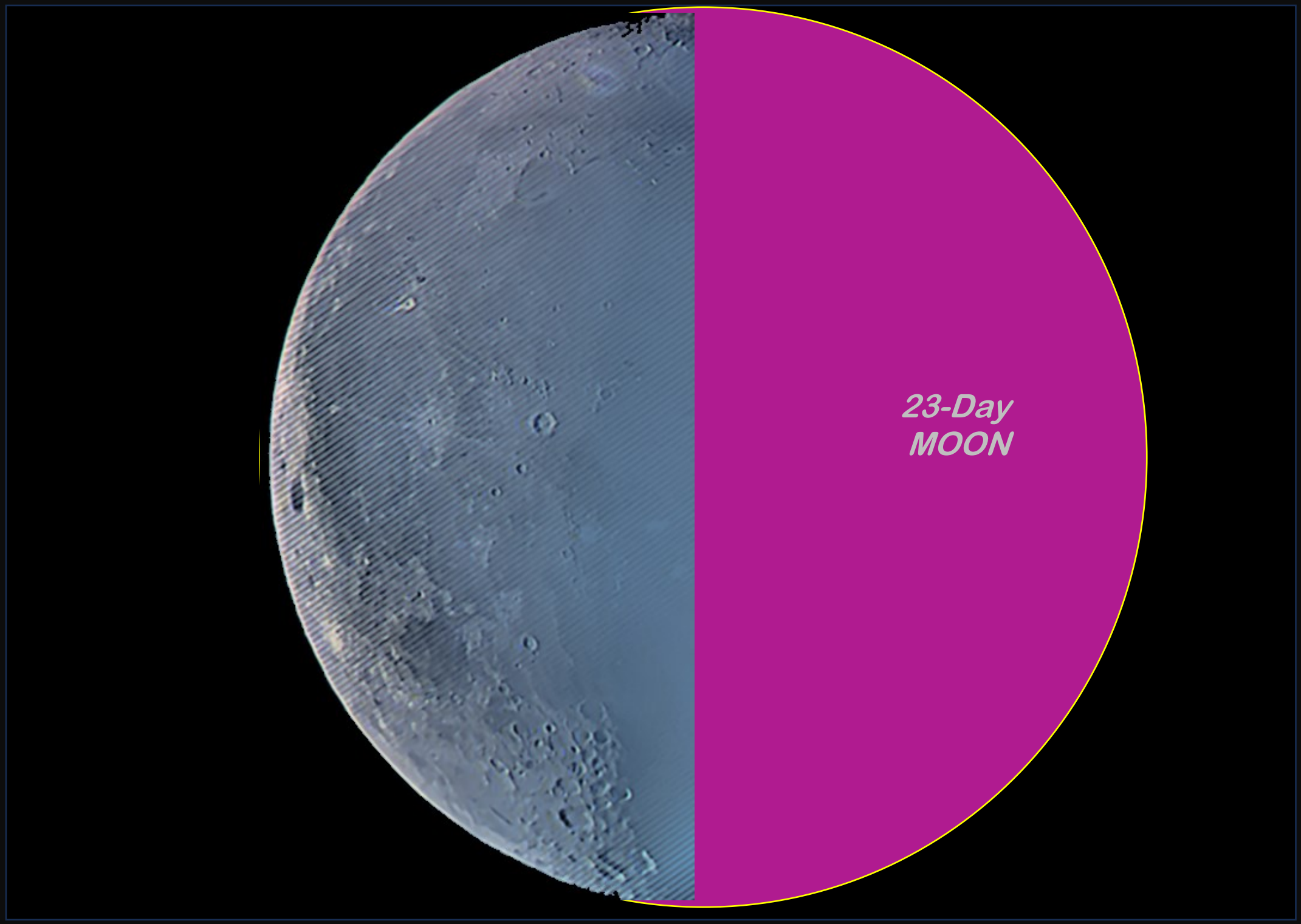

23-Day
MOON

The Daylight Moon, May 14 2020 at 09:30 AM.

It had been several weeks without an opportunity to study the Moon, so when I came out in mid-May on a bright sunny day to observe the solar activity, I also noticed **the 39% waning moon** up at ~28° altitude towards the SSW. Having caught the active region *AR2765* in the process of rotating around the western limb, I now pointed my 4" refractor at the moon to see if it was possible to catch any details here on a bright early summer forenoon.

The transparency was a good medium ~4/7 on the W part of the sky, with a sheet of altocumulus slowly closing in from the E, and the seeing was also medium ~5/10 with noticeable (but not too severe) atmospheric turbulence. The contrast on the moon was of course quite washed out due to the daylight sky, but just for fun (and because I was lunar starved) I decided I would place myself in an imaginary Apollo era LEM orbiting the moon, coming in from the NE and circling down SW towards the *Mare Humorum* region. (This is easy to do, as my 2" Amici diagonal in the Zeiss quick change system is fully rotatable, so like with the LEM thrusters, I can orientate my FOV into any position I desire):

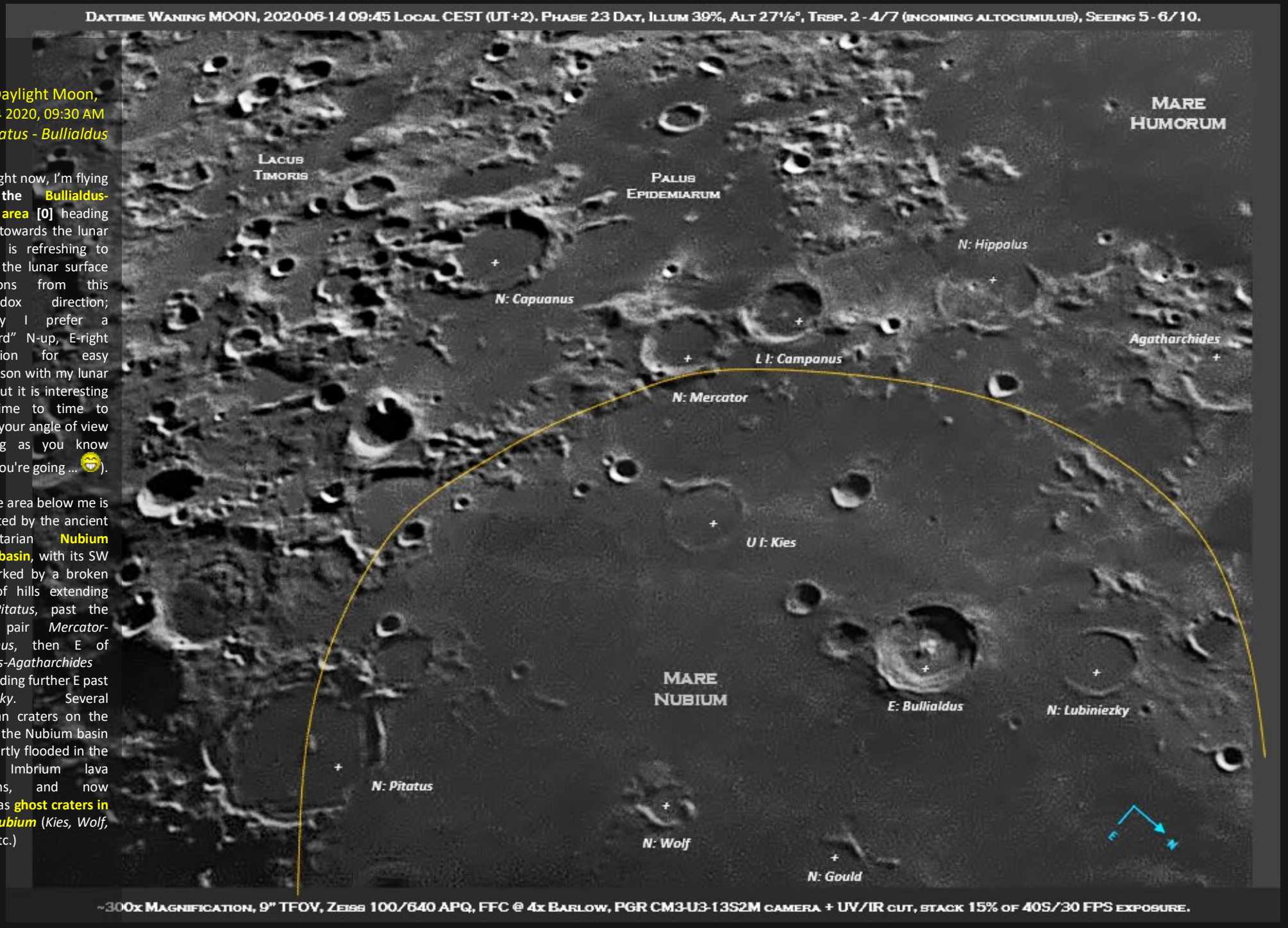
This is my imaginary flight in the LEM in orbit from the center of the Moon down towards the SW horizon. As previously mentioned, the observations here were done from Earth ☺ in broad daylight at ~10 AM local time, and so the contrast of my views were significantly reduced as compared to a nighttime observing session. Never the less it was possible for me – in a long stretch of overcast and rainy weather – to seize the opportunity for a quick lunar observing session which was both enjoyable and also inspired me to research a couple of surface features that I had not paid attention to before.

