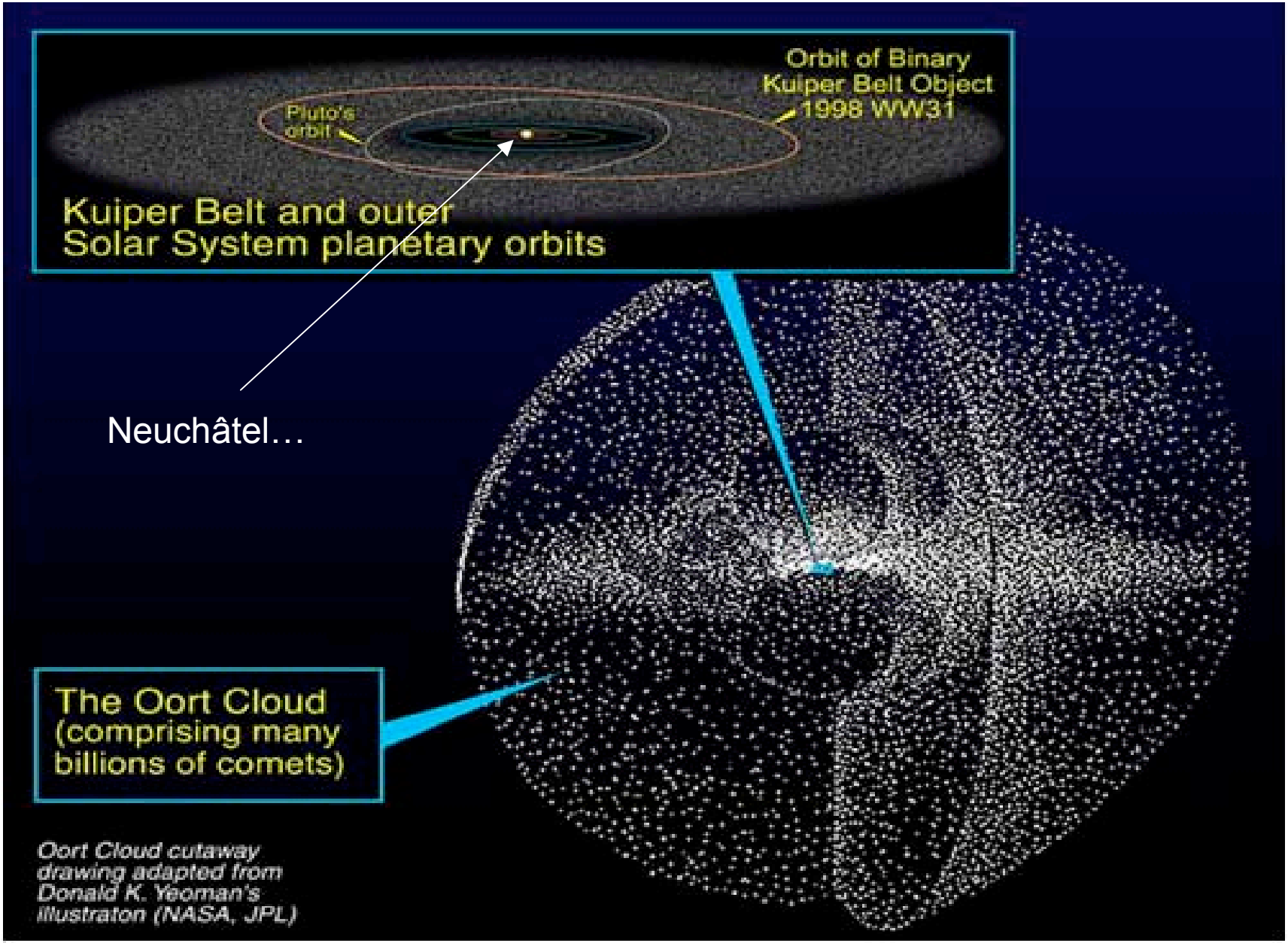
Quoi de neuf dans le système solaire?

16 juin 06 P.Debergh

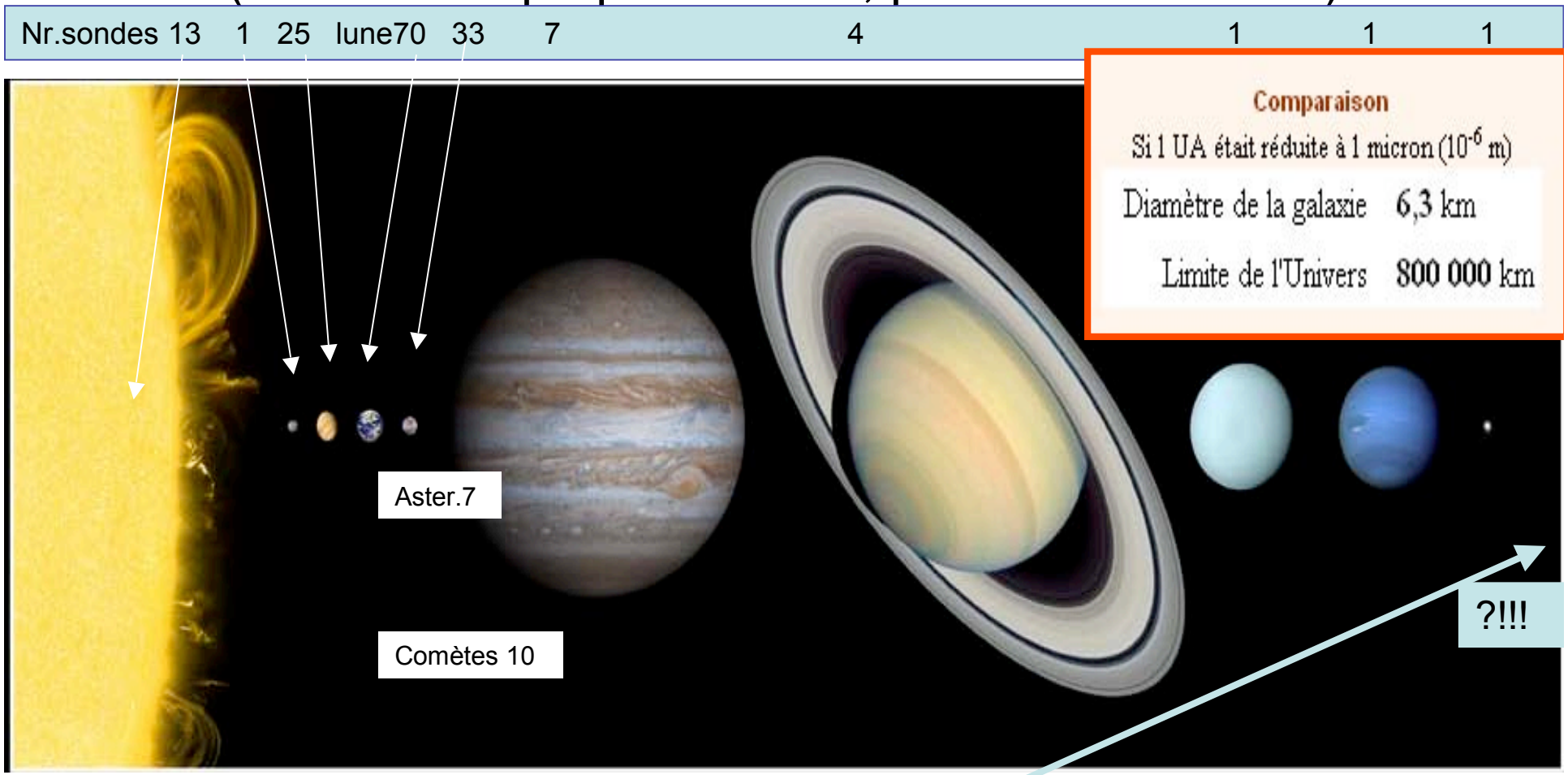
- Des Volcanoides a Mars
- De Mars, par les astéroides, à Jupiter
- De Saturne a Pluton
- De Pluton aux comètes
- Des comètes aux bords du système solaire

La structure de base du système solaire:



Visites et dimension de notre système solaire

(dimensions proportionelles, pas leur distances!)



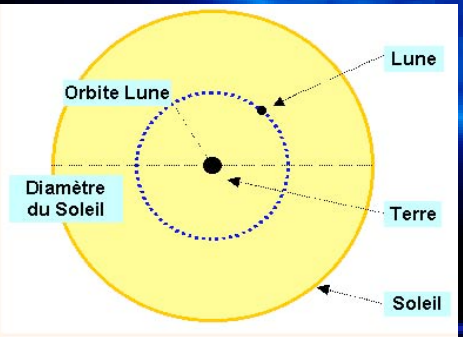
La IAU n'a toujours pas une définition unique du mot « planète » !!
= Il Y A DU NEUF dans les parages!!

Quoi de neuf au soleil?

Vol.=1.3 millions de Terres

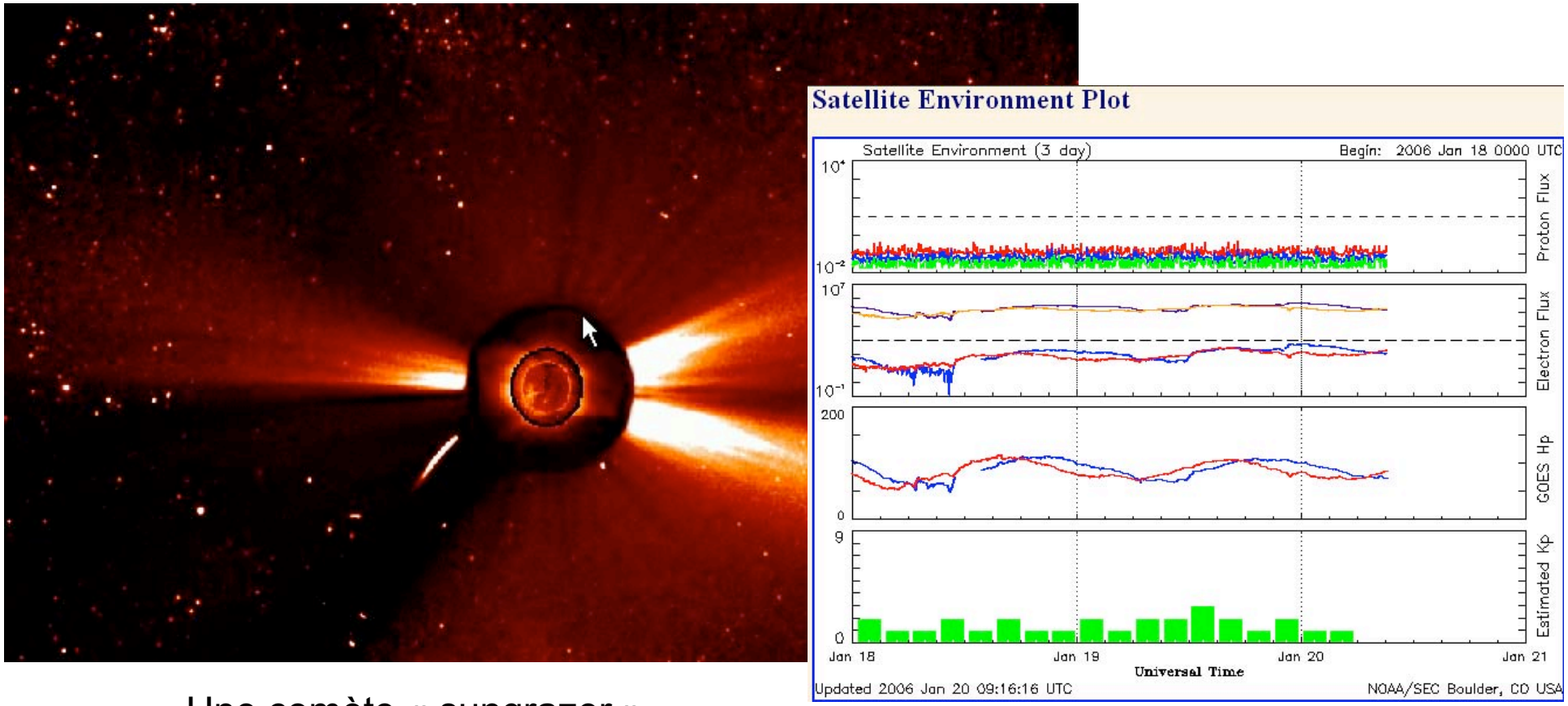
Diamètre	1 392 530 000 m
	1 392 530 km
	108 fois celui de la Terre 4 secondes-lumière

Si on plaçait le Soleil à la place de la Terre, il occuperait **deux fois** l'orbite de la Lune autour de la Terre.

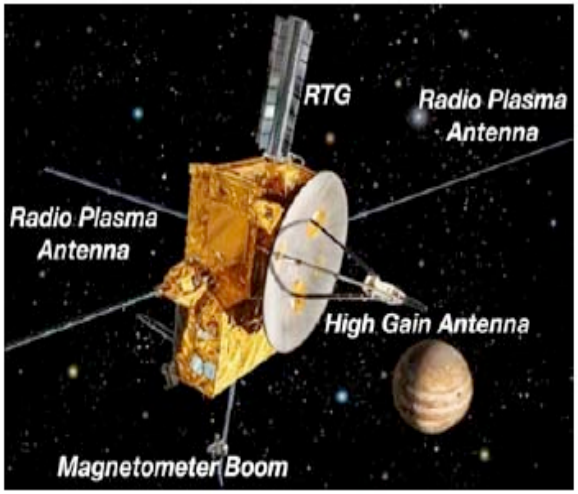


Accès en direct (!) sur le web des données des sondes spatiales, exemple:

- Solar Heliospheric Observatory (SOHO)



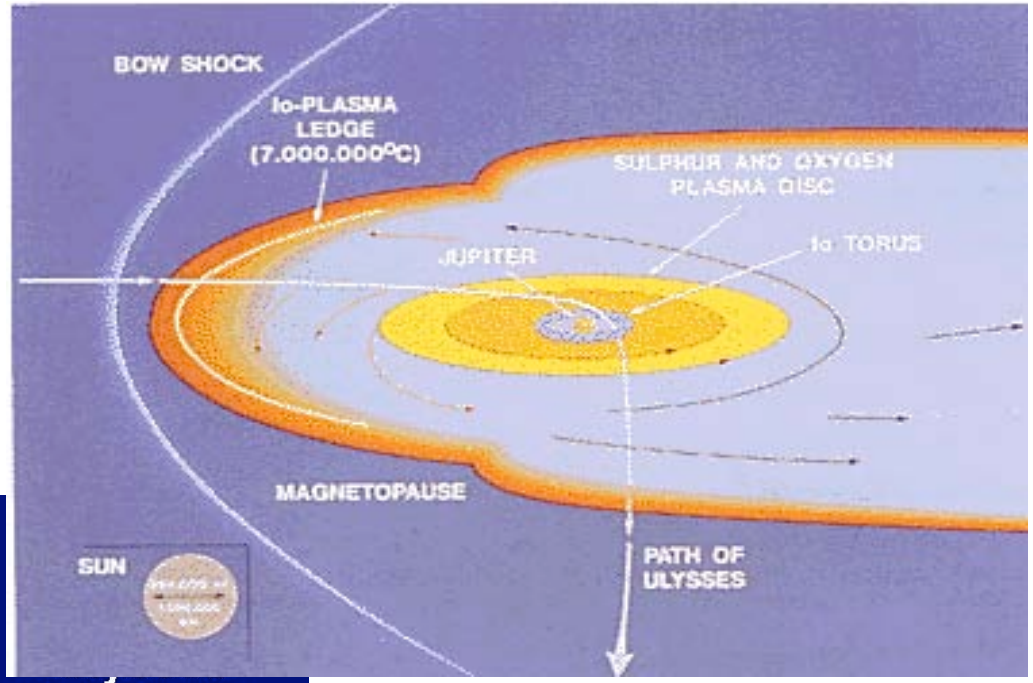
Une comète « sungrazer », englouti par le soleil

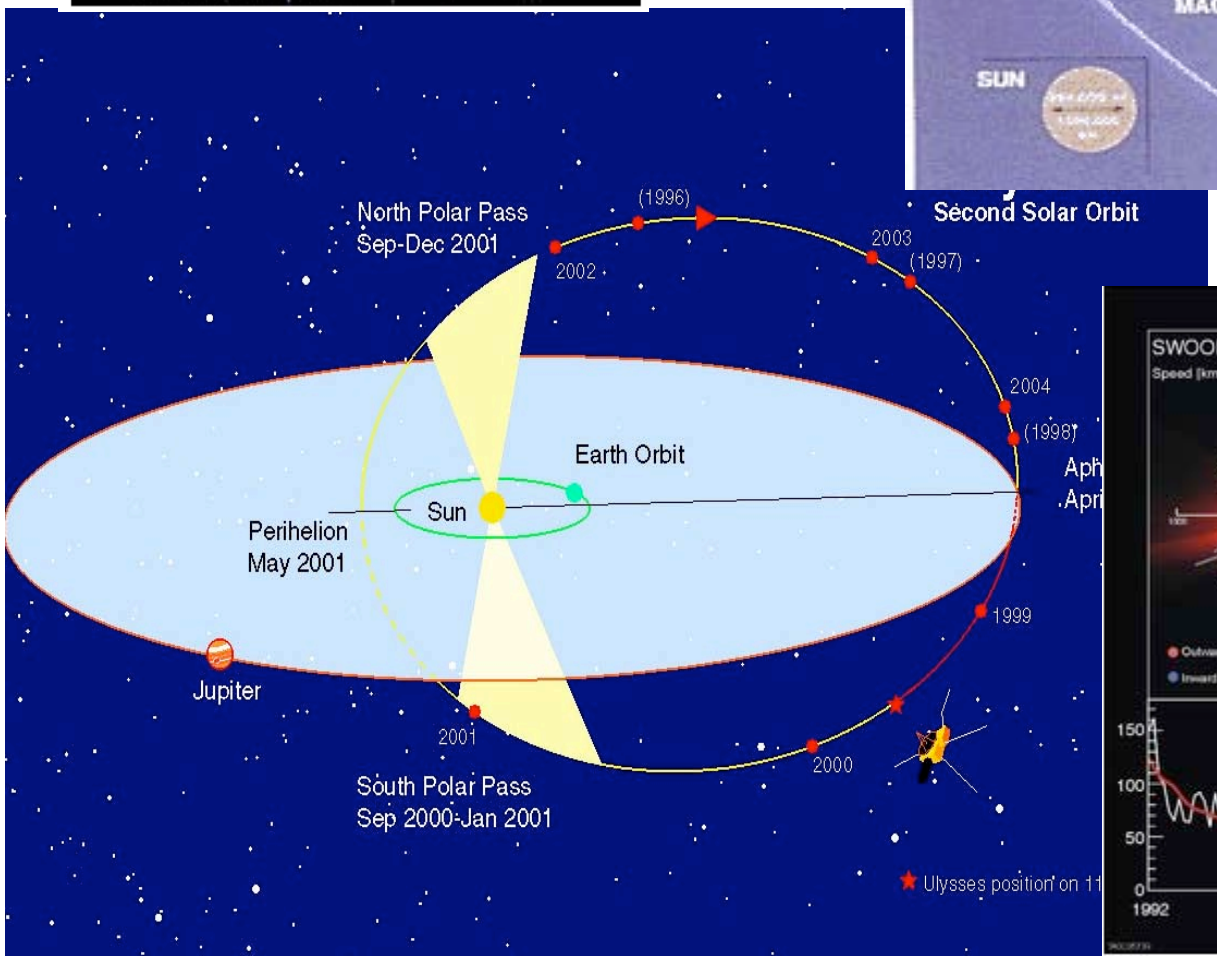


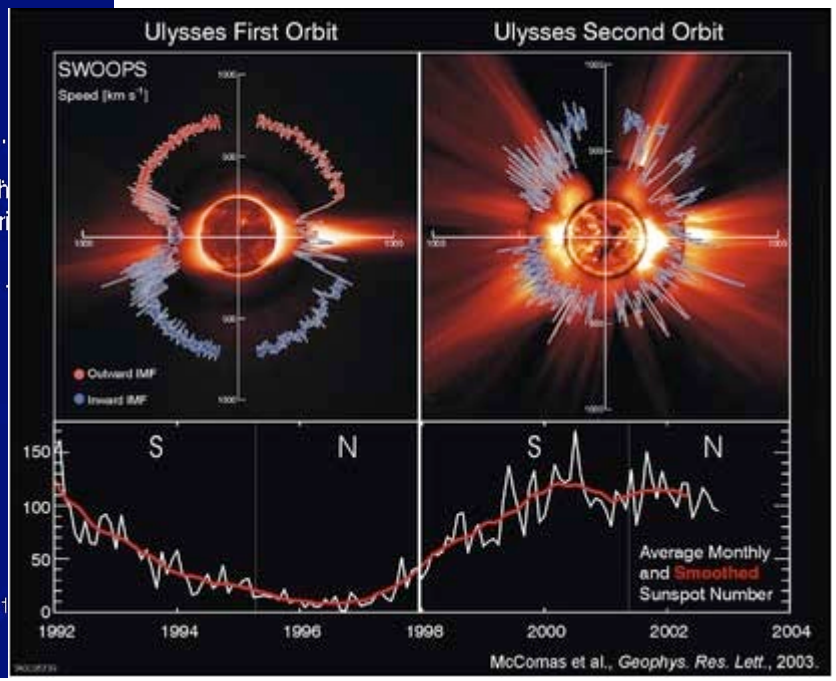
Ulysses

Nasa/JPL/ESA

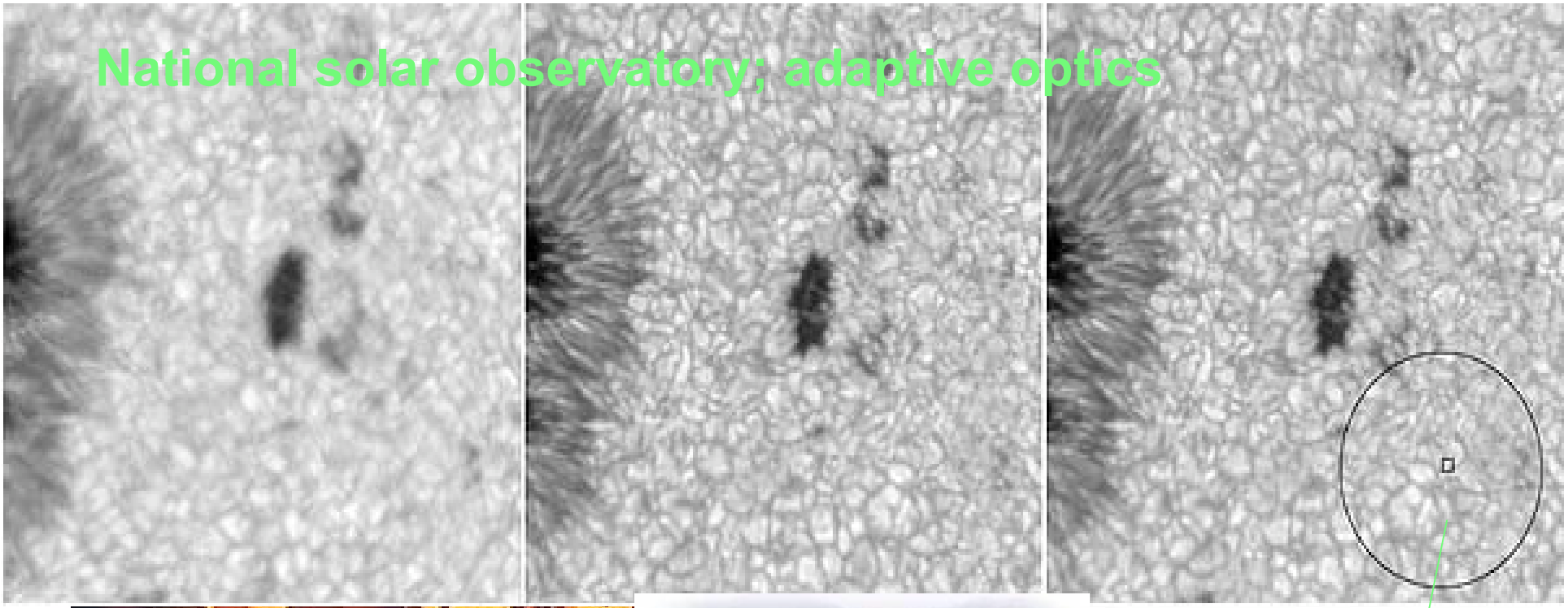
Continuera à 2008

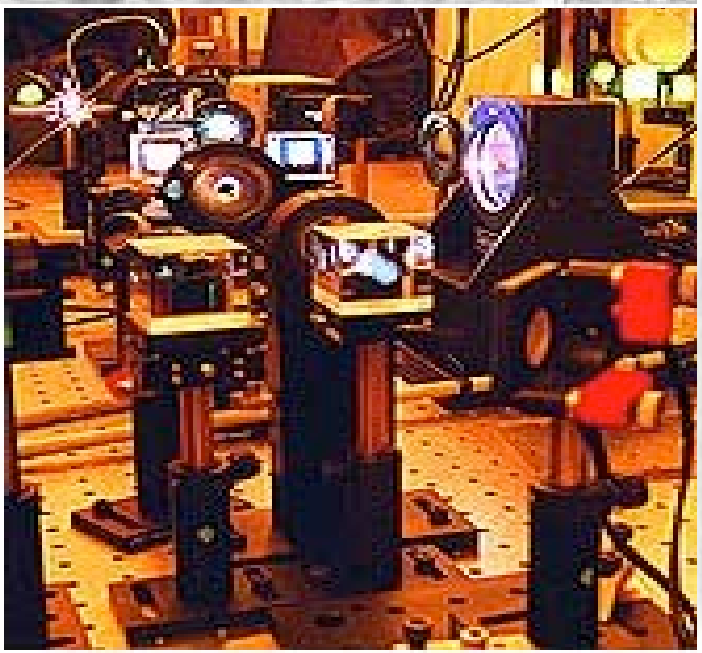


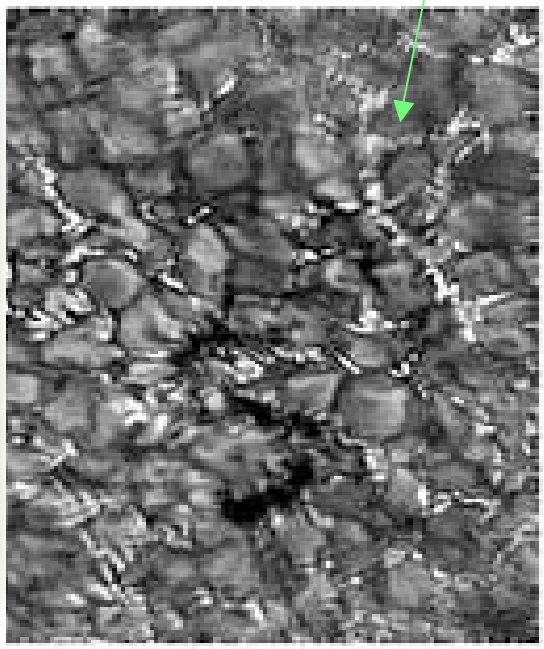


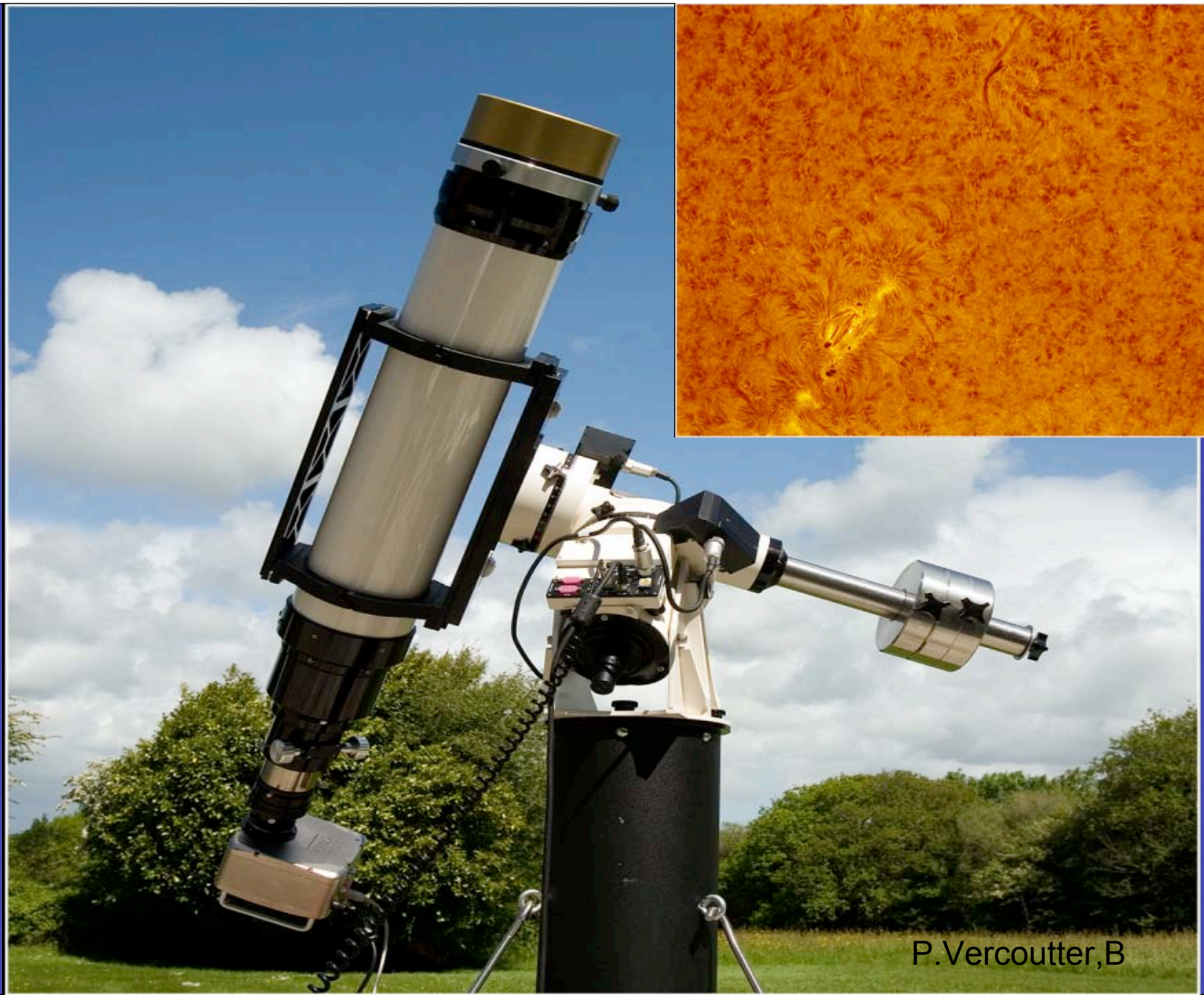


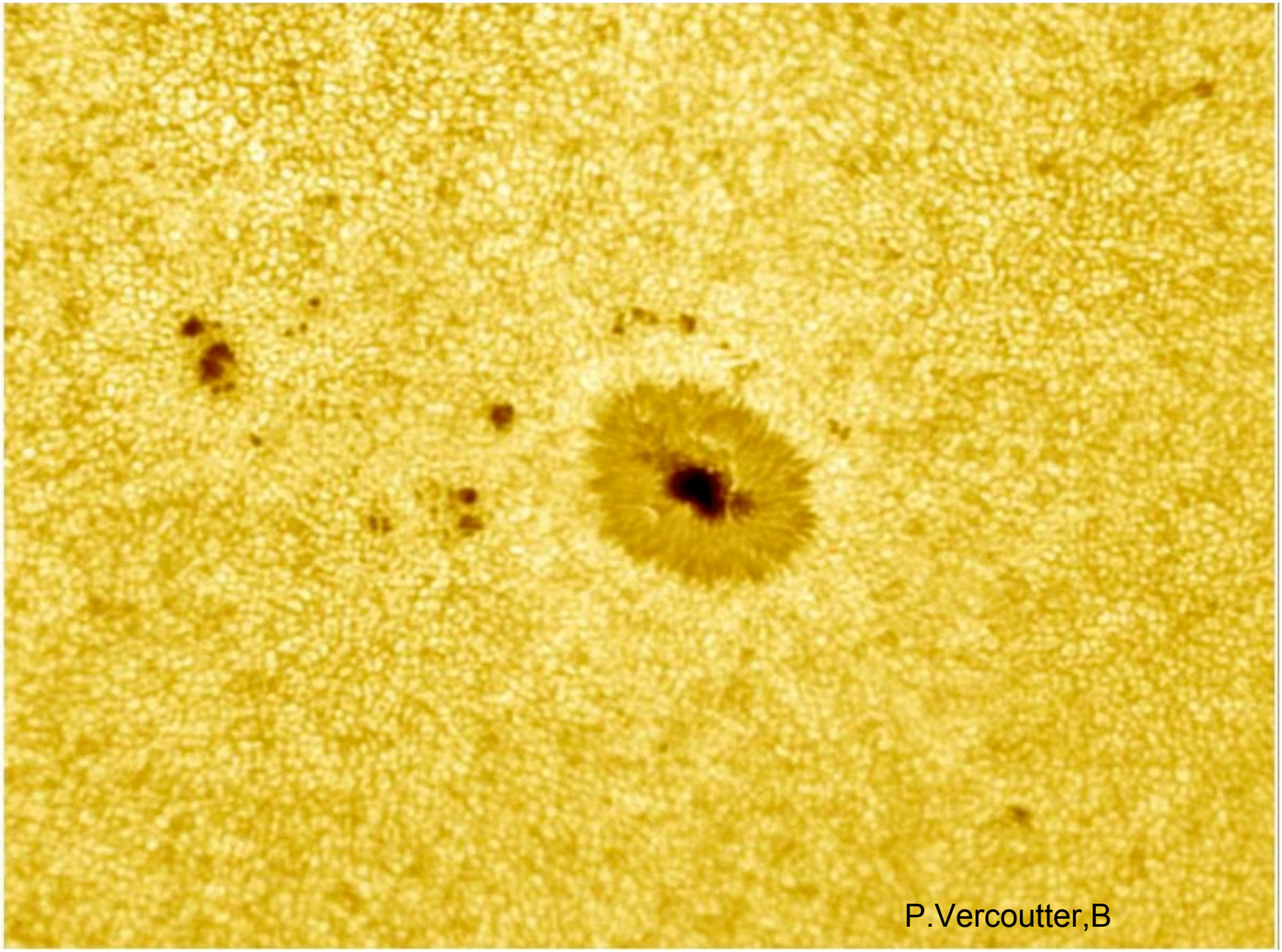
National solar observatory; adaptive optics

