

MARS

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OBSERVATIONS

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Northern Fall Equinox

By

Christophe PELLIER

ISMO 2013 | 14 Mars Note (#12)

As on the Earth, the equinoxes on Mars are important transitional periods for the meteorology. The 2014 apparition offered an uncomfortable window to observe the fall equinox for the northern hemisphere, but some nice information was gathered by observers.

Presentation of the planet at the time of equinox

In 2014 one equinox occurred on 16th August, at a solar longitude (Ls) of 180° so this was fall for the northern hemisphere. The declination of the Earth (DE) was very favourable since the tilt of the Martian northern pole was 18° toward us, so the polar region was easy to observe. Other parameters were unfortunately less comfortable

since the apparent diameter dropped to $\delta=7.3''$ at that moment. The solar elongation of the planet in our sky was less than 90° but above all, the position of the planet at the "declining" part of the ecliptic after sunset was hard for northern observers. That said, many observers were still active in favored Earth locations such as the south of United States, South America, South Africa, Asia and Australia. See Fig. 1 for diagrams.

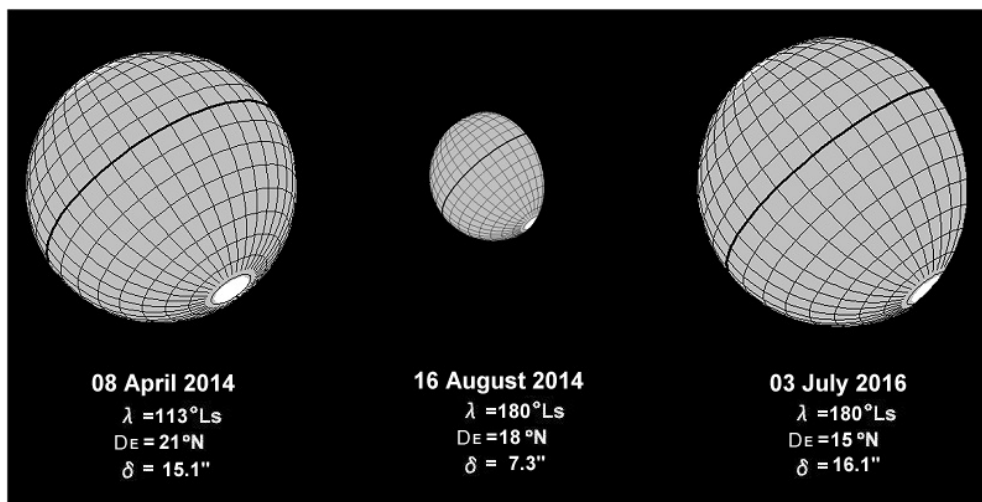


Figure 1: Diagrams of Mars' globe for different dates: at opposition in April 2014 at left, at northern fall equinox in 2014 in the middle, and at northern fall equinox in 2016 at right.

What is a fall equinox on Mars?

Fall equinox on Mars is highly comparable to a terrestrial fall equinox. On both planets, this is the time when the temperatures of the polar region that is entering the long polar night, are cooling more rapidly than the temperatures of temperate and tropical air masses of the same hemisphere. The gradient of temperatures between the pole and the equator is higher than it was during the now past summer. This situation leads to stronger gradients of pressure, stronger winds between air masses and finally to the onset of storms.

On Mars, following the MGS data, the transitional equinoxial climate starts from $\lambda=160^\circ\text{Ls}$ with increasing condensate white clouds and dust storms; by $\lambda=190^\circ/200^\circ\text{Ls}$ this ends forming the *polar hood*, a global cap of clouds that will roughly stay in place until late winter. Two storm areas are identified, that are with no surprise the low-lands Acidaliium and Utopia¹. Dust storms start there and drift eastward with the time.

