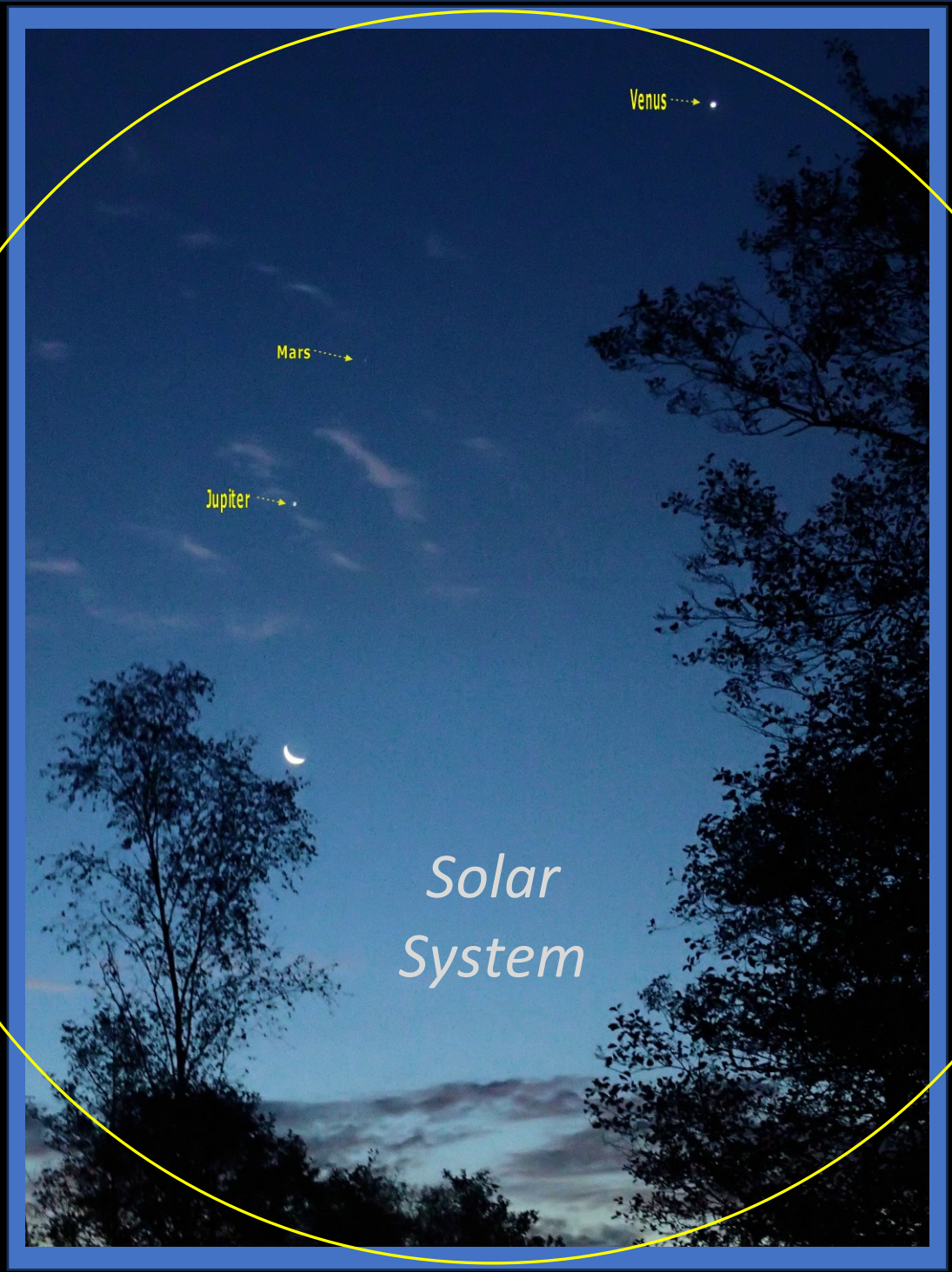
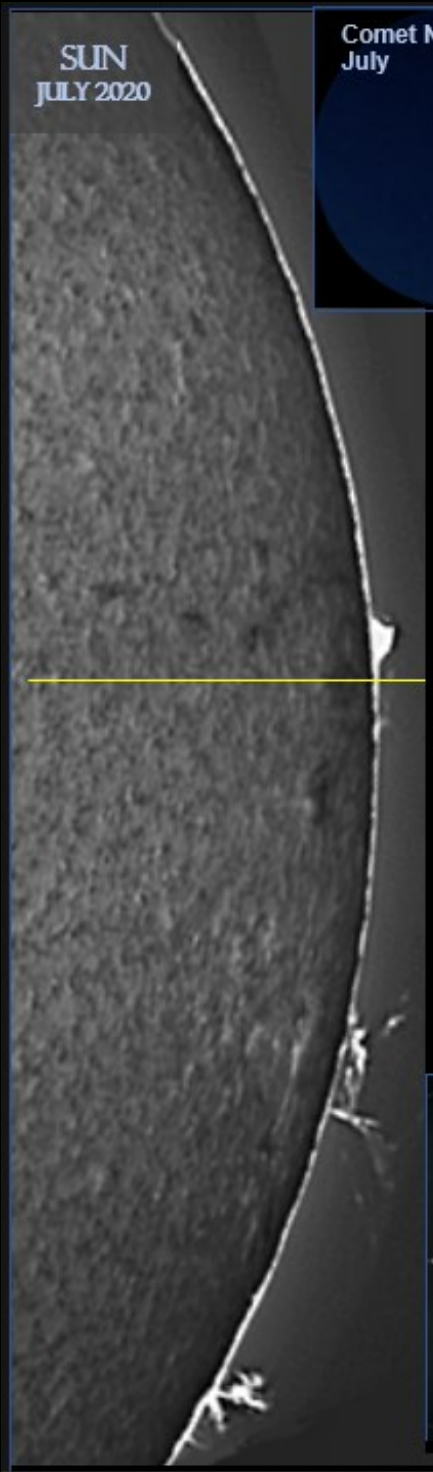
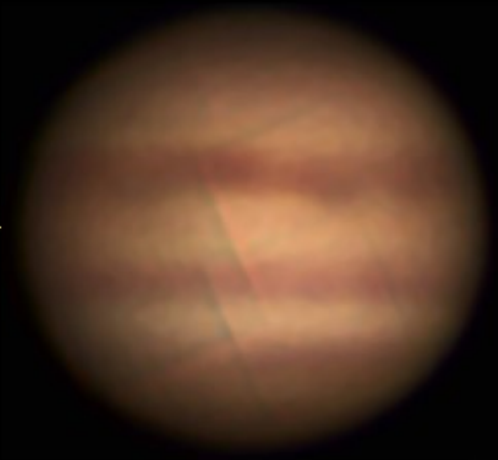

Venus
Mars
Jupiter
Solar
System

THE SOLAR SYSTEM
YEAR 2020

Here's an overview of the solar system objects I observed during the year 2020. The images show the object size approximately to scale, but not at scal distance to the sun. Below I've inserted a map showing the approximate correct distances using the Sun-Earth distance as the Astronomical Unit (AU). The small rocky inner planets (Mercury, Venus, Earth, Mars) are all within 1.6 AU from the Sun, while the large gas giants Jupiter and Saturn are far out (5-10 A and the outer icy planets Uranus and Nepture are really, REALLY distant objects (20-30 AU).



Jupiter
September



Saturn
August

Venus
August

Mars
October

Mercury
August

EARTH

Uranus
September

Neptune
September

Mercury

Image*: NASA/Johns Hopkins*

SUN, -26.7ᵐ, Alt. 42½°, App. Diameter 31'
Zeiss 100/640 APQ, Baader CC Herschel wedge with Baader 540 nm SC-filter,
TV 41mm PAN eyepiece, iPhone XS-camera snapshot

HITS Observatory, 56N 12E Copenhagen, Denmark
2020-08-07, 11:00 Local DST (CEST, UT+2)
Clear sky, light wind, temp. ~21°C (DewPt 17°C), Humidity 80%
Transparency 4-5/7, Seeing 6-7/10

Daytime
Mercury & Venus.

MERCURY, -1.2ᵐ, Alt. 50°
App. Diameter 5.5", Elong. 11° W, Illum./Phase 89%
Zeiss 100/640 APQ, FFC @ 4x Barlow, ZWO ASI120MC
Exposure 30s @ 30 FPS, 10% AS!2 stack

Superior Conjunction: 2020-08-17
Max E Elongation: 2020-10-01
Inferior conjunction: 2020-10-25

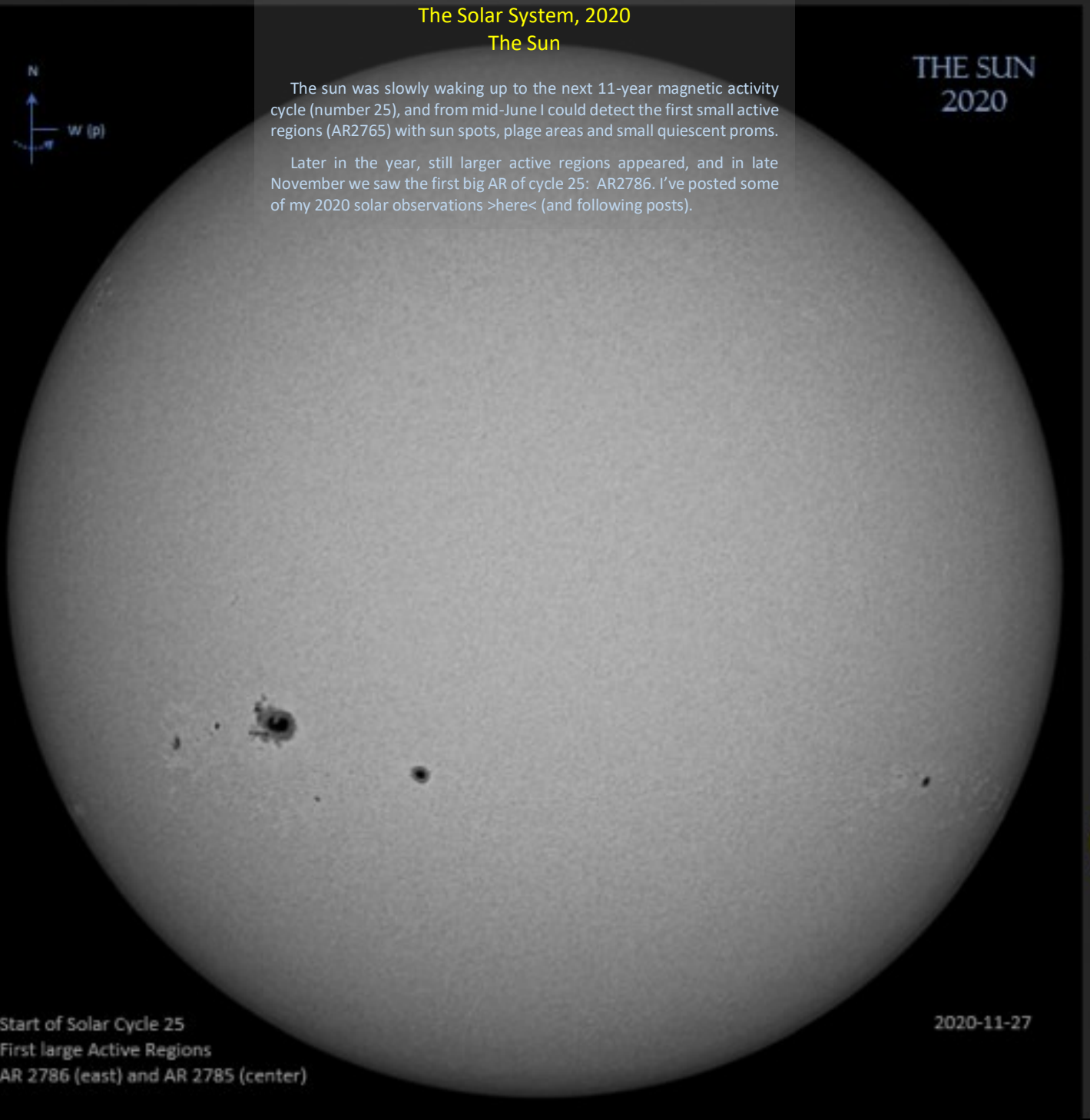
VENUS, -4.5ᵐ, Alt. 52°
App. Diameter 25", Elong. 45° W, Illum./Phase 47%
Zeiss 100/640 APQ, FFC @ 4x Barlow, ZWO ASI120MC
Exposure 30s @ 30 FPS, 5% AS!2 stack

Max W Elongation: 2020-08-13
Inferior conjunction 2021-03-26
Max. E. Elongation: 2021-10-29

The Solar System, 2020
The Sun

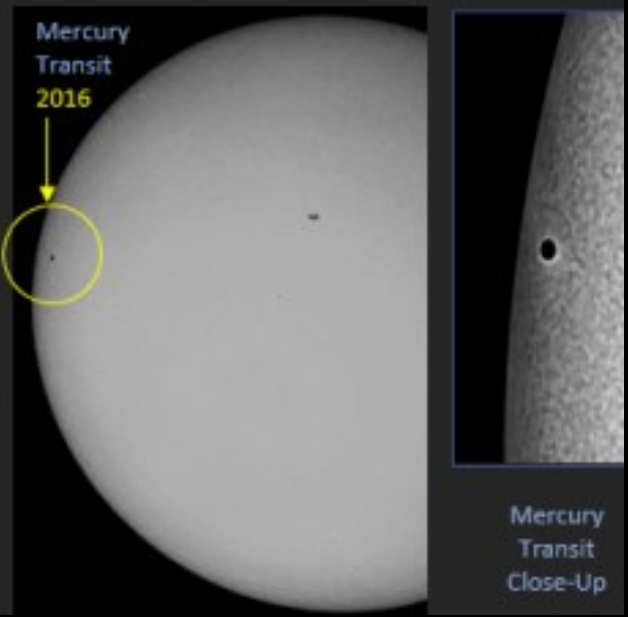
The sun was slowly waking up to the next 11-year magnetic activity cycle (number 25), and from mid-June I could detect the first small active regions (AR2765) with sun spots, plage areas and small quiescent proms.

Later in the year, still larger active regions appeared, and in late November we saw the first big AR of cycle 25: AR2786. I've posted some of my 2020 solar observations >here< (and following posts).



~250x magnification, 2020-08-07

For comparison (below) I have included a photo of Mercur transiting in front of the sun (taken back in 2016).



Observation Record

Index: PLANETS

Local UT+1

Feature(s): Mercury Transit Date: 2019-11-11 Time: 13:35 - 14:00 Location: 56 N 12 E DENMARK

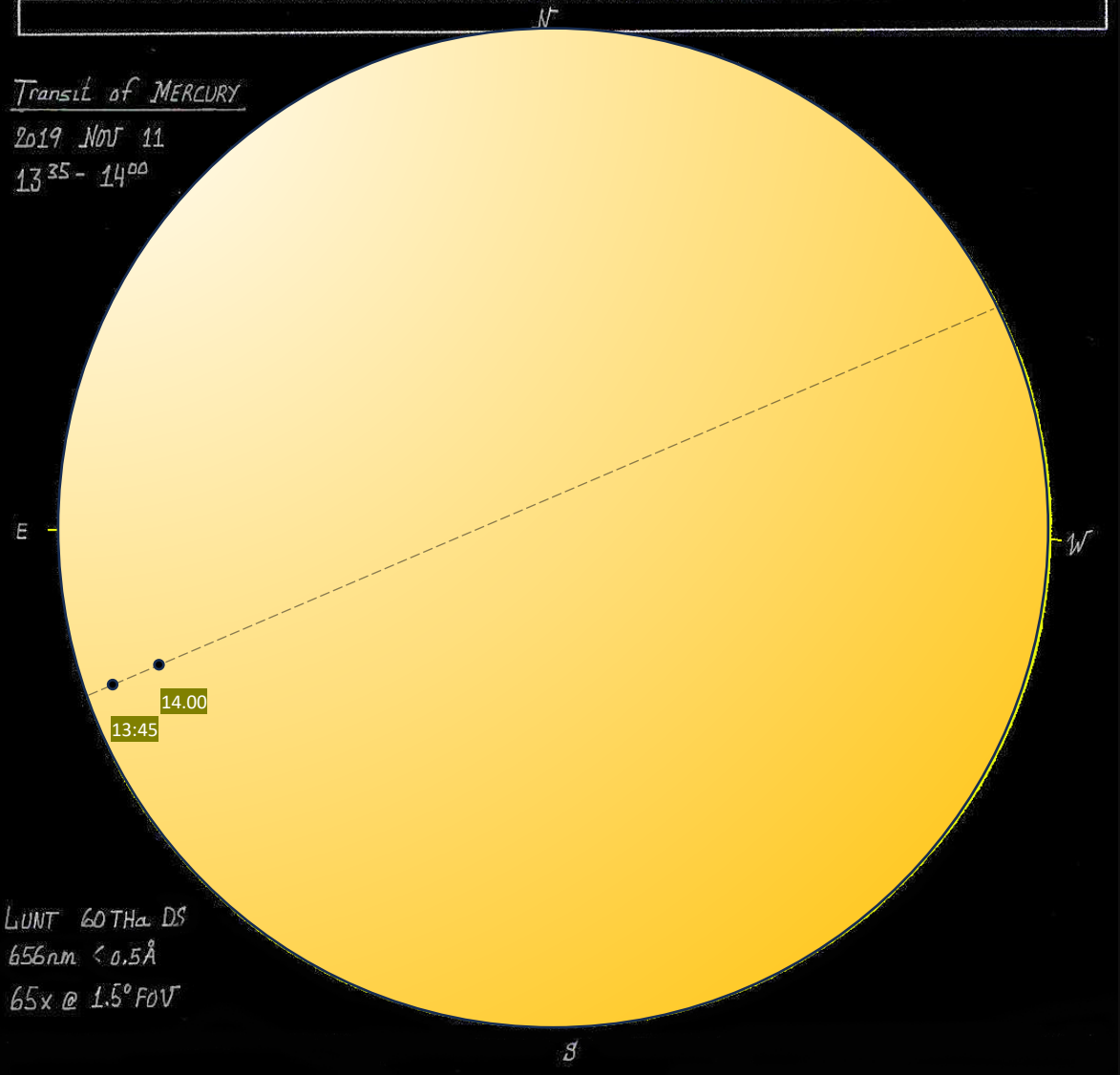
Conditions: Dense High Cirrus Seeing: 4-5/10 Instrument: LS 60THa DS50/B1200 CFT LUNT

Aperture: 60/50mm Focal Length: 500mm F/8.3 EP/Filter/Mags: + 1.7x GPC / 13mm TV Ethos

Notes: Magnification 65x, FOV 1.5°

Overcast by Cirrus and Altostratus clouds; Partly transparent in holes

Gusts of wind reducing the seeing



Mercury Transit

2019

Mercury

2024

January 12 - Mercury at Greatest Western Elongation. The planet Mercury reaches greatest western elongation of 23.5 degrees from the Sun. This is the best time to view Mercury since it will be at its highest point above the horizon in the morning sky. Look for the planet low in the eastern sky just before sunrise.

March 24 - Mercury at Greatest Eastern Elongation. The planet Mercury reaches greatest eastern elongation of 18.7 degrees from the Sun. This is the best time to view Mercury since it will be at its highest point above the horizon in the evening sky. Look for the planet low in the western sky just after sunset.

Venus

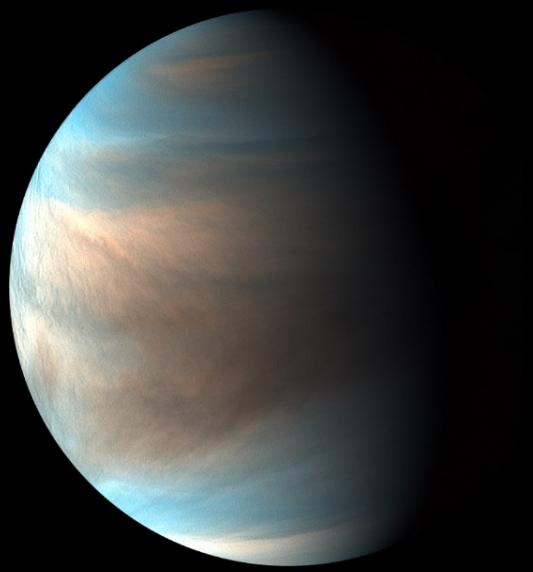
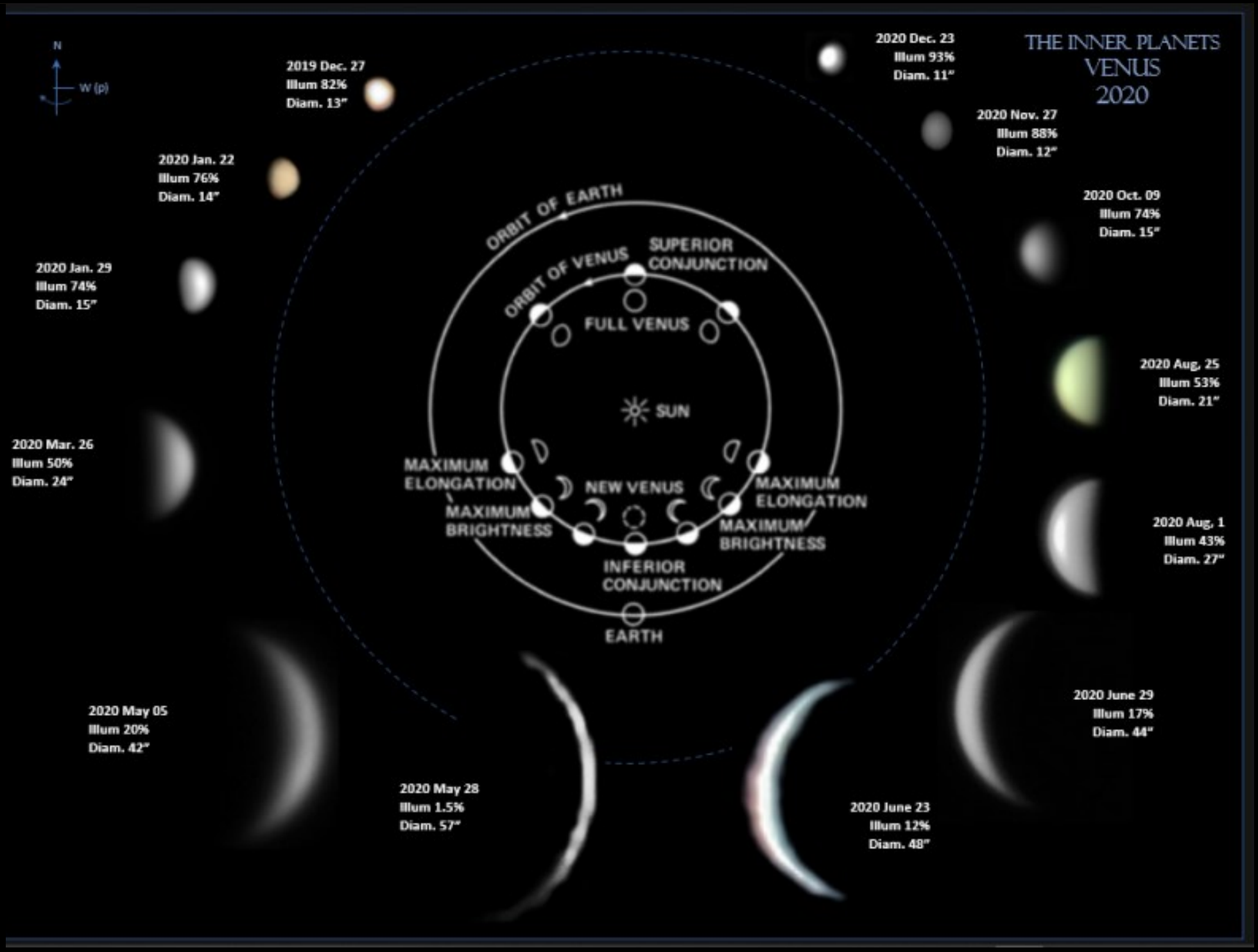


Image: *JAXA Planet-C (Venus Climate Orbiter)*

The Solar System, 2020
The inner rocky planets

The inner rocky planets were all well placed for observation in 2020, so I was able to study Mercury in the daytime close to the sun at superior solar conjunction (see previous post), and I also made a small project of observing our sister planet Venus all through the year from Dec 27. 2019 to Dec.23. 2020:



Waning gibbous Venus, 2020

It's a relatively mild (6°C) early evening in late January (2020-01-22, 17:30 CEST UT+1), -- the warmest January month in recorded meteorological history here in Denmark (i.e. in the past 147 years). I'm currently passing through nautical twilight, but that's of no significance, as my target this evening is dazzling bright Venus (another planet that has experienced a runaway greenhouse effect...). It's a calm and clear evening with a good (5/7) transparency and a seeing just above medium (7/10), -- but Venus is rather low at ~17° altitude in Aquarius towards the SW, so not surprisingly there's quite a bit wavering and atmospheric dispersion in the planet image as seen through the eyepiece.

