ISSN 0917-7388

COMMUNICATIONS IN

CMO Since 1986

# MARS

No.436

25 July 2015

OBSERVATIONS

No.62

*Published by the International Society of the Mars Observers*

## The Aphelion Cloud Belt in 2014

By

Christophe PELLIER

ISMO 2013 | 14 Mars Note (#09)

In 2012, we had a nice view on amateur images of one of the most typical meteorological features of the aphelion climate on Mars: the "Aphelion Cloud Belt" (ACB) also commonly called "equatorial cloud belt". The ACB has been fully on the 3rd Note of the 2011/2012 apparition in CMO #401*, so please refer to this former issue to read it. To recall shortly what we are talking about here, the ACB is a longitude cloudy belt made of faint white clouds, found between latitude range of 0° to 25°, roughly, or between the equator and the Lion tropique. Clouds form in altitude thanks to the northern summer Hadley cell.

In 2014, we were blessed by more detailed observations than before, including some exceptionally resolved images taken by Damian PEACH in Barbados (to be presented in Section IV).

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*http://www.kwasan.kyoto-u.ac.jp/~cmo/cmomn4/CMO401.pdf

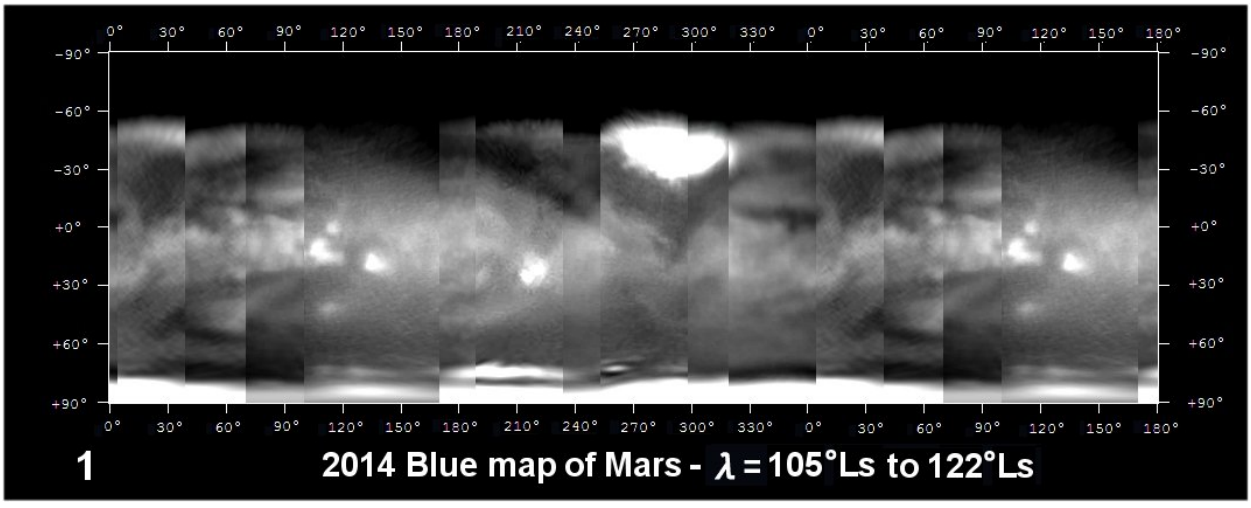


***Fig. 1: Blue filtered map of Mars during 2014. The map covers 540° in longitude (one revolution and a half).***

***List of observers:*** **Damian PEACH (15th, 27th April), John KAZANAS (19th March), Manos KARDASIS (29th March), Mark JUSTICE (15th April), Stefan BUDA (13th April), Efrain MORALES (25th March), Yann Le Gall (16th April), Christophe PELLIER (9th, 13th April)**

## I – General map and data processing

As for 2012 and 2010 (CMO #401), blue images have been map-processed and only a limited window of time has been selected around Martian mid-day, to eliminate morning and evening clouds. This kind of observation requires a number of images considerably larger than for simple surface mapping. The 2014 data, if more detailed than the 2012, is paradoxically poorer in term of good B images available. As a result, the selected window time has been enlarged (up to 3/4 hours in 2014, against 2 only in 2012). The range of the areocentric longitudes of the Sun (Ls) is comparable to that of 2012 (17 degrees in total against 14). It's a shame than no more observers send their blue images to the ISMO; the data from many excellent observers can't be used for some of the atmospheric studies.