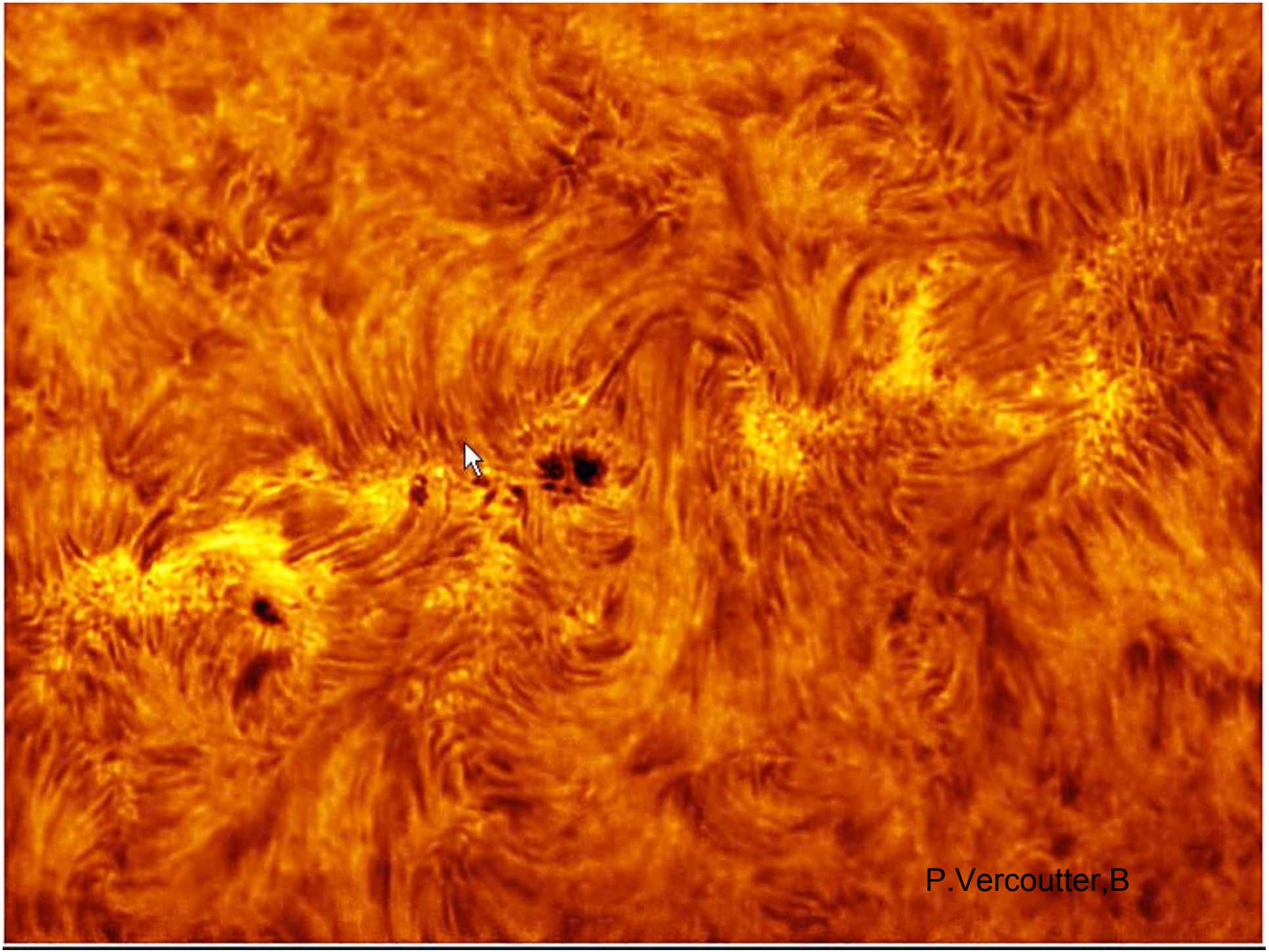


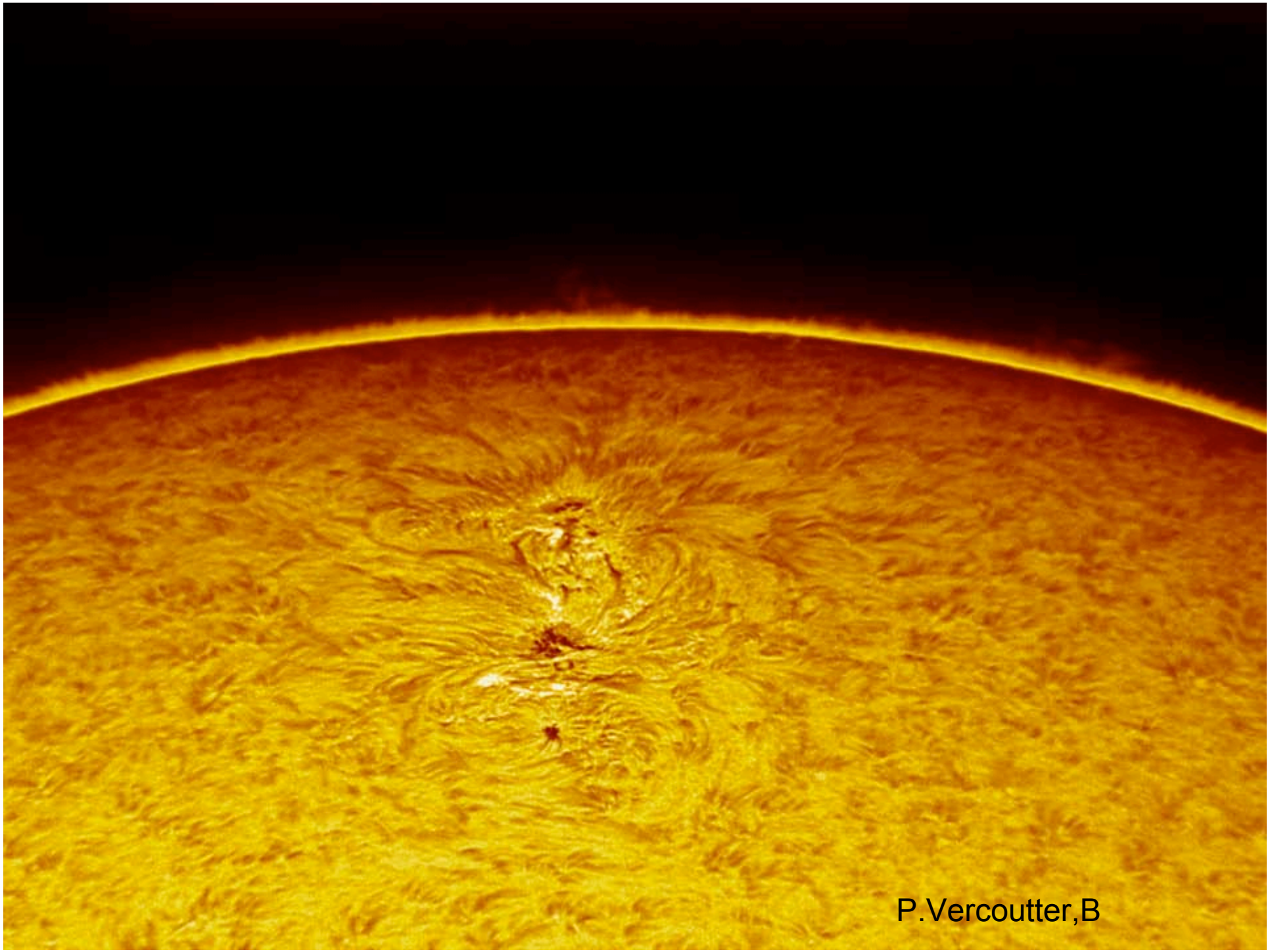





P.Vercoutter,B

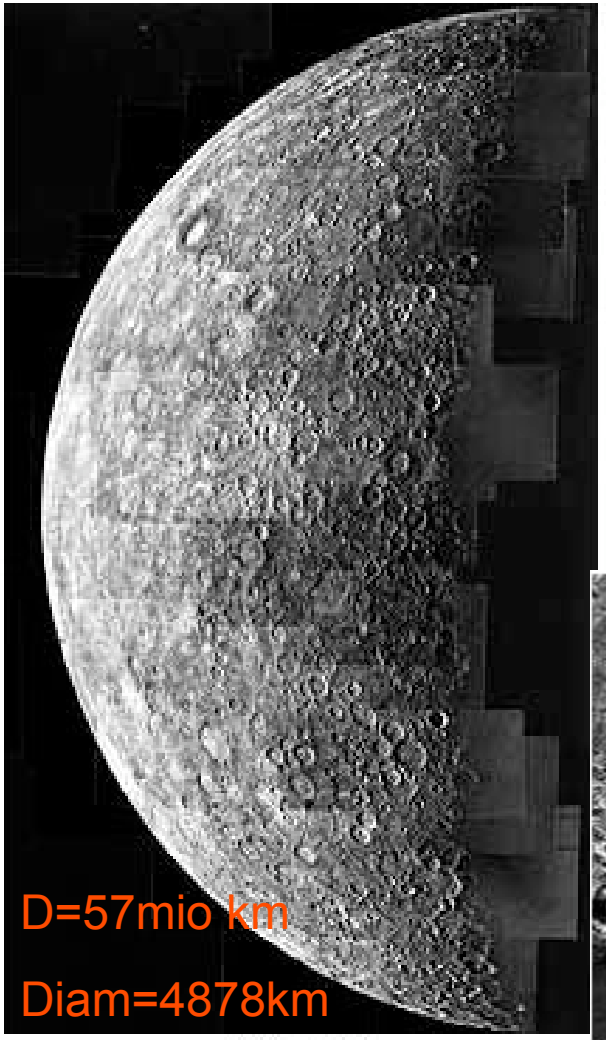

P.Vercoutter,B


P.Vercoutter,B


P.Vercoutter,B

Lumière zodiacale dû au disque de poussière

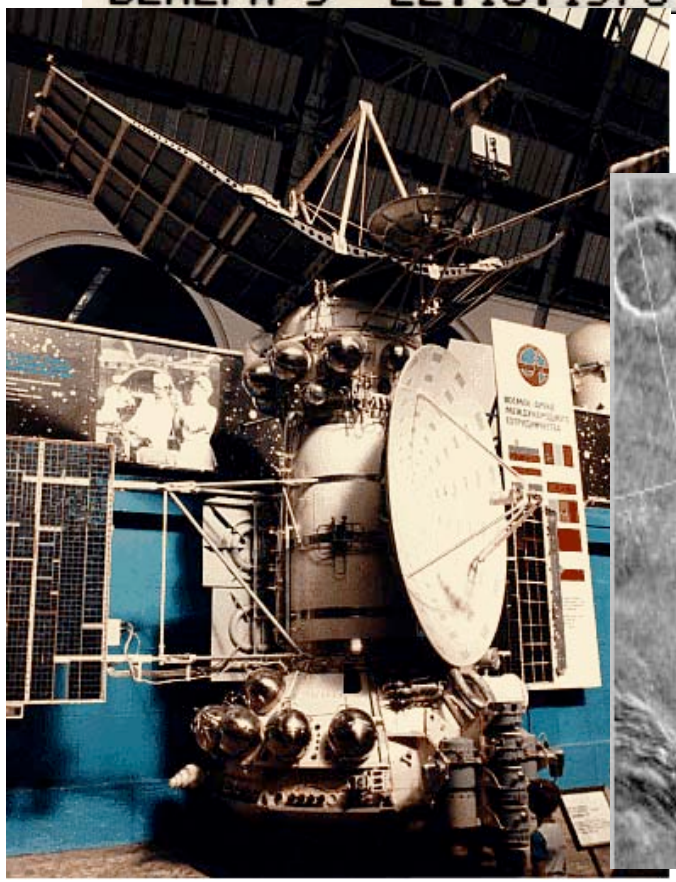
Mercure:toujours pas trouvé de vulcanoides (=planètes ou astéroides entre le soleil et mercure)



© NASA

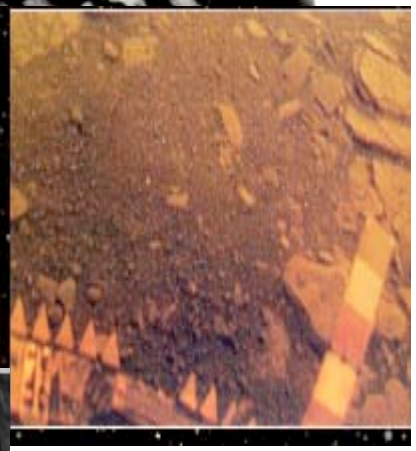
La planète Mercure vue par la sonde Mariner 10.

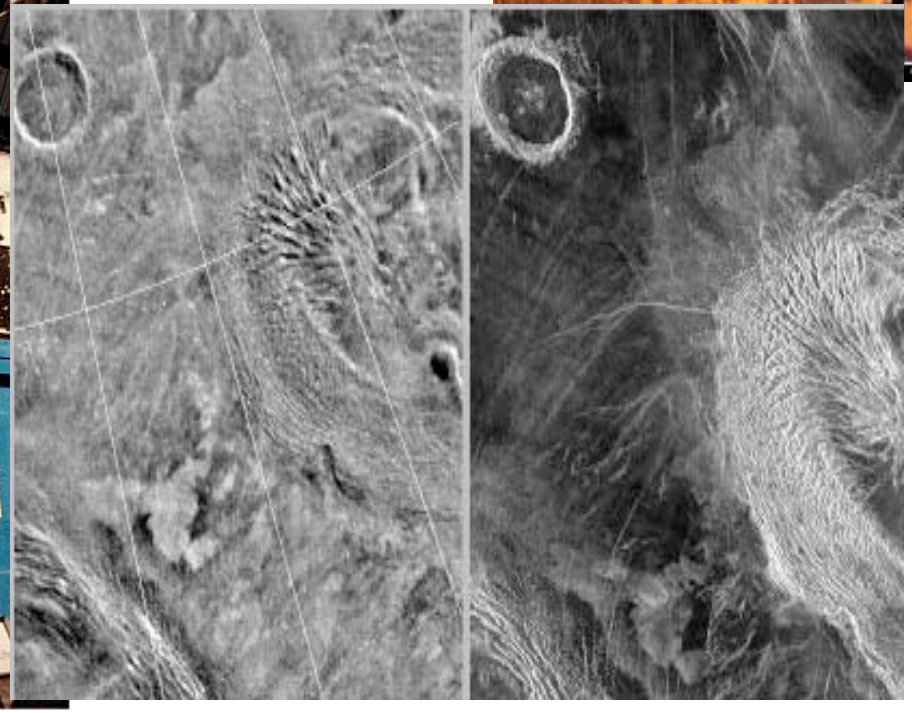
Venus, « étoile du matin et du soir »



D=108 mio km

Diam=12100km

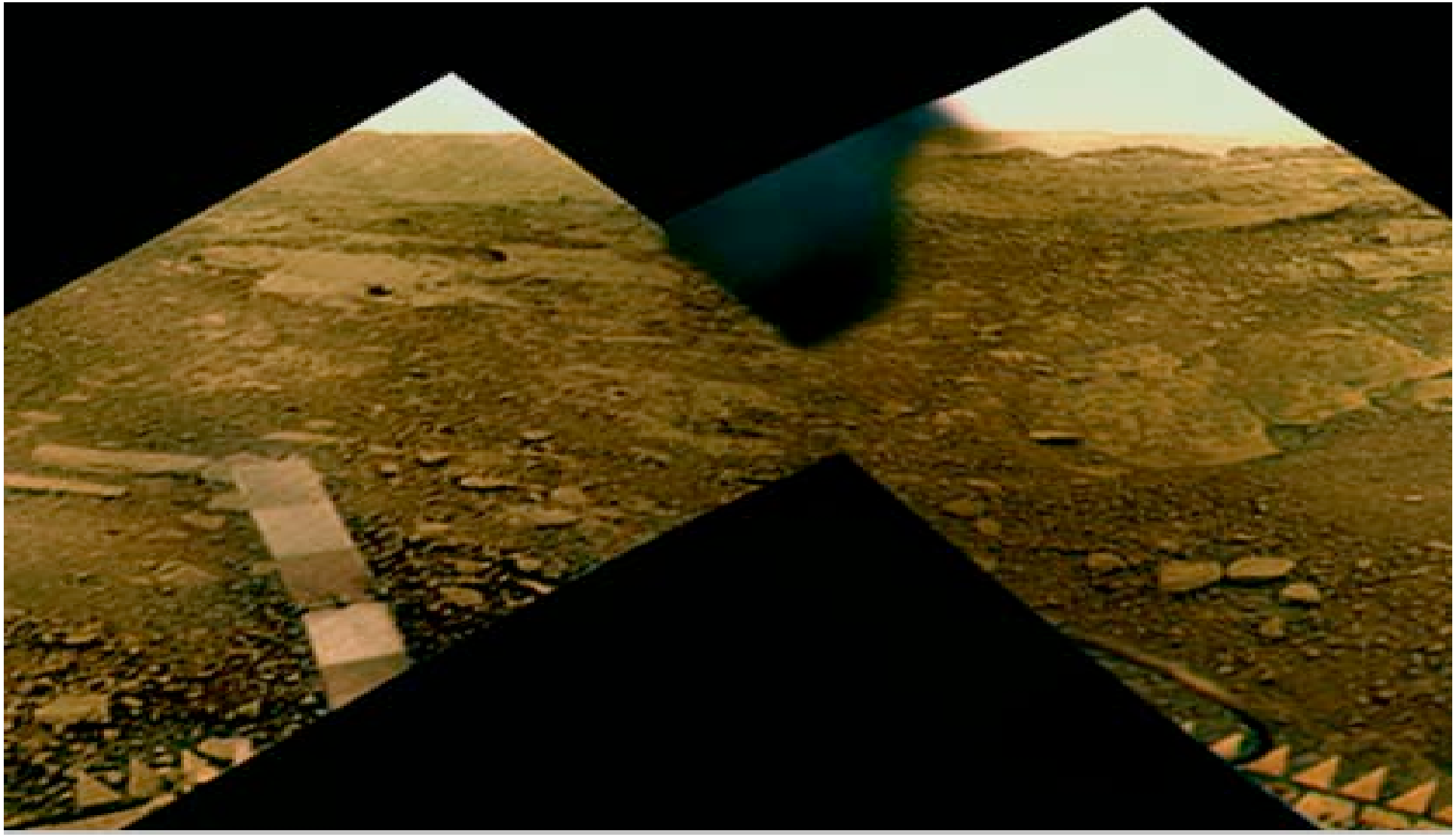




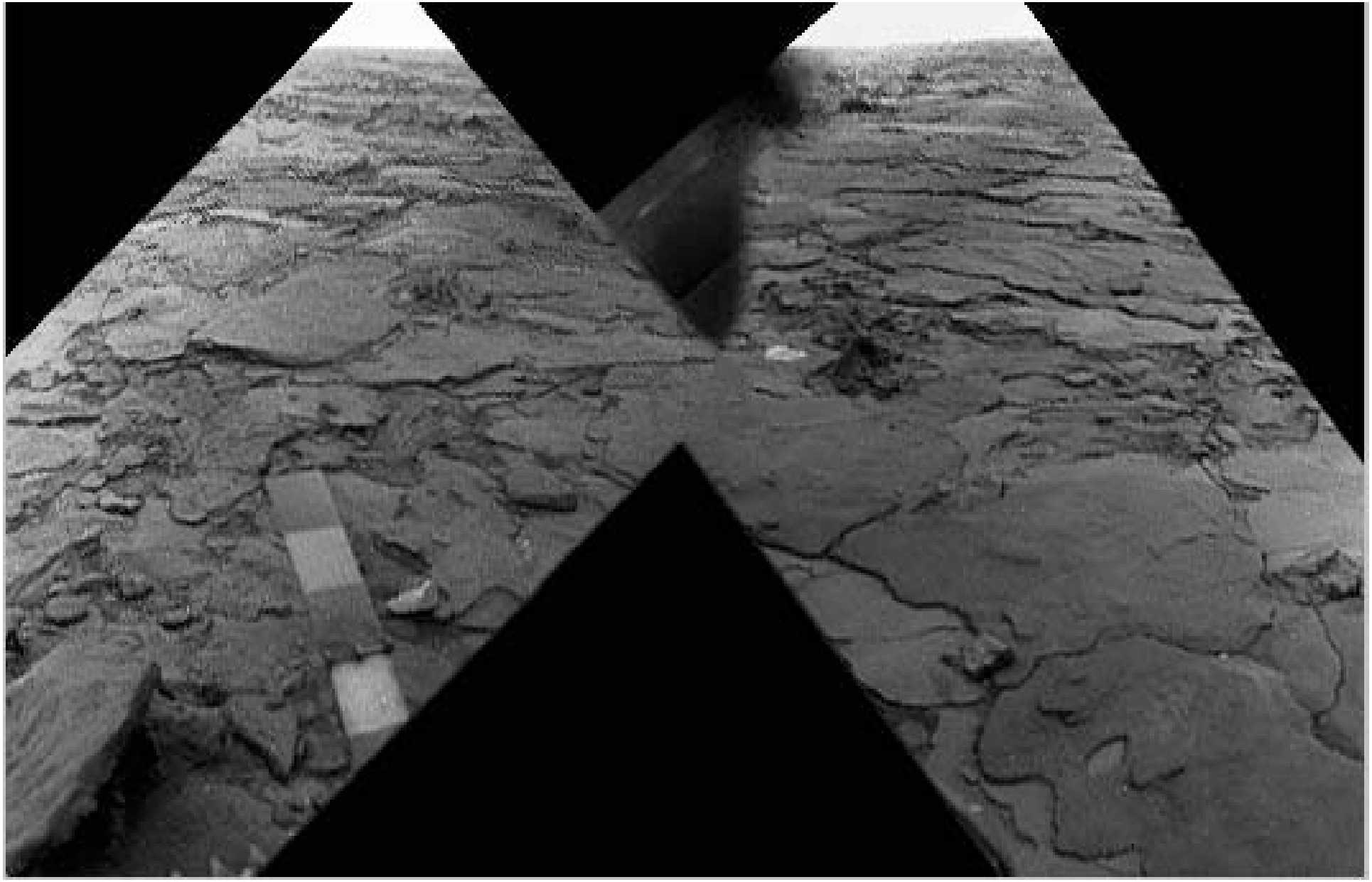
Sondes :

Pioneer Venus(78), Venera15,16(83, 84) et Magellan(90-94)

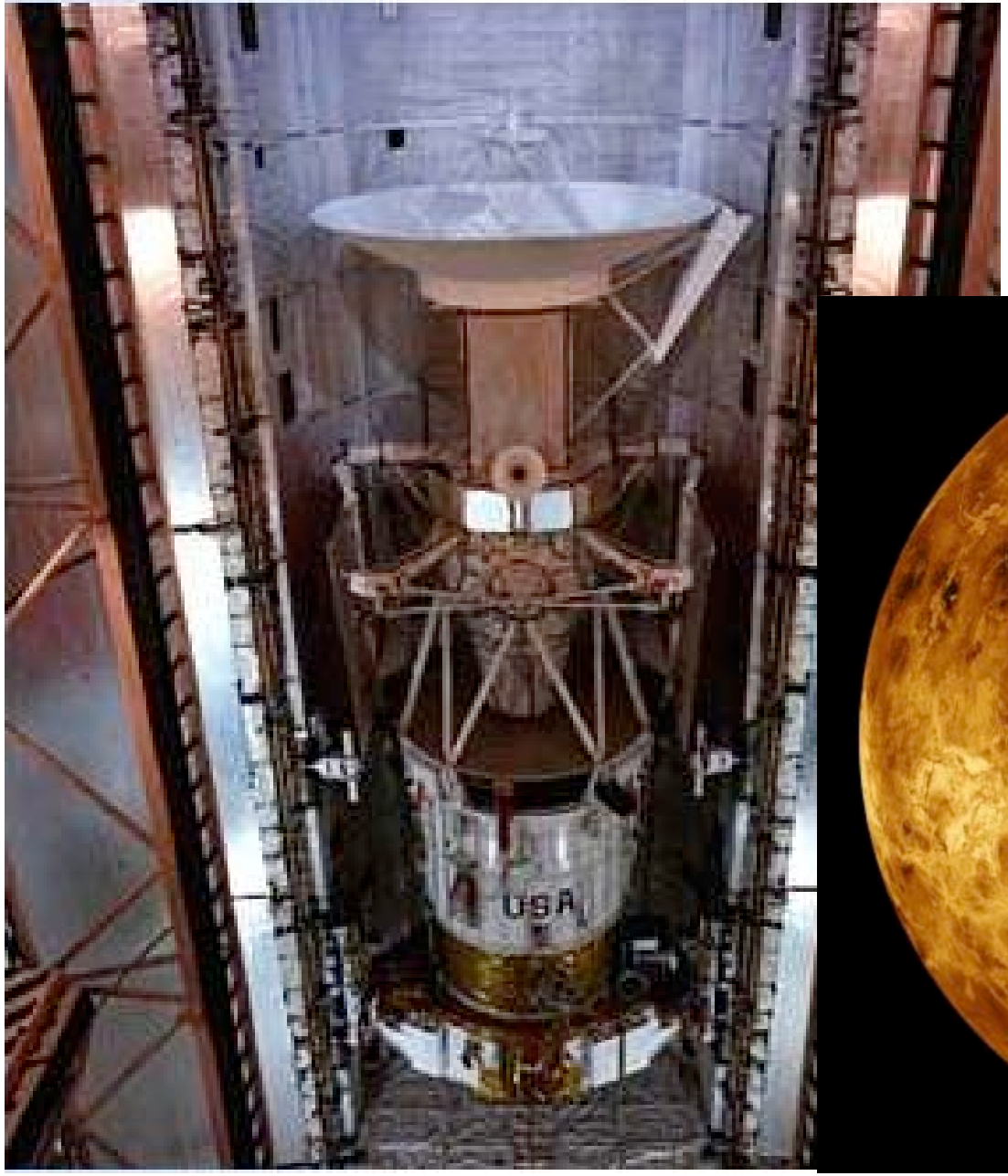
Reprocessing d’anciennes images venera13



venera14



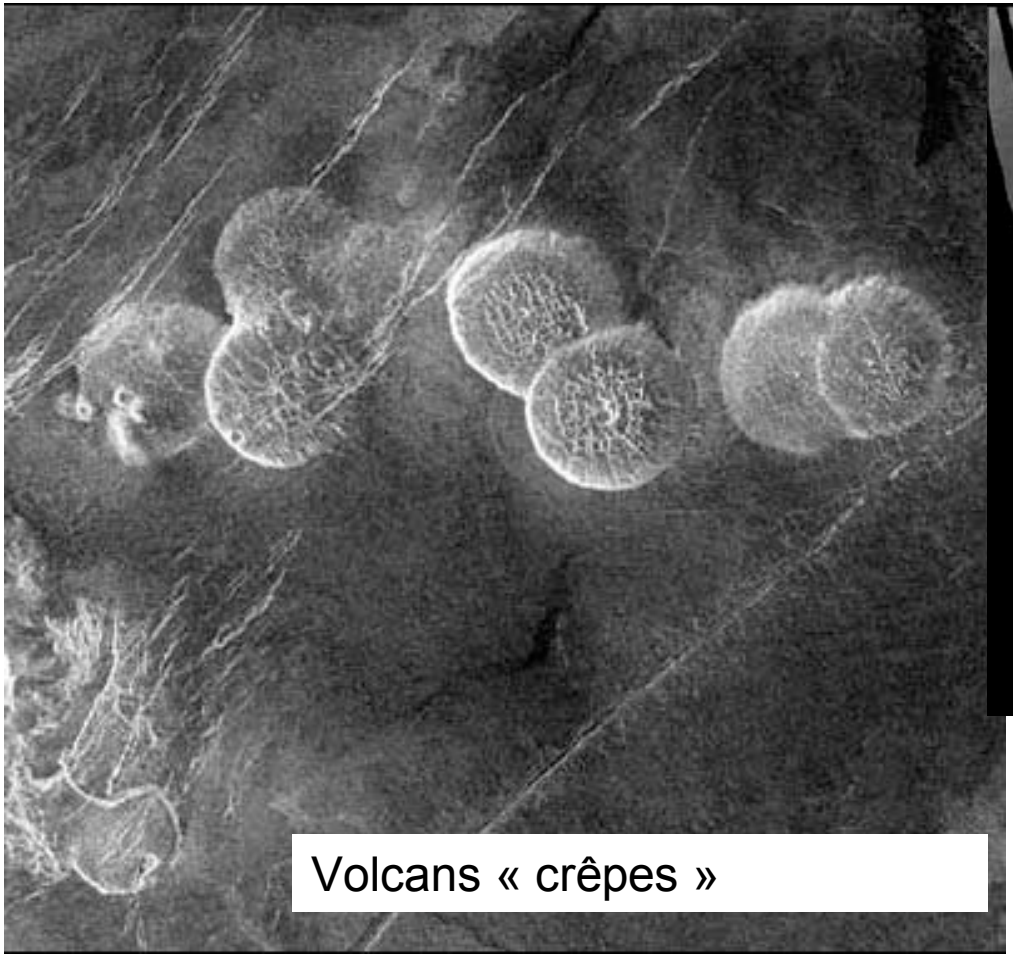
Sonde Magellan

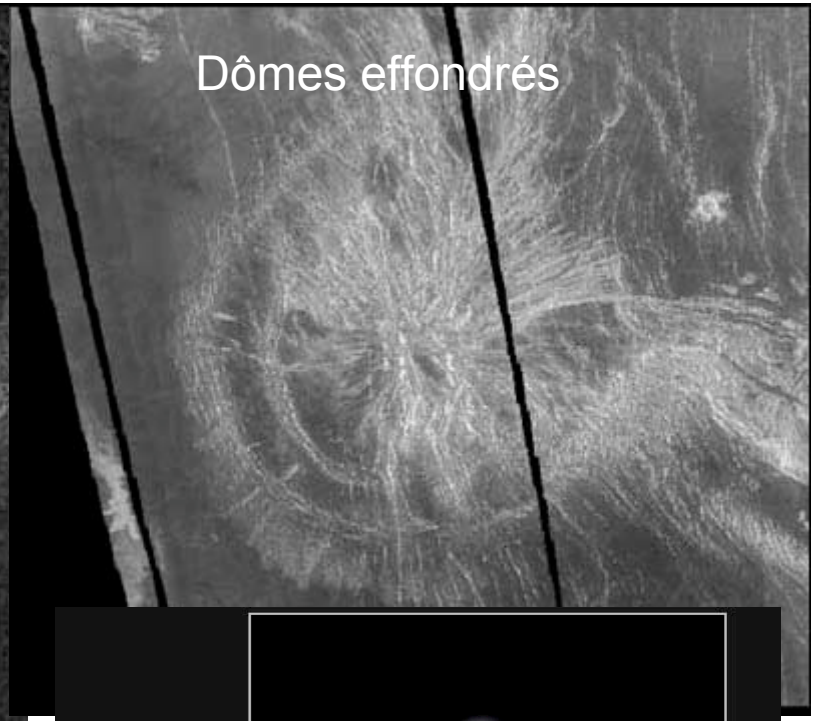


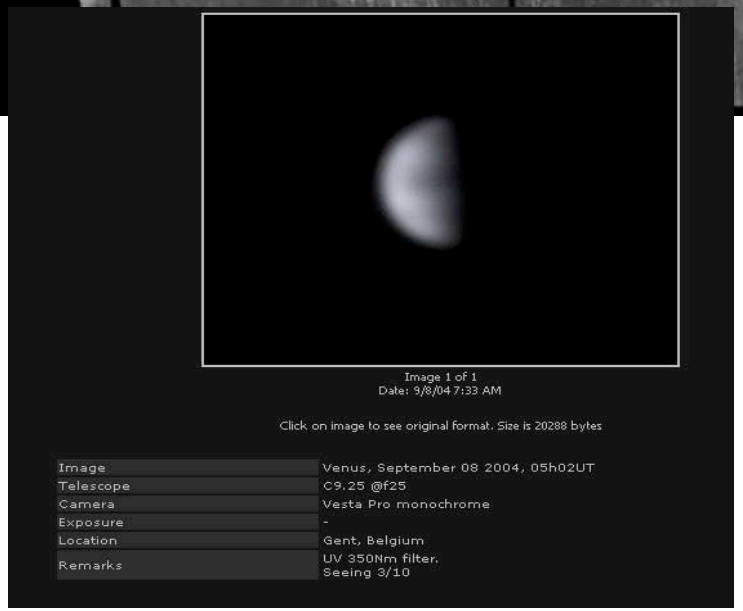
Atmosphère: CO_2 (96%);N_2;SO_2, Ar,Ne,CO,H_2SO_4,HCL,HF…

Tout pour plaire…eh.. 90 bar et h=68km! Bonjour les pluies acides…

Des volcans sous une pluie d'acide sulfurique et une pression de 90 bar…sympha!

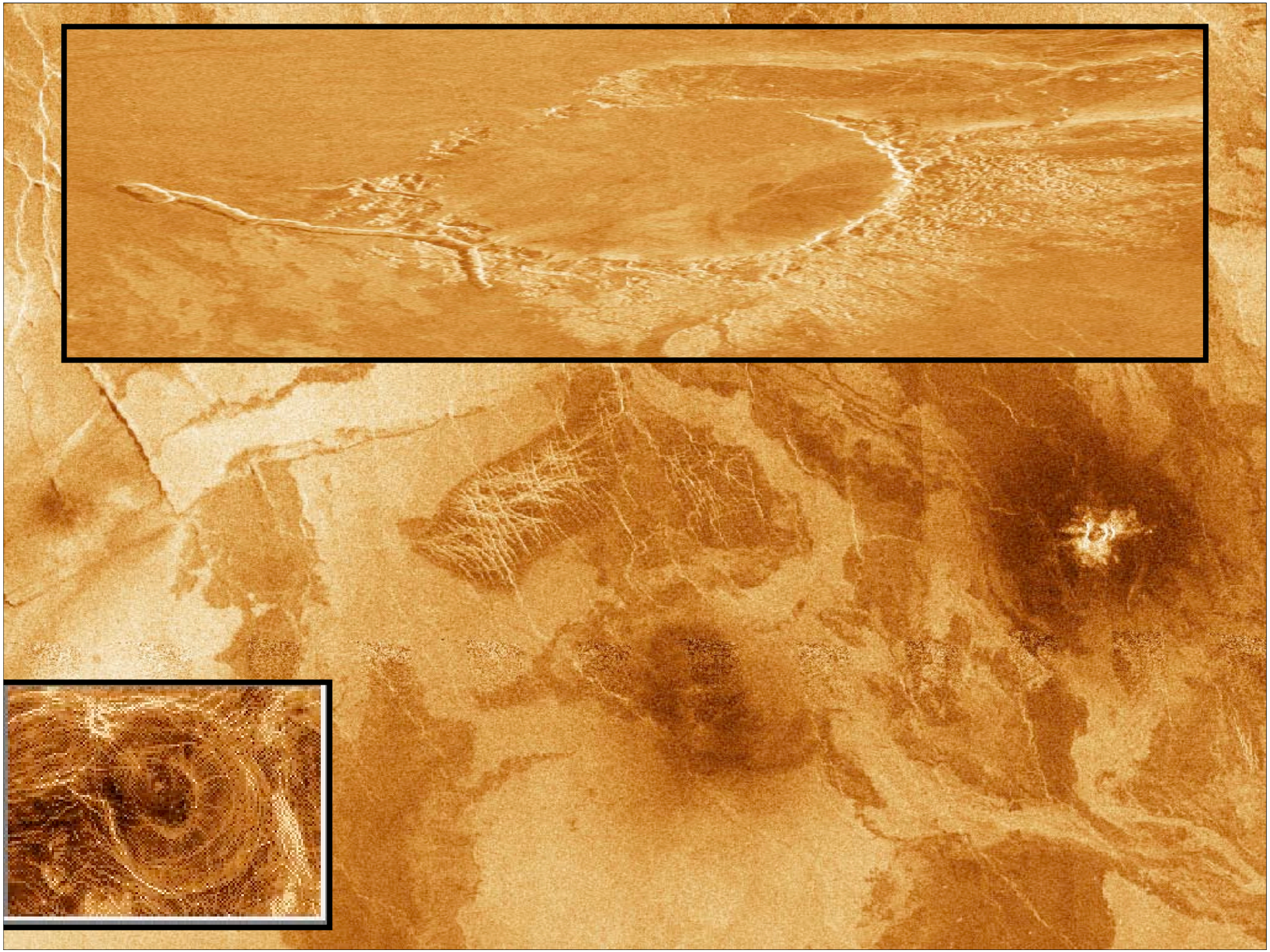




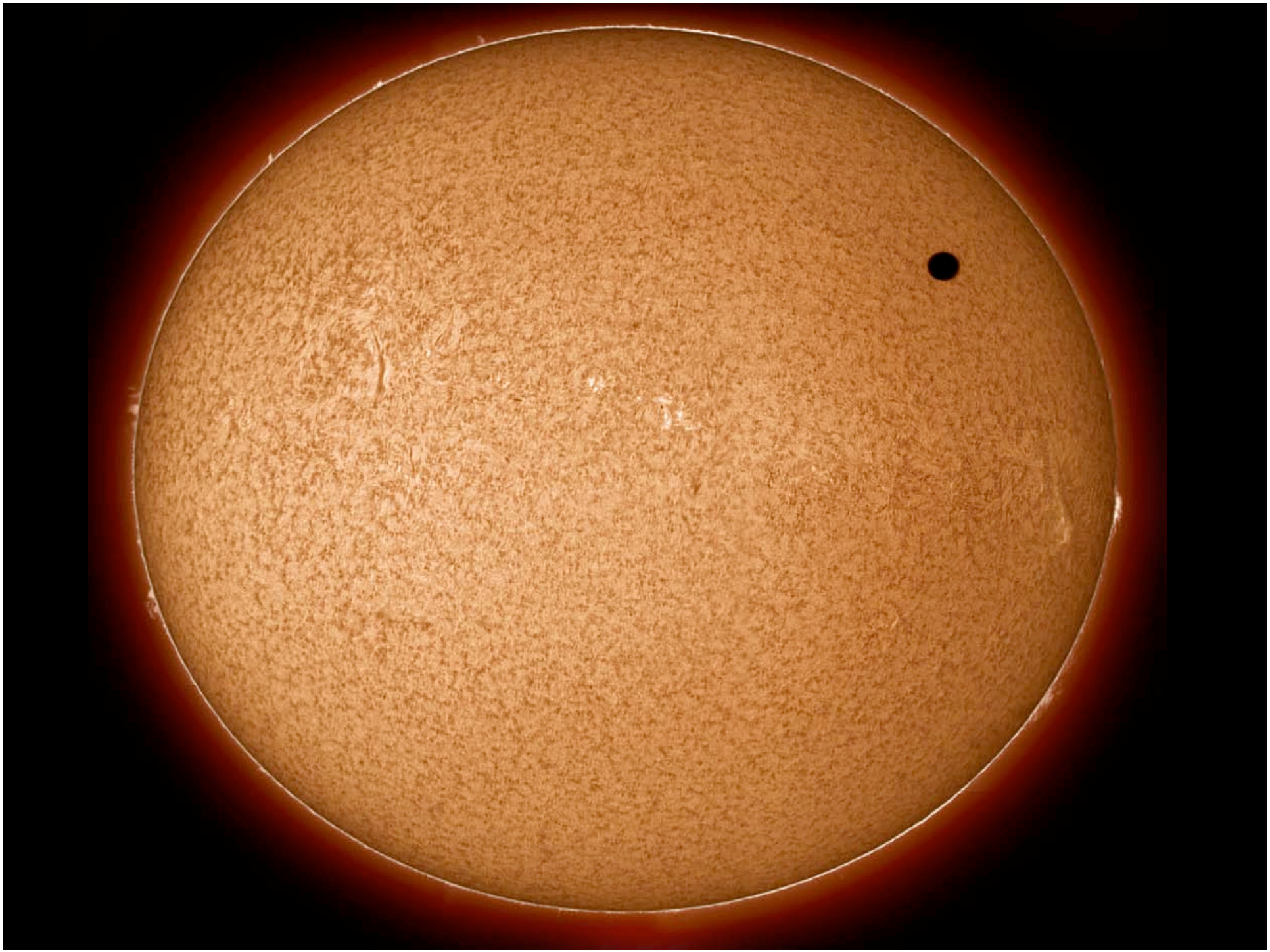


La surface de venus est jeune:

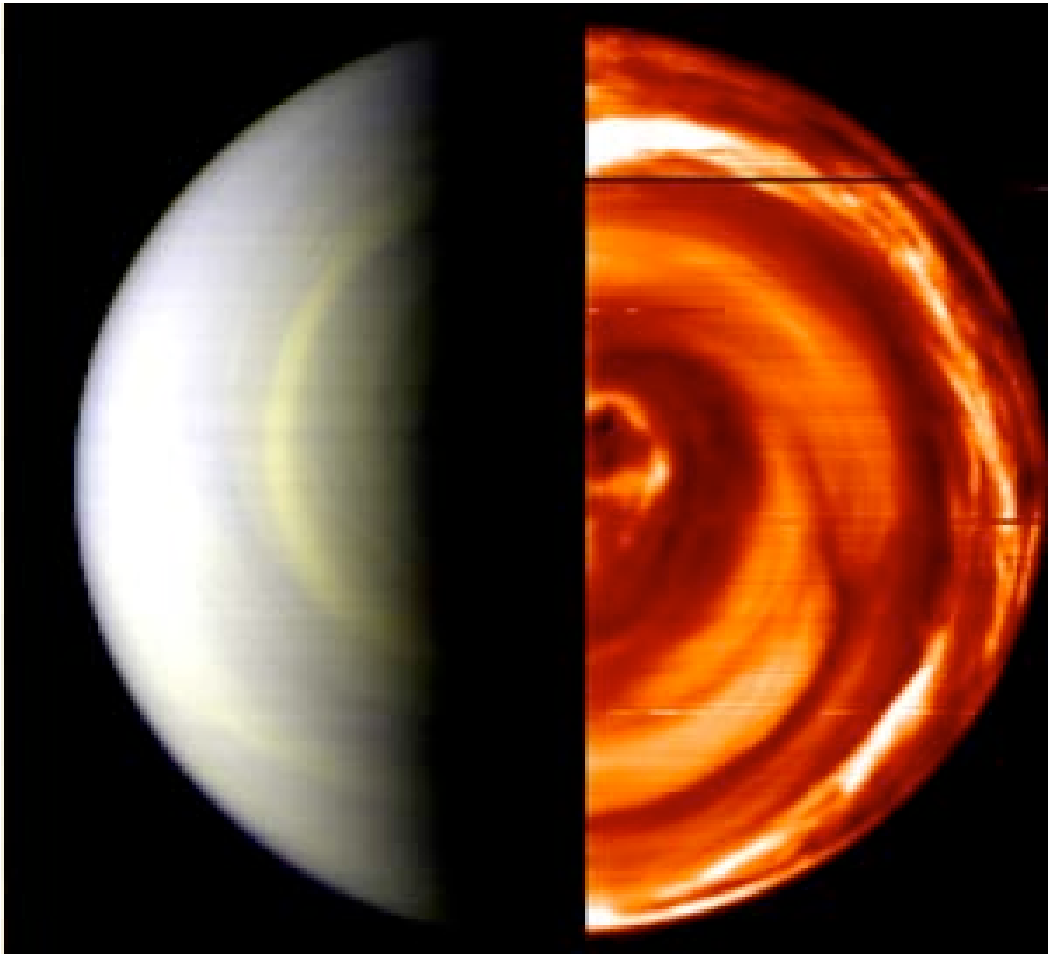
que 300 à 500 mio années!