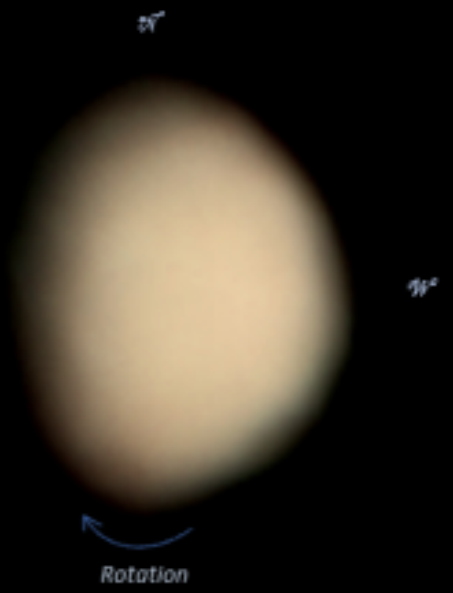
Venus has now come out of superior conjunction at the far side of the sun (which happened 2019-08-14); With Venus' orbital period being only 0.6 year, it will be steadily approaching and catching up with Earth in our orbit around the sun. This evening the Venus phase is seen as a 75% illuminated waning gibbous disc, lit up from the W by the setting sun, with the terminator curving down the E hemisphere. At inferior conjunction, Venus may sometimes transit across the solar disk, and this occurs in a pattern with pairs of transits eight years apart, separated by long gaps of 121.5 years and 105.5 years. The latest pair of Venus transits was back in 2004 & 2012 (where it was clouded in Denmark), and the next pair will be in 2117 & 2125, -- so that unfortunately is out of scope for me ☹.

As Venus passes through inferior conjunction, its position will change from E to W of the sun, and then it will transform from a waning "Evening Star" trailing sunset, to a waxing "Morning Star" preceding sunrise. This will happen around June 03. in 2020.

What I can see in the eyepiece is of course not the surface, but rather the Venusian atmosphere that consists of a thick lower layer of CO_2 (96%) topped by an upper opaque layer of highly reflective clouds of N_2 with sulfuric acid droplets (SO_2 + Water). The planet's axial rotation is in an anti-clockwise direction, with the sun rising in the W and setting in the E. The surface rotation is slow, with one Venusian day = 243 Earth days, i.e. longer than a whole Venusian year of ~225 earth days. The upper atmosphere however rotates super-fast, with a period of only 4 earth days. I can detect no details in the cloud cover, neither visually nor looking closer at my smartphone images. I think maybe with a 350/60nm deep UV-filter and my small astro-camera it may be possible to detect some structure in the high Venusian clouds; I plan to try that, one of these days...

Venus, Phase 75% illuminated
Size 14.4", Alt 18° in Aquarius
56N 12E, Denmark.
2020-01-22, 17:30 CEST (UT+1)
Transparency 5/7, Seeing: 7/10

49x Magnification, 2° TFOV
Zeiss 100/640 APQ refractor,
13mm Ethos EP
iPhone XS, NightCap v 9.7 App



172x Magnification, 0.6° TFOV
Zeiss 100/640 APQ refractor,
FFC @ 3.5x barlow, 13mm ETH
iPhone XS, NightCap v 9.7 App

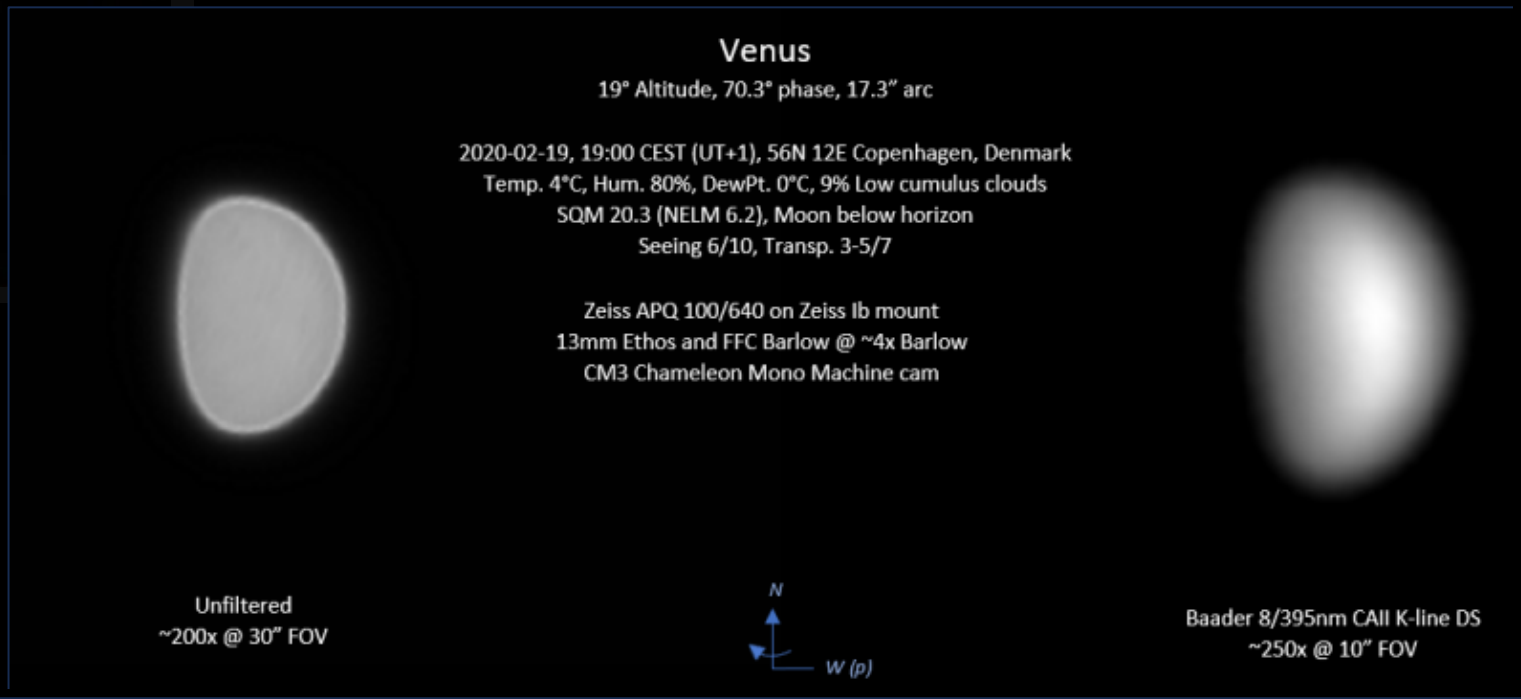
Venus, 2020

19° Altitude, 70.3° phase, 17.3” arc

It’s an early mid-February evening (2020-02-19, 19:00 CEST, UT+1) and I’m out in my suburban backyard for another attempt at viewing surface details on Venus. There has been an unexpected opening in the cloud cover, and the observing conditions are now quite good, with transparency and seeing both just above medium. I’m using my 4” refactor with a 4x Barlow plus a 13mm eyepiece (200x mag @ 30” FOV), and also live viewing with my CM3 machine-cam for a little higher magnification.

At this high magnification, the otherwise good seeing is notably distorting the image of the planet, which is “wobbling” quite a bit in the center of the FOV. Venus is brilliantly bright and no surface details can be seen. I now try with a blue filter (Wratten 38A), which notably calms the image – but seems to also make is grainier, esp. around the limb and terminator. Still no surface details. I finally try my 8/395nm K-line double stack filter (which I sometimes use for solar obs.), and this does yield a better image than the W38A; There’s a notable darkening of the Venusian atmosphere towards the limb and the terminator, and the darkening (maybe) seems to sometimes extend a bit more W around the equator – but it’s subtle, if it is there at all...

I wonder how much better a dedicated Venus UV-filter (like the Baader 60/650nm deep UV) will fare on a 4" refractor, as compared to the 8/395nm K-line... Anyone have some thoughts/experiences to share here

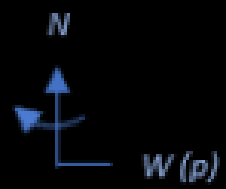


Venus at E Elongation, 2020

It's now near the end of March 2020, and Venus is just past max eastern elongation, presenting a nice half sphere with the terminator right down the middle. I'm out in my suburban backyard in a clear and calm evening, with Venus higher up and in somewhat better seeing conditions than when I last observed it two weeks past inferior conjunction back in mid-February this year.

Again, this evening I'm using my 4" refractor with a 4x barlow plus a 13mm eyepiece (200x mag @ 30" FOV), and also live viewing with my CM3 machine cam for a little higher magnification.

The image tonight shows a planet disc that has increased in size from 17.3" to 24" but also decreased in illumination from 67% to now 50% in the five weeks since my last observation. There's a notable darkening along the planet limb and terminator, presenting the planet clearly as a spherical ball rather than just a flat crescent disc. I can however still not detect any indication of cloud structure in the Venusian atmosphere (I'll need to order that deep UV-filter, -- but the price...!)



UNFILTERED
~200X @ 30" FOV

VENUS

27° ALTITUDE, 24" ARC, 89.8° PHASE, 50% ILLUMINATED ~MAX E ELONGATION (2020-03-24)

2020-02-26, 20:00 CEST (UT+1),
56N 12E Copenhagen, Denmark
Temp. 2°C, Hum. 77%, DewPt. -1°C,
SQM 20.4 (NELM 6.3) Suburban,
Low Moon at W horizon
Seeing 5/10, Transp. 4/7
Clear and calm

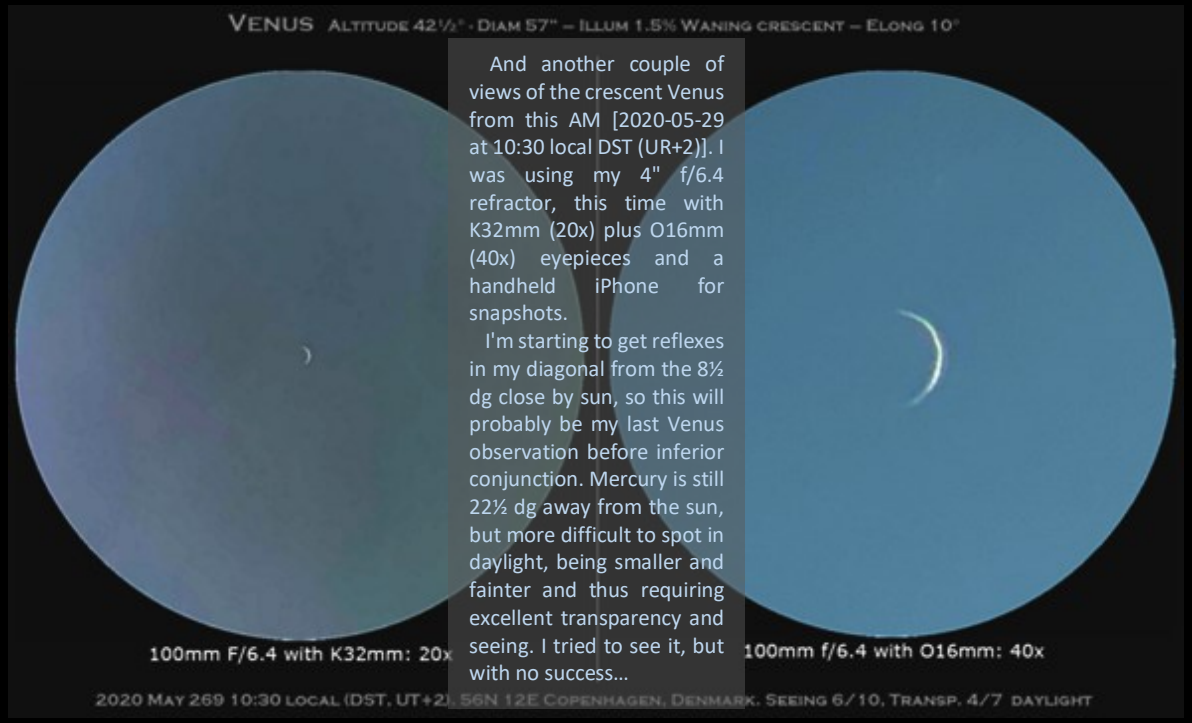
Zeiss APQ 100/640 on Zeiss Ib mount
FFC @ ~4x Barlow
CM3 Chameleon Mono Machine cam

Venus in blue jeans... 2020
Venus closing in on inferior conjunction.

Venus is closing in on inferior conjunction here in late May 2020, moving steadily closer to the sun (New Venus will be June 03. 2020). As the sun sets towards the NW, the waning crescent of the planet gets increasingly more difficult to catch in the evening twilight, at least from my suburban backyard, where buildings and trees are blocking the view towards the northern horizon.

Instead, I can use the setting circles on my manual equatorial mount to "dial in" the current position of the planet, and in this way catch a good daylight view of Venus high up on the SE sky. So, this is what I did on May 26. and 28. around 11 AM local time, and even though the sky was partly cloudy and the seeing not the best, I managed to get a good observation of crescent Venus; The best view was possibly a 4° field @15x (41mm Pan on my 4" 100 f/6.4 refractor) showing the crisp small sharp sickle sailing steadily through the huge bright blue sea of daylight sky – just beautiful!

Here's a couple of snapshots from my observation:



And another couple of views of the crescent Venus from this AM [2020-05-29 at 10:30 local DST (UR+2)]. I was using my 4" f/6.4 refractor, this time with K32mm (20x) plus O16mm (40x) eyepieces and a handheld iPhone for snapshots.

I'm starting to get reflexes in my diagonal from the 8½ dg close by sun, so this will probably be my last Venus observation before inferior conjunction. Mercury is still 22½ dg away from the sun, but more difficult to spot in daylight, being smaller and fainter and thus requiring excellent transparency and seeing. I tried to see it, but with no success…

"New Venus" (trailing Evening Star), first half of 2020.
From superior conjunction, past eastern elongation, to inferior conjunction

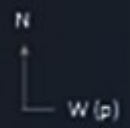
Venus crosses inferior conjunction today, swinging in its orbit right between the Earth and the Sun. This of course renders the planet invisible from our vantage point in the universe, but I have observed Venus since it moved out from superior conjunction behind the sun (2019-08-14), then east the next 220 days, while it brightened as the *"Evening Star"*, catching up with Earth until it reached its greatest eastern elongation from the sun (2020-03-24).

Then, the next 72 days, it has moved on a trajectory taking it west between the earth and the sun, where it today finally reached inferior conjunction (2020-06-03), just 33 arcminutes ***above*** the sun (alas solar disc transits only happen approximately every 100 years, the latest was in 2012 and next is scheduled to 2117).

Here's a small compilation of my Venus observations from the first half of 2020.

Venus Altitude 47° · Diam 48" – Illum 12% Waxing Crescent – Elongation 27°W – Distance 0.34 AU – Mag 50x

Here's a small video recording from my observation: https://www.youtube.com/watch?v=5oQpVxVU6Qo
(Pardon the babbling from my new garden pond...)



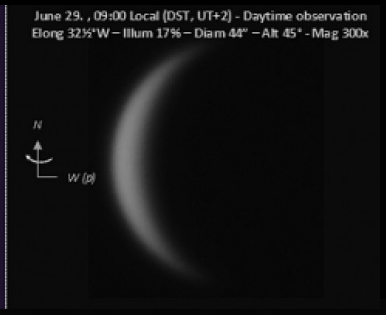
Zeiss 100/640 APQ, Ib Mount
8mm Ethos eyepiece
Neodymium + UV/IR cut Filter
iPhone Xs, NightCap v.9.7 App
80x Magnification

Venus @ 27°W Elongation.

Venus is now well past inferior conjunction (which was June 03. 2020); Today is June 23., and the waxing crescent Venus is now seen at 47° altitude, just 27° west of the Sun. On August 13. Venus will reach its max. western elongation (45.8°W), where after it will circle in towards the next superior conjunction behind the Sun (on Mar 26. 2021).

I have my 4" refractor out this early AM (09:30 Local DST, CEST UT+2), with a Neodymium + UV/IR cut filter in the diagonal to reduce the sky glow from the close by Sun. The ambient temperature is a comfortable 17°C with the humidity down at 55%, but there's a light wind resulting in some atmospheric turbulence with reduced seeing. I can however still bump up the magnification to 80x (TV 8mm Ethos), and yet get quite a good image of the brilliantly bright crescent planet.

2020 June 23, 09:30 local (DST, UT+2). 56N 12E Copenhagen, Denmark. Seeing 6-7/10 (Wind 6m/s NW), Transp. 6/7, Daylight.



Venus Altitude 45° — Elongation 32½° — Phase Waxing Crescent — Illumination 17% — Size 44" arc — Mag~300x

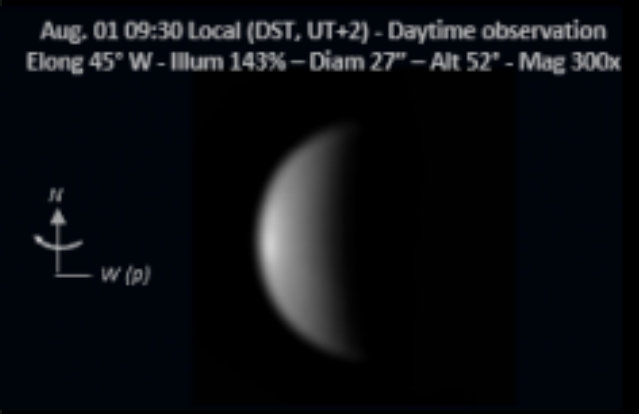
UV/IR Cut Filter, CM3-U3-13S2M, Exp. 0.19 ms. x 900 frames, 5% AS!2 stack

320-380nm Vis/IR Cut (Venus Filter), CM3-U3-13S2M, Exp. 3.5s x 50 frames, 100% RegiStax6

2020 June 29., 09:00 local DST (UT+2). 56N 12E Copenhagen, Denmark. Seeing 5/10, Transp. 5/7 — *HITS Observatory, Allan Dystrup*

Daytime VENUS

It's the first day of August 2020, and I'm out in my suburban backyard in the forenoon at 09:30 AM to observe the daytime Venus. Our sister planet is now closing in on greatest western elongation (which will be August 13.), so the illumination has increased to now 43%, while the apparent angular diameter has decreased to just 27".



Zoom in on Venus
August 25. 2020

I was out today, this early AM at 0845, for a daytime observation of Venus, through drifting clouds. The transparency was a good 5/7 after several days of rain showers, but the seeing was wavering below medium around 3-5/10 with gusts of wind.

I had my 7" Mak telescope out in the backyard, where I started with a view at 18x (TV 2x Powermate + 41mm Panoptic), then proceeded to 88x magnification using my ZWO120MC camera. The atmosphere was relatively clear and calm in the beginning of my observation, but deteriorated over the next hour with increasing wind and more clouds moving in.

Venus is now just past greatest western elongation, showing an illumination of ~56% and a diameter of a good 20". Using a 350nm narrowband UV-filter, I can see some faint shadings in the Venusian atmosphere of carbon dioxide clouds in a sulphuric dioxide haze. The seeing today does however not allow higher magnification, and thus I cannot attain better resolution than shown below.

But a nice view, never-the-less (see next slide)

VENUS @ 18X
(iPhone w. 2x optical zoom)

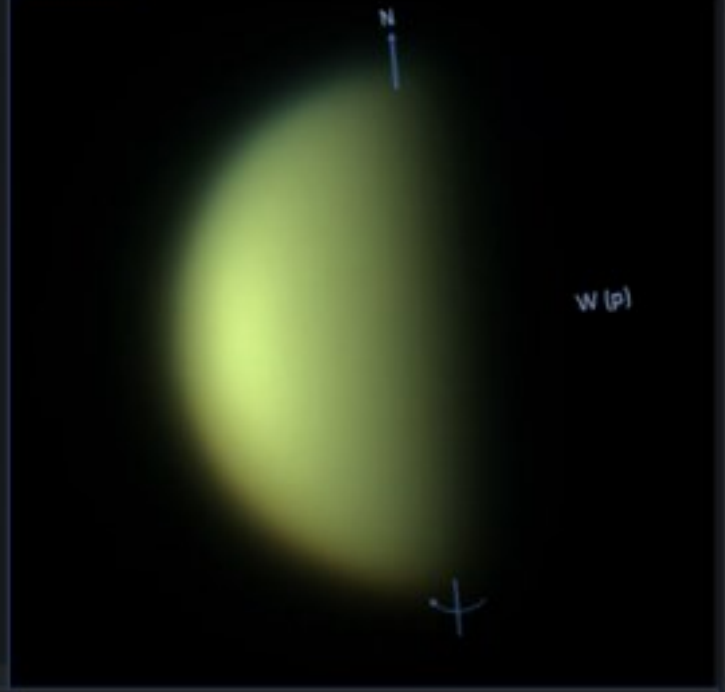
7" Mak + 2x Barlow
TV 41mm Pan EP
iPhone XS w. NightCap App
Snapshot: Exp. 0.5ms, ISO 45

VENUS @ 88 X

7" Mak + 2x Barlow
ZWO ASI120MC, Exp. 15s @ 30 FPS
8% AS!2 stack

VENUS @ 88 X
(post processing zoom-in)

7" Mak + 2x Barlow
Baader U-Filter 60nm HBW / 320-380nm
ZWO ASI120MC Exp. 15s @ 30 FPS
8% AS!2 stack



2020-08-25, 08:45 AM local DST (CEST, UT+2)
56N 12E Copenhagen, Denmark
Temp. 14°C, Hum. 67%, DewPt. 8°C
Windy 10-14 Km/h, Drifting cumulus clouds

Zeiss 180 f/10 Meniscas on Ib pier mount
Zeiss 2x Barlow, TV 41mm Pan EP
iPhone XS w. NightCap app
ZWO ASI120MC

VENUS AUGUST 25. 2020

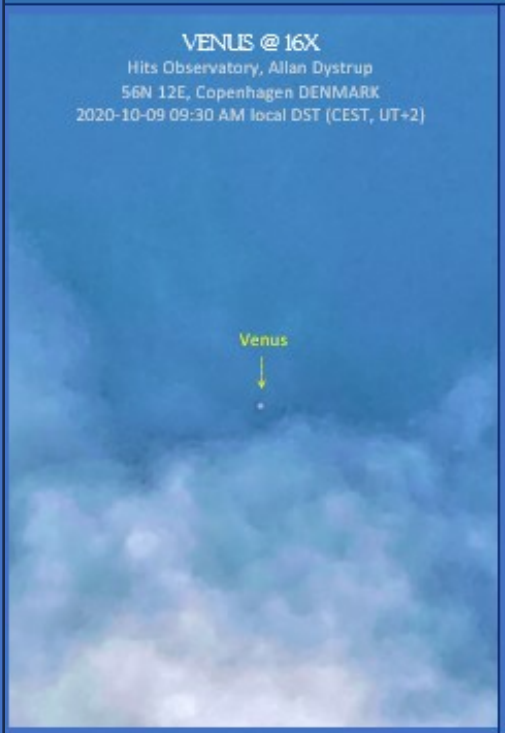
Elong. 45.3° W, App. Diameter: 20.8", Illum./Phase: 56.4%
V_mag: -4.3, Altitude 50°, SSE in Gemini

Greatest W elongation was 45.8°at August 13. 20202.
Superior conjunction will be March 26. 2021, 1.4°NW from Sun.