## II – ACB general features

The 2nd Figure below focuses on some interesting parts of the ACB, that are visible as well on science works.**

The following general bright features can be seen:

**·1** Bright part over western Chryse (Xanthe/ Lunæ Lacus). In the MGS data, this part looks to be brightest, although this does not look to be the case here.

**·2** Bright part over Amazonis

**·3** Bright part between Syrtis Major and Elysium, a bit faint here

Some over regions are cloudless, or occupied by clouds from a different nature:

**·4** Tharsis orographics (Elysium as well) : clouds from the Aphelion belt don't look to exist there

**·5** Syrtis Major gap. This narrow gap is often accompanied on its eastern side by the Syrtis blue cloud (visible but very faint here)

**·6** East Elysium gap: again very narrow, sometimes completely free of clouds

**·7** A special feature that we could call the "Amazonis loop": the ACB is narrow in longitude and found at a higher latitude than the rest of the belt, at north of the relatively high plateau of Amazonis.

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** Wang, H., Ingersoll, A. P., Martian clouds observed by MGS Mars Orbiter Camera, *J.Geophys.* **107** (2002) 5078.

## III – Comparison with previous years

On Fig. 3 we can compare the general cloud map of Mars for the last three apparitions of the planet, covering mid northern spring to early summer. Logically, the 2014 map is very close to

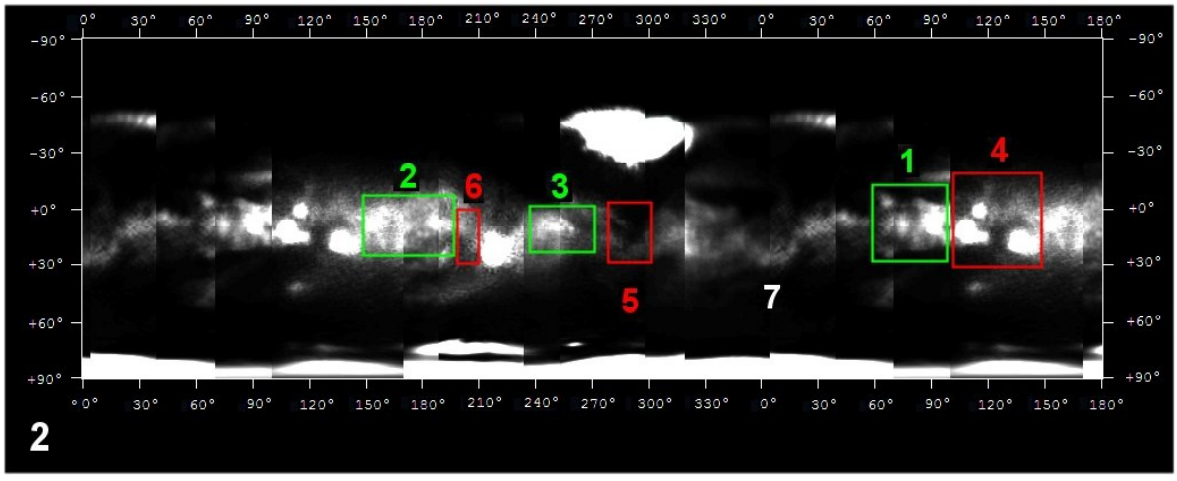


***Fig. 2: Same map as in Fig. 1 with a high-contrast processing to enhance the clouds only (and ice ground deposits).***

