

***Juno-missie***



***bij Jupiter***

*115mm F/7 APO*

*Jupiter waarnemen*



*Jupiter waarnemen*





*Jupiter waarnemen*



*Jupiter waarnemen*



# Jupiter

The background of the slide features a large, detailed image of the planet Jupiter, showing its characteristic orange, red, and white bands. Several of its moons are visible in the dark space around it, appearing as smaller, textured spheres.

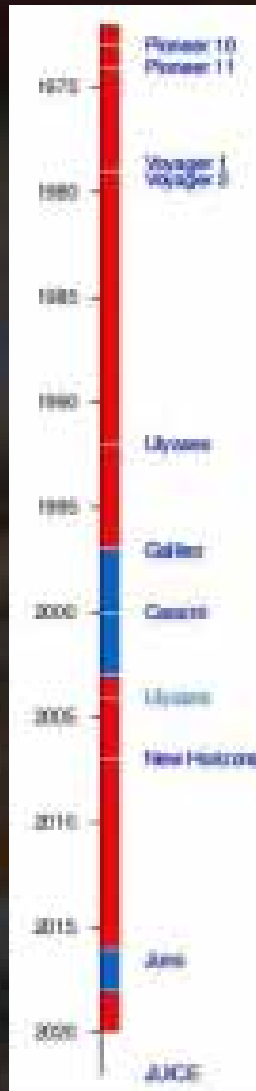
- Diameter 142.984 km
- Afstand tot de Zon 778 miljoen km
- Omlooptijd om Zon 11 jaar en 10 maanden
- Rotatie 9 uur en 55 minuten
- Temperatuur  $-125^{\circ}\text{C}$
- Manen 79

# *Bezoek van Aarde*





# Bezoek van Aarde



*Bezoek van Aarde*



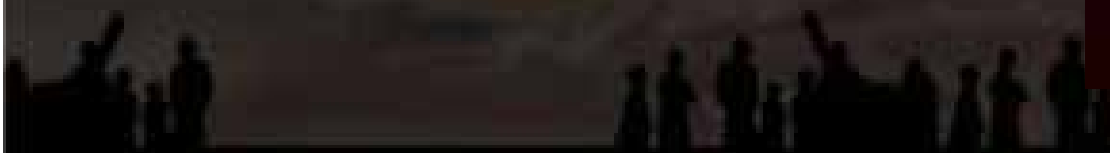


**7 dec 1995**  
150km afdaling  
2.575 km/u  
57.6 min tot max. 153°C

*Bezoek van Aarde*



*Bezoek van Aarde*



*Bezoek van Aarde*



**Juno**



## Bezoek van Aarde



Earth fly-by op 559 km

126.000 → 150.000 km/u

door aantrekking Jupiter  
verder versneld naar  
210.000 km/u

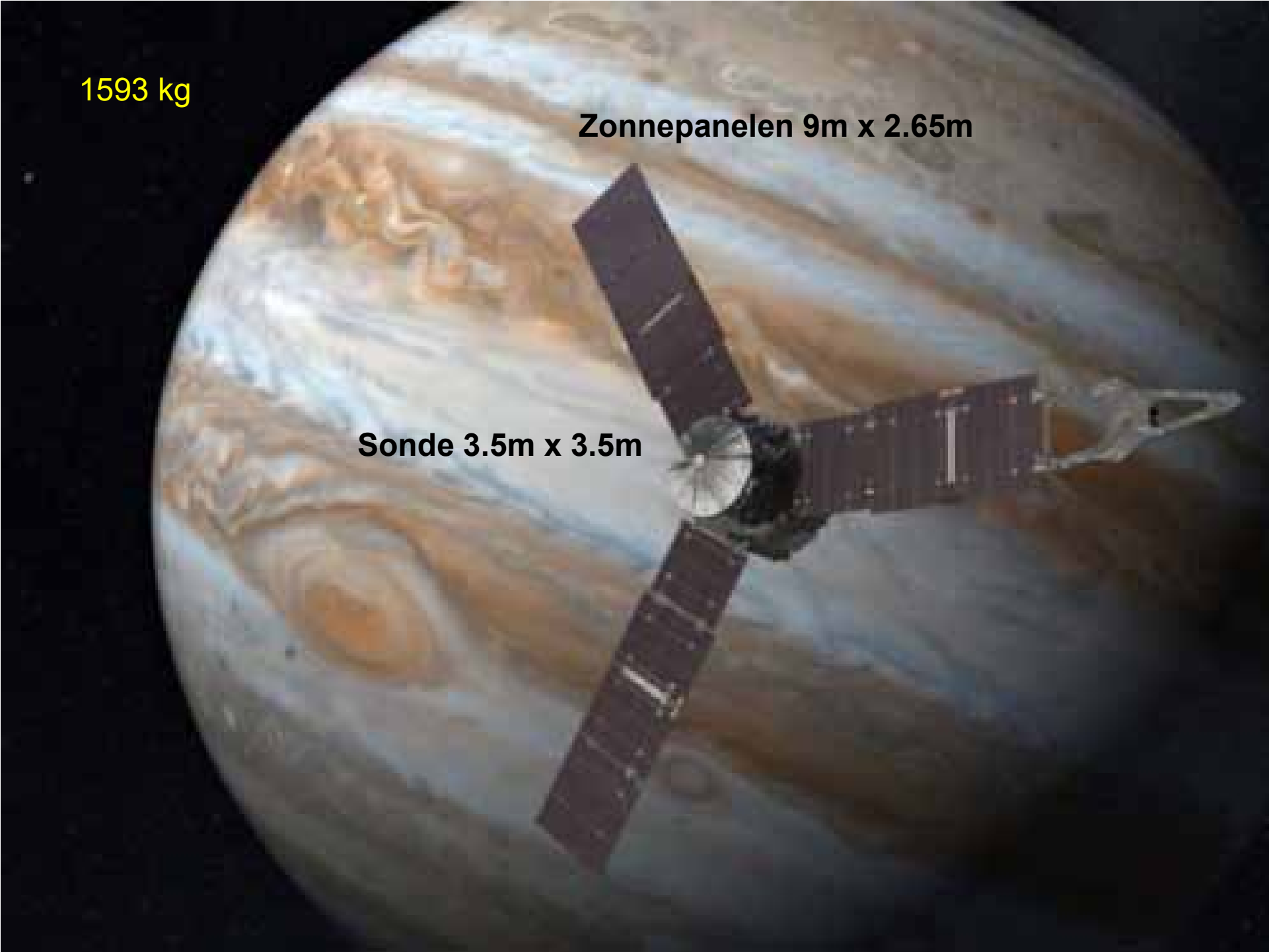




1593 kg

Zonnepanelen 9m x 2.65m

Sonde 3.5m x 3.5m



ca. 14 kW bij Aarde,  
maar slechts 486 W  
bij Jupiter





# Juno Instrumentarium

- JNC Juno Cam (max 7 banen?)
- MWR Microwave Radiometer
- JIRAM Jovian Infrared Auroral Mapper
- MAG Magnetometer
- GS Gravity Science
- JADE Jovian Auroral Distribution Experiment
- JEDI Jovian Energetic Particle Detector Instrument
- Waves Radio and Plasma Wave Sensor
- UVS Ultraviolet Imaging Spectrograph

### Jovian Auroral Distributions Experiment (JADE)



JADE will measure the distribution of electrons and the velocity distribution and composition of ions.

### Gravity Science (GS)

The Juno Gravity Science Investigation will probe the mass properties of Jupiter by using the communication subsystem to perform Doppler tracking.

### Magnetometer (MAG)

#### Advanced Stellar Compass (ASC)

ASC accurately measures the orientation of the magnetometers.



#### Fluxgate Magnetometer (FGM)

The two Fluxgate sensors will measure the magnitude and direction of the magnetic field in Jupiter's environment.

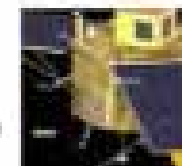
### Jupiter Energetic-particle Detector Instrument (JEDI)



JEDI is a suite of detectors that will measure the energy and angular distribution of charged particles.

### Microwave Radiometer (MWR)

MWR is designed to sound deep into the atmosphere and measure thermal emission over a range of altitudes.



### Ultraviolet Spectrograph (UVS)

UVS is an imaging spectrograph that is sensitive to ultraviolet emissions.



### JunoCam



JunoCam will provide visible-color images of the Jovian cloud tops.

### Jovian Infrared Auroral Mapper (JIRAM)

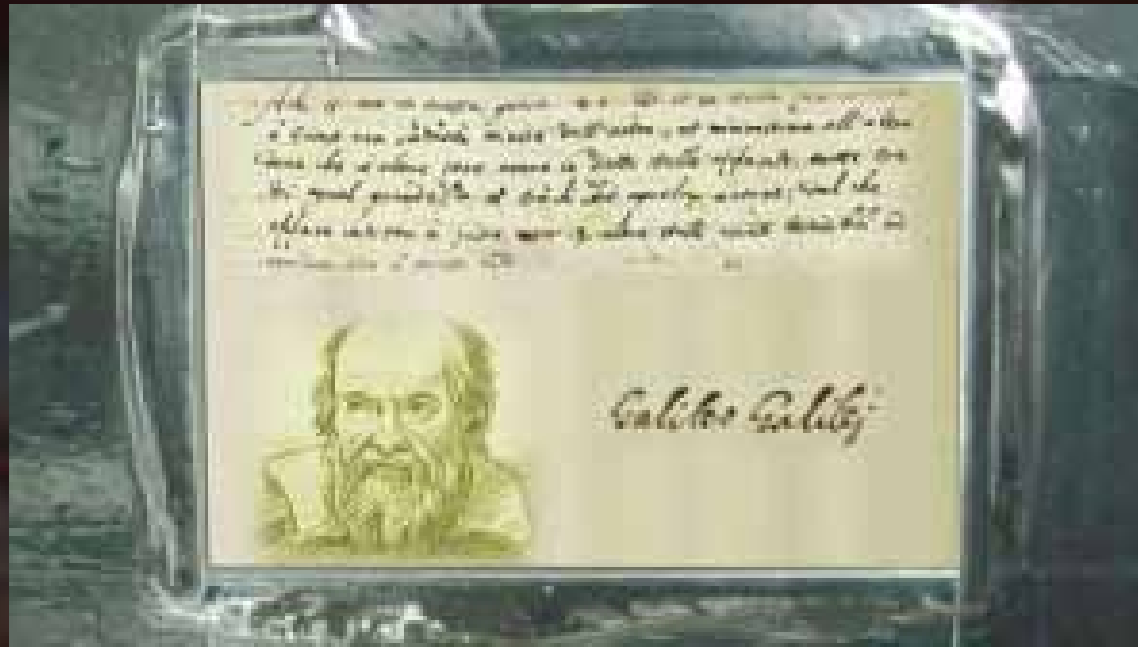


JIRAM will acquire infrared images and spectra of Jupiter. JIRAM is located on the aft-bottom deck.

### Plasma Waves Instrument (Waves)

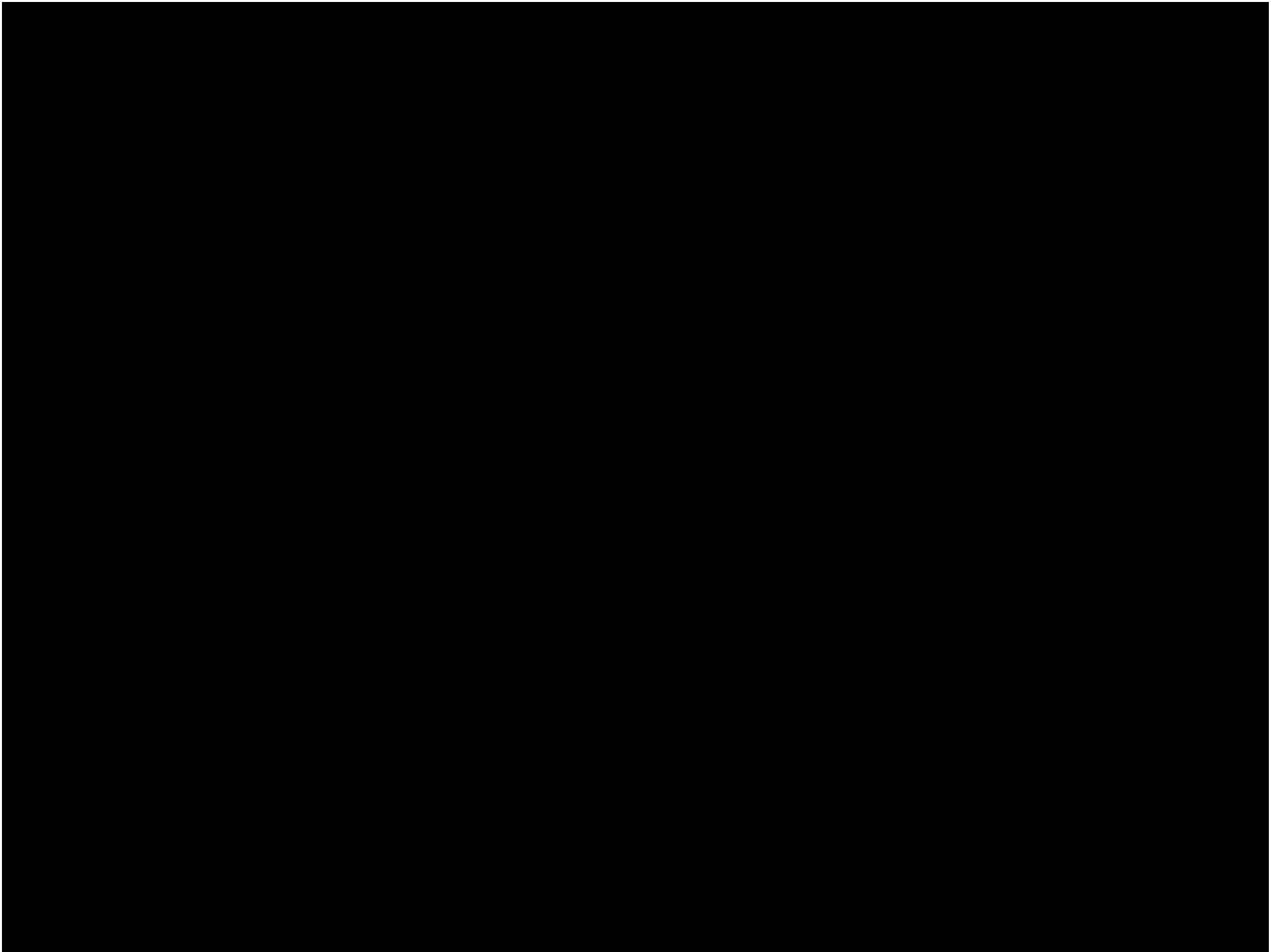
Waves will measure plasma waves and radio waves in Jupiter's magnetosphere.





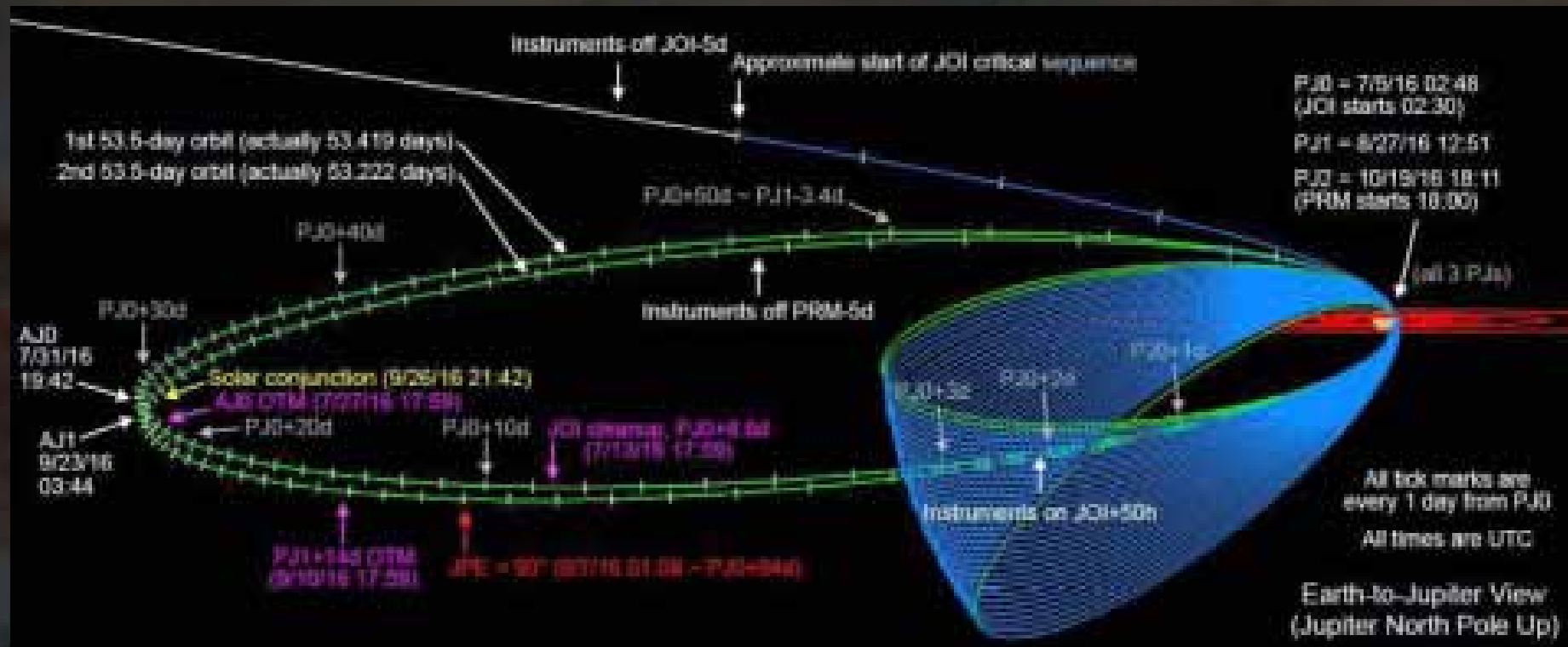
Jupiter – Juno - Galileo





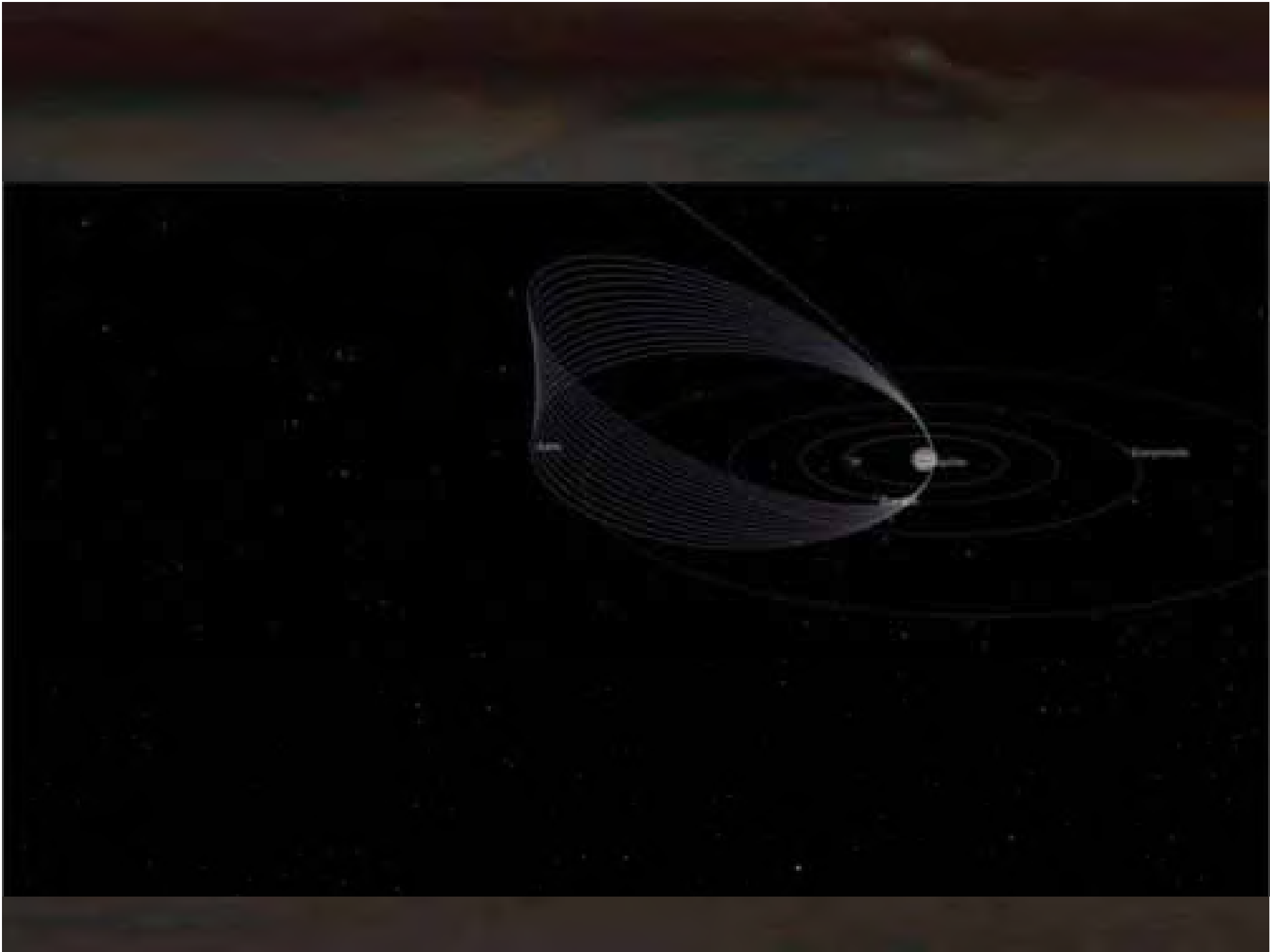






PJ2 op 19/10-2016 in 'safe mode' → geen foto's

→ PJ3 op 11/12-2016 = rescheduled Period Reduction Maneuver (later zelfs definitief afgeblazen) → blijft in baan van 53.4 dagen → wel langere levensduur → verlenging tot max. 2021?



