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# Pluto Notes for CMO/ISMO

By

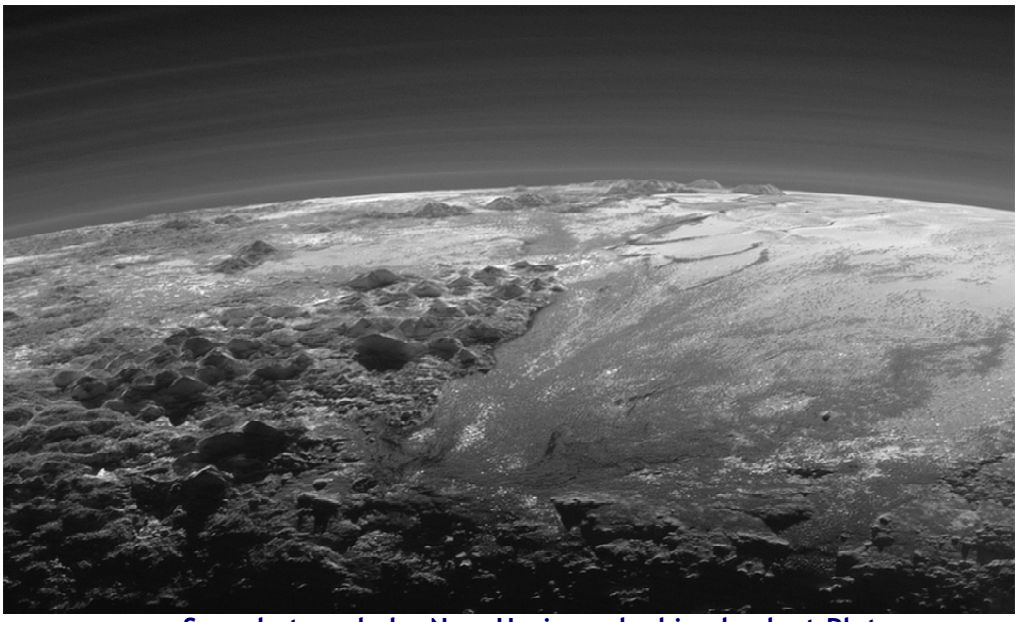
William P. SHEEHAN

## This Past Summer,

I had the opportunity to experience the excitement of the New Horizons flyby of Pluto at Lowell Observatory, where the (now dwarf) planet had been discovered 85 years previously by Clyde Tombaugh. In fact, I celebrated — under a large tent, with Jeff Hall the current Lowell director and other astronomers and dignitaries literally a stone's throw from the dome where Clyde took the plates on which he identified the moving image of the distant world — the resumption of radio communications with the spacecraft on Tuesday, July 15, 2015. I shall never forget it.

That same day was also another significant anniversary: the 50th anniversary of the Mariner 4 flyby of Mars. The two achievements 50 years to the day apart — Mariner 4 sending back the very first spacecraft images of another planet, New Horizons finishing the job by sending back images of Pluto — were apt bookends to the history of exploration of the Solar System.

I couldn't help thinking back to what I felt in 1965. Then Pluto seemed impossibly remote, and even Mars, incredibly remote. Indeed, I was just gaining conscious awareness of the planets, and had had my first view of Mars with a small telescope at the aphelic opposition that March — and still remember "how little it was, so silvery warm — a pin's-head of light!"



Snapshot made by New Horizons looking back at Pluto
about 15 minutes after its closest approach on 14 July 2015

(quoting Ogilvie in H. G. Wells's *War of the Worlds*). Odd, but I was not disappointed. I peered insatiably at that brilliant pinpoint, small in itself, portentous in its implications, for I was, at age 10, still a firm *Lowellian*. Even then the Mariner 4 spacecraft,

**Bill SHEEHAN in 1964 (10 years old)**

which resembled a Volkswagen-sized lampshade connected to a ceiling fan of solar panels but represented the cutting edge of technology at the time, was well on its way to the red planet—I could hardly wait for it to arrive. On July 14/15, 1965—Mariner 4 made its closest approach to Mars, coming within 6,118 miles (9846 km) of the surface. (The large miss trajectory had been specifically selected to avoid any chance of a crash and the possibility of contaminating the Martian soil with terrestrial microbes.) The images, with their coarse TV scanning lines, were not great even by 1965 standards; a single photo with a good 35 mm camera contained about 25 times the number of information bits of the entire Mariner 4 photo set. Furthermore, the images had surprisingly low contrast; they appeared murky and hazy, since designers had not counted on the dust, haze and mists that often veil Mars—though it is also possible that the problem was something more mundane, originating in a light-leak in the camera system. Nevertheless, poor as they were, they provided the first view of real topographic and geologic features on Mars instead of the broad shadings and shifting clouds that had been the domain of generations of telescopic observers, including Percival Lowell himself. The features included impact craters, something like three hundred in all, including one in the classical albedo region Mare Sirenum measuring 120 kilometers across (and now bearing the name "Mariner"). Most astronomers had not expected craters on Mars—though one or two, including Clyde Tombaugh, had foreseen them; Clyde argued in 1950 that the "oases," dark circular patches at the intersection of canals might be craters, while the canals were possibly cracks in the surface. Afterwards, someone pointed out that it wasn't clear just what astronomers were expecting. I can answer that: they were expecting an Earthlike planet, not a dead world like the Moon.