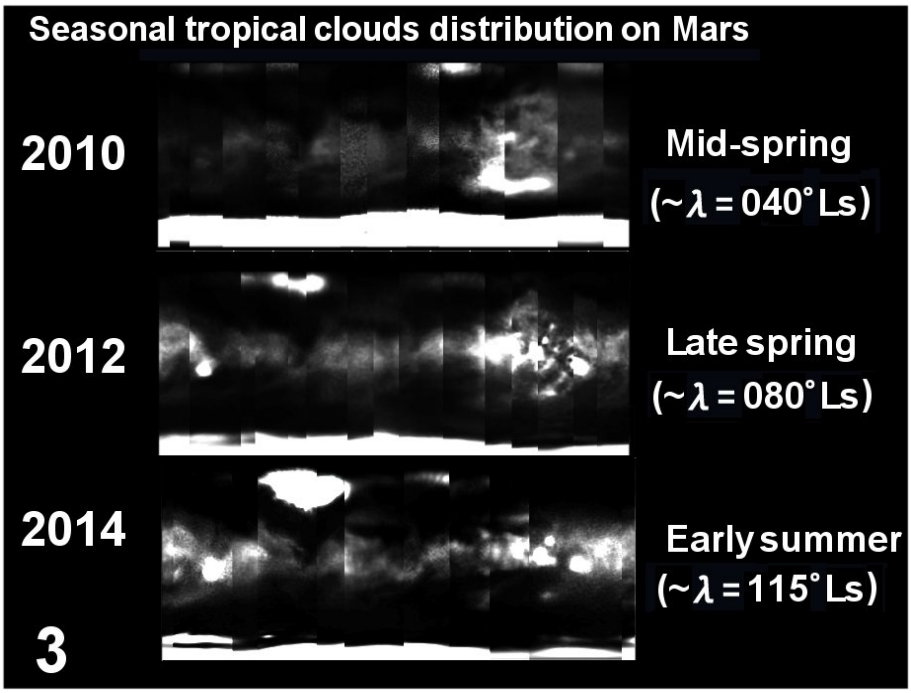


***Fig. 3: Blue maps of Mars from the three preceding apparitions at high contrast.***

↙the 2012, both apparitions covering a season where the cloud belt is formed already. The quality of this amateur processing is probably not good enough to tell if the differences seen between 2012 and 2014 are true or not. On MGS data, some differences where seen at the same seasons between 1999 and 2001.

## *IV – Some detailed features (Damian PEACH's data)*

During the opposition month, Damian PEACH went to Barbados where he took probably the most detailed amateur blue images of Mars ever. Two of them in particular where good enough to resolve the fine structure of clouds inside the ACB, showing their fibrous aspect, like ter- ↙

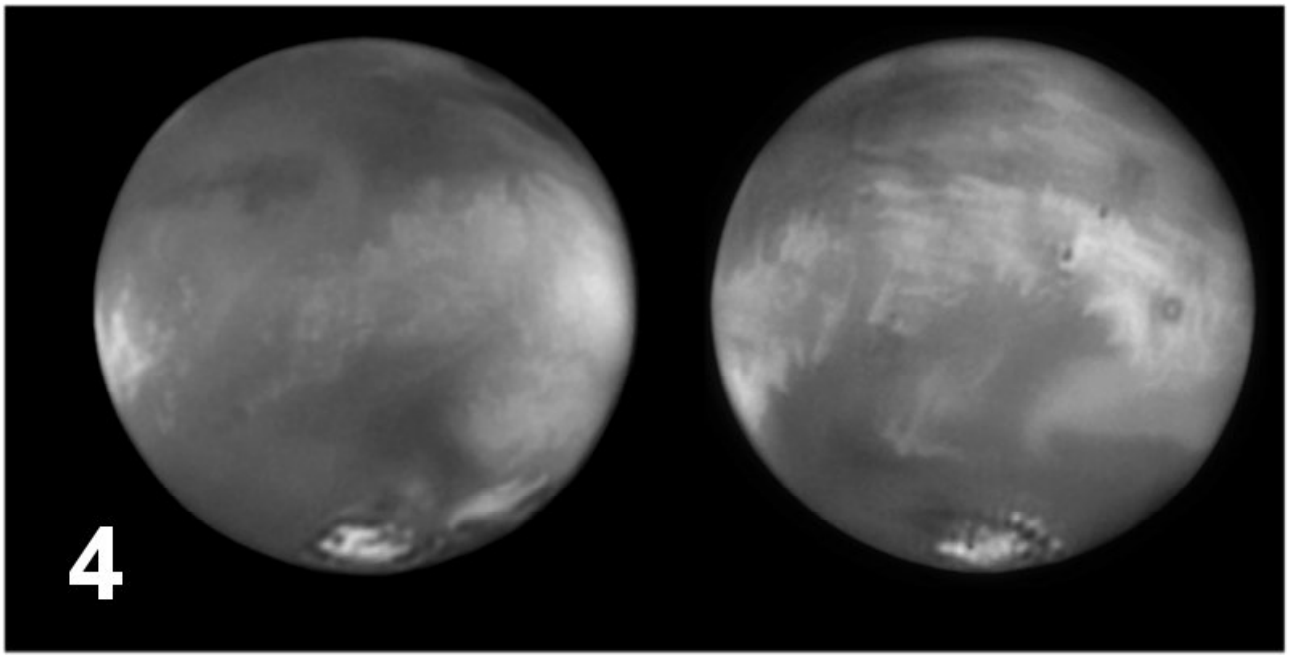


***Fig. 4: High resolution blue images of Mars taken by Damian PEACH. Left: 19th April (λ=116°Ls, ω=086°W). Right: 14th April (λ=119°Ls, ω=017°W). The Aphelion cloud belt is visible near the centre of the disk; many other detailed cloud structures can be observed.***

↙restrial cirrus. See Fig. 4. Figure 5 shows a violet image (F410M) taken by the HST in 1999 at almost the same central meridian that compares interestingly with Damian's image on 19th April.