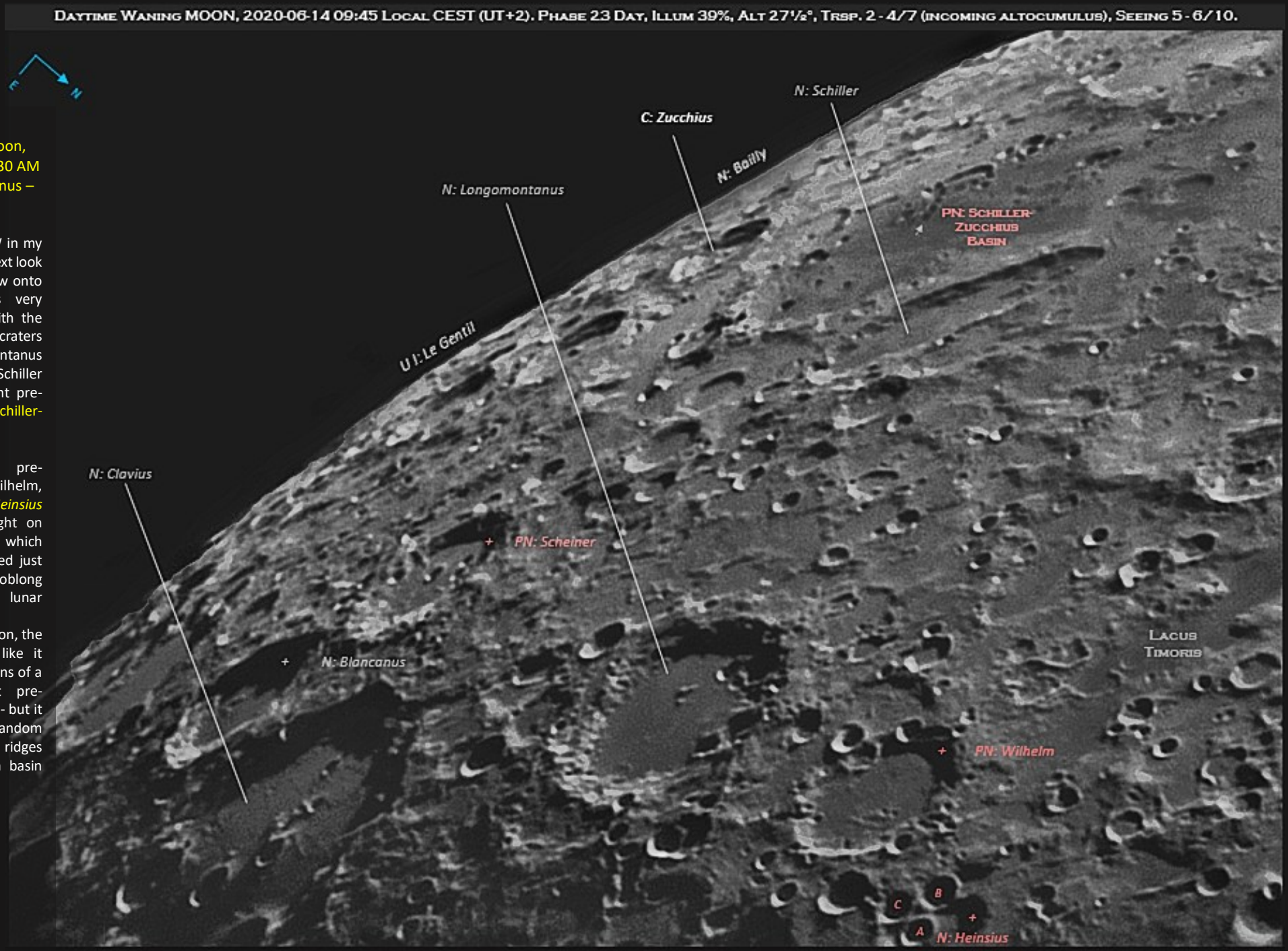
My observations were done through my small 4" refractor, both visually at 50x (TV 13mm EP), and for close-ups using my small FLIR CM3 industrial cam in live mode, while for documentation taking a series of 40s AVIs (that were later AS!2 stacked to PNG images). The camera was placed after a 4x barlow yielding 300x mag, which was too much for the daylight and seeing conditions (a 2x barlow would have given sharper images), -- but I had a cloud cover closing in from the east, so I chose to stick with the barlow at 4x mag and see what I could catch before 'curtain fall'.

The Daylight Moon,
May 14 2020, 09:30 AM
[0]: *Pitatus - Bullialdus*

Right now, I'm flying over **the Bullialdus-Pitatus area [0]** heading due SE towards the lunar limb. It is refreshing to look at the lunar surface formations from this unorthodox direction; Normally I prefer a "standard" N-up, E-right orientation for easy comparison with my lunar maps, but it is interesting from time to time to change your angle of view (as long as you know where you're going ... 😁).

The area below me is dominated by the ancient pre-Nectarian **Nubium impact basin**, with its SW rim marked by a broken range of hills extending from *Pitatus*, past the crater pair *Mercator-Campanus*, then E of *Hippalus-Agatharchides* and bending further E past *Lubiniezky*. Several Nectarian craters on the floor of the Nubium basin were partly flooded in the upper Imbrium lava eruptions, and now appear as **ghost craters in *Mare Nubium*** (*Kies, Wolf, Gould* etc.)



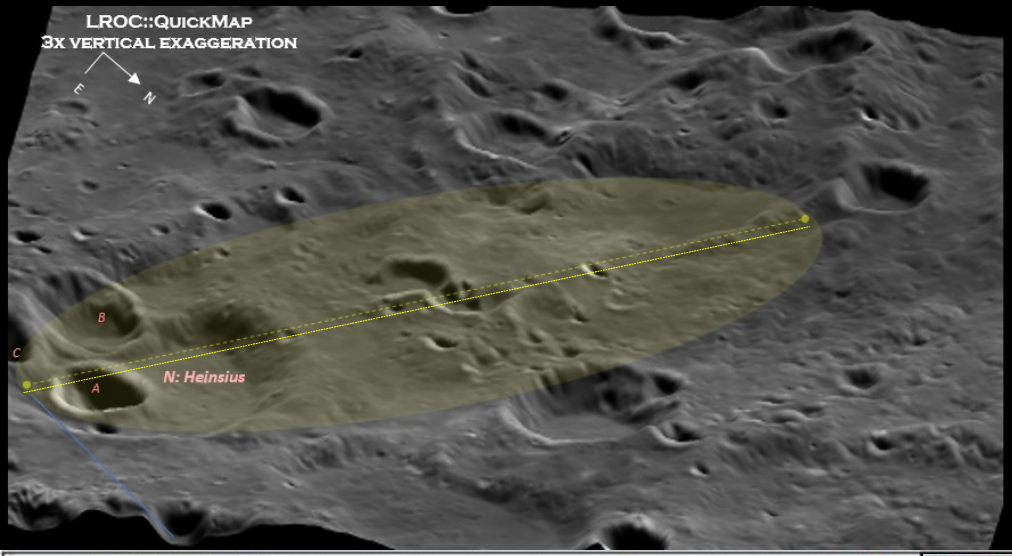


The Daylight Moon, May 14 2020, 09:30 AM [1]: Longomontanus – Schiller

Drifting further SW in my imaginary LEM, I next look out the left window onto an area that is very familiar to me, with the large Nectarian craters Clavius, Longomontanus and the elongated Schiller next to the ancient pre-Nectarian Schiller-Zucchius Basin.

Flying past the pre-Nectarian crater Wilhelm, I notice **the** *Heinsius* crater (bottom right on my snapshot), which seems to be located just at the edge of an oblong depression in the lunar surface;

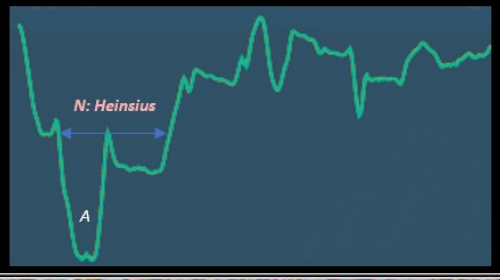
In this illumination, the depression looks like it could be the remains of a degraded ancient pre-Nectarian impact, -- but it is probably just a random alignment of ejecta ridges from the Imbrium basin excavation.