*Bezoek van Aarde*



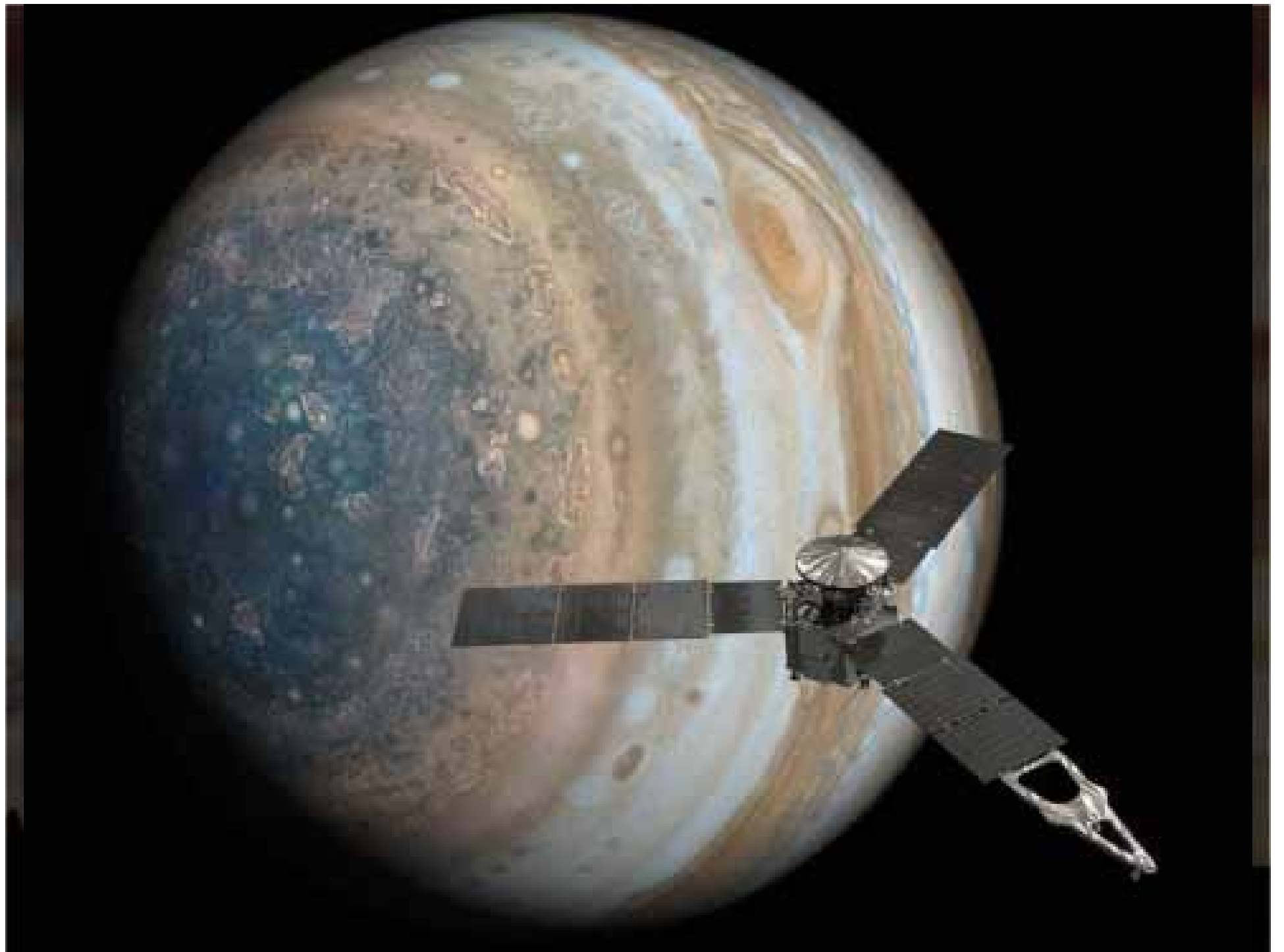
# Juno doelstellingen

- **Onderzoek naar verhouding zuurstof / waterstof (abundance water) (formatie van Jupiter)**
- **Massa-bepaling van kern (formatie van Jupiter)**
- **Nauwkeurige meting gravitationele veld (massa-verdeling)**
- **Nauwkeurige meting magnetisch veld (dynamo-theorie)**
- **Metingen van variaties in atmosfeer van temperatuur, structuur, wolken-doorzichtigheid en druk**
- **3D-beeldvorming van polaire magnetosfeer en aurora's**
- **Meting van zgn. Lense-Thirring precessie in de satellietbaan t.b.v. testen relativistische effecten i.c.m. rotatie Jupiter**



21 december 2018 = Perijove 17

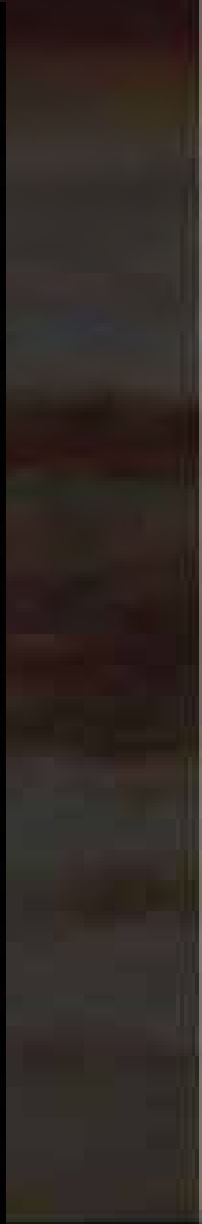




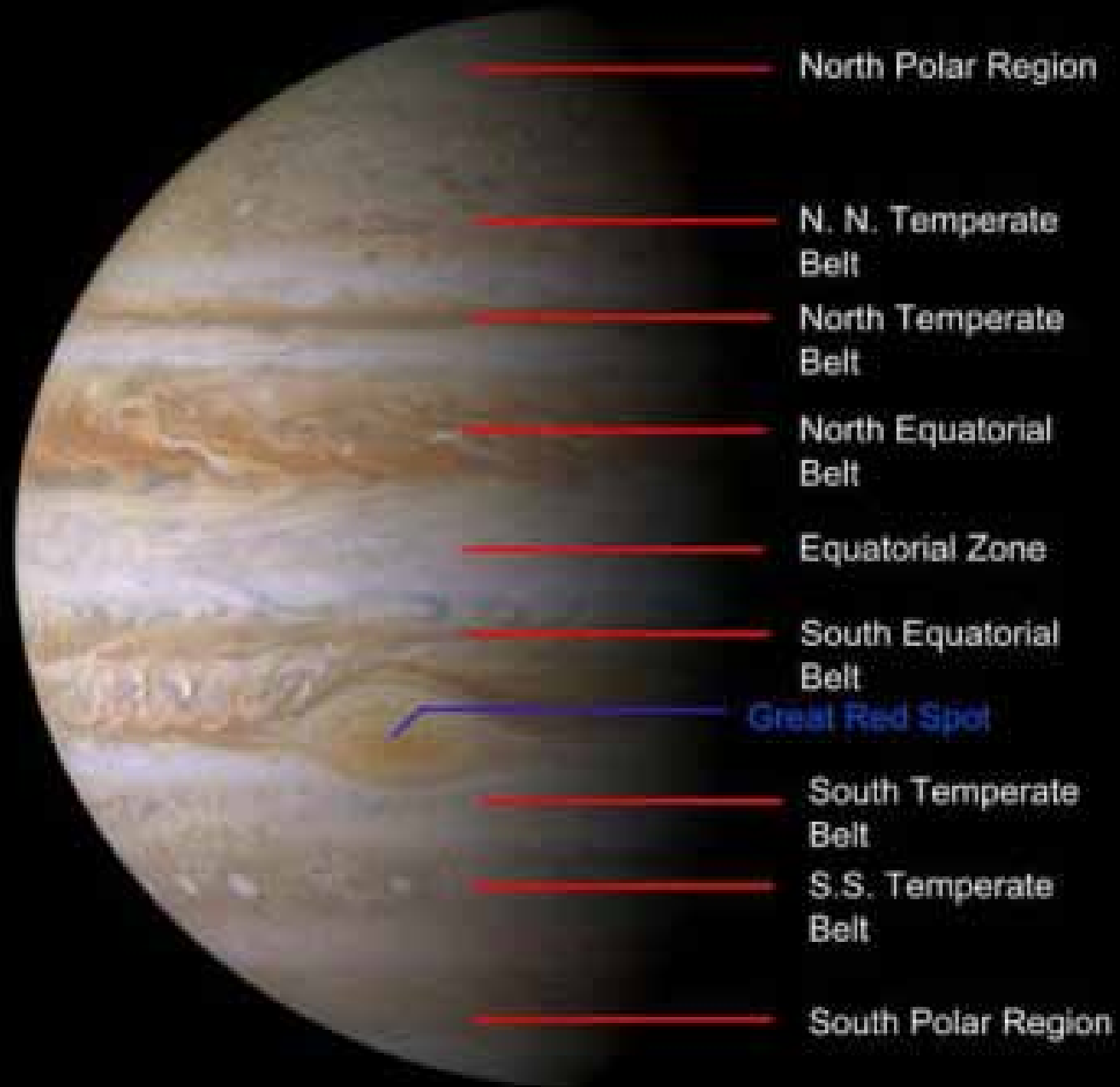
# *De joviaanse atmosfeer*

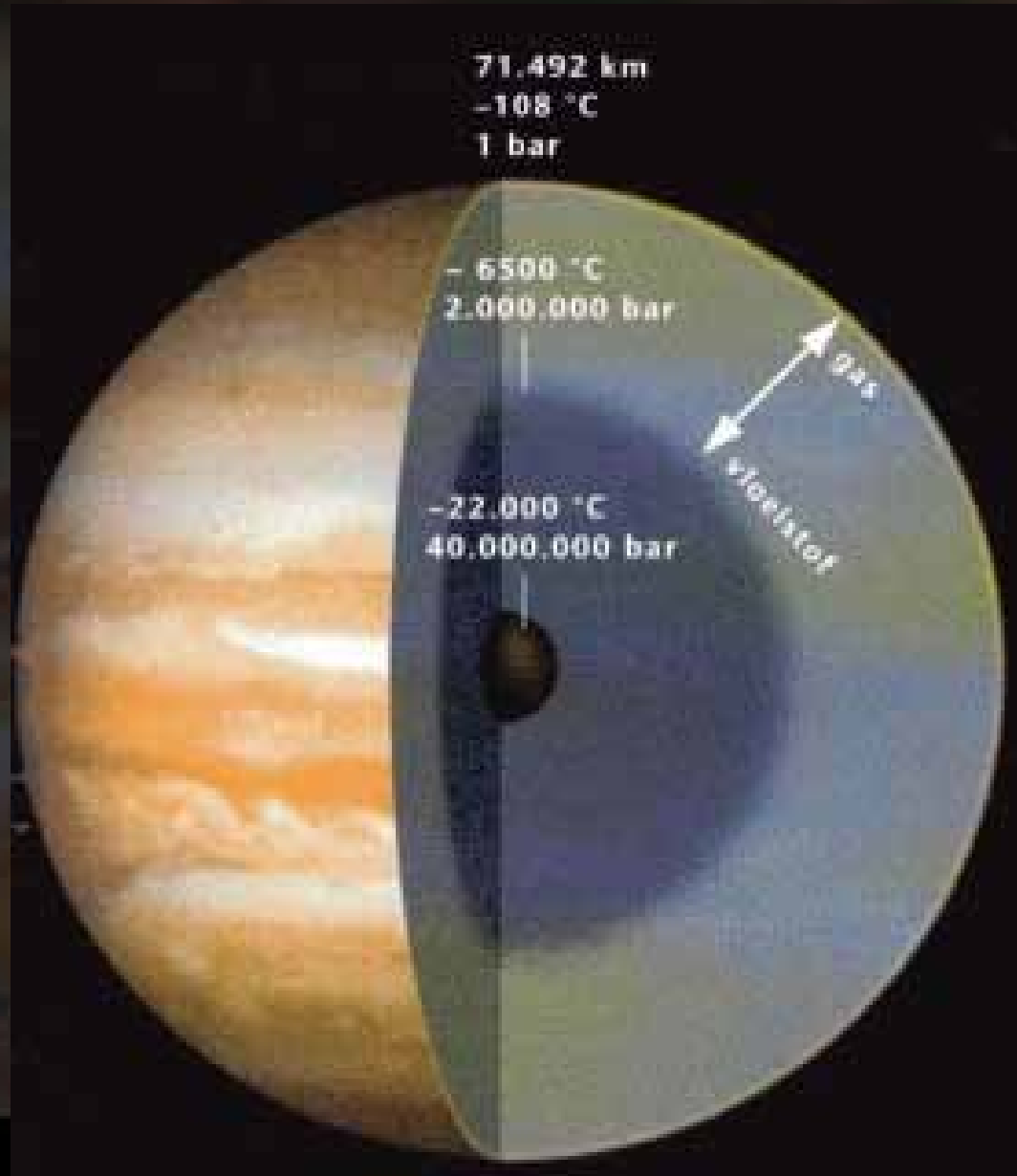


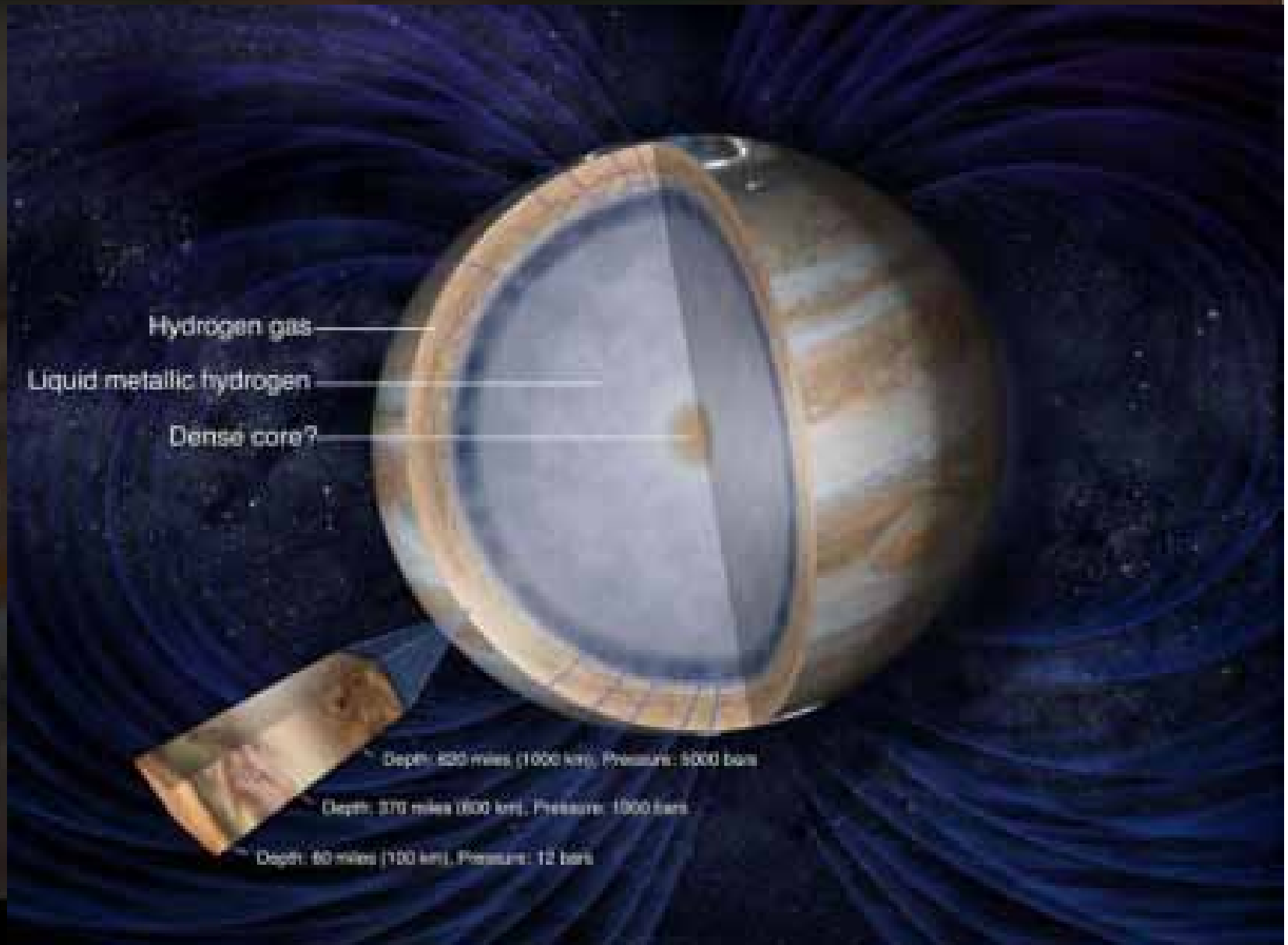
*Atmosfeer*











# Jupiter atmosfeer

- Waterstofgas ( $H_2$ ) 90%
- Helium (He) 10%
- Methaan ( $CH_4$ ) 3000 ppm
- Ammoniak ( $NH_3$ ) 260 ppm
- Waterstofdeuteride (HD) 28 ppm
- Ethaan ( $C_2H_6$ ) 5,8 ppm
- Waterdamp ( $H_2O$ ) 4 ppm
- Fosfine ( $PH_3$ ) sporen
- Waterstofsulfide ( $H_2S$ ) sporen
- Ammoniumwaterstofsulfide ( $NH_4SH$ ) sporen

*Atmosfeer*



Perijove 1

27 aug 2016



Noordpool

*Bezoek van Aarde*

Perijove 1

27 aug 2016

Zuidpool





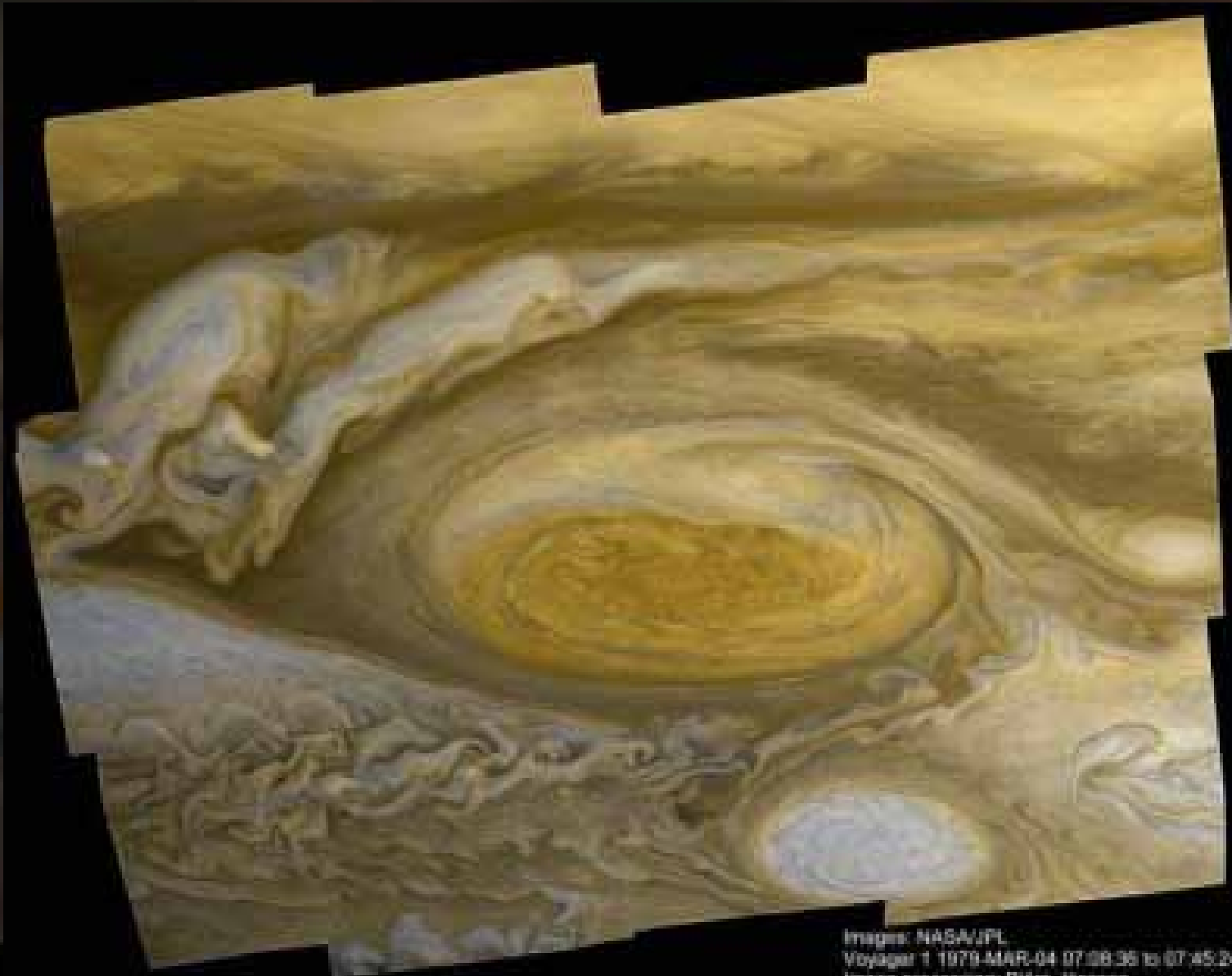




*Atmosfeer*



# Atmosfeer



Images: NASA/JPL  
Voyager 1 1979-MAR-04 07:06:36 to 07:45:24  
Image processing: Björn Jonsson