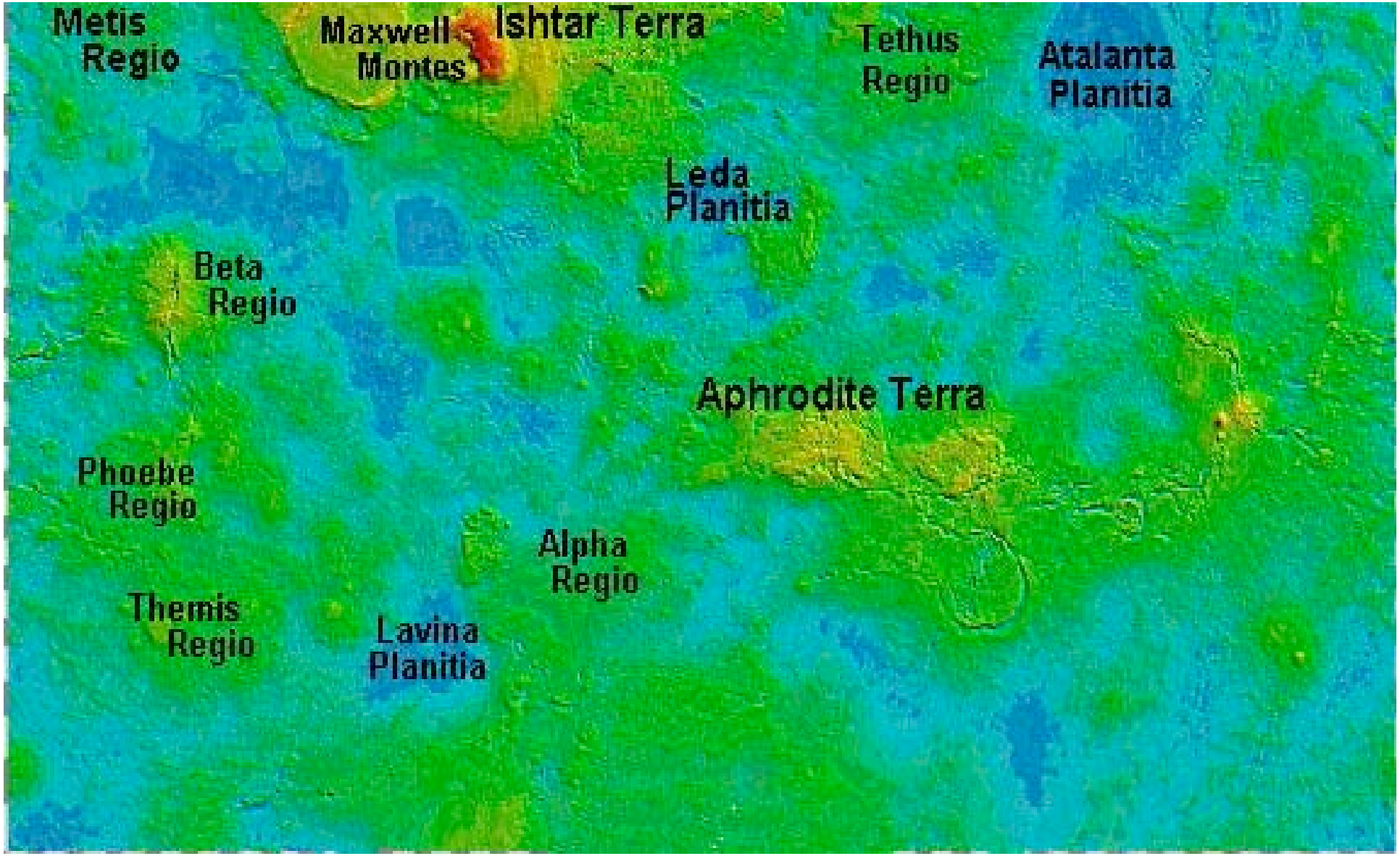
This view of the lava domes is from the 3D imager used by the Magellan spacecraft.



Première image de la sonde Venus Express



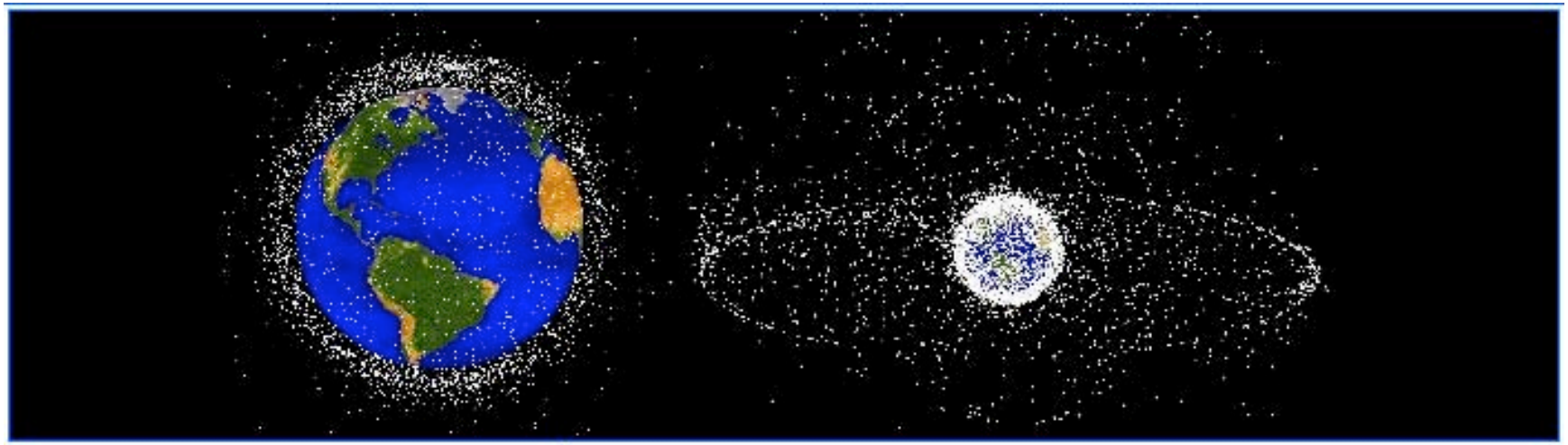
Surface Venus: seulement 500mio années



Quoi de neuf sur la Terre?

Surtout, un tas de chenis!

Cela représente plus de 20 000 tonnes de matériaux et 25 500 objets divers en orbite autour de la Terre, parmi lesquels il ne reste que 595 satellites opérationnels représentant une masse de 4 500 tonnes.



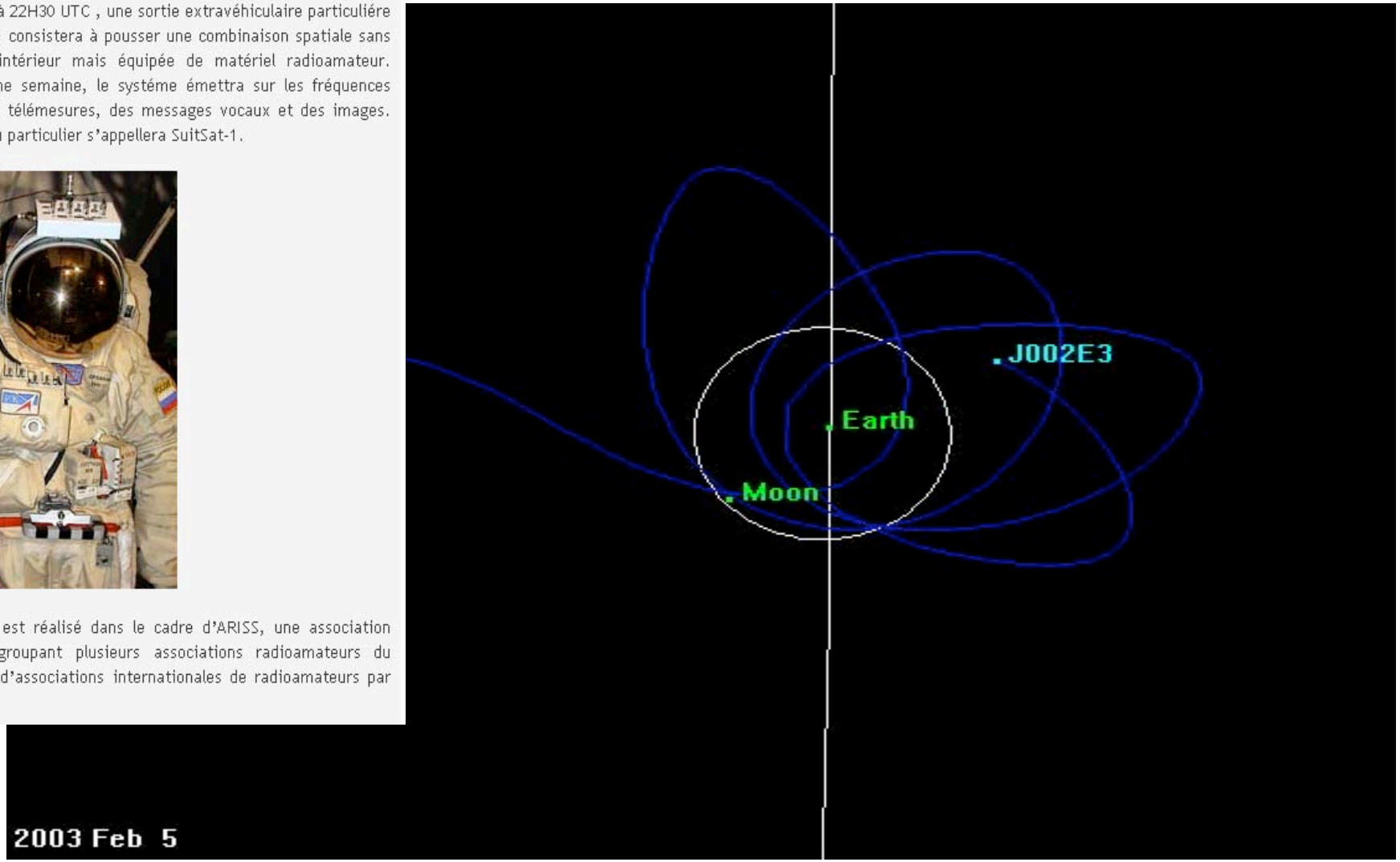
Plus de 7 000 débris sont représentés sur cette image. Ils se concentrent sur des orbites situés à 800 et 1 500 km d'altitude	Environ 8 500 gros débris de plus de 10 cm sont dispersés autour de la Terre jusqu'à l'orbite géostationnaire. 7% d'entre eux sont des satellites fonctionnels. L'USSPACECOM suit en permanence l'évolution de chacun d'entre eux.

Parmi ces objets spatiaux on dénombre 15 680 débris de plus de 10 cm orbitant entre 400 et 1 500 km d'altitude. 100 000 objets d'une taille inférieure à 10 cm sont en orbite basse et il devrait y avoir des centaines de milliers de débris de taille inférieure au centimètre pour un total de quelque 35 millions de débris si on s'attarde aux particules de moins d'un millimètre. Parmi ces débris spatiaux 41% sont constitués de fragments, 13 % sont des débris opérationnels, 17 % des étages supérieurs de lanceurs et 22 % sont des satellites qui ne sont plus en état de fonctionner sans compter les éclats de peinture, les éjections de combustible, de liquide de refroidissement...

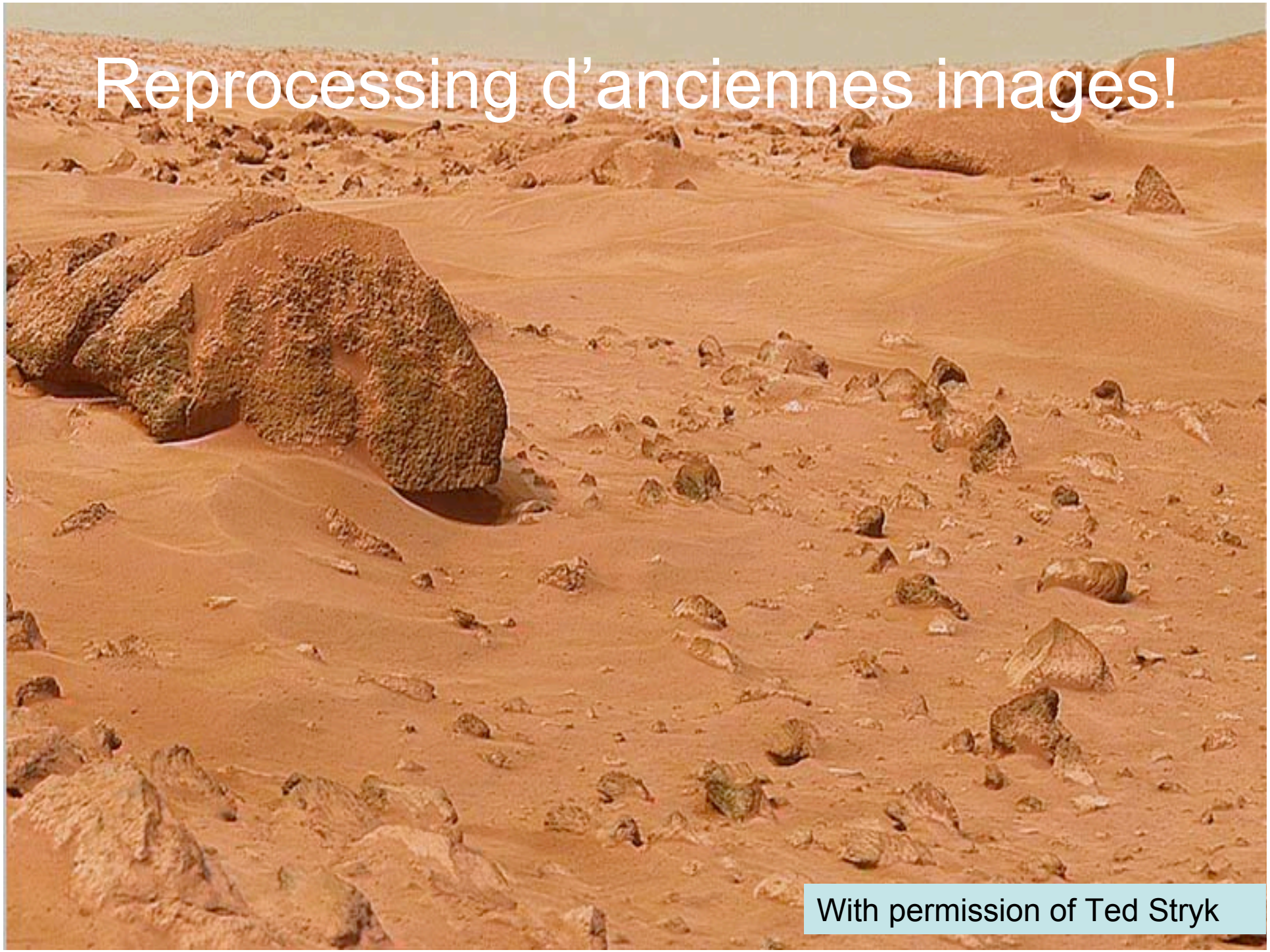
Orbite d'un gros morceau(joo2E3) de apollo14 qui est revenu et la nasa prétend qu'aucune pièce manque…

le 3 février 2006 à 22H30 UTC , une sortie extravéhiculaire particuliére sera réalisée, elle consistera à pousser une combinaison spatiale sans cosmonaute à l'intérieur mais équipée de matériel radioamateur. Pendant plus d'une semaine, le systéme émettra sur les fréquences radioamateur des télémesures, des messages vocaux et des images. Ce satellite un peu particulier s'appellera SuitSat-1.

Le projet SuiSat est réalisé dans le cadre d'ARISS, une association internationale regroupant plusieurs associations radioamateurs du monde entier et d'associations internationales de radioamateurs par satellite (AMSAT).



Reprocessing d’anciennes images!



With permission of Ted Stryk

160 sondes depuis 40 ans;Sondes et robots petits, « bon marchés », rapides plus fréquentes et bourées de technologie:

The FIDO Rover

The Rocky 8 Rover

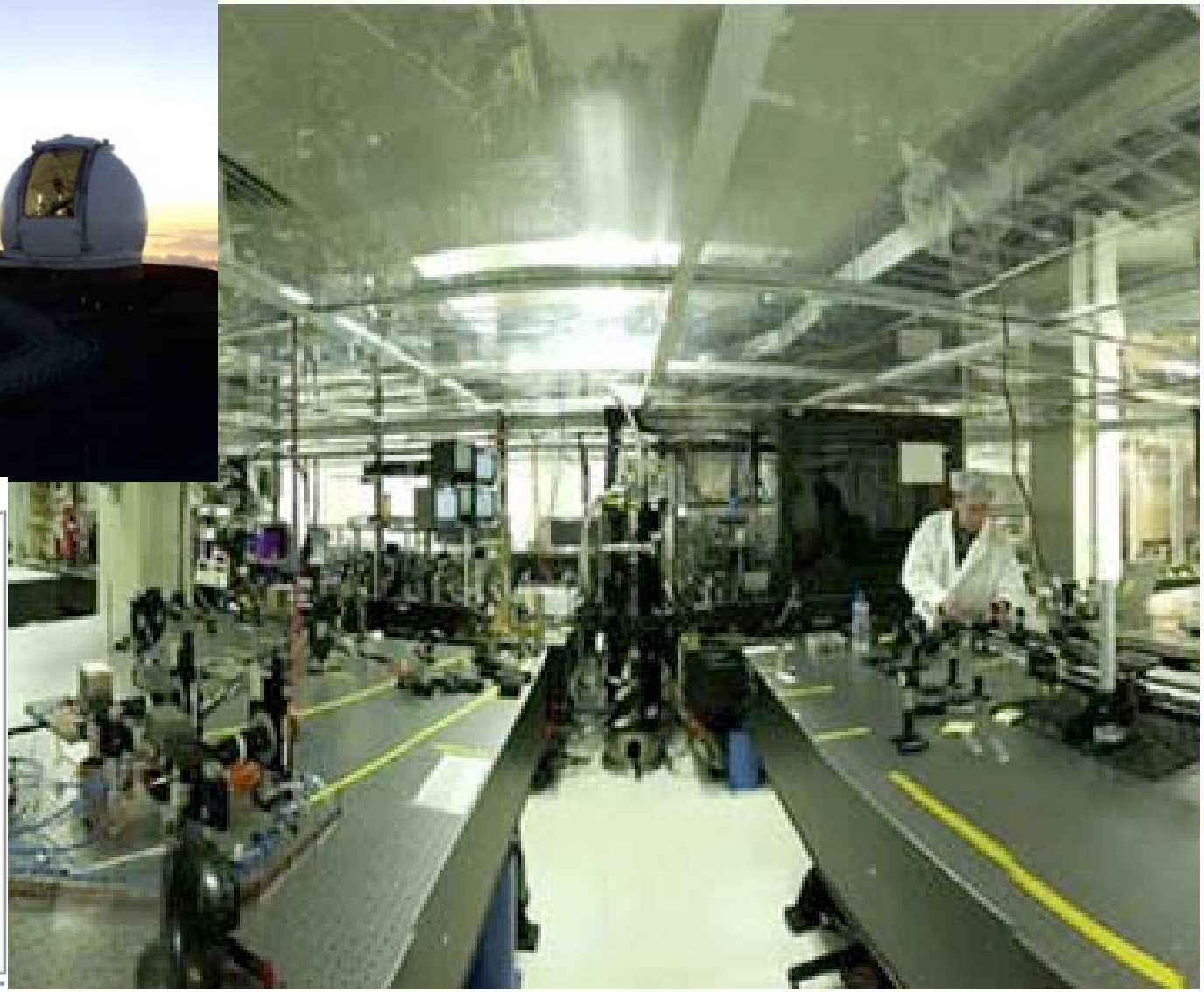
The PLuto Rover

The Rocky 7 Rover

SRR: Sample-Return Rover

Commercial Rovers

L’interferometer Keck (Hawai)



Lumière

Lumière

Ballon

il flotte
à environ
140 mètres
d'altitude

Nacelle

Caméra

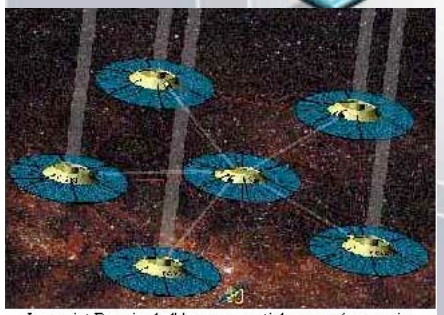
Câbles de soutien

Ils permettent
de régler
le positionnement
de la caméra

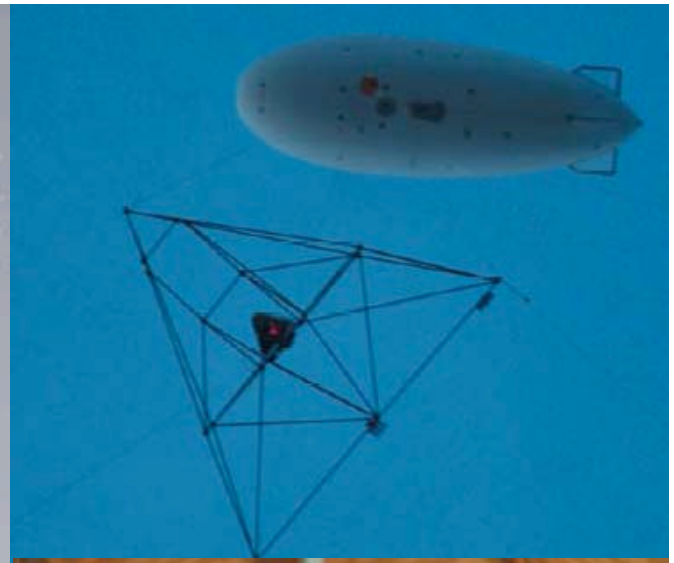
Câbles
de soutien

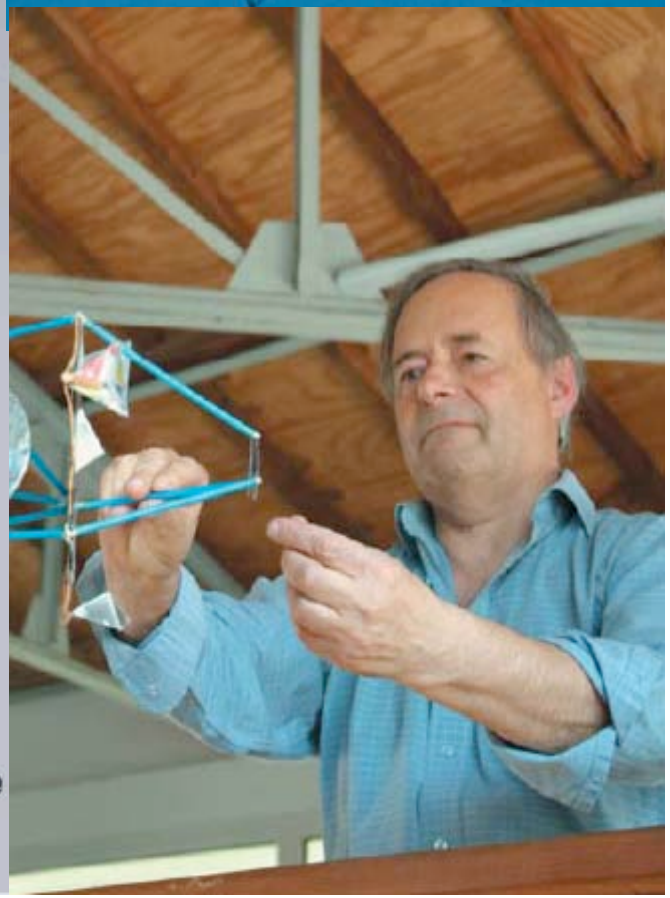
Miroirs individuels

Disposés en triangle,
ils renvoyent la lumière
vers la caméra

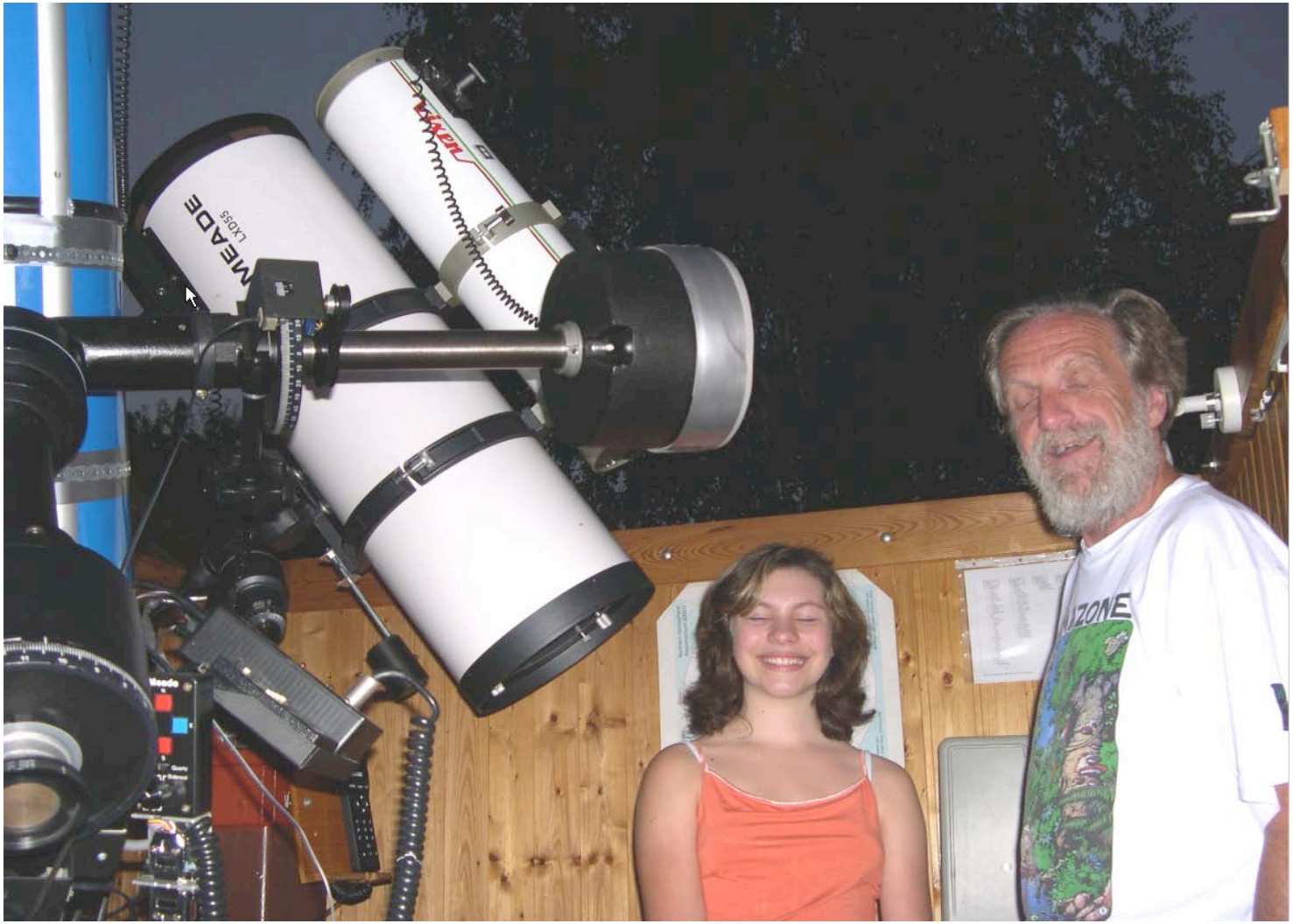


Le projet Darwin de l'Agence spatiale européenne: six télescopes spatiaux n'en formant plus qu'un seul.





- Des amateurs *quasi* profesionnels avec du matériel hypersofistiqués!



Des amateurs de la SNA (très) éclairés….