VENUS 2020
Daytime, October 09.

Here's my latest observation of Venus at 09:30 AM with the planet @ 39° W elongation and a disc of 14.8".

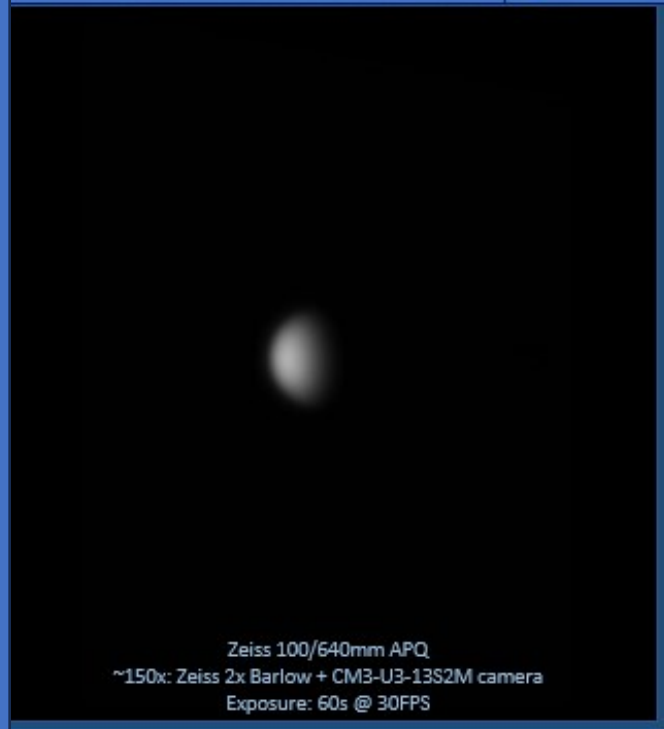
Venus har started moving in its orbit back behind the Sun, so it is now slowly decreasing in size and angular distance from the Sun. Here's the observation in context with the other views of Venus I've had this year:

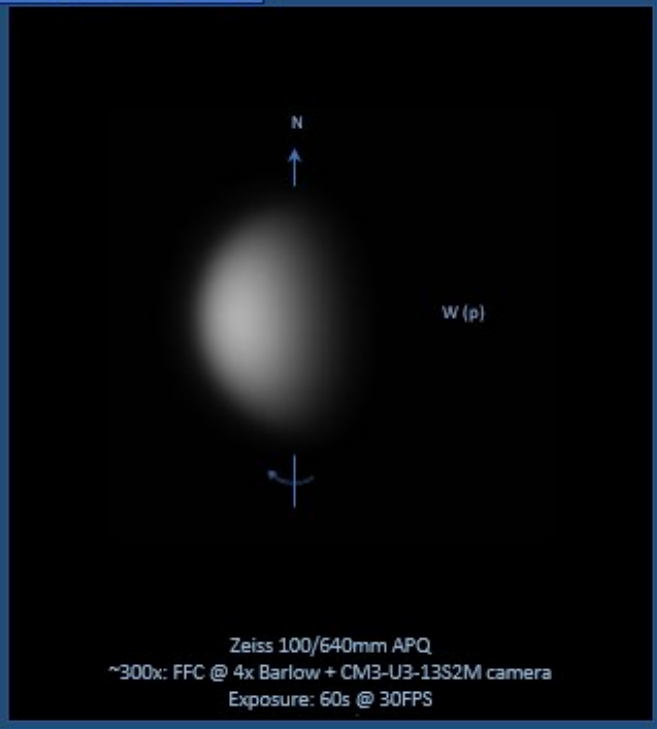


Day-time VENUS

Altitude 37°, Elongation +39° West,
Illum./Phase 74%, App. diameter 14.8"

Zeiss 100/640mm APO
16x: TV 41mm PAN eyepiece + iPhone
150x: Zeiss 2x Barlow + CM3-U3-13S2M
300x: FFC @ 4x Barlow + CM3-U3-13S2M





VENUS

2020-11-27, 11:00 AM local (CEST, UT+1)
CZJ Zeiss 100/640mm APQ
Zeiss 2x Barlow

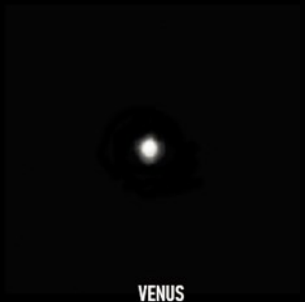
N
W (p)

Venus --
towards superior conjunction

Venus is now heading from its max. W elongation (August 25. 2020) towards its superior solar conjunction (March 26. 2021), as its orbit carries it east around the far side of the solar system to again become an evening star, as seen here from Earth.

When it was closest to Earth this year, at inferior conjunction, its apparent size was ~60", whereas it now is down at 12", which will shrink further to ~10" when at apogee. Venus is still easy to catch in the morning or noon sky, but it is now notably smaller than it was during the summer months this year.

IMX-183 mono @ 800x600 px ROI
Prime focus, Exp: 0.6ms, Gain100
30 FPS for 90s, 25% AS!3 stack
Contrast enhanced



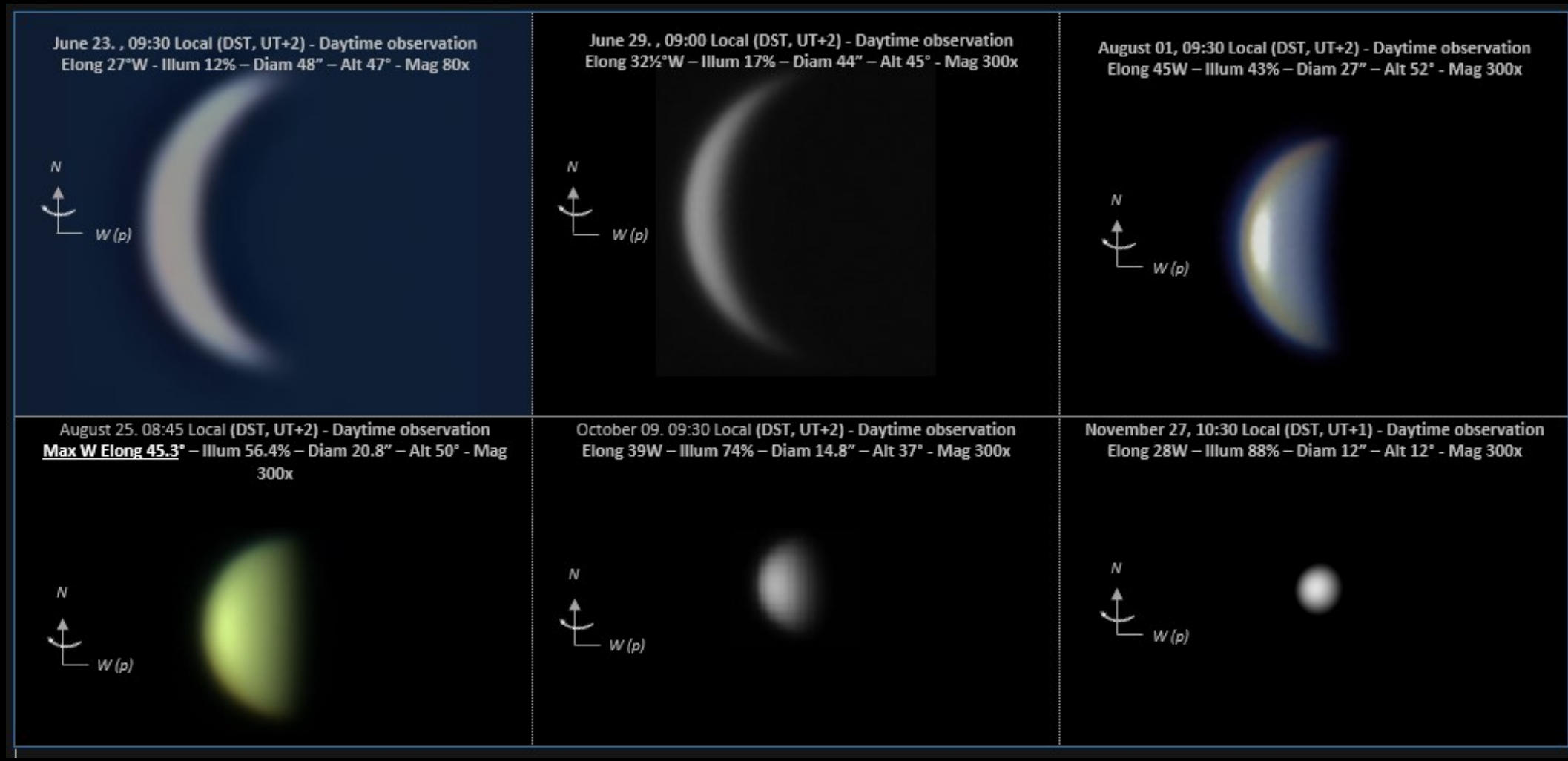
VENUS

Altitude: 8½° towards SW in Capricorn
Late afternoon in nautical twilight
Distance: 195 million km (10 light minutes)
Phase 83% illuminated, Apparent diameter 13"

2019-12-27, 17:00 local CEST (UT+1)
Temp -1°C, Humidity 81%, Dew point -4°C
Transparency 3/7 light haze, Seeing 7/10 calm

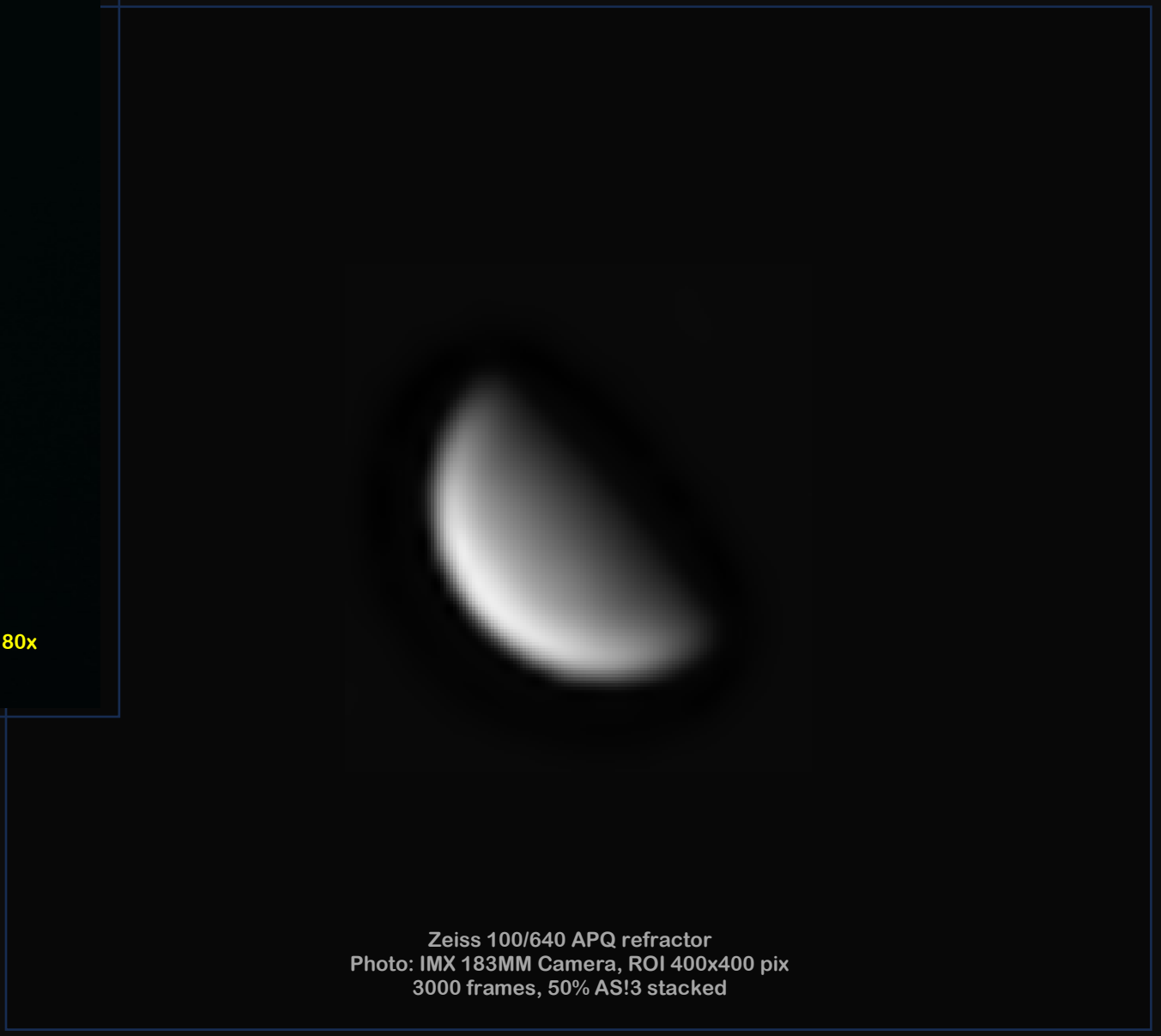
Zeiss 100/640mm Refractor; Eyepieces:
Left: 32mm Masuyama, 20x magnification
Right 13mm Ethos, 50x magnification
iPhone XS, NightCap v 9.7 App

"Old Venus" (preceding Morning Star), second half of 2020.
From inferior conjunction, past western elongation, to inferior conjunction

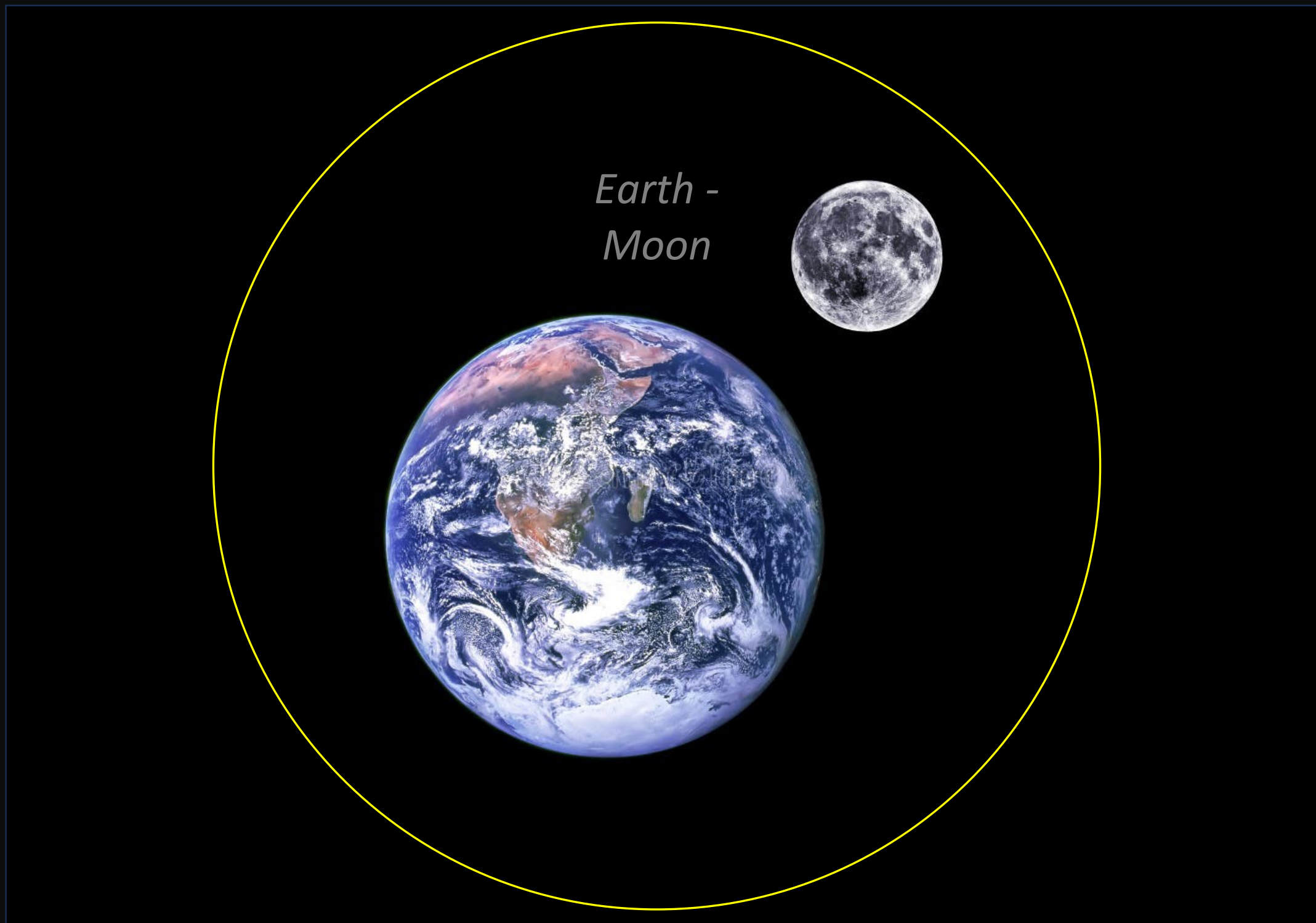


56N 12E, Copenhagen Denmark.
November 13., 2023 at ~09:00 AM Local CEST (UT+1)
VENUS phase 0.6 (60% illuminated), Elongation +45°, Altitude 33°
Transparency 3/7 (10% cloudy), Seeing: 5/10, Temp.: 5°C, Humidity 89%

Zeiss 100/640 APQ, 8mm Ethos eyepiece, **Magnification 80x**
TFOV 1.2°, Venus apparent diameter ~20''
Snapshot iPhone XS, NightCap app.

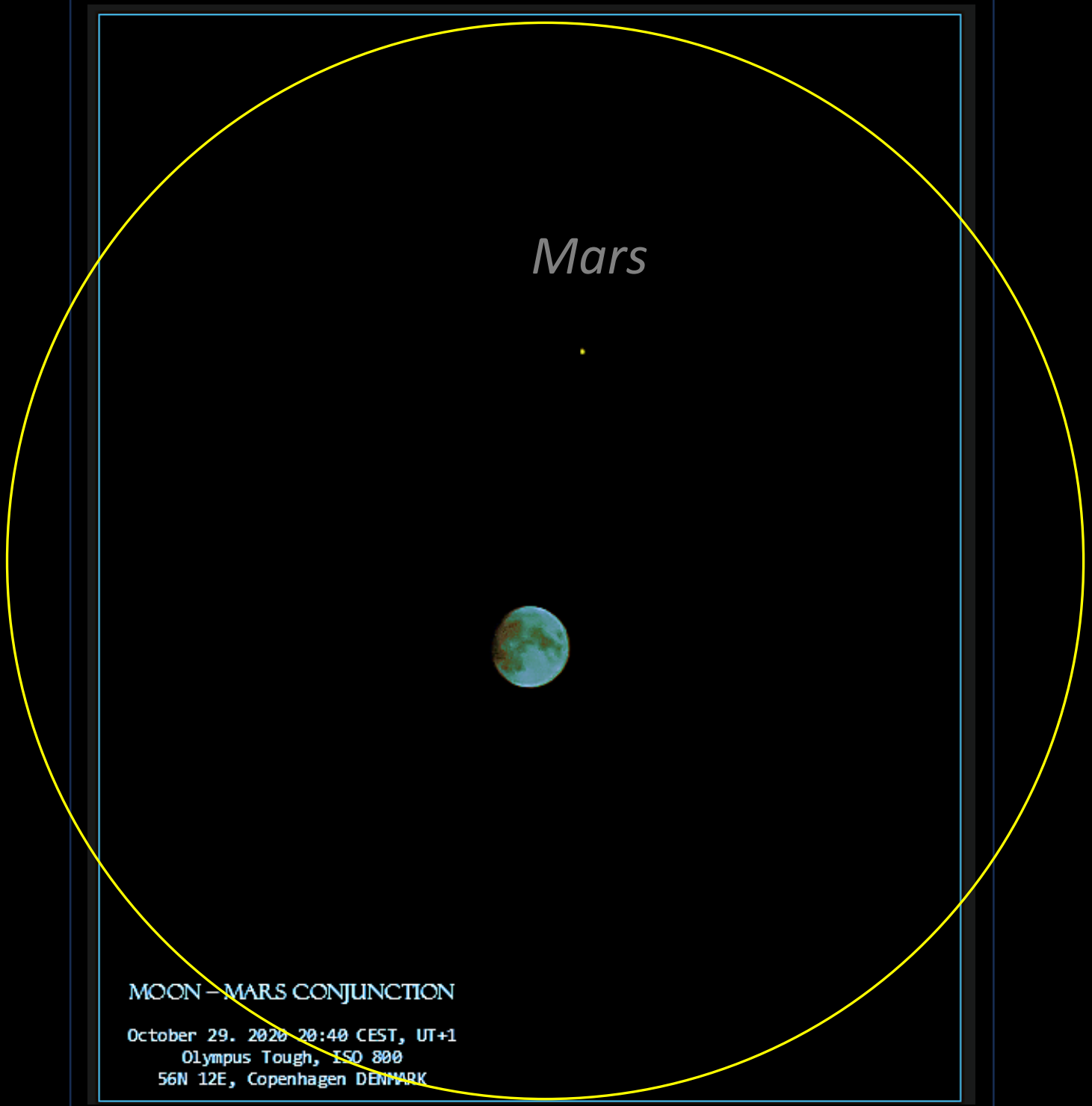


Zeiss 100/640 APQ refractor
Photo: IMX 183MM Camera, ROI 400x400 pix
3000 frames, 50% AS!3 stacked