*Jupiter waarnemen*





Great Red Spot in 1890  
Length: 22,370 miles = 2.8 Earths



Great Red Spot in 2015  
Length: 9,630 miles = 1.2 Earths





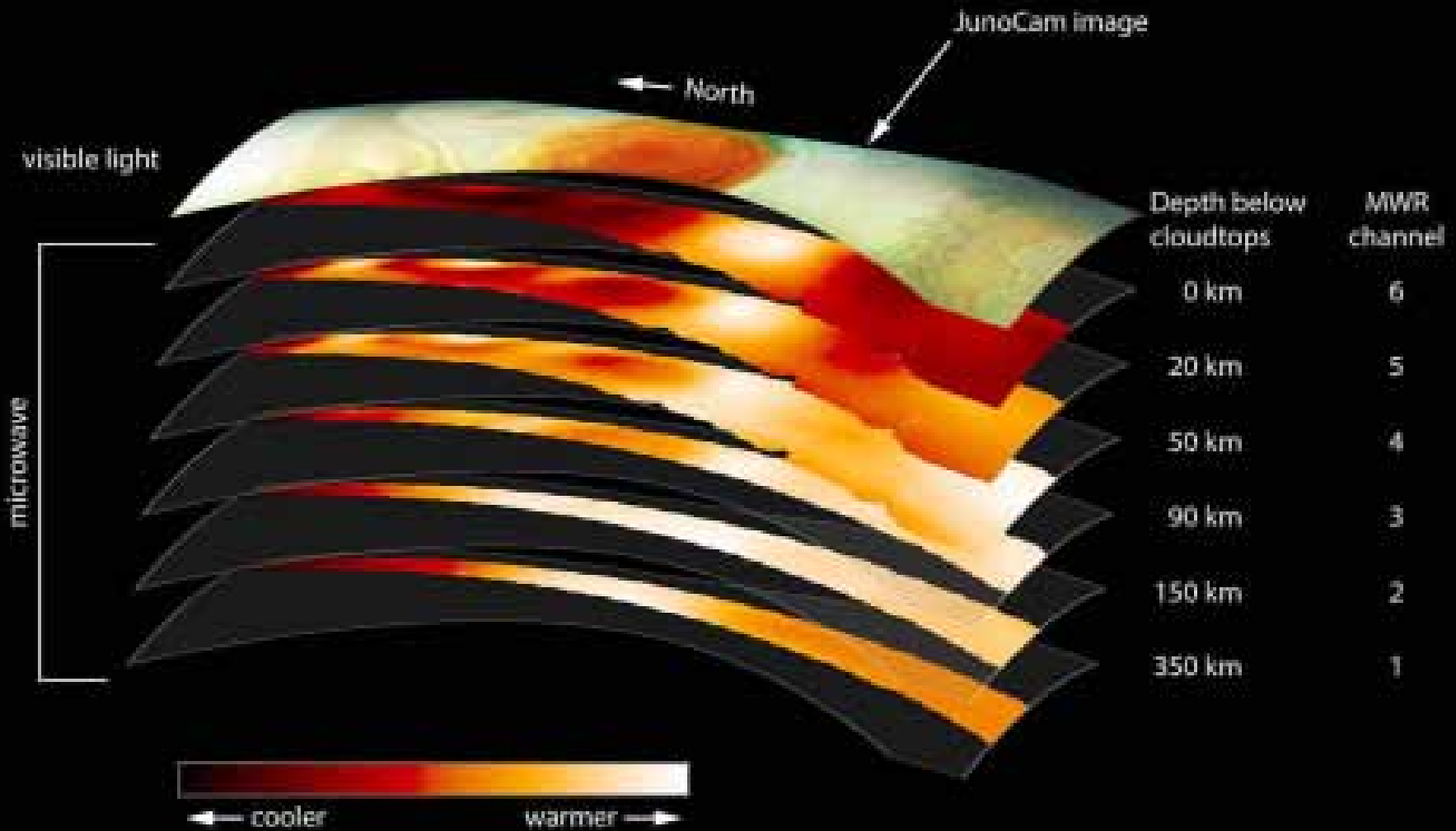


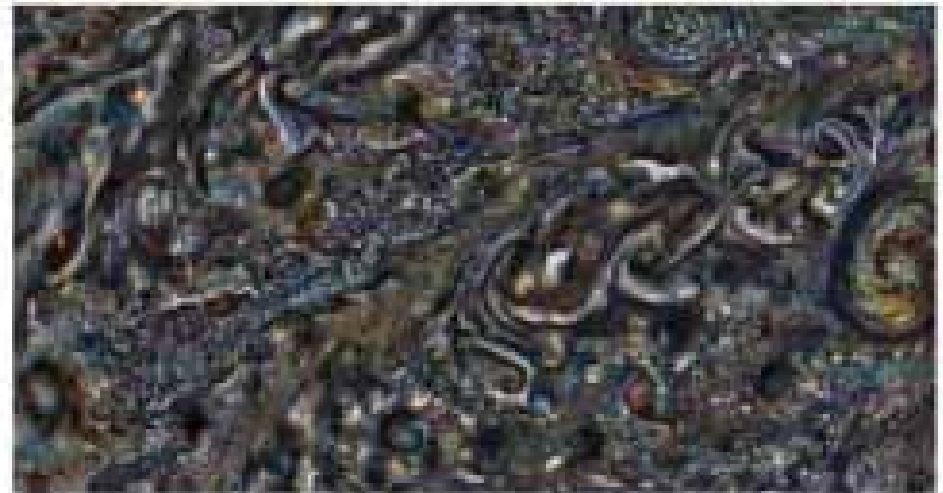
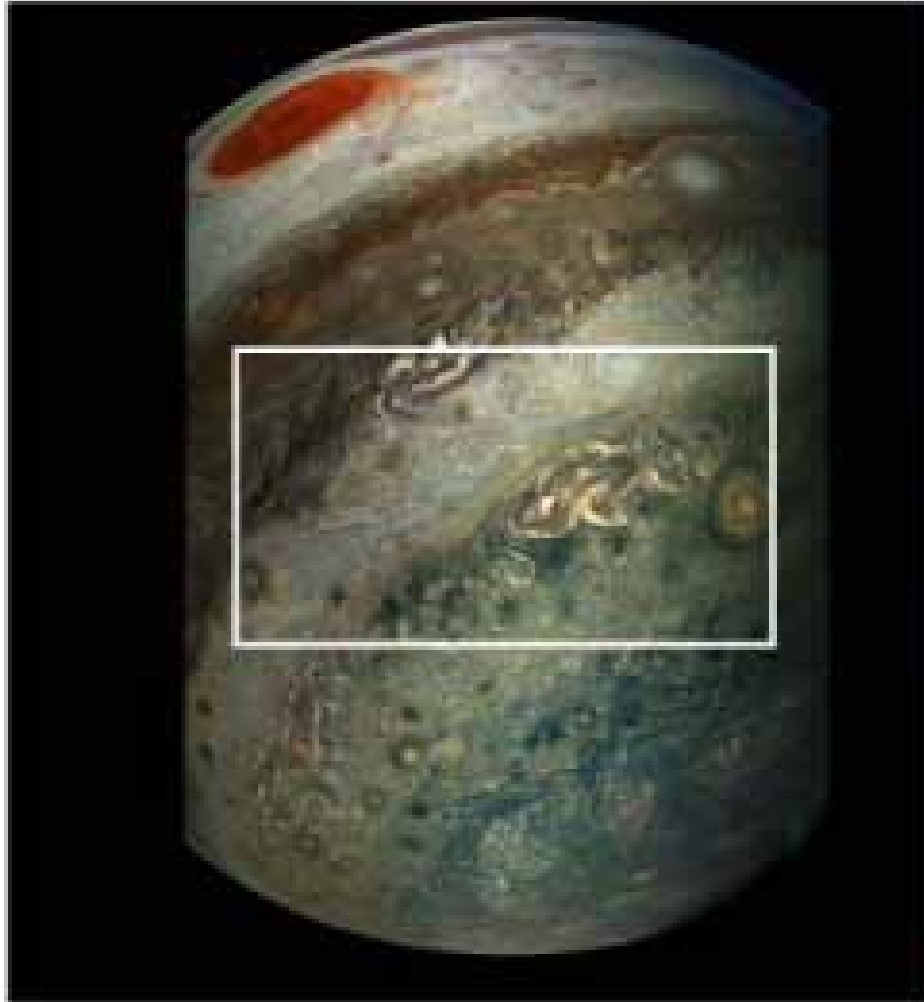