*1 As for the reason why such places are storm areas, refer to the author's talk at IWCMO: A

REVIEW OF THE LAST MARTIAN DUST STORMS

The equinox transition observed in 2014

Start of transition: Images taken in July 2014 ($\lambda=155^\circ\text{Ls}$ to $\lambda=171^\circ\text{Ls}$) reveal a clear and sudden change around mid-July, a period that corresponds to the start of activity following MGS ($\lambda=160^\circ\text{Ls}$ is reached on 12th July). From 15th July, the NPC becomes rather invisible on the images, while it was still clearly spotted before the 15th and even on the 15th (Km). In parallel, nebulosity over the north polar region (NPR) becomes visually important; so we can affirm that the transition began shortly after $\lambda=160^\circ\text{Ls}$ (Fig. 2).

Catching equinoxial dust storm activity over the NPR: As stated, storm activity is the meteorological element that proves that the transition is underway. During the second half of July, the period $\lambda=160^\circ\text{Ls} \sim \lambda=170^\circ\text{Ls}$ offers some suspect images where some well-known dark marking near the NPR look abnormally clear in near infrared. IR images can help to discriminate white clouds from dust clouds at a low level of resolution, since the first ones will disappear and

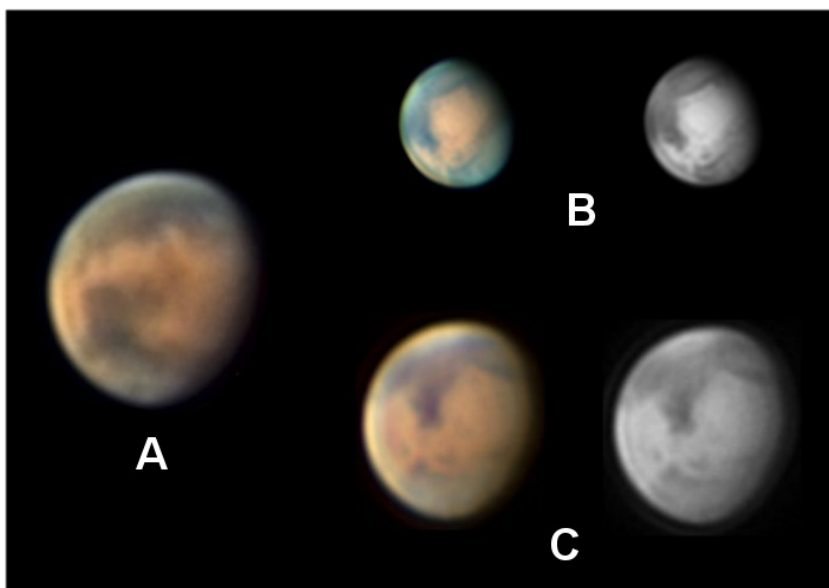
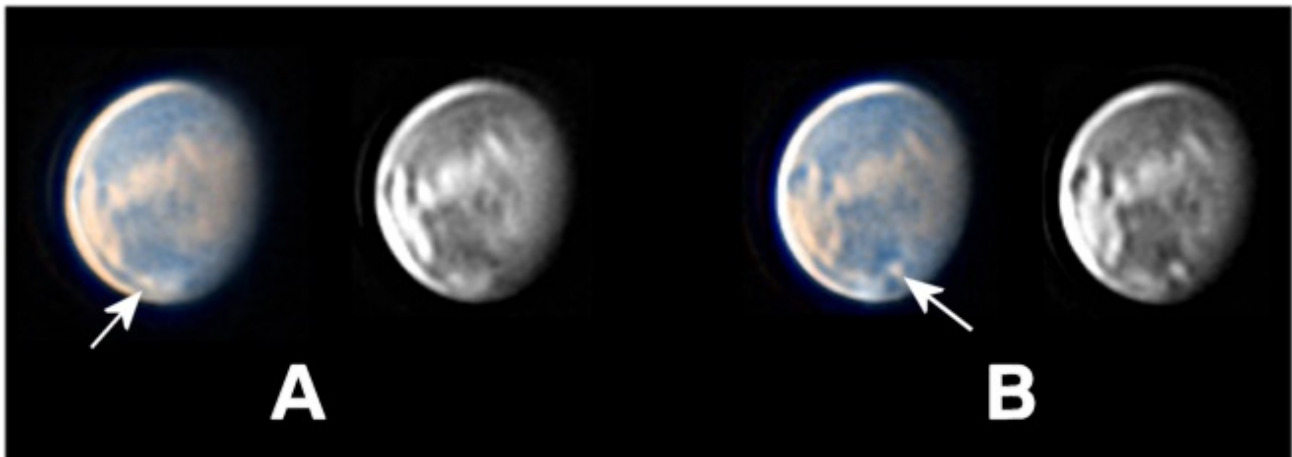


