have reduced the contrast of these two volcanoes.

A small bright spot north of Ascreus Mons is visible in an HST image recorded on August 27, 2003. It corresponds to Ceraunius Patera. This volcano is six kilometers high and has dimensions of 125 by 94 kilometers (Carr, 2006, p. 57). The coordinates of the bright spot are listed in Table 3. It will be interesting to see if others can image this feature in 2020.

Region III: 130° W to 250° W

Figures 1E, 1I, 2G, 2I and 4B show the general appearance of this region. A dark, round spot south of Mare Sirenum appears in Figures 1I, 2F and 4B. It is centered at 40° S, 159° W in early November and its radius is ~230 km. It corresponds to the 300 km crater Newton (Carr, 2006, xi). Perhaps the first record of Newton is the feature “Caralis F.” at 154° W, 40° S in Antoniadi’s Mars map (Antoniadi, 1930, 1975, plate 4). De Vaucouleurs apparently drew it on August 12, 1971, (de Vaucouleurs, 1971, 263) and September 12, 1971, (de Vaucouleurs, 1972, 20). Stephen Larson and Gary Rosenbaum also imaged it on September 9 and 10, 1988, (McKim, 1991, p. 264).

Parker reports that the Cerberus-Trivium Charontis dark area consists of only two dark dots. Peach’s November 3 image confirms this. The HST image, recorded on November 7, 2005, shows two small dark spots and two gray spots nearby. The two dark spots are centered at 9° N, 209° W and 14° N, 200° W. The northernmost spot had dimensions of 90 km (north-south) by 130 km (east-west) with an approximate area of 9,000 km^2. The two gray spots not visible in Peach’s November 3 image were centered at 12° N, 198° W and 10° N, 196° W.

Olympus Mons grew brighter near opposition. (The Olympus Mons bright spot is hereafter called “Nix Olympica.”) Bright spots centered on four other volcanoes were imaged near opposition. Table 3 lists their locations, positions and sizes. Nix Olympica was consistently imaged in Earth-based images near opposition.

One may ask: How does Nix Olympica get bright? Its brightening is believed to be from other factors besides orographic clouds for two reasons. First, it had a different color than orographic clouds on at least one occasion. Heffner records an excellent color image on October 19, 2005, which shows a bluish-white orographic cloud southeast of the bright brownish-white Olympus Mons area. Second, Nix Olympica was observed to be bright when it was on both the morning and afternoon limbs and it did not grow during the day. Orographic clouds usually develop in mid-day and grow afterwards (Slipher, 1962, p. 116).

The appearance of Olympus Mons changed between August 2005 and January 2006. It appeared as a dark spot in August when the solar phase angle was above 40°. (The solar phase angle is the distance between the Sun and observer measured from the center of Mars; it is designated as α). Figure 2A (arrow) shows most of Olympus Mons as a dark spot. At this time, α = 43°. The dark spot was almost two-thirds the size of that volcano. In a few cases when this volcano approached the evening terminator, a bright arc appeared around its western border.

By early October (α ~ 28°), a bright ring surrounded a fuzzy dark spot when it was near the central meridian. A few weeks later, this volcano was a high-contrast, bright, nearly circular spot. See Figures 1I, 2F (arrow) and 2G (arrow). Afterwards, it grew less bright. See Figure 2H (arrow). By early December (α ~ 25°), it was once again a dark spot surrounded by a bright ring. See Figure 2C (arrow). In both the October and December images, this arc extended ~200 km beyond the dark Olympus Mons spot. By January 21, 2006 (α = 37°), most of Olympus Mons was dark. The dark spot was a little smaller than that volcano. See Figure 2D (arrow). A faint bright arc was visible on its eastern border on this date when Olympus Mons was near the morning terminator.

Measurements made with WinJupos show that the dark spots in August and January are Olympus Mons, but are shifted by about three degrees east (August 2005) and west (January 2006) from the center of this volcano. In both the August and January images, the dark spot was smaller than the volcano and therefore part of the volcano may have been in the bright arc. The nature of this bright arc needs to be investigated.

What is the size and shape of Nix Olympica? To answer this question, I decided to examine high-resolution, Earth-based images using WinJupos. Ten images were examined. On each image eight longitude and latitude measurements of the outer border were made. The coordinates were plotted and the shapes were examined. See Figures 2M and 2N. Based on the graphs, the writer concludes that Nix Olympica has nearly equal north-south and east-west dimensions. This is also consistent with a Hubble Space Telescope (HST) image showing this feature on August 27, 2003. In 2005, it was equal to a circle having a diameter of 520 ± 80 km. This is close to the value Antoniadi estimated for this feature almost 100 years ago (Antoniadi, 1975, p. 205).

What is the cause of the brightening of Olympus Mons? Interestingly, a recent geological map (Tanaka et al, 2014) describes Olympus Mons and some nearby areas as “Amazonian volcanic edifice”. This is drawn as an elliptical-shaped area with the long axis pointed in the northeast-southwest direction; this is different from the shape of Nix Olympica. Therefore, the entire geological area does not brighten and, hence, other factors besides rock type should be considered as causing the brightening of Olympus Mons.

In order to shed more light on this question, I examined historical records. Schiaparelli drew a bright spot which he called “Nix Olympica” on November 11, 1879 (Flammarion, 2015, p. 283). He describes it as “… a white point which had been observed nine times. It is very small (half an arc-sec)” (Flammarion, 2015, p. 285-286). He drew it on his map near 129 W°, 21° N (Flammarion, 2015, p. 281). It lies near the position of the large volcano Olympus Mons. Antoniadi drew Nix Olympica as a bright

Table 3: Positions and Sizes of Bright Spots Near Five Large Volcanoes on Mars

Volcano	Coordinates		Diameter of Bright Spot (km)	Area of Bright Spot (km^2)
	Volcano Location[a]	Bright Spot Location		
Olympus Mons	133° W, 18° N	132° W, 18° N	520 ± 80	210,000
Ascreus Mons	105° W, 11° N	103° W, 11° N	260 ± 20	52,000
Elysium Mons[b]	213° W, 24° N	212° W, 24° N	120 ± 20	10,600
Hecates Tholus[b]	210° W, 32° N	209° W, 31° N	80 ± 20	5,600
Albor Tholus[b]	210° W, 19° N	209° W, 19° N	~60	~3,000
Ceraunius Patera[c]	97° W, 24° N	95° W, 22° N	90	6,000

[a]Measured from the map in Carr (2006, xi and xiv).
[b]Measured from an HST image made on November 7, 2005.
[c]Measured from an HST image made on August 27, 2003.