A little bit of me died that day. Mars—and Lowell's theories—had meant so much to me. It was a shock to see Mars as a battered, lifeless, Moon-like world.

It was a case where the reality was less than our dreams.

Fifty years later, as New Horizons approached and Pluto (and Charon) began to grow from points into worlds, I wondered whether I would feel the same way again.

## A Puff on the Pad

I had had the good fortune to see New Horizons off from Cape Canaveral on a site located on the west side of the Banana river, six miles from Launch Pad 41, on which the powerful Atlas V 551 stood poised, a tiny finger of light catching the fleeting sunlight. The launch had been twice postponed; one day because of high winds, the second because of a power outage caused by severe winter weather at Maryland's Goddard Flight Center. By the third day, the winds at the Cape had dropped, but broken clouds were passing overhead, and the launch was delayed for two suspenseful hours until a patch of blue arrived big enough to thread a rock-

et through.

At last, at about 2 p.m., the hold was lifted; the countdown proceeded — "T minus 10, 9, 8 ... 3, 2, 1." On cue, a puff of smoke appeared on the distant horizon, followed by a flash of orange flame. The rocket was an inverted candle — with fire spewing out the rostral end — and it rose slowly, majestically, above the pad, along a smoke- wreathed easterly arc across the sky and out over the open Atlantic.

In a minute or so it had disappeared behind blankets of cloud. I was emotionally overcome; tears welled up in my eyes. I had witnessed the departure of an emissary for a world so distant that not long ago — during my own 1960s era childhood, when I was immersed in the Race to the Moon, and depressed by Mariner 4 — it had seemed too far even to excite the imaginations of science fiction writers. It was hard to believe it, but we were now bound for the icy world of Percival Lowell's dreams.

I knew that I had been present as history was being made, and felt as privileged as those Spaniards who watched the Niña, the Pinto, and the Santa Maria set out on their portentous voyage of discovery from Palos in 1492. Columbus's three ships took two months to cross the Atlantic (with, admittedly, a layover of a full month in the Canaries). The New Horizons probe, accelerated to a speed of 61,000 kilometers/hour by the fastest rocket yet launched, made the same passage in minutes, and in only nine hours passed the orbit of the Moon. With a gravitational assist from Jupiter, it received an additional boost to 66,000 kilometers/hour. Even so — such is the vast scale of the Solar System — it took 9½ years to reach Pluto, and then it was so far away that its radio signal, traveling at the speed of light, took 4½ hours to return to the Earth.

## Encounter Week

When I watched New Horizons shoot, like a bat out of hell, upward and through the clouds, the date of its rendezvous with the planet, July 2015, seemed a very long time away. As stirring as it was to see it off, there seemed like plenty of time for things to go wrong. I'm not sure what odds I would have given of its making it, nor had I any clear idea just what to expect when it arrived in the Pluto-Charon system. Undoubtedly, if I had been asked, I would have guessed a planet rather like Neptune's large moon Triton; most of the time comatose and in the suspended animation of deep breeze, but erupting into sporadic geyser-like activity, and mantling itself in an ephemeral atmosphere, during the 20 years (out of 248) it brushes closer to the Sun than Neptune.

New Horizon's closest encounter with Pluto occurred at 11:40 UT, 14 July 2015, when the spacecraft passed within 12,500 km from Pluto's surface.

It was followed, fourteen minutes later, by the spacecraft's closest approach to Charon. The large

**Bill SHEEHAN (right) with Ewen WHITAKER (now 93) during New Horizons flyby week**

**Pluto last before the Flyby on 13 July 2015**

moon was exactly opposite Pluto from New Horizons, 28,800 km away.