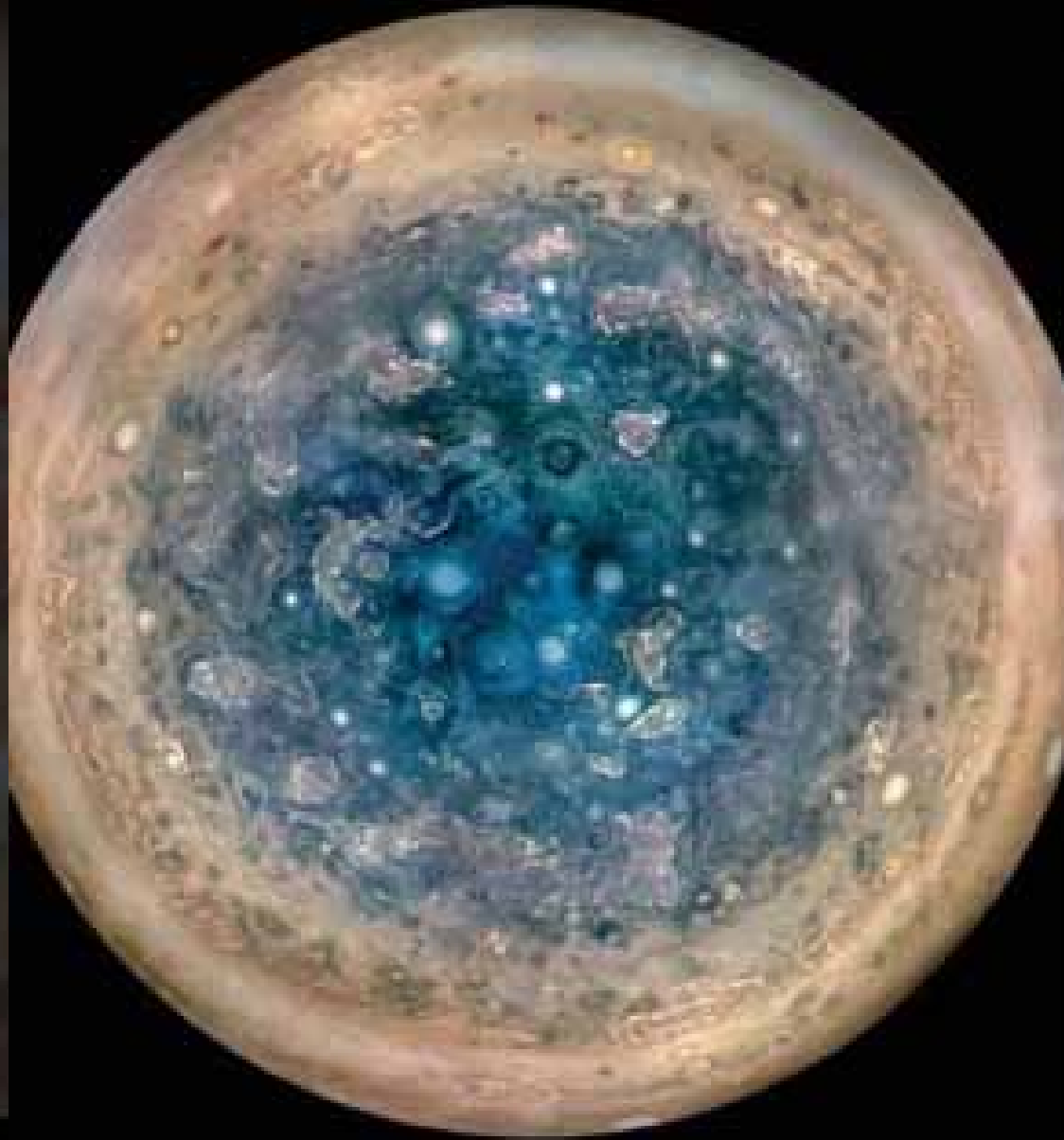








Zuidpool









NASA/JPL-Caltech/SwRI  
MSSS/Roman Tkachenko



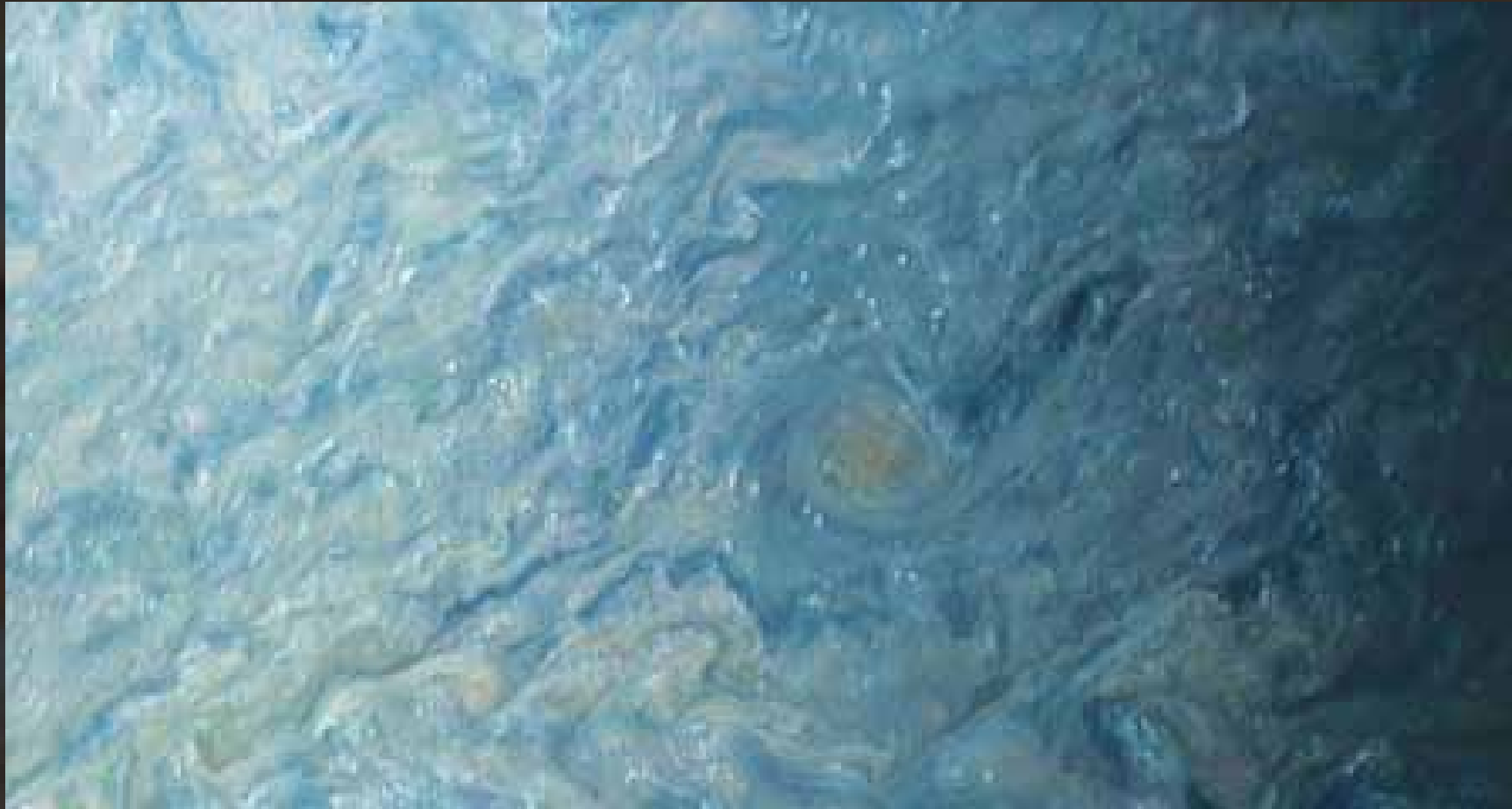




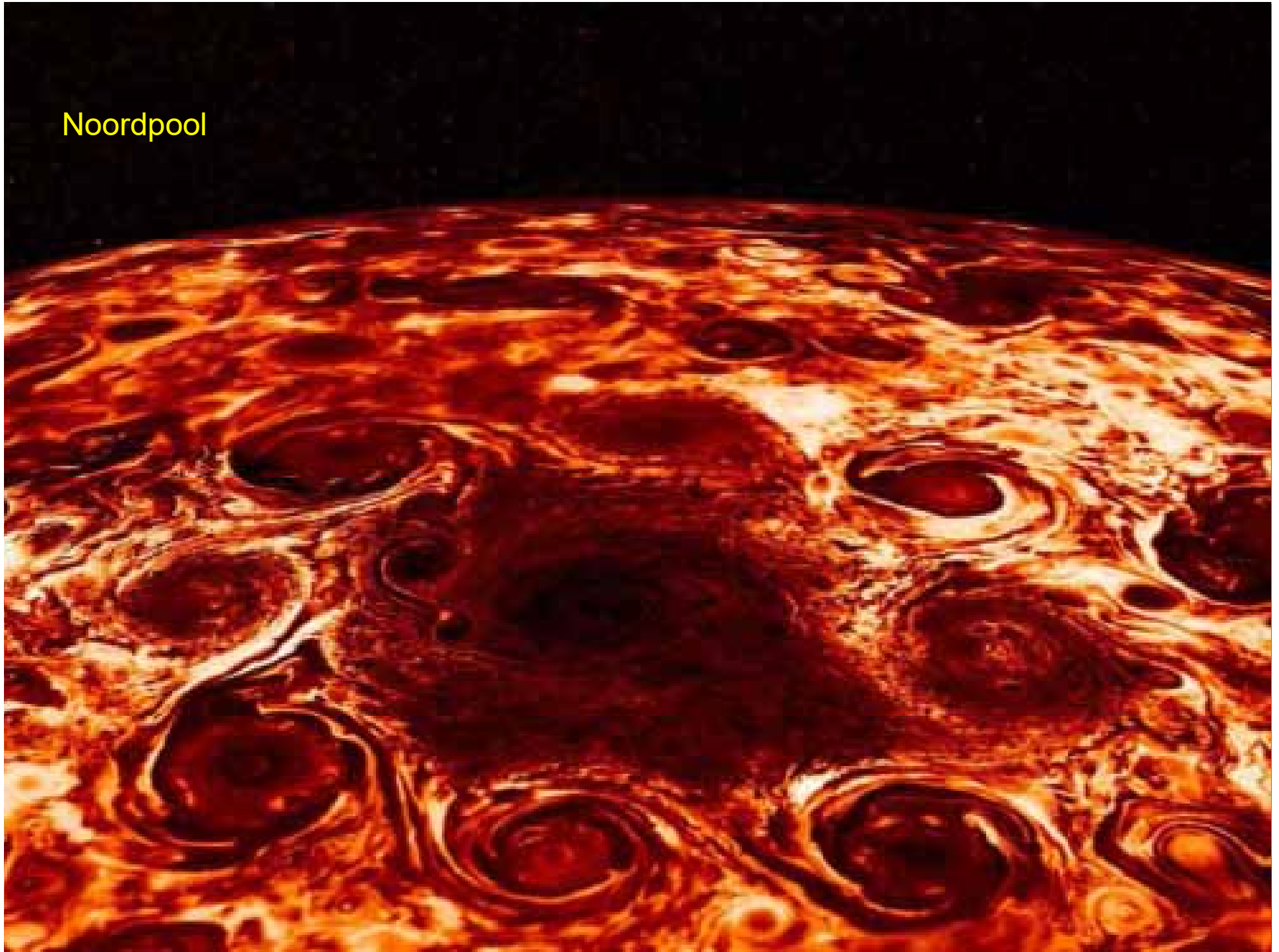




## Ammoniak spots (50km doorsnede)



Noordpool

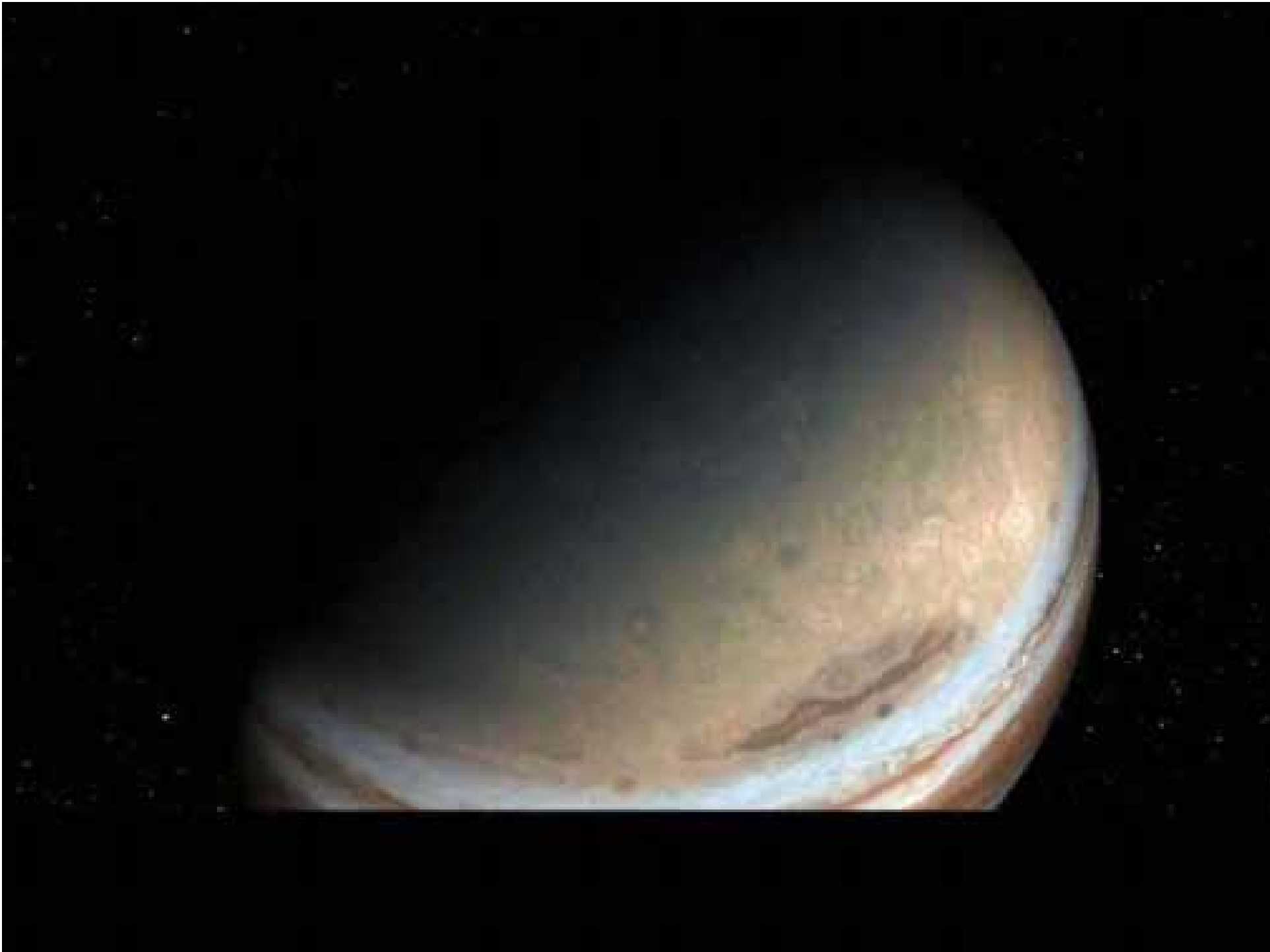




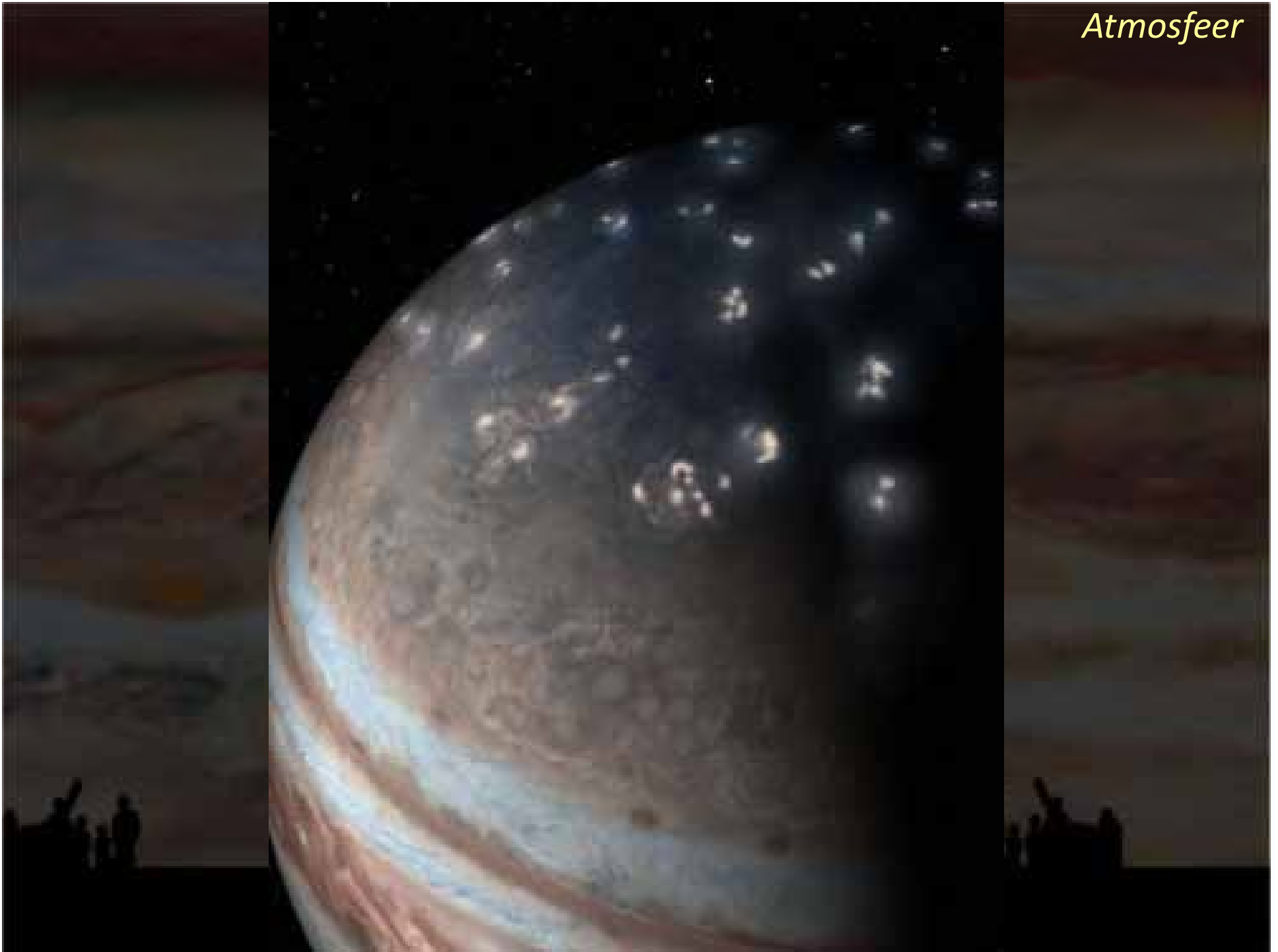


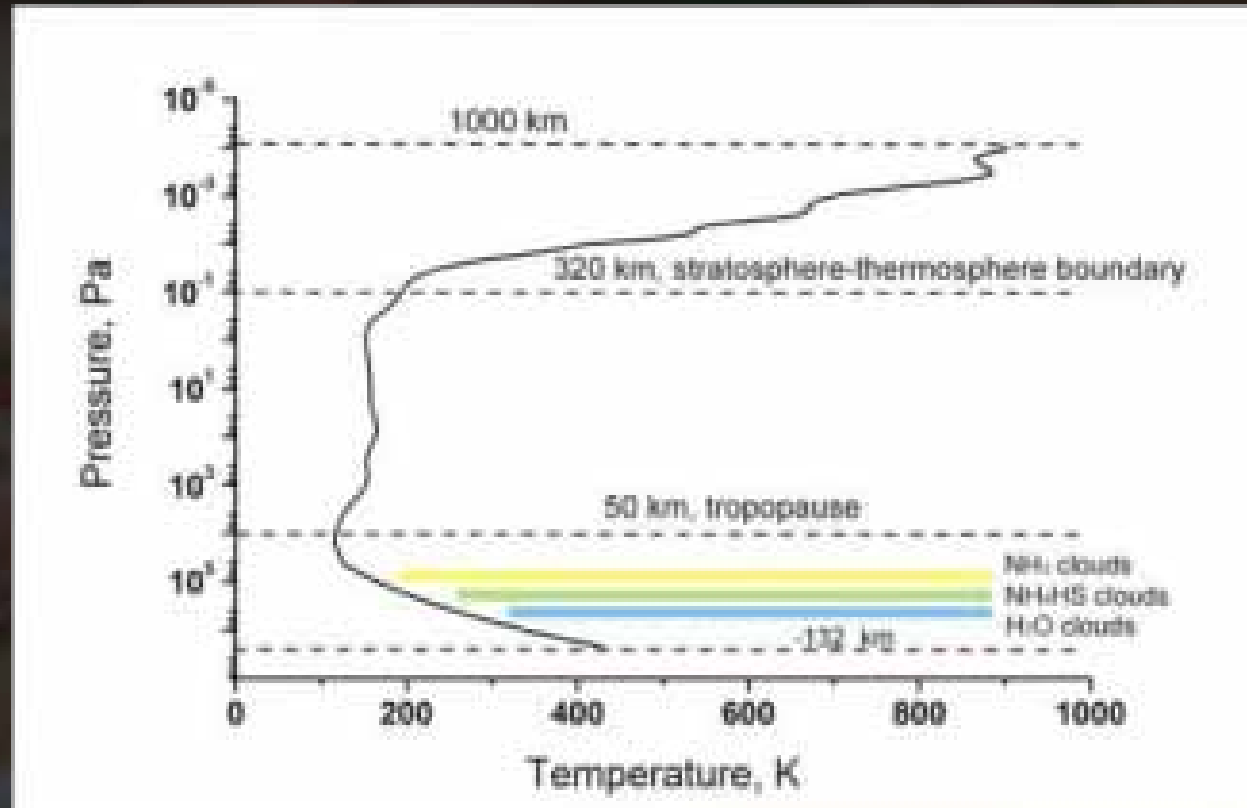
Zuidpool



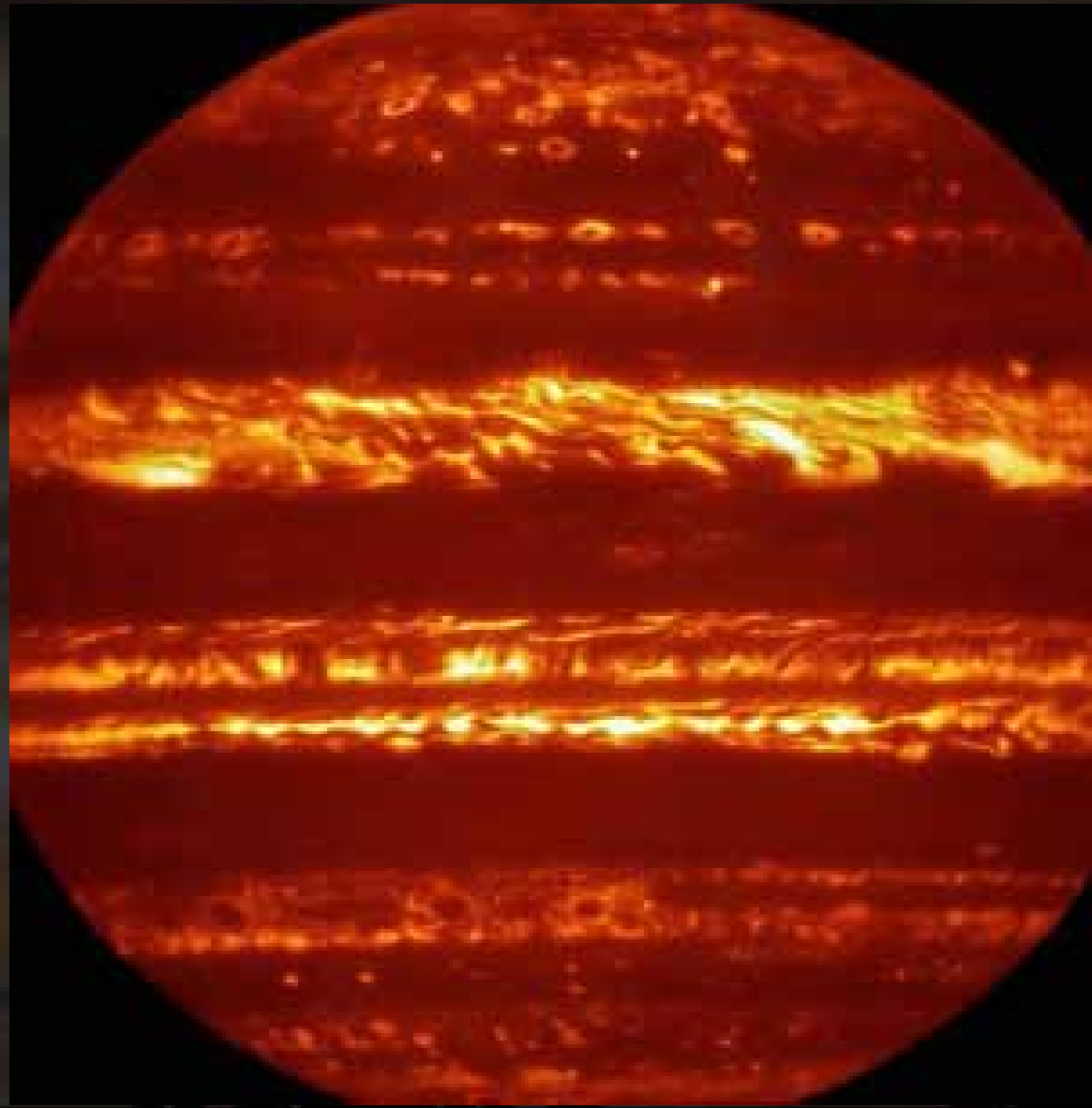


*Atmosfeer*





*Atmosfeer*



VLT /  
VISIR





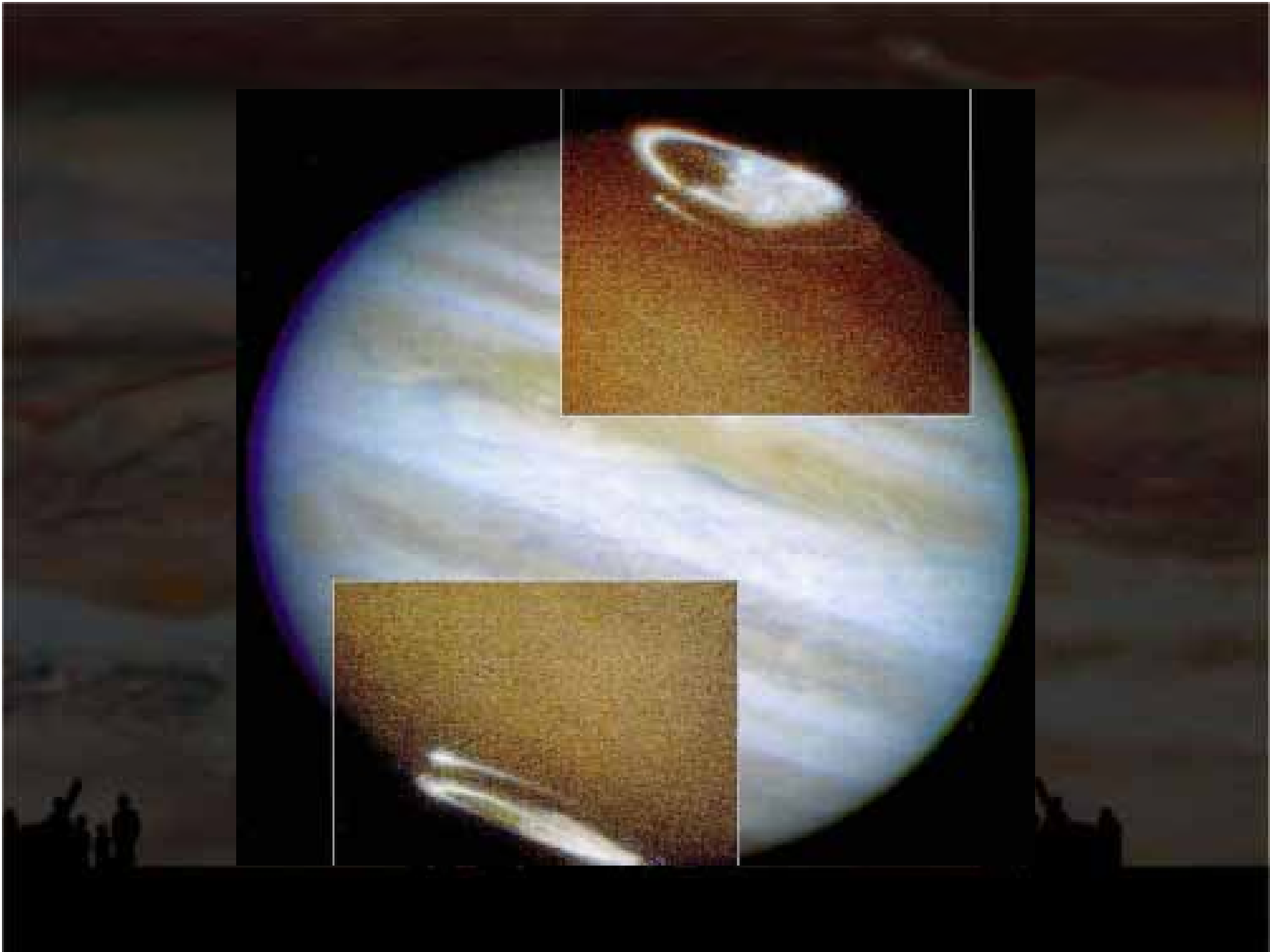
UV



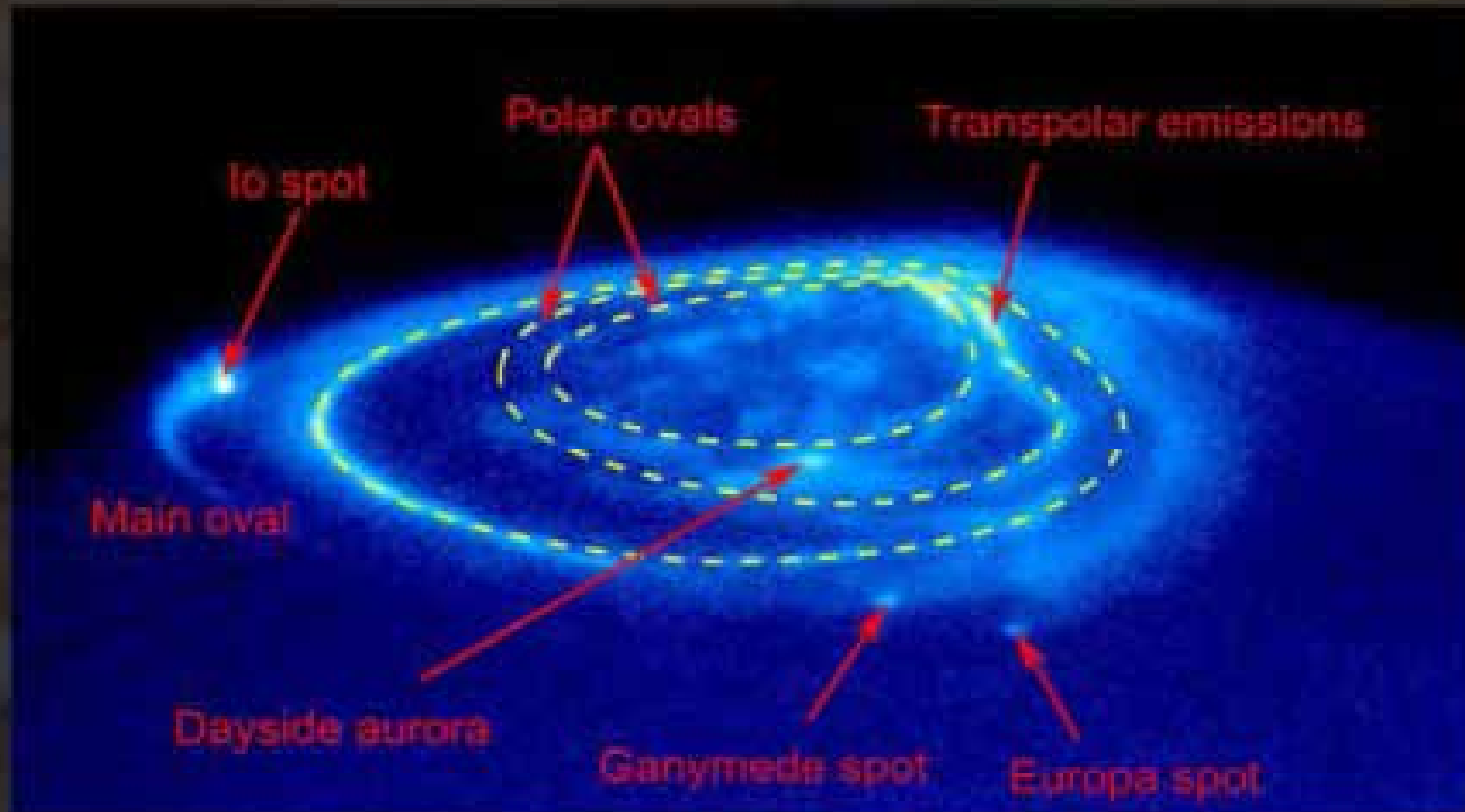


stel je voor dat je Jupiter's magnetosfeer vanaf de aarde met het oog zou kunnen zien...