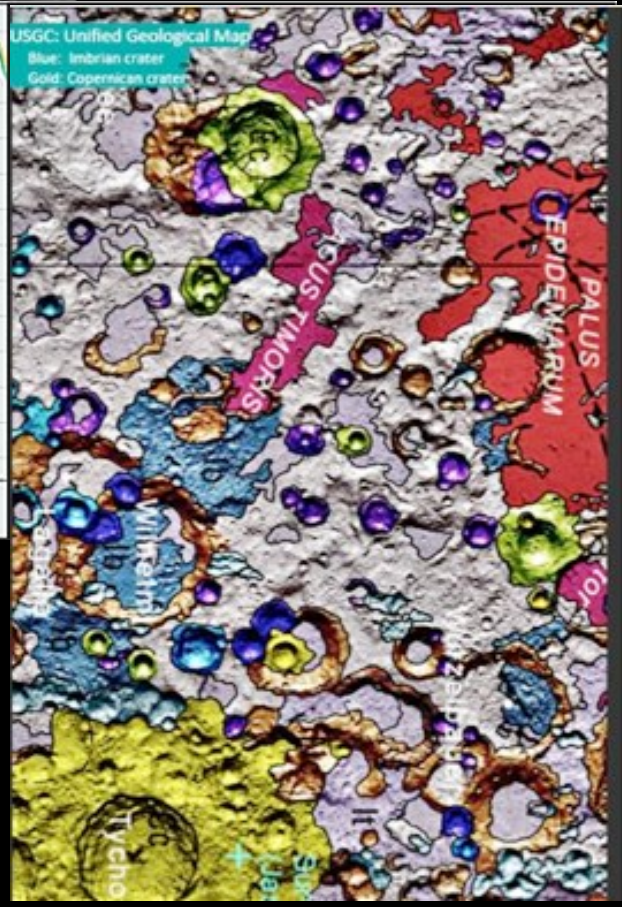
The Nectarian crater **Heinsius** seems to be located at the edge of an oblong lunar surface depression, probably a feature of the Imbrium sculpture, which by chance looks like the remains of an ancient pre-Nectarian oblique impact?

Here's a model I generated using *LROC::QuickMap* with the depression traced out (in yellow) and with a 3x vertical exaggeration; The orientation of the model is approximately as in my observation above

The transect below of the depression (3x vertical exaggerated) is ~200 Km long with a true max difference in elevation of 6 Km):



Using QuickMap I make a 3D-model with a transect of the Heinsius depression, -- but my analysis of the probable origin is inconclusive; See for yourself.

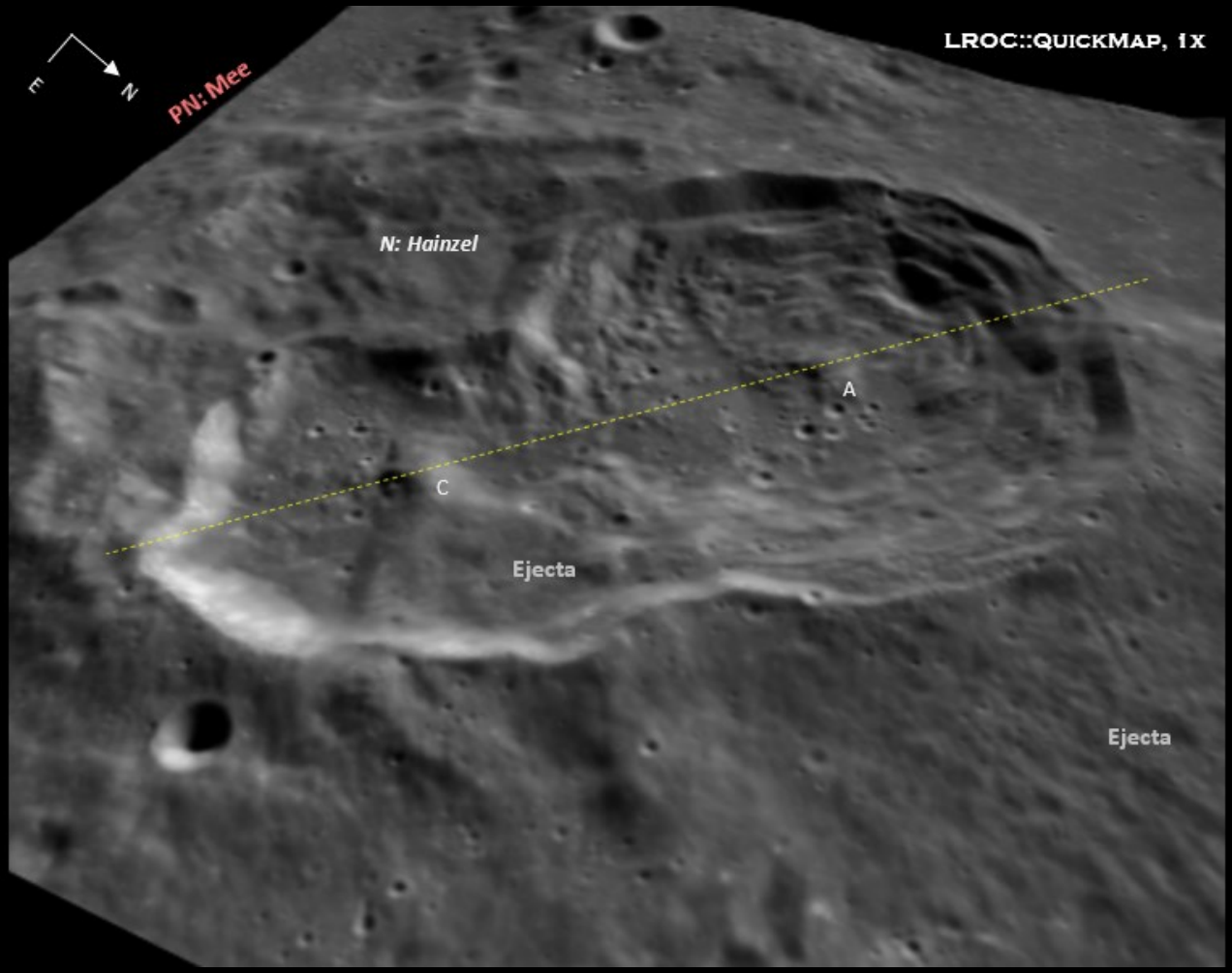


Here are a couple of supplementary maps I generated of the region west of Tycho, including the Heinsius formation and the Hainzel crater group (which I'll fly past in my next post). Oriented to match my flyby orientation, with N approximately to the right and E down:

As you can see on the transect (above), *Heinsius A* reaches a good 5 Km below mean lunar surface altitude, while the floor of Tycho is "only" at around 3½ Km depth. Still, sunlight reaches the floor of Heinsius A, so there can be no ice down there. To my knowledge the only definite evidence of water ice on the Lunar surface is from the polar regions, where the very small tilt of the Moon's rotation axis results in sunlight never reaching the floor of the deepest craters; Here in the perpetual shadow, the temp. is always kept below -157°C (-250° F), and water in the surface layers may therefore be preserved from earlier eons in the lunar history.

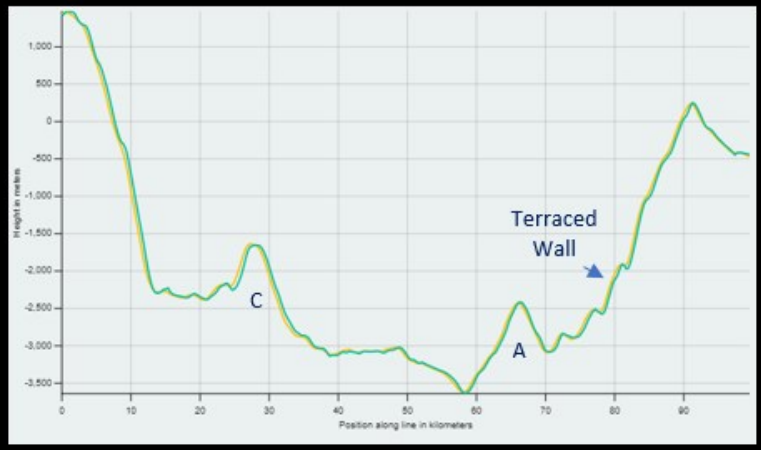
The Daylight Moon,
May 14 2020
09:30 AM
[2]: Schickard - Capuanus

Looking straight ahead in the flight path of my LEM, I now approach the Marsh of Epidemics and the Lake of Fear; I have definitely no intention of touching down here though, but there are a couple of surface features that draw my attention: first there's the Hainzel crater group between Schiller and Capuanus, and further up towards the lunar horizon, the large but shallow Schickard crater (227 Km Ø, 1.5 Km depth).