Earth -
Moon

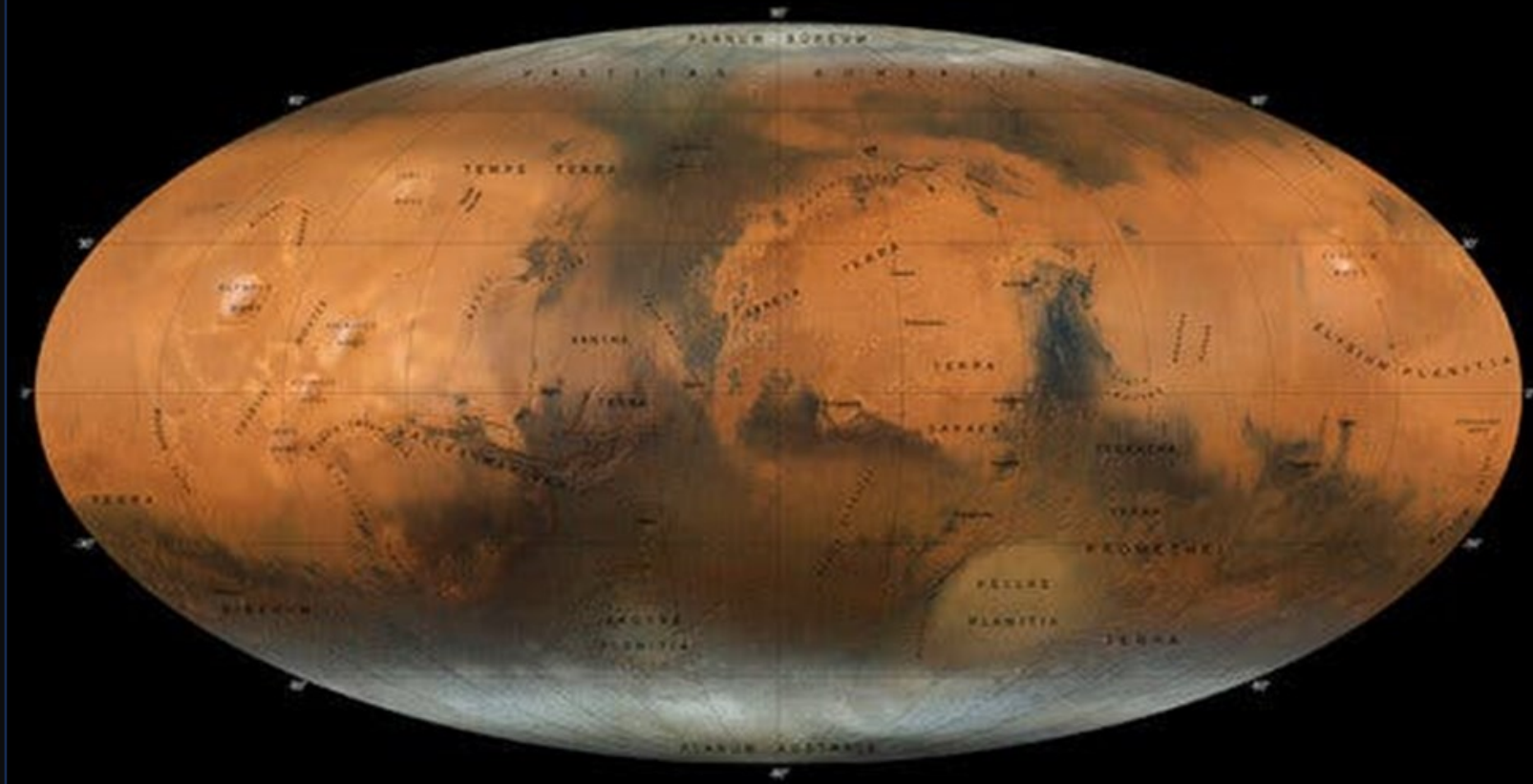
The Solar System, 2020
The Moon

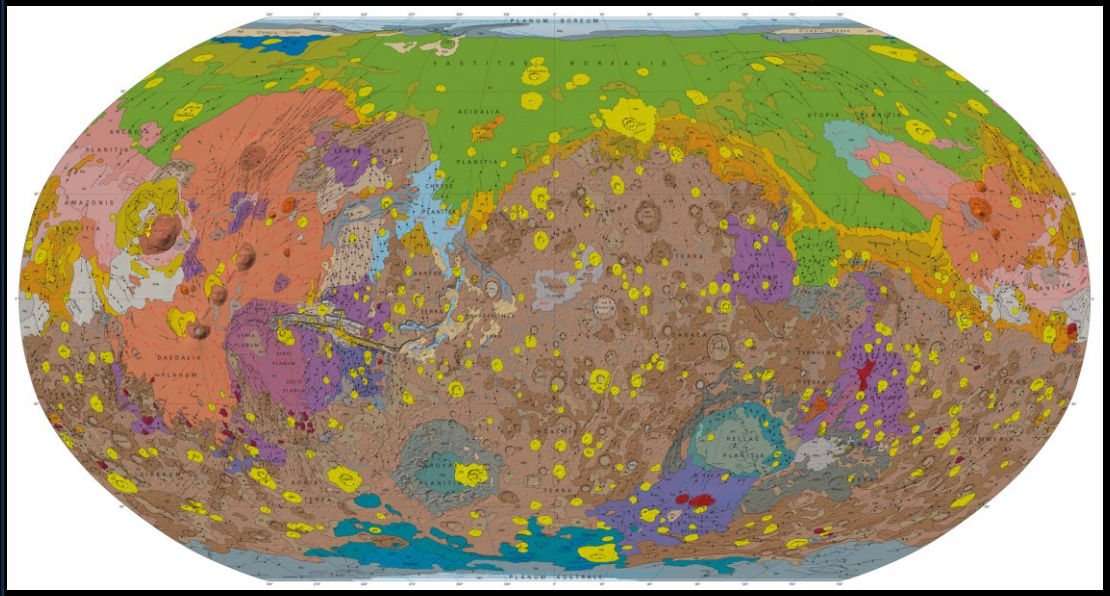
I also followed the Moon through several lunations in 2020, first with a focus on the major geologic regions, and later with close up studies of interesting areas like Plato-Anaxagoras, *Aristarchus, Humorum, Crisium, Nectaris, Serenitatis, Great Peninsula, Apennine Bench, Hyginus-Triesnecker, Imbrium, Endymion-Humboldtianum, Orientale…* and many more. Some of my 2020 lunar reports can be found here: https://qualitycode.wordpress.com/


Mars
MOON – MARS CONJUNCTION
October 29. 2020 20:40 CEST, UT+1
Olympus Tough, ISO 800
56N 12E, Copenhagen DENMARK

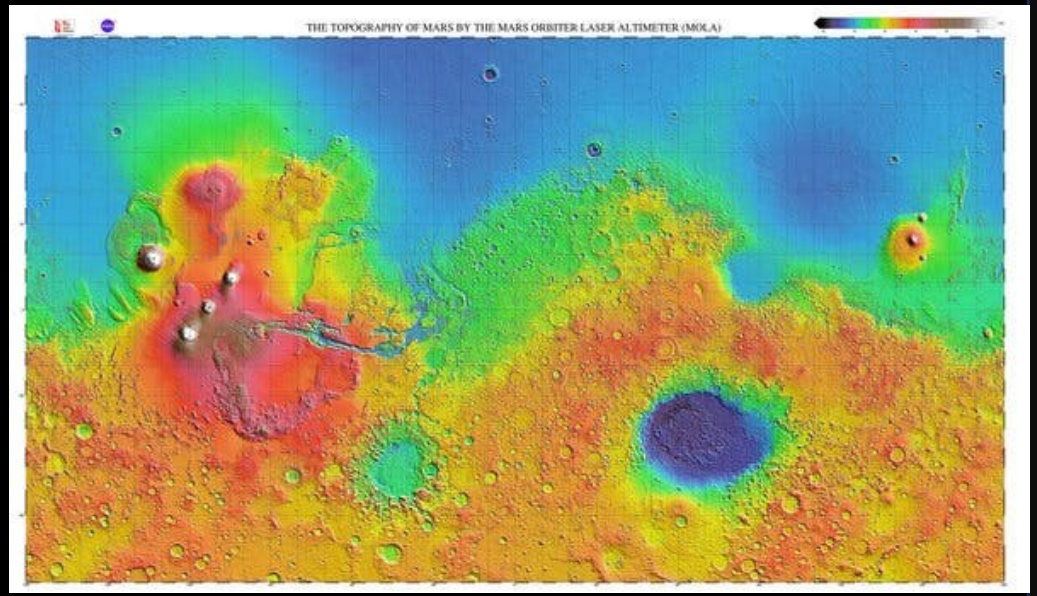

Earth
23.5°


Mars
25°





https://planetary-science.org/wp-content/uploads/2014/12/GhoO4SV.jpg



Finder

Mars in Libra, +11° ALT

Astronomy Observation Record

Index: MARS 2016

Subject(s): MARS Opposition, 2016.

Date: 2016-0601 Time: 22:10 UT Location: 56N 12E DENMARK

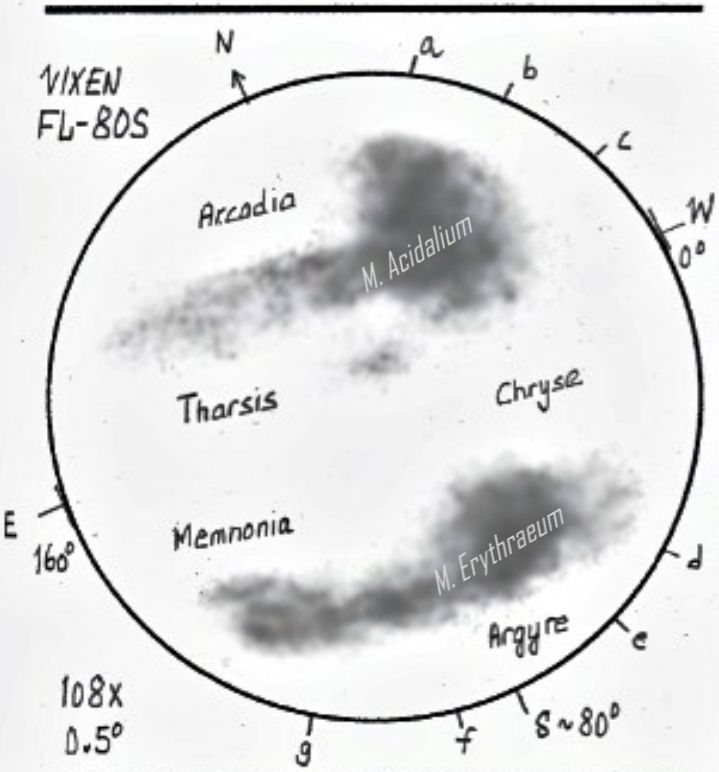
Instrument: VIXEN FL-80S Aperture: 80mm Focal Length: 640mm

Eyepieces/Magnifications: +1.7 GPC, CZJ Turret, CZJ O-16mm

Conditions: Clear, calm, warm (16°C) Seeing: 8-9/10

Transparency: 4/7, SQM 17.0, NELM 4.6

CZJ MARS Filter (Light orange)



Notes:

a: Acidalia Planitia } Mare Acidalium

b: -"- Colles }

c: -"- Cydonia Mensae / Nilacus Lacus

d: Aurorae Sinus

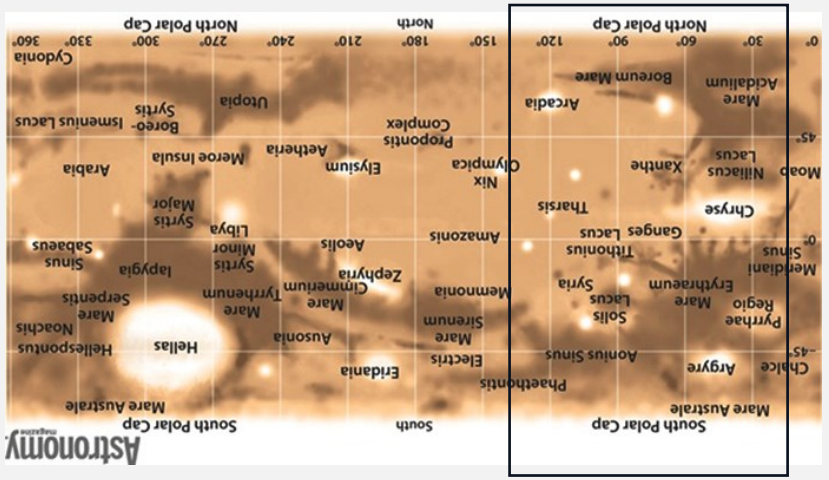
e: Mare Erythraeum

f: Solis Lacus

g: Mare Sirenum

EP: CZJ O-16mm Ortho Mag: 108x

Filter: CZJ Mars (orange) FOV: 0.5°



Mars opposition 2016

It's the hours around midnight this early morning. (2016-05-22, 22:00 UT ~ 23/05 00:00 LOC Time). The transparency is indeed poor (2/7, high haze with incoming waves of Cirrus) and the seeing only 4-5/10). **Mars,** however, is visible as a -2.1^{m} 18.4" disc, only 12dg at transit in Scorpio above the S Horizon. It is glimpsed intermittently, in the holes between the clouds, -- and this being **the night of opposition**, I thought I had to at least give it try.

I have out my **4" Vixen** (FL-102S), but even at low magnifications : 66x (3xFFC + CZJ H40) and 40x (1.7xGPC + CZJ H40) Mars is just an unsteady, unresolved yellow/reddish ball... Well, quite like an orange, in fact

In my **2" finder** (Vixen FL55-S) however, there are moments of not too lousy transparency plus a reasonably steady seeing, which show Mars at 18x up to 44x (CZJ orthos) with a clean outline and hints of shading on the disc. No obvious N polar cap though, and certainly no songs from *Mare Sirenum*... Well, I *did* try / *Allan*

PS : I ended up in fact spending more time with my 55mm finder scope on the 99% full moon, using CZJ O-10 for 44x @ 1.2dg FOV. A very nice view through the high haze of the old (4BYR, Nectarian) crater *Pontecoulant* on the SE terminator, still with steep slopes that were well lit in the setting sun. Also, the crater walls on E Mare Crisium showed up well, -- as did indeed the many small craters, ejecta and mare patches on the face of the full moon. Endless details for study.

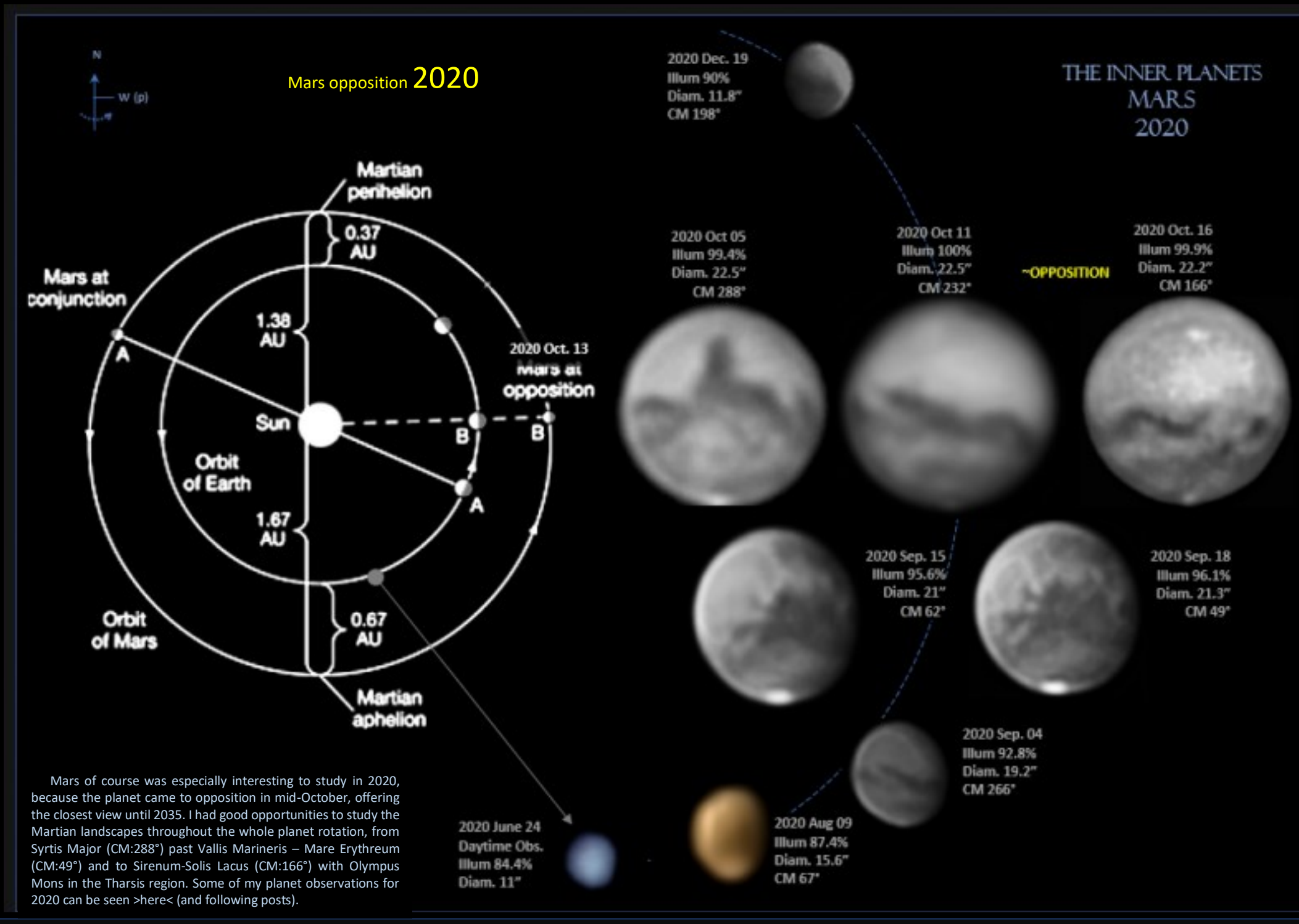
Mars 2019

MARS

Diam: 11.8", CM:198°, Alt 43°S in Pisces

56N 12E, Copenhagen Denmark
2020-12-19, 19:30 Local CEST (UT+1)
Zeiss APQ 100/640, Zeiss 2x Barlow, ZWO ASI183mm Camera
Transparency 3/7 light haze, Seeing 4/10, windy.

Astronomy Magazine



Mars of course was especially interesting to study in 2020, because the planet came to opposition in mid-October, offering the closest view until 2035. I had good opportunities to study the Martian landscapes throughout the whole planet rotation, from Syrtis Major (CM:288°) past Vallis Marineris – Mare Erythreum (CM:49°) and to Sirenum-Solis Lacus (CM:166°) with Olympus Mons in the Tharsis region. Some of my planet observations for 2020 can be seen >here< (and following posts).

Daytime Mars, 2020-06-24 09:30 AM.

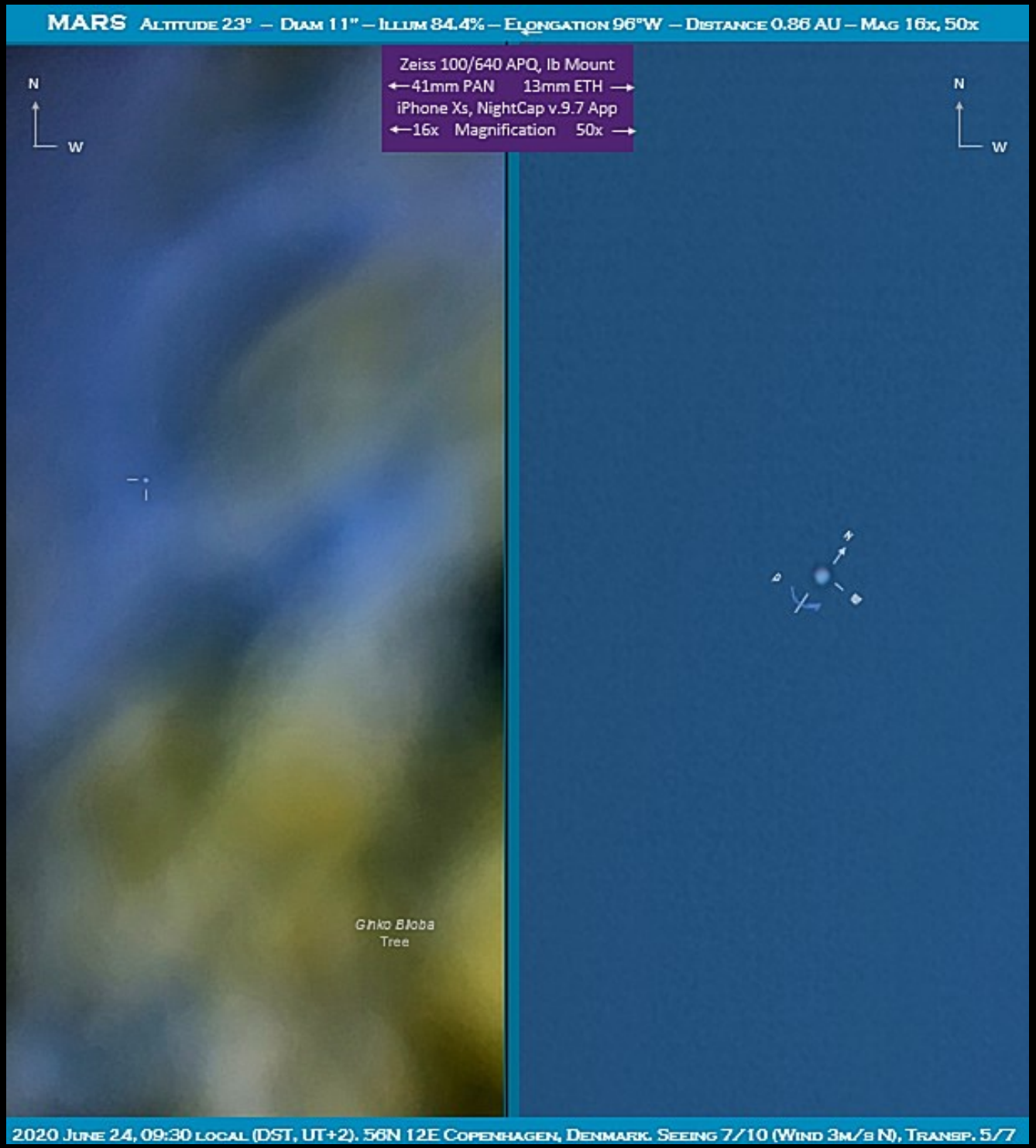
It's the early forenoon on June 24. 2020 (09:30 AM local DST, CEST UT+2), and I'm out in my backyard in broad daylight with my 4" refractor to catch a preview of Mars. The red planet is moving steadily east and up on the celestial sphere these weeks, currently crossing the border from Aquarius into Pisces and headed further up towards Aries and Taurus. On August 02. its orbit will take it closest to the sun (perihelion) where after in September, the Earth in its inner orbit will start to catch up with Mars, until both planets align with the sun on October 12 (at opposition).