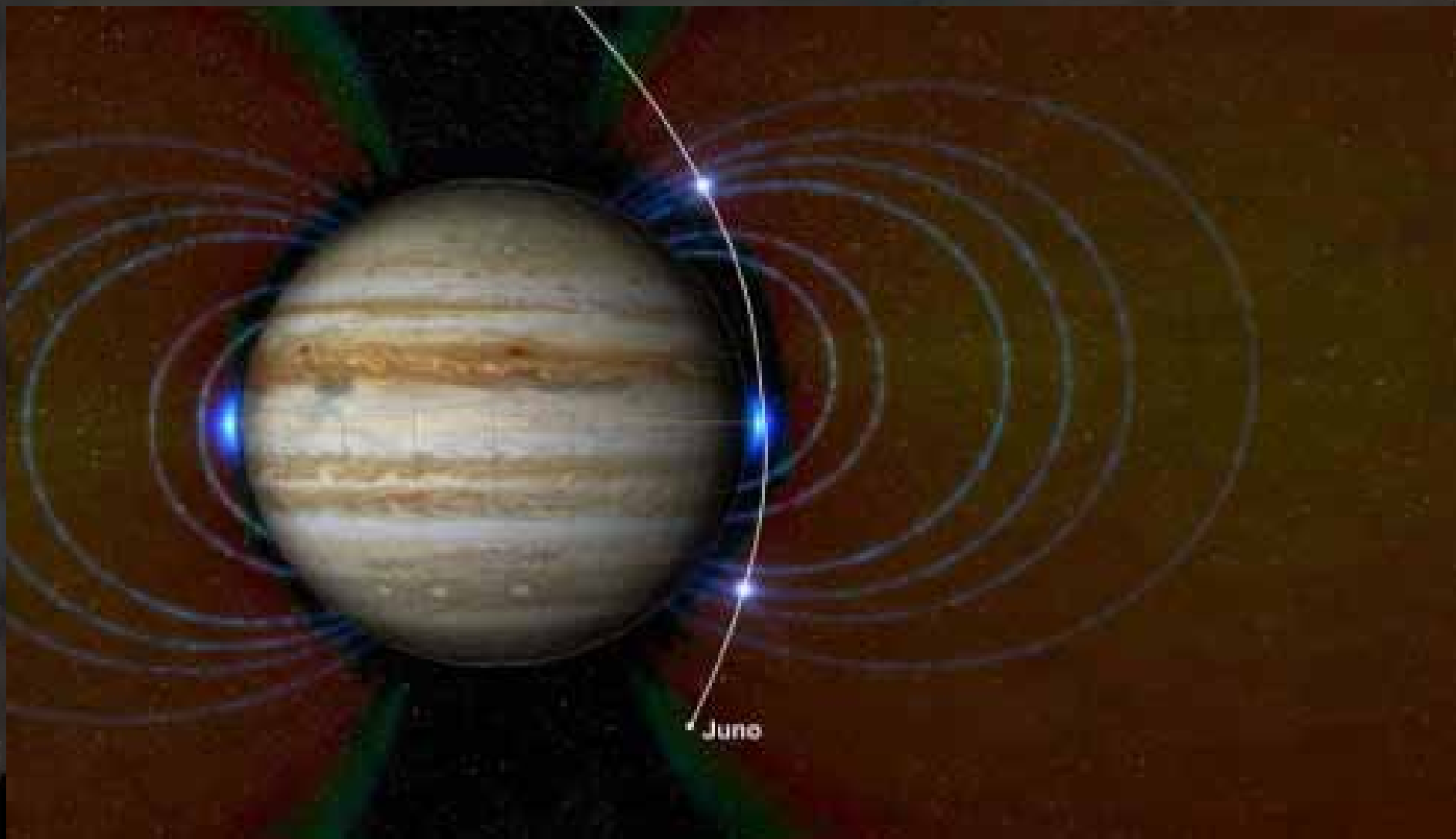






*Zuidpool Aurora (IR- Juno)*





Juno

*Het joviaanse stelsel*



*Het joviaanse stelsel*



*Het joviaanse stelsel*



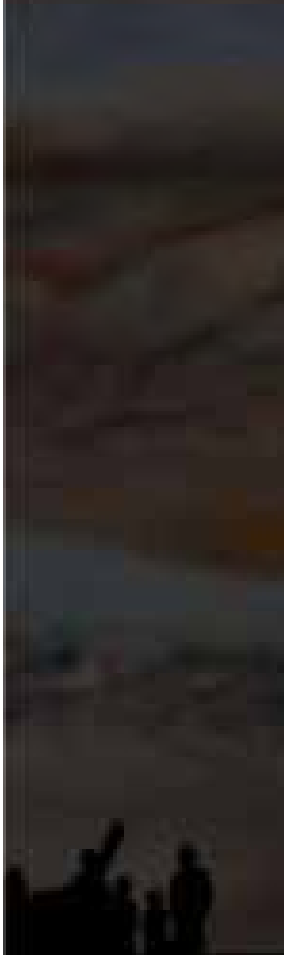
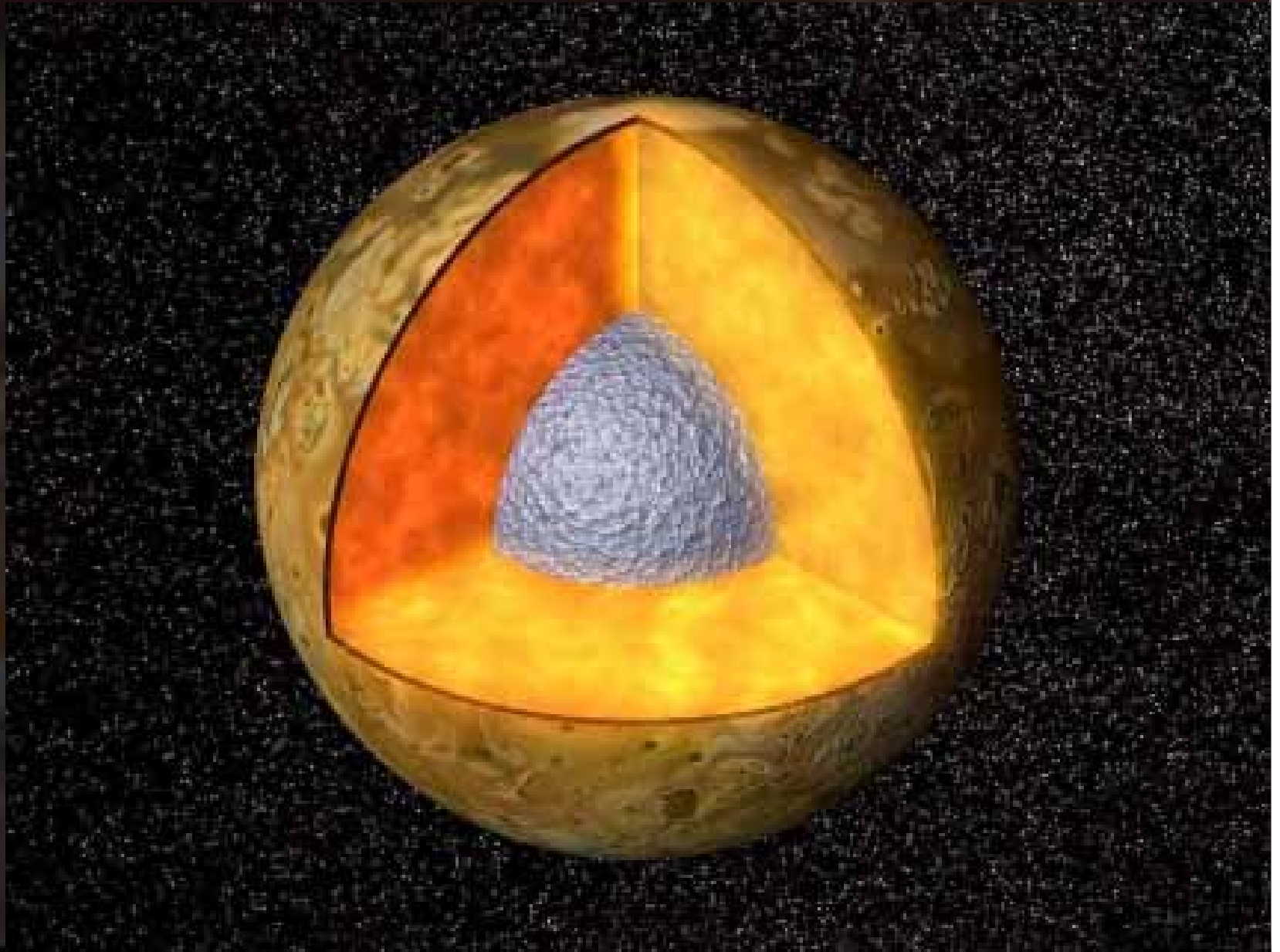
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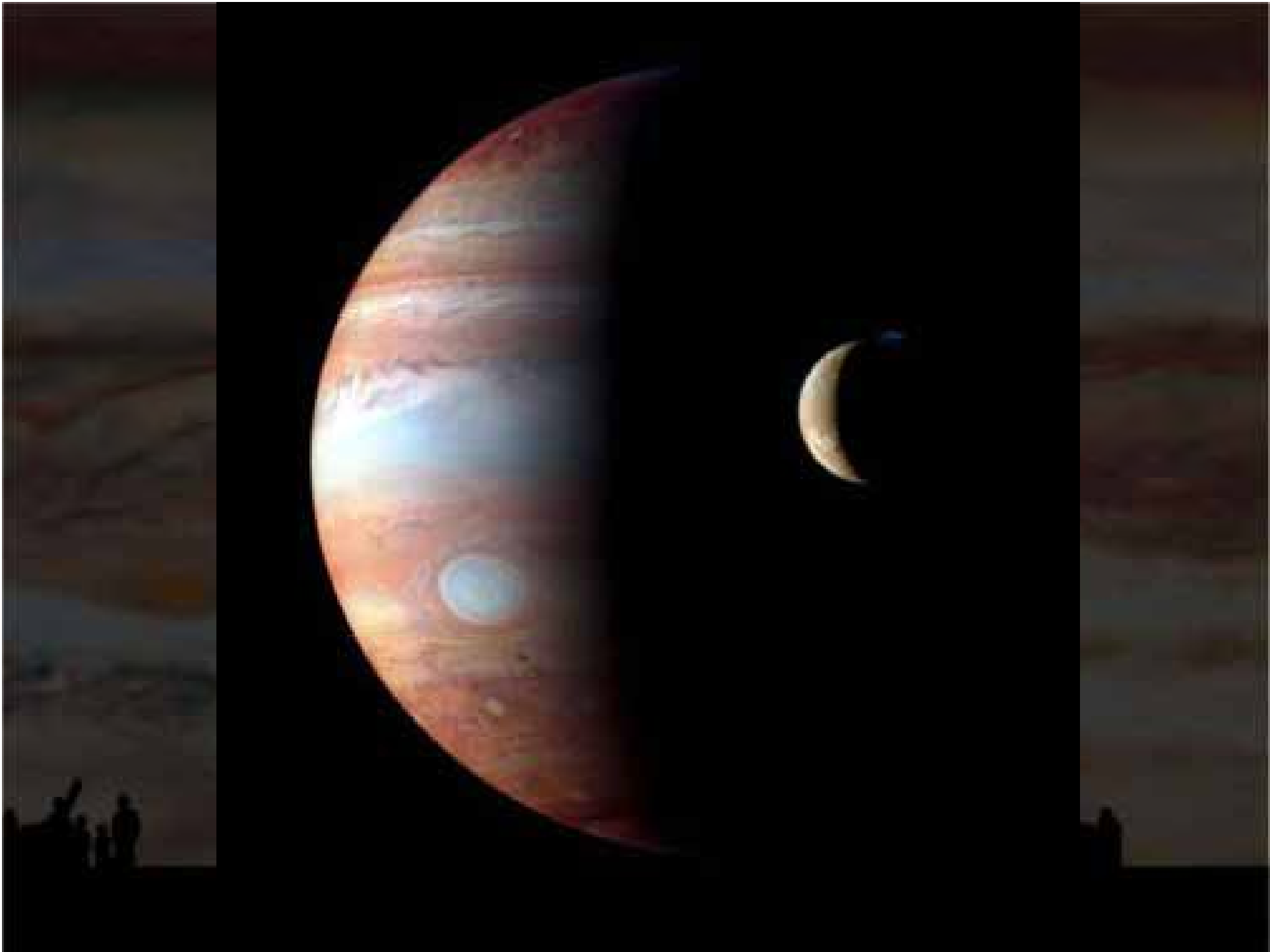


Io



*Het joviaanse stelsel*





*Het joviaanse stelsel*



## **Io Surface Changes**

Galileo 1999

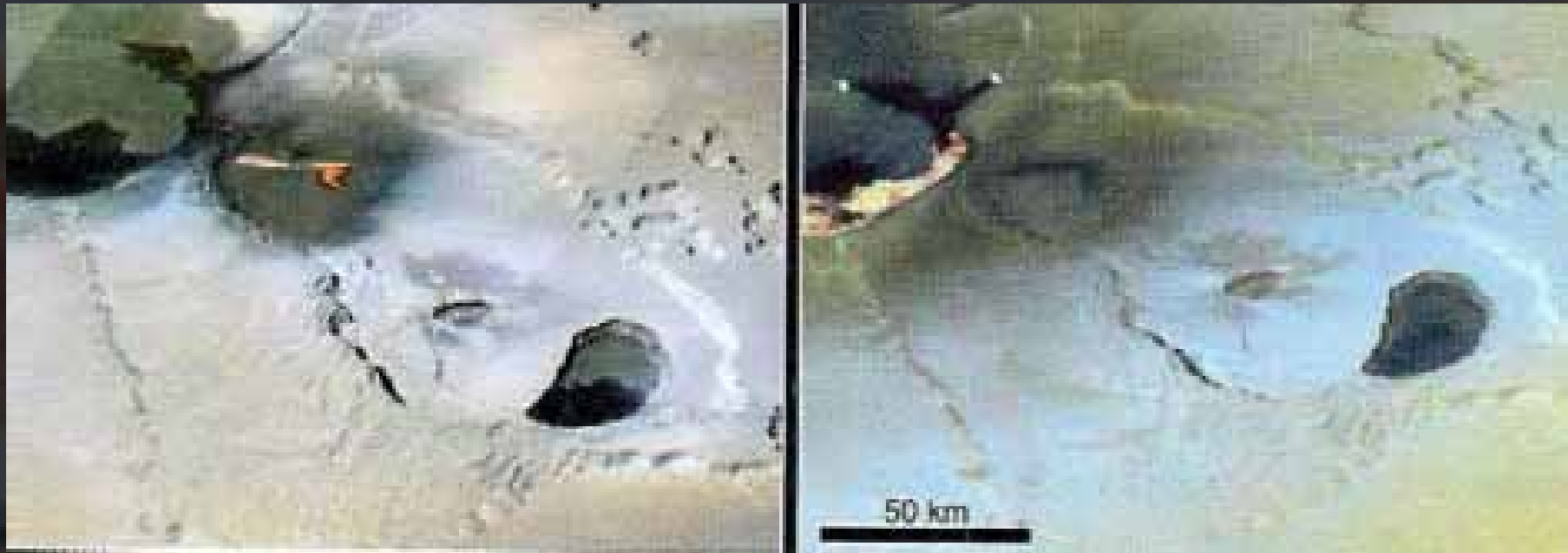
New Horizons 2007



*Het joviaanse stelsel*



Tvashtar Catena met 4 maanden verschil





90 km lange lavastroom



*Het joviaanse stelsel*

## ***Tupan Patera***

Diameter:

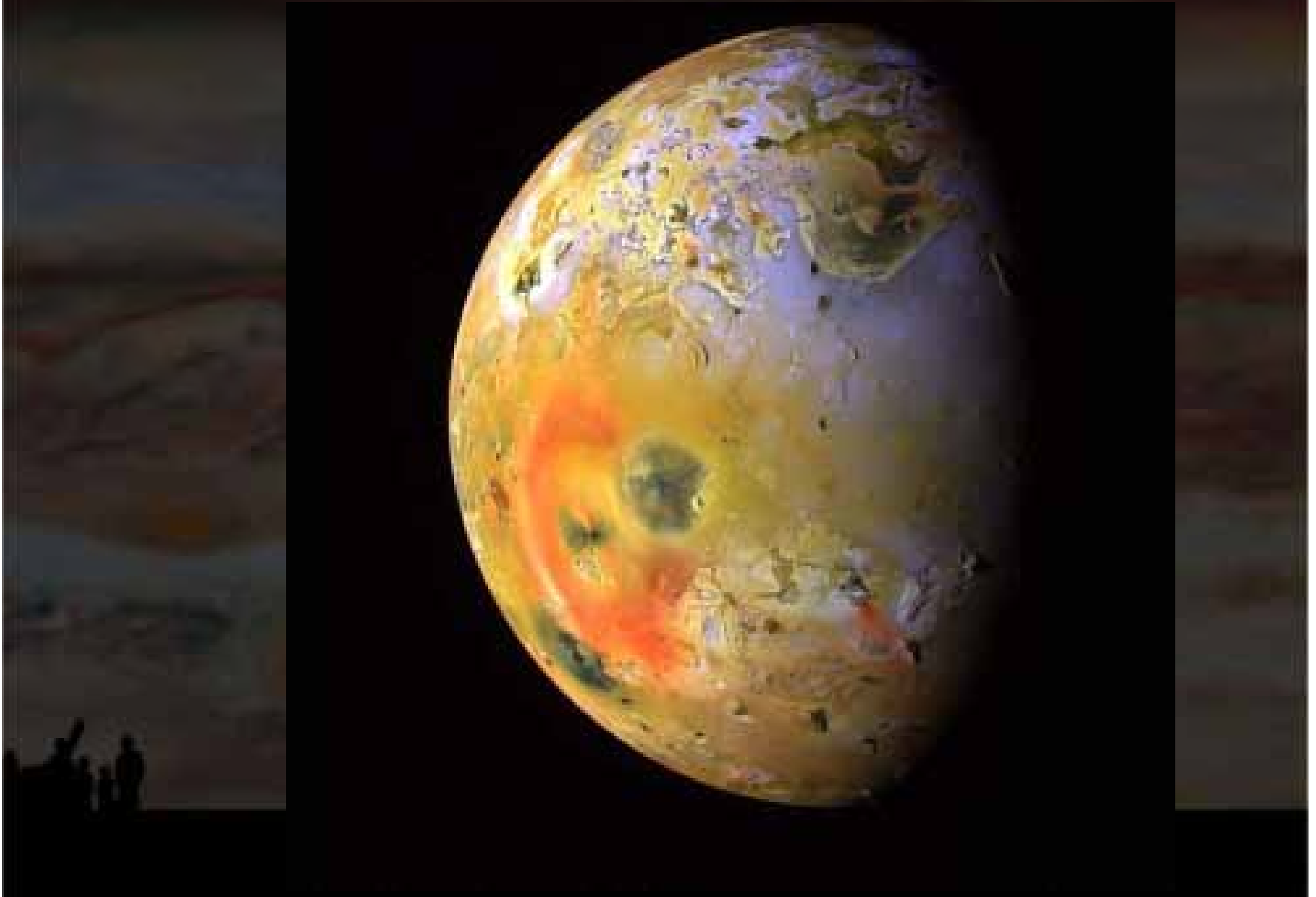
75 kilometer

Hoogte:

900 meter



*Het joviaanse stelsel*





*Het joviaanse stelsel*

Io in IR door  
New Horizons

bovenaan  
vulkaan Tvastar  
(plus diverse  
andere actieve  
vulkanen)