Here's a 3D model I generated using *LROC::QuickMap* showing the trefoil Hainzel craters at 1x (no exaggeration). The orientation of the model is approximately as in my observation above. Note the ejecta deposits into the Hainzel C crater and splashed over the N crater wall and further out onto Lacus Timoris.

A transect through the C – A craters is shown below, and could indicate a simultaneous cometary cluster impact.



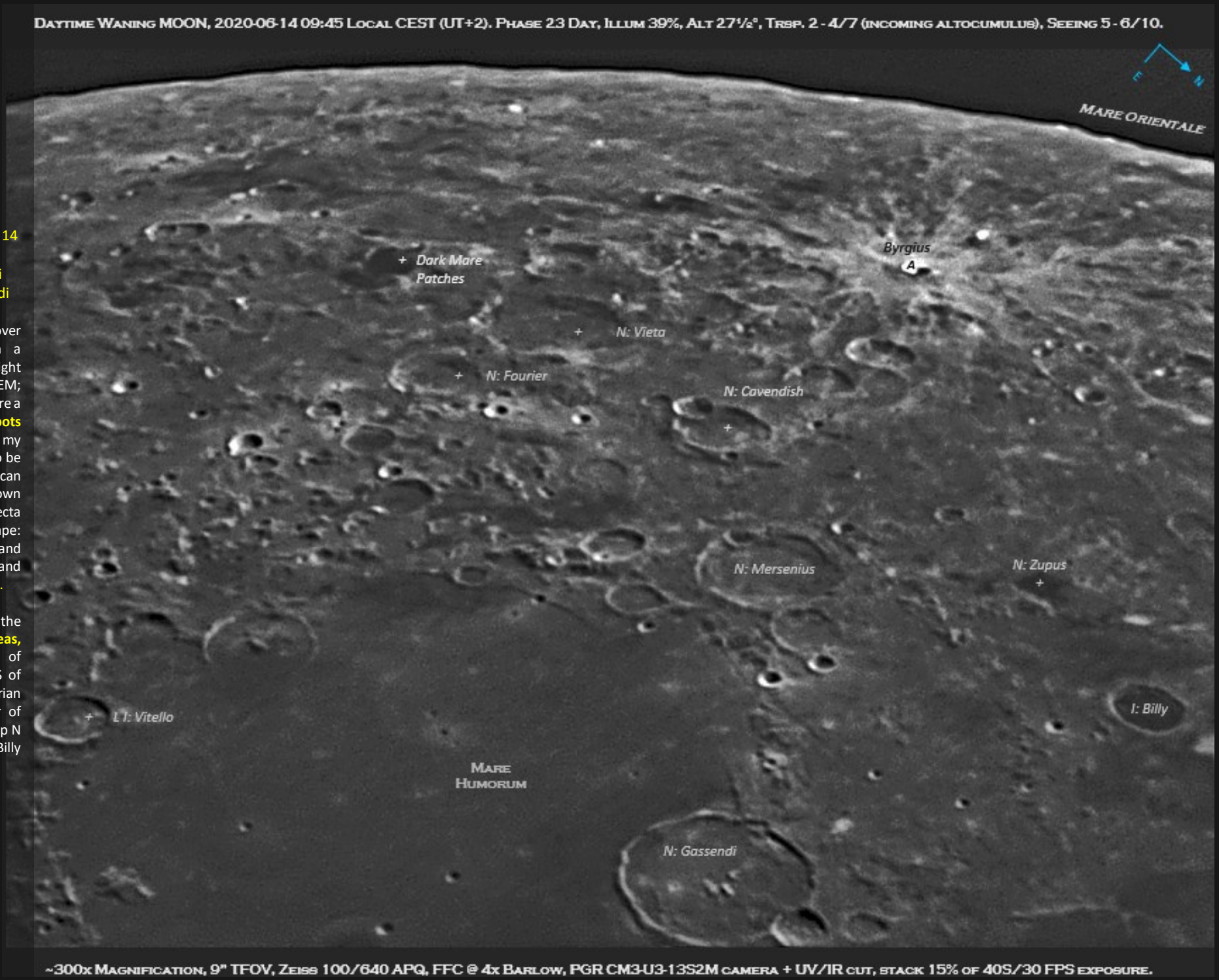
Located at the NE edge of the degraded pre-Nectarian crater Mee is seen a **trefoil of overlapping craters:** the largest and oldest (Nectarian) being Hainzel, the younger C and the youngest A. The terraced walls of Hainzel A and its ejecta carpet into C and out over the NE part of Lacus Timoris can be seen; These indicate an Eratosthenian age for Hainzel A, while Hainzel C must be older, -- anywhere from Imbrian age or possibly earlier.

The crater floor of Schickard was lava flooded in the upper Imbrian epoch, and shortly thereafter covered by light hued highland material excavated and thrown out by the Orientale Basin impact; Subsequently additional lava eruptions have covered the NW and SE parts of the floor in dark mare basalt, leaving a broad wedge of the Orientale ejecta to be seen in the central part.

The Daylight Moon, May 14 2020 09:30 AM
[3]: Byrgius – Gassendi
[4]: Rook Mts. – Grimaldi

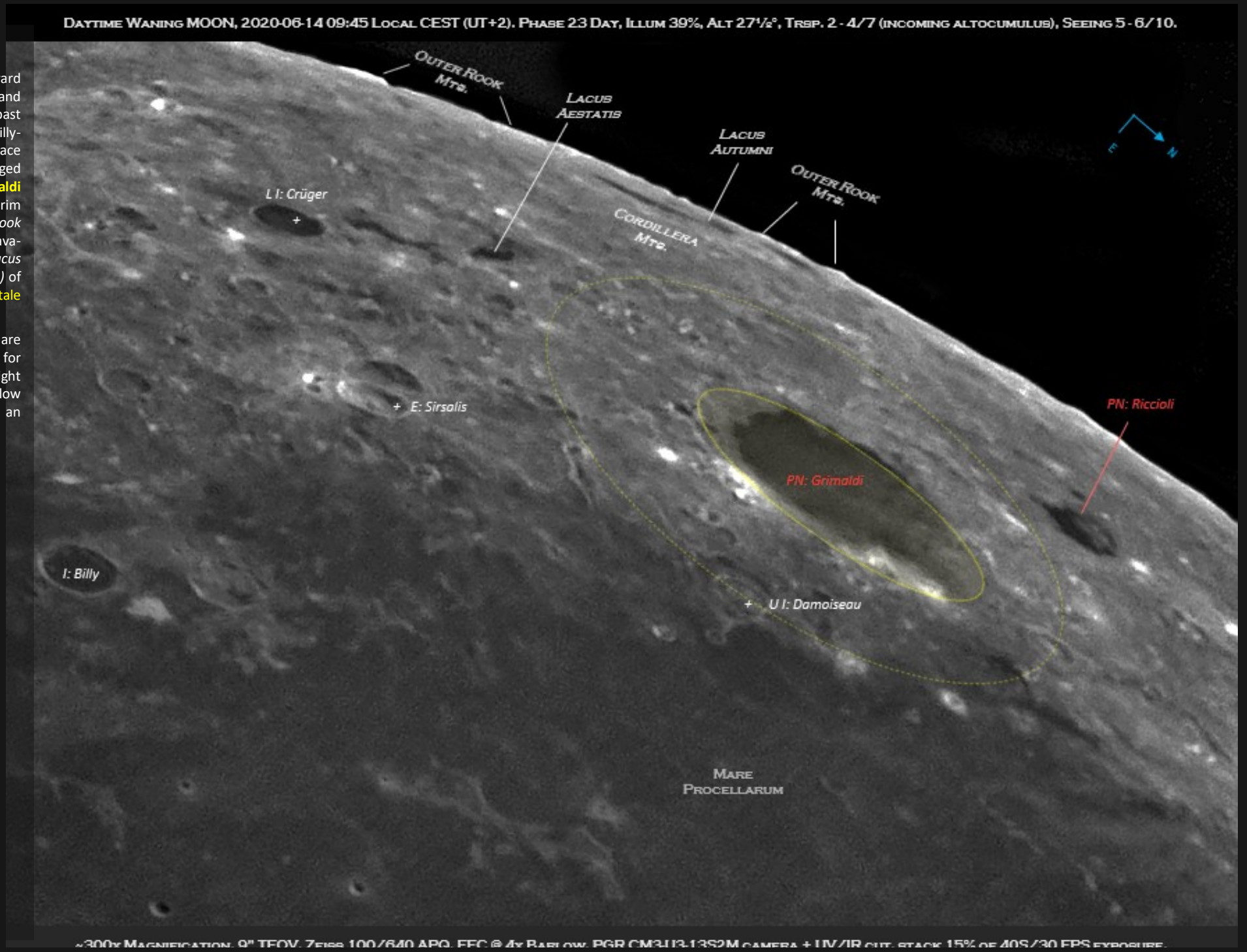
I end my daylight flyby over the waning Moon with a couple of views out the right window of my imaginary LEM; In this illumination, there are a couple of **very bright spots** which immediately draws my attention; They turn out to be two young Copernican impacts that each has thrown out a brilliant web of ejecta rays over the lunar landscape: the first is Byrgius A, and further up, past Grimaldi and Rainer Gamma, is Olbers A.