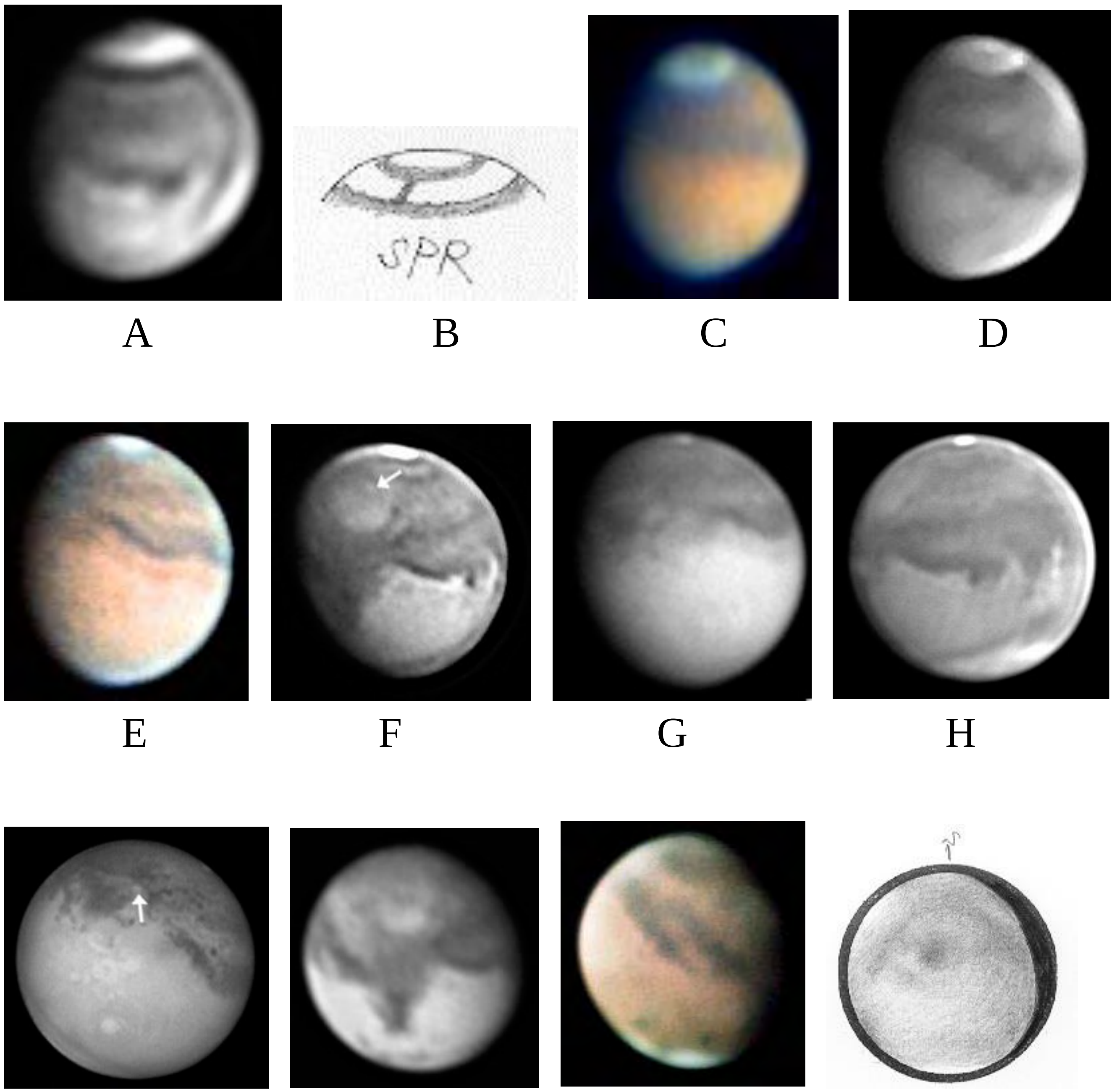


Figure 1: Images and drawings of Mars made during the 2005 apparition. South is near the top in all images and drawings. The longitude of the central meridian is abbreviated as CM. **A**: April 27, 2005 (9:30 U.T.) by Peach, red filter, 0.24 m SC, CM = 338° W, **B**: May 27, 2005 (18:45 UT) by Adachi, 0.31 m RL, CM = 177° W; **C**: May 29, 2005 (19:30.6 UT) by Einaga, 0.25 m RL, CM = 168° W; **D**: June 17, 2005 (10:09 UT) by D. Parker, 0.41 m RL, red filter, CM = 204° W; **E**: July 29, 2005 (9:29 UT) by D. Parker, 0.41 m RL, color, CM = 144° W; **F**: August 17, 2005 (8:43 UT) by D. Parker, 0.41 m RL, red filter, CM = 309° W; **G**: September 13, 2005 (13:00 UT) by Moore, 0.25 m RL, red filter, CM = 117° W; **H**: October 13, 2005 (23:11.1 UT) by Pellier, 0.21 m Mewlon, green filter, CM = 351° W; **I**: November 9, 2005 (23:15 UT) by Lazzarotti, 0.32 m Dall Kirkham, red filter, CM = 113° W; **J**: December 15, 2005 (9:12.2 UT) by Einaga, 0.25 m RL, red filter, CM = 305° W; **K**: January 14, 2006 (0:01 UT) by D. Parker, 0.41 m RL, RGB, CM = 250° W; **L**: February 13, 2006 (10:00 UT) by Adachi, 0.31 m RL, CM = 110° W.