Figure 2: **A:** certainly one of the very last image showing the north polar cap, by Teruaki KUMAMORI, on 15th July 2014 ($\lambda=162^\circ\text{Ls}$). **B:** only six days later (21st July, $\lambda=165^\circ\text{Ls}$), the NPC is not visible anymore; in RGB, a veil looks present over a wide NPR with a slight yellow/gray tint. At right is an IR view, showing that the area is abnormally light. Images: Trevor BARRY (Australia). **C:** same comparison and comments for 28th July ($\lambda=168^\circ\text{Ls}$), by Yukio MORITA.

**Figure 3: A: 9th August RGB and IR images by Paul MAXSON.
B: same thing on 10th August. Dust clouds are arrowed.**



the second will remain visible.

The first clear evidence of dust storm activity inside the NPR is caught by Paul MAXSON on 9th and 10th August at a solar longitude of $\lambda=175^\circ\text{Ls}$ / 176°Ls , only one week before equinox (Fig. 3). Other nice images are taken by Paul on days following the equinox, although a bit less clear.

In September, the NPH in place, only low activity detected: Observers continued to follow the red planet in September; during this month, the NPH looks installed, and some images again may show some dust storm inside the hood. The scene is never completely clear but at this martian season, white and yellow clouds are difficult to separate visually. The IR images are again helpful, but RGB images must be watched as well, because a cream color inside the clouds must also be an evidence for dust (the creamy hue being due to the ochre color of dust being filtered by white clouds - this requires very accu-

rate color rendition).

Conclusion

The scene remains the same in early October, but this is when this topic comes to an end, because on 7th October, the season $\lambda=210^\circ\text{Ls}$ is reached, and this is when another climatic period opens: the northern fall cross-equatorial storm season ($\lambda=210^\circ\text{Ls}$ to 240°Ls). Please refer to CMO n°438 Note 11 published in the preceding issue.

The northern fall equinox looks normal in 2014, but the data is not precise enough to say more. This will however form the main topic of observation for the next 2016 apparition, as opposition will take place on $\lambda=157^\circ\text{Ls}$ (22nd May) with a favourable D_E of 10°N (increasing after opposition) and a large apparent diameter ($\delta=18''$ and more). The key season of northern fall equinox will follow very shortly thereafter ($\lambda=180^\circ\text{Ls}$ reached on 3rd July). □

Forthcoming 2016 Mars (#03)

Ephemeris for the Observations of the 2016 Mars. I *November & December 2015*

By

Masami MURAKAMI

WE now start a serial running of the Ephemeris for the surface observations of

the planet Mars in 2016. We here list up the necessary elements of the Ephemeris for period from 1

November 2015 till 31 December 2015: The data are listed for every day at 00:00 GMT (not TDT). The symbols ω and ϕ denote the longitude and latitude of the sub-Earth point respectively. The symbols λ , δ and ι stand for the areocentric longitude of the Sun, the apparent diameter and the phase angle respectively. We also add the column of the Posi-

tion Angle Π of the axis rotation, measured eastwards from the north point: This is useful to determine the north pole direction from the $p \leftarrow \rightarrow f$. The apparent declination of the planet is also given at the final column (denoted D).

The data here are basically based on *The Astronomical Almanac for the Year 2015*.