Right now, I see Mars at an altitude of 22° towards the SW (96°W elongation from the Sun), with an apparent angular diameter of only 11" and an illumination of 84.4% (at opposition it will be fully illuminated and double in size: 22.6" diameter).

At 16x magnification it shows up as just a bright star (visual magnitude ~ -0.4) while at 50x magnification it is evident that it is a planet, and I can just glimpse the disc as a ~80% illuminated slightly oblong 'American football', with the Sun-facing E hemisphere fully lit up, whereas the far W horizon is in shadow. The dark Syrtis Major dusty plain should be right at the center of Mars this AM, -- and at times I think I catch glimpses of this surface feature..., but it is probably just the seeing that is pulling my eye.

Moon - Mars Conjunction

2020 October 29., time ~ 19-21 Local CEST (UT+1); Handheld snapshot with Olympus Tough pocket camera.



HITS Observatory, Allan Dystrup
56N 12E, Copenhagen Denmark

2020-08-09 01:00 Local DST (CEST, UT+2)
Temp 15°C, Hum. 93%, DewPt 14°C
Calm, partly cloudy (drifting high cirrocumulus)
SQM 20.1 (NELM 6.5) Suburban

MARS @ 115dg W elongation 15.6" app. diam.

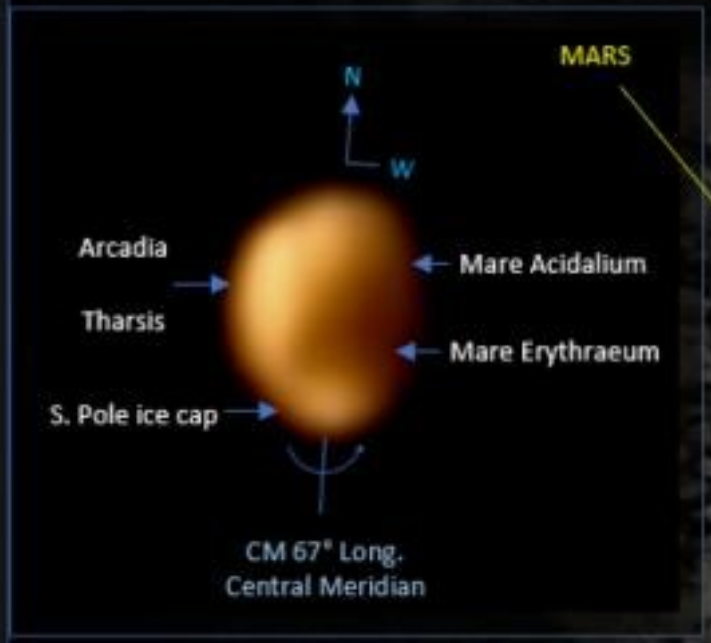
I went out the past weekend to observe Jupiter and Saturn, -- but at just an hour past midnight, they were down at ~10dg above the horizon towards the SW, and already entangled in haze and trees.

Instead, I had a quick look at the 27-day waning Moon, with Mars less than 5dg to the E; Here's a snapshot of the Moon plus a minute long stack of Mars, both taken with my smartphone camera, in holes through the drifting clouds.

MOON

Altitude 27° in Pisces, 27 days, 74% illumination

Zeiss 100/640 APQ on Ib Mount, Zeiss 2x Barlow
TV 13mm Ethos, iPhone XS with NightCap Zoom 4x
Snapshot: 98x @ 1° TFOV



MARS

Elongation 115°W, Altitude 21° in Pisces, Magnitude -1^{m}
4.76° E of the Moon, App. Diameter 15.6", Illumination/Phase 87.4%
[Opposition will be: 2020-10-14 at mag. -2.7^{m} and 22.34" diameter]

Zeiss 100/640 APQ on Ib Mount, Zeiss 2x Barlow
TV 13mm Ethos, iPhone XS with NightCap Zoom 4x
Exp.60s @ 30 FPS, 98x @ 1° TFOV, 8% AS!2 stack.

62X

TV 13mm Ethos,
iPhone XS w. NightCap App
Exp. 1/40s @ ISO 24, Snapshot

200X

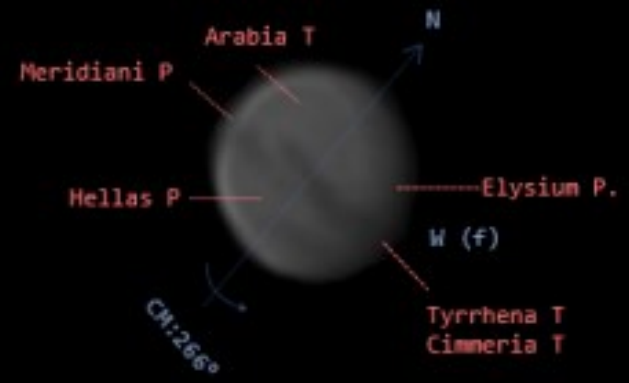
CM3-U3-13S2M camera
Exp. 15s @ 30 FPS, 200x, 10% AS!3 stack

MARS

Elongation 133°W, Altitude 40.8° in Pisces, Magnitude-v -1.9^{m}
App. Diam. 19.2", Illum./Phase 92%, 37.5° E of the 99.1% Moon
[Opposition will be: 2020-10-14 at mag. -2.7^{m} and 22.34" diamete

56N 12E, Copenhagen, Denmark.
2020-09-03 04:00 Local DST, CEST UT+2.
Temp. 12°C, Hum. 90%, DewPt. 11°C
LP SQM 19.7 (NELM 5.9) Bright Suburban

Zeiss 100/640 APQ on Zeiss Ib pillar Mount ,
Baader FFC @ ~4x Barlow



200x, Post-processing Zoom-in

Zoom in on Mars, early September 2020.

Here's my latest observation of Mars, from an early September morning around 04 AM; Improvement in details from my previous observation a month ago, but it should be still better in October this year...

~150x

Zeiss 2x Barlow
SC Exp. 15s @ 30 FPS
15% AS!3 stack

~300x

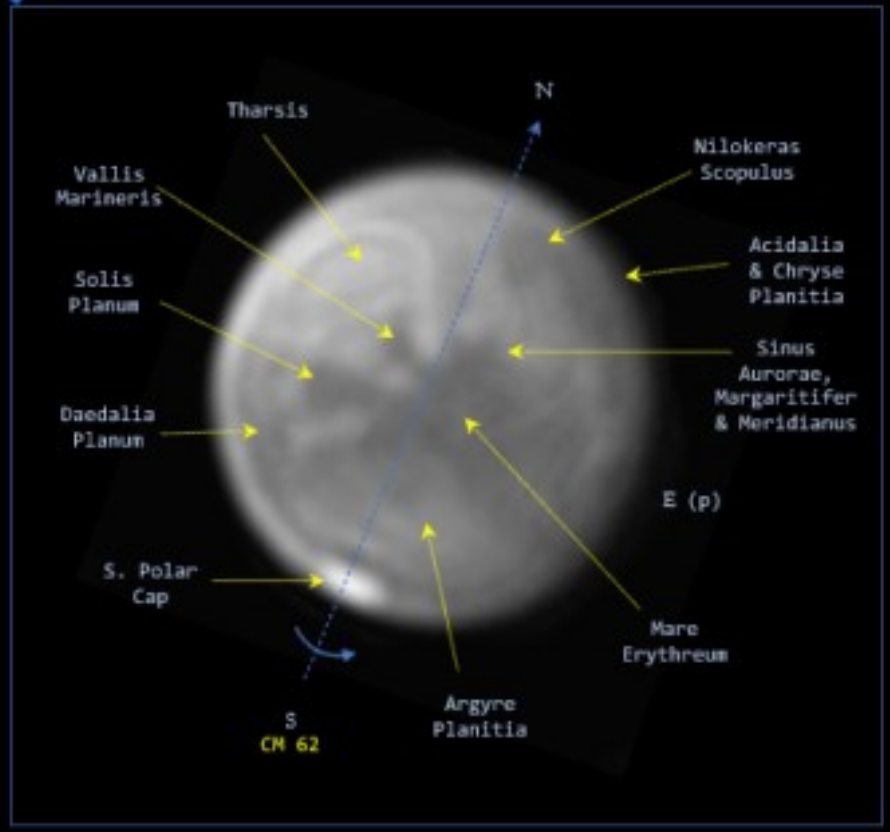
Baader FFC @ 4x Barlow
SC Exp. 15s @ 30 FPS
8% AS!3 stack

Zoom-In

MARS

2020-09-15, 02:00 Local DST (CEST, UT+2)
Elongation +144 W, Altitude 38° SSE in Pisces, Magnitude -1.9
App. Diameter 21", Illum./Phase 95.6%, Central Meridian (CM): 62
[Opposition will be: 2020-10-14 at mag. -2.7^{m} and 22.34" diameter]

56N 12E, Copenhagen, DENMARK
Temp. 14°C, Hum. 97%, DewPt. 14°C
Transparency 4/7, Seeing 8/10



MARS
in a 4" refractor

Behold a couple of my Mars observations from the past early mornings, both made in medium transparency but good seeing. The second one a bit hampered by tube currents due to a steep temperature diff. inside/outside at ~15C.

Zeiss 100/640 APQ, Zeiss Ib Mount on pier.
FLIR CM3-U3-13S2M machine cam.

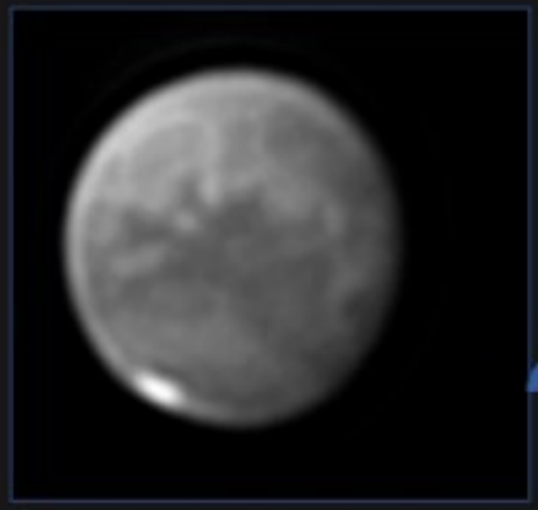
HITS Observatory – *Allan Dystrup*

MARS

~150x

Zeiss 2x Barlow
SC Exp. 30s @ 30 FPS
5% AS!3 stack

~300x

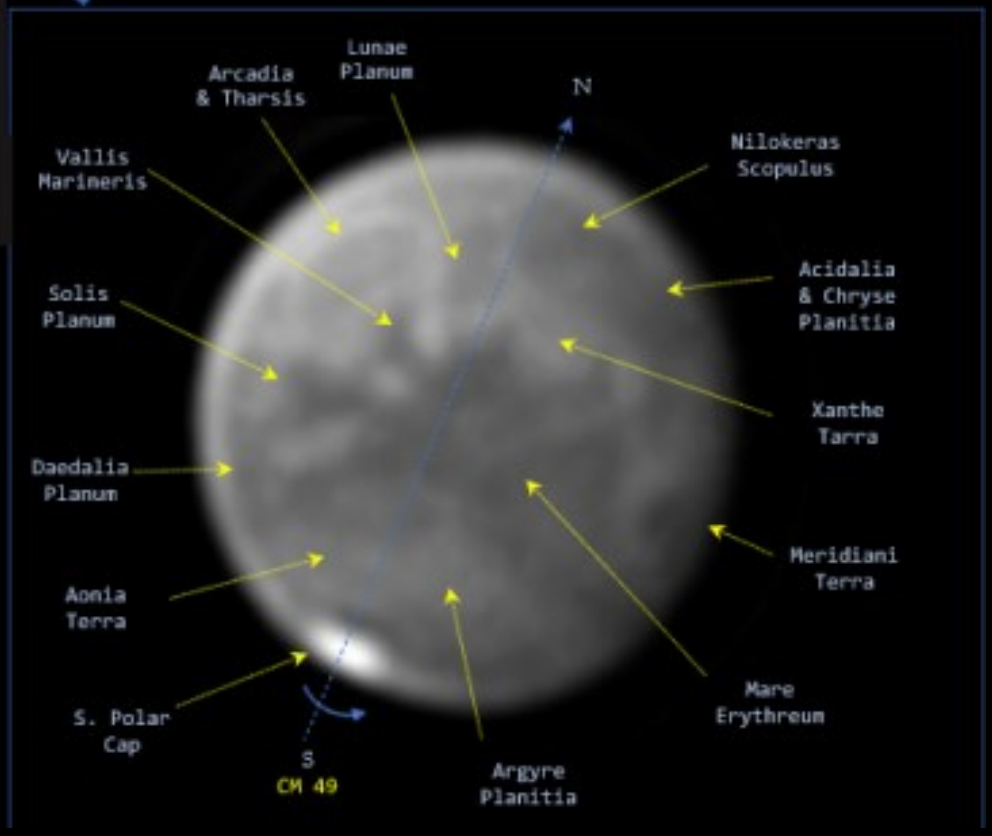


Baader FFC @ 4x Barlow
SC Exp. 60s @ 30 FPS
4% AS!3 stack

2020-09-18, 01:30 Local DST (CEST, UT+2)
Elongation +148 W, Altitude 40° S in Pisces, Magnitude -2.1
App. Diameter 21.3", Illum./ Phase 96.1%, Central Meridian (CM): 49°
[Opposition will be: 2020-10-14 at mag. -2.7[m] and 22.34" diameter]

56N 12E, Copenhagen, DENMARK
Temp. 7°C, Hum. 83%, DewPt. 4°C
LP: SQM 20.9 (NELM 6.5), Suburban Transition
Transparency 5/7, Seeing 8/10

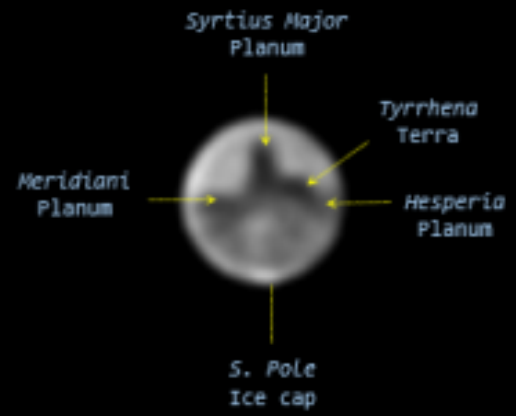
Zoom-In



Zeiss 100/640 APQ, Zeiss Ib Mount on pier.
FLIR CM3-U3-13S2M machine cam.

HITS Observatory – *Allan Dystrup*

150X



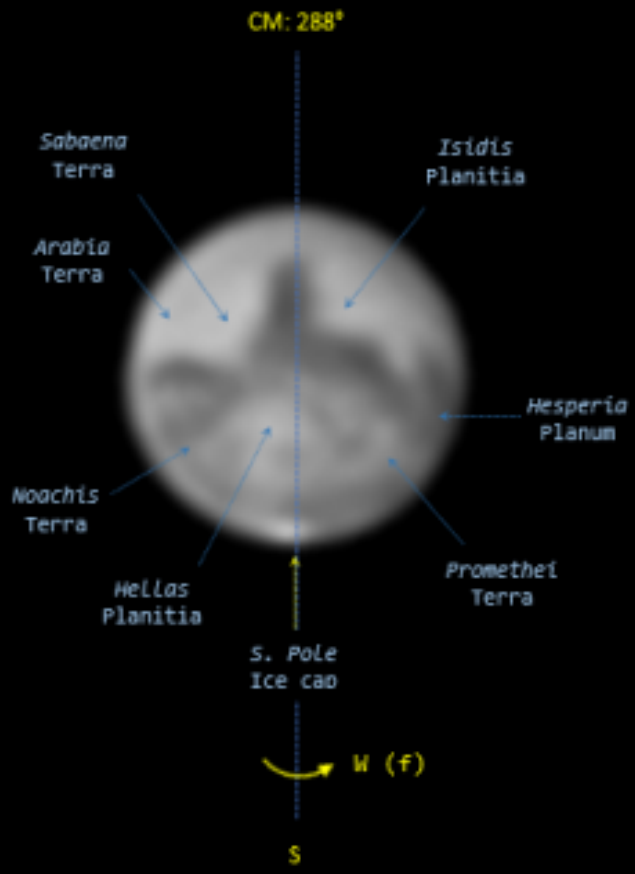
MARS

Hits Observatory, Allan Dystrup
56N 12E, Copenhagen Denmark
2020-10-05, 04:30 Local DST (CEST, UT+2)

Mars Elongation: 168° W, Altitude 30.6° SW in Pisces
Illum./Phase: 99.4, M_v: -2.5, Diam.: 22.5", CM: 287.7°

[Opposition @ 2020-10-14 (M_v -2.7, Diam.: 22.3"]

~300X



MARS -- up to opposition 2020

Here are a couple of my zoom-in on Mars observations, up to the 2020 opposition at October 13. Both were done using my 4" refractor from my suburban backyard in around medium conditions with respect to both transparency and seeing.

ZEISS 100/640 APQ
CM3-U3-13S2M camera

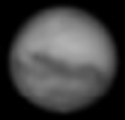
1): Zeiss 2x Barlow: Exp. 1m45s @ 30 FPS, 150x, 10% AS!3 stack

2): Baader FFC @ 4x Barlow: Exp. 2m45s @ 30 FPS, 300x, 10% AS!3 stack

MARS AT OPPOSITION 2020

80X
SC Exp. 20s @ 30FPS, 5% AS!3

150X
SC Exp. 60s @ 30FPS, 5% AS!3



Elong. 175°W, Alt. 38° towards S in Pisces
App. Diam. 22.5", Phase/Illum.: 100%

Zeiss 100/640mm APQ
FLIR CM3-U3-12S2M Machine Cam.

80x: Native
150x: Zeiss 2x Barlow
300x: Baader FFC @ 4x Barlow

300X
SC Exp. 60s @ 30FPS, 5% AS!3

HITS OBSERVATORY, ALLAN DYSTRUP

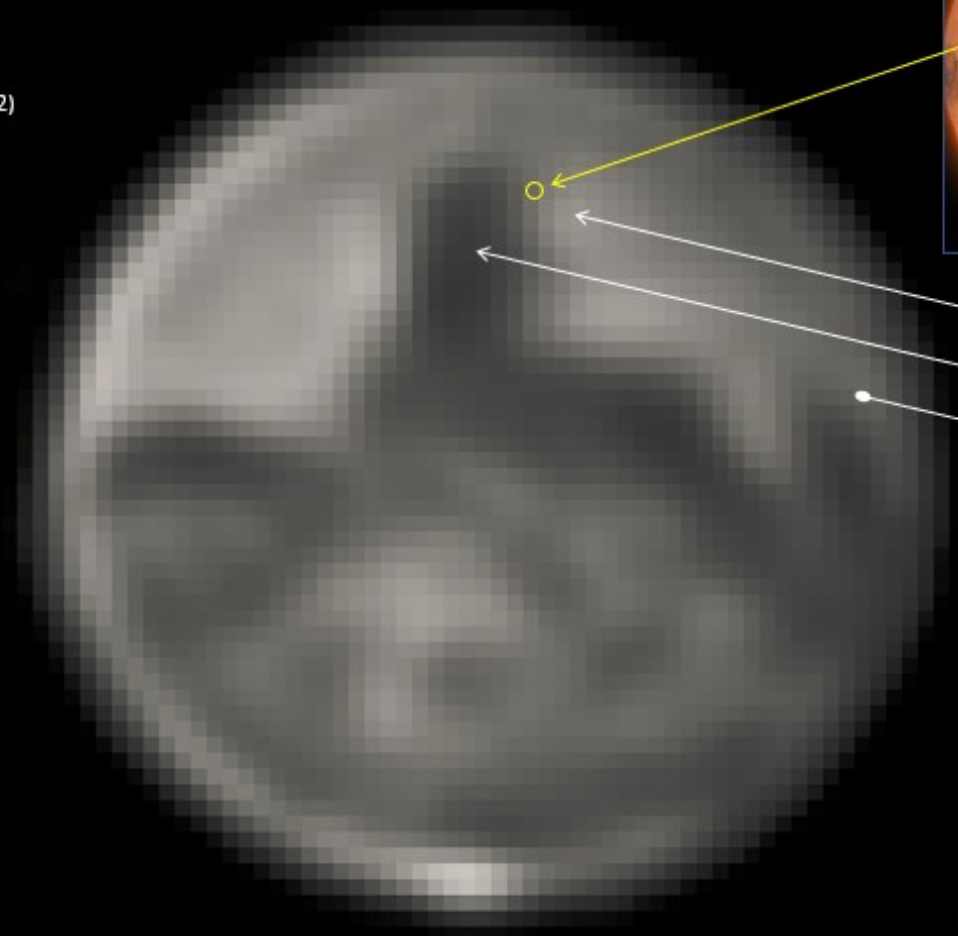
2020-10-11 02:00 AM Local DST (CEST, UT+2)
6°C, 87% Humidity, 4° Dew Point
Thin Cirrus clouds, light wind
Transparency 4/7, Seeing 4-5/10
[opposition at 2020-10-13]

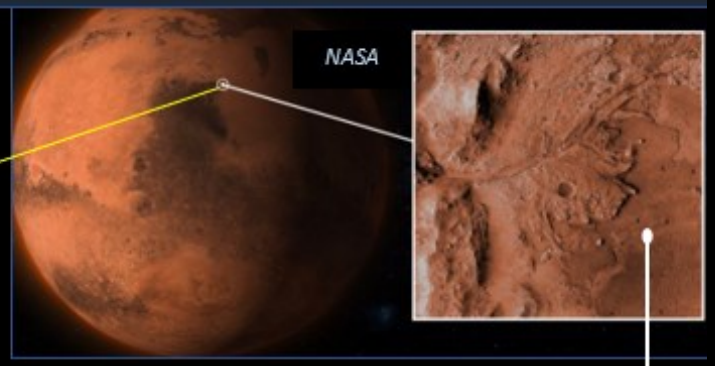
MARS

Hits Observatory, Allan Dystrup
56N 12E, Copenhagen Denmark
2020-10-05, 04:30 Local DST (CEST, UT+2)

Mars Elongation: 168° W,
Altitude 30.6° SW in Pisces
Illum./Phase: 99.4, M_v: -2.5,
Diam.: 22.5", CM: 287.7°

[Opposition @ 2020-10-14
(M_v -2.7, Diam.: 22.3")]