Equally conspicuous in the high sun are **some dark areas,** formed by a couple of unnamed mare patches S of Vieta and in the Nectarian Zupus crater, plus a pair of lava-filled craters further up N in the Imbrian impacts: Billy and Crüger.



Leaning forward towards the window and looking up further N, past Byrgius A and Billy-Crüger, I can faintly trace out the double-ringed **impact basin of Grimaldi** as well as the eastern rim (the *Cordillera* and *Rook* Mt. chains) and the lava-filled trenches *(Lacus Autumni* and *Aestatis)* of the far-side Orientale impact basin.

These features are however not suitable for a detailed study right now, due to the low resolution and an unfavorable lunation.



The Daylight Moon, May 14 2020 at 09:30 AM
[5] Olbers A – Reiner γ

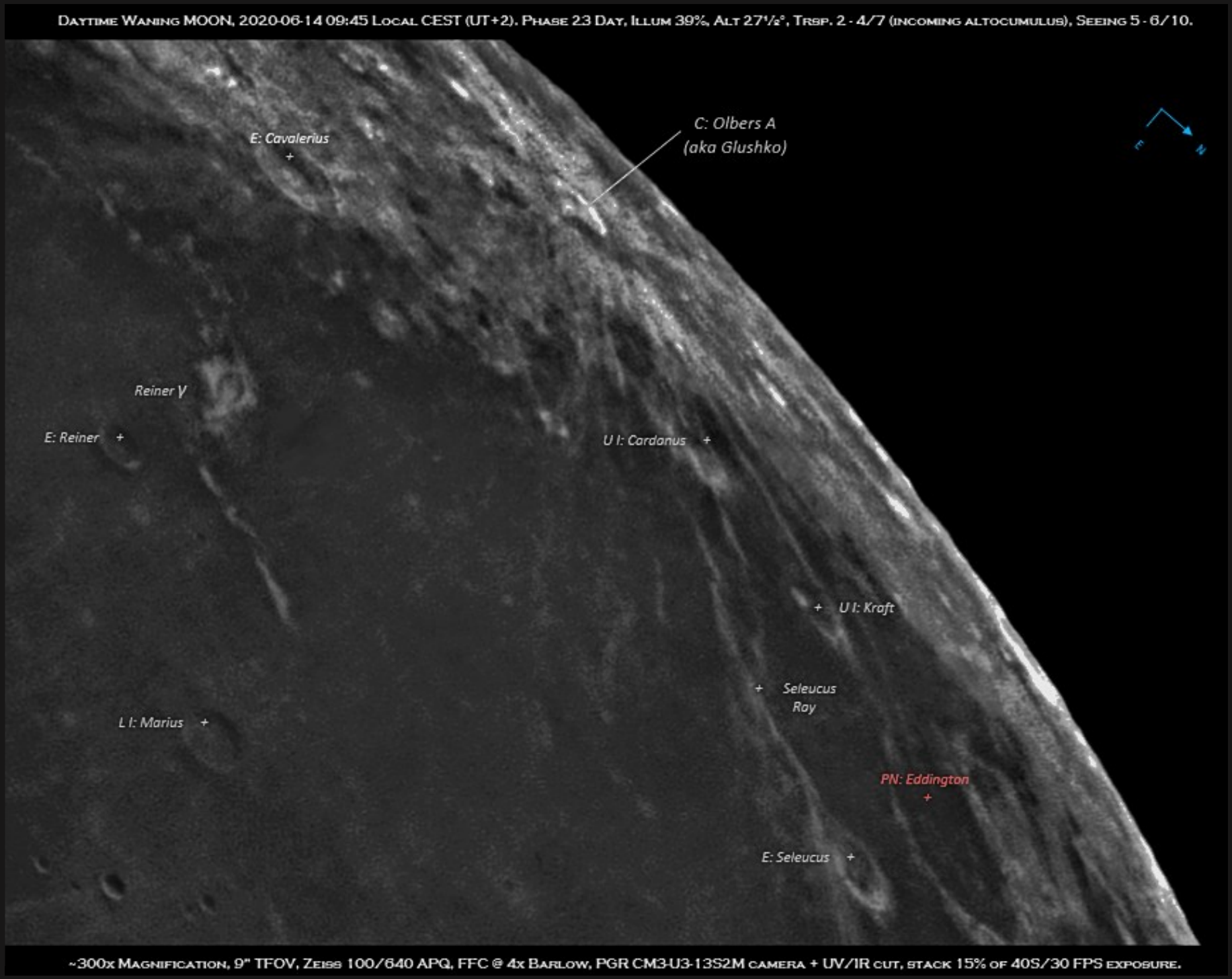
Past Grimaldi I can glimpse the ***Reiner Gamma*** magnetic swirl and the ***Olbers A*** crater.

Reiner γ shows its two tails, the brightest up N and the fainter and more broken up swirl down S. The swirl is associated with a strong magnetic field

Olbers A has thrown out bright ejecta rays predominantly up NNW, indicating an oblique impact coming in low from SSE. The brightest ray across Procellarum is seen from the crater Cardanus up N to Seleucus (the *Seleucus Ray*)

Olbers A is a magnificent 43 km wide rayed crater, also known since 1993 as *Glushko*. Olbers A had a low angle impact from SSE (low angle oblique impact for there are few rays to the NNW and SSE.)

Northwest are three very old craters, including Eddington flooded by lavas.



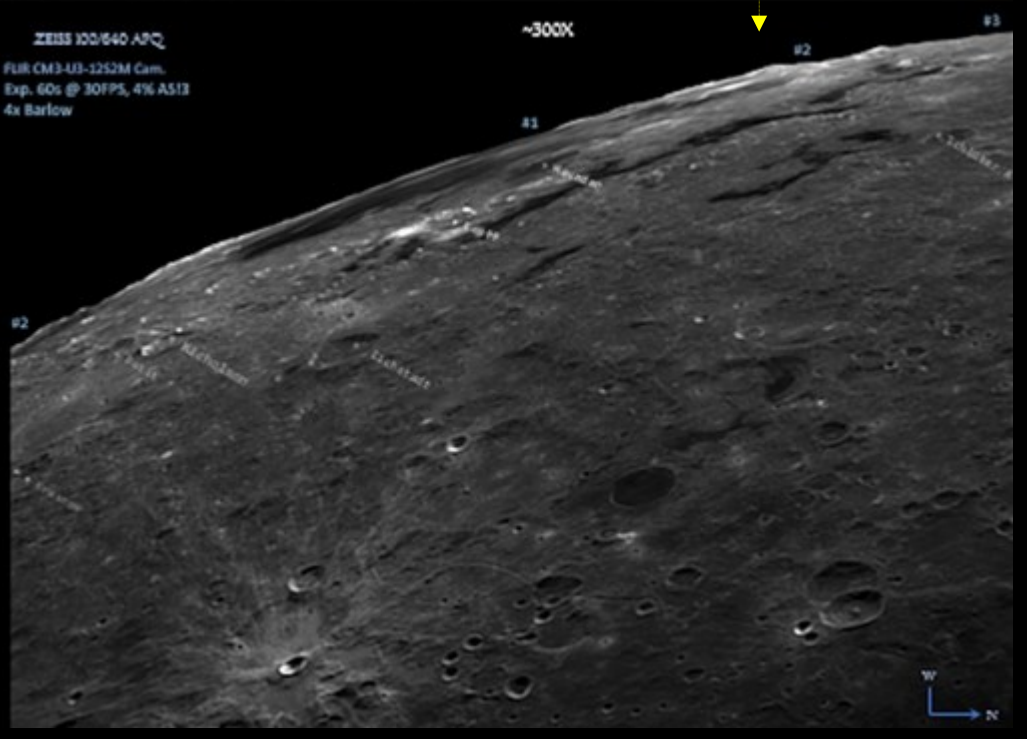
24-Day MOON

22-24 Day MOON
Daytime view of Orientale Basin

The large 3-ringed Orientale Basin is the result of a young Imbrian impact; It is now featuring two large craters in the central lava-filled interior: *Maunder* and *Kopff*. The crater Kopff is right on 90° W longitude, so the Orientale Mare with Maunder and the far side of the basin rings are all “beyond the bend” so to speak, out in the western libration zone.