Materiel d’amateur très sofistiqué

et ce n’est qu’un début…

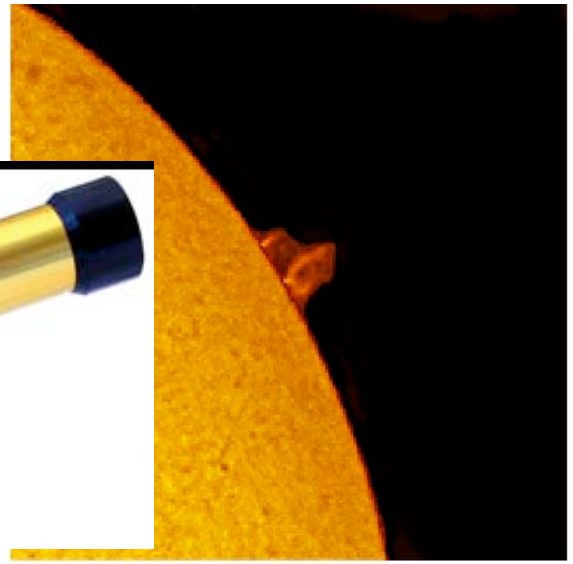
-GPS positioning, alignement automatique

- Ritchey-Chrétien design comme le HST

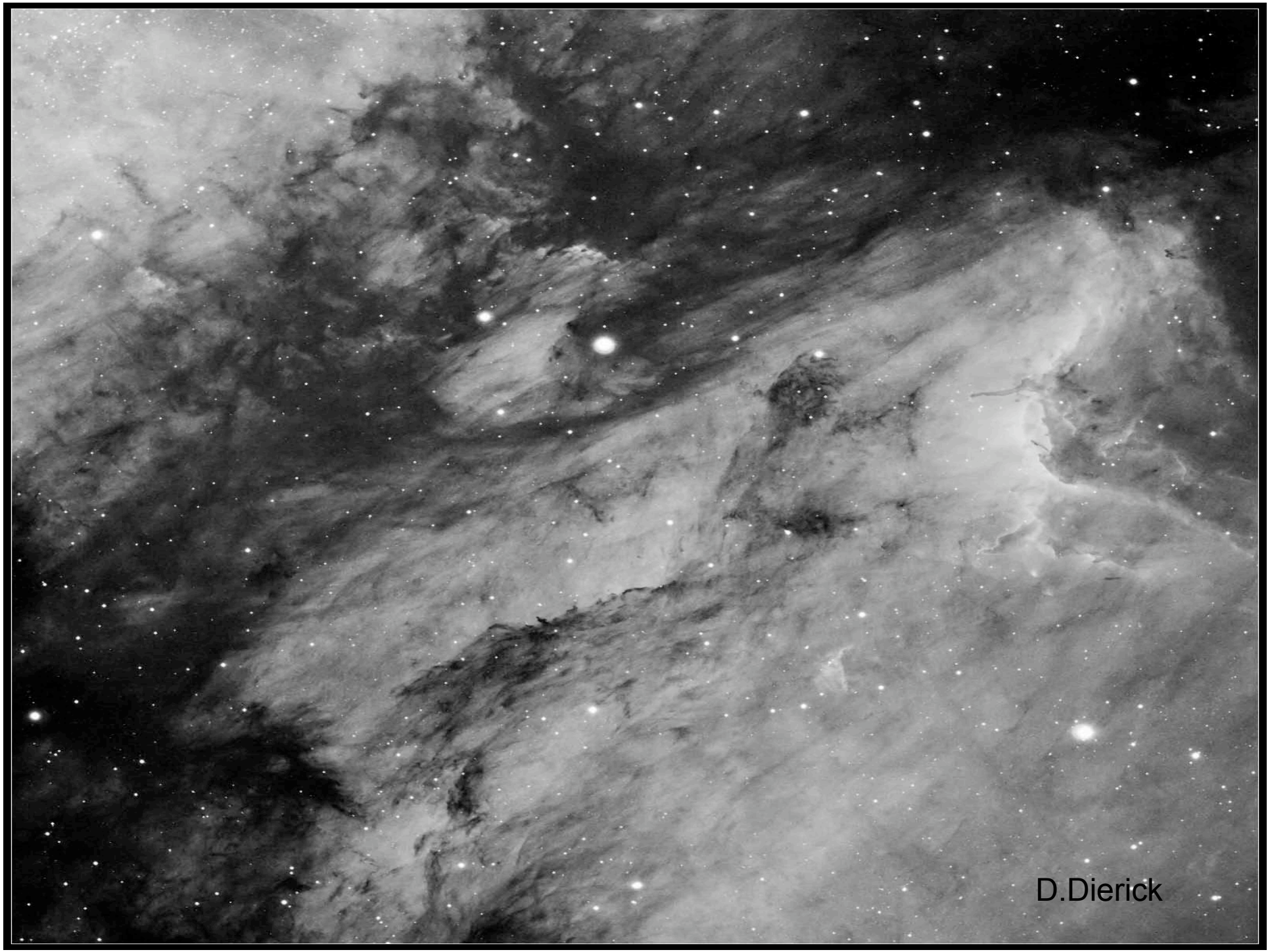
-PC control

--track pad avec des miliers d’objets

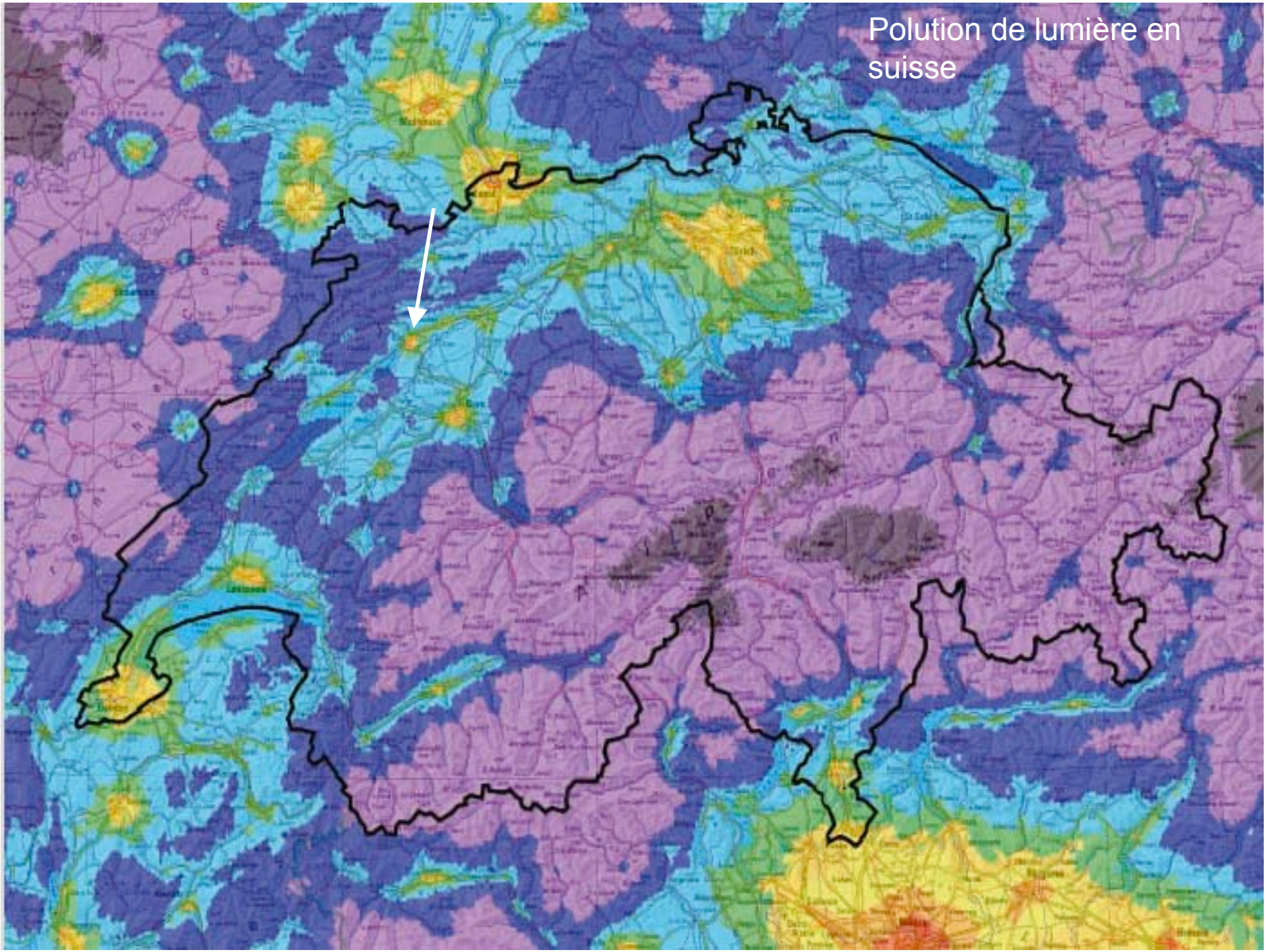
-telescope solaire « H alpha » pour moins de 1000chf:



Amateur (D.Dierick) qui fait de la photo deepsky au centre de Gand, a 200m de la gare;grace aux CCD et des filtres spéciales

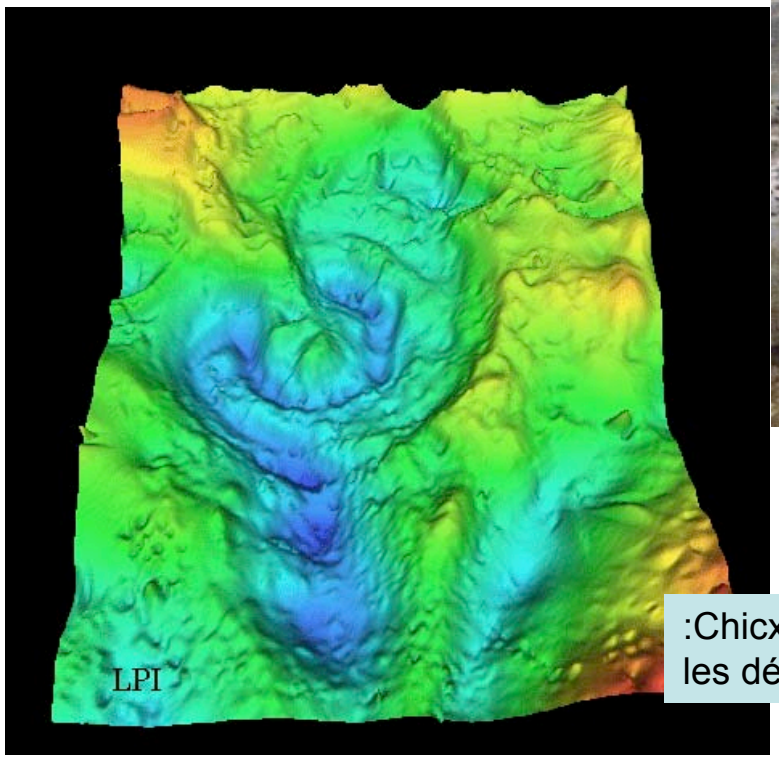

D.Dierick

J.Habsh, B


Polution de lumière en suisse

Chaque jour 10 tonnes de météorites tombent sur terre.
Réseau de surveillance des 2000 objets > 100m pour éviter que….

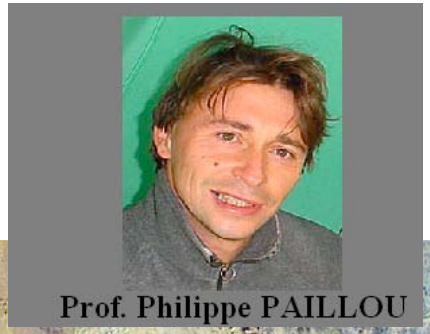
Meteor Crater a Arizona(USA,Flagstaff):

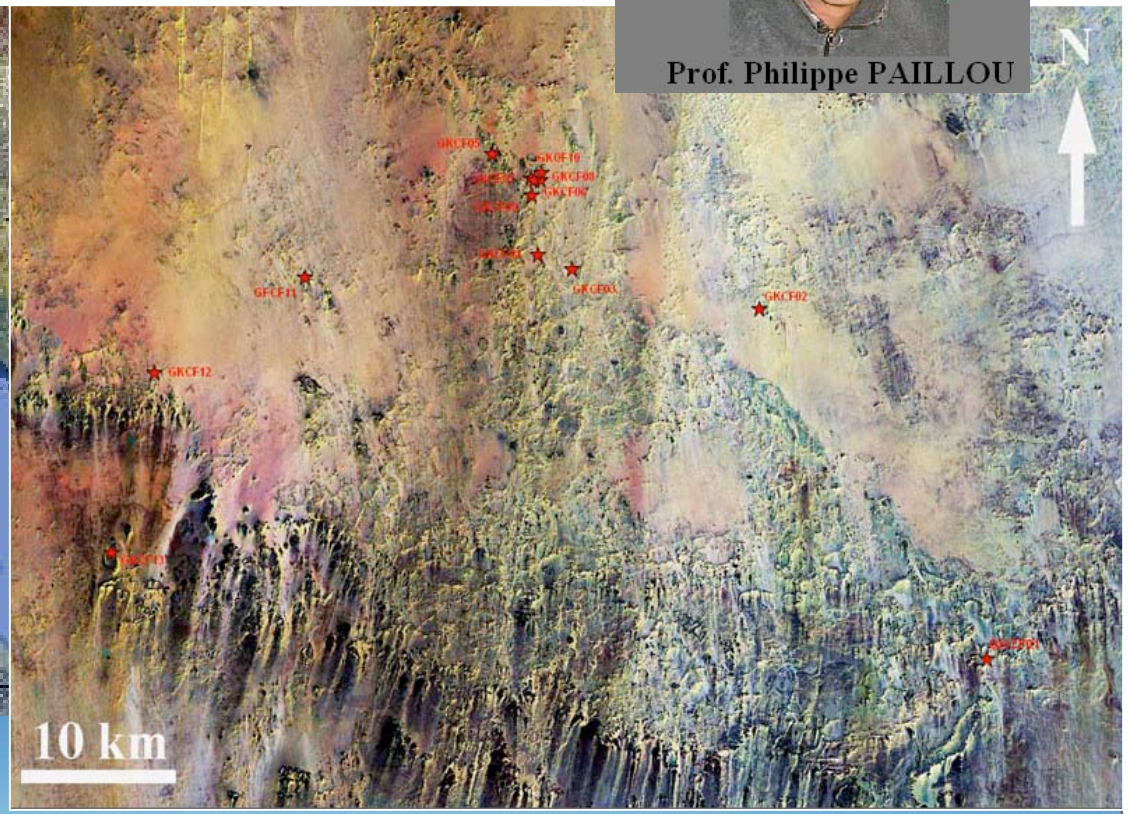


:Chicxulub.bonjour les dégats!

Attention des geocroiseurs: plus que 2000 découverts!

Du jamais vu ! Plus de 5 000 km2, une centaine d'impacts, le plus vaste champ de cratères de météorites se trouve dans le désert égyptien.





La sonde Voyager 1 fut la première à observer une chaîne de cratères dans le Système Solaire et, depuis, on en a trouvé sur la Lune, et même dans le désert du Sahara. Aujourd'hui, avec l'avènement de Google Earth, tout un chacun peut partir en quête de chaînes de cratères !

GOOGLE

Mars/lune!!

Le cratère Kebira vu par Google Earth

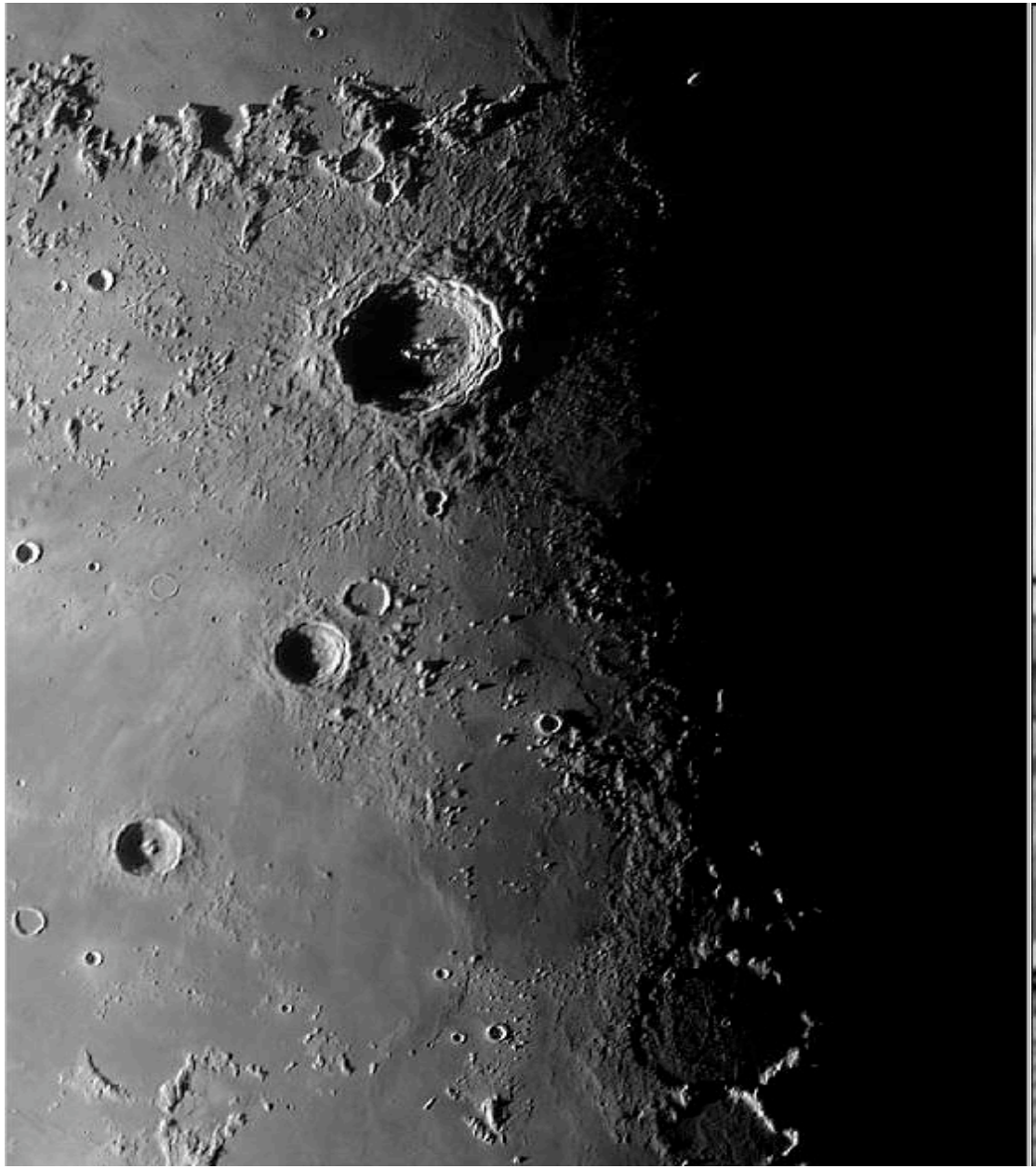
(Crédits : Google Inc)

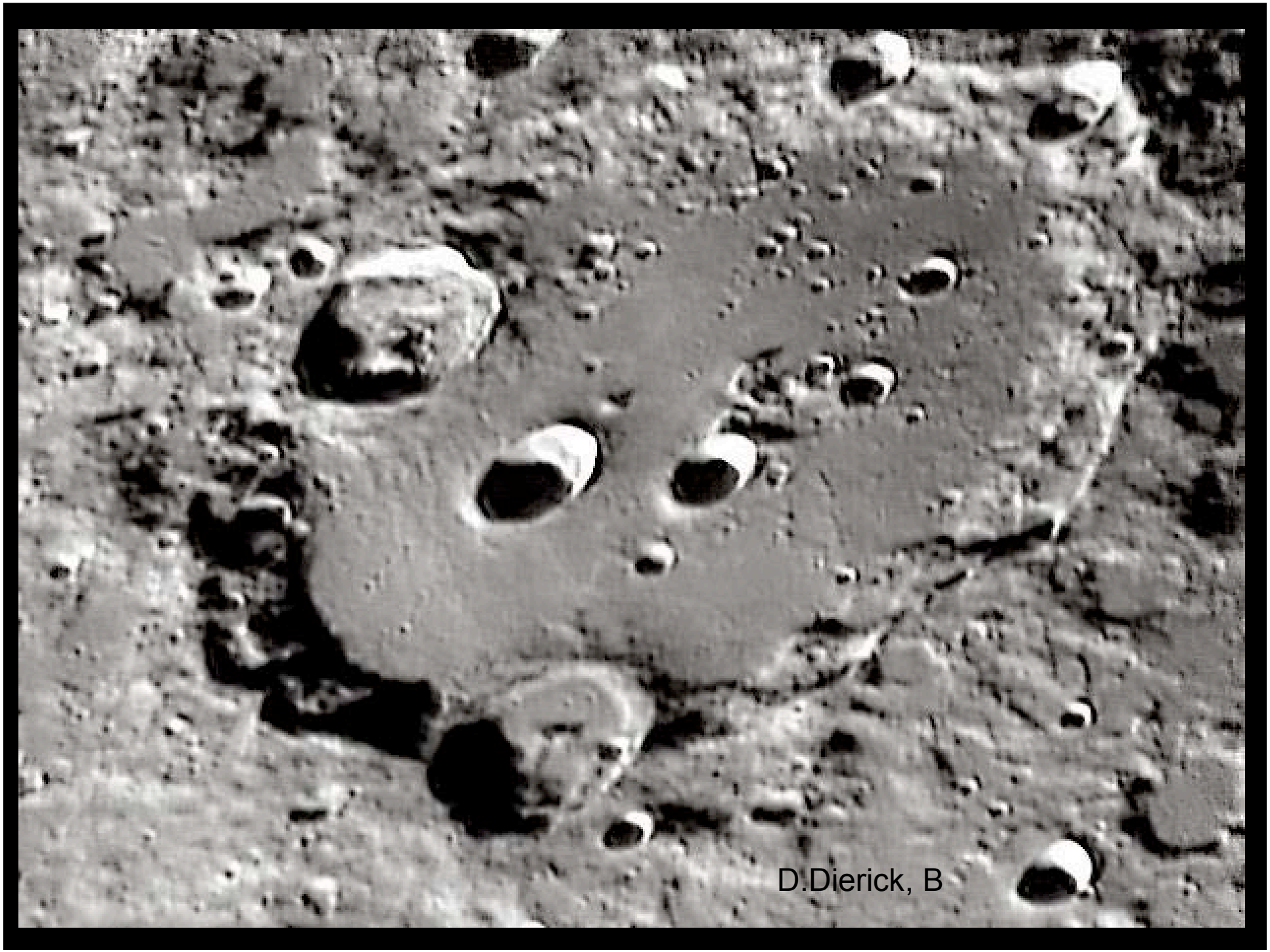
Une chaîne de cratères sur la lune de Jupiter Ganymède

Cratère d'Aorounga, au Tchad

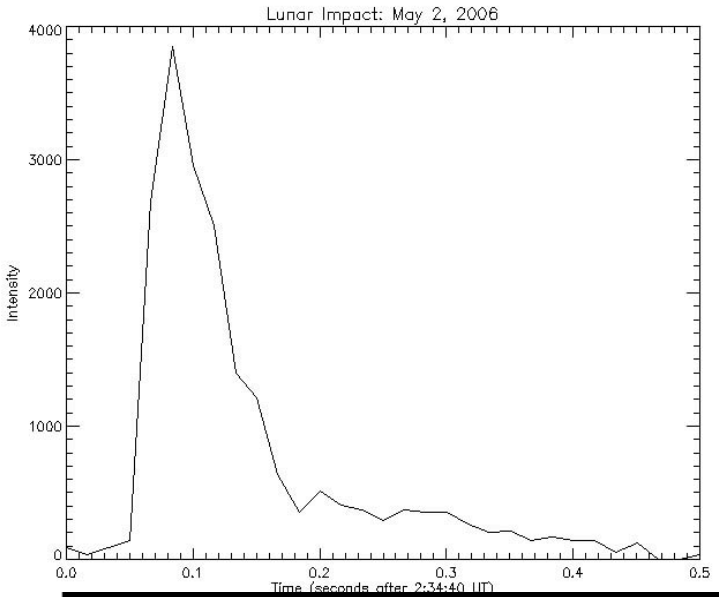
La lune

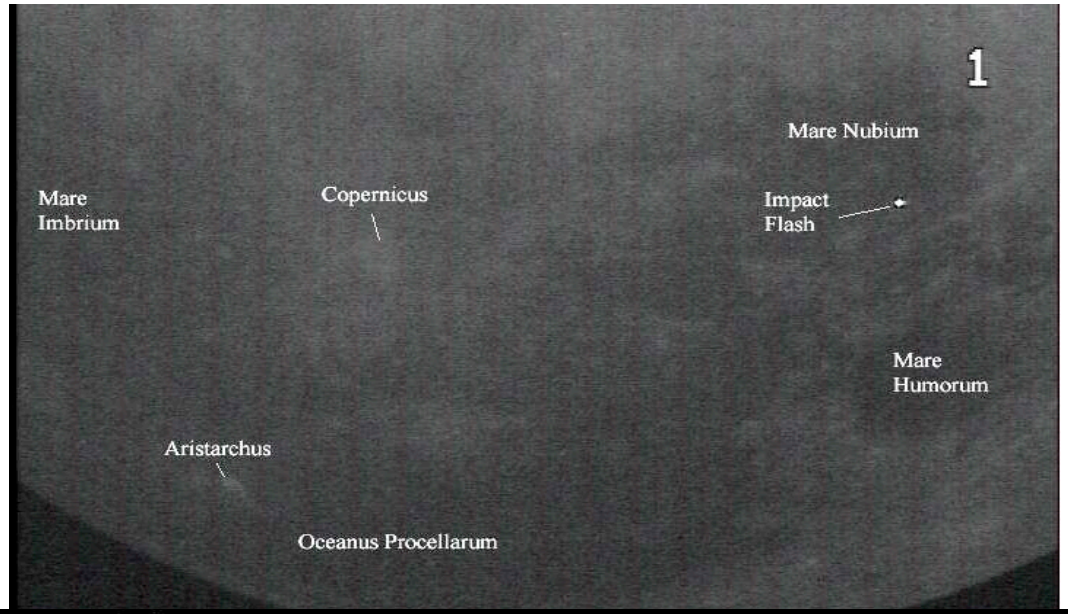
D.Dierick, B

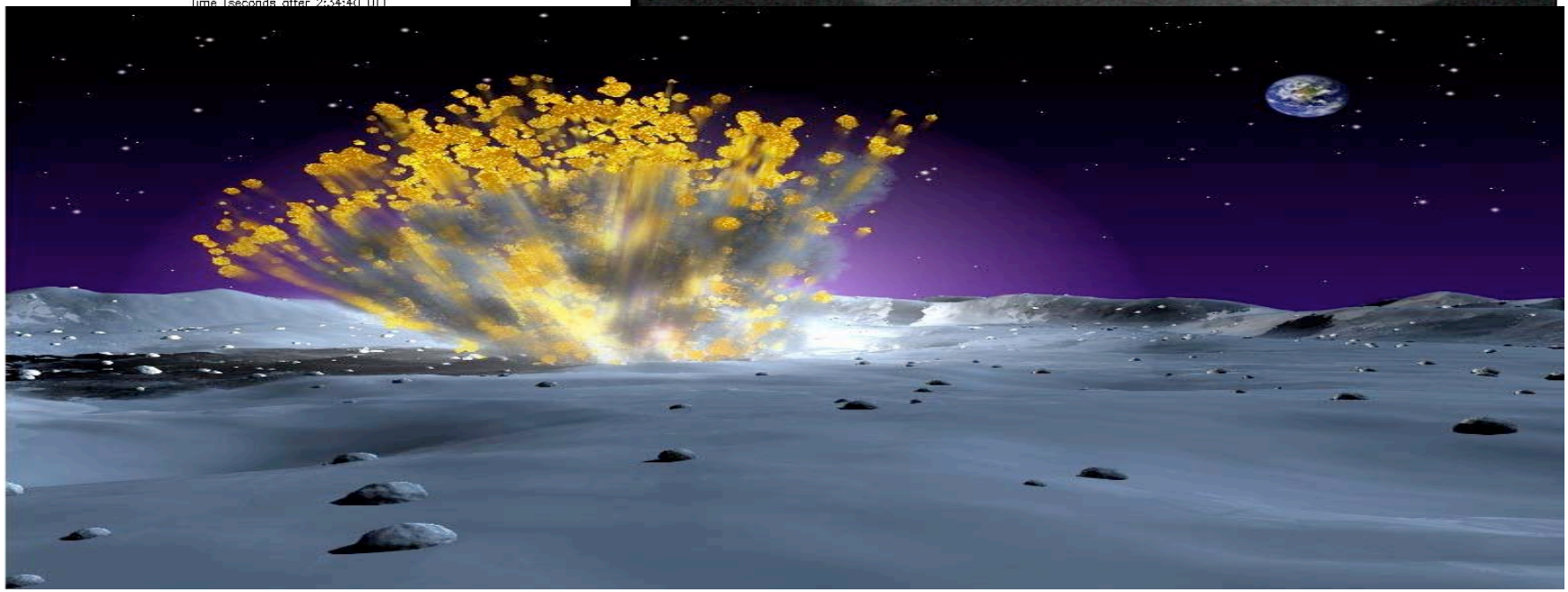



D.Dierick, B

Impact de meteorites sur la lune, HIER!

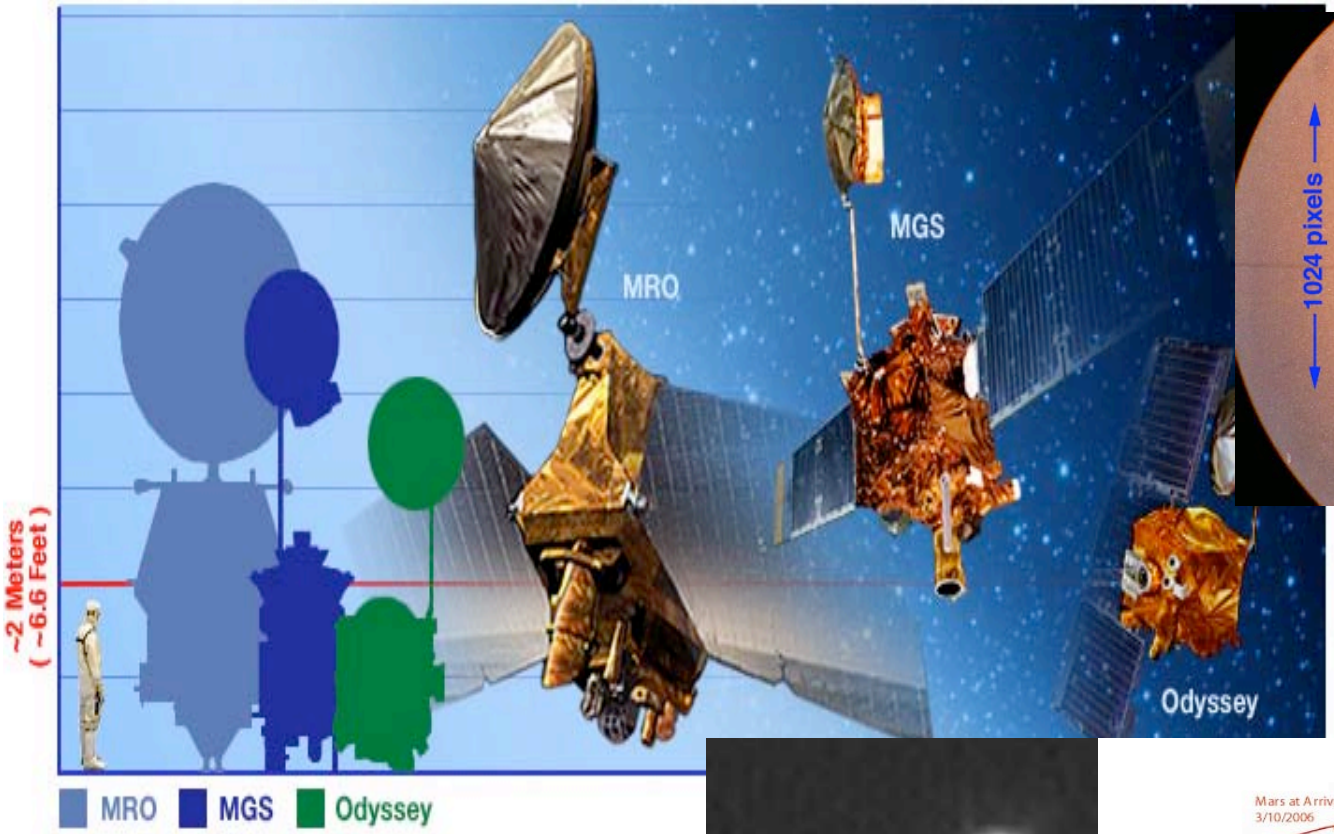


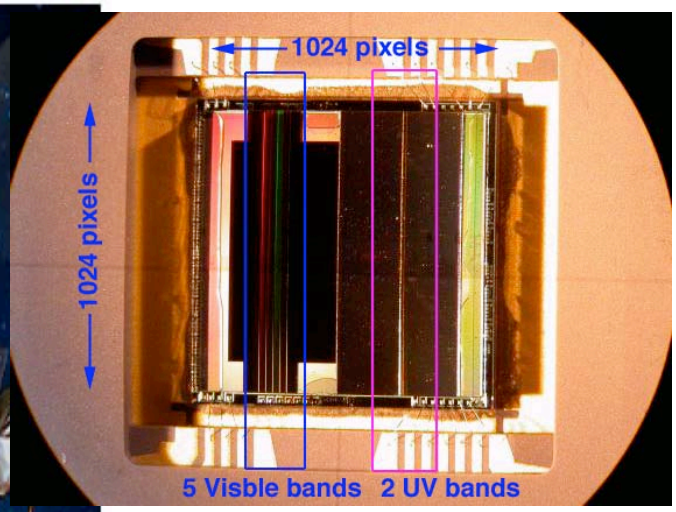




Mars: des volcans, de l'eau et des tempêtes (et des robots…!)

D=228mio km
Diam=6800km





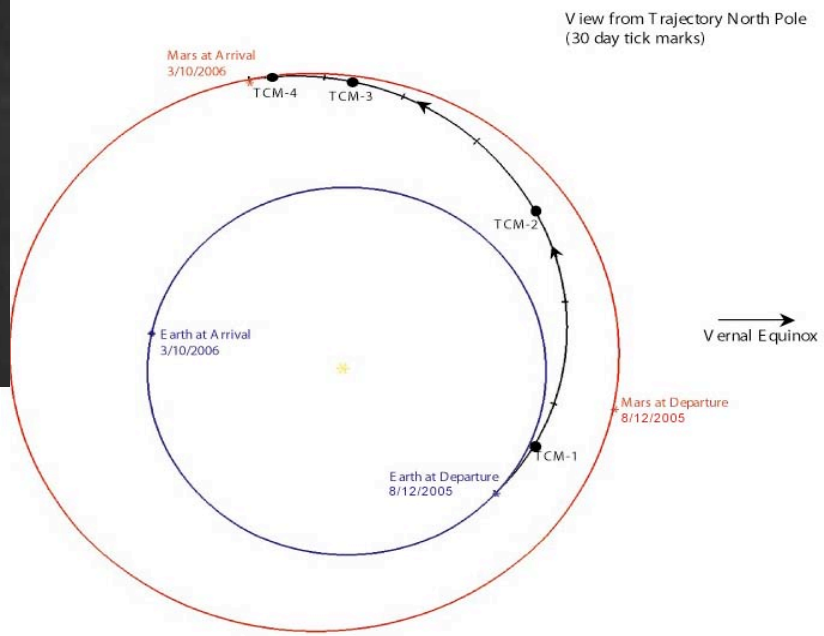
NEW!

MARS RECONNAISSANCE ORBITER EST ARRIVE !!!

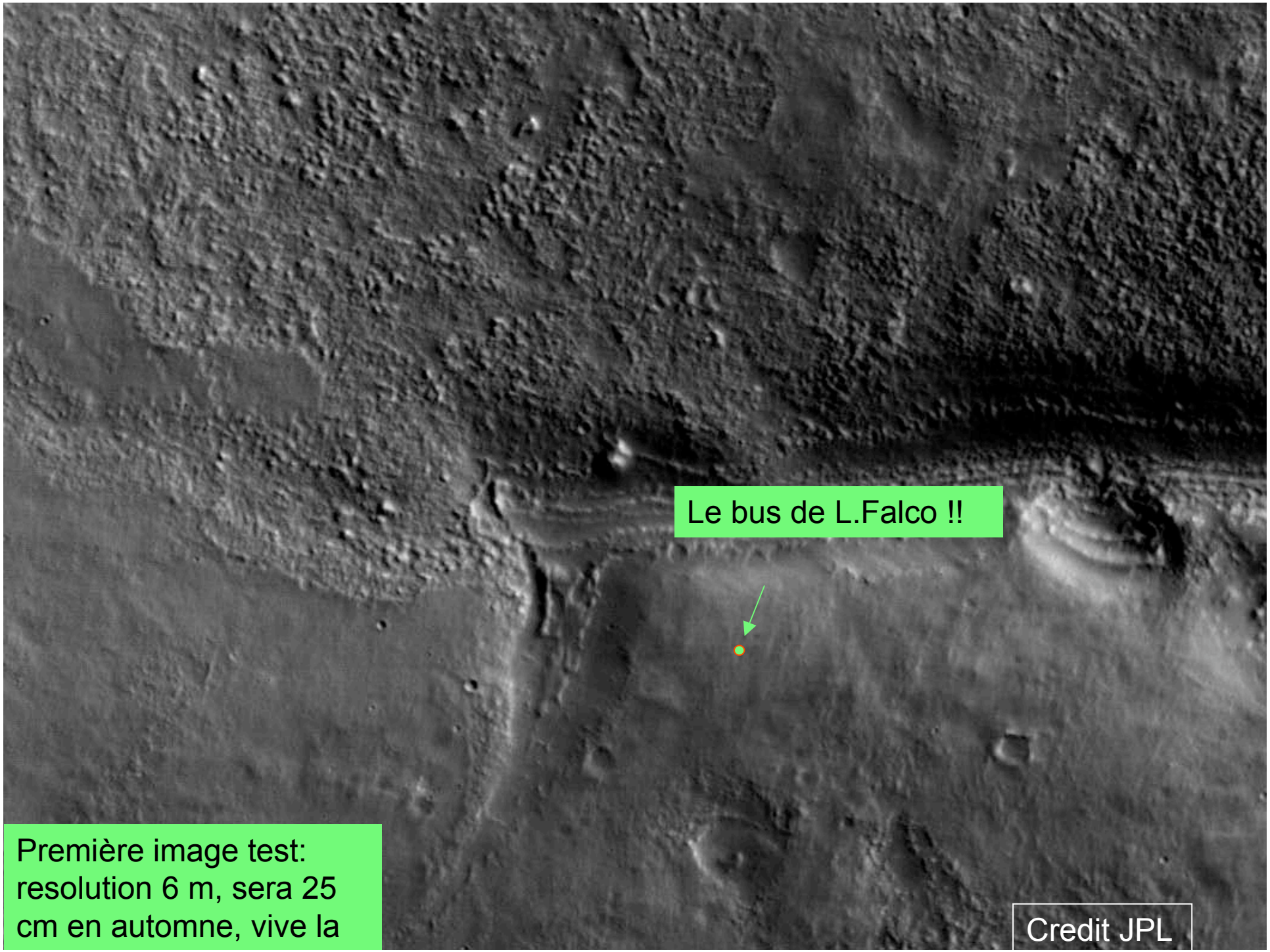
Suivez la page web

du JPL!!

Mars Global Surveyor photo par Mars Odysee à 90km !



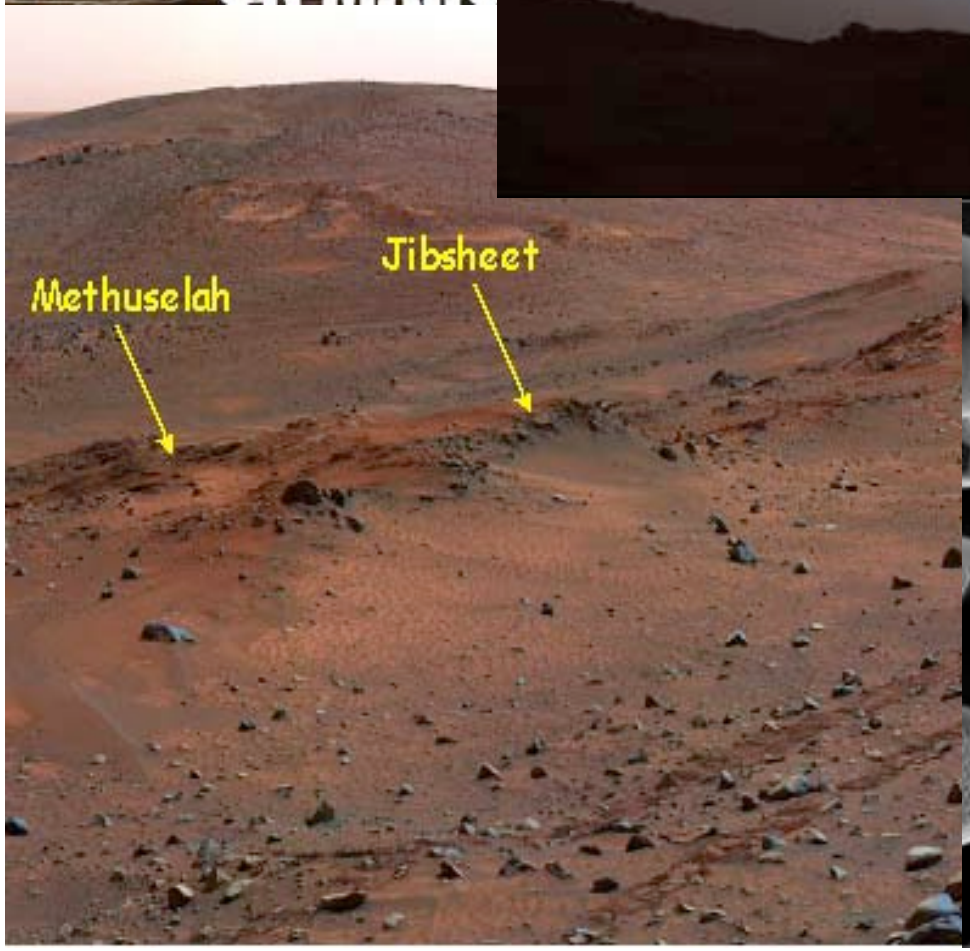
Hop les bleus!!