*Het joviaanse stelsel*



Io in IR door Juno

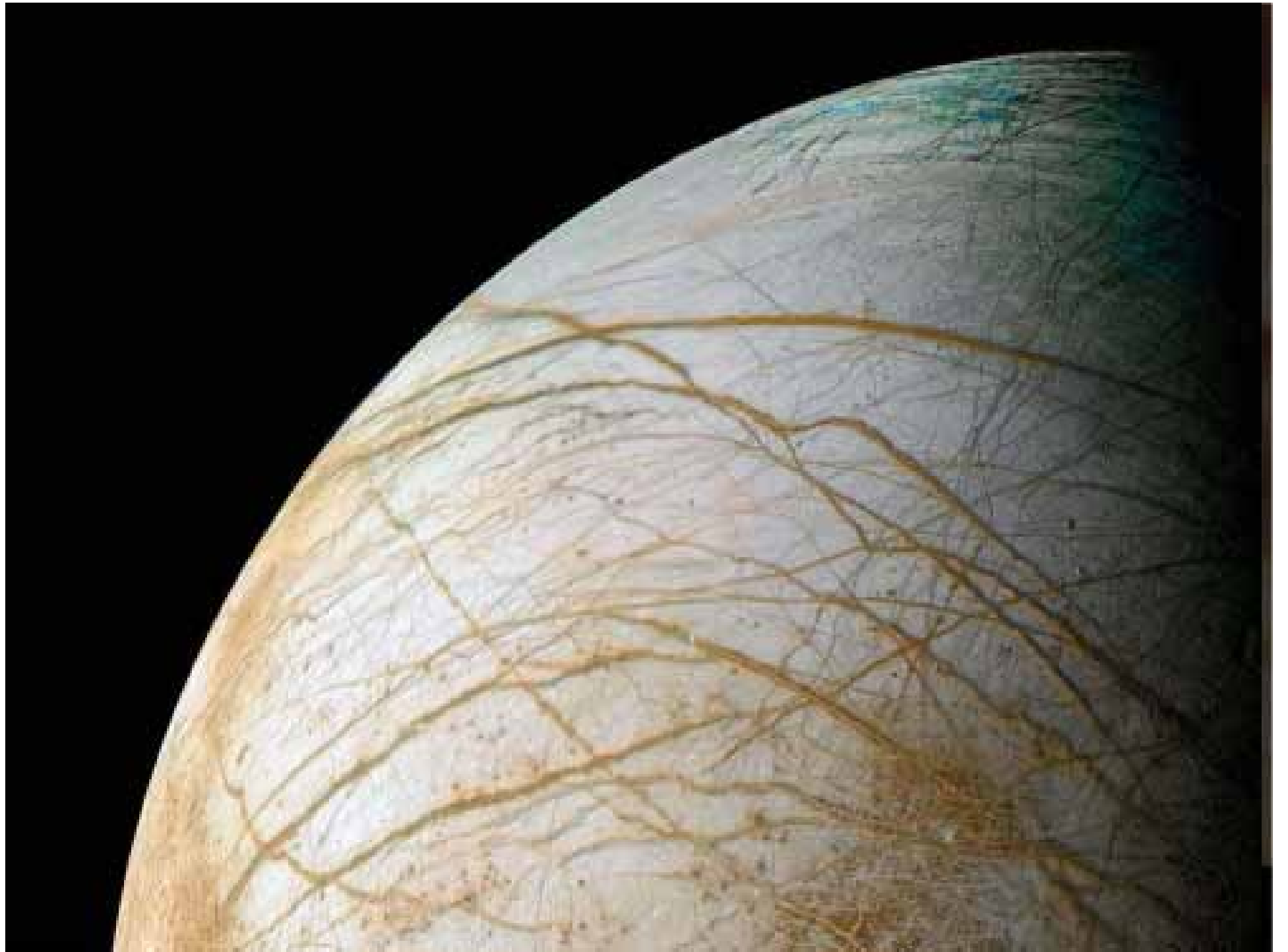
*Het joviaanse stelsel*

Io en  
Europa



# Europa

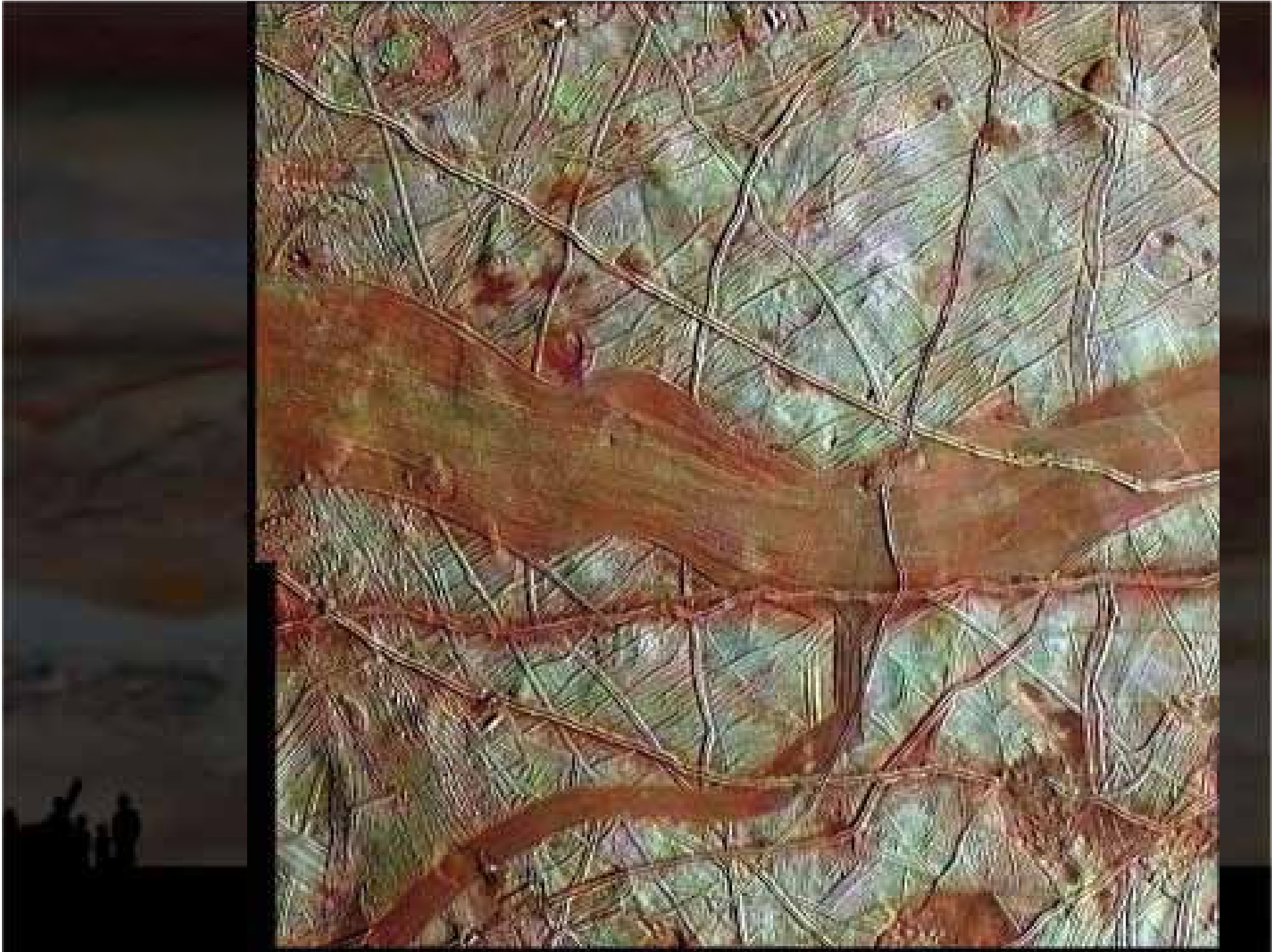






*Het joviaanse stelsel*

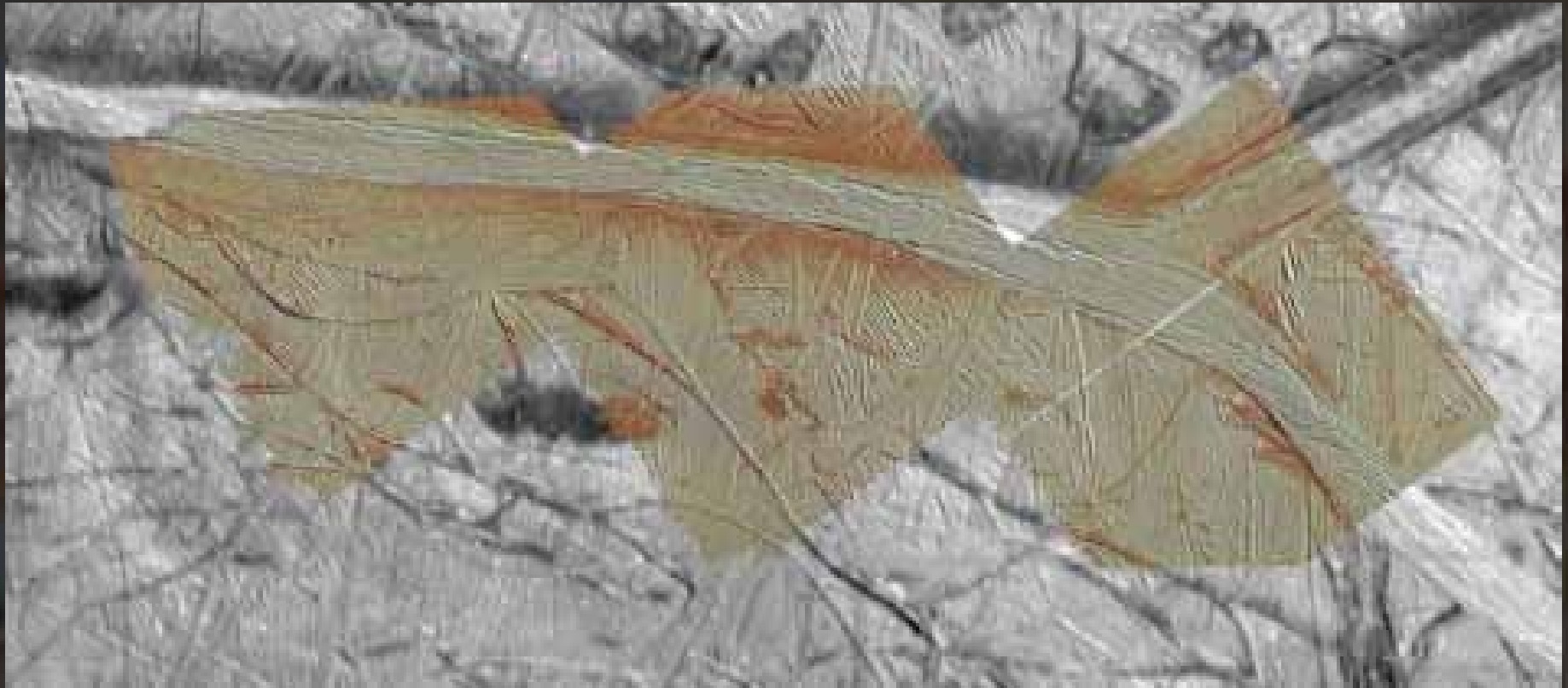




*Het joviaanse stelsel*

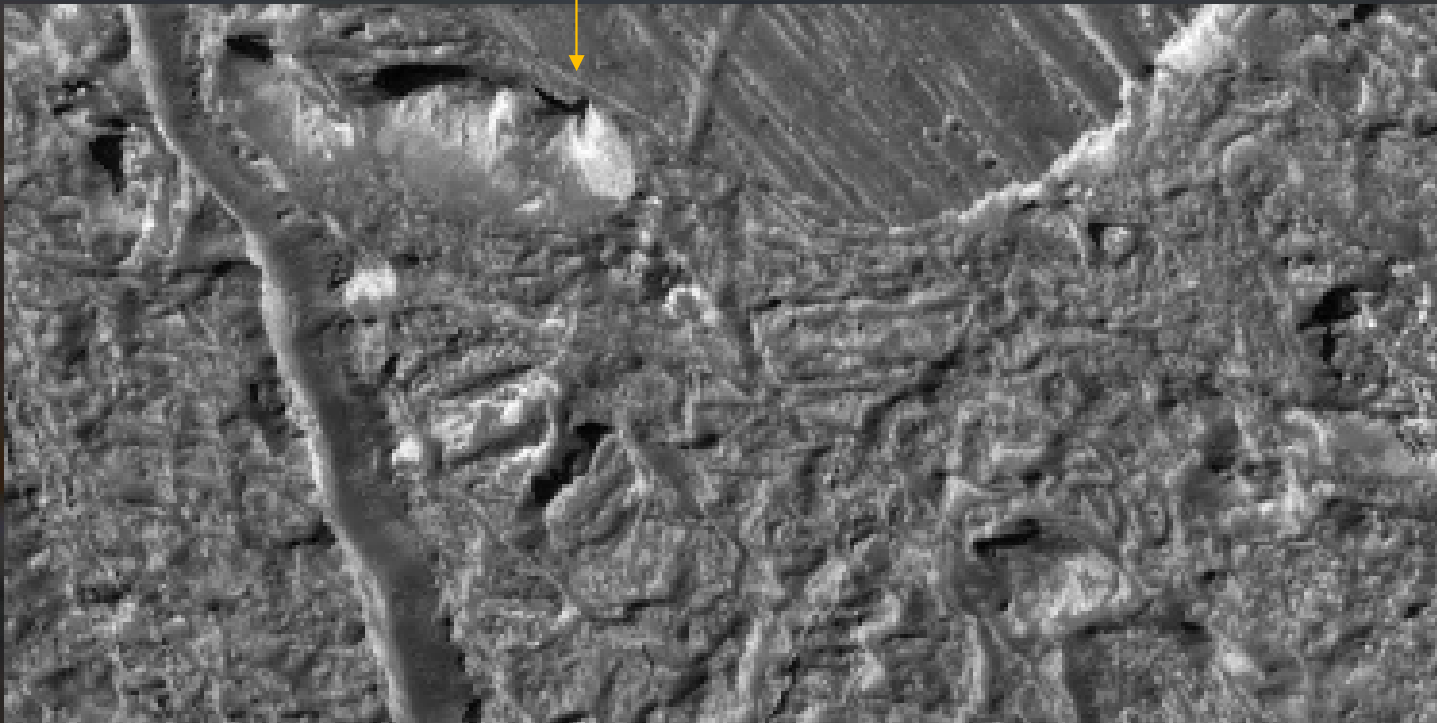


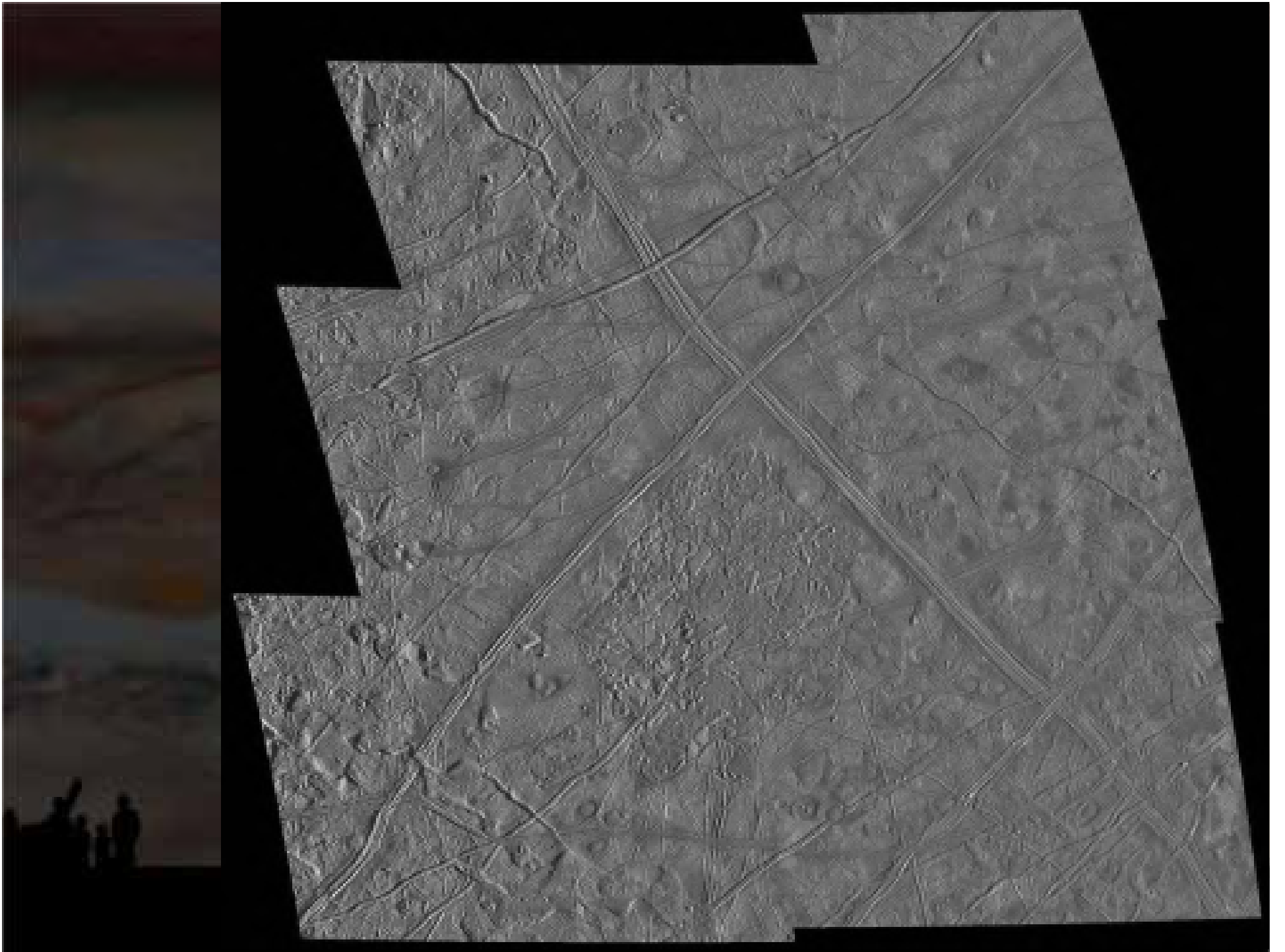
*Het joviaanse stelsel*



*Het joviaanse stelsel*

IJsberg 250m hoog



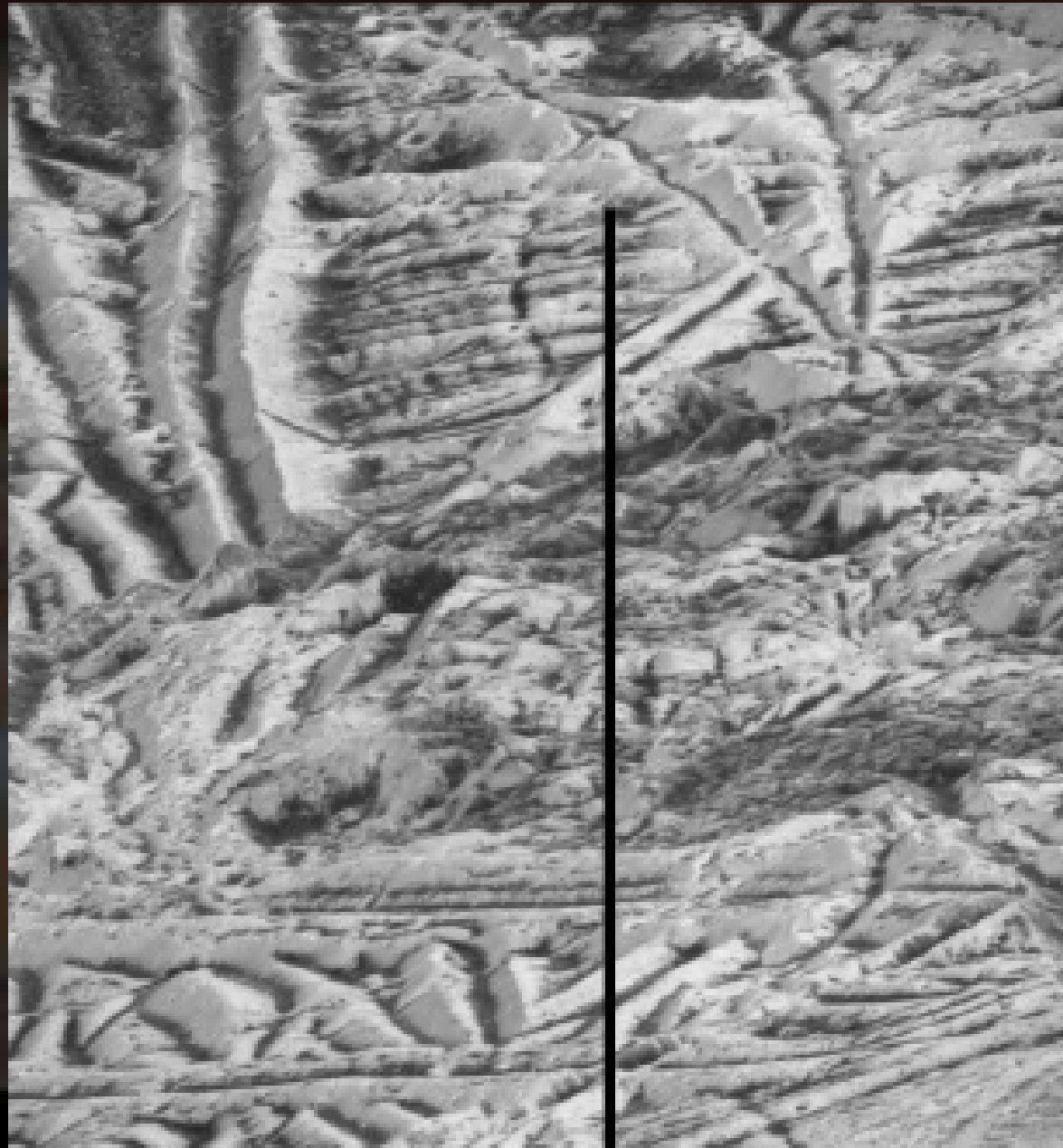


*Het joviaanse stelsel*



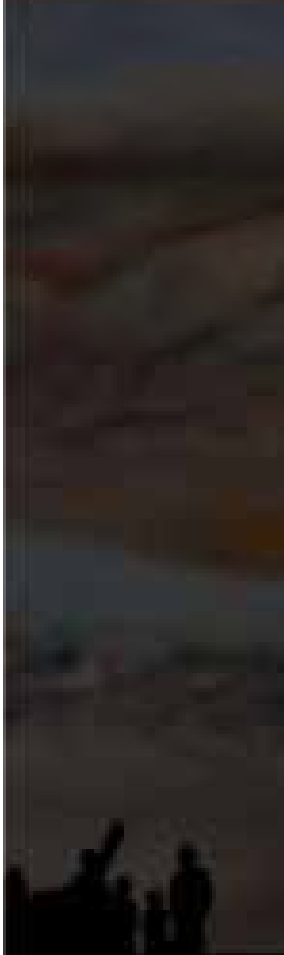
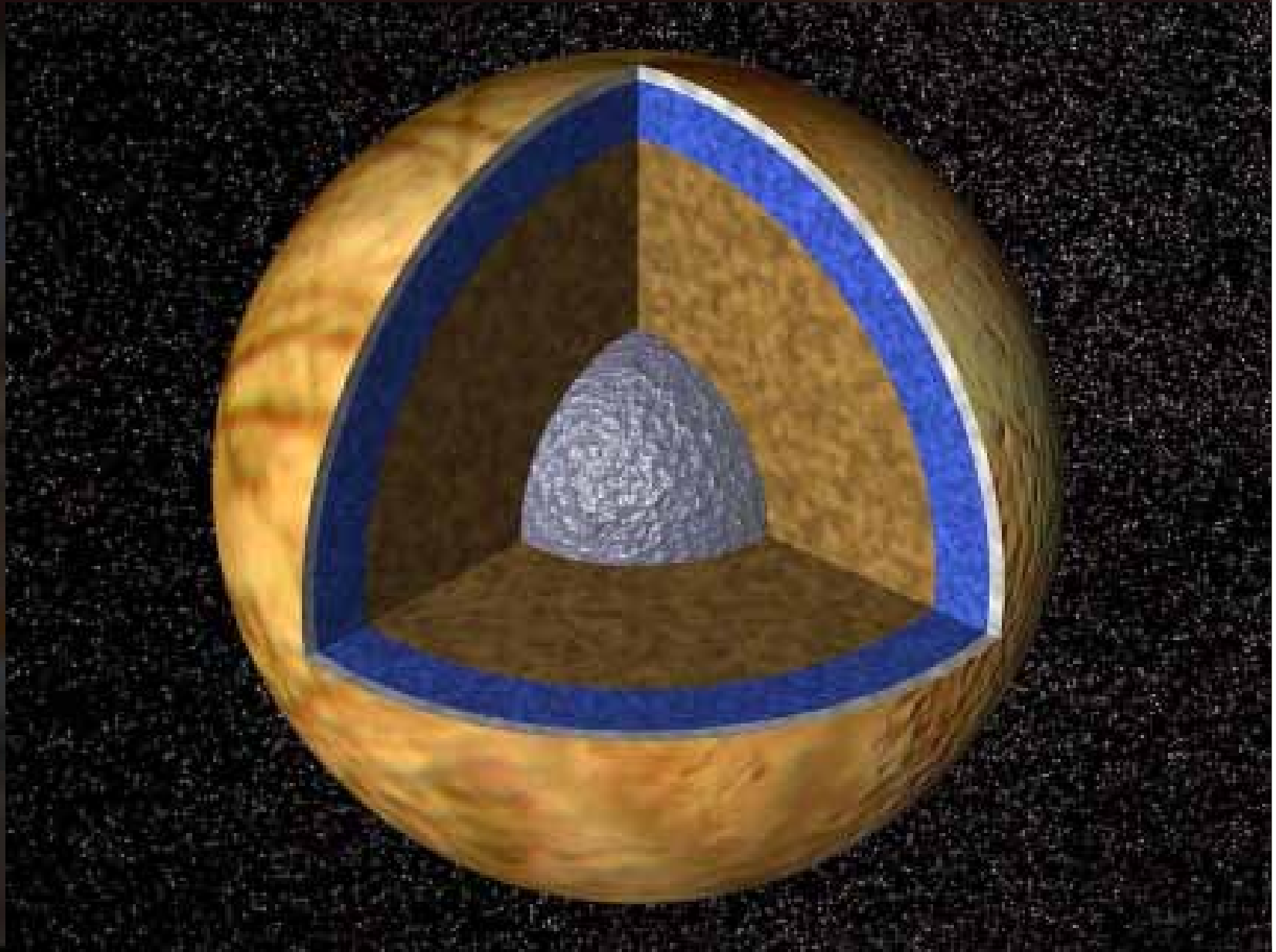
hoogste  
resolutie  
Galileo