Date (00:00GMT)	ω	ϕ	λ	δ	ι	Π	D
01 November 2015	294.81°W	25.59°N	62.38°Ls	4.22"	25.1°	23.2°	+04°08'
02 November 2015	285.04°W	25.59°N	62.82°Ls	4.27"	25.3°	23.5°	+03°54'
03 November 2015	275.28°W	25.58°N	63.26°Ls	4.28"	25.5°	23.8°	+03°39'
04 November 2015	265.51°W	25.57°N	63.70°Ls	4.30"	25.7°	24.1°	+03°25'
05 November 2015	255.75°W	25.56°N	64.13°Ls	4.31"	25.8°	24.4°	+03°11'
06 November 2015	245.98°W	25.55°N	64.57°Ls	4.32"	26.0°	24.8°	+02°56'
07 November 2015	236.22°W	25.53°N	65.01°Ls	4.34"	26.2°	25.1°	+02°42'
08 November 2015	226.46°W	25.50°N	65.44°Ls	4.35"	26.4°	25.4°	+02°28'
09 November 2015	216.70°W	25.48°N	65.88°Ls	4.37"	26.5°	25.7°	+02°14'
10 November 2015	206.94°W	25.45°N	66.31°Ls	4.38"	26.7°	26.0°	+01°59'
11 November 2015	197.18°W	25.42°N	66.75°Ls	4.40"	26.9°	26.3°	+01°45'
12 November 2015	187.43°W	25.38°N	67.19°Ls	4.41"	27.0°	26.6°	+01°31'
13 November 2015	177.67°W	25.35°N	67.62°Ls	4.43"	27.2°	26.9°	+01°17'
14 November 2015	167.91°W	25.31°N	68.06°Ls	4.44"	27.3°	27.2°	+01°02'
15 November 2015	158.15°W	25.26°N	68.50°Ls	4.46"	27.5°	27.5°	+00°48'
16 November 2015	148.41°W	25.22°N	68.94°Ls	4.48"	27.7°	27.8°	+00°34'
17 November 2015	138.64°W	25.17°N	69.37°Ls	4.49"	27.8°	28.0°	+00°20'
18 November 2015	128.90°W	25.12°N	69.81°Ls	4.51"	28.0°	28.3°	+00°06'
19 November 2015	119.16°W	25.06°N	70.25°Ls	4.53"	28.2°	28.6°	-00°08'
20 November 2015	109.41°W	25.00°N	70.68°Ls	4.55"	28.3°	28.9°	-00°22'
21 November 2015	099.67°W	24.94°N	71.12°Ls	4.56"	28.5°	29.1°	-00°36'
22 November 2015	089.92°W	24.88°N	71.55°Ls	4.58"	28.6°	29.4°	-00°50'
23 November 2015	080.18°W	24.81°N	71.99°Ls	4.60"	28.8°	29.7°	-01°04'
24 November 2015	070.45°W	24.74°N	72.43°Ls	4.62"	29.0°	29.9°	-01°18'
25 November 2015	060.72°W	24.66°N	72.86°Ls	4.64"	29.1°	30.2°	-01°32'
26 November 2015	050.97°W	24.59°N	73.30°Ls	4.66"	29.3°	30.4°	-01°46'
27 November 2015	041.24°W	24.51°N	73.74°Ls	4.68"	29.5°	30.7°	-02°00'
28 November 2015	031.52°W	24.43°N	74.17°Ls	4.70"	29.6°	30.9°	-02°14'
29 November 2015	021.78°W	24.34°N	74.61°Ls	4.72"	29.8°	31.1°	-02°27'
30 November 2015	012.04°W	24.26°N	75.04°Ls	4.74"	29.9°	31.4°	-02°41'
01 December 2015	002.32°W	24.17°N	75.48°Ls	4.76"	30.1°	31.6°	-02°55'
02 December 2015	352.59°W	24.08°N	75.92°Ls	4.78"	30.2°	31.8°	-03°09'
03 December 2015	342.87°W	23.98°N	76.35°Ls	4.80"	30.4°	32.1°	-03°23'
04 December 2015	333.14°W	23.89°N	76.79°Ls	4.82"	30.5°	32.3°	-03°36'
05 December 2015	323.42°W	23.79°N	77.23°Ls	4.84"	30.7°	32.5°	-03°50'
06 December 2015	313.71°W	23.69°N	77.67°Ls	4.87"	30.8°	32.7°	-04°03'
07 December 2015	303.99°W	23.58°N	78.10°Ls	4.89"	31.0°	32.9°	-04°17'
08 December 2015	294.27°W	23.48°N	78.54°Ls	4.91"	31.1°	33.1°	-04°30'
09 December 2015	284.56°W	23.37°N	78.98°Ls	4.93"	31.2°	33.3°	-04°43'
10 December 2015	274.85°W	23.25°N	79.42°Ls	4.96"	31.4°	33.5°	-04°57'