Below is a view of the Orientale region from October 11. 2020, showing first the main features in perspective as seen through my 4” refractor, and then for comparison a “rectified” view based on LROC:: Quickmap data:

MOON 24dy (30%)
Waning Crescent,
Alt:30° in Virgo
2020-01-19, 09:00 CEST (UT+1)
Broad Daylight, Clear & Calm
Transparency: 5/7, Seeing: 8/10

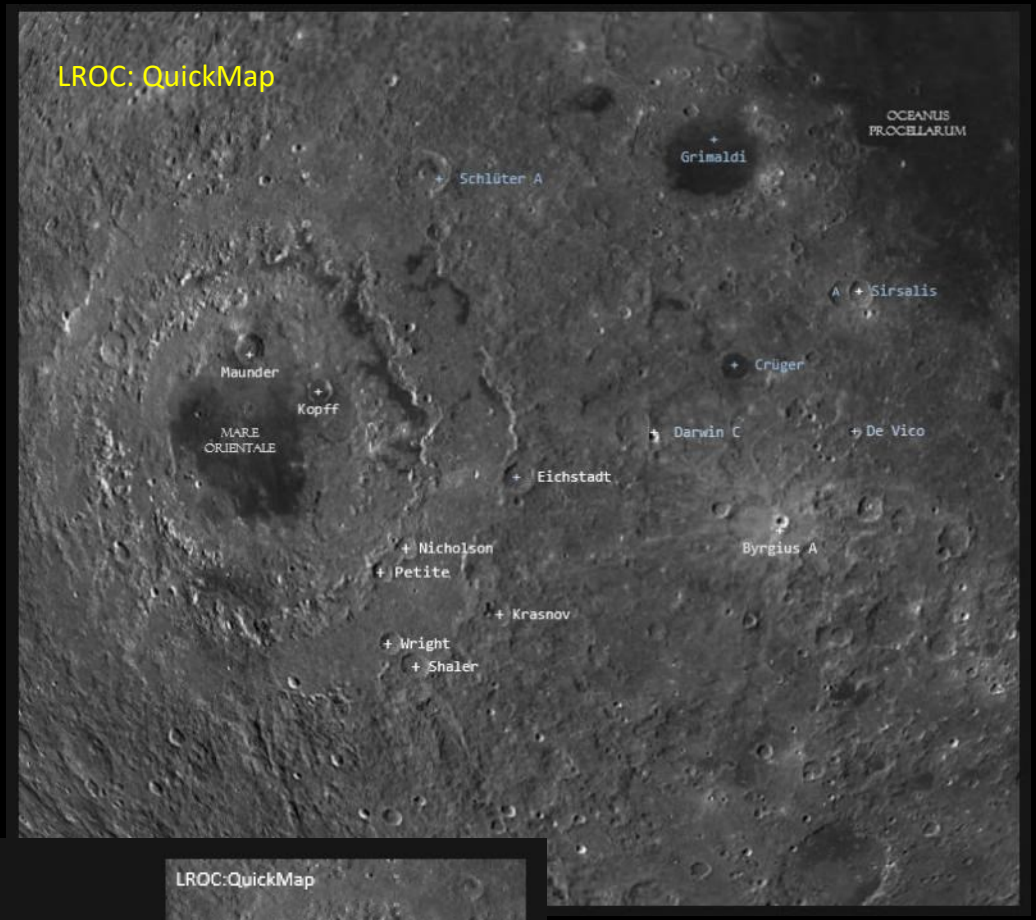


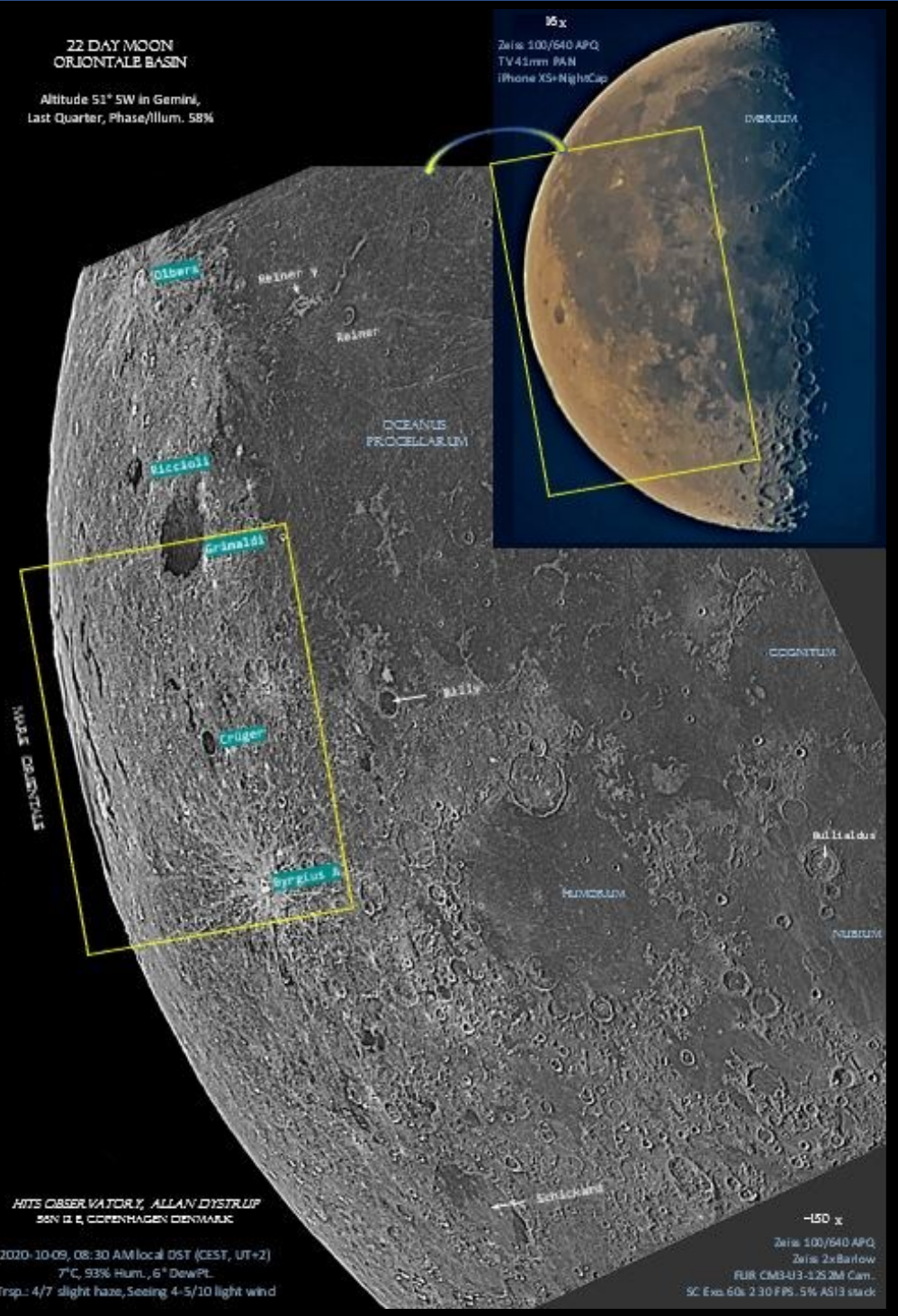

24 DAY MOON
ORIENTALE BASIN
HITS Observatory, Allan Dystrup
56N 12E, Copenhagen Denmark
2020-10-11 08:30 AM Local DST (UT+2)
7°C, 93% Hum., 6°DewPt.
Trsp. 4/5 slight haze, Seeing 5/10
ZEISS 100/640 APQ
FLIR CM3-U3-12S2M Cam.
Exp. 60s @ 30FPS, 4% AS!3
80x Native
~80X
W
N