The flyby was a complete success, and we are still, over two months afterwards, receiving downloads of data from the spacecraft (and will continue to do so for another year). The latest images came back just last week. As Alan Stern, principal investigator, summed up in three words immediately after the flyby: "We did it." In contrast to the disappointment of Mariner 4, Pluto has surpassed our expectations and delighted us. Nature is more inventive than we give her credit for. When discovered by Clyde in 1930, it was a mere speck of light blinking on the frontier of the Solar System; now we know it as a strangely beautiful and complicated world. It is far different from what anyone could have dreamed, and the basic enigma that it seems to present is that of its surprisingly fresh and youthful surface (especially in the large smooth plain that has been unofficially named "Tombaugh regio." As Alan Stern put it in an interview this past week, echoing themes about the evolution of worlds that go back as far as Percival Lowell himself:

"Geological processes require heat, and therein

lies the riddle. There's really no good model for how these small planets can have their engines running after four billion years. As planets get smaller, the ratio of surface area compared to their mass goes up. That means that they can't trap the heat inside very long. They cool off."

"He gestures to the paper cup of coffee on the table in front of a large cup of coffee will go cold faster than a big pot. The tidal forces from a nearby gas giant, a planet like Pluto, which is one-sixth the size of our moon and circles the outer reaches of our Solar System, should be long dead." (And of course that's what everyone expected.)

Different models proposed prior to the New Horizons arrival showed that a number of different things might happen, depending on the amount of nitrogen available and the thermal inertia of the atmosphere. In one scenario, there are two polar caps, in another, there are large caps at only one or the other of the poles. Then there are the effects of methane to consider—a much more efficient greenhouse gas than carbon dioxide. At present, all we can say is that the complexity of Pluto—and the resurfacing of certain areas—is broadly consistent with what could be deduced from the orbital geometry and axial tilt.

There will no doubt be many detailed analyses presented in the next year as more data is downloaded from the spacecraft, but for now, it is enough for us to savor each new set of images that NASA releases from the flyby of a lifetime. □

# Disturbances at Xanthe and around Lunæ Lacus after the Northern Autumnal Equinox

By

**Masatsugu MINAMI**

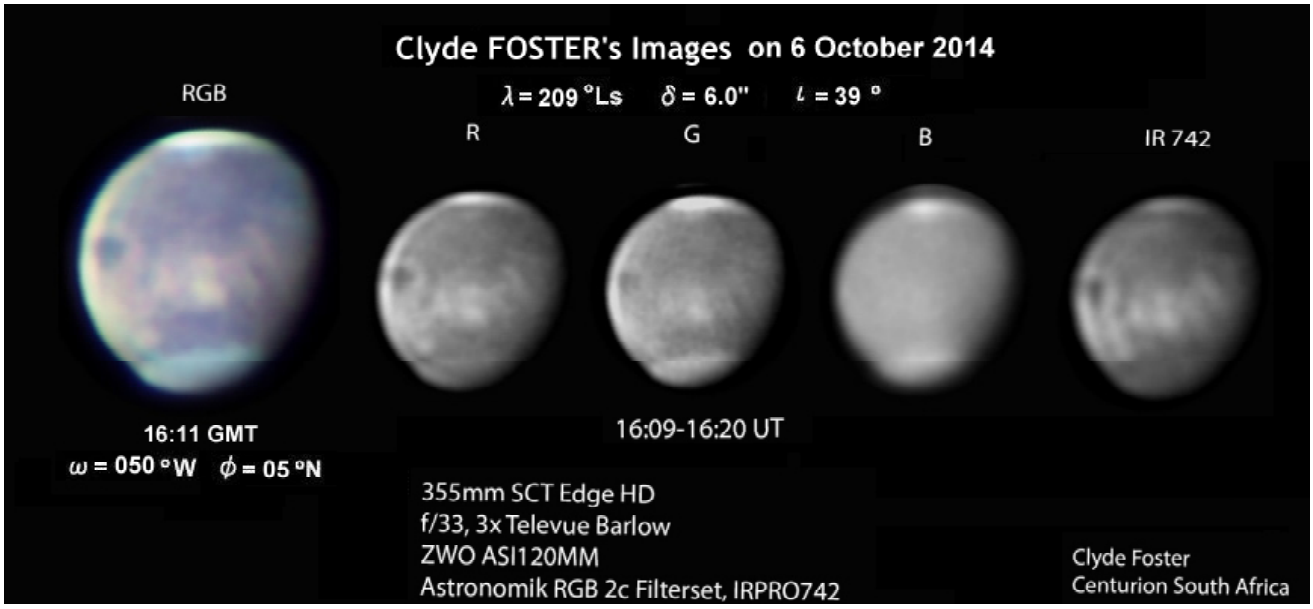
**ISMO 2013|14 Mars Note (#11) and Forthcoming 2016 Mars (#01)**