The 2014 apparition was the last one to correctly observe the fully formed aphelion cloud belt. In 2016 the season will reach the second half of northern summer and we will have two main objectives:

·1 Trying to detect the small-scale change of clouds, that should develop a tendency to evolve from cirrus to convective forms (puffy or patchy). This promises to be very difficult because an excellent level of resolution will be required.

·2 Observing the decay of the aphelion cloud belt, that disintegrates around $\lambda$=150°Ls, at the time of opposition. □

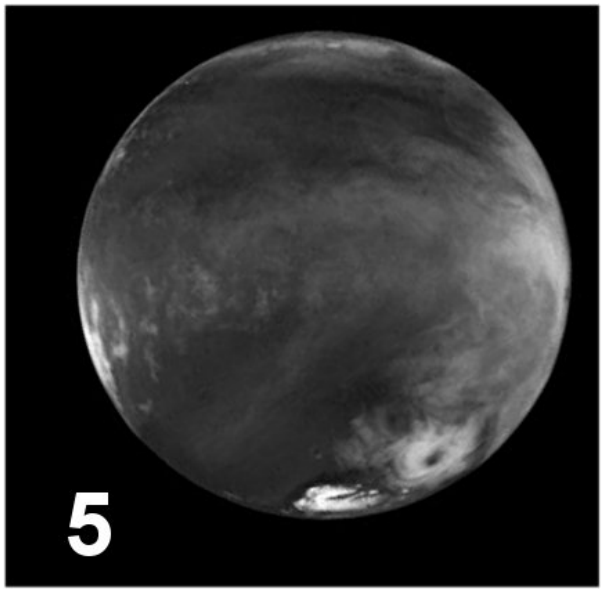


***Fig. 5: HST image taken on 27th April 1999 (λ=130°Ls, ω=018°W) with F410M filter. Compare with Fig. 4, left image.***

## On the Observations of the BAA Mars Section Made during the Period 1913~1914. Part III

By

**Masatsugu MINAMI**

WE have been a bit concerned with ANTONIADI's report of the BAA Mars Section observations made in 1913|1914. E.-M. ANTONIADI worked as the Director for the BAA Mars Section from 1896 to 1916 (during the period he treated 10 apparitions including the peripheral apparition in 1909). In 1909, the maximal angular diameter was 24.03 arcsecs, while in the case of 1913|1914 the maximal diameter was only 15.05 arcsecs. However the planet shined quite high up seen from England and France, and when it was at opposition on 5 January 1914, its apparent declination was +26°34'.

The following review is the sequel to Part II in CMO #434 (Part I was in #431) and shall treat SECTION III of the original article. The title is simply "SOLIS LACUS". It is hence interesting to see how Solis L was described, but it is rather disappointing without any interesting detail about the inside of the "Lake". The range treated here is Ω=070°W~120°W (as well Φ=60°S~60°N) so that the Tharsis ridges are included. This also raises our expectations how ANTONIADI may close in on the true aspect of the area, but it is also disappointing: No more than Ascræus Lacus is described. As to Pavonis Lacus, it was introduced by ANTONIADI himself in 1909, but it seems throughout his life he had never hit on the idea that Arsia Silva, Pavonis Lacus and Ascræus Lacus make an interesting trio. This might have

been caused by the reasons that he did not treat much enough observations which were exhaustive around the area during all his life.

SECTION III begins with a review of Bosporus Gemmatus: This is very the same style as he took on the occasion of the 1909 apparition (to further add, that the title of Section III is " Solis L" is all the same in the 1909 report and others).

**BOSPORUS GEMMATUS**: This was faint in 1913|1914. The only sketch in which it was darkish was Thomson's of 26 January.

**AONIUS SINUS** was indiscernible to Phillips (21 December 1913 at ω=097°W: Fig. below), Thomson and the Director (Antoniadi: 1 March 1914 at ω=112°W, 28 February 1914 at ω=141°W). "But McEwen described it 'distinctly outlined' on 7 October 1913, 'clearly visible' on 10 November and 16 December 1913; distinct 'the pointed N end' on 7 April 1914; 'the darkest visible detail' on 11, 13 and 14 April; and 'very dark' on 15|16 April 1914."