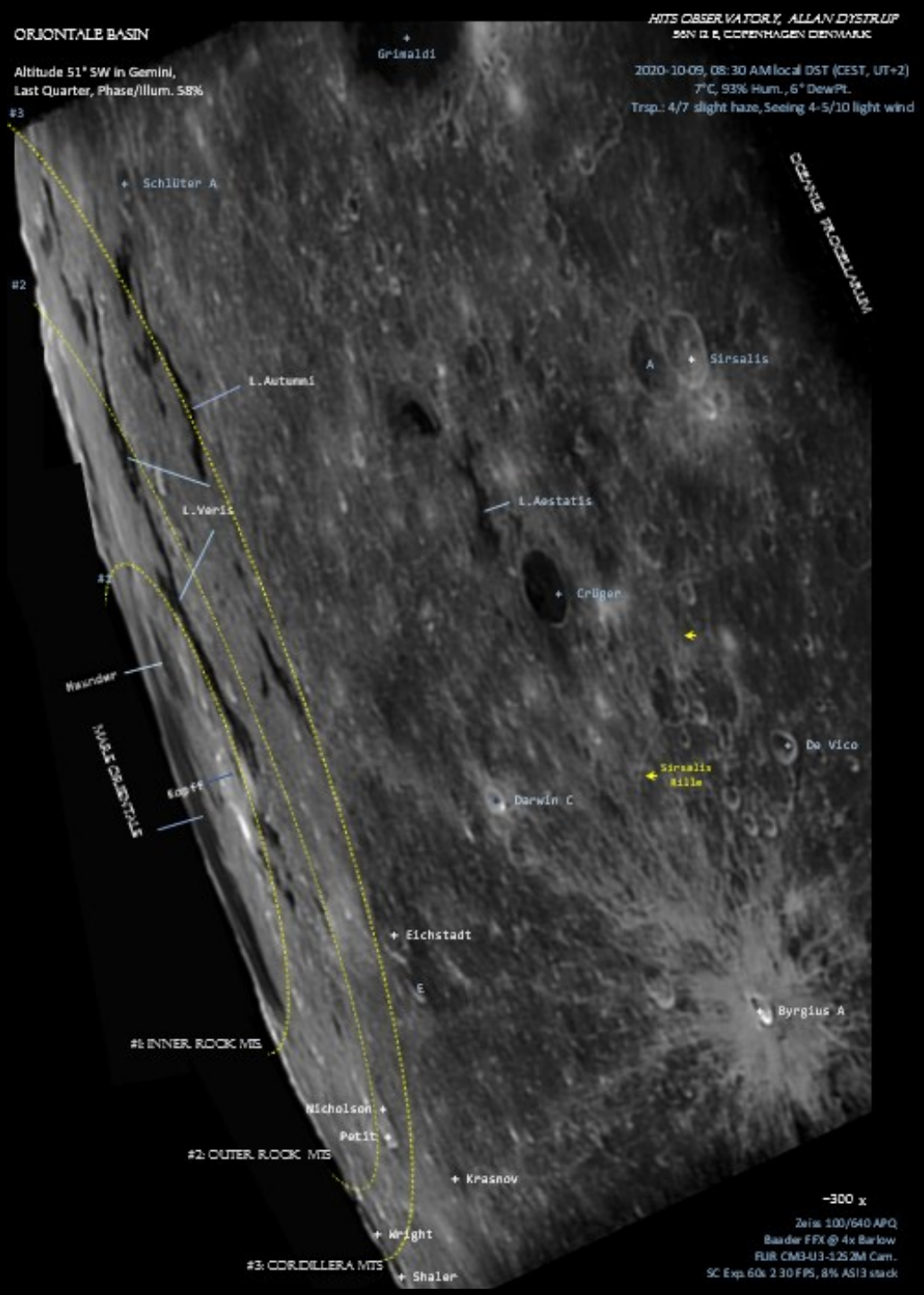

ZEISS 100/640 APQ
FLIR CM3-U3-12S2M Cam.
Exp. 60s @ 30FPS, 4% AS!3
4x Barlow
~300X
#3
#2
#1
* Schlüter A
* Maunder
* Koptt
#2
* Nicholson
* Petit
* Eichstadt
* Krasnov
W
N

22-24 Day MOON
Daytime view of Orientale Basin

Here's a more detailed identification of the main features around the Orientale Basin, as viewable here from Earth. I've used a rather harsh increase in contrast to bring out the details more clearly for closer inspection, so please bear with that...







The **first basin ring #1: the Inner Rook Mts.** can be seen as a range of bright mountain peaks bordering Mare Orientale towards the E, and it can be faintly traced right at the limb in the far distance beyond the Mare.

Outside ring #1 is seen the long lava-filled trench Lacus Veris, enclosed by **basin ring #2: the Outer Rook Mts.** This ring can be traced from the crater pair Petit and Nicholson at the S end, up along the E shore of Lake Veris, and then seen clearly in ragged profile at the lunar limb NW of the Orientale basin.

The outer ring #3: the Cordillera Mts. can be followed from the crater pair Wright and Shaler at the S end, up N past Krasnov and Eichstädt, enclosing the trench with Lacus Autumnis, before bending W past the crater Schlüter A. The Cordilleras is an up-warped scarp facing away from us, so there are no dramatic peaks or mountain ranges seen in profile here...

The Orientale Basin.
(Geology)

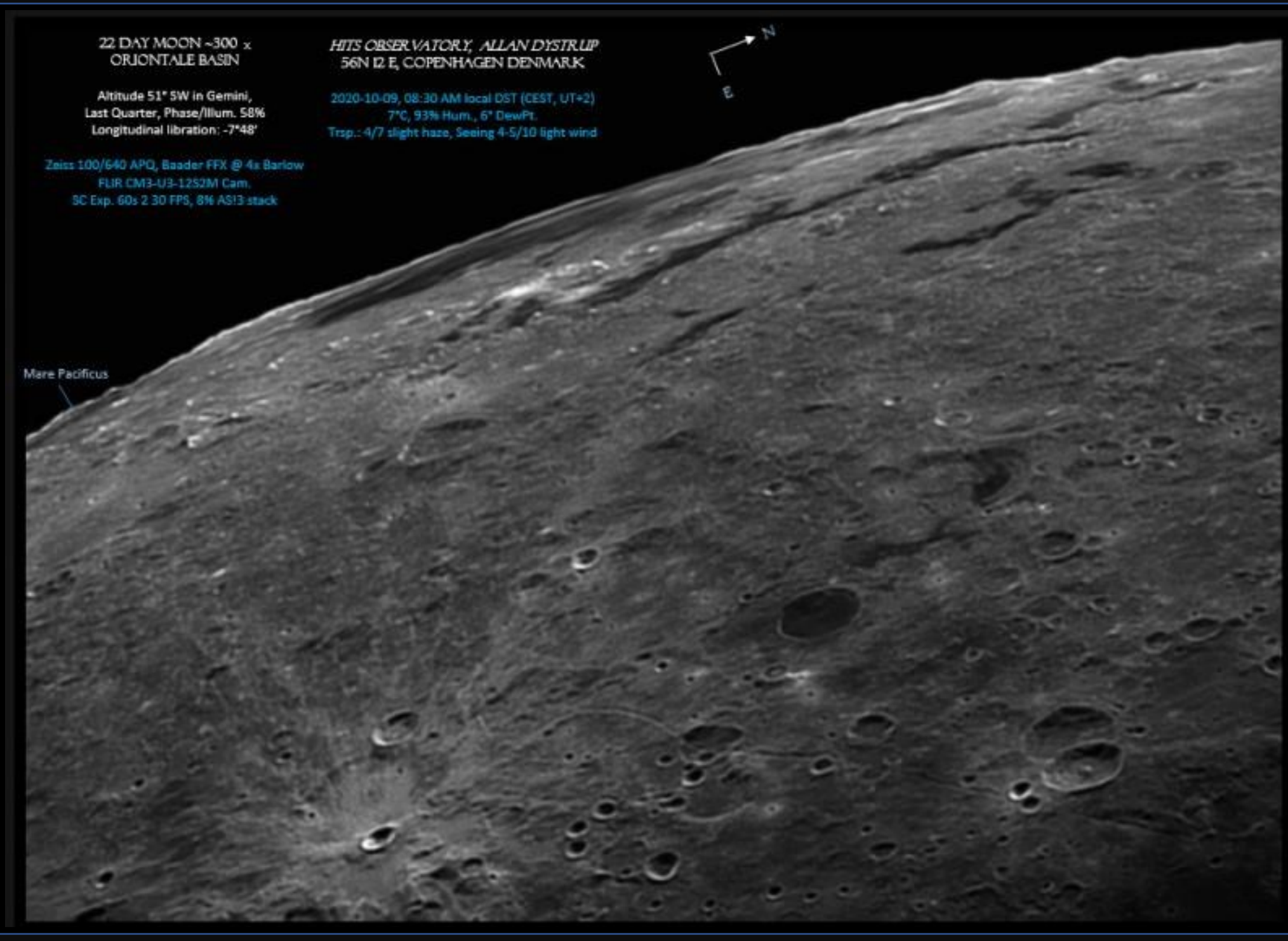
It has been two weeks with typical autumn weather here in Scandinavia, i.e. a series of low pressures dragging in warm- and cold fronts from the Atlantic with mostly overcast and rainy days and nights. So, let me return to my latest observing session of the 22-day Moon on October 09 at 08:30 AM. The observation was done in broad daylight with the moon up at a good 51° altitude and with a significant libration of -7° exposing the eastern part of the large multiring Mare Orientale basin.