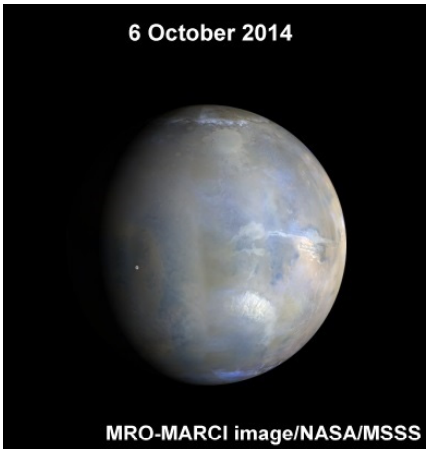
This article deals first with the excellent work by Clyde FOSTER (*CFs*) who detected an interesting local dust at the northern Xanthe on 6 October 2014 (λ=209°Ls) at ω=050°W. As to this observation we timely reviewed in the 2013/14 Mars Report in CMO #340 at page Ser3-0870. At present we have no other particular comments on *CFs*'s work, but it showed a beauty of discovery of the local dust when the apparent diameter was shrinking to δ=6.0", and this may be counted as one of the most suggestive phenomena worthy of special mention. This phenomenon in 2014 will be expected to occur again in 2016 (as well as in 2018), especially to be checked by the observers in Australia and South Africa because of the specific apparent declinations in 2016. So here we would like to discuss such cases as the one observed by *CFs* in 2014 under a wider perspective.

The *CFs*'s images are shown at the top of the next page, originally published in the Web Site of the CMO/ISMO Mars Gallery (Ref. 1]):

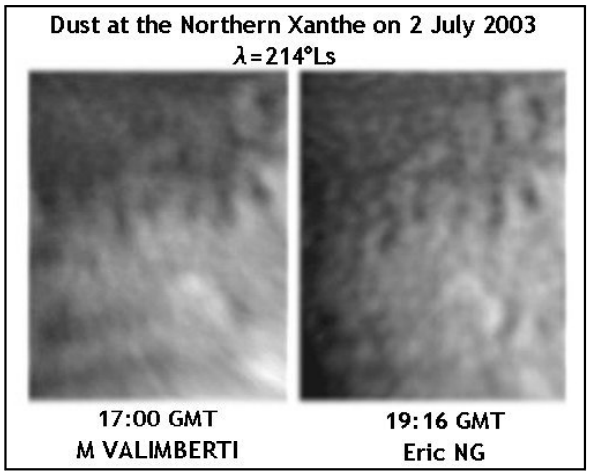
It was also noteworthy that *CFs* continued to take the RGB decompositions on consecutive days (see 2013/14 CMO/ISMO Mars Gallery).

This dust disturbance on 6 Oct is visible in G, while not so evident in B so that this must have been a dried dust: This must have been a typical local dust disturbance which dispersed at night. As noted by Reiichi KONNAÏ in CMO #428 LtE (received on 18 October 2014 at 01:23 JST) at page Ser3-0841, the dust was detected also by MRO-MARCI on 6 October where it was shown clearly to the north of Auroræ Sinus with a frilled boundary (see the next page). The expression of MRO-MARCI is not necessarily parallel with the one taken at the terrestrial basis: The dust which creeps inside the deep valley at Agathodæmon is quite evident on the composed image of MRO-



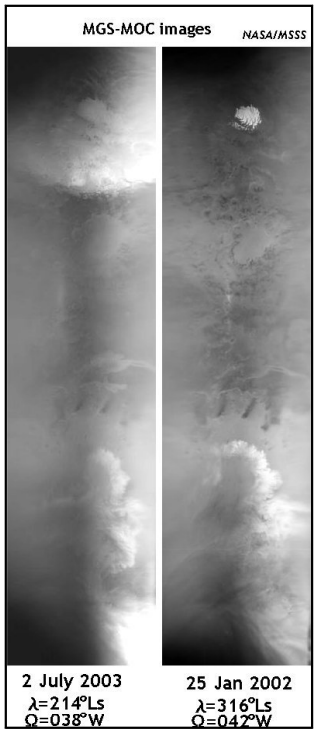

MARCI, but not necessarily on the images from taken from the Earth. The dust sunken inside a depressed valley must have not been so evident to us, depending on the angle of the incident Sun-light.




Note that the dust was located at the northern Xanthe. We also gave an N.B. at the final line of the report of the 6 Oct observation in CMO #430 as follows:

**N.B.bis**: By the way, in 2003 at λ=214°Ls, not so different from the present season, some CMO members as VALIMBERTI, PAU, NG, KUMAMORI, ISHADOH, and MINAMI detected a local dust in Xanthe near Nilokeras on 2 July 2003. This was summarised in CMO #289 (and so please try to refer to Ref. 2]).