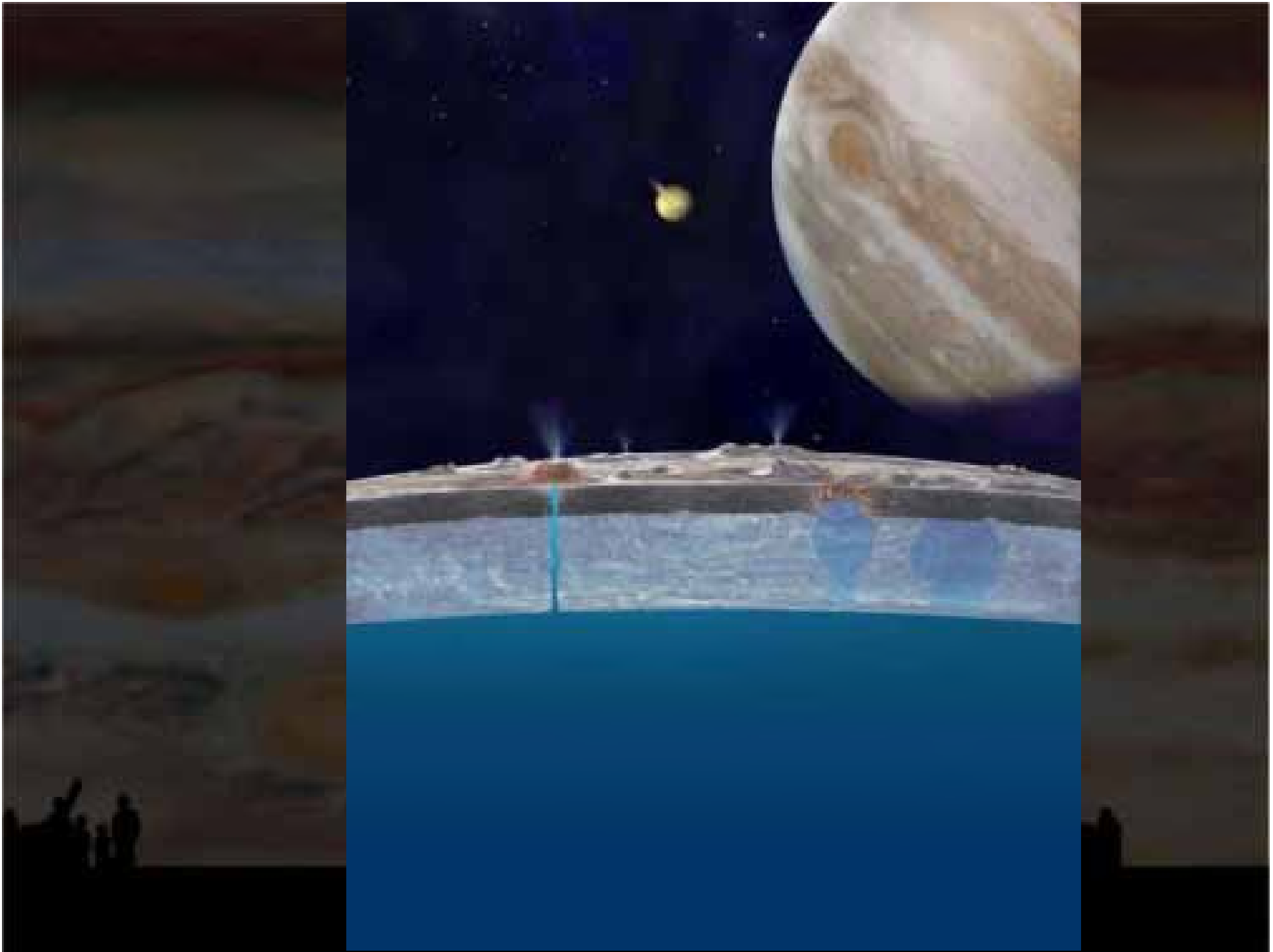
6m / pixel





*Het joviaanse stelsel*



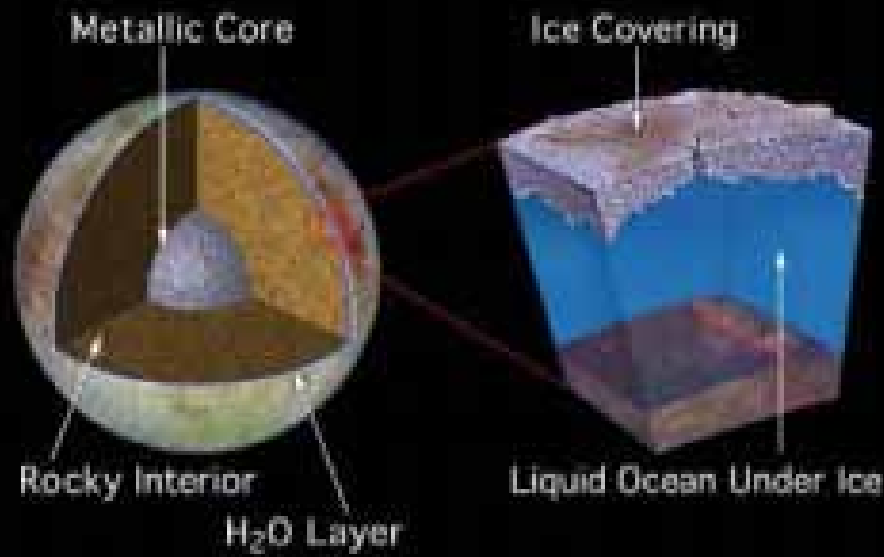


HST

waterdamp



*Het joviaanse stelsel*



# Ganymedes



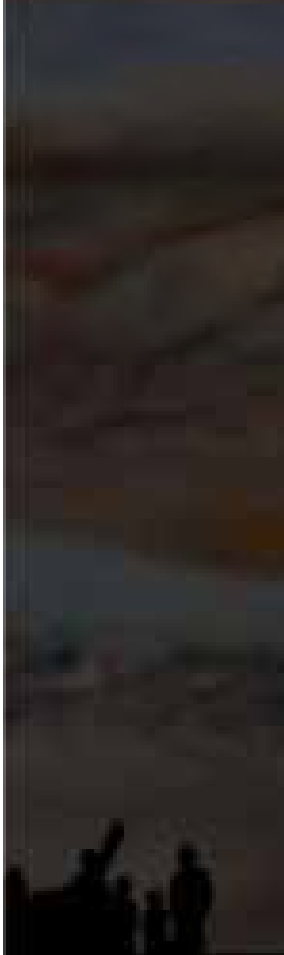
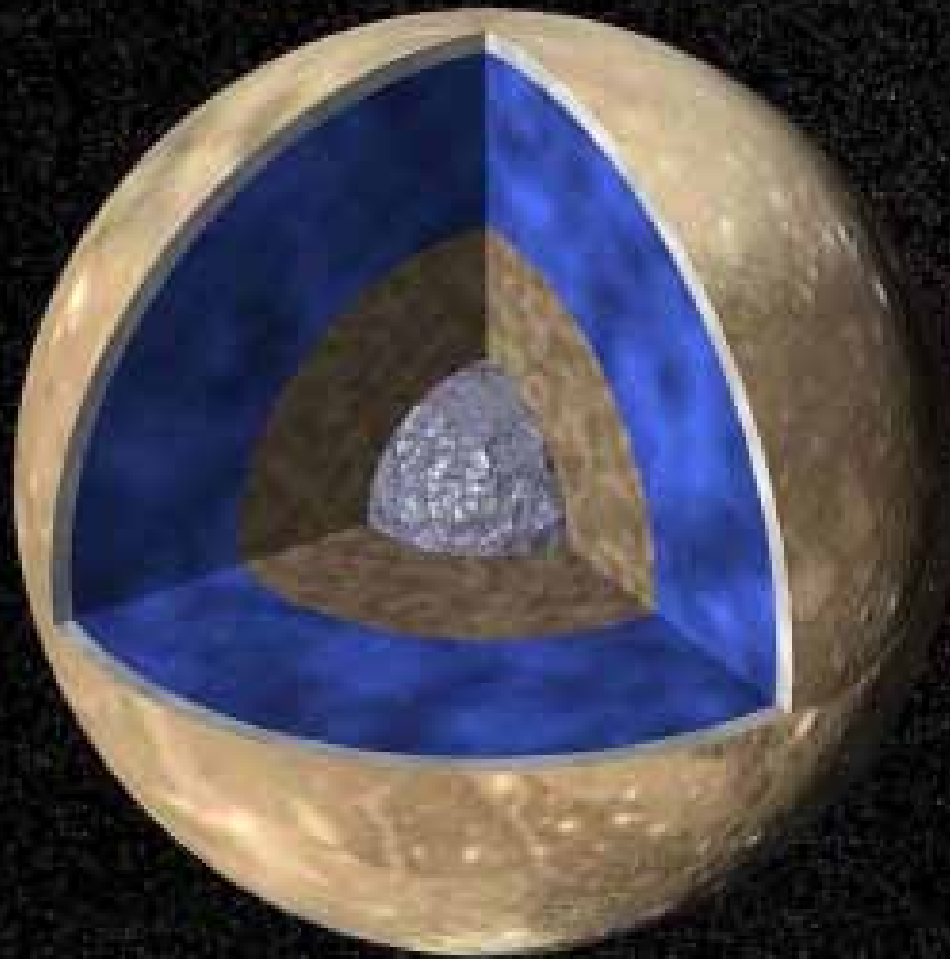


*Het joviaanse stelsel*

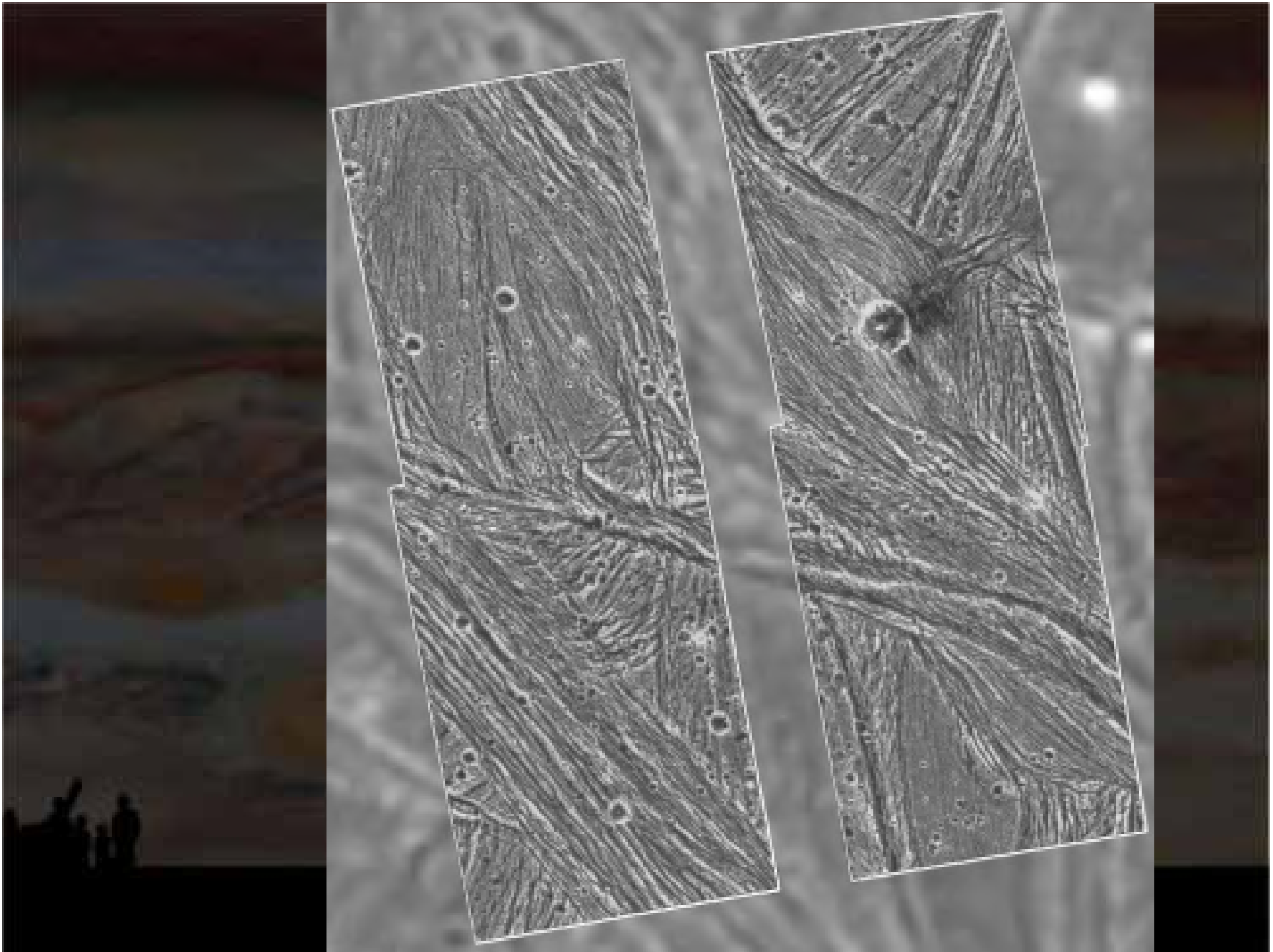


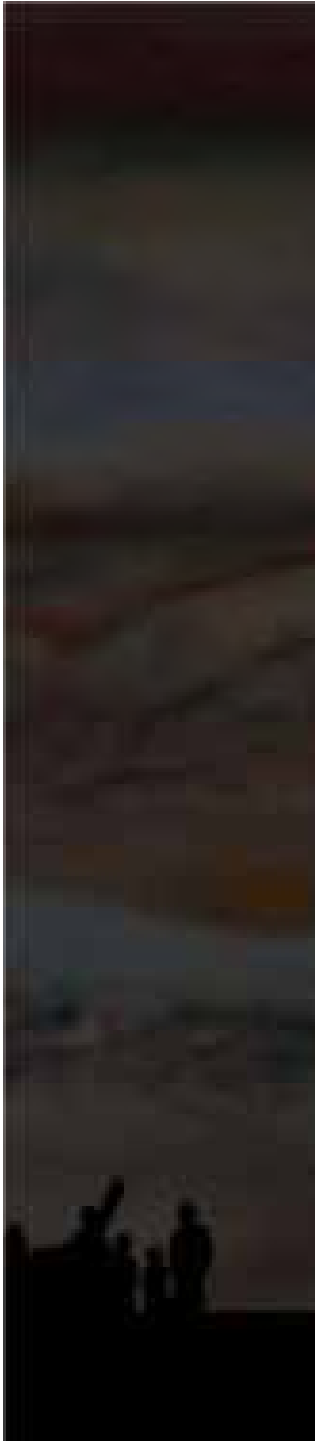
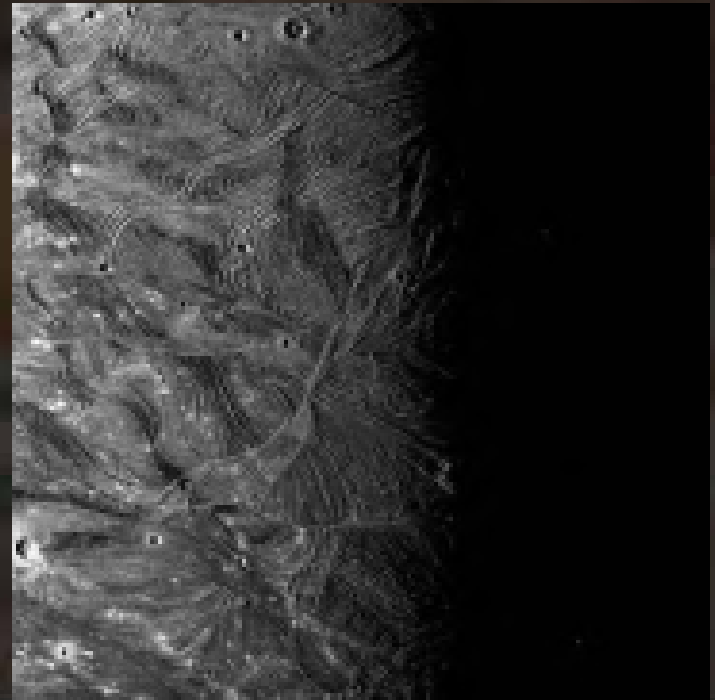
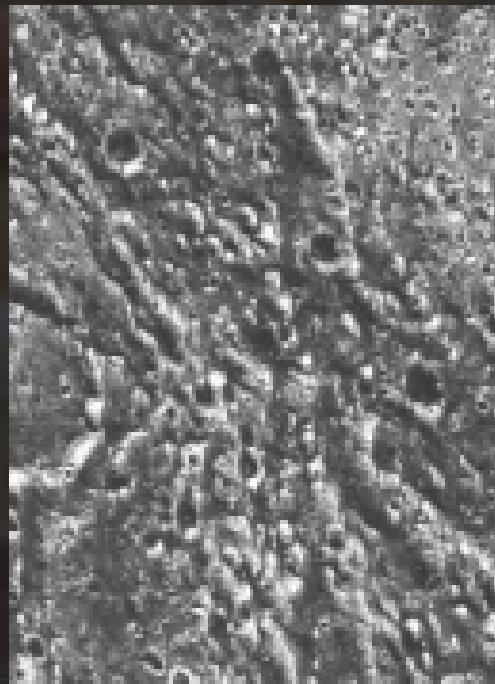
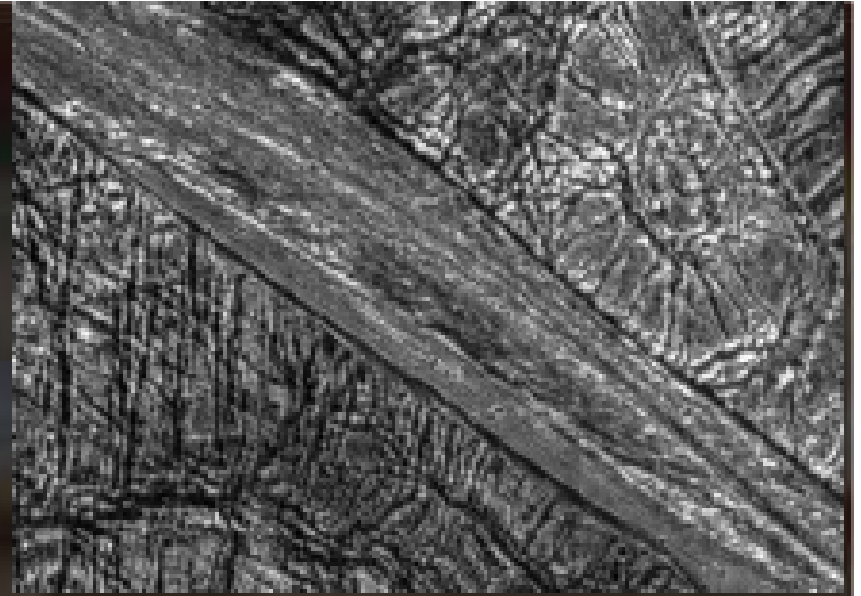
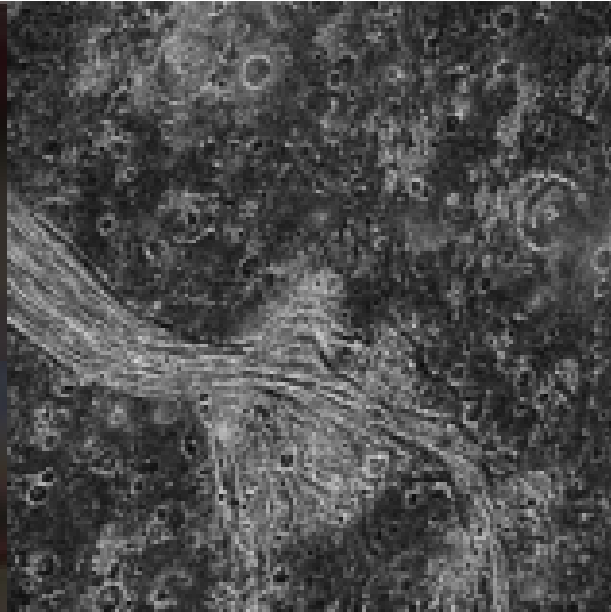
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*Het joviaanse stelsel*