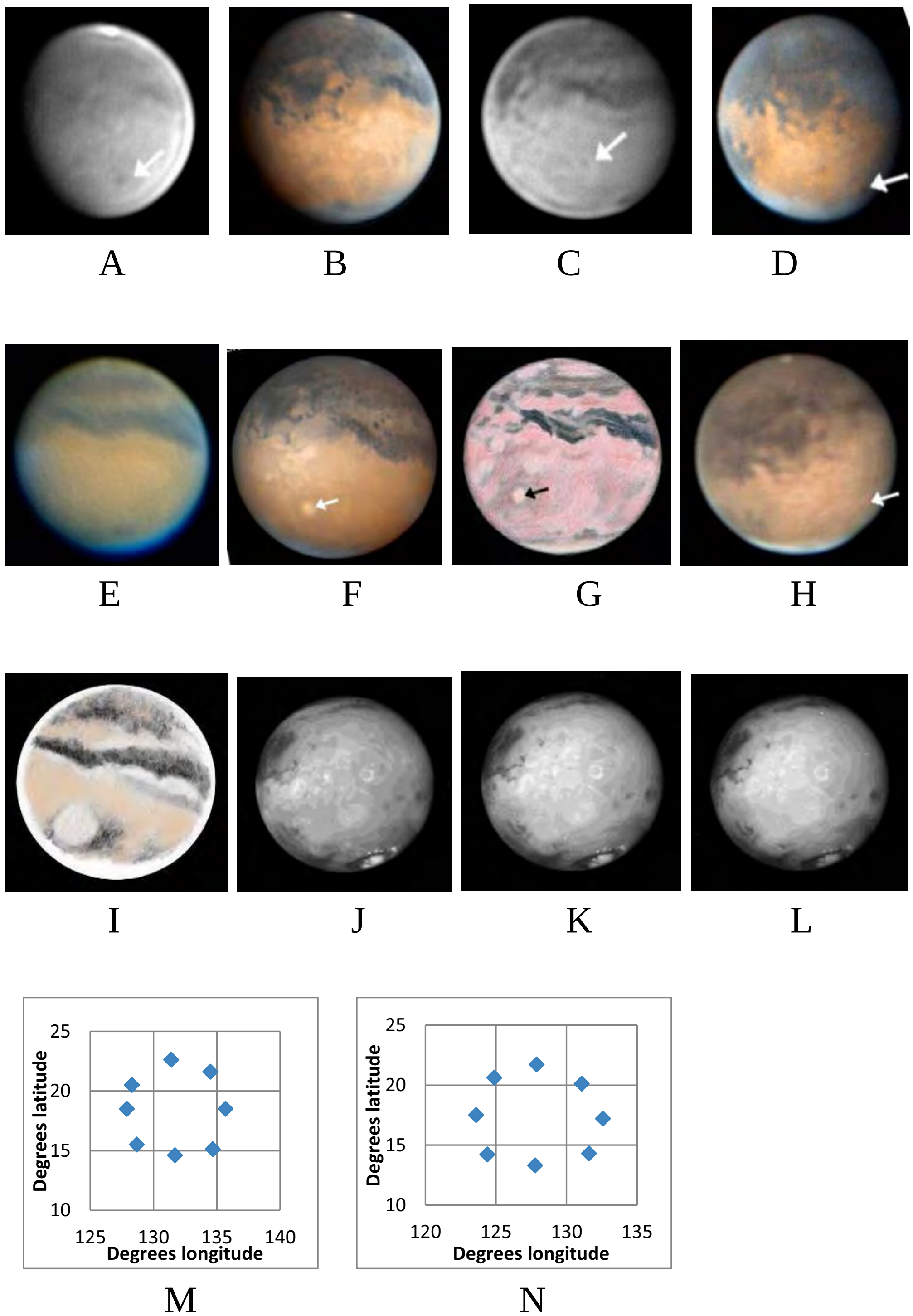


Figure 2: Images of Nix Olympica in 2005. **A**: August 29, 2005 (2:47 U.T.) by Pellier, 0.36 m SC, green filter, CM = 108° W; **B**: October 5, 2005 (1:27 UT) by Peach, 0.24 m SC, color, CM = 105° W; **C**: December 10, 2005 (19:58 UT) by Pellier, 0.36 m SC, red filter, CM = 148° W; **D**: January 21, 2006 (18:37 UT) by Peach, 0.35 m SC, color. CM = 95° W; **E**: October 16, 2005 (12:50:41 UT) by Akutus, 0.28 m RL, CM =173° W; **F**: November 6, 2005 (23:05 UT) by Peach, 0.35 m SC, CM = 137° W; **G**: November 8, 2005 (1:17 to 2:15 UT) by Biver, 0.26 m RL, CM = 160° to 175°W; **H**: November 19, 2005 (3:02 UT) by Phillips, 0.25 m RR, CM = 89° W; **I**: Nov. 7, 2005 (2:15 UT) by Hernandez, 0.23 m Maksutov-Cassegrain, Seeing = 5, CM = 183° W; **J**: April 28, 1999 by the HST, with the F547N filter; **K**: April 28, 1999 by the HST, with the F588N filter; **L**: April 28, 1999 by the HST, with the F631N filter, **M**: map of Nix Olympica based on measurements made from a November 5, 2005 image recorded by Pellier, north is at the top; **N**: map of Nix Olympica based on measurements made from a November 6, 2005 image recorded by Peach, north is at the top.

Table 4: Characteristics When Nix Olympica was Observed

Date	Solar Phase Angle (Degrees)[a]	Sub-Solar Latitude (Degrees)	Sub-Earth Latitude (Degrees)	L_s (Degrees)
Nov. 11, 1879[b]	-5	-14	-12	326
Oct. 28, 1911	-24	-15	-5	323
Sept. 26, 1924	26	-25	-19	267
Nov. 1, 1926	-3	-18	-15	315
Dec. 29 & 30, 1928	7, 8	1	-1	10
July 21, 1939[c]	-5	-14	-10	215
Jan. 19, 1961[d]	16	10	1	24
Nov. 25, 1962[d]	-37	8	20	18
Nov. 28, 1962[d]	-36	8	20	19
Aug. 7, 1971	-6	-19	-15	230
Aug. 16, 1971	7	-21	-15	236
July 9, 1986	-4	-9	-6	202
July 11, 1986	4	-10	-6	203
Sept. 10, 1988	-17	-26	-21	269
Aug. 21, 2003	-9	-23	-19	245
Aug. 27, 2003	-5	-24	-19	249

[a]Solar phase angles are negative before opposition and positive afterwards.

[b]The JPL Ephemeris does not report values this early and, hence, I list the values for Nov. 11, 1958 which is 79 years later. The listed values are nearly the same every 79 years.

[c]From Slipher (1962, p. 141)

[d]From Both (1963, p. 18)

oval on November 1, 1926 (Antoniadi, 1930, 1975, p. 205) and he draws it as a nearly circular white spot centered at 127° W, 20° N in his Mars Map (Antoniadi, 1930, 1975, Plate 3).

He estimated its diameter as being 8° or 500 km. He also reported seeing this feature on December 29 and 30, 1928 and October 28, 1911. Finally Antoniadi reports that others observed Nix Olympia in 1888, 1903 and 1916. Nix Olympica was also drawn and imaged in 1971 (de Vaucouleurs, 1971, 263), 1986 (McKim, 1989, 215, 217); 1988 (McKim, 1991, 264) and August 27, 2003 (McKim, 2010a, 280). Table 4 lists dates when Nix Olympica was observed.

The solar phase angle probably controls the visibility of Nix Olympica. Other factors, however, may also be important. One trend in Table 4 is that Nix Olympica is more likely to be observed at negative phase angles (before opposition) than at positive ones (after opposition). This feature was observed eleven times at negative phase angles, but only six times at positive phase angles. Furthermore, Nix Olympica was imaged for a longer time period before opposition in 2005 (October 16 to November 7) than after opposition (November 7 to November 19). Finally, it was not a solid bright feature in HST images made on April 28, 1999 even though $\alpha < 4°$. See Figures 2J – 2L. Therefore, it is concluded that other factors besides the solar phase angle may affect the brightness of this feature.

What may affect the appearance of Nix Olympica? Perhaps there is a frost coating which develops at night at high elevations and it evaporates into thin mists in the daytime which reflect light similar to how the Edom region did back in 2001 when flashes were observed. To shed more light on this mystery, I believe that quantitative brightness measurements of this feature need to be made in different color filters. Images made with CCD cameras have brightness data. A line profile across the image can yield a brightness value of Nix Olympica. I am hoping that observers will attempt this in the 2020 apparition.

The HST image on November 7, 2005, shows bright spots near the three large Elysium volcanoes. Measurements of these spots were made using WinJupos and the results are summarized in Table 3. Elysium Mons appears as a fuzzy bright spot in Parker's November 9 image.

South Polar Cap

The writer used WinJupos to measure the latitudes of the SPC edge using the same procedure as described elsewhere (Schmude, 2013, p. 234). Essentially, latitudes were measured at each 15° longitude interval for six different ranges of Ls. The resulting maps of the SPC are illustrated in Figure 5. The last map in Figure 5 is based on measurements made from HST images. It is in agreement with a map made by Schiaparelli in late 1879 (Flammarion, 2015, p. 288).

Table 5: Mean Latitudes of the SPC During The 2005 and 2003 Apparitions

2005 Apparition		
L_s Range	Mean Latitude (°S)	Mean Radius (Degrees of Latitude)
274-282	82.4	7.6
282-290	81.8	8.2
290-298	82.6	7.4
298-306	83.4	6.6
306-314	85.0	5.0
314-322	87.1	2.9
2003 Apparition (Re-evaluation)		
L_s Range	Mean Latitude (°S)	Mean Radius (Degrees of Latitude)
190-194	57.8	32.2
194-198	58.2	31.8
198-202	60.2	29.8
202-206	60.6	29.4
206-210	62.2	27.8
210-214	62.2	27.8
214-218	64.0	26.0
218-222	64.8	25.2
222-226	66.1	23.9
226-230	67.3	22.7
230-234	68.8	21.2
234-238	70.1	19.9
238-242	71.7	18.3
242-246	72.2	17.8
246-250	73.2	16.8
250-254	78.2	11.8
254-258	79.2	10.8
258-262	81.5	8.5
262-266	81.2	8.8
266-270	81.6	8.4
270-274	81.5	8.5
274-278	82.5	7.5
278-282	83.4	6.6
282-286	83.7	6.3
286-290	84.2	5.8
290-294	83.8	6.2

The writer also re-examined 2003 images and used WinJupos to draw maps of the SPC for that year. His results are illustrated in Figure 6. Dark areas, which are called "cryptic terrain", (James et al., 2001, p. 23,635) were inside of the SPC during early and mid-southern spring. These areas are shown as dark patches in the SPC maps. The mean latitudes of the 2003 and 2005 SPC are listed in Table 5. These values are consistent with the SPC maps published in James et al. (2001, pp, 23,639 and 23,640).