It should be remarked that the dust in 2003 also occurred at the northern Xanthe, and the season λ=214°Ls is not so far from the *CFs* case (λ=209°Ls). So we may be admitted to say that both show a high resemblance. In 2003, just before the great apparition the apparent diameter was as large as δ=16.9" on 2 July. Here are shown the images of Maurice VALIMBERTI and Eric NG. There exists quite a time difference between the two shots, but the images of the dust don't show any possible difference. The image of the dust on 2 July 2003 was taken by MGS-MOC as shown here →, and its lhs swath shows the one corresponding to the case of VALIMBERTI and others. It is of interest to see the rhs swath which was taken at the very different season (at λ=315°Ls), but the dust itself looks quite the same as the one at λ=214°Ls. That is, at different seasons the similar dust marking appeared at a similar place. The



outlines of the dust bursts turned out to be quite textured having the similar frills. This will imply that the occurrence of dusts must have been depending on the delicate configuration of the very ground (quite lowland with a slight slope), but we may be declined to believe that it is less dependent on the season. This is however not quite the case.

The purpose of this kind of Note is first to trace the phenomena in 2014, while we also aim at issuing some propositions useful in 2016. It is therefore appropriate to take the work of seasons into account. To seek the seasonal changes, it is indispensable to refer to the data which were obtained during the similar apparitions.

In the case of the 2016 apparitions, the 2001, 1986, 1969, 1954,….apparitions are the cases. The article in Ref. 3] is one example. As described in it, the 1954 case showed a darkening of Lunæ Lacus at λ=202°Ls, and at λ=227°Ls Lunæ Lacus was not only quite dark but also its nothern neighbourhood was associated with a dust (on 3 September 1954). This data remained quite personal so that we cannot easily regard it universal, but we may suggest that during the period λ=200°Ls～λ=230°Ls we have to carefully watch the area of Lunæ Lacus. Reference 3] also suggests that in 1969, the area of Lunæ Lacus was described quite dark during λ=205°Ls～λ=207°Ls. This data is also quite personal, but we may safely say that we should pay attention to the neighbourhood of Lunæ Lacus from λ=200°Ls onward (at least after the northern autumnal equinox (λ=180°Ls)).

The reason why any so-called dark-marking turns to be very dark must be due to the fact that a descending high pressure air governs the marking area to sweep clean the dirty sands over the marking. At the same time there will be associated with a rising air (updraft) near the area. That is, there will be born a storm cell or several storm-cells around the area. The reason why the season after the northern autumnal equinox is involved is because the upper air begins to be cooled down earlier than the ground, and hence high pressure air masses find their activities. The downbursts may give rise to several dust patterns on the ground (some could cause a large obscuration because of the updraft parts of the cells). In this sense, λ=214°Ls in 2003 and λ=209°Ls pinned down by Clyde FOSTER (*CFs*) do both belong to the term in question.

According to Ref. 4] (as cited in Ref. 2]), the dusty disturbances incessantly take place on the northern hemisphere, and during the period of λ=109°Ls~λ=274°Ls in 1999 they checked a total of 783 dusts on MGS-MOC images. However if they choose such dusts as having larger area than $10^6 km^2$ the amount of each dust is not so much. If we further restrict our search inside the windows near Lunæ Lacus and neglect such dusts which occurred deep in south, then the following are the cases of the seasons when the windows near Lunæ Lacus proved to be active: λ=135°Ls, 150°Ls, 158°Ls, 159°Ls, 160°Ls, 162°Ls, 187°Ls, 194°Ls, 203°Ls, 210°Ls, 221°Ls, 223°Ls, 224°Ls, and 227°Ls (maybe different from the descriptions in Ref. 2]). Note also that we did not count such large dust disturbances which occurred in quite a different hemisphere. The dusts at λ=150°Ls~165°Ls were those appeared near the small perimeter of the north polar cap (npc) since the npc reached the final state. So also in 1999, we may say the period λ=210°Ls~λ=227°Ls when strong dust disturbances were given rise to. Especially in 199, the dusts at λ=210°Ls and 221°Ls are said to have repeated to be reproduced for a fortnight. And some were reproduced near on the lower southern hemisphere (cross equatorial). Note here that the resonance reproduction does not necessarily imply “to have moved.” The article (Ref. 4]) by Bruce CANTOR and others is said to have traced the duration λ=109°Ls~λ=274°Ls, but it is suggested even after the Winter Solstice such reproductions of dusts occur during λ=300°Ls~λ=318°Ls: This looks they must have obtained from the investigations of the MGS-MOC in 1998 especially at

Chryse. Miraculously the image on 25 Jan 2002 (λ= 316°Ls), above cited, fits the season.

Huiqun WANG and others discuss the cross-equatorial dusts in Ref. 5] in the framework of the GCM (General Circulation Model). However the present writer does not stand on the side of the view that the dusts themselves move southward (even at present as well as when we wrote Ref. 2]). The storm cells will be given rise to collectively, but it's nothing but some will spontaneously build a small cell or a few cells on the southern side. To sum up, the period of λ=210°Ls~230°Ls must be a challenging term when we should construct a closer connections with the world-wide Mars observers.