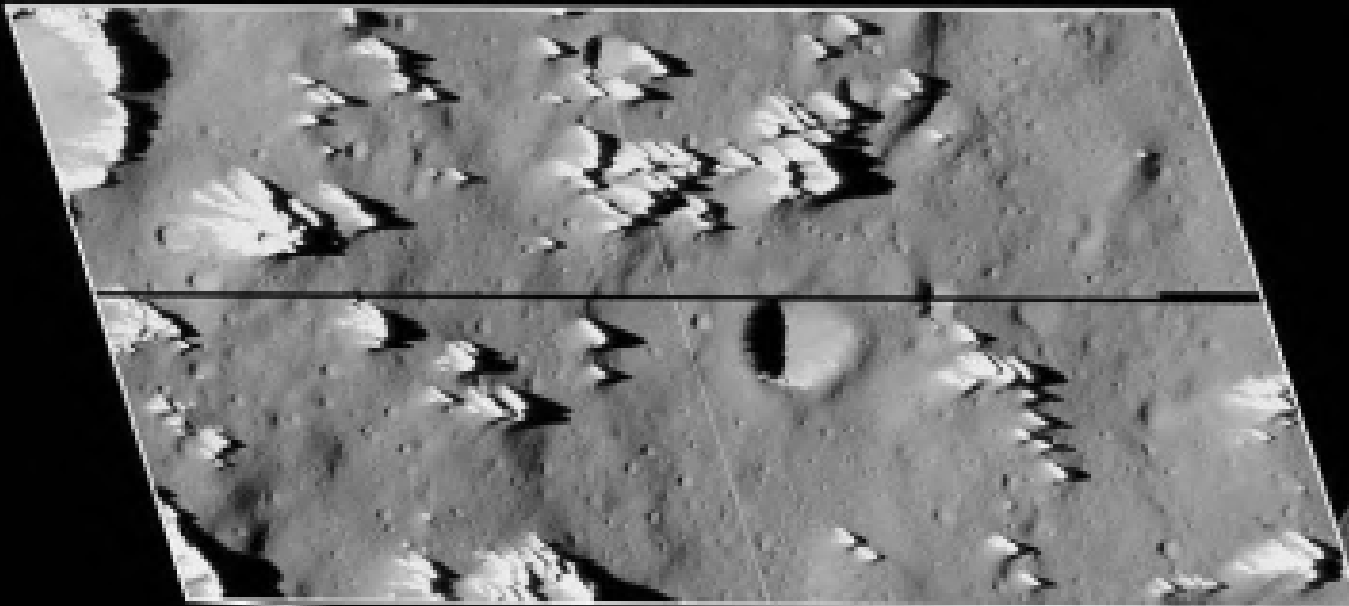
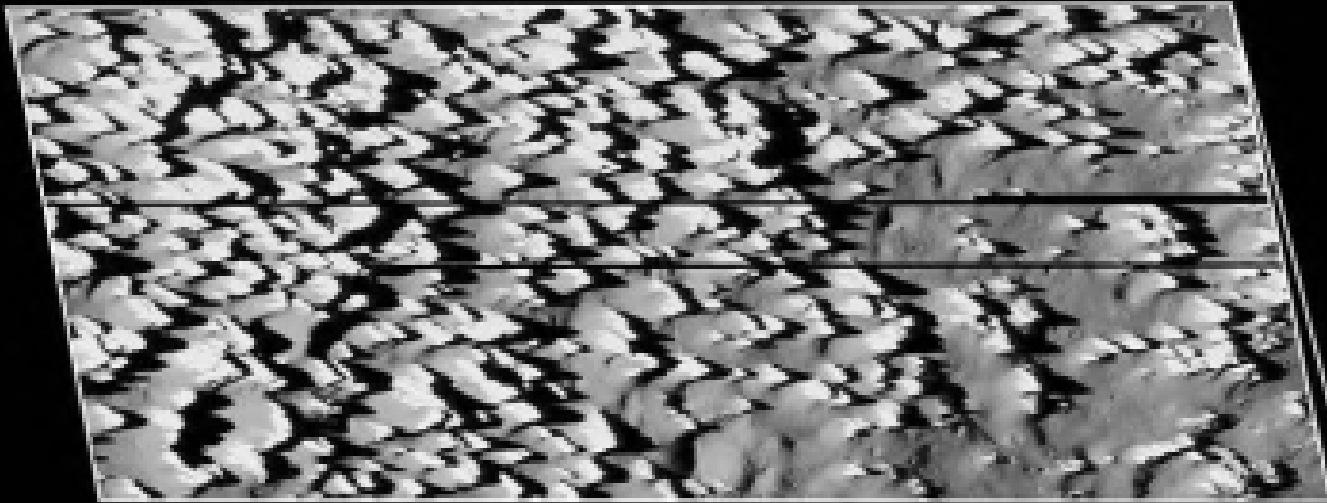


*Het joviaanse stelsel*

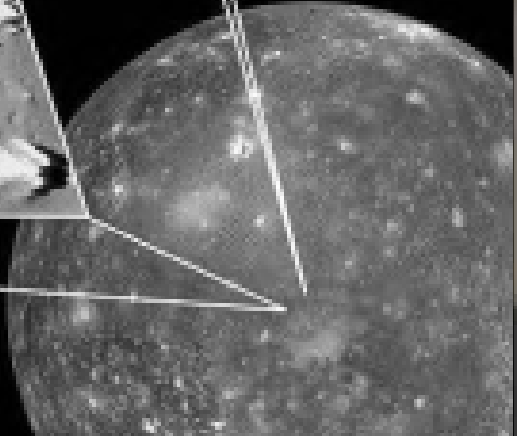


# Callisto

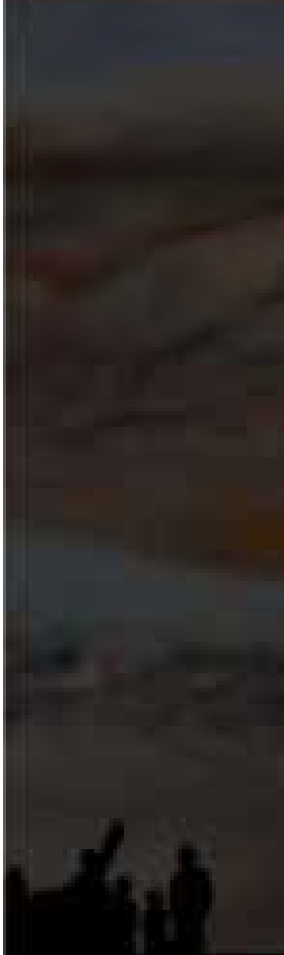
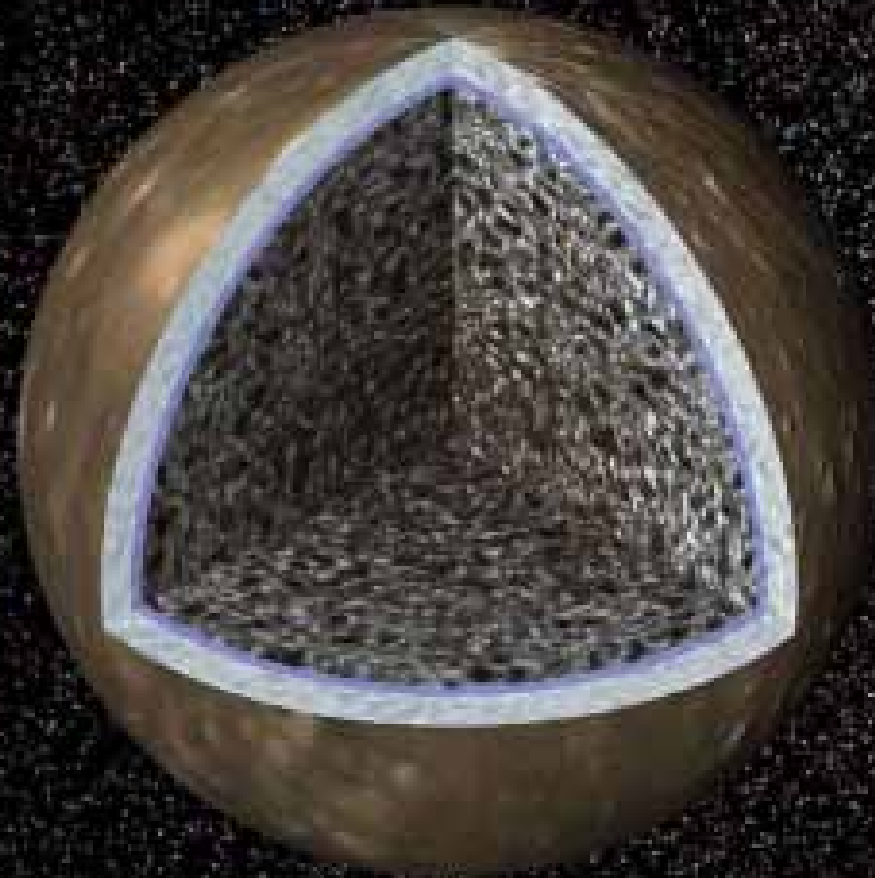




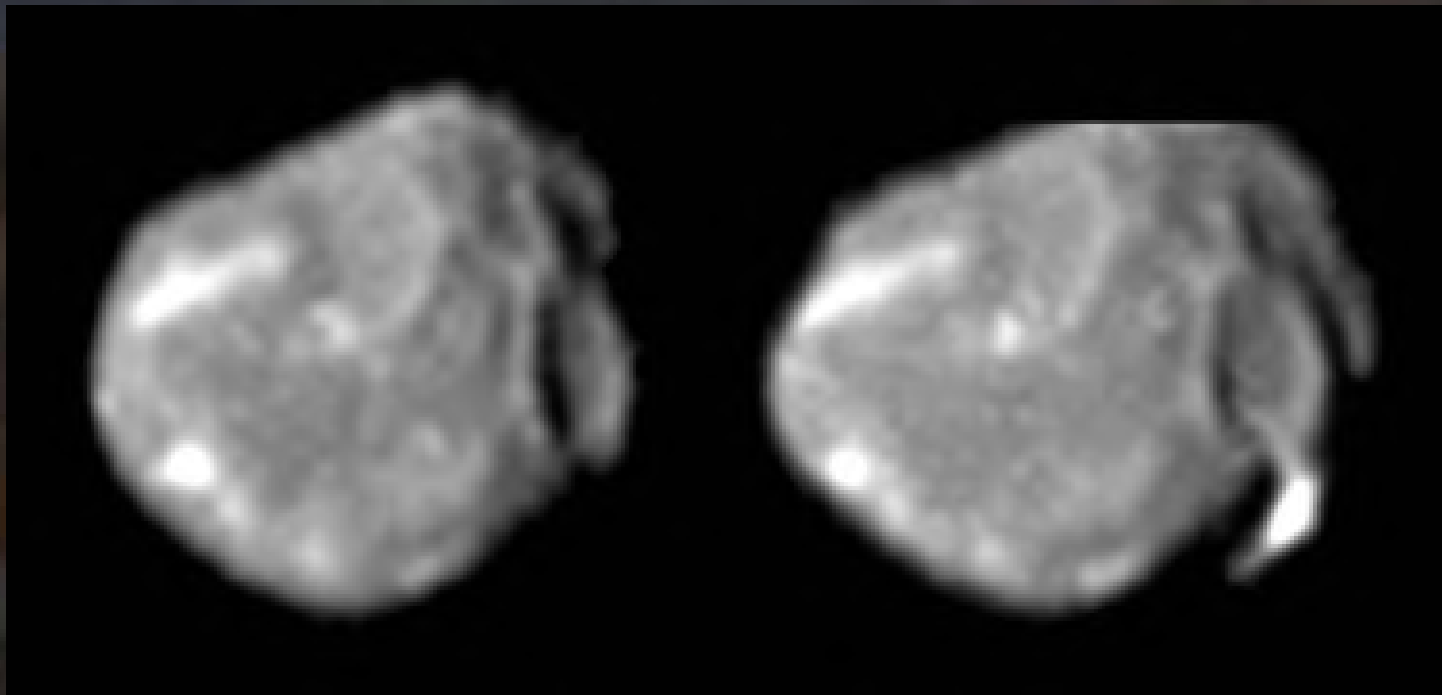
5 km



*Het joviaanse stelsel*



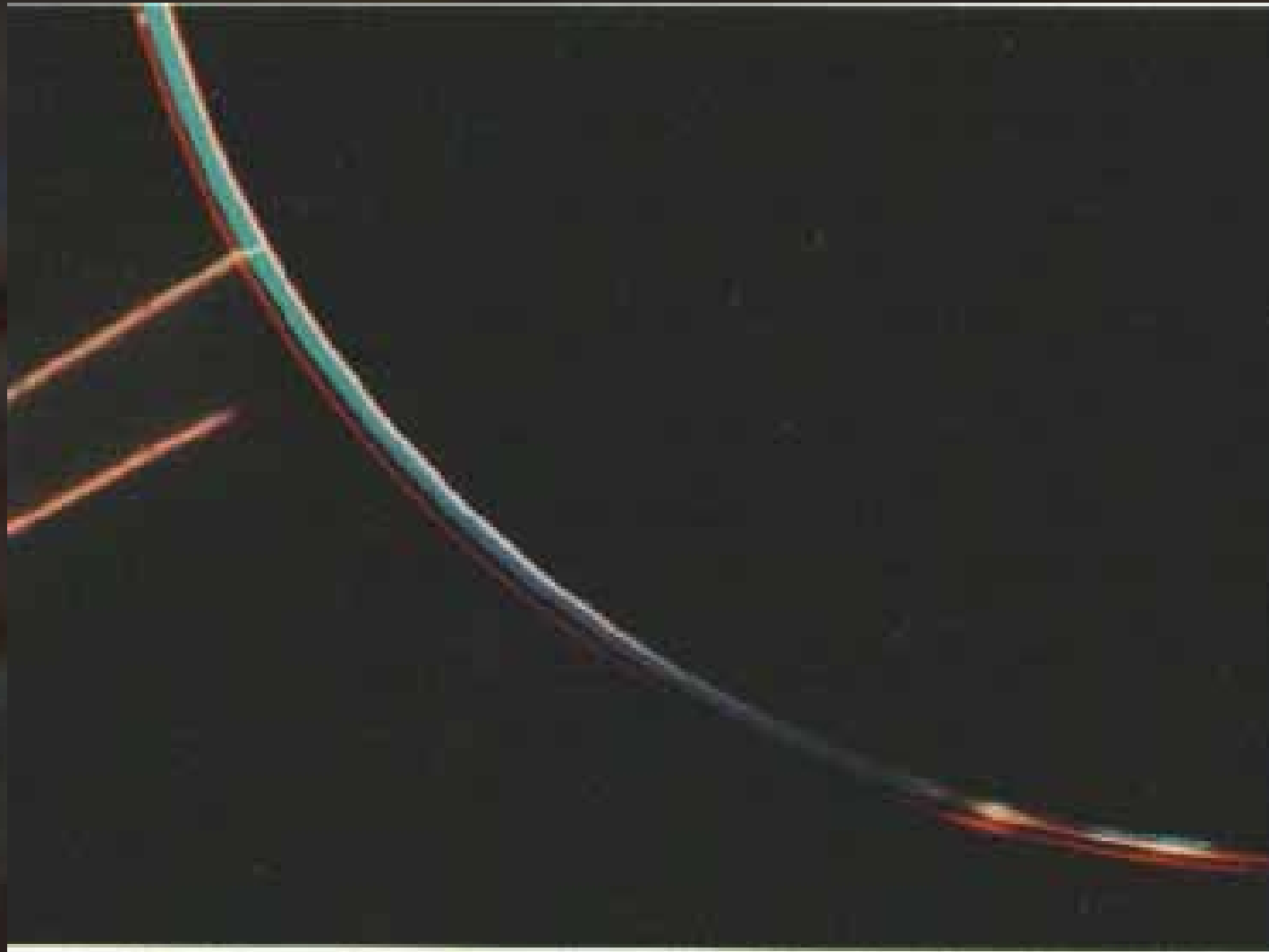
# Amalthea



84 km



# *Joviaans ringsysteem*

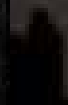




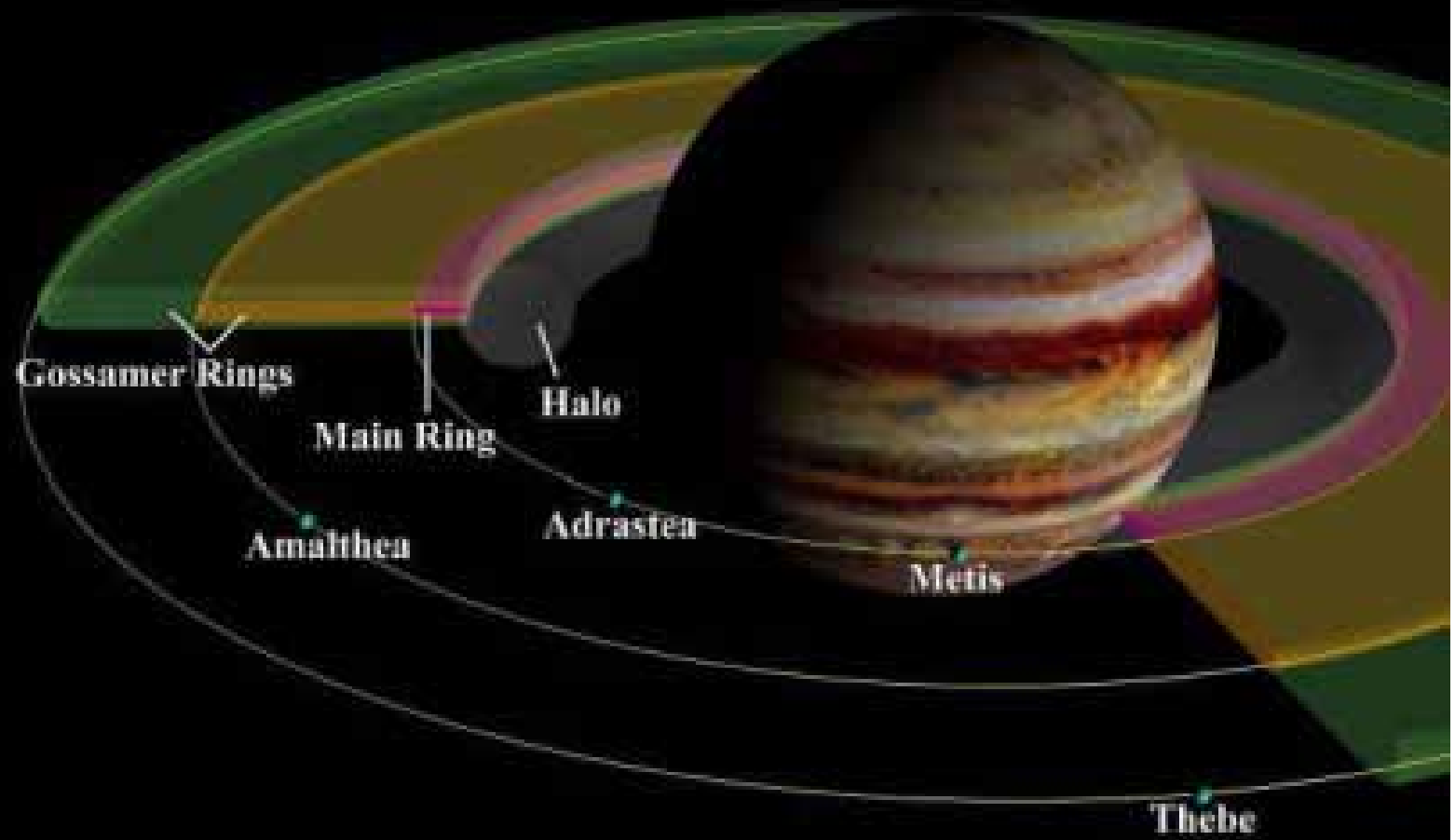
*Joviaans ringsysteem*



*Joviaans ringsysteem*



# Joviaans ringsysteem



*Toekomstige missies*

# Europa Clipper

NASA

Lancering 2025? Missie vanaf 2028?



# **JUICE** JUpiter ICy moons Explorer

ESA Lancering 2022? Missie vanaf 2029?

Vanaf 2033 in baan om Ganymedes