Dust Storms

Dust storms were judged to be present if they covered dark areas, were bright in red light and changed shape within a few days. The first storm was imaged on August 2 and 4. See arrows in Figures 3A and 3B. Based on WinJupos measurements, it was centered at 63° S, 97° W on August 4. This was a "local" dust storm (McKim, 1999, p. 119). Based on images recorded on August 6 (Schmidt) and August 7 (Grafton), it is concluded that this storm was much dimmer than on August 4.

A second event or possible continuation of the August 4 storm was imaged by Owens on August 12 (10:03 UT) near 65° S, 80° W. It was near the SPC. On the next day, M. Adachi describes the SPC as yellow. This was also a local event. A third storm is illustrated in Figures 3C to 3H. A bright spot in Chryse was imaged by Sonka on October 13 at 2:19 UT. About 21 hours later, Pellier imaged a bright spot extending south towards Eos. This storm appeared to grow until October 27 (Figure 3H). On that date it had covered an area of several million square kilometers.

Afterwards, it appeared to dissipate. This storm was a regional event. It covered portions of Chryse, Mare Erythraeum, Eos, Argyre II and Margaritifer Sinus.

Table 6: Tharsis Clouds on September 4, 2005 Imaged by Don Parker With a Blue Filter

Universal Time	Central Meridian Longitude (°W)	Local Time for 120° W	Cloud Area[a] (10^6 km^2)
7:25	120	~1400 Hours	0.14
7:45	125	~1420 Hours	0.36
8:21	133	~1500 Hours	0.57
8:56	142	~1540 Hours	0.61
9:29	150	~1600 Hours	0.61

[a]The area was computed assuming an elliptical shape.

Several people (Warren, Schaeffer, Grafton and Morales) imaged a bright feature at 12° N, 50° N on November 23. Warren reports that it was not visible a day earlier. It was bright in red, green and blue light and it may have been a small dust storm or a condensate cloud. It did not cover any resolvable dark areas. I measured Warren's November 23 image and it was at 50° W, 11° N and had dimensions of 1,000 km by 400 km.

Condensate Clouds

Condensate clouds are brighter in blue than in red light. Earth-based images

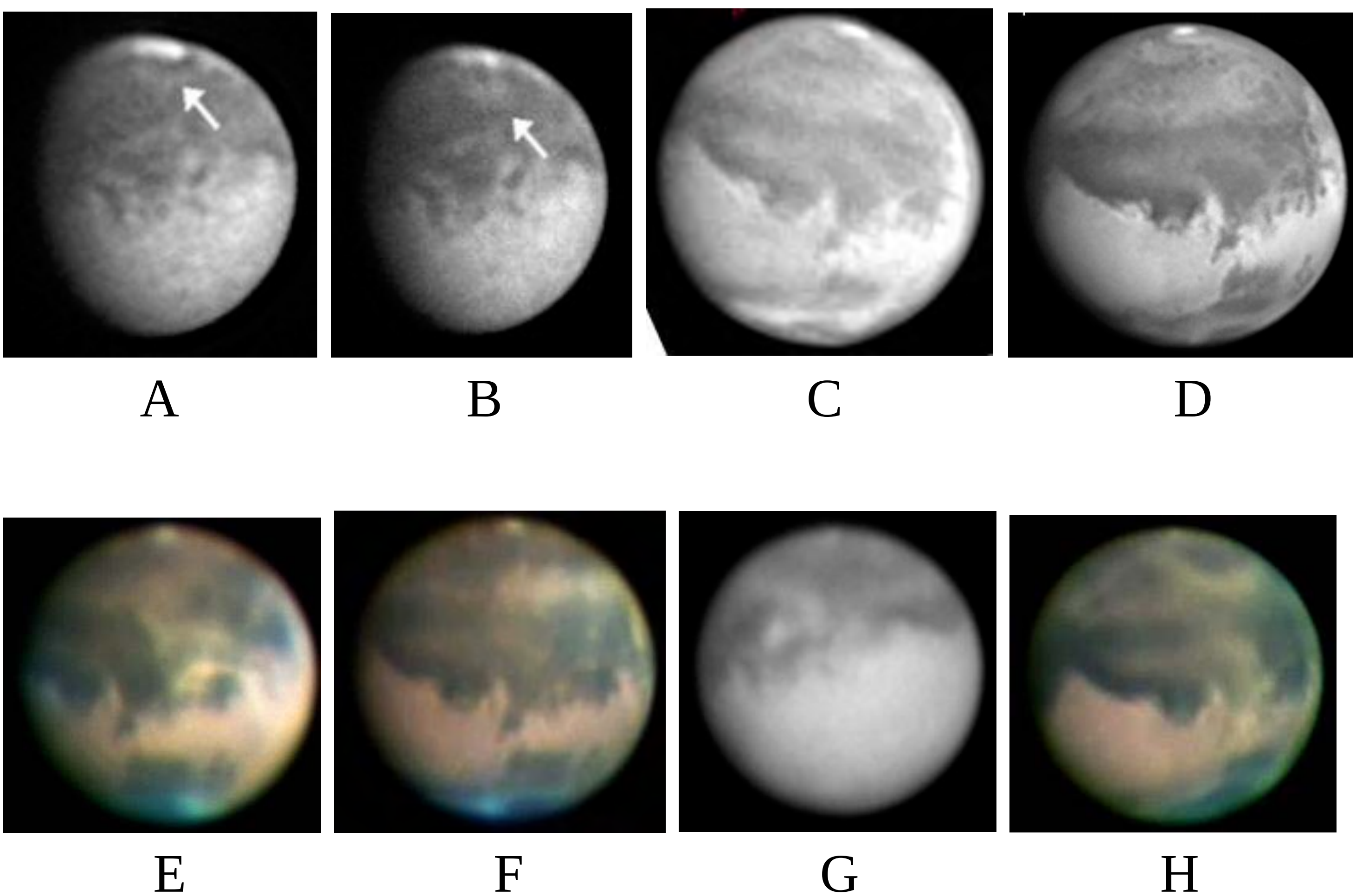


Figure 3: Images of Mars showing dust storms in 2005. **A**: August 2, 2005 (8:04 UT) by D. Parker, red filter, 0.41 m RL, CM = 84° W; **B**: August 4, 2005 (09:25 UT) by D. Parker, red filter, 0.41 m RL, CM = 85° W; **C**: October 15, 2005 (0:48 UT) by Zannelli, red filter, 0.24 m SC, CM = 5° W; **D**: October 16, 2005 (1:04 UT) by Peach, red filter, 0.24 m SC, CM = 0° W; **E**: October 20, 2005 (5:37 UT) by Sherrod, color, 0.41 m SC, CM = 31° W; **F**: October 23, 2005 (6:05 UT) by Sherrod, color, 0.41 m SC, CM = 12° W; **G**: October 23, 2005 (12:48:18 UT) by Fukui, IR light, 0.25 m Dall-Kirkham, CM = 110° W; **H**: October 27, 2005 (7:18 UT) by Sherrod, color, 0.41 m SC, CM = 354° W.

show these clouds developing in several areas. They include orographic clouds on the flanks of one or more Tharsis volcanoes, the NPH and SPH along with clouds over Edom, Libya and Argyre. I will discuss these.