We next try to see how the above set of λ is distributed in the calendar in 2016 based on Ref. 6].

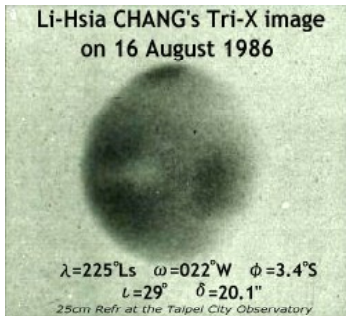
First of all, the period where δ is larger than 10" starts on 14 March 2016 to 8 September 2016. If we watch some high-latitude dust around the npc, putting λ=160°Ls in mind, we should be careful from the end of May to the beginning of June 2016. The planet is at opposition on 22 May, and δ is keeping δ=18″ and φ=9.4°N, and hence the apparition is favourable to watch the dusts near the perimeter of the npc. On 30 May the planet will be closest to the Earth with the maximal diameter δ=18.6" and φ=12°N. The equinox λ=180°Ls will come on 3 July (δ=16.1"), λ=202°Ls comes on 12 August 2016 with δ=11.9", λ=209°Ls will be on 23 August, λ=214°Ls will be on 1 September with δ=10.4", and λ=227°Ls will be on 21 September with δ=9.2".

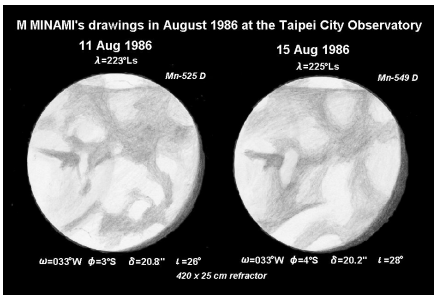
As characteristics of the apparition in 2016, as in 1954, 1969, 1986 and in 2001, the altitudes of the planet Mars appear terribly lower for the observers in the terrestrial Northern Hemisphere because of the apparent declination. On the other hand, this apparition must be very favourable for the observers in Australia and South Africa. So we hope they will try to examine the Martian surface conscientiously during the seasons.

The apparent declination will be 19.5°S around on 14 March when δ=10", 21.6°S on 22 May when the planet will be at opposition, 21.5°S on 30 May when Mars is closest to the Earth. Further, it will be 21°S on 3 July, 23.6°S on 12 August, 25.1°S on 1 September, and will be near 26°S on 21 September. This may be a bit better than in 1954 and 1986, when it approached 28°S.

Before closing this Note, we would like to complement the above cases by referring to a particular case in 1986. The year 2001 was also a candidate, but in this case a global dust storm was entrained very early at λ=183°Ls to the extent that it was impossible to catch the area of Lunæ Lacus after λ=200°Ls.

In 1986, the present writer went to Taiwan and stayed there for longer than half a year to observe Mars, because in Taipei, Taiwan, the planet shined higher by about 10 degrees than in Japan. Some details will be written in a near future, but we would like to touch on the specific disturbance which we witnessed around at λ=225°Ls. Here is shown a Tri-X Pan image made by CHANG Li-Hsia (張麗霞) of the Taipei City Observatory on 16 August 1986. The image here is shown in a B/W inverted view, and so the white patch at the afternoon side implies Sinus Meridiani which was followed by a large dark part in Chryse covered by a water-vapour disturbance (as dark as the spc) due to the water vapour complexity associated with the active north polar hood. The area had looked strange from a few days before. Here are also shown our drawings on 11 August and 15 August taken at the same LCM.



In 2016, λ=225°Ls visits on 18 September. Since another milestone at λ=227°Ls is so near that we should try to concentrate on the region in mid-September.

**P.S.**: After writing Ref. 3], I suddenly recalled an old Japanese article written around in 1980 by Toshihiko ŌSAWA (1935~2001) who reported that in August 1969, Charles F. CAPEN, M. MINAMI and the author (T. ŌSAWA) detected in Tempe a darkening of *Issedon* in a dark brownish colour. At that time, the present writer made no correspondence with ŌSAWA and so my observations must have been communicated to him via Tsuneo SAHEKI (1916~1996). ŌSAWA was also a member of the A.L.P.O. and communicated with C. F. CAPEN (1926~1986): So I suppose the raw observations of CAPEN in August 1969 around at λ=210°Ls might be kept among the Lowell Observatory archives. □

## References

Ref. 1] CMO/ISMO Mars Gallery:
http://www.kwasan.kyoto-u.ac.jp/~cmo/cmons/2013/141006/CFs06Oct14.jpg