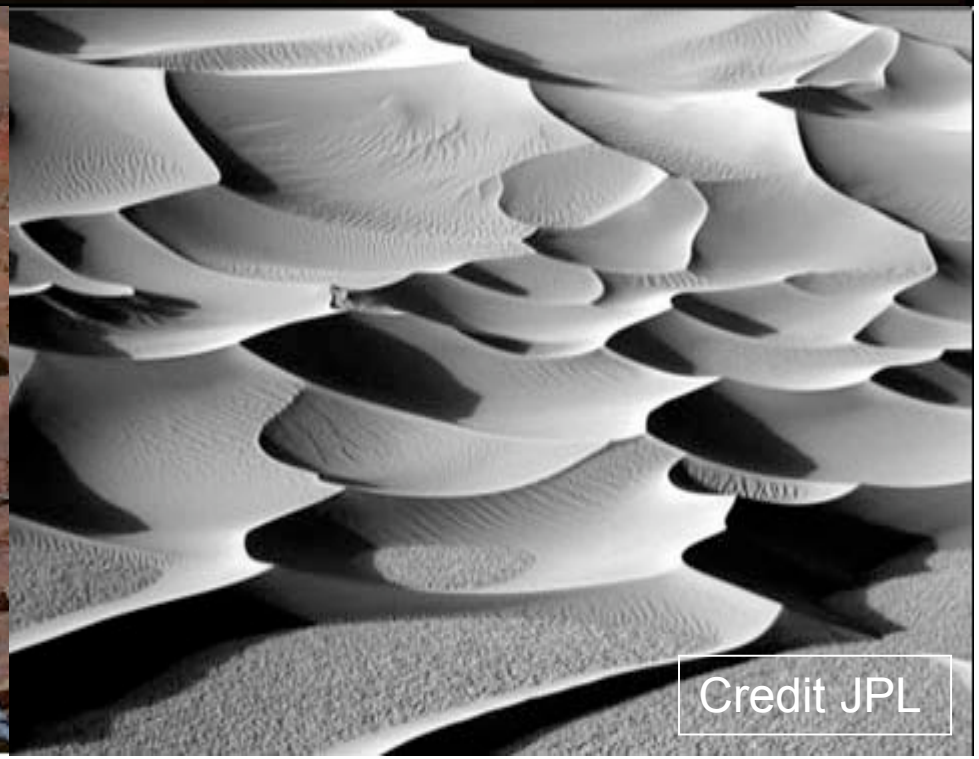

Le bus de L.Falco !!
Première image test: resolution 6 m, sera 25 cm en automne, vive la
Credit JPL

Spirit et Opportunity

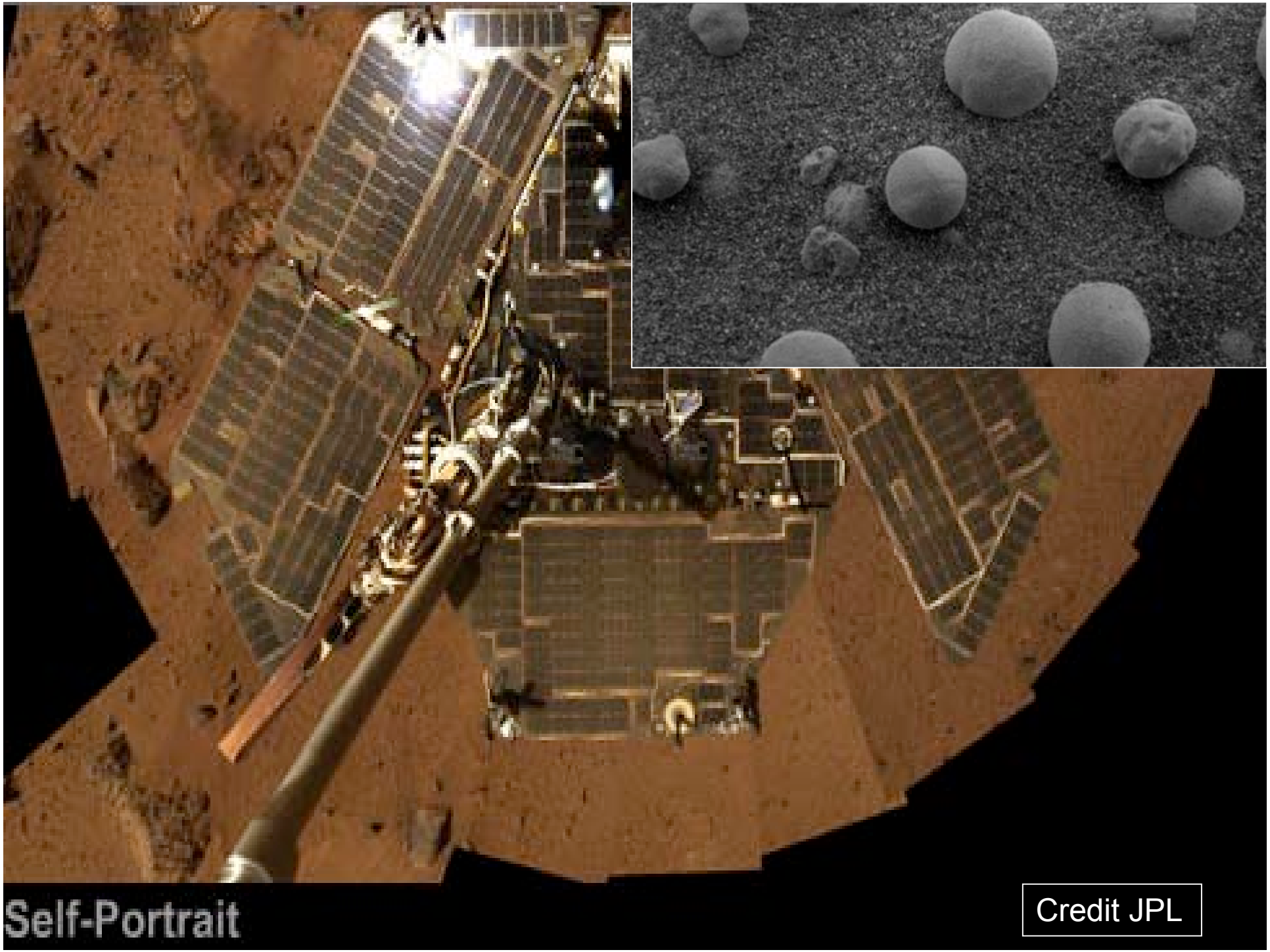
Neuchâtel en hiver?

Non, mars au printemps!





Credit JPL


Self-Portrait
Credit JPL

Spirit: All 76,850 Raw Images - *26 new images since 01/31/2006 05:05:43 PST*

Sol 738 raw images have arrived!

Spirit began performing activities requested by the science team during Sol 739. Those images and other data are currently being sent back to Earth for posting on Sc 740. Any data not transmitted on Sol 740 will be stored onboard the rover and sent or subsequent days during the next possible communications opportunities. (Black spaces typically mean partial data has arrived, but Spirit will fill in the rest of the data as soon as possible). Stay tuned!

The 26 new (or updated) images are marked in **orange**.

How to decode the image filenames

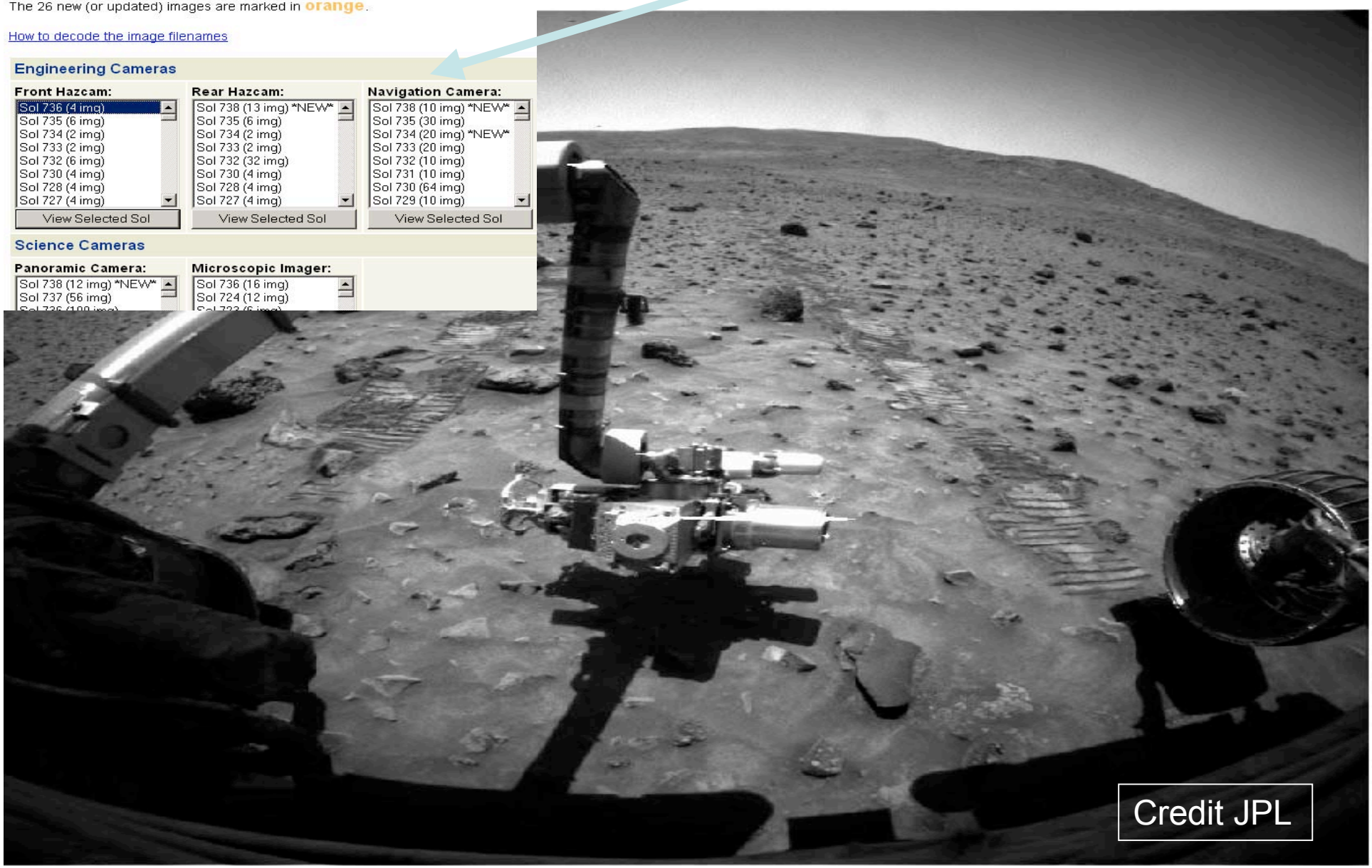
Engineering Cameras

Front Hazcam:	Rear Hazcam:	Navigation Camera:
Sol 736 (4 img)	Sol 738 (13 img) *NEW*	Sol 738 (10 img) *NEW*
Sol 735 (6 img)	Sol 735 (6 img)	Sol 735 (30 img)
Sol 734 (2 img)	Sol 734 (2 img)	Sol 734 (20 img) *NEW*
Sol 733 (2 img)	Sol 733 (2 img)	Sol 733 (20 img)
Sol 732 (6 img)	Sol 732 (32 img)	Sol 732 (10 img)
Sol 730 (4 img)	Sol 730 (4 img)	Sol 731 (10 img)
Sol 728 (4 img)	Sol 728 (4 img)	Sol 730 (64 img)
Sol 727 (4 img)	Sol 727 (4 img)	Sol 729 (10 img)
View Selected Sol	View Selected Sol	View Selected Sol

Science Cameras

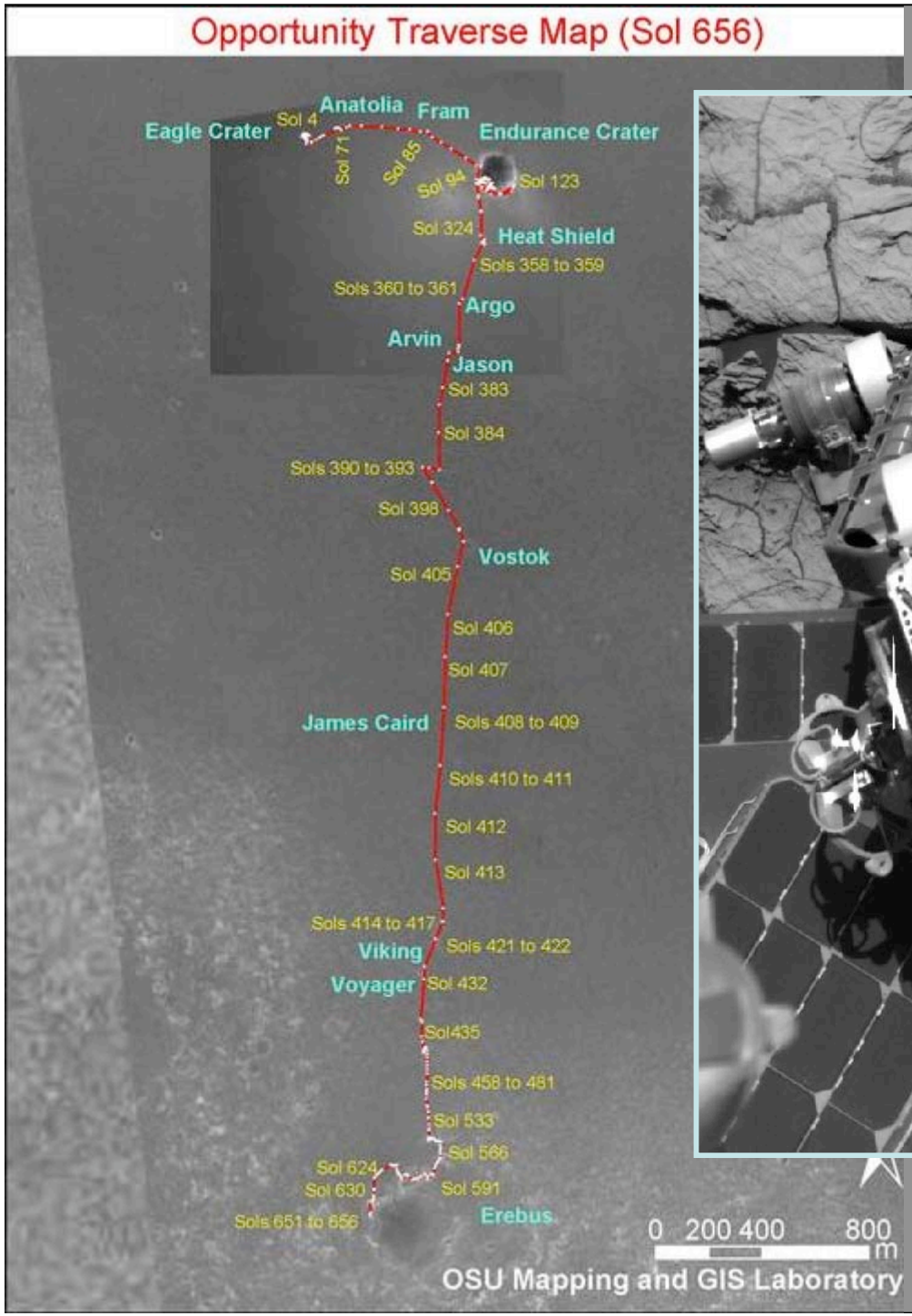
Panoramic Camera:	Microscopic Imager:
Sol 738 (12 img) *NEW*	Sol 736 (16 img)
Sol 737 (56 img)	Sol 724 (12 img)

Tous les images sont accessibles au public !!!



Credit JPL

Les strates de Homeplate


Opportunity Traverse Map (Sol 656)
Eagle Crater
Anatolia
Fram
Endurance Crater
Sol 4
Sol 71
Sol 85
Sol 94
Sol 123
Sol 324
Heat Shield
Sols 358 to 359
Sols 360 to 361
Argo
Arvin
Jason
Sol 383
Sol 384
Sols 390 to 393
Sol 398
Vostok
Sol 405
Sol 406
Sol 407
James Caird
Sols 408 to 409
Sols 410 to 411
Sol 412
Sol 413
Sols 414 to 417
Viking
Sols 421 to 422
Voyager
Sol 432
Sol435
Sols 458 to 481
Sol 533
Sol 566
Sol 624
Sol 630
Sol 591
Sols 651 to 656
Erebus
0 200 400 800
m
OSU Mapping and GIS Laboratory

Credit JPL

Nicholson crater (mars)

Ice-filled crater

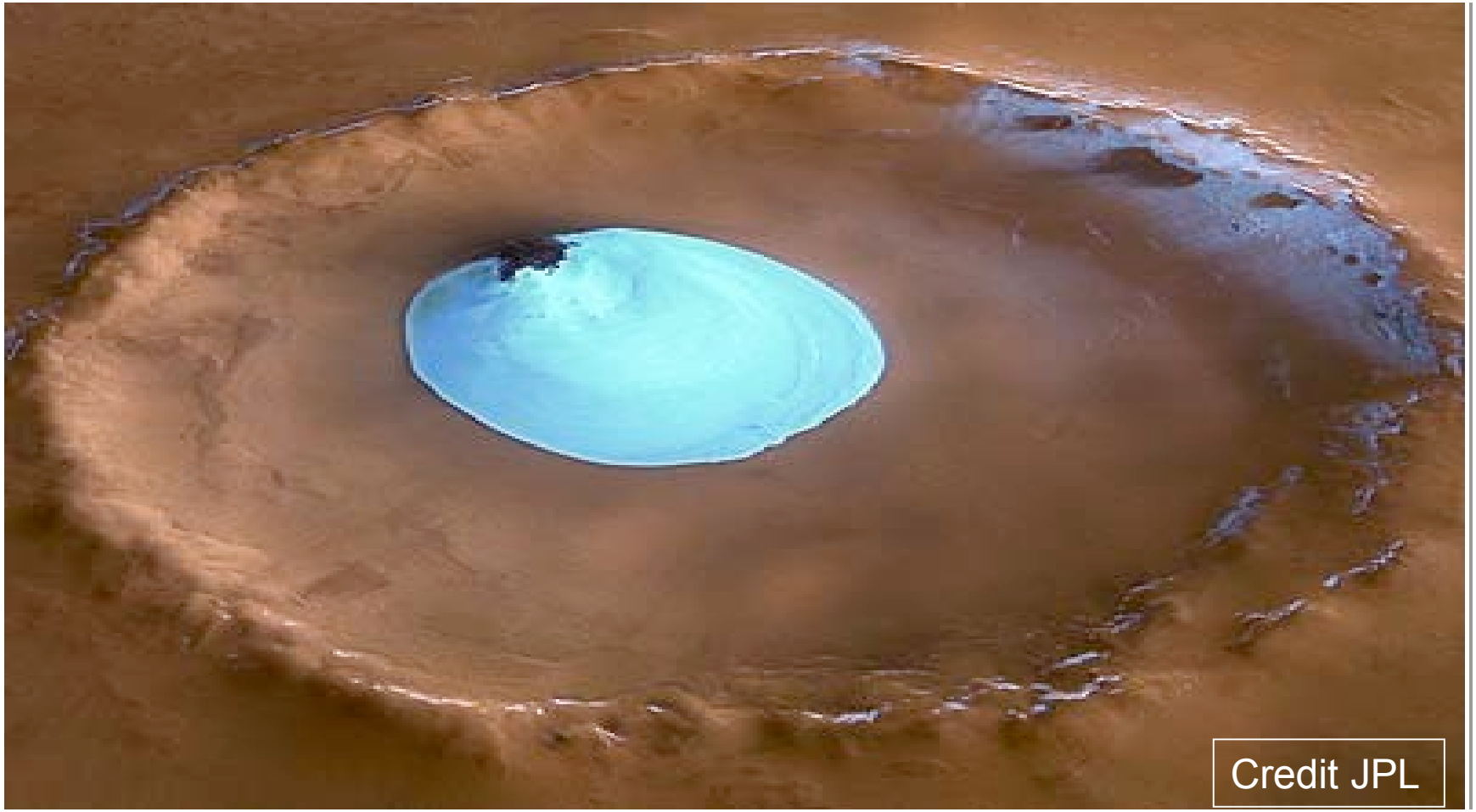
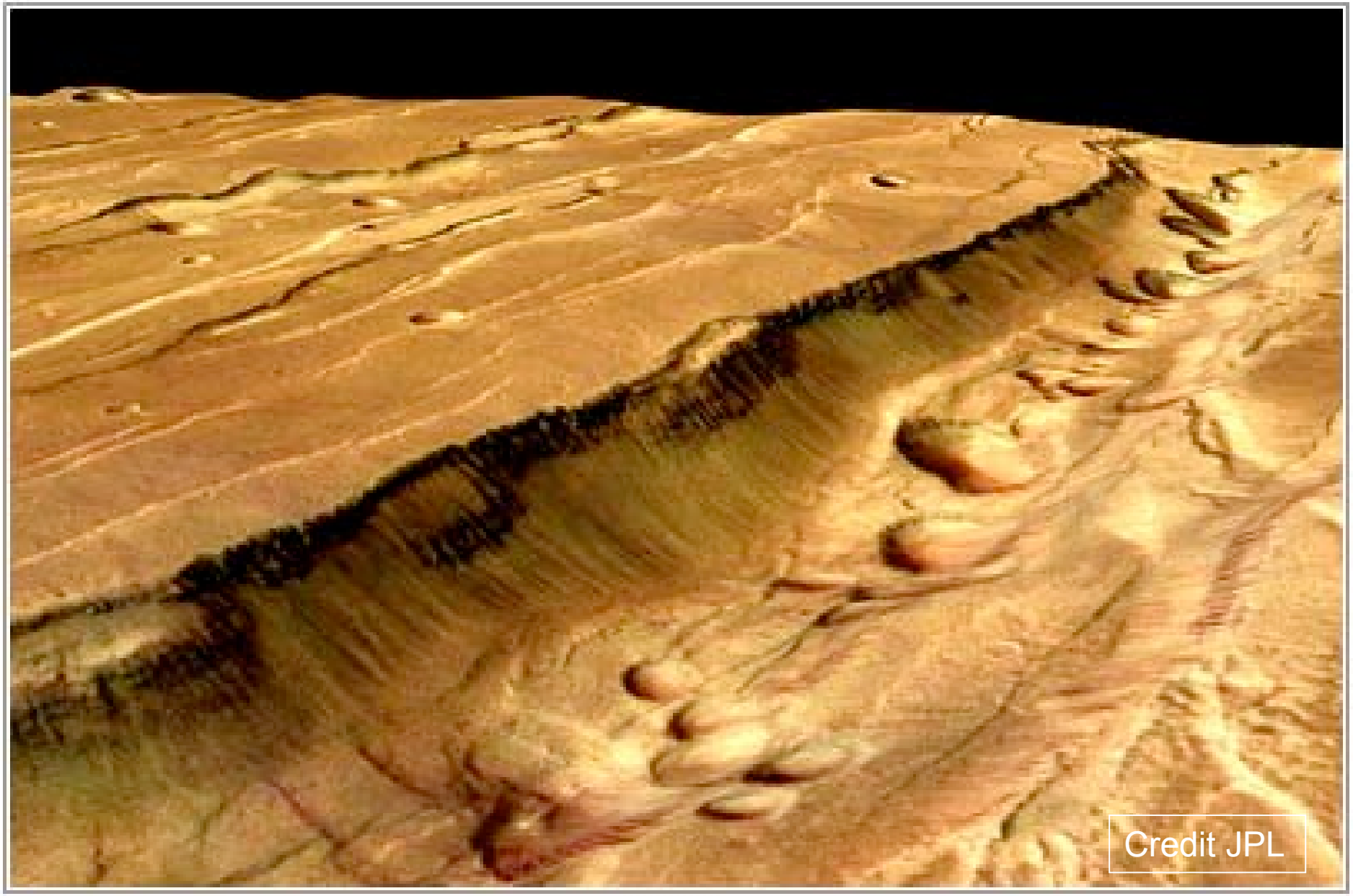
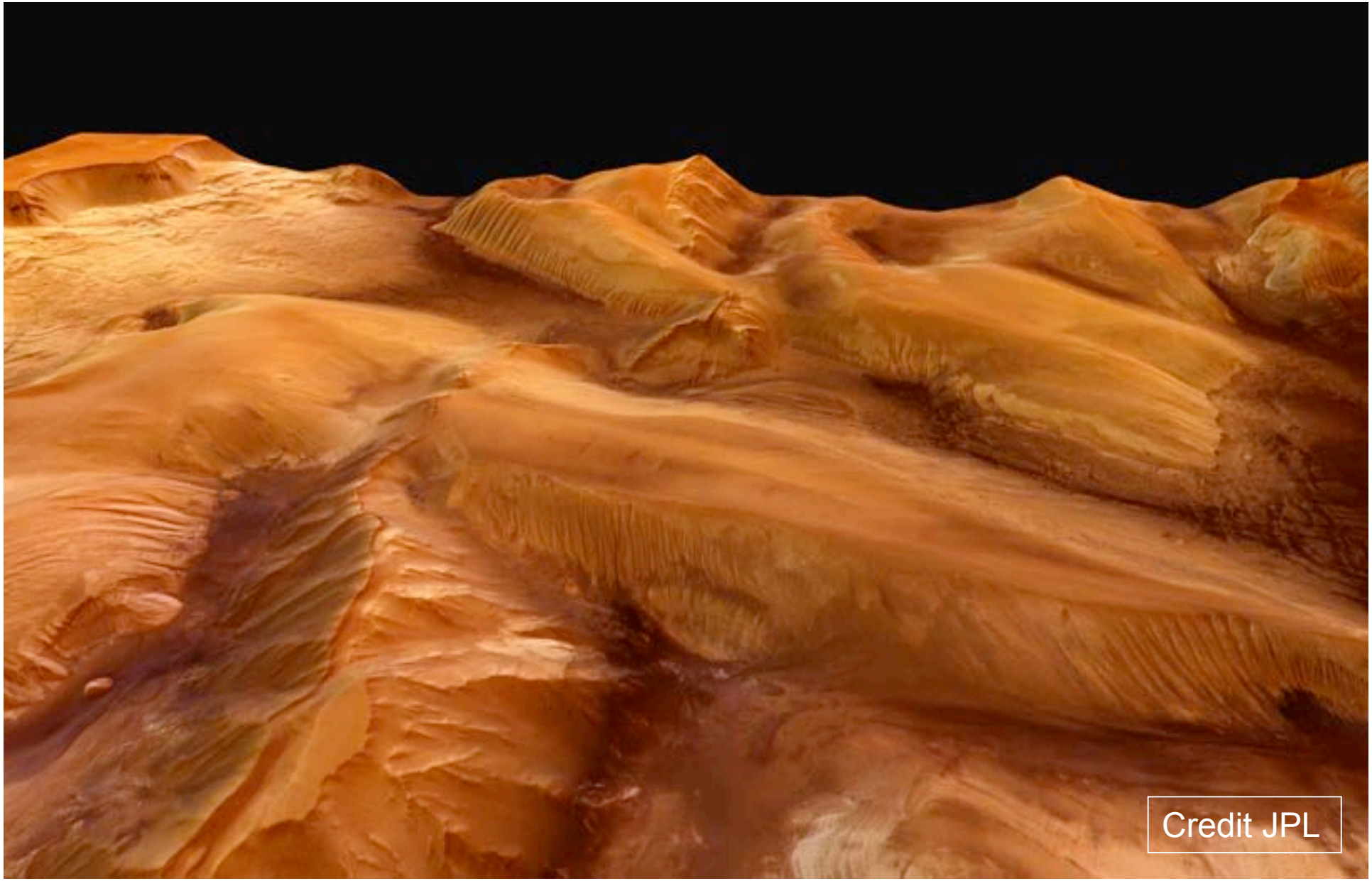


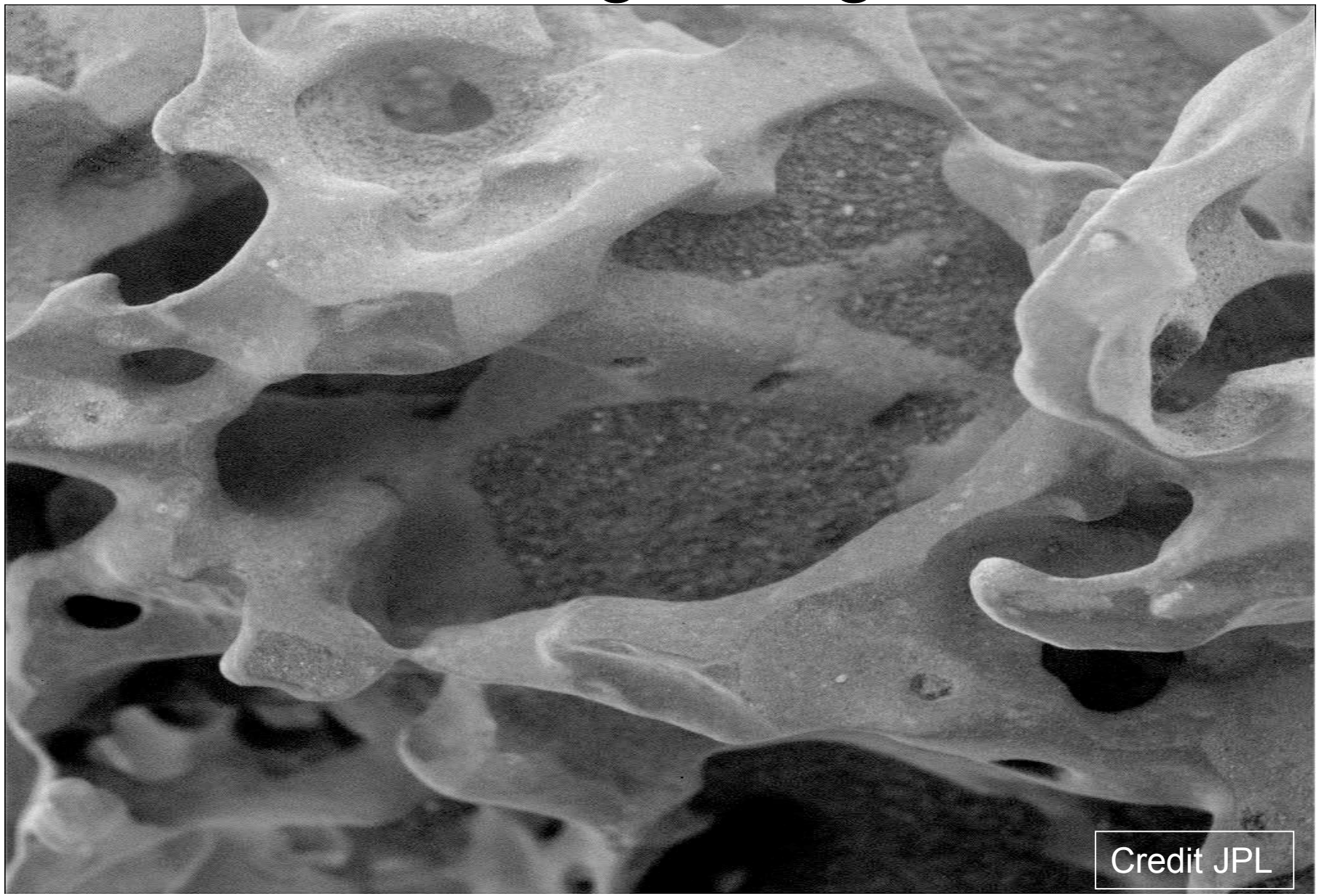
Image 3D d’un effondrement de terrain



Ophir Chasma

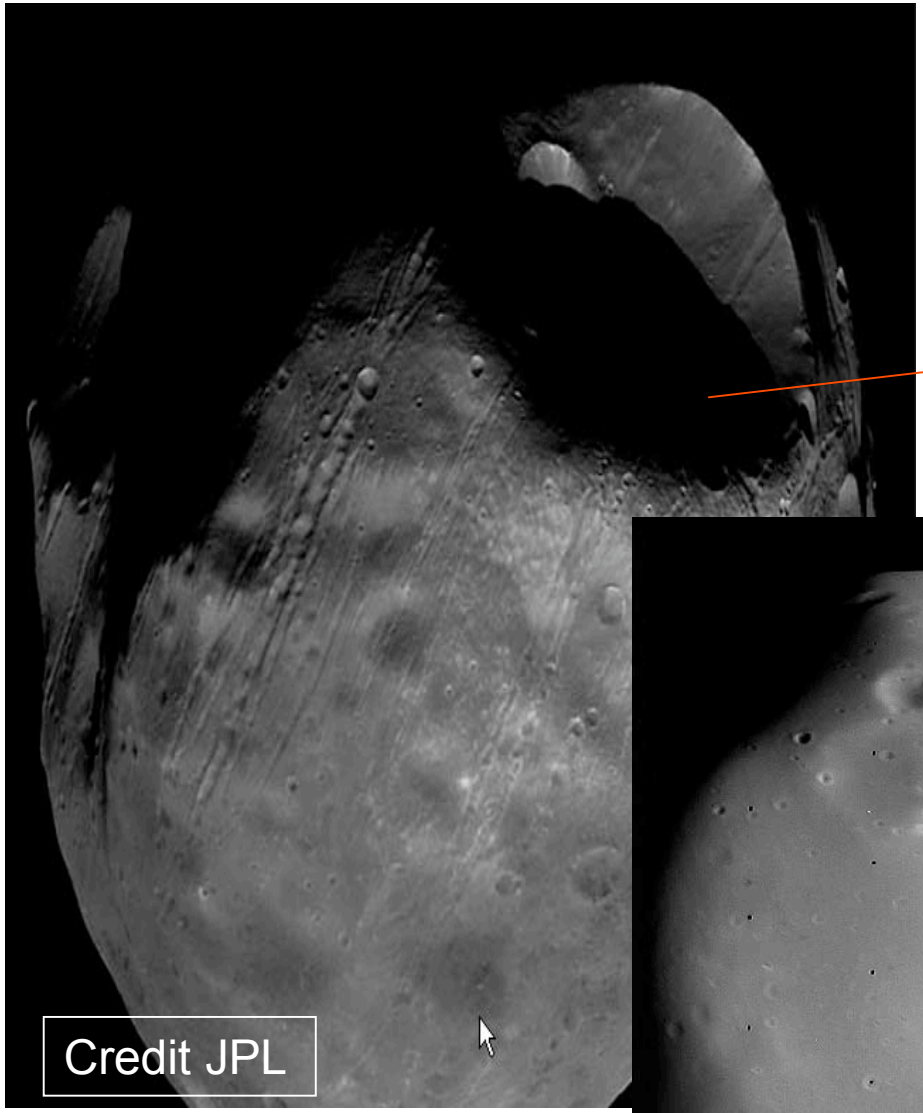


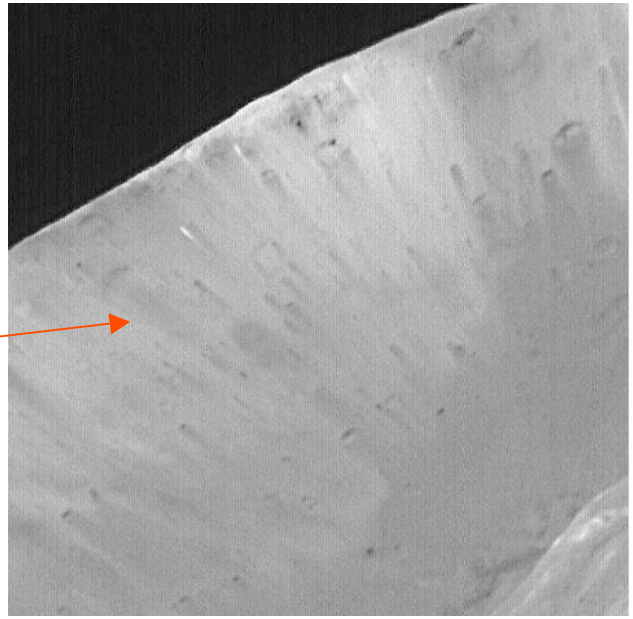
Gong-Gong

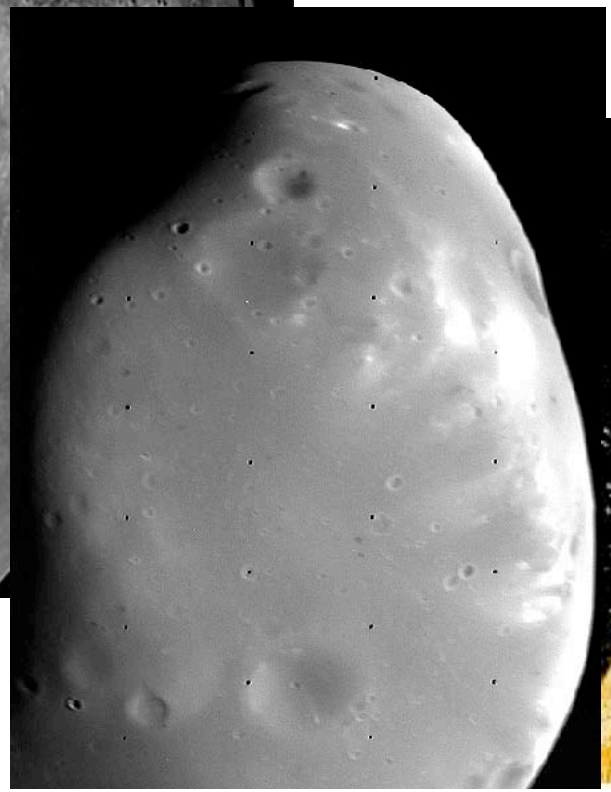


Credit JPL

Satelites de Mars:Phobos et Deimos

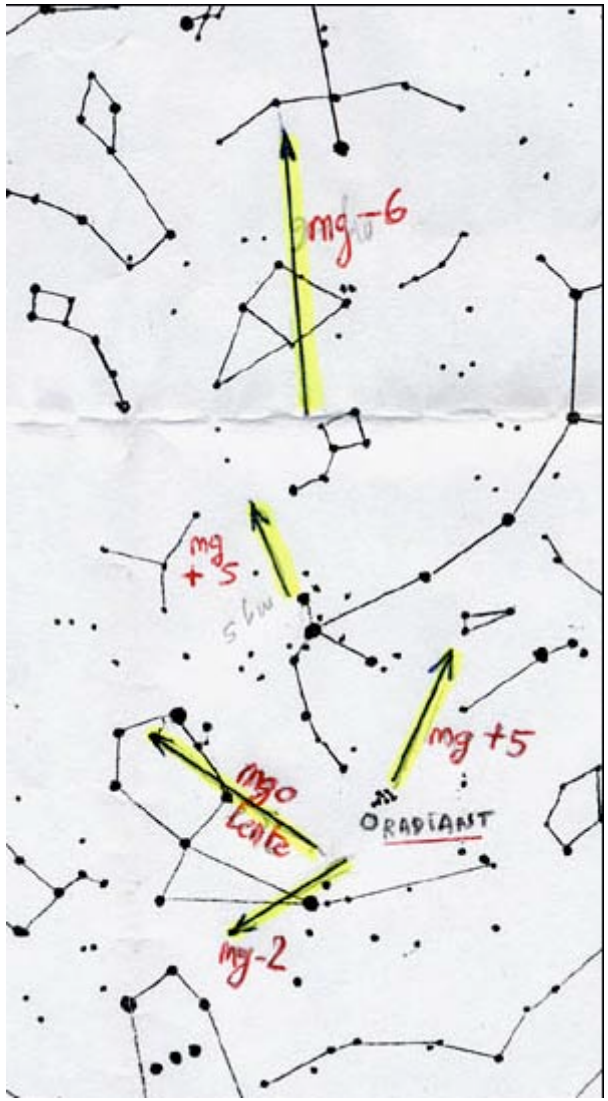




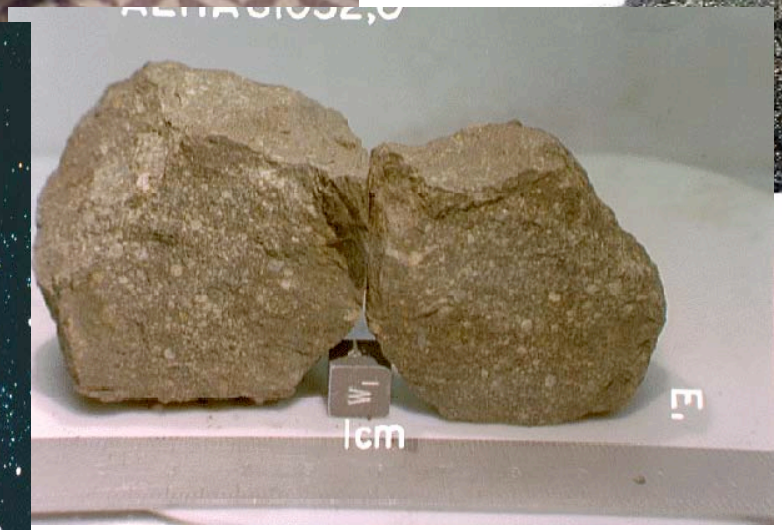


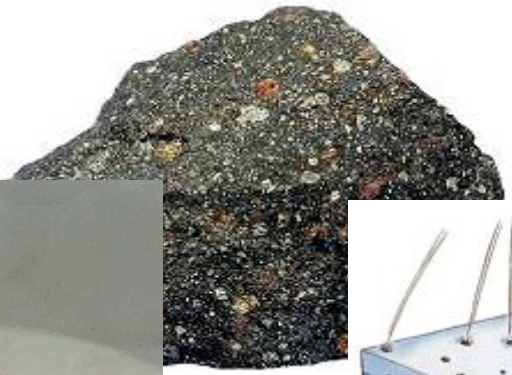
USSR images: Ted Stryk reprocessed (with permission)