**THAUMASIA** "appeared to Phillips, Thomson and the Director outlined only to E and SE, owing to the extreme faintness of Sinus Aonius. The resulting form is charted in Plate III (not reproduced here). Thaumasia's SE part rose white to McEwen on 6 and 7 September 1913; its SW part rose 'bright white' to him on 10 October; the 'land' was bright risen to him on 13 October; its S part rose white to him on 24 December; the whole district appeared to him white on CM on 27 December; Thomson saw it whitish setting on 22 January 1914; and (*sic*) McEwen on 7 and 9 April; and the 'land' looked again brightish to McEwen on 14 April."

"On 21 December, Phillips drew a whitish spot on Thaumasia due W of Solis Lacus; while Thomson wrote on 26 January that over the *f* part of Thaumasia there was a light patch." "As Phillips saw almost the same thing in 1911, and the Director in 1909, this lighter district would seem to be permanent here."

**AUREA CHERSO** "appears to have encroached E into Auroræ Sinus, according to McEwen; a statement which Thomson confirms on 26 January and Phillips controverts on 21 December (←Figure)".

**SOLIS LACUS**, "Oval to Thomson and the Director, looked pear-shaped and revealed more structure to Phillips (←Figure). It appeared occasionally dark. The data of McEwen, Phillips, Thomson and the Director show that this 'lake' was seemingly dark on 9 November; indiscernible on 10 and 11 November; faintish on 16 and 20 December;

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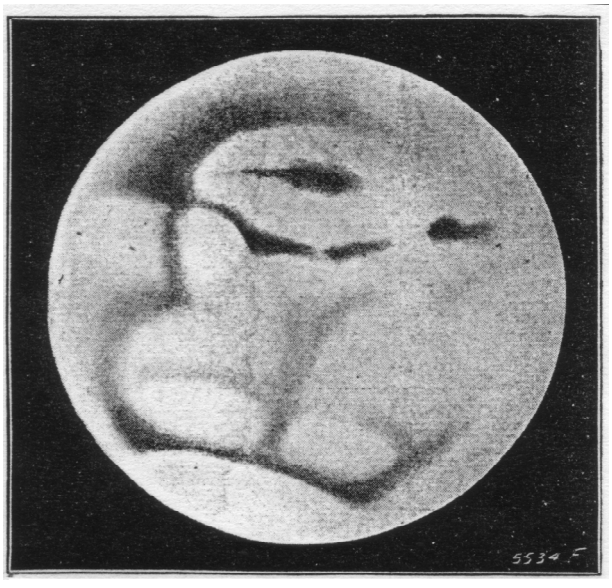
**T E R PHILLIPS' sketch on 21 December 1913 at ω=097°W, φ=7° by the use of a 12¼" Spec.**



very dark on 21 December; confused on 22 December; invisible on 27|28 December; very dark on 23|24 January; normally dark on 26 January; not seen on 31 January; very faint on 28 January, 1 and 6 March; and again indiscernible from 9 April to 16 April."

The abrupt changing of the "Lake" in December appears abnormal to us, but here is no associated data with the Local Time for each observation, and so we cannot add any suggestion. Thomson's drawing on 22 December at ω=072°W looks quite curious and does not suggest any existence of Solis Lacus, quite contrary to Phillips's drawing on the before on 21 December at ω=097°W (Figure ↑).

**DÆDALIA** "showed nothing abnormal."

**TITHONIUS LACUS** "presented its ordinary compound form to Phillips, Thomson and the Director; the W-shaped structure being caught by Phillips, the components, Ceti Lacus and Melas Lacus, by Thomson. The drawings of these observers, with those of McEwen, establish that the 'lake' was apparently unnoticed on 9 November; that it was very faint on 10|11 November; confused on 16 and 20 December; dark on 21 December; again confused on 22 December; faint on 27|28 December; dark on 26 January; faintish on 31 January, 28 February, 1 and 6 March; and that it was not seen later."

**PHŒNICIS LACUS** "was drawn by Phillips as a dark oval knot on 21 December (see Figure above)."

**LACUS ASCRÆUS** "is barely indicated as a very pale and diffused smudge by Phillips on the same date (Fig). McEwen found it 'faint' on 13 October, 'distinctly visible' on 31 January, and diffused on 10 March."