Ref. 2] MINAMI, M. Xanthe Dust on 2 July 2003
http://www.kwasan.kyoto-u.ac.jp/~cmo/cmomn3/289Note02_03/index.htm

Ref. 3] MINAMI, M. Personal/Nostalgic Reminiscences of the Mars Apparitions in 1954, 1969, 1986 and 2001. Part I (1954 and 1969 Cases)
http://www.kwasan.kyoto-u.ac.jp/~cmo/cmomn4/CMO437.pdf

Ref. 4] CANTOR, B. E. and others, ″Martian dust storms: 1999 Mars Orbiter Camera observations" *Jour. Geophy. Research*, **106** (2001) 23,653

Ref. 5] WANG, H. H. and others, Cyclones, tides, and the origin of a cross-equatorial dust storm on Mars" *JGR Letters* **30** (2002) 41-1~41-4 .

Ref. 6] *The Astronomical Almanac for the Year 2016* (published by the USNO and Her Majesty's NAO)

# Letters to the Editor

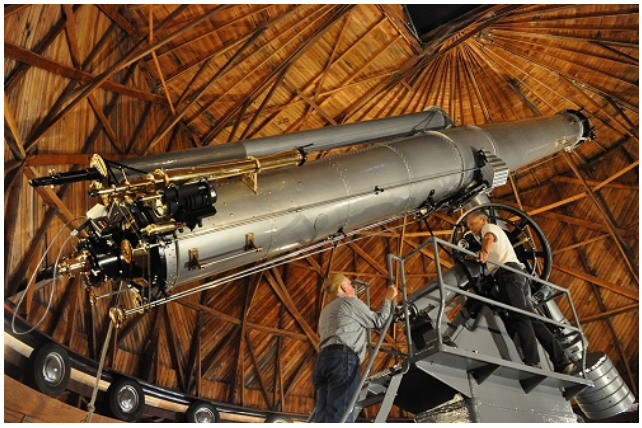
●·····***Subject: Re: August 9***
***Received: 1 September 2015 at 06:03 JST***

Dear Masatsugu, I am sorry to hear of your continuing health problems, and of course understand the delay in your responding. My situation here has been a mixture of good and bad. The good--it looks as if Dale Cruikshank and I will get a go-ahead from U of Arizona Press to do a Pluto book for them. So this should keep me quite busy the next year. The bad news is that my job for the state of Minnesota is being phased out as of October 1; which was quite unexpected. For sometime we have had governors whose philosophy has been Reaganesque--no new taxes, "starve the beast" of state government. I have contracted for nine years in Willmar with various remnant programs of a state hospital that was closed and whose campus was sold off to private agriculture (poultry) interests in 2008, and these remnant programs are now--like the last bits of a melting glacier--going away as well. There is the private healthcare sector but unfortunately that is organized (in the US) entirely around profits; so though I have some job offers now I will have to travel and also will have to work a kind of assembly-line which is not appealing. I will have to do some careful thinking about my options alas.

Congratulations on the 30 years of CMO--that is a great record. Do you think we could do a highlights of CMO sometime next year perhaps?

I will write up something about the Pluto flyby as experienced in Flagstaff, and will also do something for the January issue--perhaps noting that

2016 will both enjoy a favorable opposition of Mars (perhaps to be observed with the newly refurbished Clark; see below) and also the centennial of Percival Lowell's death? Kind regards,



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On Mon, 31 August 2015 at 2:38 PM, Masatsugu Minami wrote:

Dear Bill, I am sorry I have been silent for a while. To tell the truth, I have not been so well in health, mostly because of decrease in physical fitness. Really I cannot walk long, nor write long. This time, concerning the CMO, I needed too much time to edit. I cannot sometimes remember some of English words (possibly due to my senile dementia tendency).

Thank you very much for your email "August 9". Though I could not respond promptly, I appreciated with pleasure what you wrote.

I hear nowadays 40% of the citizens in Hiroshima and Nagasaki cannot identify the days August 6 and August 9 as what days. Every year ceremonies in Hiroshima and Nagasaki have been on TV air. This year the message of the Mayor of Nagasaki City, Tomihisa Taué, was especially impressive. He mildly criticized in good Japanese the recent trend of the Japanese Government. Without any war for 70 years in Japan, the Abe Government does now show a tendency to oligarchy. They apparently want to change Article 9 of the Japanese Constitution (which declares that the Japanese people forever renounce war as a sovereign right of the nation and the threat or use of force as means of settling international disputes).

(Do you remember that the Mayor of Nagasaki is eventful? The former Mayor of Nagasaki, called Iccho Itoh, was shot dead in 2007, and the Mayor before Iccho Itoh was attempted to be shot in 1990. You and I were to see Iccho Itoh Mayor in 2004, but unfortunately he was away from the office and so some others met us. Three years later he was shot.)