Orographic Clouds

Orographic clouds in the Tharsis area were imaged frequently between July 29, 2005 (L_s = 258°) and January 24, 2006 (L_s = 1°). They were generally most distinct when the Tharsis region was near the evening terminator (or limb). They weakened during late October and early November when a regional dust storm was expanding. Orographic clouds were usually not imaged near Olympus Mons in 2005; however, Parker reports clouds near Olympus Mons on September 7, November 9 and December 15, 2005. In 2003, orographic clouds in the Tharsis region were imaged between 178° < L_s < 246° (Schmude et al., 2004, 35). Benson (2006, 367) reports these clouds near Olympus, Pavonis and Ascraeus Mons develop by 1400 hours local time for 0° < L_s < 185°. Therefore, they may develop at almost any L_s value in the Martian year; however, on some dates they may develop after 1400 hours local time.

Don Parker imaged orographic clouds for over two hours on September 4. The writer used WinJupos to measure their locations and approximate sizes. The results are summarized in Table 6. They formed near the northern and eastern edges of Arsia Mons. One faint cloud at 8:56 UT also formed near Ascreus Mons. No obvious cloud formed near Olympus Mons. The combined area of the Tharsis clouds grew as they approached the evening limb. This is consistent with historical records (Slipher, 1962, p. 116).

North Polar Hood (NPH)

Figure 4 shows images of the NPH. The writer made careful drawings of it on several dates in October. It changed from one night to the next. See Figure 4A. Sherrod also imaged dramatic changes in the NPH on October 20 and 23. See Figures 4G and 4H. In fact, the cloud position in Sherrod's October 20 image matches the position in my October 20 drawing. See Figure 4A and 4G. Peach also imaged a brighter cloud in the NPH on September 18 which was not visible a day earlier. See Figures 4C and 4D. Minami observed similar variability of the NPH between October 20 and 23, 1990 (McKim, 1992, p. 261). Figure 4B shows the NPH in an HST image. Note that a thin cloud lies south of the main hood. A thin southerly cloud may have also been imaged on October 31. See Figures 4E and 4F.

What was the cause of the variability of the NPH? One possibility is dust. During late October a regional dust storm developed. The writer analyzed 41 images made between October 1 and December 1, 2005. These were broken into three groups based on time: October 1 to October 20, October 22 to November 12 and November 13 to December 1. The mean respective latitudes of the NPH for the time increments were 45° N, 48° N and 41° N. The standard errors for all three values were 0.7°. Therefore, it appears that the regional dust storm in late October caused the NPH to shrink. After this storm dissipated, the NPH grew. McKim (1999, 115) reports that the NPH “appeared to fade and thin” as a result of the dust storms in October and November of 1990.

South Polar Hood (SPH)

The SPH developed gradually. Parker reports clouds developing near the SPC in late August (274° < L_s < 279°). See Figure 7C. These were imaged in September and early October but diminished later in that month. See Figures 7A, 7B, 7D and 7E. The regional dust storm taking place at that time may be the reason for the lack of clouds in the South Polar Region in late October and early November. Mobberley imaged clouds in the South Polar Region on November 19, 2005 (L_s = 326°).

Essentially, he and others imaged a cloud on the morning terminator centered at 77° S. See Figure 7G. During most of December several individuals imaged small clouds near the South Pole Yunoki imaged a blanket of clouds covering the South Polar Region on December 6 (L_s = 336°). Figure 7H shows the SPH. Following this date the hood appeared to thicken and thin. Figure 7F shows a patchy hood. It did not have the same light intensity through the end of January 2006. The images lacked sufficient resolution after January 31, 2006, for detailed cloud studies. Therefore, it appears that the SPH went through three stages: between late-August and mid-October (274° < L_s < 309°), parts of the polar hood appeared; between late-October and late-November (310° < L_s < 326°), the SPH weakened; and in early December (L_s > 336°), it grew but did not retain a uniform thickness from one day to the next.

Other Non-Polar Clouds

Clouds were in other parts of Mars besides Tharsis and the polar regions. See Figure 7. On several occasions, clouds developed in Edom (350° W, 2° N). See Figures 7A and 7B (arrow). This cloud was brightest near the evening terminator. It became weaker in late October. Peach imaged a bright cloud over Sinus Meridiani on December 19, 2005, which probably also covered Edom. Peach reports a “faint mist over Edom” on January 29, 2006, (L_s = 4°). Almost two weeks later, D. Parker reports that Edom was bright in red light. The Edom area is where flashes were observed in 1954, 1958 (Dobbins and Sheehan, 2001, p. 16) and 2001 (Haas, 2003, 43). Clouds were also imaged in Libya (280° W, 1° N) during September