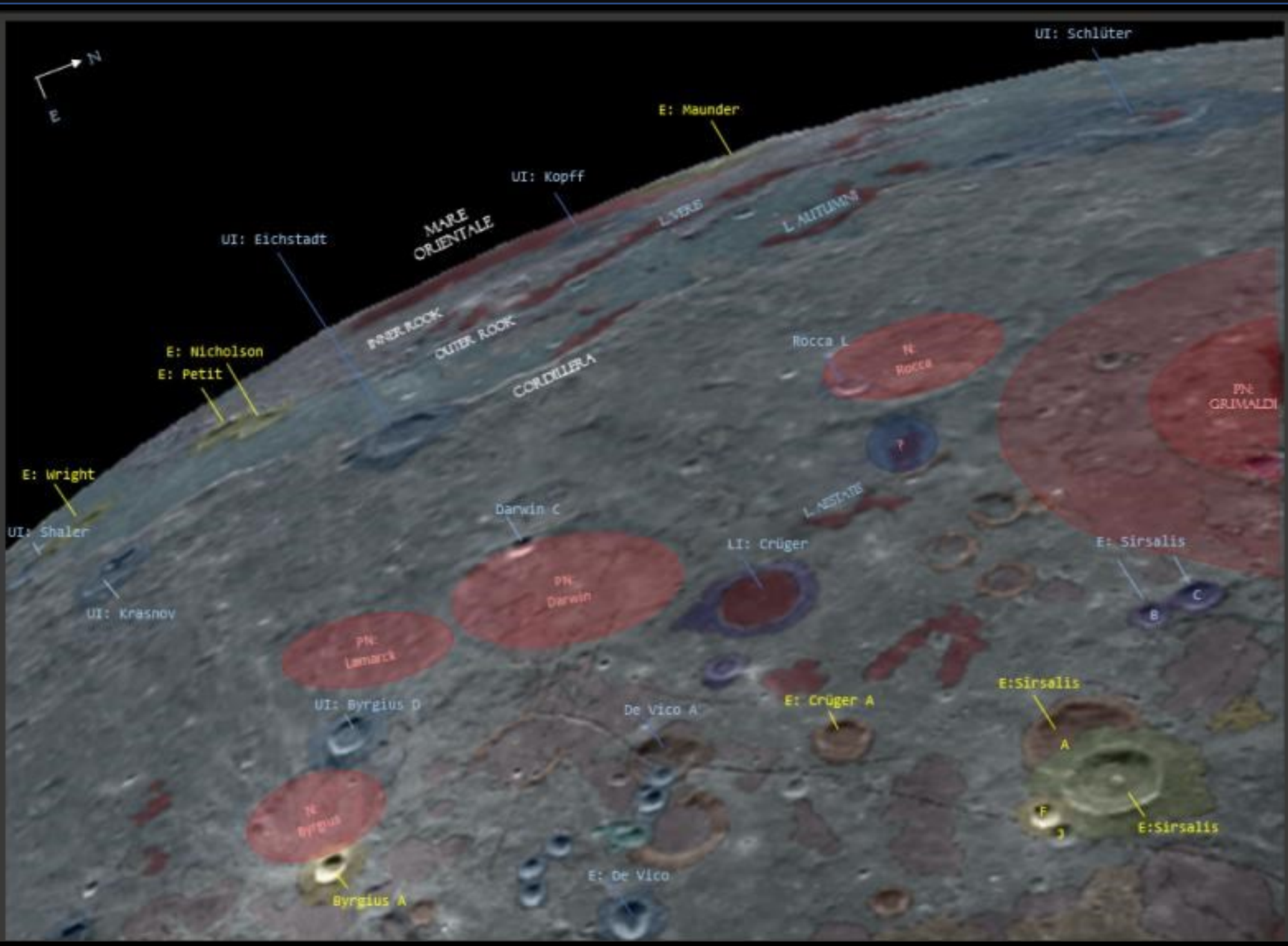
The **Orientale Basin rings** can be identified on my image, with the Cordillera Mts. from Wright and Shaler to Krasnov, up past Eichstadt, Lacus Autumni and past Schlüter; Then the Outer Rook Mts., from Nicholson and Petit, up past and enclosing Lacus Veris; And finally, the Inner Rook Mts., seen in profile on the far (western) side of Lacus Veris stretching up past and enclosing Kopff and Maunder at the northern end. Interestingly, I can also identify as a thin white line the innermost (unnamed) ring, right at the edge of Mare Orientale where the mare basalt borders on the basin ejecta. Even more interesting is the "Mare Pacificus" seen at the S end of Orientale, enclosed by the Outer Rook Mtn. range. This formation is actually not mare lava but rather part of a pyroclastic ring of fire fountain ash deposits from a V-vent (Pacificus V1) in the Outer Rooks at the center of the ash ring. Here's a LROC image of the formation:

The highland region between Oceanus Procellarum and the Orientale Basin shows several ancient eroded basins and large craters, such as the pre-Nectarian (~4.4 Byr) 2-ringed Grimaldi Basin and the Darwin and Lamarck walled plains, plus the Nectarian (3.9 Byr) Byrgius and Rocca craters. These old features have to a large degree been filled in by ejecta from the giant lower Imbrian Orientale Basin impact (~3.85 Byr), but with some effort they can still be traced.

The old highland crust has since been peppered by upper Imbrian (~3.5 Byr) and young (~3-1.5 Byr) Eratosthenian impacts, and some of the excavations (Grimaldi, Crüger and the unnamed crater N of Lacus Aestatis) were lava filled in the late upper Imbrian and the Eratosthenian Epochs. A prominent feature on the photo is the 330 km long rille in the Orientale ejecta carpet running from N of Byrgius, across the 'De Vico A' crater, then up north E of 'Crüger A' and Sirsalis out to Oceanus Procellarum.

The Sirsalis Rille is obviously younger than the lower Imbrian Orientale Basin ejecta (< 3.85 Byr), but older than the Eratosthenian craters (>3 Byr) positioned on top of it (Sirsalis J and F). The Sirsalis Rille was thus formed in late Imbrium by magma rising as a sheet from the mantle, up through the crust along a long (sic!) crack, radial to Oceanus Procellarum (the fracture was probably created by the ancient Gargantuum impact). The rising magma pushed aside the crust, but solidified before it could erupt onto the surface, leaving the long sunken rille over a solidified buried magma ribbon (known in geology as a 'graben' over a 'dyke') which can be detected today as a strong magnetic anomaly.


22 DAY MOON ~300 x
ORIONTALE BASIN
Altitude 51° SW in Gemini,
Last Quarter, Phase/Illum. 58%
Longitudinal libration: -7°48'
Zeiss 100/640 APO, Baader FFX @ 4x Barlow
FLIR CM3-U3-12S2M Cam.
SC Exp. 60s 2 30 FPS, 8% AS!3 stack
HITS OBSERVATORY, ALLAN DYSTRUP
56N 12 E, COPENHAGEN DENMARK
2020-10-09, 08:30 AM local DST (CEST, UT+2)
7°C, 93% Hum., 6° DewPt.
Trsp.: 4/7 slight haze, Seeing 4-5/10 light wind
N
E
Mare Pacificus


N
E
UI: Schlüter
E: Maunder
UI: Kopff
MARE ORIENTALE
L. VERUS
L. AUTUMNI
UI: Eichstadt
INNER ROOK
OUTER ROOK
CORDILLERA
E: Nicholson
E: Petit
Rocca L
PN: Rocca
PN: GRIMALDI
E: Wright
UI: Shaler
L. HESTIAE
Darwin C
LI: Crüger
E: Sirsalis
PN: Darwin
UI: Krasnov
B
C
PN: Lamarck
UI: Byrgius D
De Vico A
E: Crüger A
E:Sirsalis
A
PN: Byrgius
F
J
E:Sirsalis
E: De Vico
Byrgius A