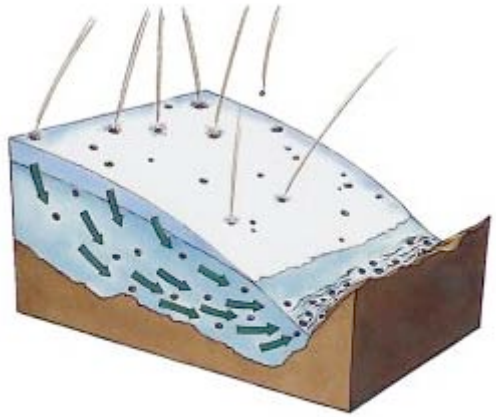
Pluie de météores



Meteorites (=météores tombés sur la terre)







L'Antarctique est un véritable concentrateur de météorites.

Types de météorites

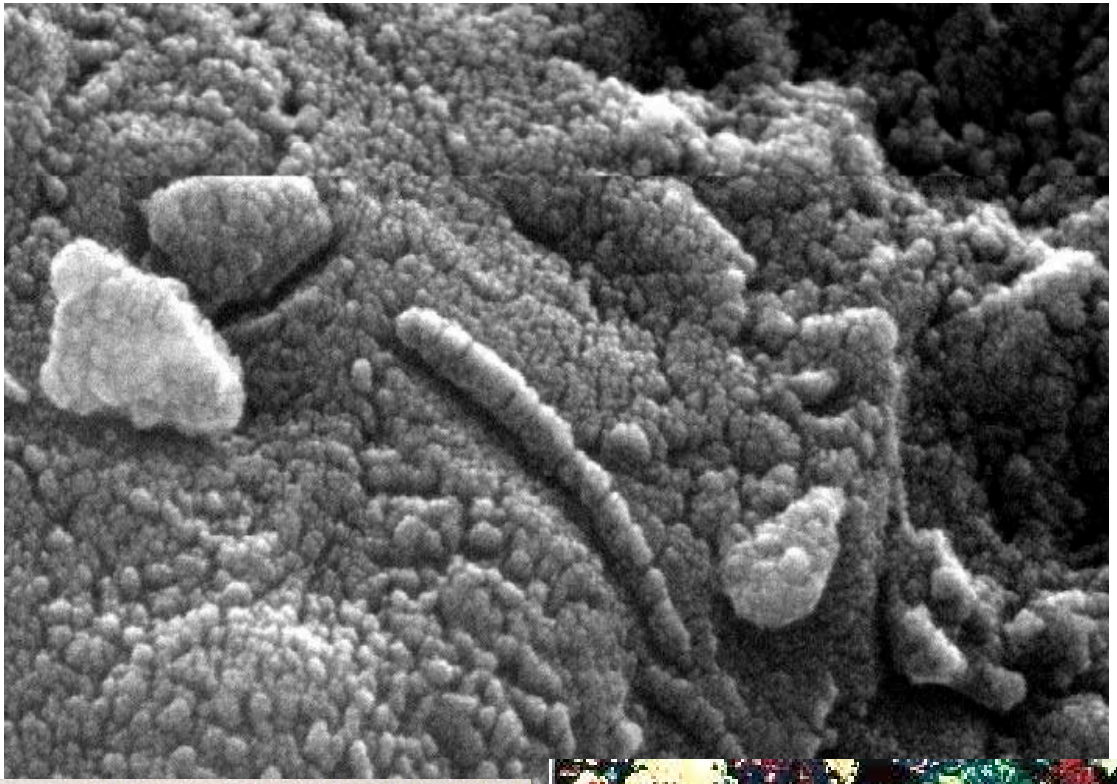
Type	Calculé à partir des météorites récupérées en Antarctique		Catalogue de Graham
	% en masse	% en nombre	% en nombre
Chondrites	75,07	85,37	64,30
Achondrites	9,41	7,62	5,00
Météorites mixtes	4,15	0,97	3,00
Météorites métalliques	11,37	6,05	27,70

Un fragment de la 13ème météorite martienne découverte sur Terre, Dar al Gani 476, surnommé lucky 13 (Crédit photo : droits réservés).

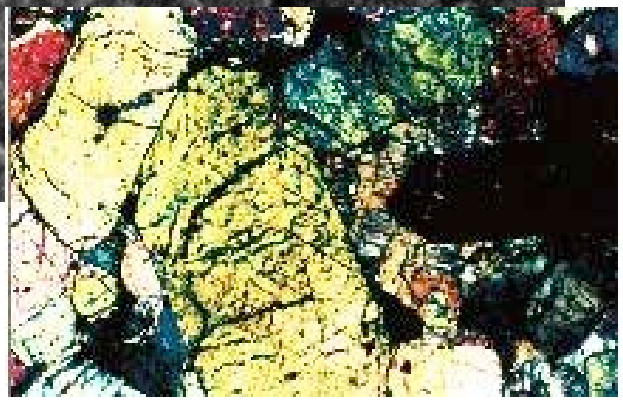
Los Angeles 001, une belle météorite martienne de 452 g. La croûte de fusion est encore bien visible sur la partie supérieure de la pierre. Le cube témoin mesure 1 cm de côté (Crédit photo : Ron Baalke).

Les SNC (Shergottites-Nakhlites-Chassignites,inde1865, egypte1911, France1815) viennent de MARS !!

Météorites de Mars

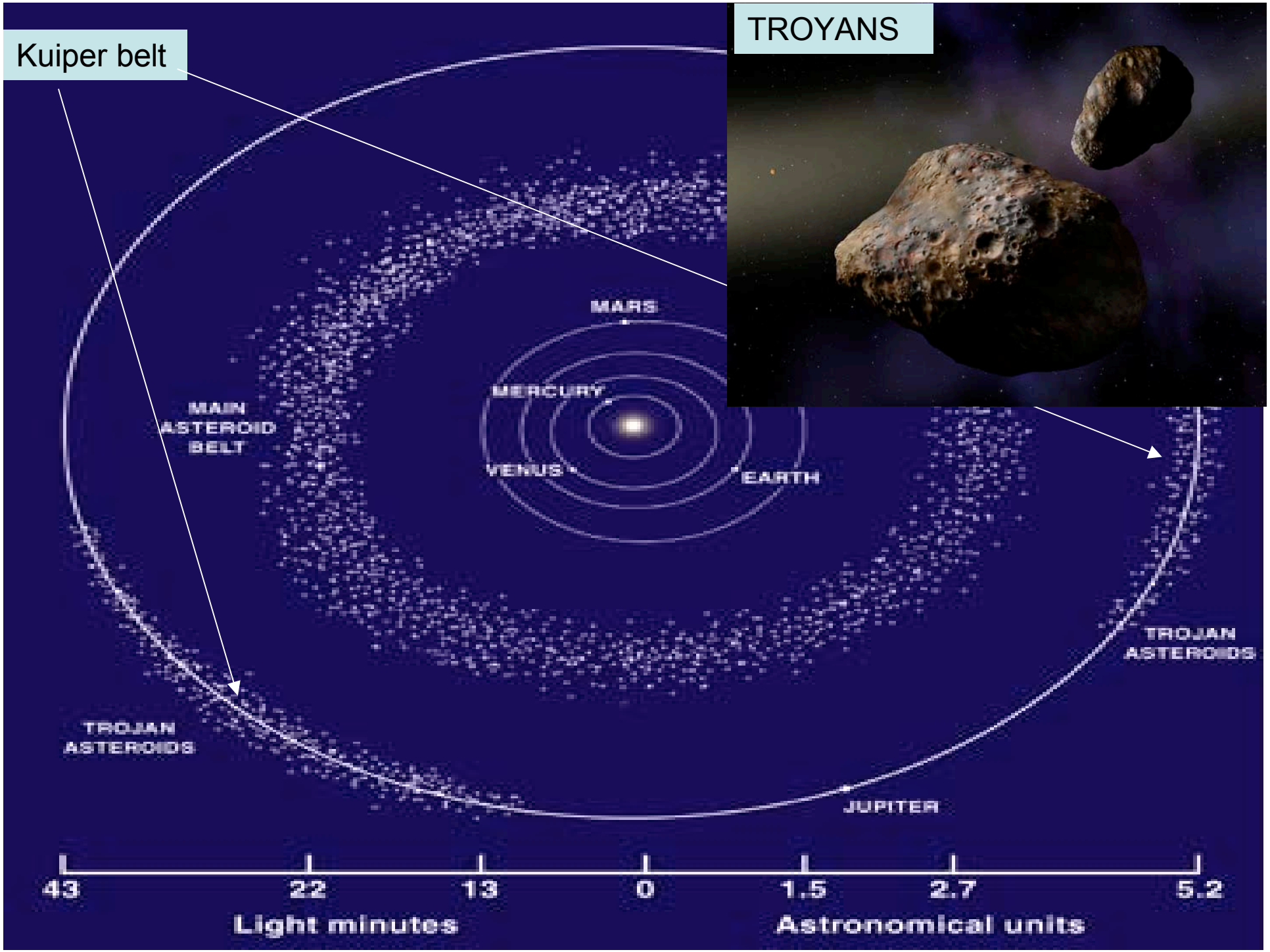


Chassignite (France, 1815). Cette pierre est restée très longtemps unique, jusqu'à la découverte de NWA 2737 (Crédit photo : Martin Horejsi).

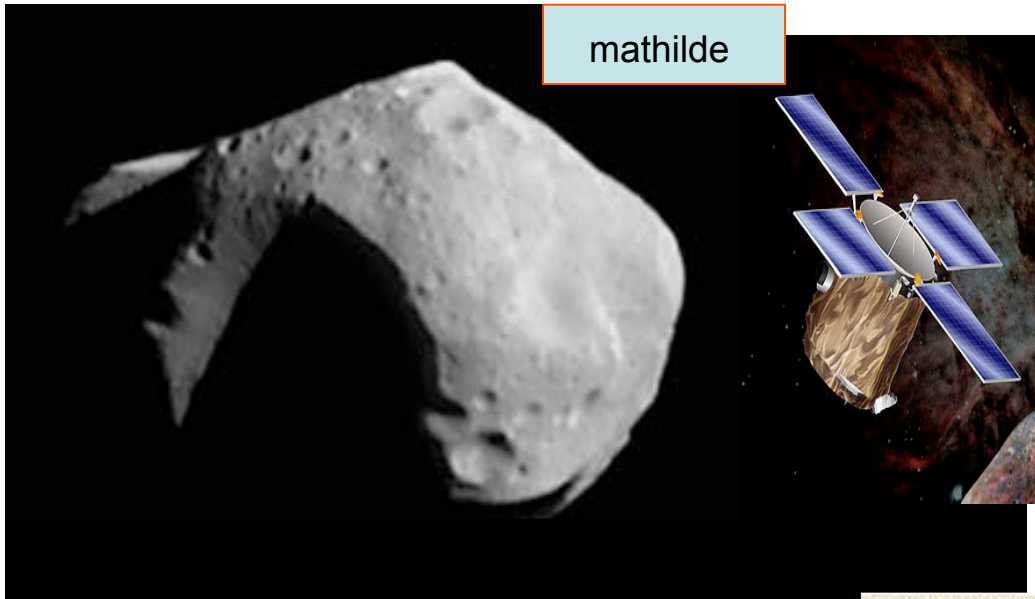


Nakhlite (Egypte, 1911). Lors de sa chute à Nakhla, près d'Alexandrie, cette pierre aurait écrasé un chien ! Les accidents mortels produits par la chute de météorites sont cependant rarissimes (Crédit photo : Université d'Hawaii).

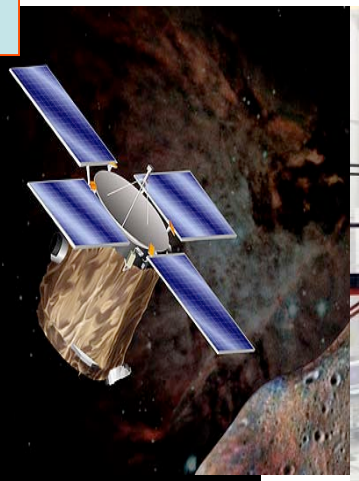
Les SNC

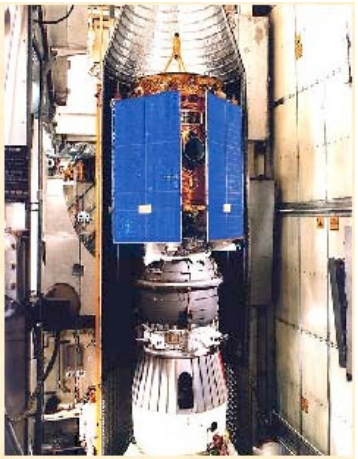

Kuiper belt
TROYANS
MARS
MERCURY
MAIN
ASTEROID
BELT
VENUS
EARTH
TROJAN
ASTEROIDS
TROJAN
ASTEROIDS
JUPITER
43
22
13
0
1.5
2.7
5.2
Light minutes
Astronomical units

Asteroides :Mathilde, Ida and its moon Dactyl



mathilde

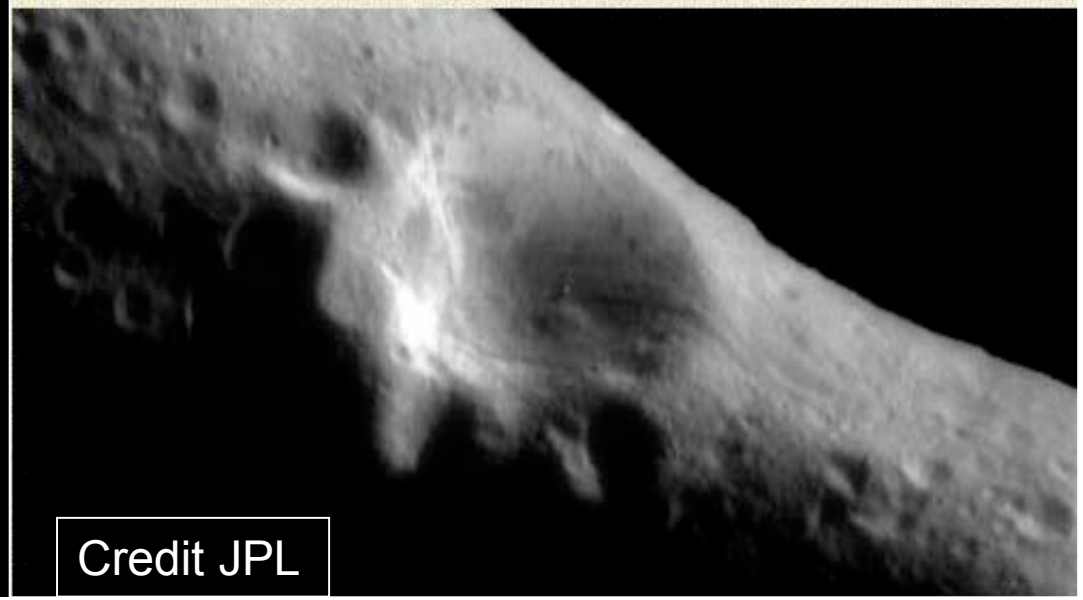




Ida, Dactyl

Vue de galileo

L'astéroïde Eros vu par la sonde NEAR



Credit JPL

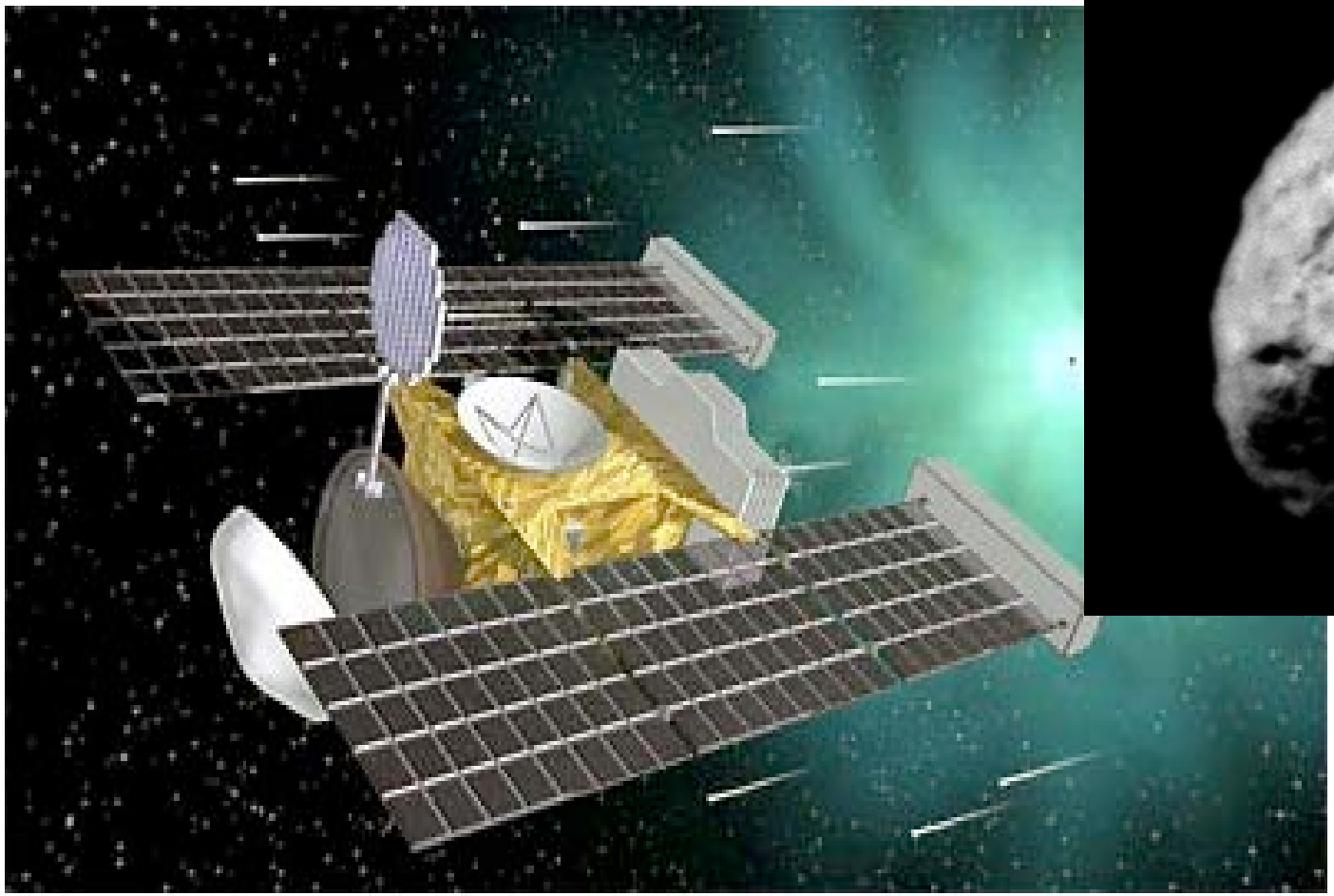
Sonde Hayabusa :a collectionné des échantillons et les reportera (pas) sur terre!

Left hand side image shows the area named "MUSES Sea" taken at 4:58 Nov.20, and right hand side image was taken at 6:24 Nov.26. A white light spot inside a red circle is the Target Marker with 880,000 names of the people.

4:58 Nov.20.

6:24 Nov.26.

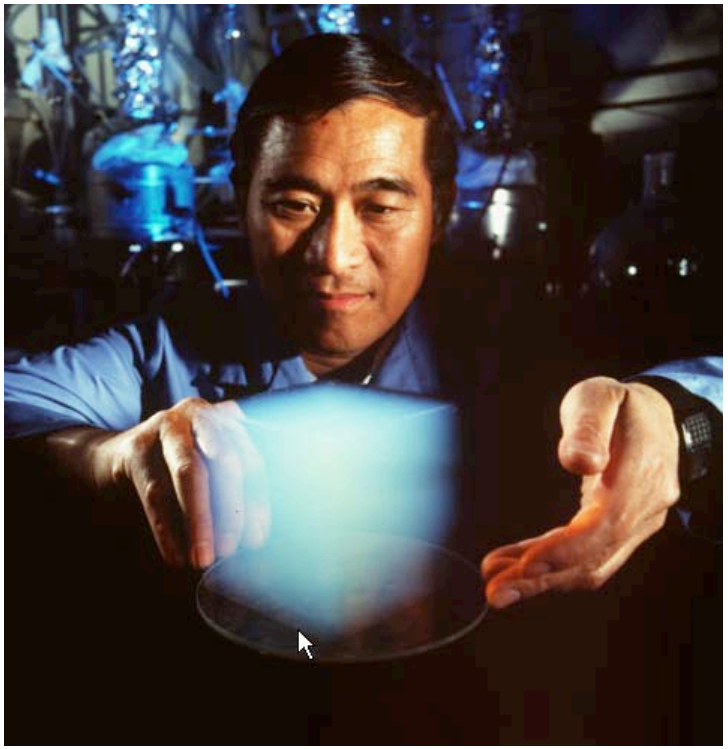
Stardust visite la comète WILD2



Stardust spacecraft collecting dust from the tail of comet Wild 2. *(NASA images)*

Stardust Collector

AEROGEL QUICK FACTS



It is 99.8% Air

Provides 39 times more insulating than the best fiberglass insulation

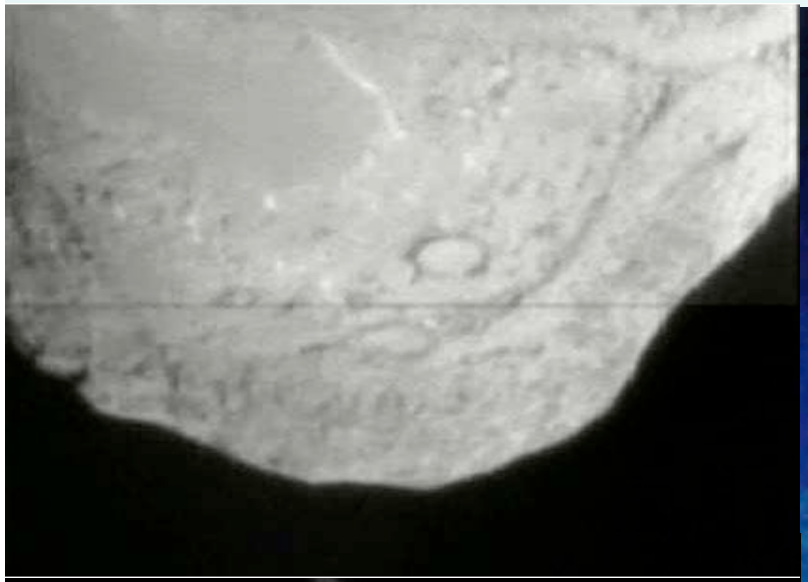
Is 1,000 times less dense than glass

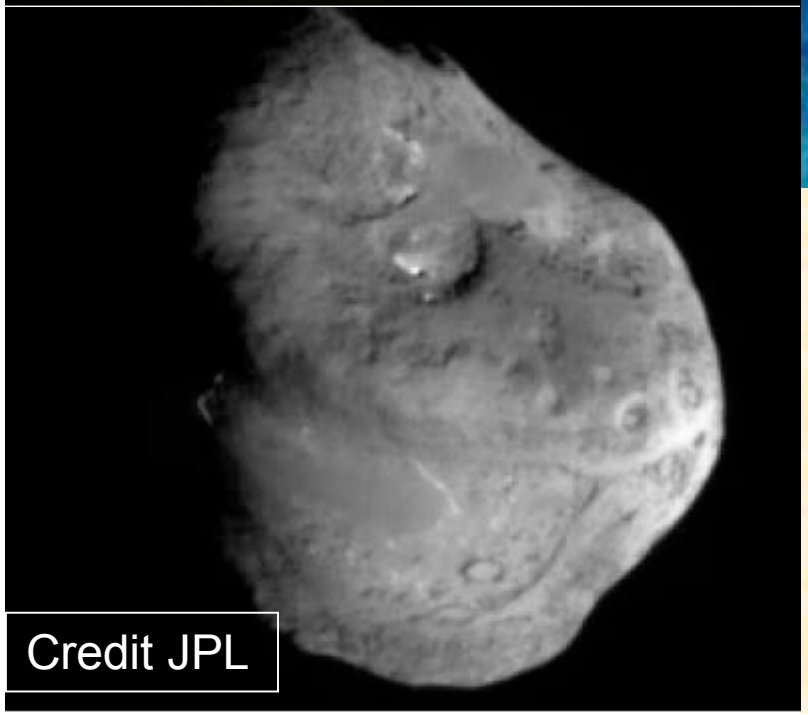
Was used on the Mars Pathfinder rover

Le gel utilisé pour capturer les poussières de la comète WILD

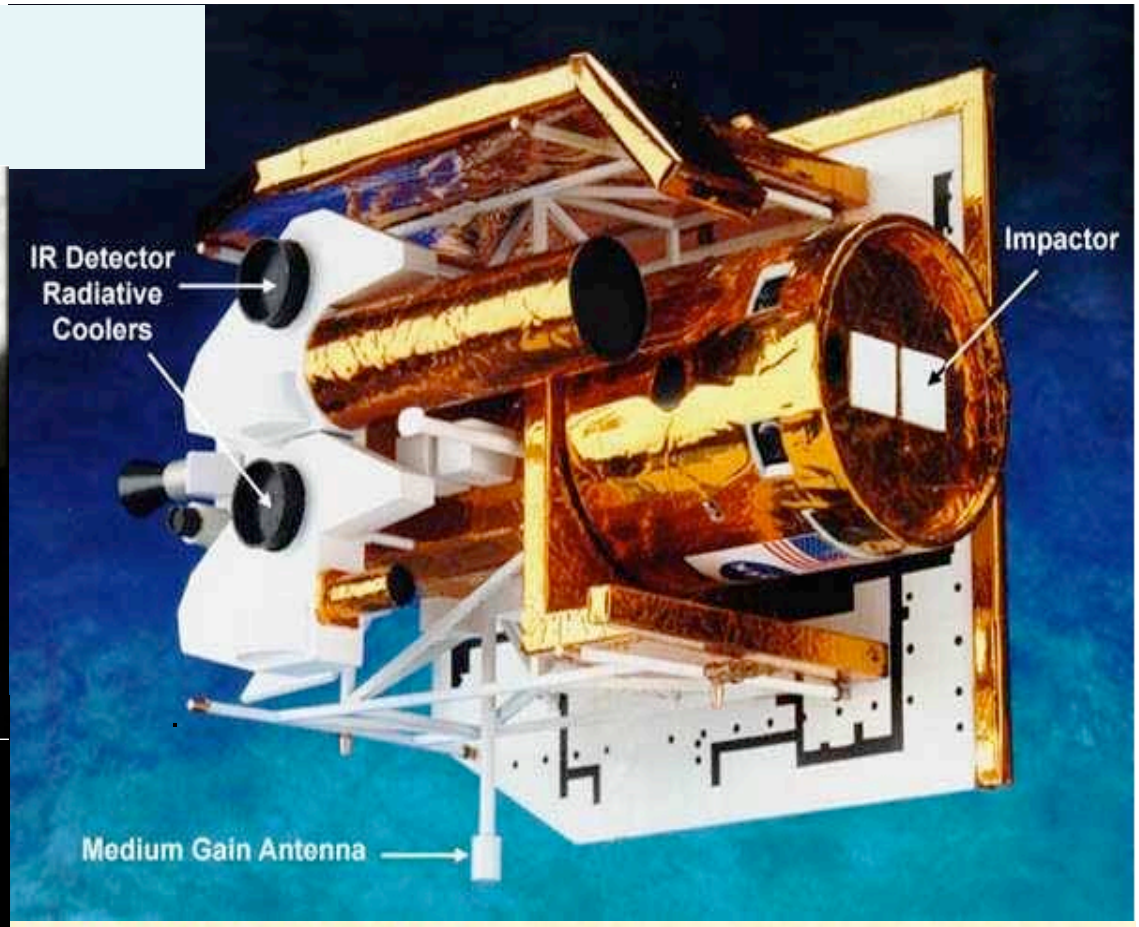
Sonde DEEP IMPACT

Sur la comète P9/Tempel, juillet05



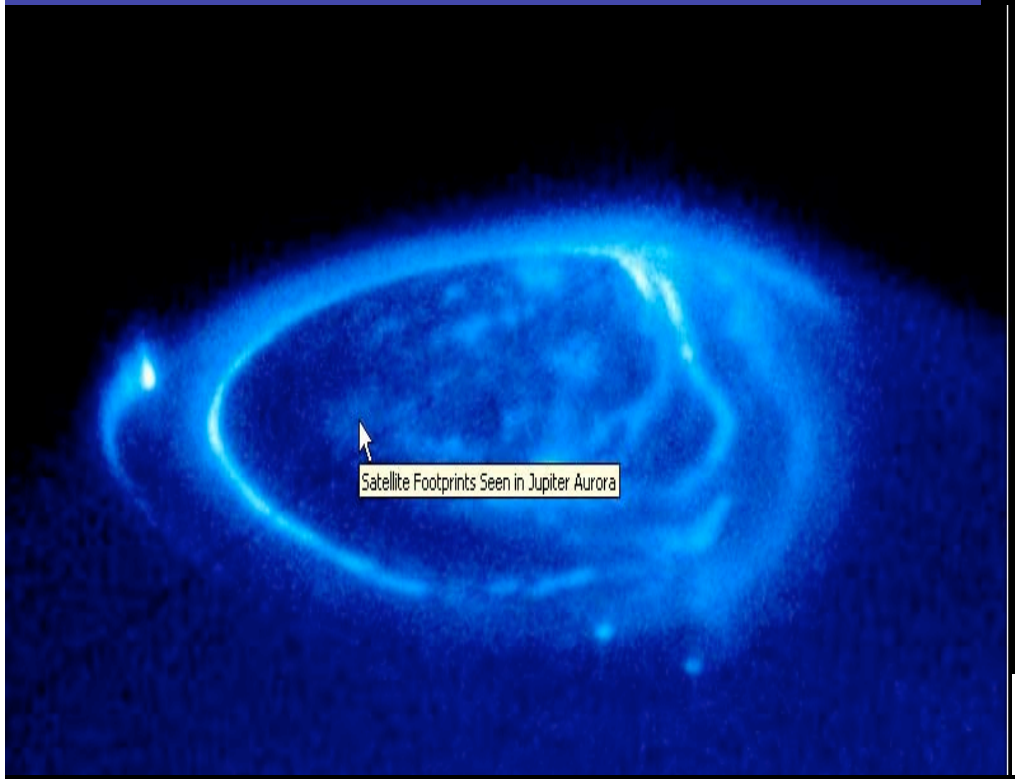


Credit JPL

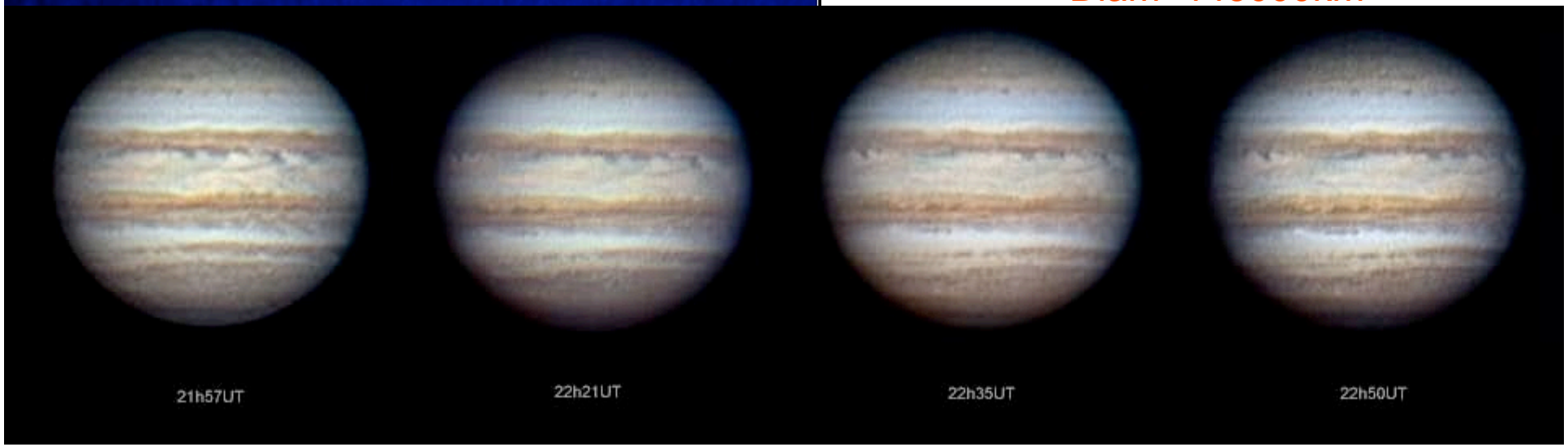


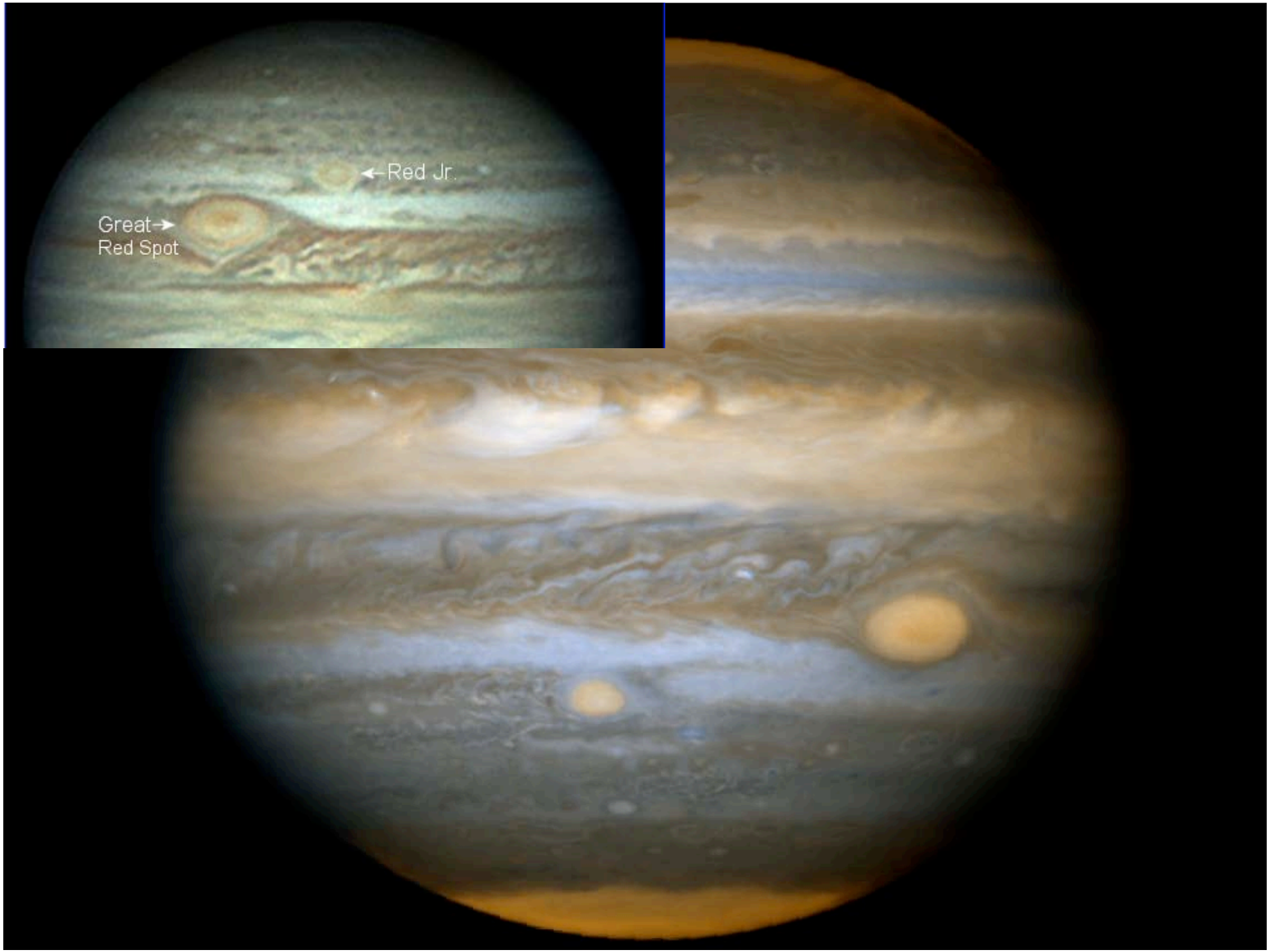
L'impact vu depuis la sonde :