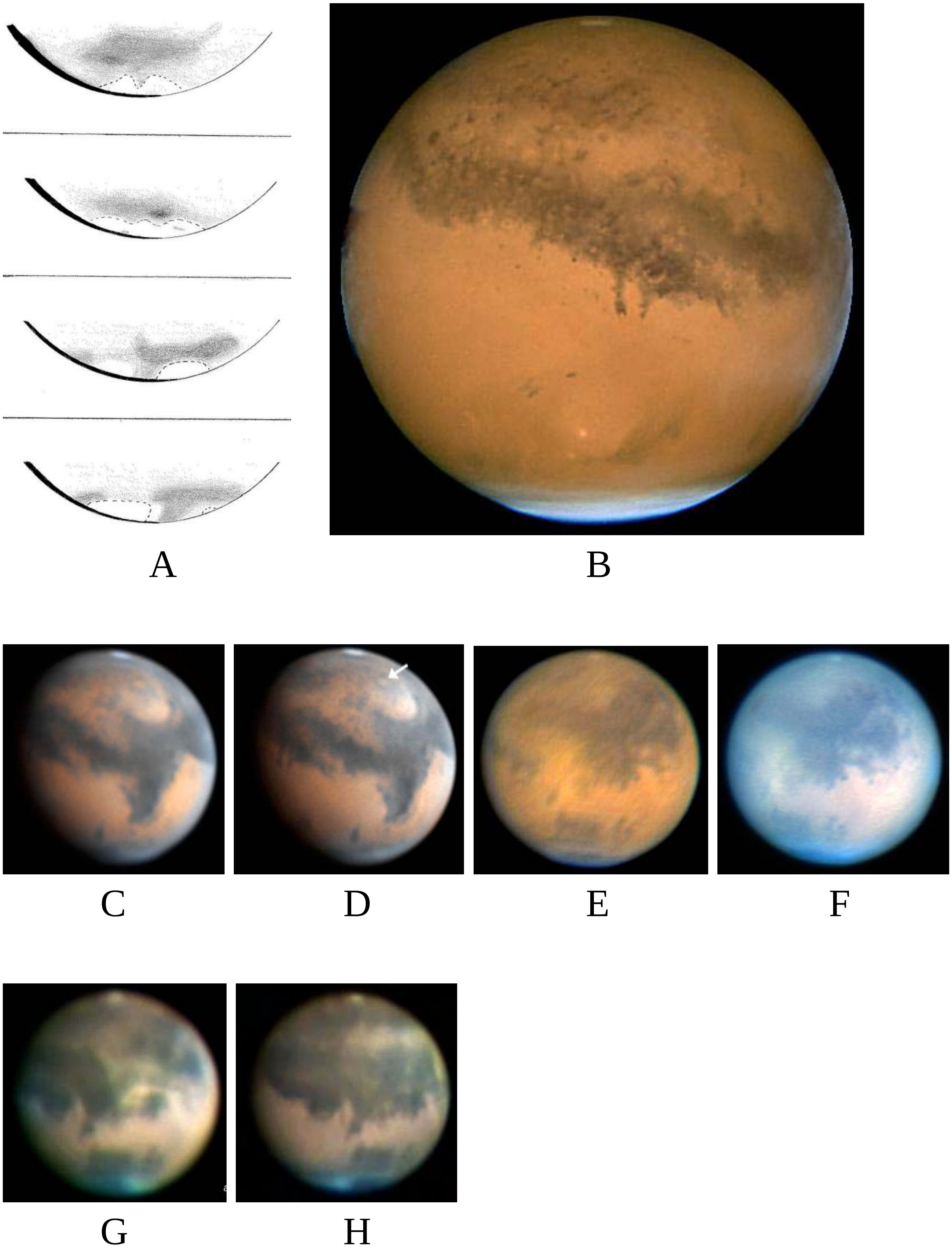


Figure 4: **A**: Four drawings of the North Polar Hood made by the writer on October 18, 19, 20 and 22, 2005, 0.12 m RR; **B**: November 7, 2005 (4:27-4:33 UT) by the Hubble Space Telescope, color; **C**: September 17, 2005 by Peach, color, 0.24 m SC; **D**: September 18, 2005 by Peach, color, 0.24m SC; **E**: October 31, 2005 (12:30:20 UT) by Takimoto, color, 0.31 m RL; **F**: October 31, 2005 (13:51 UT) by Heffner, color, 0.28 m SC; **G**: October 20, 2005 (5:37 UT) by Sherrod, color image, 0.41 m SC; **H**: October 23, 2005 (6:05 UT) by Sherrod, color image, 0.41 m SC.

and October. See Figures 7C (arrow) and 7D.

On September 3, 2005, Yunoki imaged a faint cloud when the central meridian longitude = 261°. At that time, the local time was about 3 pm. This cloud was usually brightest near the evening limb, but it was also visible when it was near local noon. Between February 8 and 10, 2006 (L_s = 9°), Peach reports clouds in Libya.

A third cloud was imaged in Argyre (35° W, 50° S). Vandebergh reports a "weak haze" over Argyre on August 2. There were reports of clouds in Argyre during the months of August, September and October. Peach reports that Argyre was bright on several dates during January 20 to 25, 2006.

Based on measurements of two images (November 17, 2005 by Pellier and Mobberley), the cloud was centered at 36° W, 51° S which matches the Argyre albedo feature to about 1°. The Argyre basin and Galle crater are centered at 42° W, 49° S (Carr, 2006, xii) and hence, the center of this cloud was a bit east of the center of these features. This white spot was usually brighter in blue than in red light which leads the writer to believe that it was not dust.

Position of Phobos

Boudreau recorded several images of Phobos on November 4, 2005, as it went through greatest elongation. The writer measured the distance between Phobos and Mars' center at different times. He then fit the distance and times to a quadratic equation and used the equation to determine the time of maximum distance to be 05:27 UT with an uncertainty of three minutes. The predicted time of greatest eastern elongation is 05:26 UT with an uncertainty of 0.1 hours. (Astronomical Almanac, 2003, p. F7).

Jones took several images of Mars and Phobos on November 9 (22:40 to 23:30 UT). The writer used the same technique as he used for Boudreau's images to determine a time of maximum eastern elongation of 23:08 UT with an uncertainty of three minutes. The predicted time of eastern elongation is 23:10 UT with an uncertainty of 0.1 hours (Astronomical Almanac, 2003, p. F7). It is concluded that Phobos was at its predicted positions on November 4 and 9, 2005, to within a few minutes.

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References

Antoniadi, E. M. "The Planet Mars" (Translated by P. Moore) Keith Reid Ltd. Shaldon, Devon (1930, 1975).

Astronomical Almanac for the Year 2004, U. S. Govt. Printing Office, Washington DC, 2002.

Astronomical Almanac for the Year 2005, U. S. Govt. Printing Office, Washington DC, 2003.

Astronomical Almanac for the Year 2006, U. S. Govt. Printing Office, Washington DC, 2004.

Benson, J. L., James, P. B., Cantor, B. A. and Remigio, R. "Interannual variability of water ice clouds over major martian volcanoes observed by MOC" Icarus, Vol. 184, pp. 365-371, 2006. *http://adsabs.harvard.edu/abs/2006Icar..184..365B*

Both, E. "Recent Visual Observations of Mars" Sky & Telescope, 26, No. 1, p. 17-19, 1963. *http://adsabs.harvard.edu/abs/1963S%26T….26…17B*

http://adsabs.harvard.edu/abs/1963S%26T….26…17B

Carr, M. H. "The Surface of Mars" Cambridge University Press, Cambridge, 2006.

De Vaucouleurs, G. "Telescopic Observations of Mars in 1971 – II" Sky & Telescope, Vol. 42, 1971. No. 5, pp. 263-265.

De Vaucouleurs, G. "Telescopic Observations of Mars in 1971 – III" Sky & Telescope, Vol. 43, 1072. No. 1, pp. 20-21. *http://www.researchgate.net/publication/252674531_Telescopic_Observations_of_Mars_in_1971_III*

Dobbins, T. and Sheehan, W. "The Martian – Flares Mystery" Sky & Telescope, Vol. 101, 2001. No. 5, pp. 115-123. *http://adsabs.harvard.edu/abs/2001S%26T…101e.115D*

Flammarion, C. "Camille Flammarion's The Planet Mars" (Translated by P. Moore and edited by W. Sheehan), Springer International Publishing, Switzerland, 2015.

Haas, W. H. "Flashes on Mars Observed in 1937 and Some Random Remarks" Journal of the Assn of Lunar & Planetary Observers, Vol. 45, No. 1 (Winter) pp. 43-45. *http://adsabs.harvard.edu/full/2003JALPO..45a.43H*

James, P. B. Cantor, B. A. and Davis, S. "Mars Orbiter Camera observations of the Martian south polar cap in 1999-2000" Journal of Geophysical Research, Vol. 106, 2001. No. E10, pp. 23,635 – 23, 652. *http://onlinelibrary.wiley.com/doi/10.1029/2000JE001313/full*

Mallama, A. "The magnitude and albedo of Mars" Icarus, 192, 2007. pp. 404-416. *http://www.sciencedirect.com/science/article/pii/S0019103507003156*

McKim, R. "The Opposition of Mars, 1986" Journal of the British Astronomical Assn, Vol. 99, 1989. No. 5, pp. 215-232. *http://adsabs.harvard.edu/full/1989JBAA...99..215M*

McKim, R., "The opposition of Mars, 1988" Journal of the British Astronomical Assn, Vol. 101, 1991. No. 5, pp. 264-283. http://adsabs.harvard.edu/full/1991JBAA..101..264M

McKim, R. "The opposition of Mars, 1990" Journal of the British Astronomical Assn, Vol. 102, 1992. No. 5, pp. 248-264. http://adsabs.harvard.edu/full/1992JBAA..102..248M

McKim, R. "Telescopic Martian Dust Storms: A Narrative and Catalogue" Memoirs of the British Astronomical Society, Vol. 44, 1999. pp. 1-165. http://www.britastro.org/mars/memoir.htm

McKim, R., "The great perihelic opposition of Mars, 2003: Part 1" Journal of the British Astronomical Assn, Vol. 120, 2010a. No. 5, pp. 280-295. http://adsabs.harvard.edu/full/2010JBAA..120..280M

McKim, R., "The opposition of Mars, 2005: Part I" Journal of the British Astronomical Assn, Vol 121, 2011a. No. 3, pp. 143-154. http://adsabs.harvard.edu/full/2011JBAA..121..143M