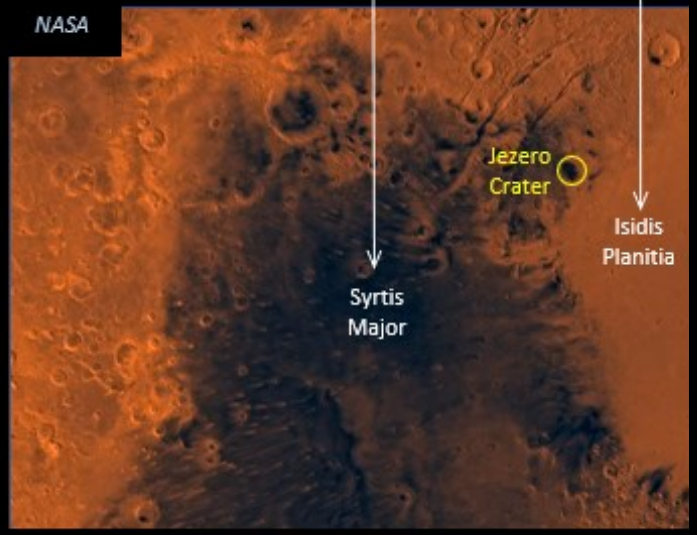
Curiosity
Rover

Syrtis Major
Dark volcanic basalt plain

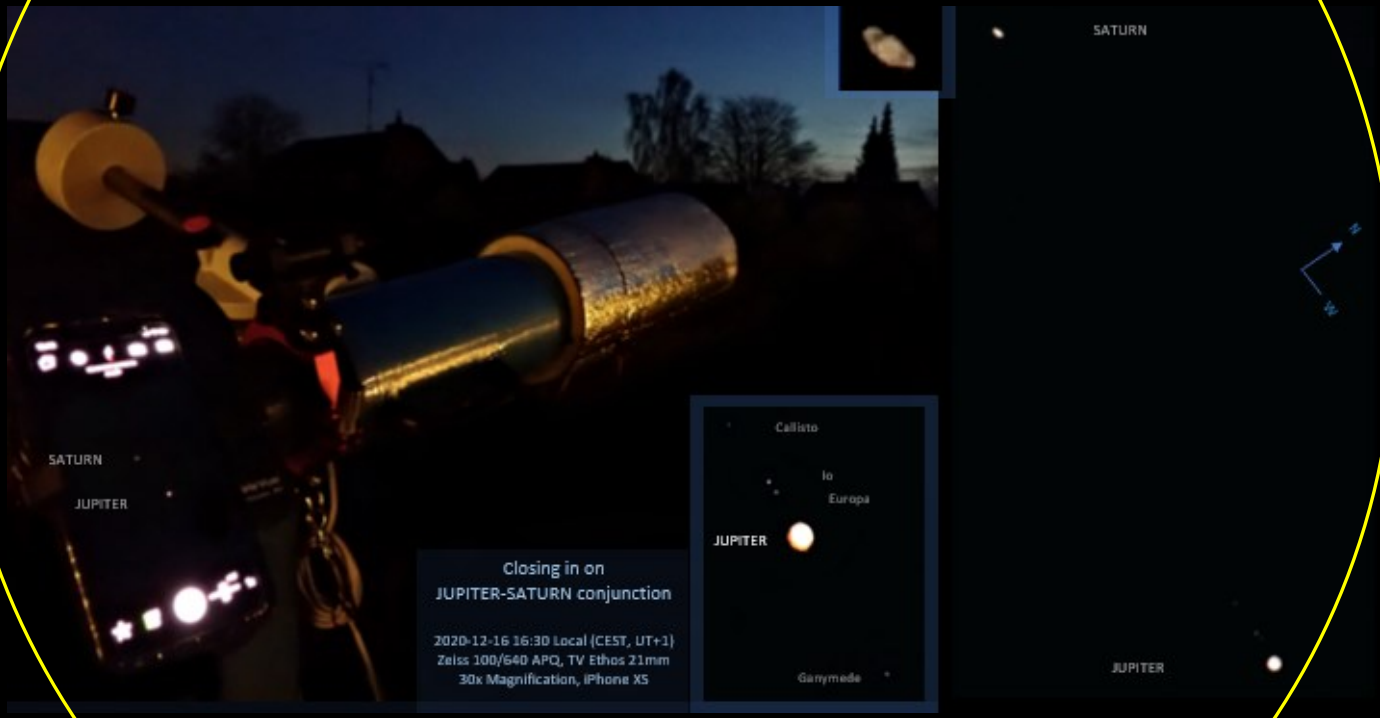
Isidis Planitia
Ancient Crater

ZEISS 100/640 APQ
CM3-U3-13S2M camera

Baader FFC @ 4x Barlow
Exp. 2m45s @ 30 FPS, 300x, 10% AS!3 stack



The inner Gas Giants:

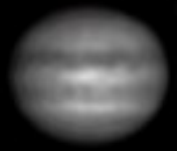


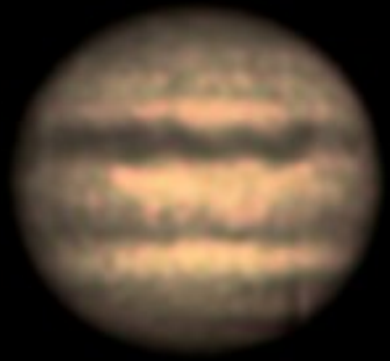
Jupiter & Saturn

THE GAS AND ICE GIANTS
2020

2020 was not a good year to study Jupiter and Saturn. Both planets were low on the night sky, as seen from my 56° northern latitude, and thus the views have been significantly degraded. I did get a couple of good observations though, when the clouds cleared for a few nights in late summer (August-September). The fall season has been horrible for astronomy here in northern Europe, mostly overcast and rain (November-December have seen less sunlight than in the past 60 years...).

JUPITER



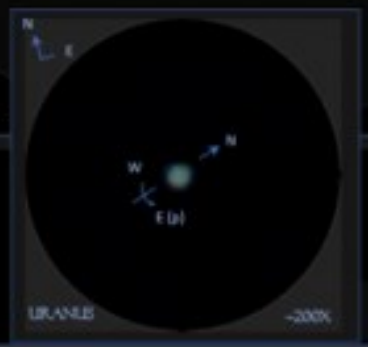


SATURN

URANUS, ~46X

TV 41mm Panoptic
16x @ 4° TFOV
iPhone X
NightCap
Exp. 1s
ISO 5000

Diam 3.7"
m_v: 5.7, SB: 8.3
Alt 42° SE I Aries



URANUS →

FFC @ ~4x Barlow
TV 13mm Ethos
Ca. 200x @ 0.5°
iPhone XS, NightCap
Exp. ¼s @ ISO 100

OUTER GAS GIANTS

SGN 12E Copenhagen, Denmark
2020-09-15 01:30 Local DST (CEST, UT+2)
Transparency 3-4/7 (high haze), Seeing 8/10
Temp 14°C, Humidity 97%, DewPt 14°C

ZEISS 100/640MM APQ

HITS Observatory
Allan Dystrup

NEPTUNE ~46X

TV 41mm Panoptic
16x @ 4°TFOV
iPhone XS
NightCap
Exp. 1s
ISO 2200

Diam 2.4"
m_v: 7.7, SB: 9.3
Alt 27.6° SE I Aquarius

← NEPTUNE

FFC @ ~4x Bar
TV 13mm Et
Ca. 200x @ 0
iPhone XS, NIght
Exp. 1s @ ISO 9

A midnight encounter with the Gas Giants .

It's mid-July, just past midnight (2020-07-22, 00:30 CEST, UT+2), and the two large gas giant planets of our solar system: Jupiter and Saturn, are now seen due south, a good 10° above the horizon. There's a school of *Cumulus Humilis* drifting by from NW, but with some patience I can study the planets in the holes between the clouds.

I have my 4" refractor out in the backyard, and now point my laser first at Jupiter. Already at 16x, the planet is beautifully seen together with its four Galileian moons, just above my neighbor's aerial. Increasing the magnification to 50x, I can glimpse the two dark equatorial belts around the bright equatorial zone, as well as the somewhat darker N and S polar regions. Also, at this magnification, there are clear differences between the Jovian moons, the brightest being the largest (Ganymede) and the faintest the smallest (Europa), while Callisto and Io seem to have around the same intermediate total brightness (which is interesting, because Io is significantly smaller but also has a higher surface brightness due to the sulphurous lava flows from volcanoes erupting in >500 km high plumes).

At ~300x magnification, Jupiter shows some details, notably the north equatorial belt with a barge up into the N tropical zone and two festoons trailing E down into the equatorial zone.

Sweeping E now, I catch Saturn in the 4" refractor. At 16x it is a small but obvious oval with a ball in the center, like a tiny fried egg. At 50x it is rather like Galileo sketched it: a planet with two "ears". At ~300x Saturn shows some shading on the surface (notably the light hued equatorial belt and the darker polar region NEB+NPR), plus a ring with two sections: the outer darker A-ring and the inner bright B-ring. The shadows of the ring on the planet and of the planet on the ring can also be glimpsed.

Granted, the conditions tonight for observing the gas giants are far from optimal (low altitude combined with mediocre transparency and seeing), so though the low magnification observations were actually quite beautiful, the high magnification views were not up to my expectations. I blame this partly on the observing conditions but also on the camera I used for recording the views: The Chameleon machine cam does great on the Sun and Moon, but it seems to reach its limits on the planets. Next time I plan to switch to my ASI120MC for hopefully better results.

Zeiss 4" f/6.4, TV Pan 41mm, 68°FOV,
16x, iPhone Xs afocal

1x, iPhone Xs handheld

Zeiss 4" f/6.4, TV Pan 41mm, 68°FOV,
16x, iPhone Xs afocal

Zeiss 4" f/6.4, FFC @ 4x barlow, TV Pan 41mm,
50x, iPhone Xs afocal

Zeiss 4" f/6.4, FFC @ 4x barlow, TV Pan 41mm,
50x, iPhone Xs afocal

Both planets are seen due south in Sagittarius, Saturn is east (left) of Jupiter and a little higher up. Saturn, being more than double the distance than Jupiter, is seen as smaller and fainter here from Earth.

	Saturn	Jupiter
Altitude	13°2′	11°30′
Vis. Mag	0.3	-2.3
App. Diam.	18.5"	47.6"
Distance	9 AU 1.345 MKm	4.1 AU 620 MKm

Moons		
	C: Callisto	1.6"
	G: Ganymede	1.8"
	I: Io	1.2"
	E: Europa	1.0"

Zeiss 4" f/6.4, FFC @ 4x barlow,
~300x, PGR CM3-U3-13SM2 Cam, Exp: 100ms x 15s, 5% Stack

Zeiss 4" f/6.4, FFC @ 4x barlow,
~300x, PGR CM3-U3-13SM2 Cam, Exp: 100ms x 15s, 5% Stack

Gas Giants 2020-07-22 00:30 Local DST (CEST, UT+2), Transparency varying 2-3/7, Seeing medium 5/10, Astronomical dusk

HITS OBSERVATORY, *ALLAN DYSTRUP*

56N 12E, Copenhagen, Denmark
2020-08-13 01:00 AM Local DST (CEST, UT+2)
Temp.15°C, Hum. 85%, DewPt. 13°C
Calm & clear, Transp. 4/7, Seeing 7-8/10
SQM 20.5 (NELM 6.3)

ZEISS 100/640 APQ

Baader FFC @ 4x Barlow
ZWO ASI120MC camera
Exp. 30s @ 30 FPS, 5% AS!2 stack
Magnification ~300x

SATURN ~300X

Elongation 156°, Altitude 11°, SSW in Sagittarius, Diameter 18.3"

JUPITER ~300X

Elongation 148°, Altitude 8°, SSW in Sagittarius, Diameter 46.3"
(GRS behind horizon)

The Gas Giants.

It has been a week with high pressure summer weather over Scandinavia, calm and clear with day temperatures above 30 °C, -- and a lot of evaporation resulting in notable heat haze down towards the horizon.

I've been out in my backyard in the Nordic twilight around midnight, accompanied by my 4" refractor and 7" Mak to have a look at the two great gas giant planets: Jupiter and Saturn. Though the seeing was above medium, the transparency was down at 3/7 and the NELM only 5-6 (Sub)Urban, so the views were rather soft.

JUPITER ~100X Zeiss 100/640 APQ, Zeiss 2x Barlow, + TV 13mm Ethos, iPhone Xs + NightCap App

Jupiter 2016-03-26

Astronomy Observation Record

Index: PLANET

Subject(s): JUPITER

Date: 26-03-16 Time: 19:00 UT Location: 56 N 12 E, DENMARK

Instrument: VIXEN FL-80S Aperture: 80mm Focal Length: 640 mm

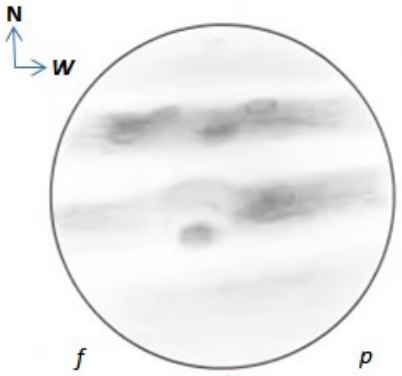
Eyepieces/Magnifications: FFC + 1.7x GPC + CZJ TURRET + O-25 / 160 X

Conditions: No wind, High haze, 2°C, 97% Hum. Seeing: 7/10

Transparency: 3-4/7, SQM 17.7 (NELM 4.9, BORTLE 7 URBAN TR.)

Notes: 36% MOON in VIRGO Below horizon (RISE 19:46 UT)
JUPITER in LEO

EP: Mag:
Filter: FOV:



EP: Mag:
Filter: FOV:

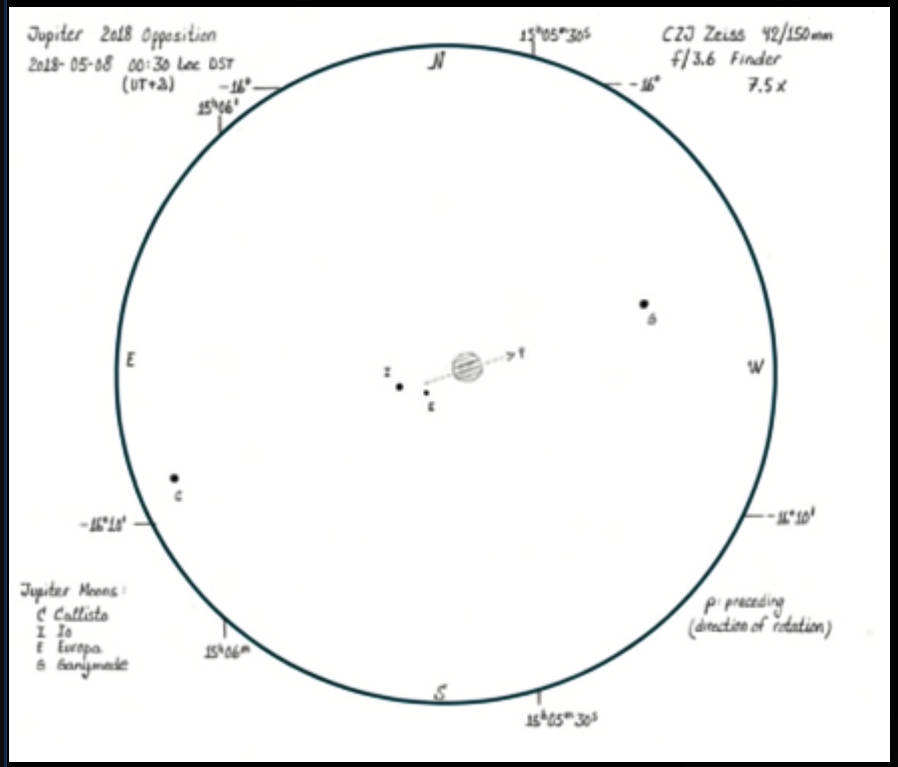
It's an early evening, 20:00 Local Time, March 26. 2016. It's relatively mild, but very humid and with a thin cover of high cirrus.

My goal for tonight was the second Leo Triplet (M95/96/105), but I can't see the galaxies at all in these conditions, so instead i train my small Vixen 80mm refractor on Jupiter.

The seeing is good, but the transparency rather lousy. Having been starved for starry nights for severel weeks, here's never the less my rough sketch of a "soft" Jupiter through high haze.

The NEB and SEB were obvious, as were the polar regions; The GRS was close to transit and showed up as a dark spot with lighter surroundings. The W (preceeding) SEB was noticeably darker than the E, more turbulent band. There were 3 darker regions / festoons visible in the NEB.

The N and S TB were not clearly visible this night. There was hardly any color noticeable (but hey!, the FL-80S is an APO, right?...)



Jupiter at the 2018 opposition
(2018-05-08, 00:30 Loc DST, UT+2).

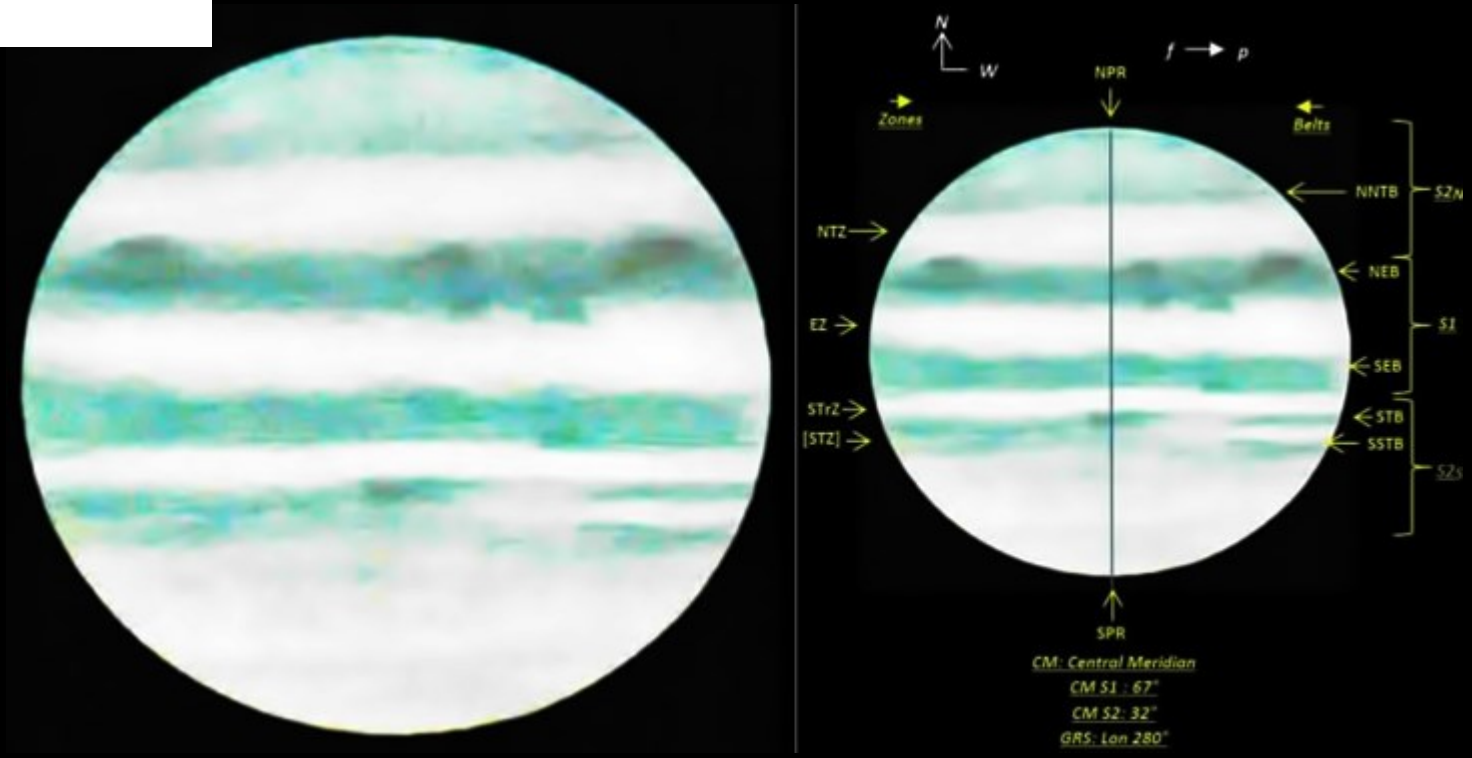
Setup: CZJ Zeiss 100mm refractor with Baader FFC, Zeiss diagonal, Zeiss Mark V bino plus 2x Zeiss 25mm OPMI Eyepieces. Magnification ~150x. Jupiter was at a low altitude (~17° in Libra), so the observing conditions were significantly impacted by atmospheric dust and dispersion (Trsp.~ 4/7, Seeing ~7-8/10). Furthermore, at 56°N 12°E in Denmark we are currently in astronomical dusk (the border between astronomical twilight and night) even at solar midnight, so I'm observing from a bright suburban sky (Bortle 6).

Never the less, I was able to record some details, as shown in my drawing below (annotated to the right). The upwelling white ammonia crystal clouds in the equatorial, northern temperate and southern tropical zones were evident; especially the STrZ band was bright white. Also, the southern temperate zone was visible in the SW quadrant of the planet.

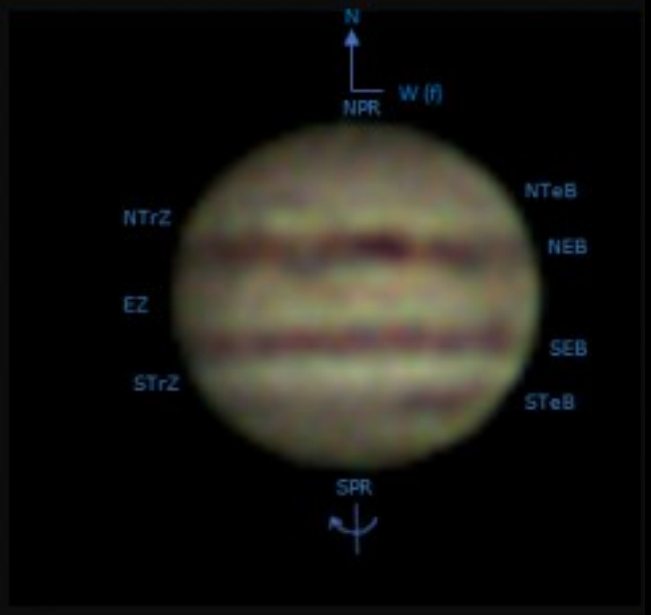
Several bands of cool, downwelling dark brown hydrosulfide ice clouds were visible, notably the northern and southern equatorial belts, but also the north-north temperate and the south and south-south temperate belts were clearly delineating the northern pole region resp. the southern pole region.

The System-1 central meridian was at 68°, while the great red spot (GRS anticyclone) was at 280° longitude, i.e. at the backside of the planet. There were however three dark barge cyclones visible in the NEB, with two broad plumes trailing SE into the EZ. The pole regions didn't show much detail, though the SPR did at times have a mottled appearance, which may have been caused by small white spot cyclones in the STB (?).