**MINAMI's Note:** The season in 1913|1914 might have been slightly earlier to watch the morning Tharsis ridges as the dark spots. However the next apparition in 1915|1916 might be said akin to the 1995 apparition (Mars was at opposition on 10 February 1916 while in 1995 on 12 February). The year 1995 or 1997 was a year when the dark spots began to be noticed visually by several amateurs. If the season exceeds λ=090°Ls, the triple dots are easily imaged as seen for example in the 2011|2012 CMO Mars Gallery. In the BAA 1915|1916 report (this being the final report written by ANTONIADI), he wrote there "ASCRÆUS LACUS was often drawn as a faint smudge by McEwen, and also by on 23 March 1916." However the smudge is never any dot (note furthermore that the dots of such kind had been observed by E E BARNARD already in 1894, and so this should have been one of special topics talked among the Mars observers). Unfortunately ANTONIADI missed the final chance because the next 1918 apparition might have been quite favourable since the season λ=090°Ls~λ=110°Ls was going to visit. □

**OPHIR** "rose whitish to Thomson on 22 November and 27 December; set bright to the Director on 28 February, and 'very white' to McEwen on 14 April."

**THARSIS** "rose whitish to Thomson on 22 December; set whitish to Phillips on 17 and 24 January, and to Thomson on 27 January."

**ASCURIS LACUS** "comes out as a dusky patch at the base of Ceraunius on the drawings of McEwen dated 10 November, 31 January, 9 April and 14 April."

**MÆOTIS PALUS** "can be identified as a

large, darkish condensation on McEwen's drawings of 6 and 7 October, on those of Phillips of 21 December (Figure) and 17 January, and on McEwen's sketch of 15 April."

That's all of SECTION III because we are to omit the appendix of "Minor Detail". The column of "Minor Detail" deals with Agathodæmon, Ceraunius, Chrysorrhoas, Nectar, Nilus. As the canal observers of Agathodæmon and Ceraunius, McEwen, Thomson, Phillips and the Director are recorded. Any observation of the canals is associated with the value of width, such as 2°, 3° or 4° or so on. □

## Letters to the Editor

●····***Subject: Re: How are you going? from Masatsugu Minami***
***Received: 2 June 2015 at 14:37 JST***

Dear Masatsugu, Yesterday at lunch I was casually reading the last two CMO issues that I had not time to read before. I was thinking into writing something complementary to your note #07 about Elysium. The fact that the cloud is not trailing eastward to the contrary of the Tharsis afternoon clouds is very interesting. Maybe we can explain it by the difference of latitude, and the position of the Hadley cell... if it sounds fine to you ? The passing of Don was regrettable : (he was of course one the persons that most inspired me when I was learning planetary astronomy (with you, needless to say, and a few other ones). We dedicated our book "Astronomie planetaire" to him. Talking about this, I would like to send you a free issue of the book.

Please keep me informed about how you are going in general, Masatsugu...

With my best wishes,

○····***Subject: Re: How are you going? from Masatsugu***
***Received: 16 June 2015 at 05:32 JST***

Dear Masatsugu, I will try to send you my note tomorrow. Research work took a bit more time than expected - at final it will be a Note about the winter Hellas in 2014... Best wishes, Christophe

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Le 02/06/2015 20:53, Masatsugu MINAMI a écrit :

Dear Christophe, Thank you so much for your prompt reply. Yes, it will be appropriate at this time if you kindly show us how the possible lee cloud of Elysium Mons trails southward. In the 1970's, Smith and Smith gave some statistics of the Elysium cloud activity, where the seasonal cycle of the Elysium cloud was not so different from the curve applied for Olympus Mons. At that time they estimated no more than the densities of the cloud images in B (during the period 1924~1969). However at present we should say we might be able to derive much more nicer results. We are satisfactory if you will give in #435 your further comprehensive analysis. Thanks for your kindness. ・・・・.

With best wishes, Masatsugu

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○····***Subject: 2014 Note 8***
***Received: 17 June 2015 at 05:30 JST***

Hi friends, Here is my note for CMO #435. Please tell me if you have some remarks... Best wishes,

○····***Subject: Re: Received your note***
***Received: 22 June 2015 at 18:34 JST***

Dear Reiichi, Thanks once again for the translation! I think I may have overlooked a bit Anthony's image:-/however the angle of view is less favourable. I think that the trailing clouds above the orographic only happen later in the season - as they are due to the trade winds coming from the southern return of the summer Hadley cell.... that will be onset around mid-spring. However we do not observed an eastern trailing cloud in the case of Elysium as Masatsugu recalled in one last note...