McKim, R., "The opposition of Mars, 2005: Part II" Journal of the British Astronomical Assn, Vol. 121, 2011b. No. 4, pp. 215-222. http://adsabs.harvard.edu/full/2011JBAA..121..215M

Schmude, R. W. Jr. et al. "ALPO Observations of the 2003 Apparition of Mars" Journal of the Assn of Lunar & Planetary Observers, Vol. 46, No. 4 (Autumn 2004) pp. 28-45. http://adsabs.harvard.edu/full/2004JALPO..46d..28S

Schmude, R. W. Jr. "Mars: Photometric and Polarization Studies in 2005 – 2008" Journal of the Assn of Lunar & Planetary Observers, Vol. 51, No. 1 (Winter 2009). pp. 29-34. http://adsabs.harvard.edu/full/2008JALPO..51a..25S

Schmude, R. W. Jr. "The North Polar Cap of Mars from 2007 to 2012" Journal of the Royal Astronomical Society of Canada, Vol. 107, 2013. pp. 233-239. http://articles.adsabs.harvard.edu/cgi-bin/nph-iarticle_query?bibcode=2013JRASC.107..233L&db_key=AST&page_ind=2&plate_select=NO&data_type=GIF&type=SCREEN_GIF&classic=YES

Schmude, R. W. Jr., "Some Recent Studies of Mars: The North Polar Cap, Cecropia and Hellas". Georgia Journal of Science, Vol. 72, 2014. Nos. 2 – 4, pp. 109-119. http://web.b.ebscohost.com/abstract?direct=true&profile=ehost&scope=site&authtype=crawler&jrnl=01479369&AN=102441731&h=8JqEb3Y5PYGz5ST3%2bmiPsaBfxkUtem476HvjnzqtNm3ucaqGuvvFAQsFtdzWncy1mIm4SDPeUVOjW64vn%2fqp4Q%3d%3d&crl=f&resultNs=AdminWebAuth&resultLocal=ErrCrlNotAuth&crlhashurl=login.aspx%3fdirect%3dtrue%26profile%3dehost%26scope%3dsite%26authtype%3dcrawler%26jrnl%3d01479369%26AN%3d102441731

Slipher, E. C. "Mars: The Photographic Story" (J. S. Hall, editor) Sky Publishing Corp., Cambridge, MA, 1962.

Tanaka, K. L. et al. Geological Map of Mars, U. S. Geological Survey Scientific Investigations, Map 3292, 2014. http://pubs.usgs.gov/sim/3292/

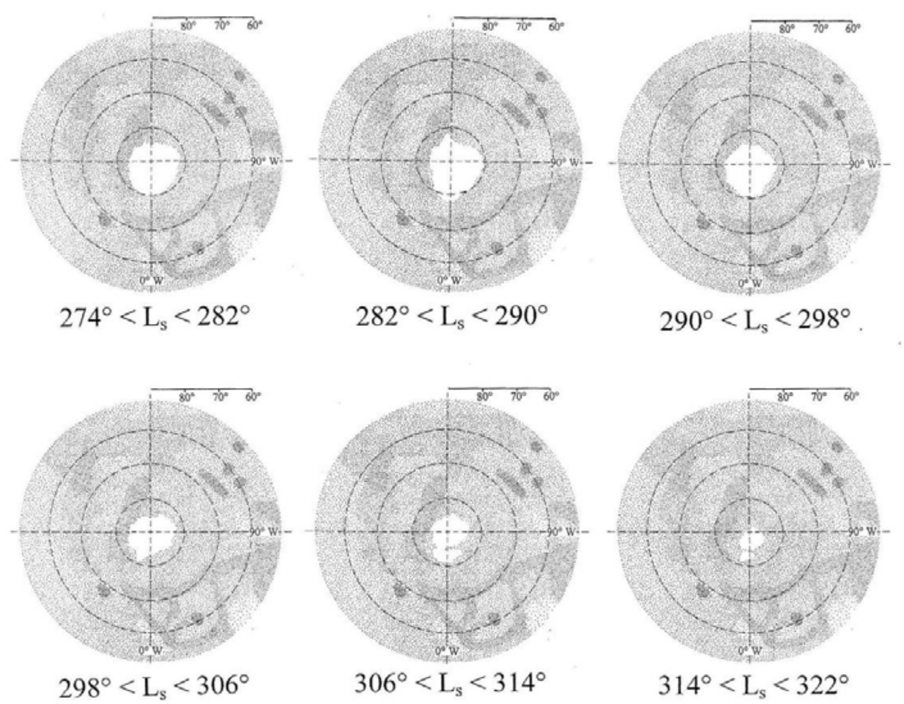

Figure 5: Maps of the 2005 SPC made by the writer using Earth-based images and HST images. Most of the Earth-based images were made in red and near-infrared light.