Date (00:00GMT)	ω	ϕ	λ	δ	ι	Π	D
11 December 2015	265.14°W	23.14°N	79.85°Ls	4.98"	31.5°	33.7°	-05°10'
12 December 2015	255.43°W	23.02°N	80.29°Ls	5.00"	31.6°	33.9°	-05°23'
13 December 2015	245.73°W	22.90°N	80.73°Ls	5.03"	31.8°	34.1°	-05°37'
14 December 2015	236.03°W	22.78°N	81.17°Ls	5.05"	31.9°	34.3°	-05°49'
15 December 2015	226.33°W	22.66°N	81.60°Ls	5.08"	32.1°	34.5°	-06°02'
16 December 2015	216.63°W	22.54°N	82.04°Ls	5.10"	32.2°	34.6°	-06°15'
17 December 2015	206.94°W	22.41°N	82.48°Ls	5.13"	32.3°	34.8°	-06°28'
18 December 2015	197.25°W	22.28°N	82.92°Ls	5.16"	32.5°	35.0°	-06°41'
19 December 2015	187.56°W	22.14°N	83.35°Ls	5.18"	32.6°	35.1°	-06°54'
20 December 2015	177.87°W	22.01°N	83.79°Ls	5.21"	32.7°	35.3°	-07°07'
21 December 2015	168.19°W	21.87°N	84.23°Ls	5.24"	32.9°	35.4°	-07°19'
22 December 2015	158.51°W	21.74°N	84.67°Ls	5.27"	33.0°	35.6°	-07°32'
23 December 2015	148.83°W	21.60°N	85.11°Ls	5.29"	33.2°	35.7°	-07°44'
24 December 2015	139.15°W	21.46°N	85.55°Ls	5.32"	33.3°	35.9°	-07°57'
25 December 2015	129.48°W	21.31°N	85.99°Ls	5.35"	33.4°	36.0°	-08°09'
26 December 2015	119.81°W	21.17°N	86.43°Ls	5.38"	33.5°	36.1°	-08°21'
27 December 2015	110.13°W	21.02°N	86.87°Ls	5.41"	33.6°	36.3°	-08°34'
28 December 2015	100.46°W	20.87°N	87.31°Ls	5.44"	33.7°	36.4°	-08°46'
29 December 2015	090.80°W	20.72°N	87.75°Ls	5.47"	33.8°	36.5°	-08°58'
30 December 2015	081.14°W	20.57°N	88.19°Ls	5.50"	34.0°	36.6°	-09°10'
31 December 2015	071.48°W	20.41°N	88.63°Ls	5.53"	34.1°	36.8°	-09°22'
01 January 2016	061.82°W	20.26°N	89.07°Ls	5.56"	34.2°	36.9°	-09°34'

(to be continued)

Letters to the Editor

●.....*Subject: Fwd: CMO #439 uploaded*
Received: 29 October 2015 at 04:36 JST

Hi, Jim (and Masatsugu), I checked an ephemeris program. For the declination of the Sun and the earth to coincide (at values near zero), you need to be very near the date of opposition (May 20/21), and at that time Edom Promontorium will be near the CM only for observers in the Eastern hemisphere. We'll be out of luck from Arizona...

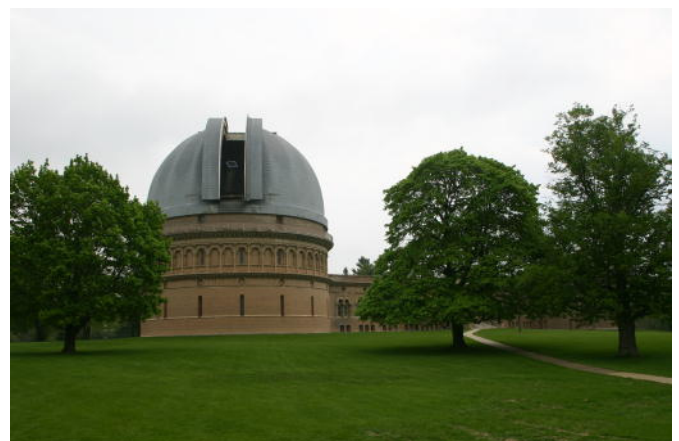
But Japan will be in the thick of it this time.