Best wishes,

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Message du : 19/06/2015 16:26
Subject : Received your note

Dear Christophe, I have started translating your 2014 Note #8 for the CMO Japanese version. Now I am translating your note and Bill's essay simultaneously! Yes, contemporary imagers' performances are great, they are fighting at the limit of optical resolution. Terby crater is just a near limit object. Not only the imager, I feel, but also the analyst needs some image processing in his/her eye/brain system in judging those delicate findings. I agree with you that Christopher Go's 05 April 2014 image clearly shows the Terby crater, as equivalently as Anthony Wesly's 04 April image (refer to my 06 April 2014 CMO LtE).

It's now the Martian season when the trailing orography of Elysium Mons should emerge, but unfortunately Mars is just in conjunction which means the probe data like MRO MARCI Weather Report, only means for us, will not be transmitted back to the Earth for several weeks because of telecommunication failures. The Elysium Mons Orographic trailing should be eastward as some sophisticated meteorological simulation models predicted.

Best Regards, Reiichi KONNAÏ

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○····***Subject: Re: Thank you for your excellent Note for CMO***
***Received: 30 June 2015 at 05:32 JST***

Dear Masatsugu, Many thanks for your compliments. You are welcome to correct the orientation of the figures... I will be more rigourous next time ;) I'm going to check the reference you are indicating. Best wishes, I'm thinking about a next note for CMO #436....

○····***Subject: ISMO 2014 Note 9***
***Received: 15 July 2015 at 00:35 JST***

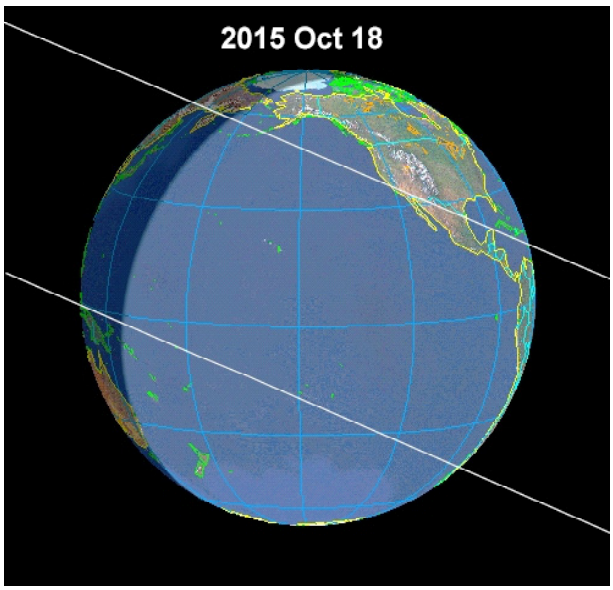
Dear all, Here is my note for CMO #436. Hoping that all is well with the documents... Best wishes,

**Christophe PELLIER** (Nantes, FRANCE)

●·····***Subject: Occultation of Chi Leonis by Mars***
***Received: 4 June 2015 at 01:01 JST***

Dear Masami -- This is to notify all observers that Mars will occult a bright star, Chi Leonis, on **18 October, 2015.** Video or rapid sequence imaging of this event may reveal the density of Mars' atmosphere at the areocentric latitudes of the recordings. Those who lack the capability of making brightness measurements will still find the event to be visually interesting. The event will be visible favorably from Japan, and at low altitude from the Philippines. It may be visible in daytime from Pacific Islands and parts of the Western Hemisphere.

See the attached path map. As seen from Tokyo (latitude +35.6895 degrees, longitude +139.6917 degrees), Mars will be 22 degrees above the eastern horizon with an azimuth of 97 degrees, and the Sun will be 18 degrees below the horizon. The duration of the occultation will be 156 seconds, beginning at 19:22:57 UT at about 11 degrees north Martian latitude, and ending at 19:25:33 UT at about 19 degrees north Martian latitude.




As seen from Cebu (latitude +10.3157 degrees, longitude +123.8854 degrees), Mars will be 8 degrees above the horizon at an azimuth of 84 degrees, and the Sun 31 degrees below the horizon. The duration will be 129 seconds, beginning at 19:23:01 UT at about 35 degrees south Martian latitude, and ending at 19:25:10 UT at about 28 degrees south Martian latitude.