After primarily deep sky projects the past months, I hope to be able to do some planet observation this early summer (Jupiter, Saturn, Mars), using my small classic refractors. Here's my latest observation of Jupiter at the 2018 opposition



Jupiter Moons, 2019



Zeiss APQ 100/640
TV Panoptic 41mm, 16x @ 4° field
iPhone XS, NightCap 9.7
Afocal snapshot: 1/3 sec @ ISO 32

Zeiss APQ 100/640
Zeiss 2x Barlow, ~100x @ 1° field
ZWO ASI120MC, SharpCap 3.2
15 Sec @ 30 FPS, 8% AS!3 stack

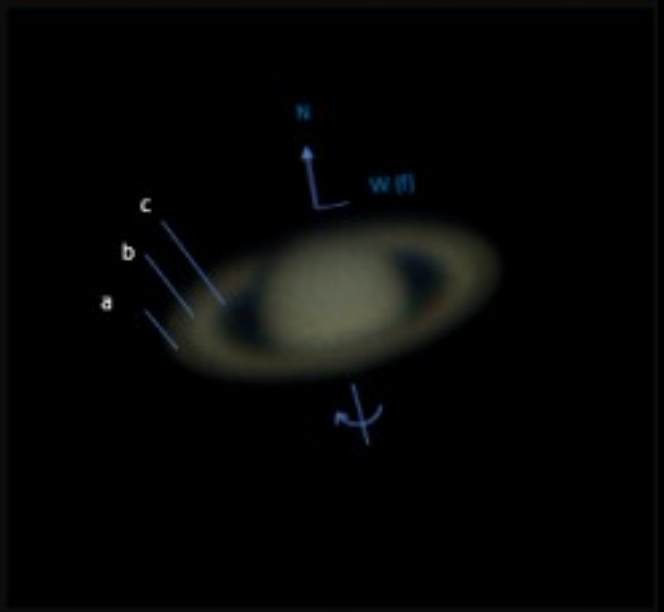
Zeiss APQ 100/640
Baader FFC Barlow @ ~4x, ~200x @ 1/2° field
ZWO ASI120MC, SharpCap 3.2
2 sec @ 30 FPS, 10% AS!3 Stack

The Gas Giants --Early September 2020

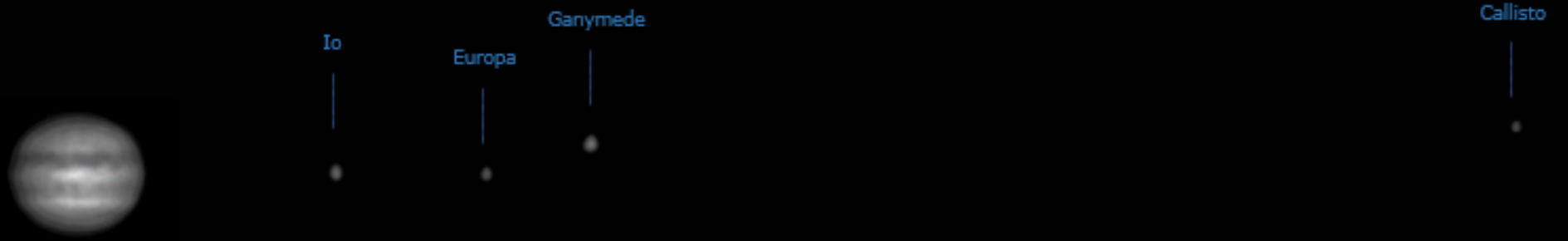
Here's another look at Jupiter & Saturn through my 4" refractor; I studied the planets at a low ~11° altitude, in nautical dusk and through atmospheric haze with an unsteady seeing. And yet, always something to see...

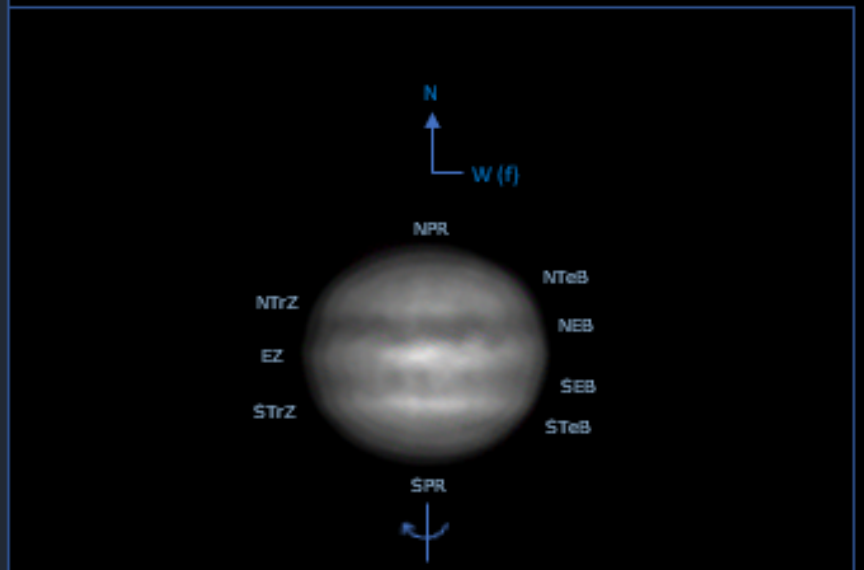
56N 12 E Copenhagen, Denmark
2020-09-08 20:30 local DST, CEST UT+2
Low altitude, <medium transparence & seeing

	Jupiter	Saturn
Altitude S in SGR:	11° 04'	11° 20'
Diameter:	43.37"	17.8"



JUPITER @ ~ 400X





Alt. 9.8° SSE in Sgr
Brightness -2.7m,
Diam 46", Elong. 145°

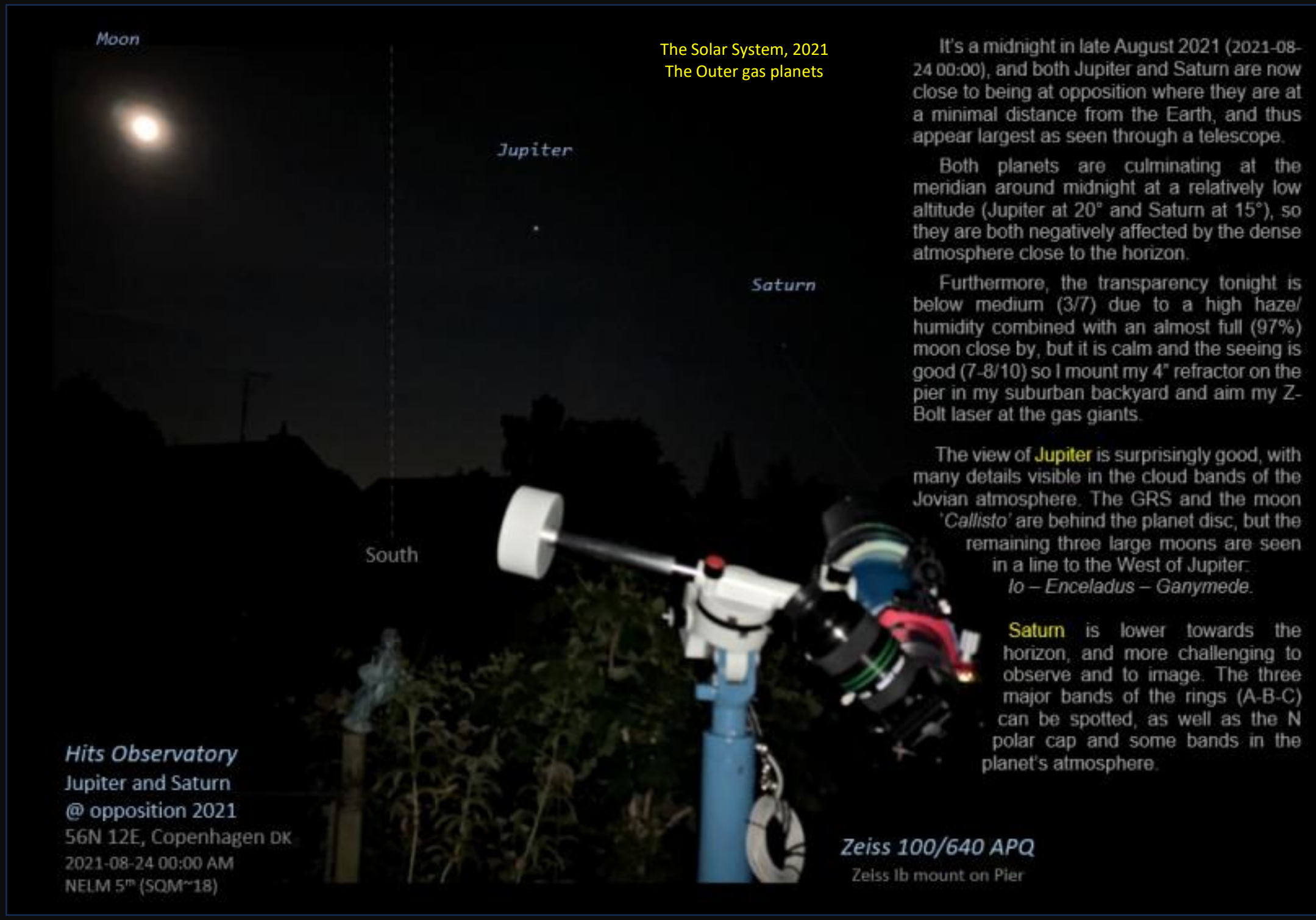
HITS OBSERVATORY, *ALLAN DYSTRUP*

56N 12E, Copenhagen, Denmark
2020-08-15 21:30 AM Local DST (CEST, UT+2)
Civil / Nautical Twilight

Temp.20°C, Hum. 75%, DewPt. 15°C
Calm & clear, Transp. 3/7, Seeing 6-7/10
SQM 17.6 (NELM 4.8), B7 (Sub)Urban sky

ZEISS 180 / 1800 MENISCAS

Zeiss 2x Barlow
CM3-U3-13S2M camera, SharpCap capture
Exp. 15s @ 30 FPS, 8% AS!2 stack
Magnification ~400x



The Solar System, 2021
The Outer gas planets

It's a midnight in late August 2021 (2021-08-24 00:00), and both Jupiter and Saturn are now close to being at opposition where they are at a minimal distance from the Earth, and thus appear largest as seen through a telescope.

Both planets are culminating at the meridian around midnight at a relatively low altitude (Jupiter at 20° and Saturn at 15°), so they are both negatively affected by the dense atmosphere close to the horizon.

Furthermore, the transparency tonight is below medium (3/7) due to a high haze/ humidity combined with an almost full (97%) moon close by, but it is calm and the seeing is good (7-8/10) so I mount my 4" refractor on the pier in my suburban backyard and aim my Z-Bolt laser at the gas giants.

The view of Jupiter is surprisingly good, with many details visible in the cloud bands of the Jovian atmosphere. The GRS and the moon '*Callisto*' are behind the planet disc, but the remaining three large moons are seen in a line to the West of Jupiter: *Io – Enceladus – Ganymede*.

Saturn is lower towards the horizon, and more challenging to observe and to image. The three major bands of the rings (A-B-C) can be spotted, as well as the N polar cap and some bands in the planet's atmosphere.


Hits Observatory
Jupiter at opposition 2021
56N 12E, Copenhagen DENMARK
2021-08-24 00:15 AM
Allan Dystrup
Jupiter
Io
Enceladus
Ganymede
Zeiss 100/640 APQ
Zeiss 2x Barlow
IMX183MM camera, ROI 1600x1200
Exposure: 60s @ 30 fps, 25% AS!3 Stack

Hits Observatory

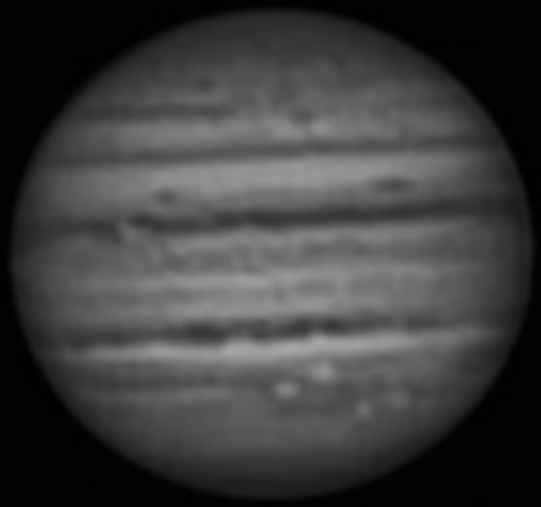
Jupiter at opposition 2021

56N 12E, Copenhagen DENMARK

2021-08-24 00:30 AM

Allan Dystrup

Jupiter



Io

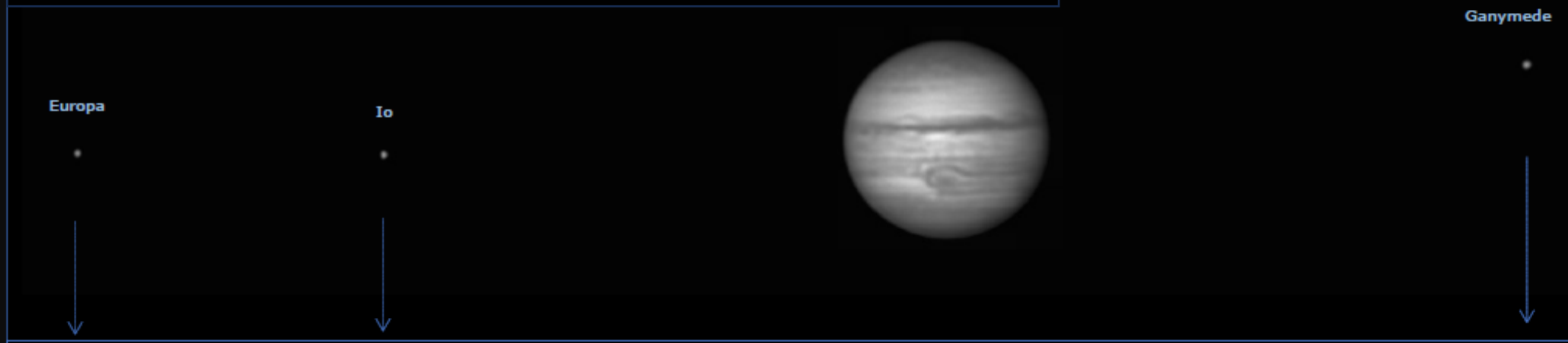
Zeiss 100/640 APQ

Zeiss 2x Barlow

IMX183MM camera, ROI **800x600**

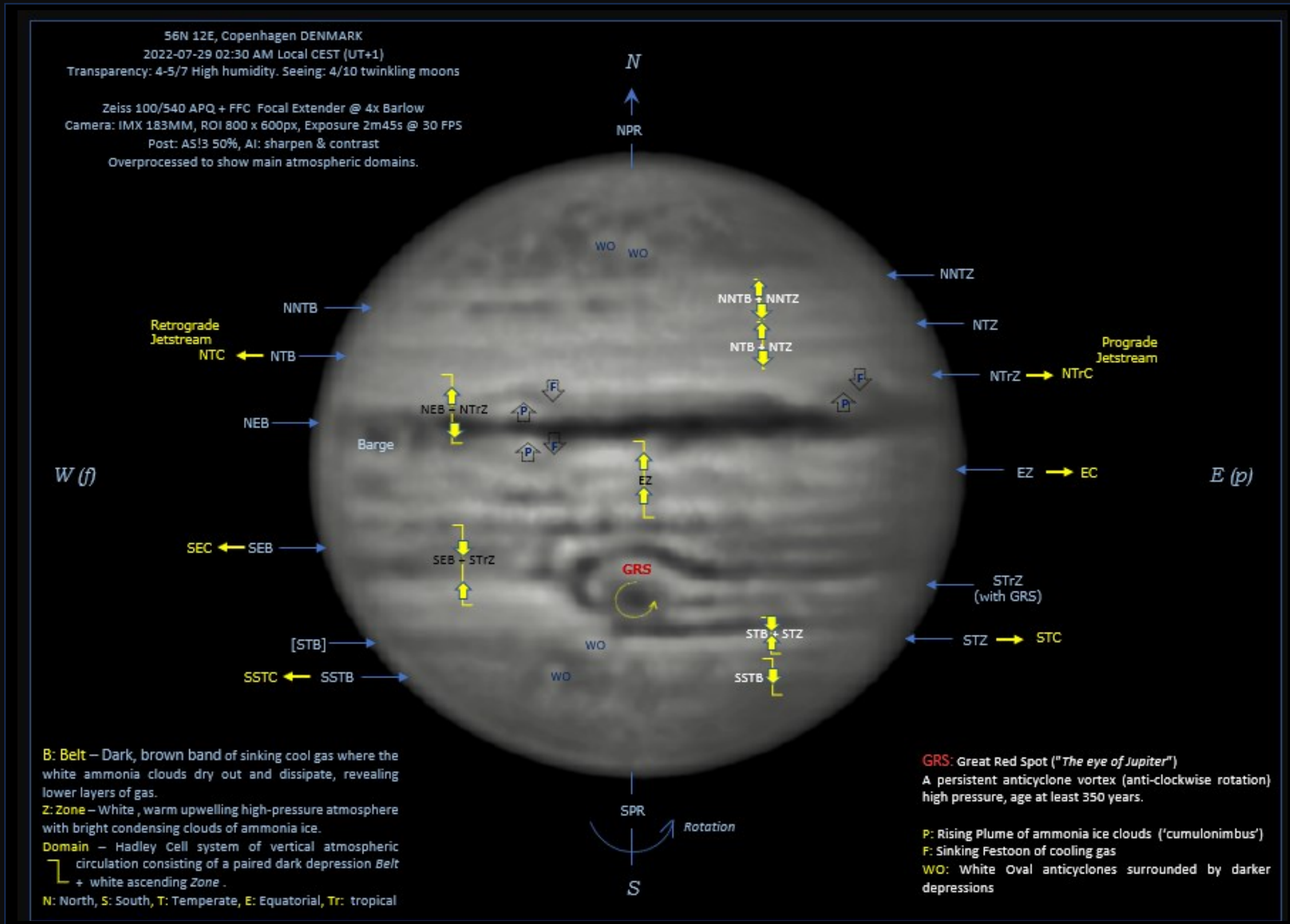
Exposure: 60s @ 30 fps, 25% AS!3 Stack

Zoom in on Jupiter, 2022



56N 12E, Copenhagen DENMARK
2022-07-29 02:30 AM Local CEST (UT+1)
Transparency: 4-5/7 High humidity. Seeing: 4/10 twinkling moons

Zeiss 100/540 APQ + Zeiss 2x Focal Extender (Barlow)
Camera: IMX 183MM, ROI 2744 x 1836px, Exposure 2m45s @ 30 FPS
Post: AS!3 50%, AI: sharpen & contrast



B: Belt – Dark, brown band of sinking cool gas where the white ammonia clouds dry out and dissipate, revealing lower layers of gas.
Z: Zone – White , warm upwelling high-pressure atmosphere with bright condensing clouds of ammonia ice.
Domain – Hadley Cell system of vertical atmospheric circulation consisting of a paired dark depression *Belt* + white ascending *Zone* .
N: North, S: South, T: Temperate, E: Equatorial, Tr: tropical

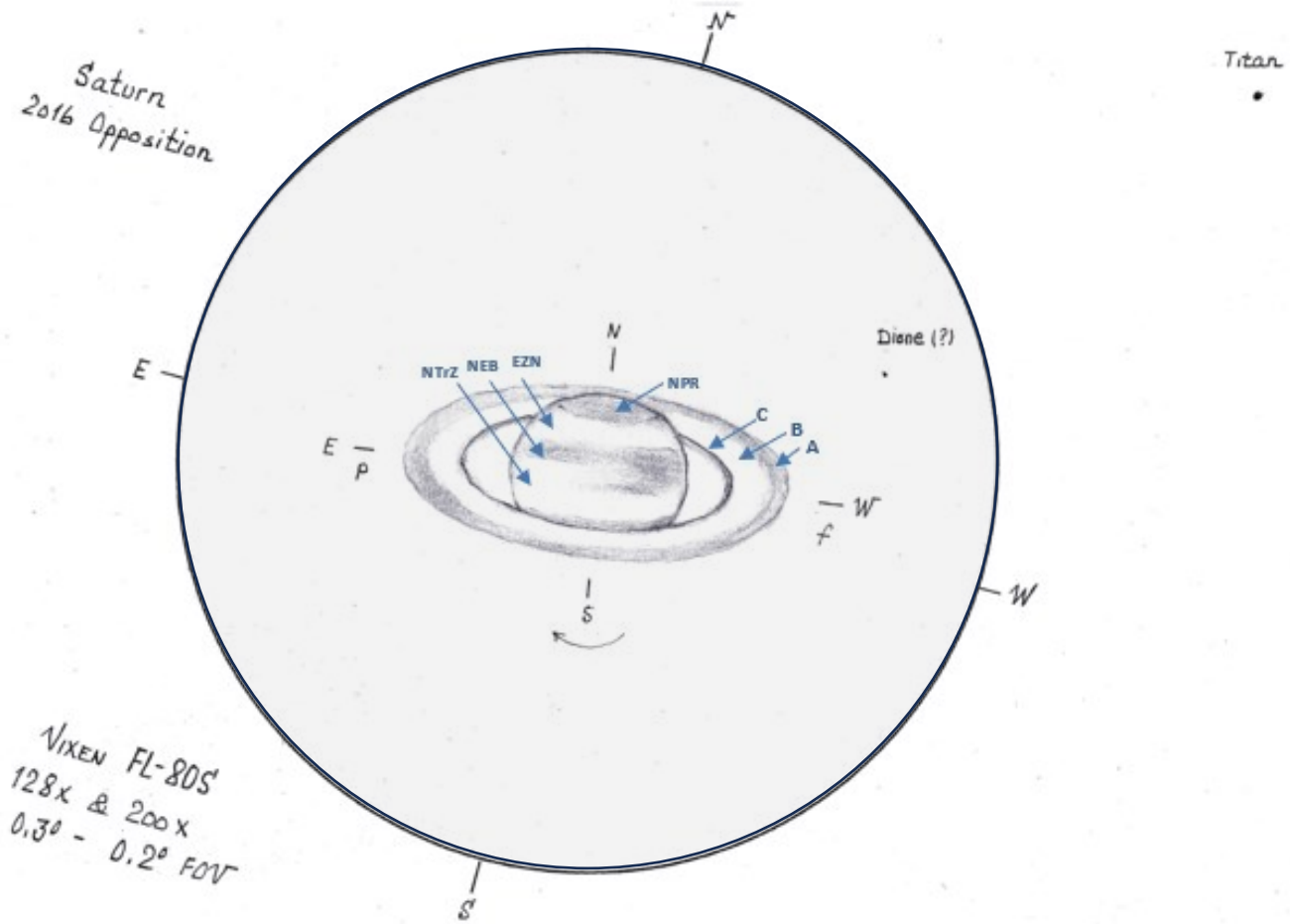
GRS: Great Red Spot ("*The eye of Jupiter*")
A persistent anticyclone vortex (anti-clockwise rotation) high pressure, age at least 350 years.

P: Rising Plume of ammonia ice clouds ('cumulonimbus')
F: Sinking Festoon of cooling gas
WO: White Oval anticyclones surrounded by darker depressions

Observation Record

Index: SATURN 2016 OPPOSITION

Feature(s): Saturn at opposition 2016	Date: 2016-06-04	Time: 22 30 UT	Location: 56N 12E, DENMARK
Conditions: Trsp. 5/7	Seeing: 6/10	Instrument: VIXEN FL-80S	
Aperture: 80mm / 640	Focal Length: 3.5x FFC ~ 2240 mm	EP/Filter/Mags: + 1.7x GPC / O-16mm CZJ / 200x	
Notes: Calm, warm (13°C), medium Trsp & Seeing, Nautical twilight SQM 17,3, NELM 4.7			
Saturn in S. Ophichius, 13° ALT, 26° ring tilt			



Saturn @ 2016
opposition

It's an hour past midnight local time, and Saturn is at 13° altitude in southern *Ophiuchus*, 1 day after the 2016 opposition (on June 03.). The early morning is clear and balmy (13°C), typical for our temperate, high pressure summer weather. Both seeing and transparency are around medium, which -- combined with the northern nautical twilight and my suburban observation site (SQM 17,3 / NELM 4.7) -- results in somewhat soft images in my small 80mm Vixen FL-80S refractor.