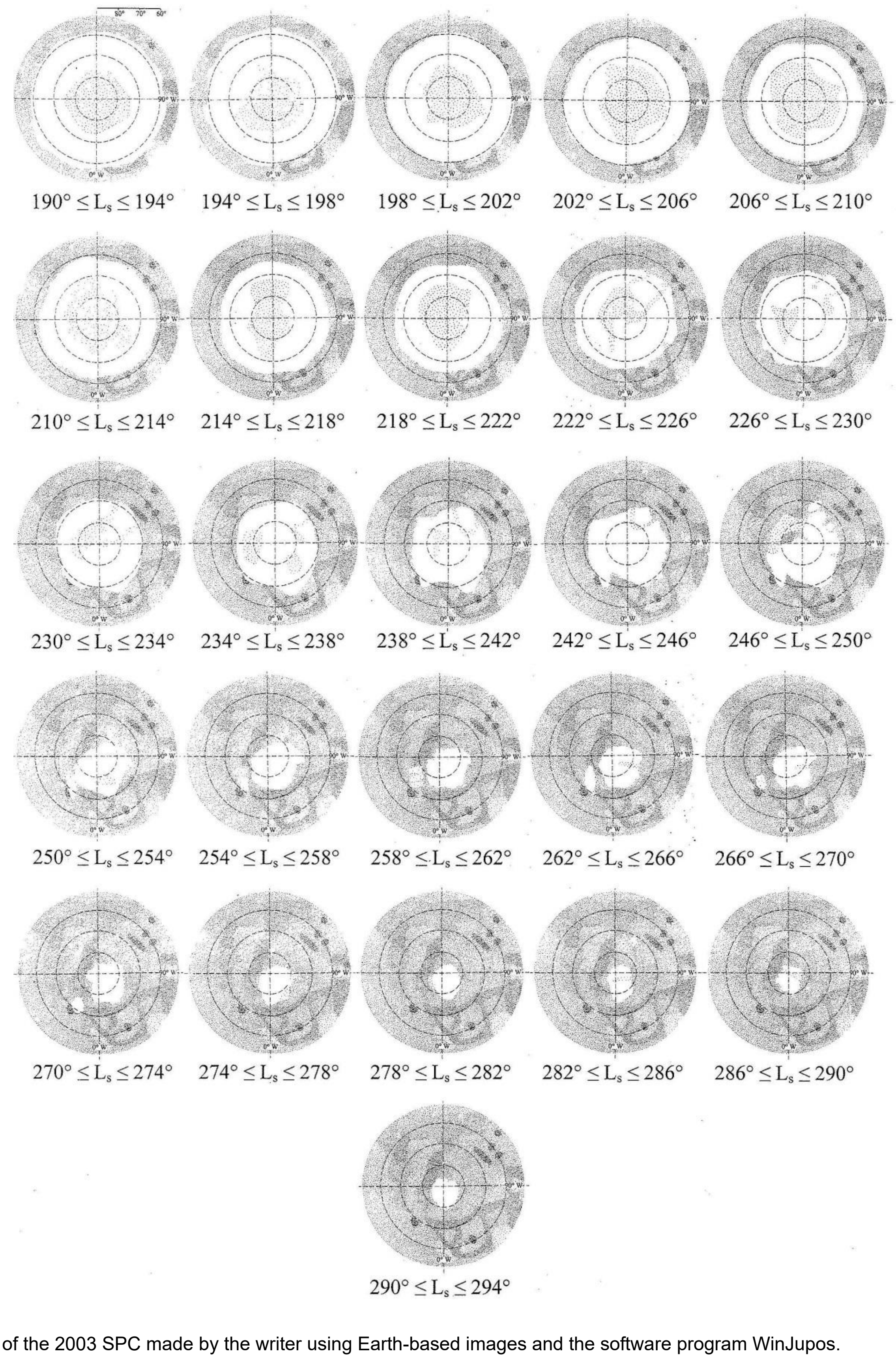

Figure 6: Maps of the 2003 SPC made by the writer using Earth-based images and the software program WinJupos.

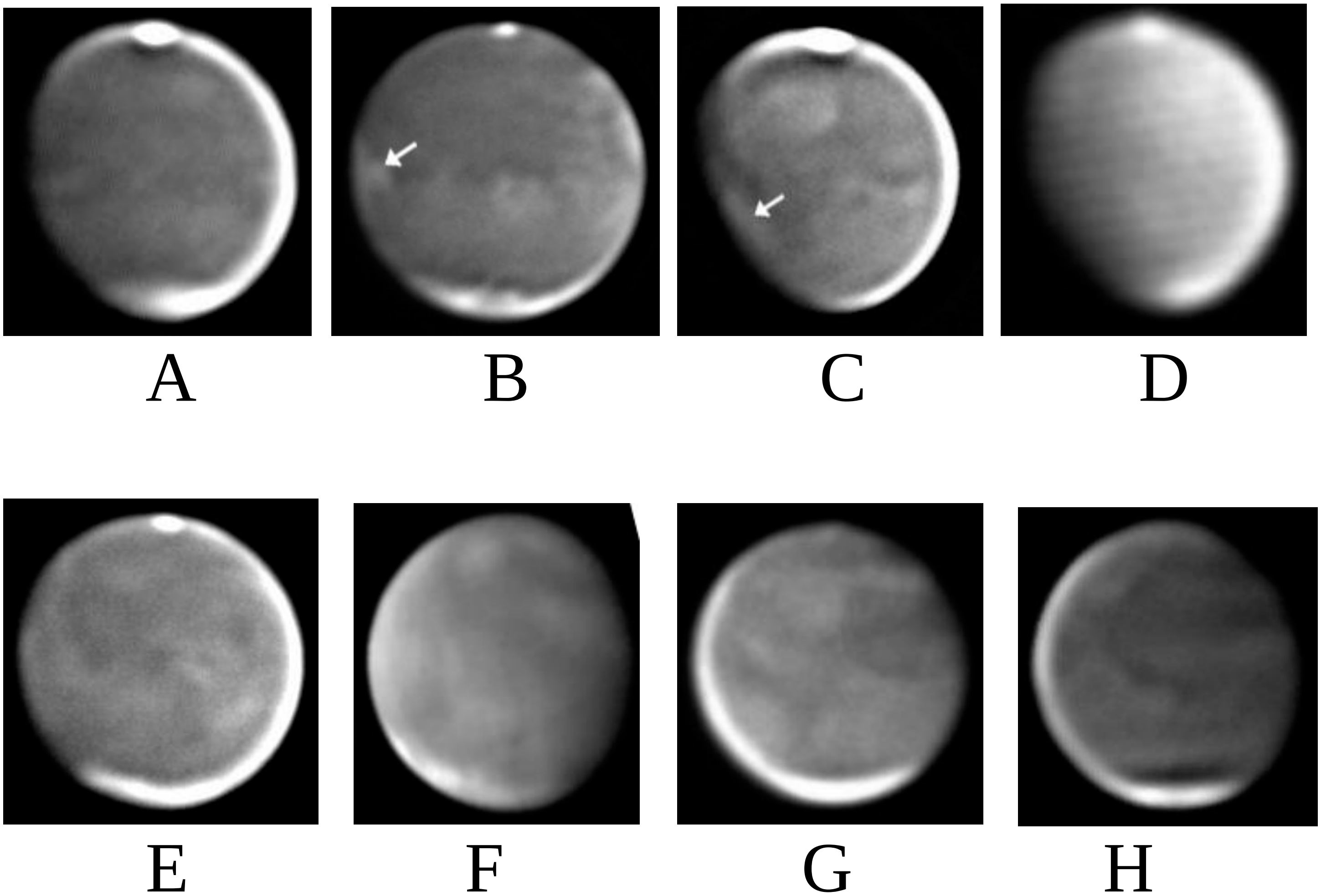

Figure 7: Images of clouds on Mars. South is at near the top in all images. Unless stated otherwise all images were made with a blue filter. A: September 8, 2005 (2:45 UT) by Pellier, CM = 14° W, blue-violet filter; B: October 18, 2005 (4:30 UT) by D. Parker, CM = 33° W; C: August 17, 2005 (8:00 UT) by D. Parker, CM = 299° W; D: September 13, 2005 (16:55:50 UT) by Yunoki, CM = 174° W; E: October 9, 2005 (0:03 UT) by Pellier, CM = 48° W; F: January 21, 2006 (18:25 UT) by Peach, CM = 93° W; G: November 25, 2005 (2:14 UT) by D. Parker, CM = 24° W; H: January 4, 2006 (0:27 UT) by D. Parker, CM = 351° W.

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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*, also called *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.

Subscription rates and terms are listed below (effective March 1, 2015).

We heartily invite you to join the ALPO and look forward to hearing from you.

- ..$US14 – 4 issues of the digital Journal only, all countries, e-mail address required
- ..$US24 – 8 issues of the digital Journal only, all countries, e-mail address required
- ..$US39 – 4 issues of the paper Journal only, US, Mexico and Canada
- ..$US72 – 8 issues of the paper Journal only, US, Mexico and Canada
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- ..$US75 – Sustaining Member level, 4 issues of the digital and paper Journal, all countries
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For your convenience, you may join online via the via the Internet or by completing the form at the bottom of this page.

To join or renew online, simply left-click on this Astronomical League web page:
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Afterwards, e-mail the ALPO membership secretary at *matt.will@alpo-astronomy.org* with your name, address, the type of membership and amount paid.

If using the form below, please make payment by check or money order, payable (through a U.S. bank and encoded with U.S. standard banking numbers) to "ALPO" There is a 20-percent surcharge on all memberships obtained through subscription agencies or which require an invoice. Send to: ALPO Membership Secretary, P.O. Box 13456, Springfield, Illinois 62791-3456 USA.

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Please share your observing interests with the ALPO by entering the appropriate codes on the blank line below.
Interest____

Interest Abbreviations
0 = Sun 1 = Mercury 2 = Venus 3 = Moon 4 = Mars 5 = Jupiter 6 = Saturn 7 = Uranus 8 = Neptune 9 = Pluto A = Asteroids C = Comets D = CCD Imaging E = Eclipses & Transits H = History I = Instruments M = Meteors & Meteorites P = Photography R = Radio Astronomy S = Computing & Astronomical Software T = Tutoring & Training Program (including Youth)