Yes, we should like to receive a next opening essay for CMO #438 (September issue) from you. You might touch some stories at Lowell Observatory in mid-July concerning Pluto. We would be thankful to you if we could receive your article by 15 September.

You may know, but our CMO will welcome the 30th anniversary in January 2016 (first published on 25 January 1986). And hence we would like to invite you to write the first essay of the January 2016 issue. We of course welcome your other articles in October, November and December. I hope I could be free from the senile dementia for a while.

With best wishes,
Masatsugu

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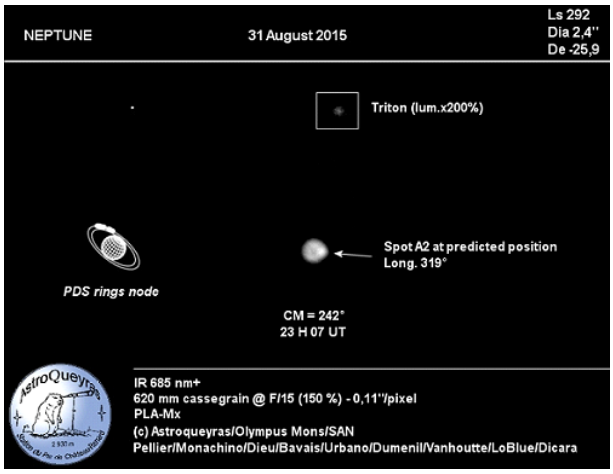
**Bill SHEEHAN** (Willmar, MN)

●·····***Subject: Neptune with spot A2 2015 aug. 31th***
***Received: 1 September 2015 at 21:42 JST***

Hi all, Here is an image of Neptune taken last night with the 620 mm Cassegrain of Astroqueyras, where I'm participating to a one week mission with Belgian club Olympus Mons (Giuseppe Monachino being the chief of mission). Conditions were briefly good but deteriorated later, preventing me from taking more images.



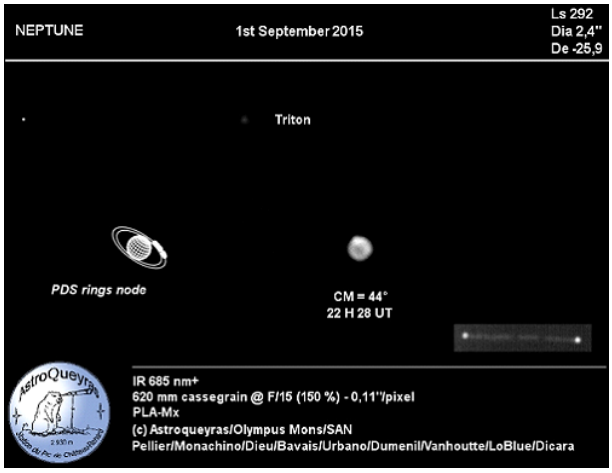
http://www.astrosurf.com/pellier/N2015-08-31_23-07_IR_AQ

The image shows a bright spot at predicted position of long. 319° (thanks Marc !). We will have another chance to catch it on Thursday evening.

Best wishes

○····***Subject: Neptune on September 1st 2015***
***Received: 2 September 2015 at 20:06 JST***

Hi all, Here is a new image of Neptune from last night. Some brightening is caught as usual on the south hemisphere, one being more conspicuous.




http://www.astrosurf.com/pellier/N2015-09-01_22-28_IR_AQ

Seeing was excellent but with passing clouds and only one image could be secured. The night ambience was fantastic, very quiet and steady, with the moonlight reflecting on floating ghost clouds in the valley and around the italian Viso mount :

http://www.astrosurf.com/pellier/vallee_aq_nuit

Best wishes,

**Christophe PELLIER** (Nantes, FRANCE)

●·····***Subject: Enceladus Has a Global Ocean***
***Received: 16 September 2015 at 09:13 JST***

Dear Friends and Colleagues, Today, my imaging science team members and I announced the conclusion of several years' of work to find evidence of a global ocean within Saturn's moon, Enceladus. We've known for some time that a liquid layer is present, but not how extensive it is.

Well, now we do. [The paper in the journal *Icarus* reporting this news has been posted online today, but won't really be officially published for another week.]

In the meantime, you can find more information in my Facebook post giving the back story to this exciting report : http://t.co/6NbrhG5g0C

And here find today's press release:

http://www.ciclops.org/view.php?id=8199

Enjoy!

**Carolyn PORCO**

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

☆ ☆ ☆


## *International Society of the Mars Observers (ISMO)*

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**CMO #438/ ISMO #64 (25 September 2015)**

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