I have both my Baader FFC @ 3.5x plus a 1.7x GPX in front of my CZJ Zeiss Amici turret, and I now click up the magnification from 80x (ATC K-40) to 128x (CZJ O-25) and finally 200x (CZJ O-16). The last one is overkill for the current observation conditions, -- it does not add any details - , but I like the larger image frame, so I stay at that magnification for my drawing.

The Saturn globe is seen as a mottled ball, where NPR and NEB can be glimpsed as darker areas, while EZN and NTrZ are seen as lighter bands across the marble. The dark outer A-ring and bright inner B-ring are both beautifully outlined, although I cannot clearly identify the dark Cassini division between them. The innermost C (Crepe) ring can be discerned in glimpses out in the ansae, along the inner line of the B ring.

Saturn's largest moon Titan (8.5m) is easily seen, and I suspect I can also spot Dione (10.6m), -- both moons visible to the W of the planet.

SATURN @ 171 X

Star

Star

HITS Observatory, *Allan Dystrup*
56N 12E Copenhagen suburb, Denmark
2020-08-14 23:00 Local DST (CEST+2)
Calm & clear, slight haze @ horizon
Trsp. 4/7, Seeing 8/10, LP ~6 NELM

Zeiss 180/1800 Meniscas
Zeiss 2x Barlow, TV 21mm Ethos
171x Magnification
iPhone XS w. NightCap App, Snapshot

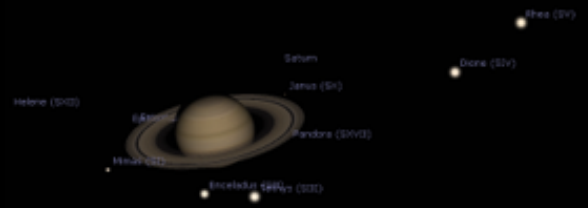
SATURN:
Alt. 13° in Sgr
Elong. 154°
Diam. 18.3"

MOONS:
Titan
Rhea
Dione
Enceladus (not seen)

2020

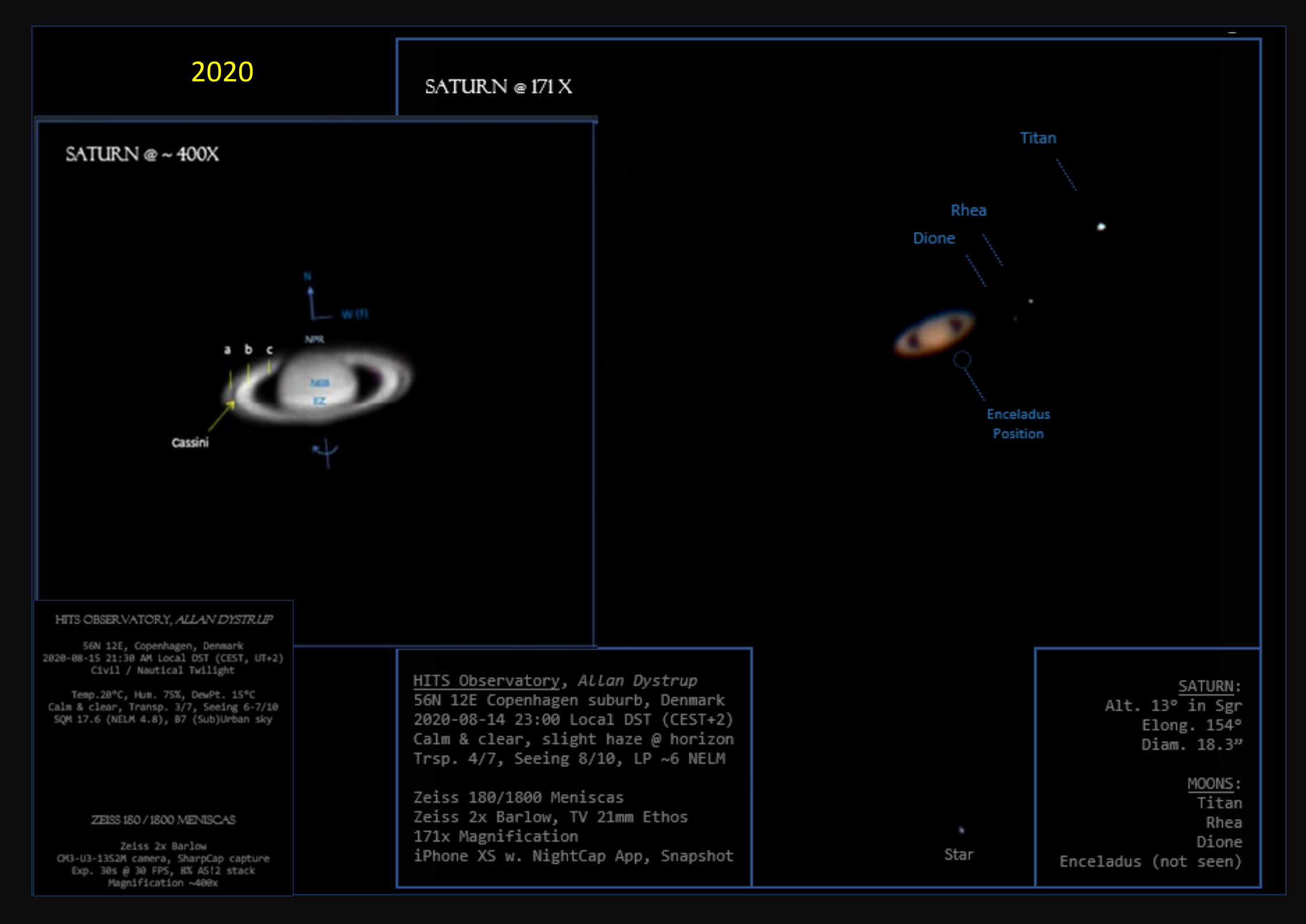
I was out tonight, close to midnight (2020-08-14,~ 23:30), for a quick look at the largest of Saturn's 82 moons: Titan (5.000 km Ø), Rhea (1.500 Km Ø) and Dione (1.100 km Ø).

I should have also looked for *Iapetus* (1.500 km Ø), but as its orbit takes it further out from Saturn, it was not in my immediate FOV centered on Saturn; In contrast, the interesting but quite small *Enceladus* (500 km Ø) is in orbit quite close to Saturn, but this caused it to be difficult to spot due to the bright light from Saturn's surface and rings.



2020

SATURN @ 171 X



SATURN @ ~ 400X

HITS OBSERVATORY, *ALLAN DYSTRUP*

56N 12E, Copenhagen, Denmark
2020-08-15 21:30 AM Local DST (CEST, UT+2)
Civil / Nautical Twilight

Temp.20°C, Hum. 75%, DewPt. 15°C
Calm & clear, Transp. 3/7, Seeing 6-7/10
SQM 17.6 (NELM 4.8), B7 (Sub)Urban sky

ZEISS 180 / 1800 MENISCAS

Zeiss 2x Barlow
CM3-U3-13S2M camera, SharpCap capture
Exp. 30s @ 30 FPS, 8% AS!2 stack
Magnification ~400x

HITS Observatory, *Allan Dystrup*
56N 12E Copenhagen suburb, Denmark
2020-08-14 23:00 Local DST (CEST+2)
Calm & clear, slight haze @ horizon
Trsp. 4/7, Seeing 8/10, LP ~6 NELM

Zeiss 180/1800 Meniscas
Zeiss 2x Barlow, TV 21mm Ethos
171x Magnification
iPhone XS w. NightCap App, Snapshot

SATURN:
Alt. 13° in Sgr
Elong. 154°
Diam. 18.3"

MOONS:
Titan
Rhea
Dione
Enceladus (not seen)

Opposition 2020

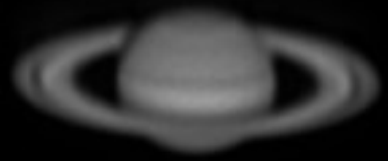
Hits Observatory

Saturn at opposition 2021

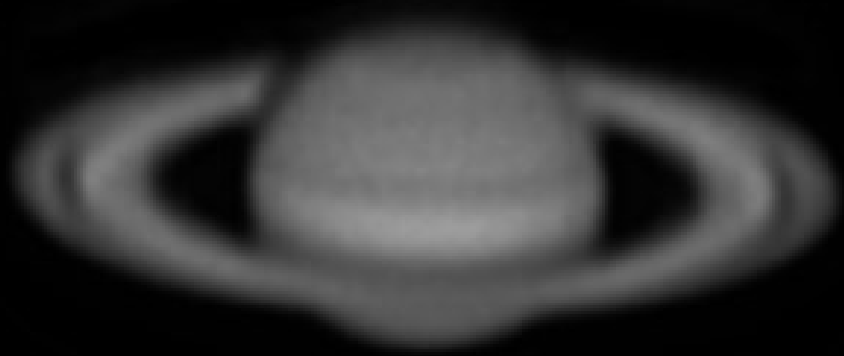
56N 12E, Copenhagen DENMARK

2021-08-24 00:45 AM

Allan Dystrup



Zoom-In



Zeiss 100/640 APQ

Zeiss 2x Barlow

IMX183MM camera, ROI 800x600

Exposure: 30s @ 30 fps, 25% AS!3 Stack

It's a couple of hours past midnight, 3 nights before the opposition of Saturn (scheduled at August 14. 2022 ~1700 UTC); Saturn is currently in the NE 'corner' of *Capricorn*, close to the tip of the horn (δ Cap ~ *Deneb Algedi*), while a 98% full moon is sinking towards the SW horizon, close by in SW Capricorn.

As with all summer oppositions, Saturn is rather low (currently @ 18.5° Alt.) towards our S horizon as observed here from 56° N Latitude in Scandinavia, and with some atmospheric turbulence combined with a good amount of light pollution as is present tonight, the observing conditions are far from perfect .

Never the less, I have my 4" f/6.4 refractor out in my suburban backyard, and starting with a 2x barlow plus a red longpass filter, I'm ready to aim at Saturn. At medium magnifications I can easily see the bright main Equatorial Zone (EZn) surrounded by the darker EB and NEBs Belts. Also, the A- and B- rings separated by the Cassini Division is obvious, as are the 4 brightest Saturnian Moons: Titan, Rhea, Tethys and Dione; Enceladus was also faintly glimpsed, just below the W 'ear' of the rings (but I didn't catch it in my photo).

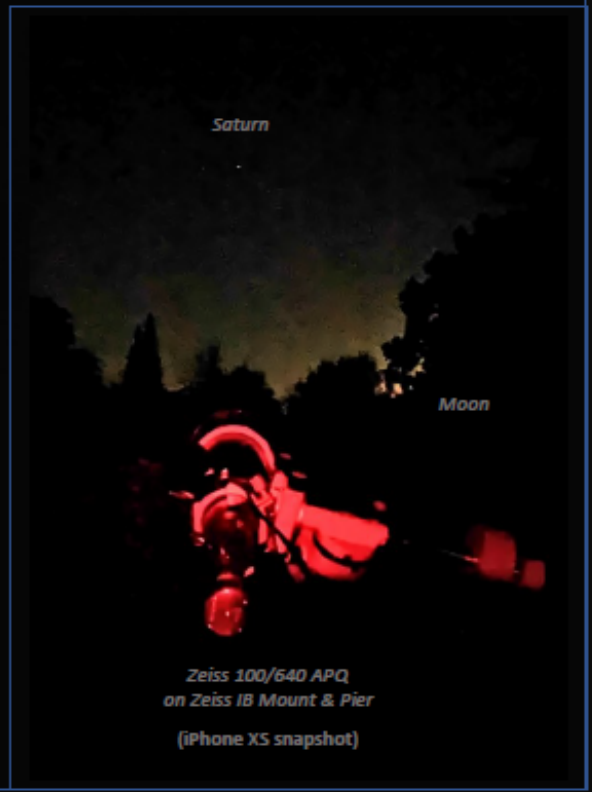
SATURN

Opposition 2022

56N 12E, Copenhagen DENMARK
2022-08-11, 02:30 AM local (CEST, UT+1)

Transp.: 4/7 slight haze, Seeing: 4/10
Temp.: 13°C, Humidity 93%, DewPt.: 11°C
Moon: 98% illum., low @ 6° Alt. SW in SW Capricorn
Saturn @ 18.5° Alt towards the S in NE Capricorn
SQM 20.3 (NELM 6.2), Bortle 5 Suburban Sky

Zeiss 100/640 APQ on Zeiss Ib mount & Pier
Barlow: Zeiss 2x; Filter: 610nm red longpass
Camera IMX183MM, ROI 800 x 600px
Exp.: 60s @ 30 FPS, AS!3 stack 50%
AI: tone and contrast adjustment.



Zeiss 100/640 APQ
on Zeiss IB Mount & Pier

(iPhone XS snapshot)

SATURN

Details

56N 12E, Copenhagen DENMARK
2022-08-11, 03:00 AM local (CEST, UT+1)

Transp.: 4/7 slight haze, Seeing: 4/10
Temp.: 13°C, Humidity 93%, DewPt.: 11°C
Moon: 98% illum., low @ 6° Alt. SW in SW Capricorn
Saturn @ 18.5° Alt towards the S in NE Capricorn
SQM 20.3 (NELM 6.2), Bortle 5 Suburban Sky

Zeiss 100/640 APQ on Zeiss Ib mount & Pier
Barlow: Baader FFC @ 4x; Filter: 610nm red longpass
Camera IMX183MM, ROI 800 x 600px
Exp.: 60s @ 30 FPS, AS!3 stack 50%
AI: tone and contrast adjustment.

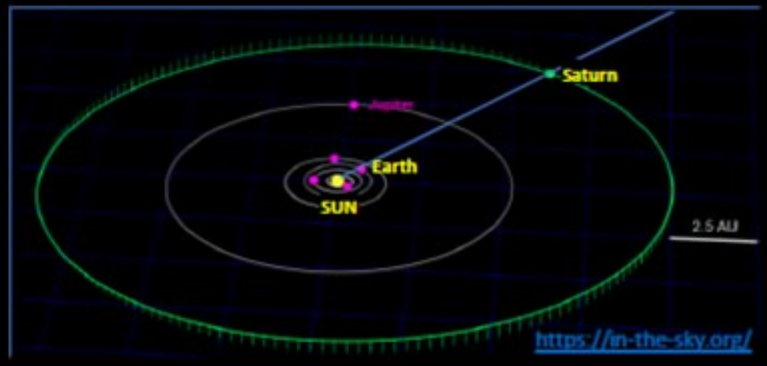
N: North; n: northern part
S: South; s: southern part
P: Polar
Te: Temperate
Tr: Tropical
E: Equatorial

C: Cap
R: Region
B: Belt
Z: Zone

Saturn, 3 days before opposition (@ 14. August) in 2022.

The Saturn upper atmosphere is seen as a veil of haze composed of tiny ammonia crystals, while the lower atmosphere shows belts of ammonium hydrosulphide and water. The atmospheric circulation is driven by strong prograde (east-ward) jetstreams, sculpting the Hadley-Cell domains of upwelling lighter-hued Zones and sinking cooler and darker Belts.

The rings are tilted ~14° towards Earth, showing the outer A-part, the Cassini Division and the 3 parts of the middle B-ring; The faint inner C ("crepe") ring was not clearly seen in this observation, and neither was Encke's Division in the A ring.



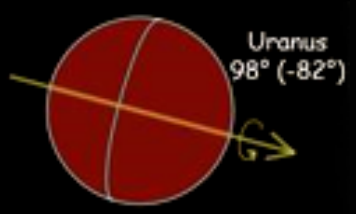
The outer Gas Giants:

Uranus
&
Neptune

The distance to from the Sun to Earth is one Astronomical Unit (1 AU), and the distances to the neighboring rocky planets are: Venus 0.7 AU and Mars 1.5 AU, to the inner gas giants: Jupiter 5 AU and Saturn 9.5AU, while the outer gas giants are located at: Uranus 19 AU and Neptune 30 AU. If you have ever walked a planet model made to scale, you will know that Uranus and Neptune are really, REALLY far out compared to the other planets in our solar system.

This of course reflects (and refracts) in our views of these planets, which at low magnification looks just like stars, although a tiny bit softer and less affected by atmospheric turbulence. At higher magnification, Uranus is seen as an obvious small (3.7") blueish disk, while Neptune is an even smaller (2.4") point, still recognizable as a disk with a fainter grey-blueish hue. Both planets have a gas atmosphere of molecular hydrogen and atomic helium over a deep icy ocean composed of water, methane and ammonia, that covers a small solid ice and rock core. Traces of methane in the atmosphere are responsible for the blueish tint of these planets.

The axial tilt of Neptune at 28½° is almost the same as that of the Earth, while the rotational axis of Uranus is tilted 98° in relation to its orbit around the sun (probably caused by to collisions with other planetesimals in the early solar system). Uranus is thus, so to speak, "lying down and rolling along" in its orbit, with each pole experiencing a 42 Earth-year long day followed by a 42 Earth-year night. It takes Uranus a human lifetime to complete one orbit around the sun (84 Earth years), while Neptune takes double as long (165 Earth years), so no human will ever survive one year on Neptune...



OUTER GAS GIANTS

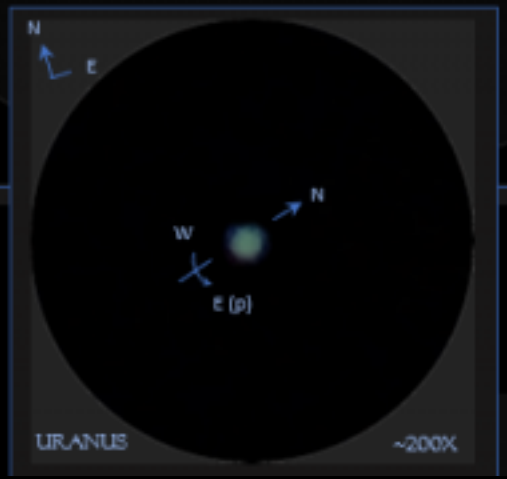
56N 12E Copenhagen, Denmark
2020-09-15 01:30 Local DST (CEST, UT+2)
Transparency 3-4/7 (high haze), Seeing 8/10
Temp 14°C, Humidity 97%, DewPt 14°C

ZEISS 100 / 640MM APQ

URANUS, ~16X

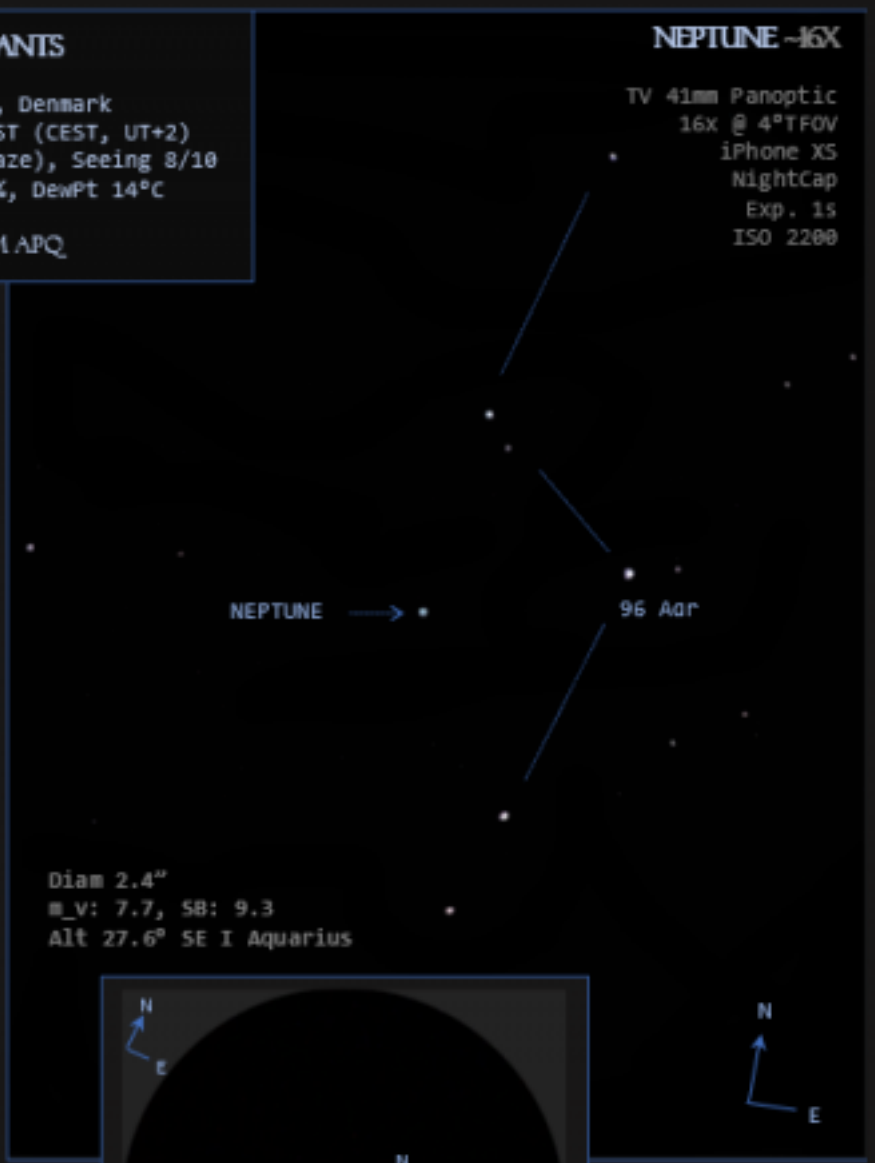
TV 41mm Panoptic
16x @ 4° TFOV
iPhone X
NightCap
Exp. 1s
ISO 5000

Diam 3.7"
m_v: 5.7, SB: 8.3
Alt 42° SE I Aries

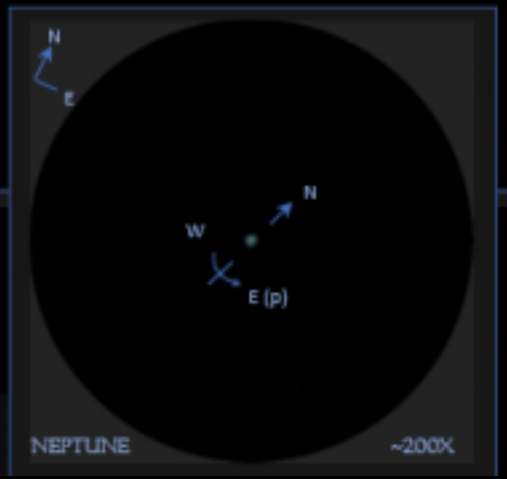


NEPTUNE ~16X

TV 41mm Panoptic
16x @ 4°TFOV
iPhone XS
NightCap
Exp. 1s
ISO 2200



Diam 2.4"
m_v: 7.7, SB: 9.3
Alt 27.6° SE I Aquarius



URANUS →

FFC @ ~4x Barlow
TV 13mm Ethos
Ca. 200x @ 0.5°
iPhone XS, NightCap
Exp. ⅛s @ ISO 100

← NEPTUNE

FFC @ ~4x Barlow
TV 13mm Ethos
Ca. 200x @ 0.5°
iPhone XS, NightCap
Exp. 1s @ ISO 9000

HITS Observatory
Allan Dystrup