Jim--this means that attempts to observe the "glint" phenomenon won't be a factor in planning dates for a visit to Arizona, and those that you mentioned are "in" again. Best wishes,

○.....*Subject: Martian anniversaries*
Received: 15 November 2015 at 07:25 JST

Dear Masatsugu and friends, Just noting that yesterday (November 13) was the 100th anniversary of Mellish's daylight observation, during which he purported to have seen craters on a very small disk.

Some years ago, when at Yerkes, I set the telescope at the coordinates, and found that at the time of the observation Mars would have been close to



the meridian. See the image attached which shows the dome in position.

The CM calculation shows that Mellish would have seen the region of Solis Lacus, Valles Marineris and the numerous small circular spots that are found in this region-it does seem to me that under exquisite conditions he might very well have gotten the impression of cracks and craters; especially as he does not seem to have been a Mars expert at the time. Best

Whatever the case, his observation was evocative, and deserves to be remembered for the enchantment that Mars is capable of. Best.

***Interesting that almost at the same moment, Einstein in Berlin was solving the problem of Mercury's perihelion based on the gravitational equations of General Relativity.

PS. I also note that on Thursday we had the 99th anniversary of the death of Percival Lowell.

Bill SHEEHAN (Willmar, MN)

●...Subject: *October 31, 2015*
Received: *1 November 2015 at 13:47 JST*

Hi - I have attached my fist image of Mars during the 2015-16 apparition. Thanks,

Frank J MELILLO (Holtsville, NY)

●...Subject: *For CMO 440*
Received: *6 November 2015 at 19:20 JST*

Dear Masatsugu, For the next CMO issue, I'm preparing a 2014 note about the fall equinox on Mars - tell me if there is something planned already. Best

○...Subject: *Re: RE: For CMO 440*
Received: *23 November 2015 at 18:12 JST*

Dear Masatsugu, I will be late by a few hours - I

still need to make the figures, but the text is over. So I will have it ready tonight... Best wishes,

Christophe PELLIER (Nantes, FRANCE)

●...Subject: *Mo03Nov_15*
Received: *10 November 2015 at 01:03 JST*

I started to shooting the planet Mars from 2 November and the first image was sent to Mr MURAKAMI. However the image from 3 November looks better, and hence I would like to regard this as the first image in this apparition.

I am looking forward to your continuous support in this apparition also. Best wishes

Yukio MORITA (Hiroshima, JAPAN)

●...Subject: *Mars 26 November 2015 IR*
Received: *16 November 2015 at 13:45 JST*

Hi, All: An IR capture of Mars from this morning, with the Elysium region fairly central. Possibly some detail in the NPC? Best regards,

Clyde FOSTER (Centurion, SOUTH AFRICA)

●...Subject: *Mars 2015//11/18*
Received: *18 November 2015 at 20:28 JST*

Hello, 6 months before opposition the tiny Mars reveals some secrets! Mano

Manos KARDASIS (Glyfada-Athens, GREECE)

●...Subject: *Mars - November 15th, 10:00ut*
Received: *20 November 2015 at 04:02 JST*

Hi Mr. Minami, I hope all is well. Here is my latest session of Mars from November 15th, 10:00ut.

Efrain MORALES (Aguadilla, PUERTO RICO)

☆ ☆ ☆

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Editorial Board: Tadashi ASADA, Masatsugu MINAMI, Masami MURAKAMI, Takashi NAKAJIMA and Akinori NISHITA



☆ Any e-mail to CMO/ISMO including the image files is acknowledged if addressed to cmo@mars.dti.ne.jp (Masami MURAKAMI in Yokohama) vzv03210@nifty.com (Masatsugu MINAMI at Mikuni-Sakai, Fukui)

☆ Usual mails to CMO are acknowledged if addressed to

Dr Masatsugu MINAMI, 3-6-74 Midori-ga-Oka, Mikuni, Sakai City, Fukui, 913-0048 JAPAN