Jupiter

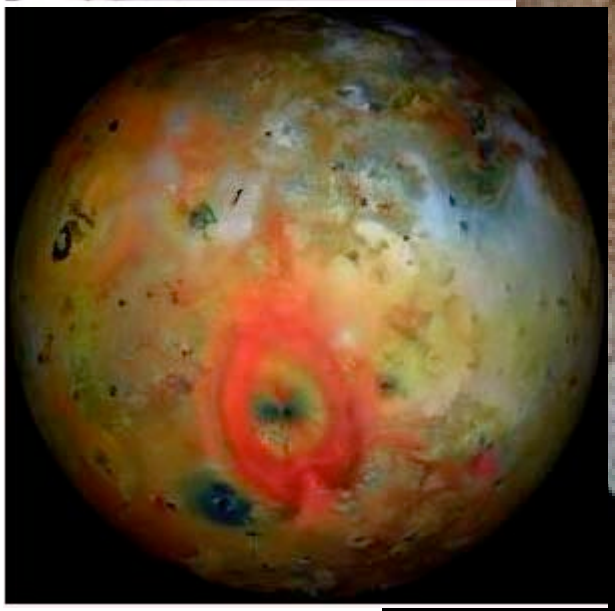


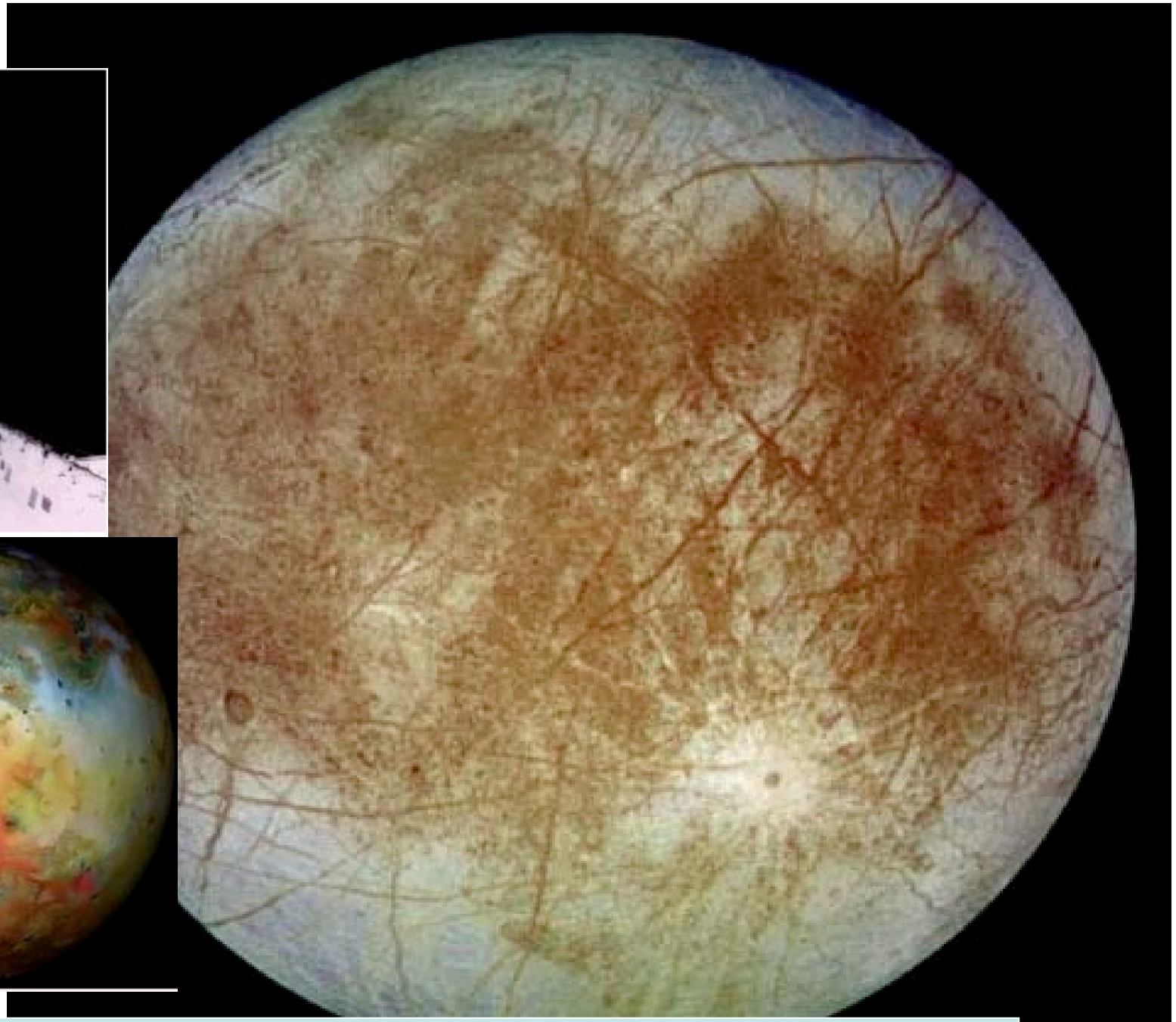
D=778mio km
Diam=143000km




Red Jr.
Great
Red Spot

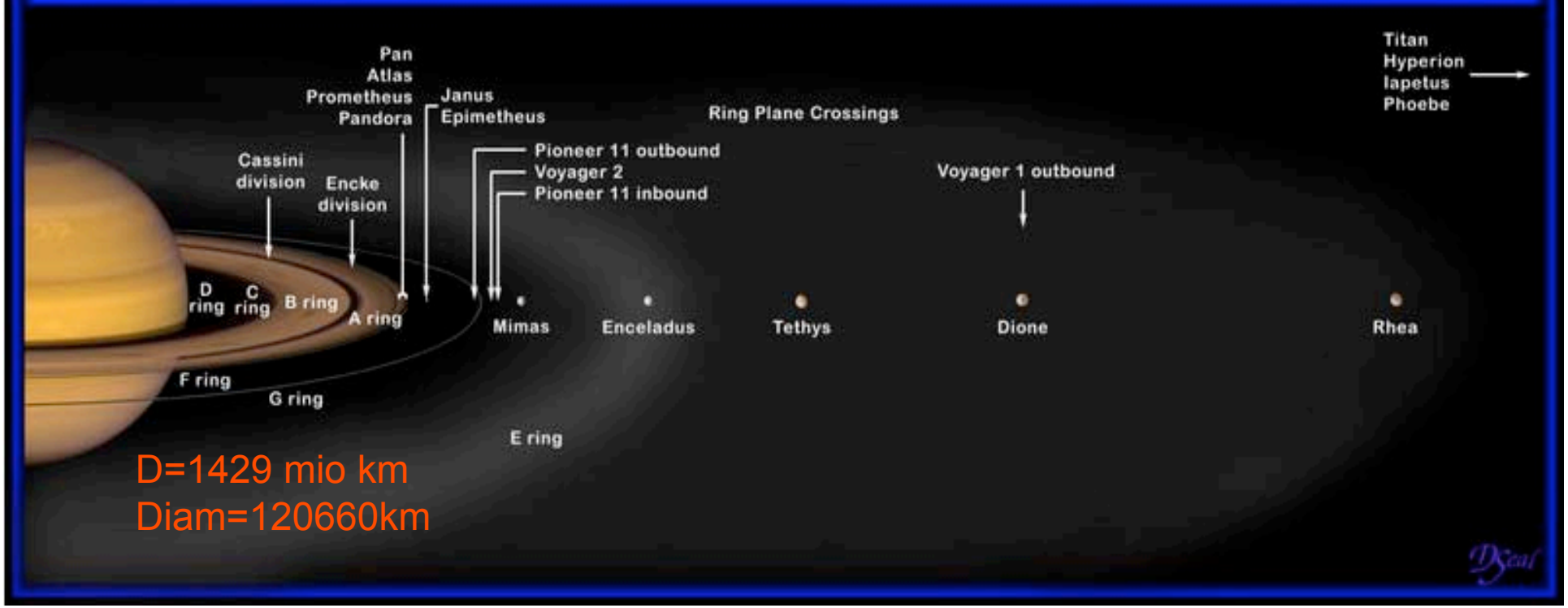
La sonde galileo





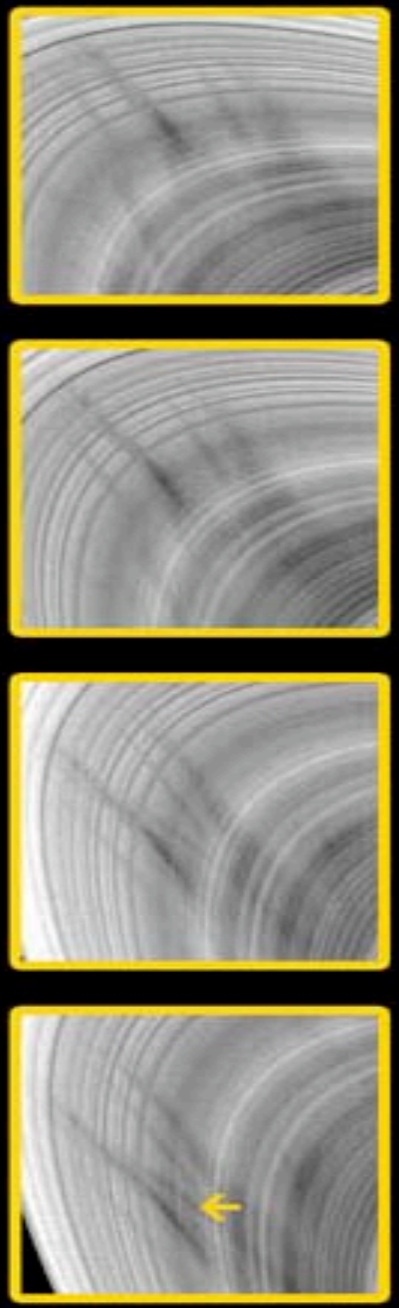
IO et Europe: glace 70km, océan 100km de profond?