Mars will be at magnitude +1.75, with a solar elongation of 40 degrees in the morning sky, and an apparent diameter of 4.1 arc seconds. Chi Leonis is an F0 star of magnitude 4.63, or a fifteenth as bright as Mars. It is also known at HIP 54182. Although a green or blue filter may enhance the contrast be-

tween Mars and the star, the use of such a filter may or may not enhance the quality of the data a particular observer obtains. Some occultations by Mars have been measured by measuring the change in the combined brightness of Mars plus the star, rather than trying to measure the star alone. The technique that is used should depend on the observer's judgement, in view of the instruments he has available.

The critical time of the observation, in which the atmosphere of Mars will partially block the starlight, will last only about 3 seconds at disappearance and reappearance. Reappearance will be in the illumination defect, so that the star might be seen slightly separated from the terminator and be more easily detected. However, the illumination defect will be only 0.16 arc seconds wide at its widest point.

Phobos and Deimos will also occult the star, but these events will not be visible at night from areas of Earth where there are known observers. Further detail about the events involving Mars, Phobos, and Deimos is available at

https://groups.yahoo.com/neo/groups/IOTAoccultations/files/Mars%20%26%20its%20moons%20occult%20Chi%20Leonis%2018-Oct-2015/

including more detailed path maps and detailed data on the locations of path limits. You must join the IOTA Yahoo message group to access these files (joining is easy). Alternatively, you are invited to obtain the information directly from me by contacting me at rjvmd@hughes.net .

The computations for such data are difficult. Observers are asked to contact me about their observations, unless they have previously coordinated with a interested astronomer. With high regards,

**Roger VENABLE** (Mars Section, A.L.P.O.)
Vice President, IOTA

●·····***Subject: Gigantic Impact Basin on Pluto?***
***Received: 8 July 2015 at 00:26 JST***

Dear Bill, I believe you are now awfully busy in the Plutonic ore fascination. When I was enjoying the "textbooky" animation showing the mutually tidally locked Pluto/Sharon system's rotation/revolution(just like a hammer throwing performance!)...

http://www.nasa.gov/nh/pluto-charon-surfaces-in-color

I noticed a huge quasi-circular lighter area on the "hammer thrower's back of the head", the antipodal region of the sub-Charon point on Pluto; what on Pluto is that!? An upper limit size Gigantic impact basin, one third across of the main body, like the Hellas on Mars!? Please take good care of yourself in this special period!

PS: My wife Reiko is well for now, we will be visiting Kyoto next week to enjoy Gion-Matsuri, one of the most famous festivals in Japan.

**Reiichi KONNAÏ** (Fukushima, JAPAN)

●·····***Subject: An Historic Encounter with Pluto ... Up Ahead!***
***Received: 13 July 2015 at 06:20 JST***

July 12, 2015

Dear Friends and Colleagues, An historic moment is nearly upon us.

In only two more days, and after a long journey of nine years, the New Horizons spacecraft will make its highly anticipated flight past Pluto and its five moons. With scientific sensors on alert, the spacecraft will silently and quickly go about athering precious bits of insight into what prevails on and around this body, more than 30 times farther from the Sun than is the Earth. Its arrival at Pluto marks the start of our official exploration of the Kuiper Belt ... that distant realm beyond Neptune where dwell millions of small, pristine icy bodies, and the source of many of the spectacular comets that from time to time grace the skies of the Earth. With hopefully two more encounters with smaller Kuiper Belt objects forthcoming in the next several years, next Tuesday's flyby also marks the beginning of the end of our initial reconnaissance of our solar system.

We have come far.

Already, strange features are seen on Pluto's surface (see attached 2 recent images of Pluto).

Might they be as strange as the structures Voyager found in 1989 on Neptune's moon Triton, a body of similar size and composition to Pluto, and believed also to be from the Kuiper Belt?

I would say so.

Accordingly, in preparation for our grand entrance into the Kuiper Belt in two days' time, and in anticipation of that moment when we come face to face for the first time with its most renowned member, gaze upon the phenomenal discoveries Voyager made at Triton 26 years ago, seen here in this large mosaic of Voyager images ...

http://www.ciclops.org/view_media/18314/Global-Color-Mosaic-of-Triton

... and wonder.

And allow next Tuesday to remind you that you have been blessed to live in extraordinary times.

(Mosaic caption here:

http://www.ciclops.org/view.php?id=3580 ;

More Triton images can be found at

http://t.co/NLj3N1pQzu )

Enjoy!

**Carolyn PORCO** (Boulder, CO)

Cassini Imaging Team leader
Director, CICLOPS, Space Science Institute,
Visiting Scholar, UC Berkeley, CA
Fellow, California Academy of Sciences

☆ ☆ ☆

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**CMO #436/ ISMO #62 (25 July 2015)**

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