Saturn's Satellites and Ring Structure

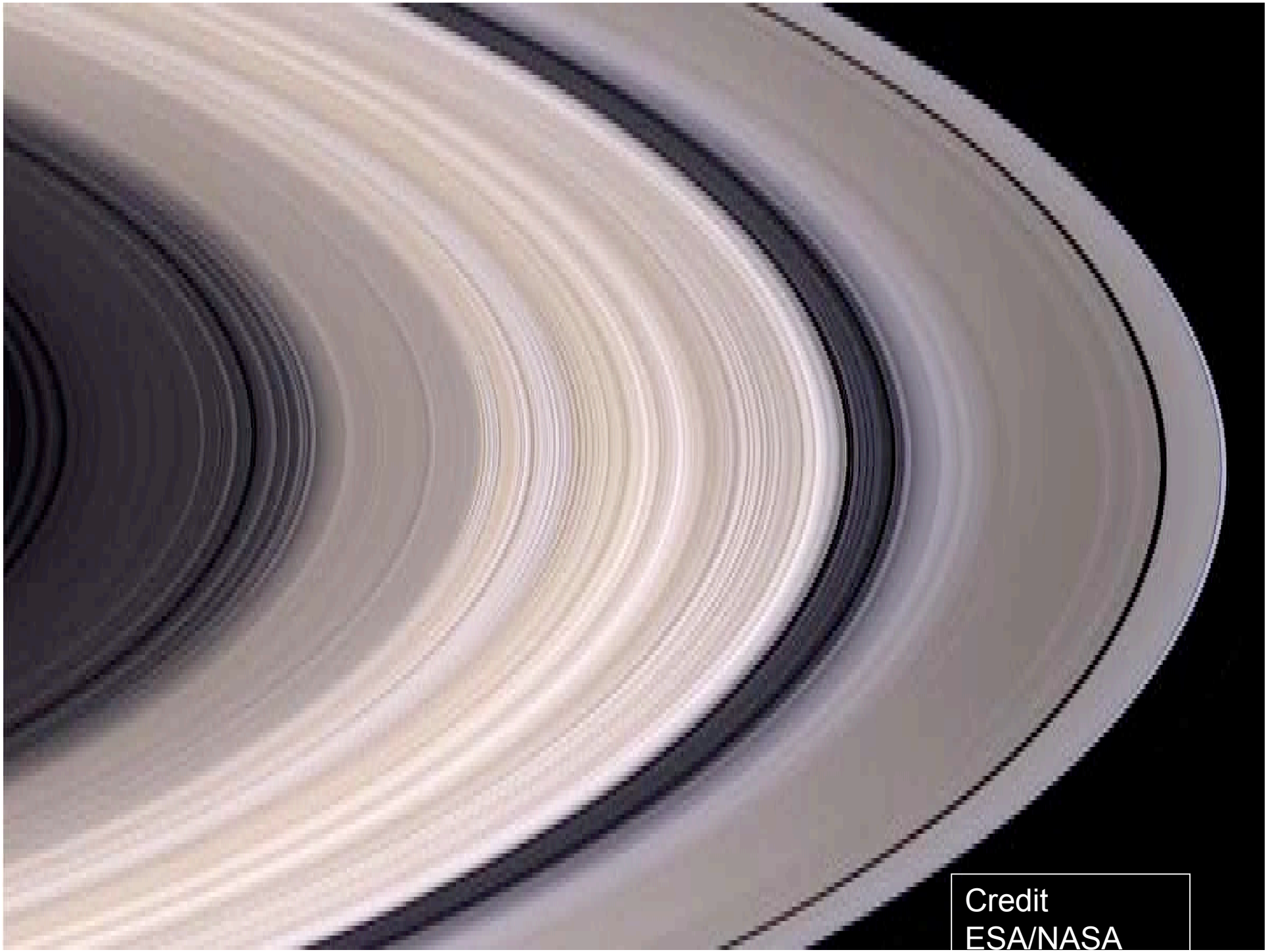


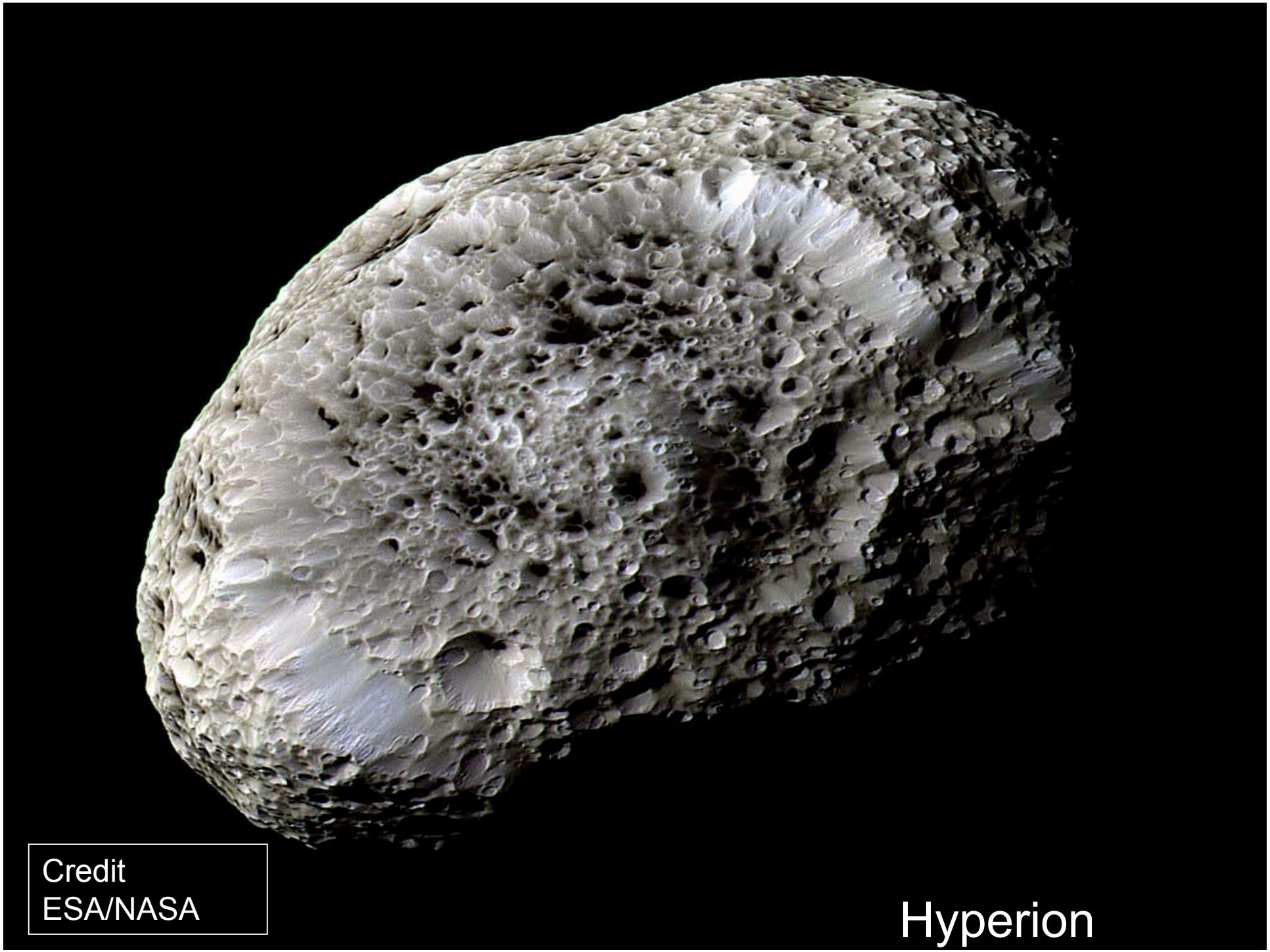
D=1429 mio km
Diam=120660km

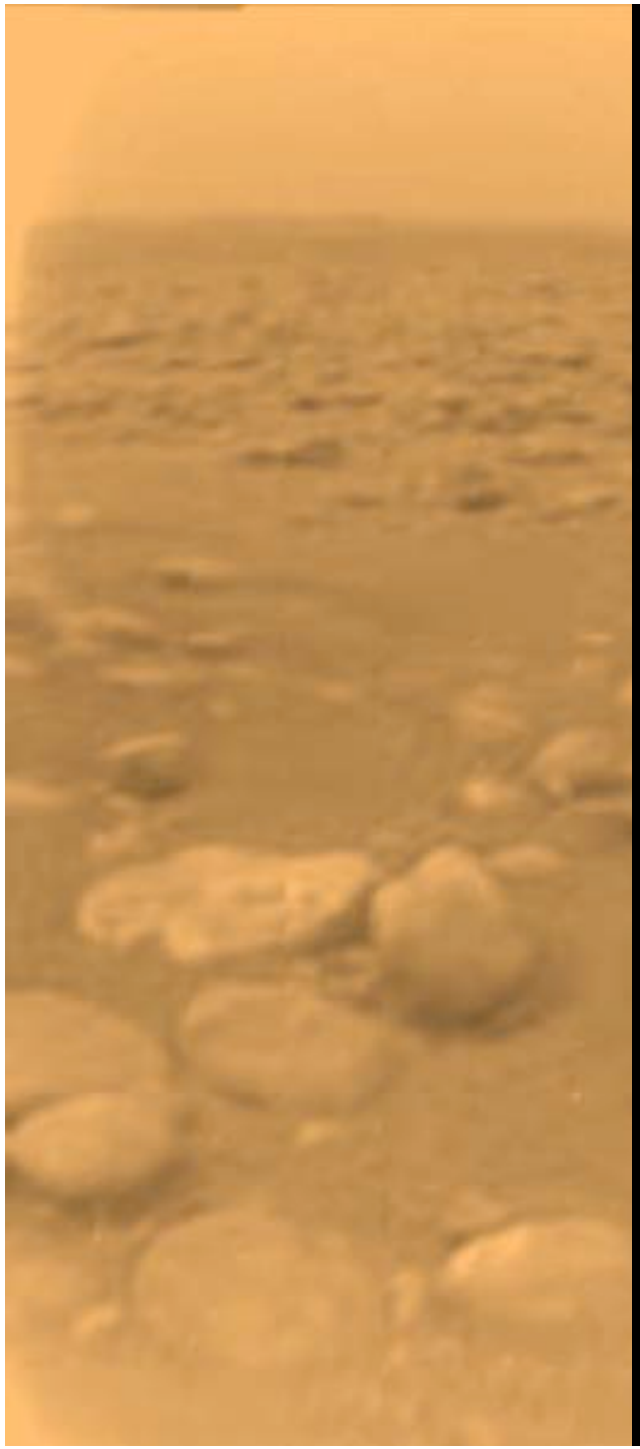
Les « Spokes » sont réapparus

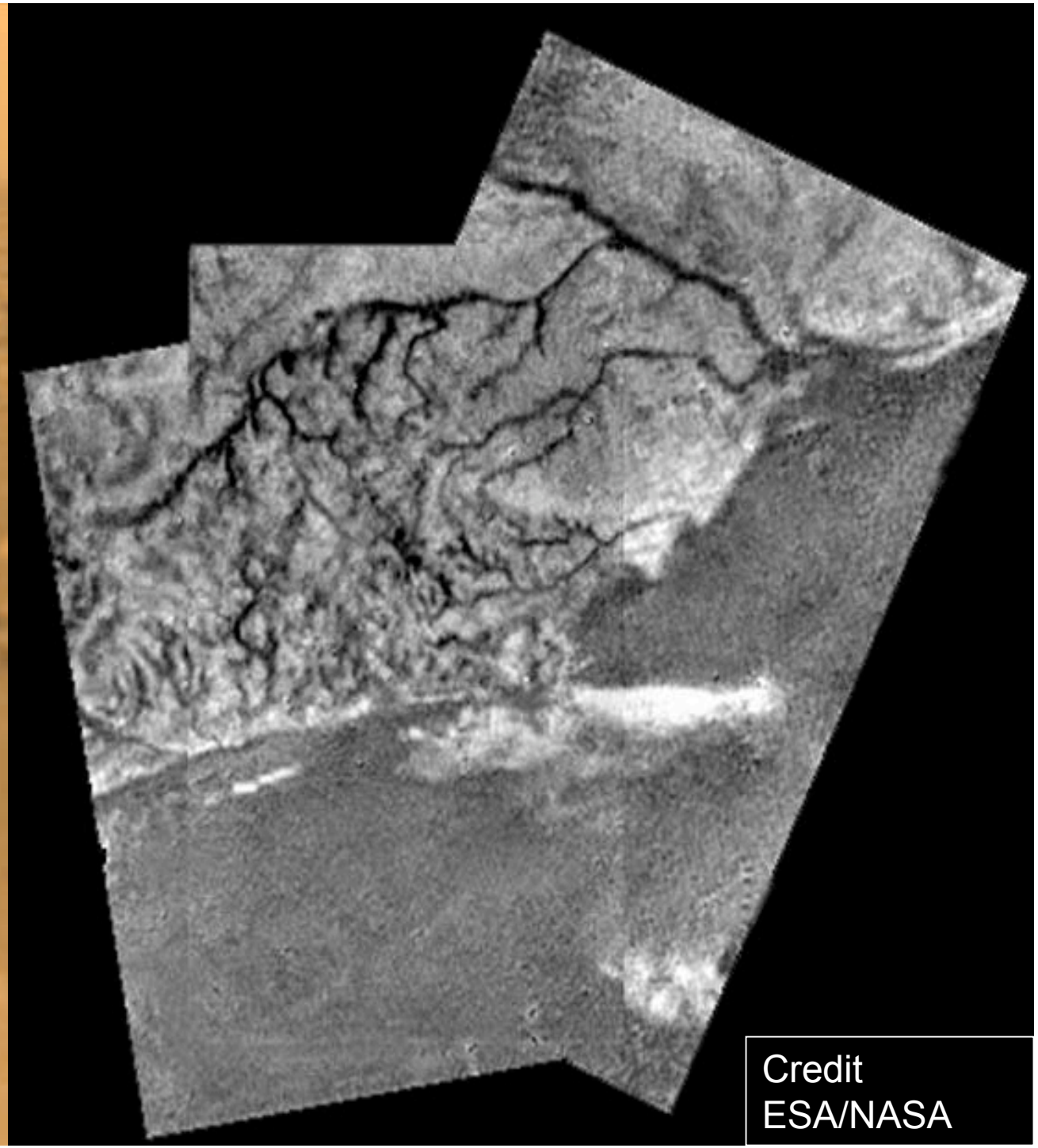


Credit
ESA/NASA

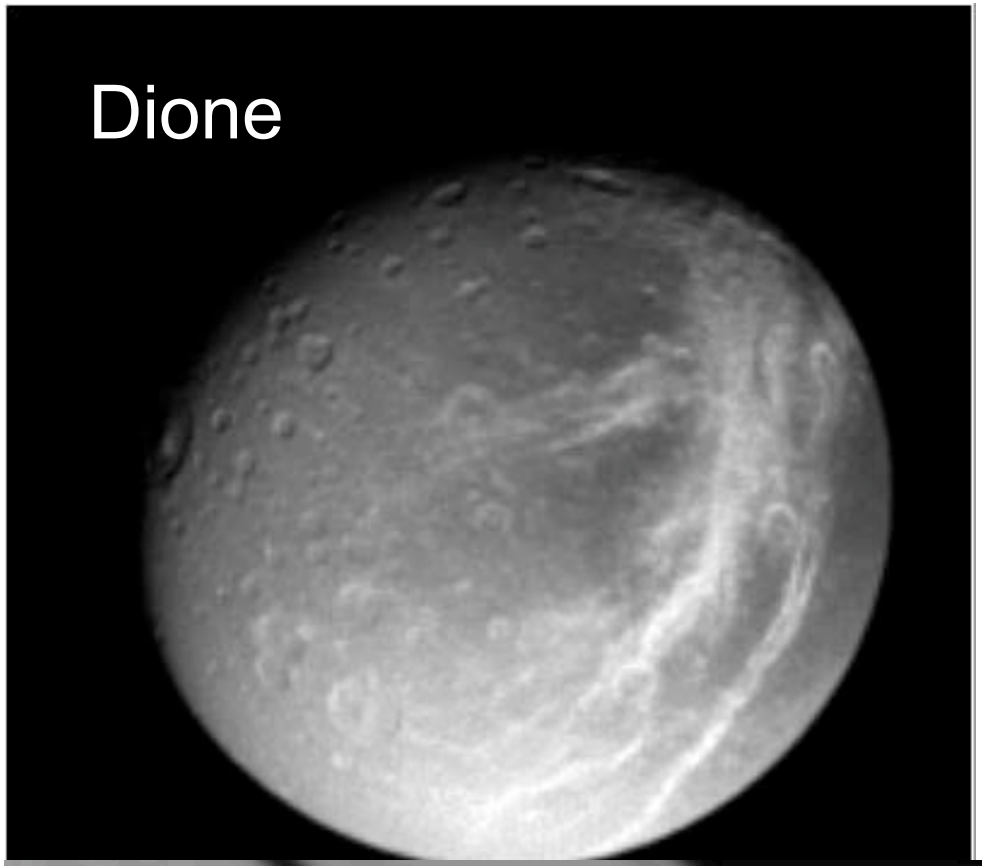

Credit
ESA/NASA

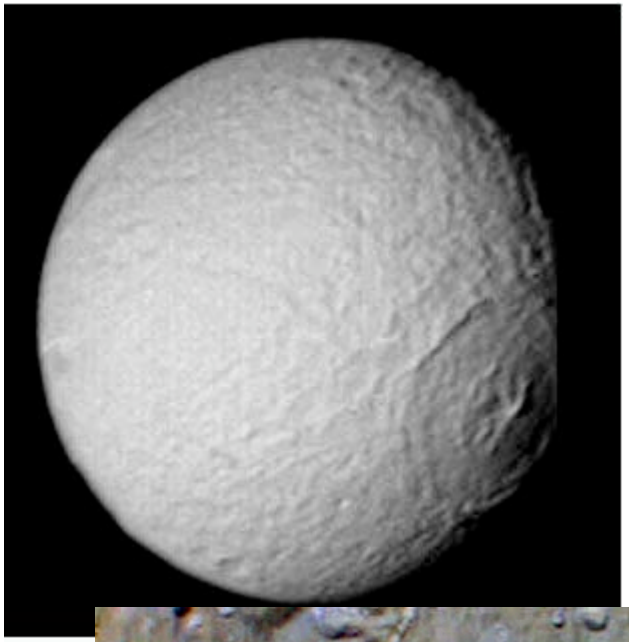

Credit
ESA/NASA
Hyperion



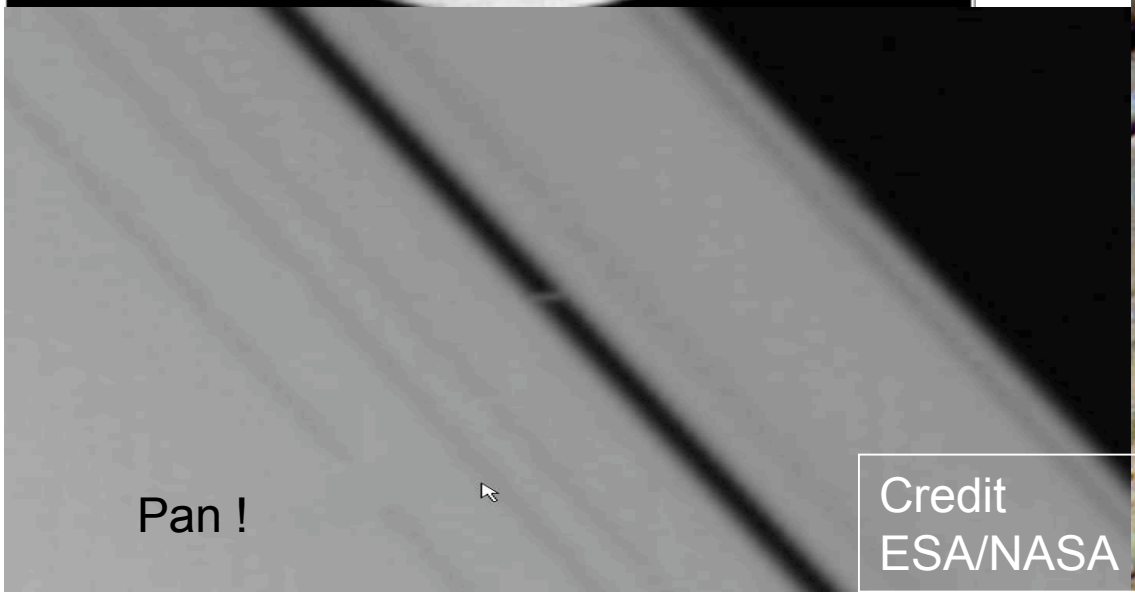


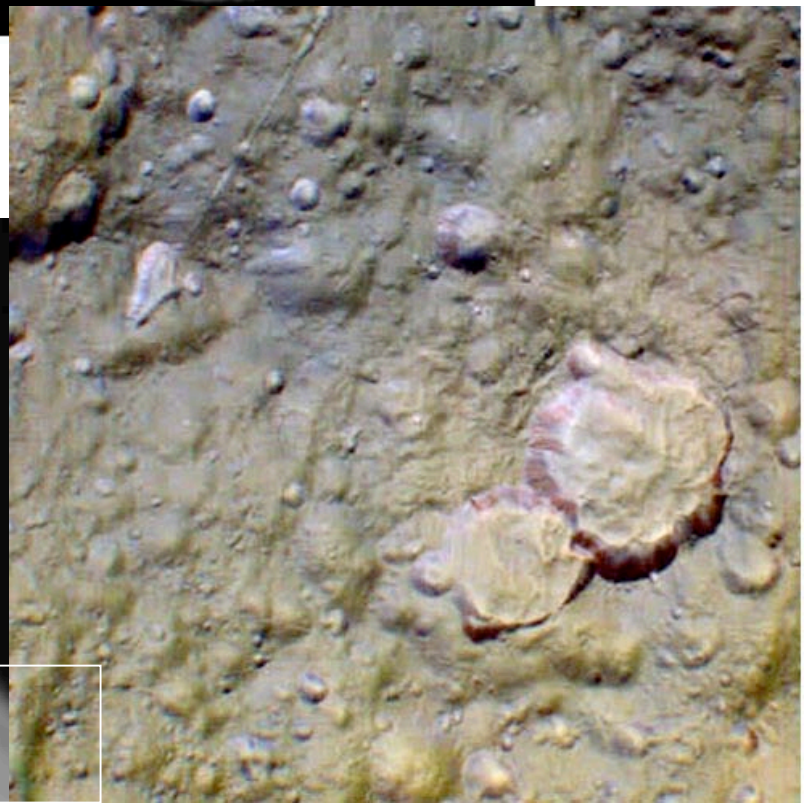
Credit
ESA/NASA





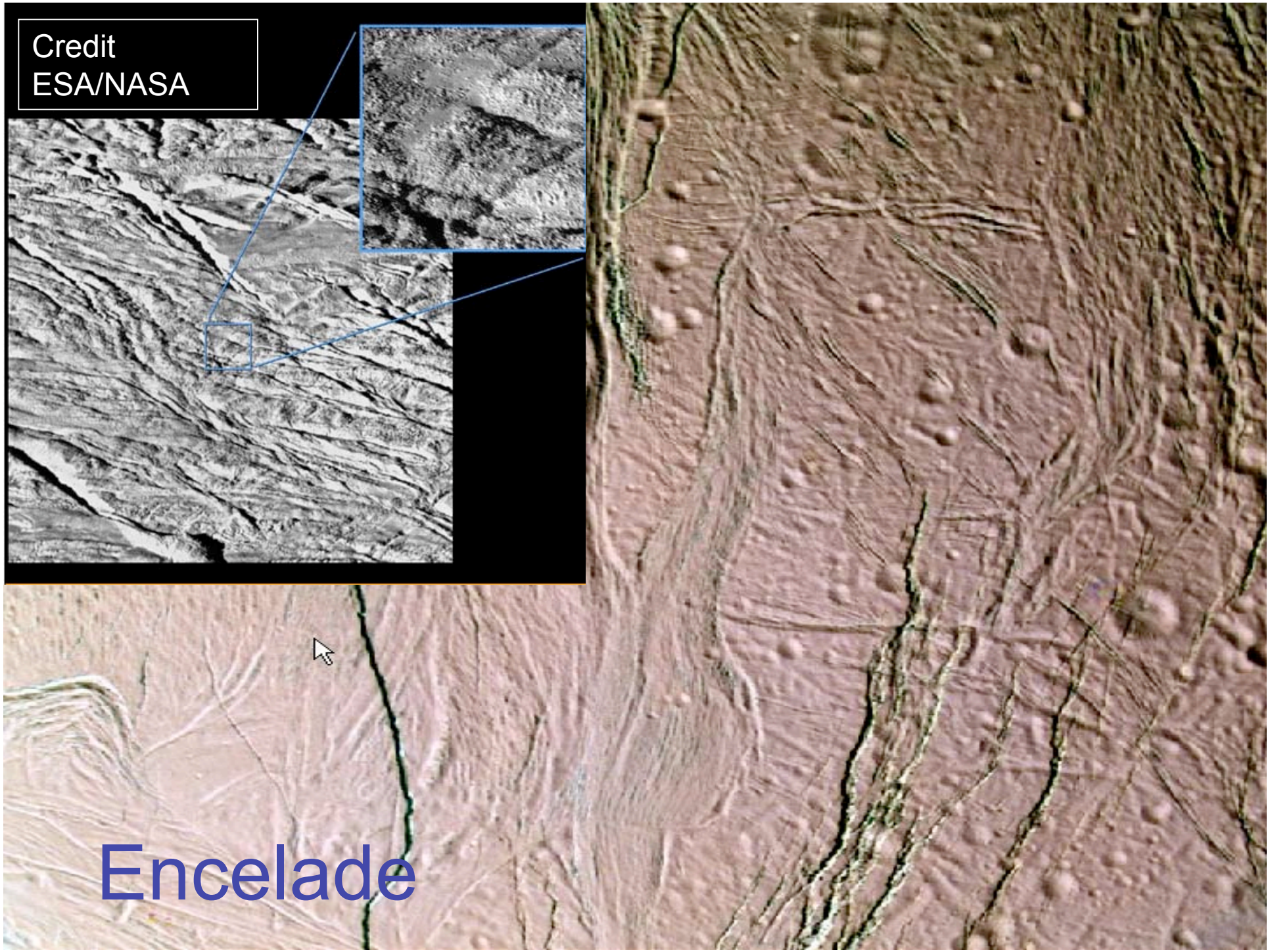
Thetis

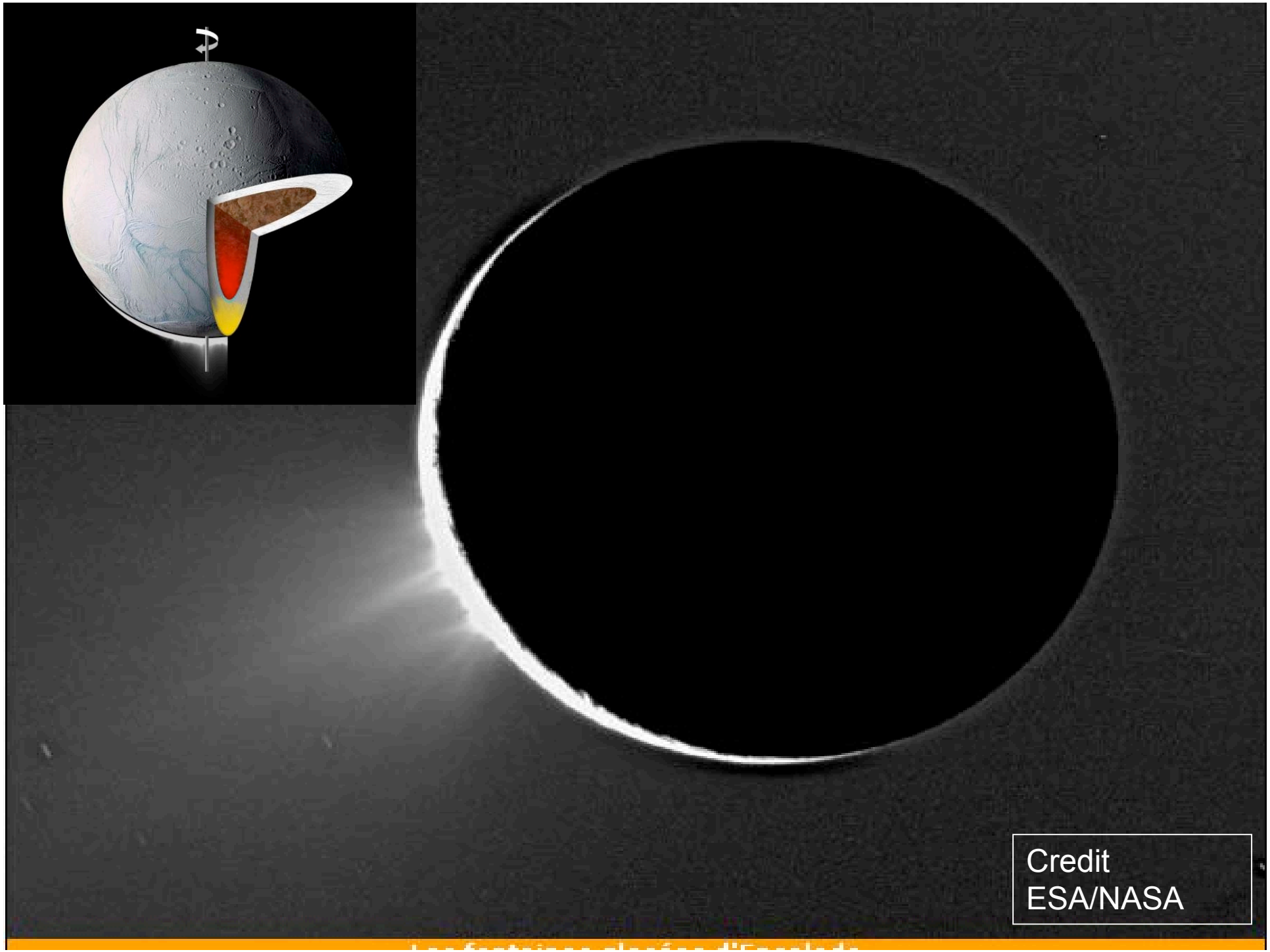




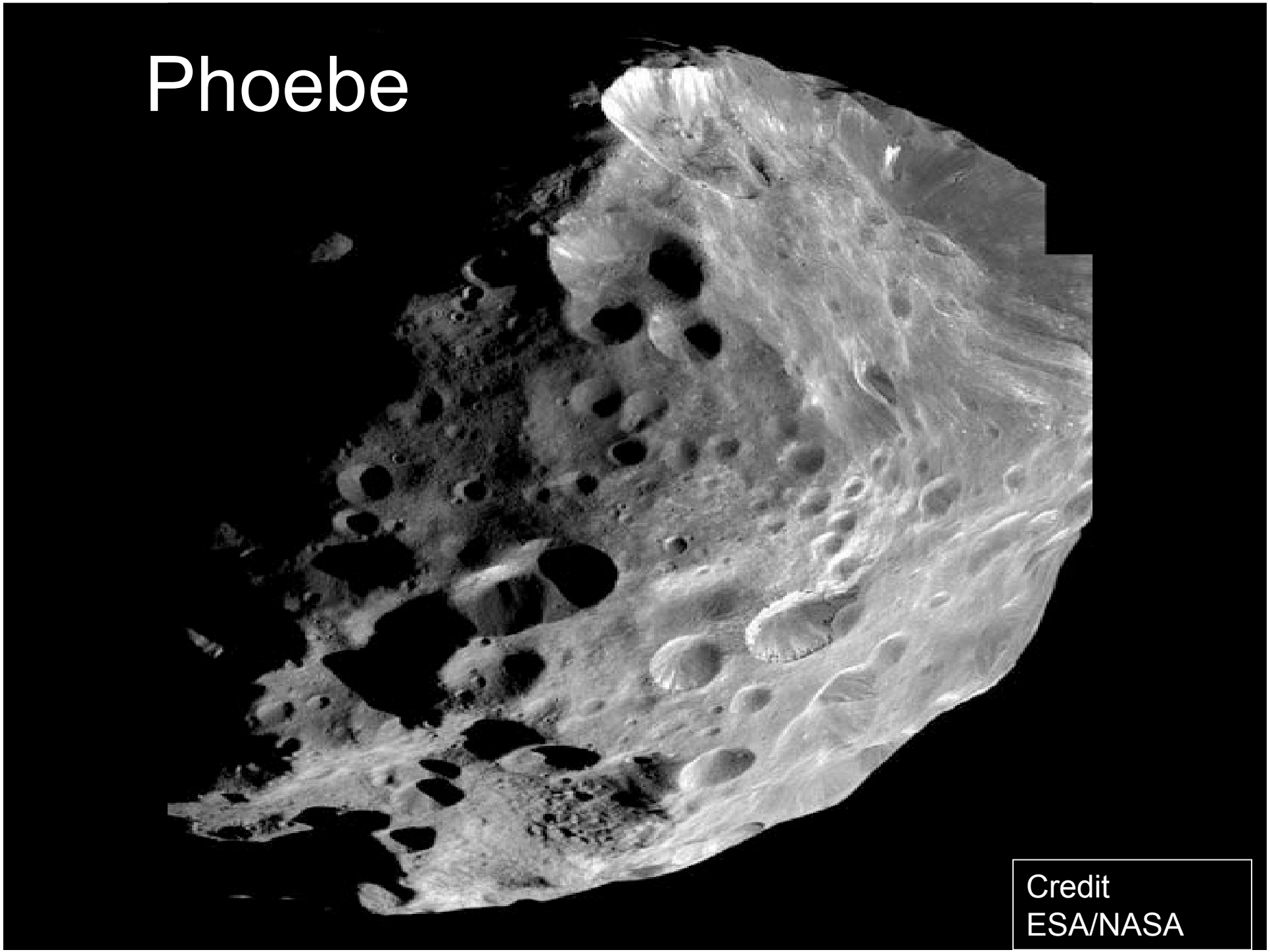
Credit
ESA/NASA

Thetis et Telesto (24km)


Credit
ESA/NASA
Encelade

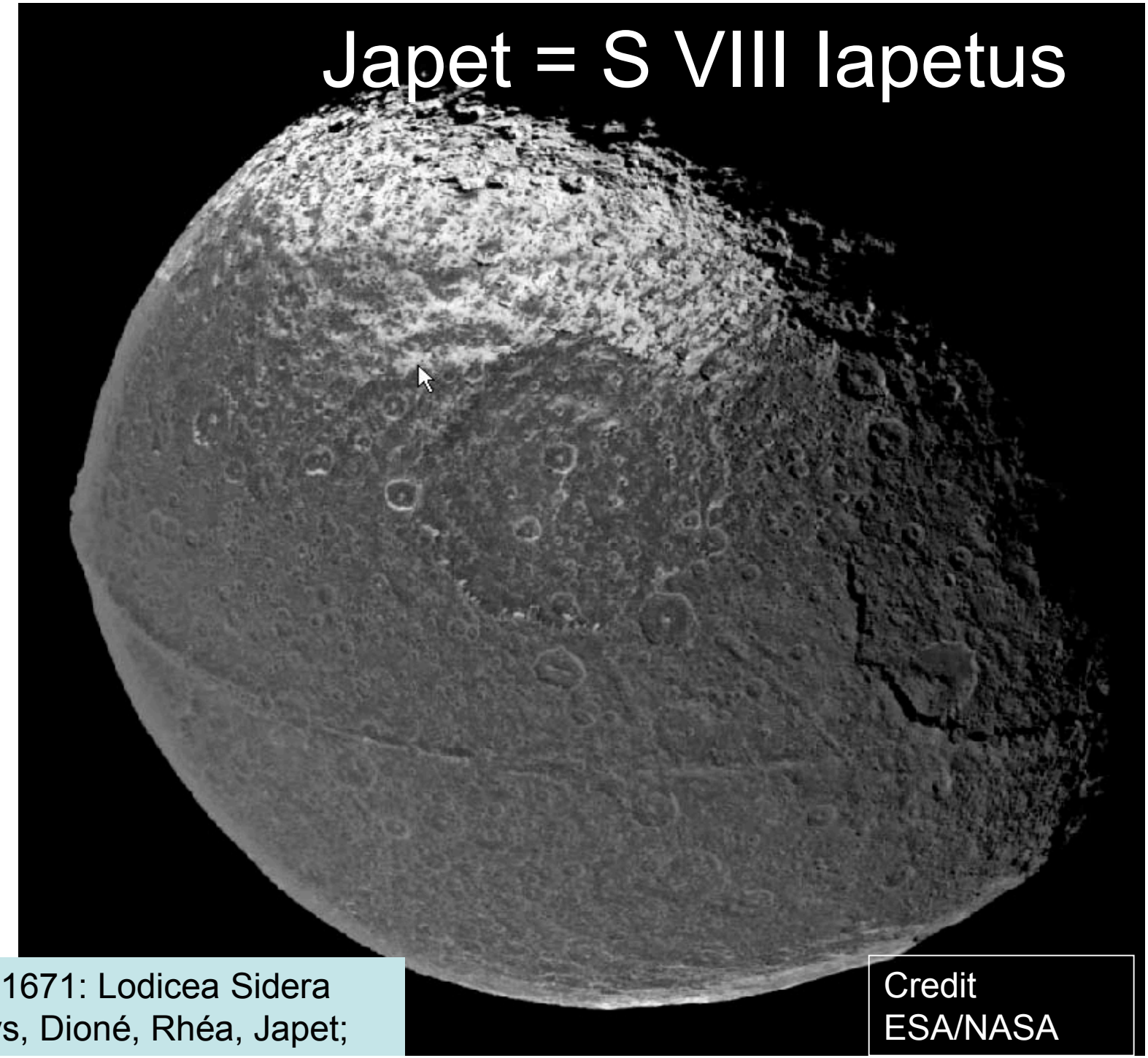

Credit
ESA/NASA

Phoebe



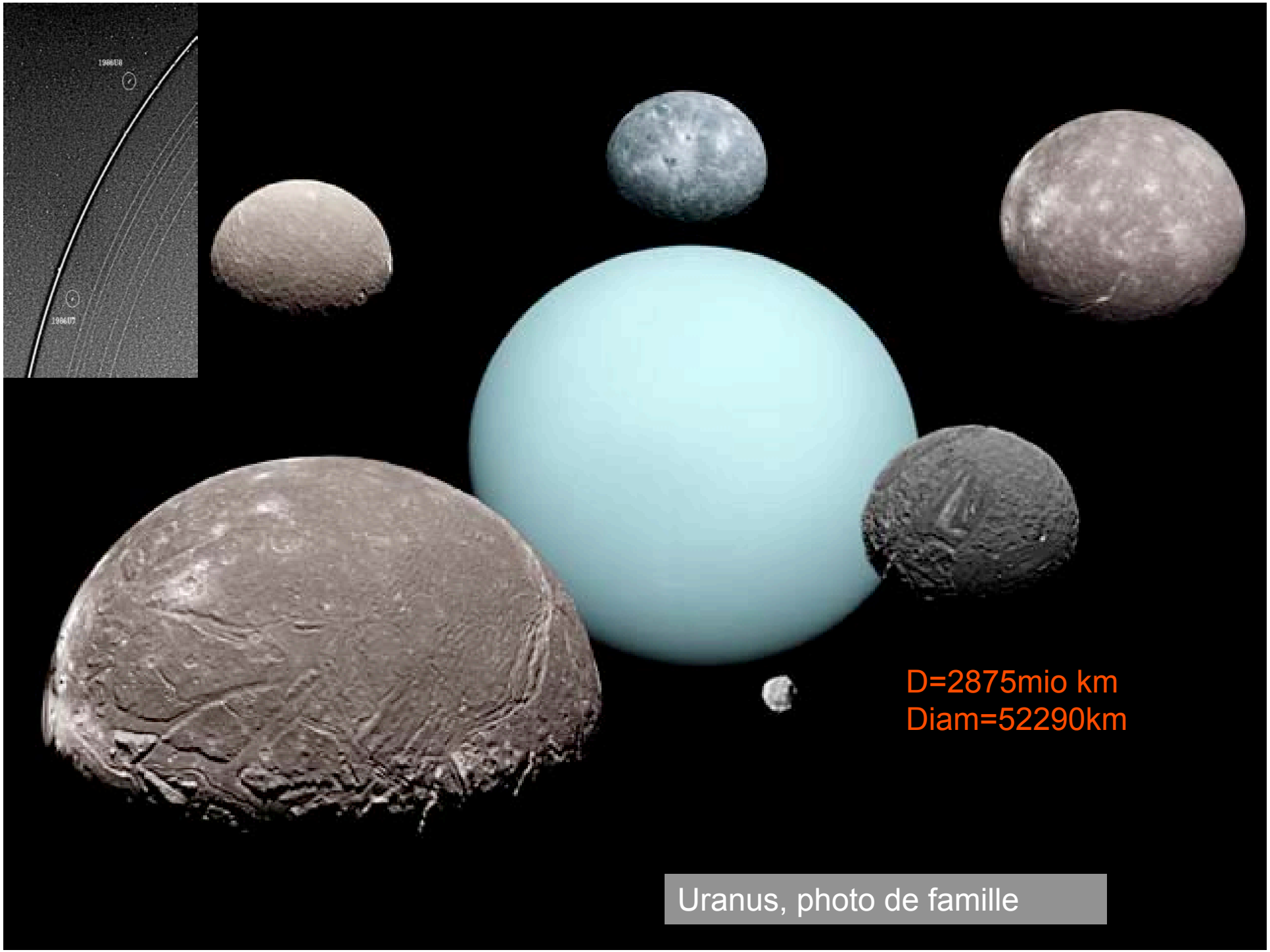
Credit
ESA/NASA

Japet = S VIII Iapetus



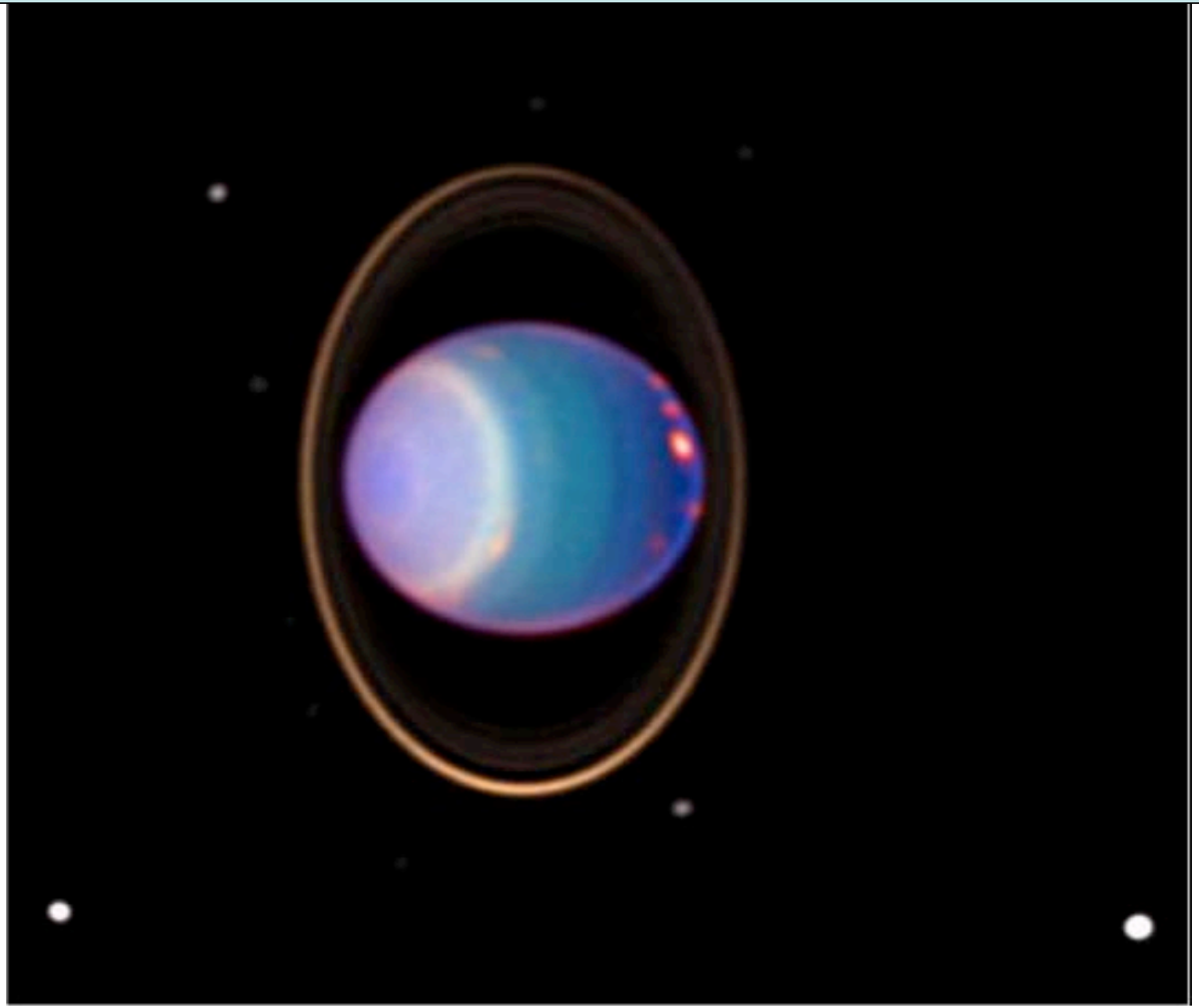
Casini, 1671: Lodicea Sidera
(Théthys, Dioné, Rhéa, Japet;

Credit
ESA/NASA

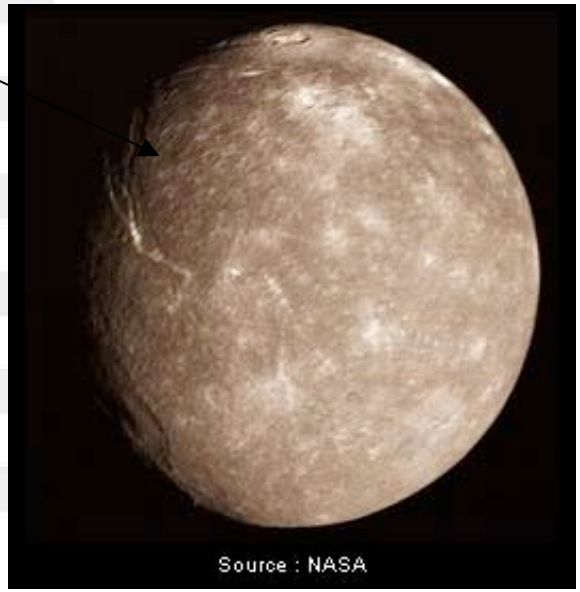


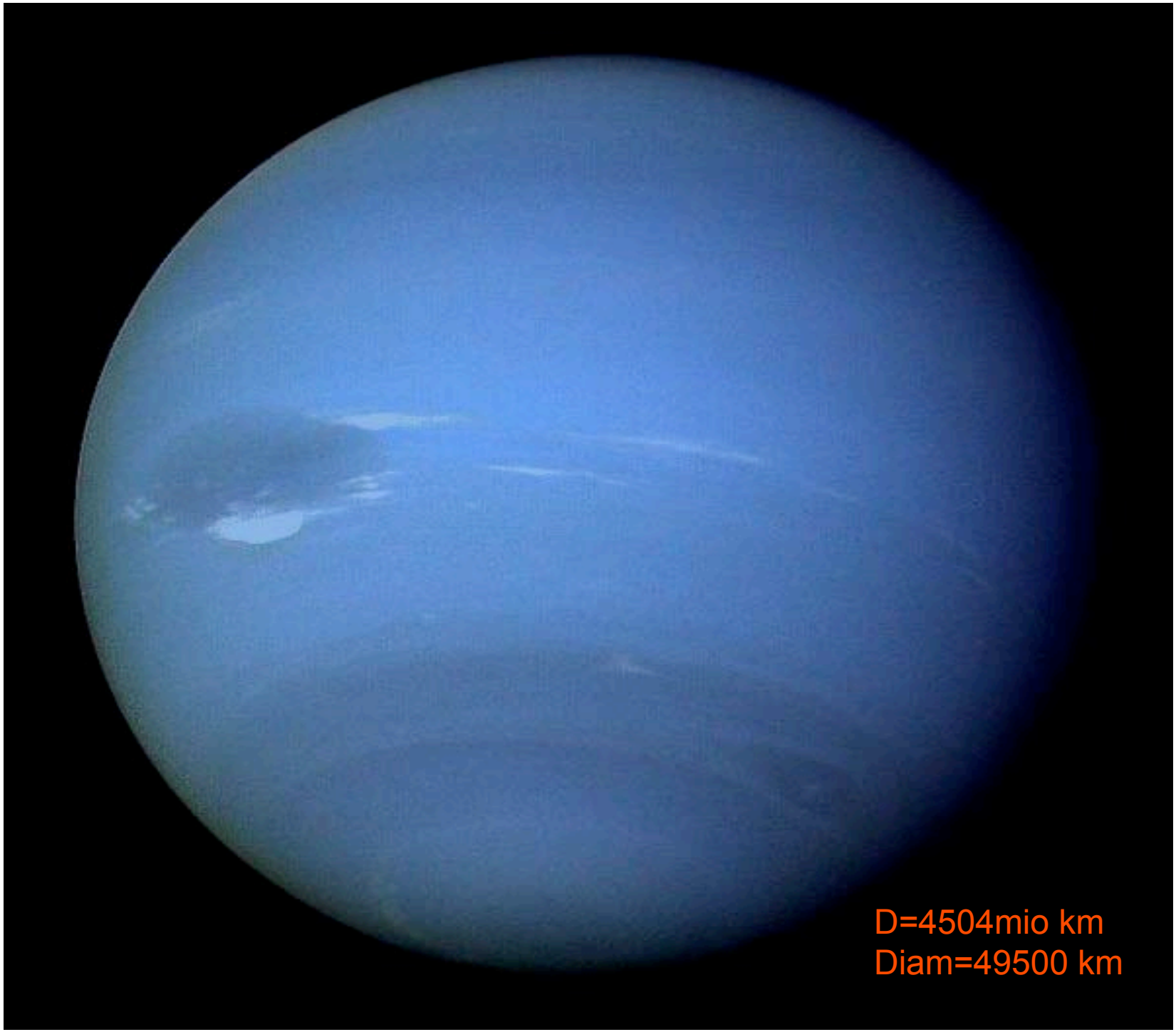
Uranus, photo de famille

HST: Uranus et 10 de ses satelites;image IR



Satellites d'Uranus				
Nom	Diamètre (km)	Masse (10^{16} kg)	Rayon orbital moyen (km)	Période de révolution (d)
Cordélia	40	4,5 (?)	49 800	0,335
Ophélie	43	5,4 (?)	53 800	0,376
Bianca	51	9,3 (?)	59 200	0,435
Cressida	80	34,3 (?)	61 800	0,464
Desdémone	64	17,8 (?)	62 700	0,474
Juliette	94	55,7 (?)	64 400	0,493
Portia	135	168 (?)	66 100	0,513
Rosalinde	72	25,4 (?)	69 900	0,558
Cupidon	12	0,12 (?)	74 800	0,618
Bélinda	81	35,7 (?)	75 300	0,624
Perdita	80	40,0 (?)	76 416	0,638
Puck	162	289 (?)	86 000	0,762
Mab	16	0,28 (?)	97 734	0,923
Miranda	474	6600	129 900	1,413
Ariel	1159	135 000	190 900	2,520
Umbriel	1169	117 000	266 000	4,144
Titania	1578	352 000	436 300	8,706
Obéron	1523	301 000		
Francisco	12	0,13 (?)		
Caliban	98	73 (?)		
Stéphano	20	0,60 (?)		
Trinculo	10	0,075 (?)		
Sycorax	190	540 (?)		
Margaret	11	0,10 (?)		
Prospéro	30	2,1 (?)		
Sétébos	30	2,1 (?)		
Ferdinand	12	0,13 (?)		





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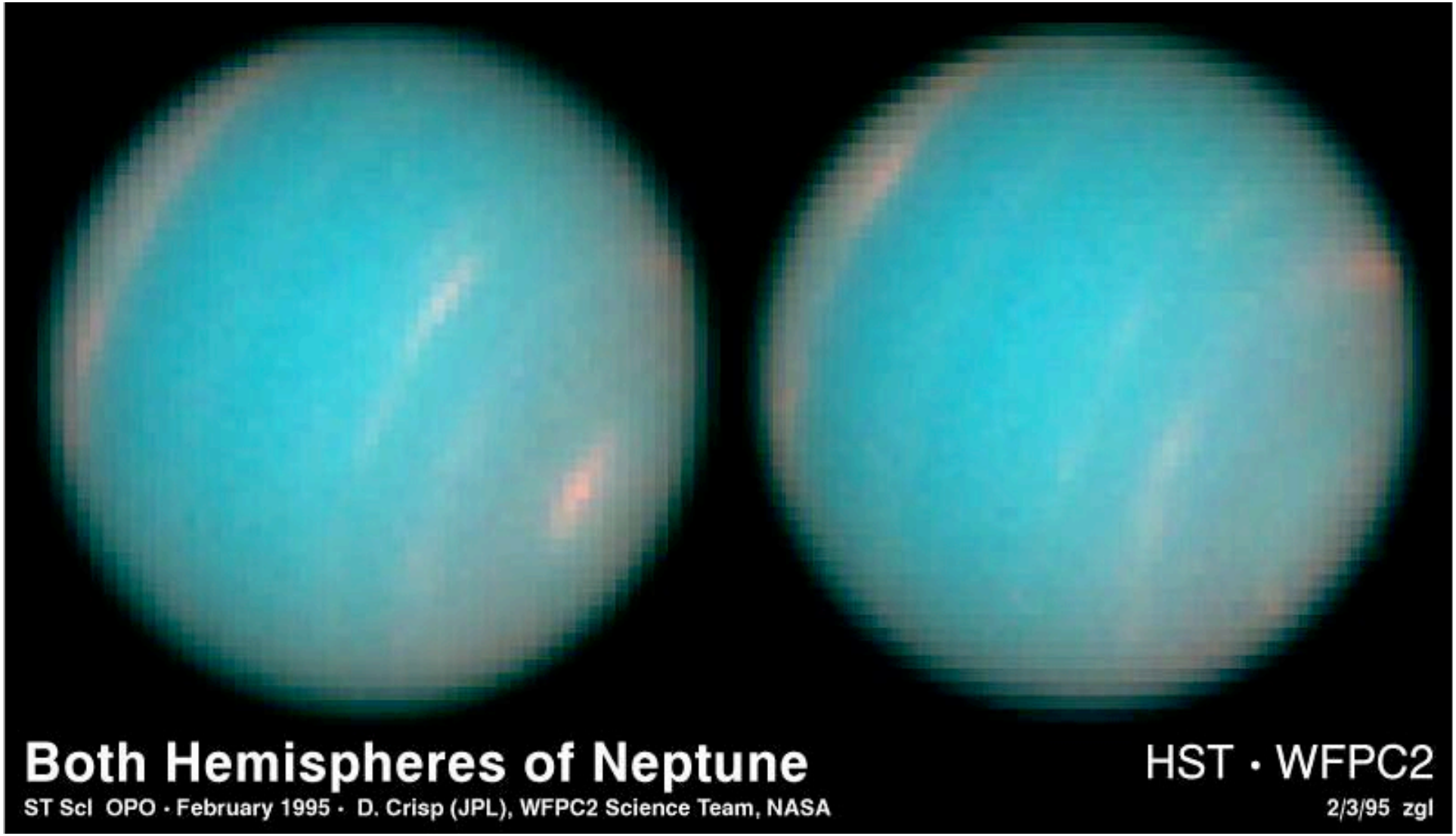
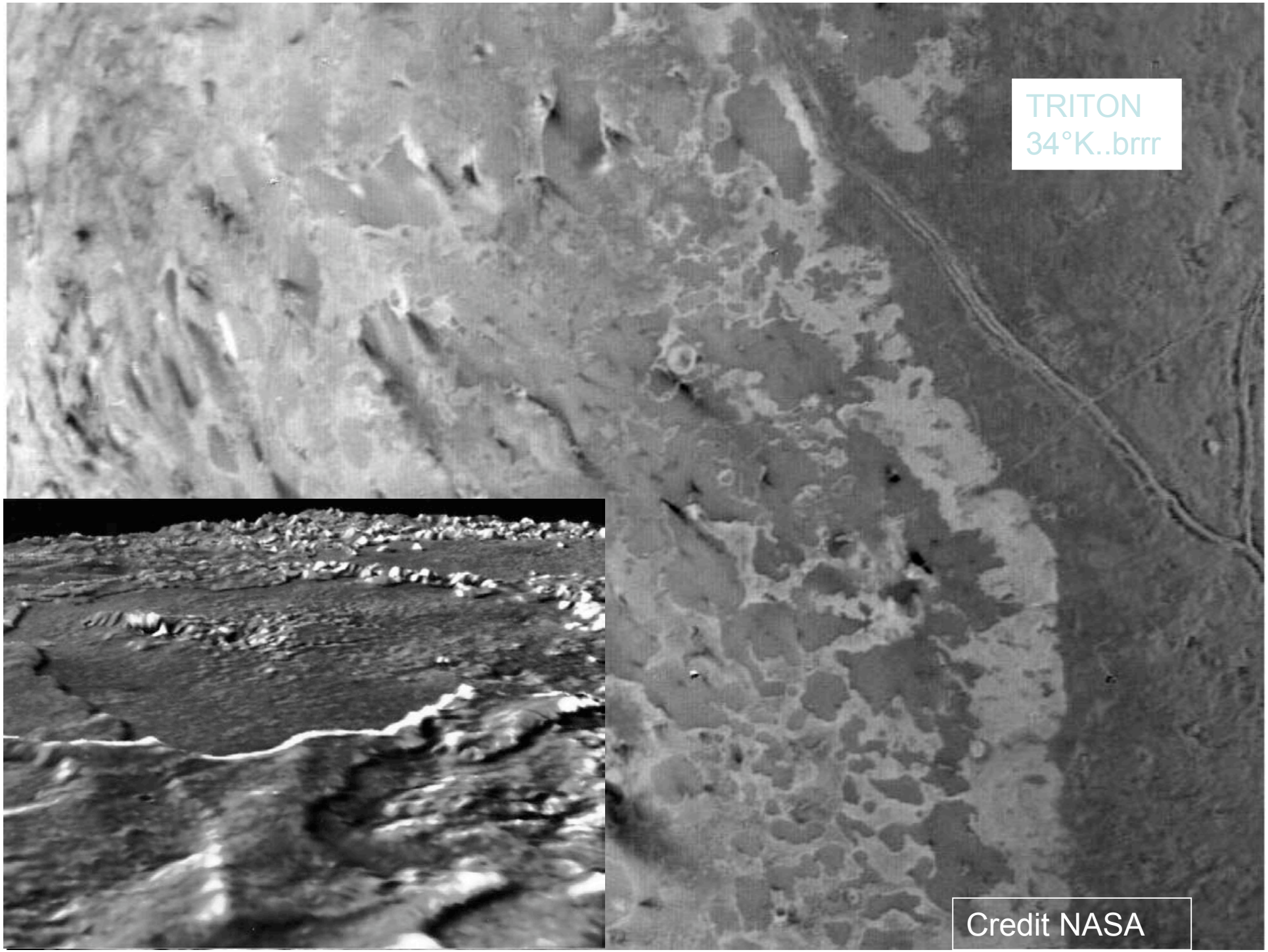
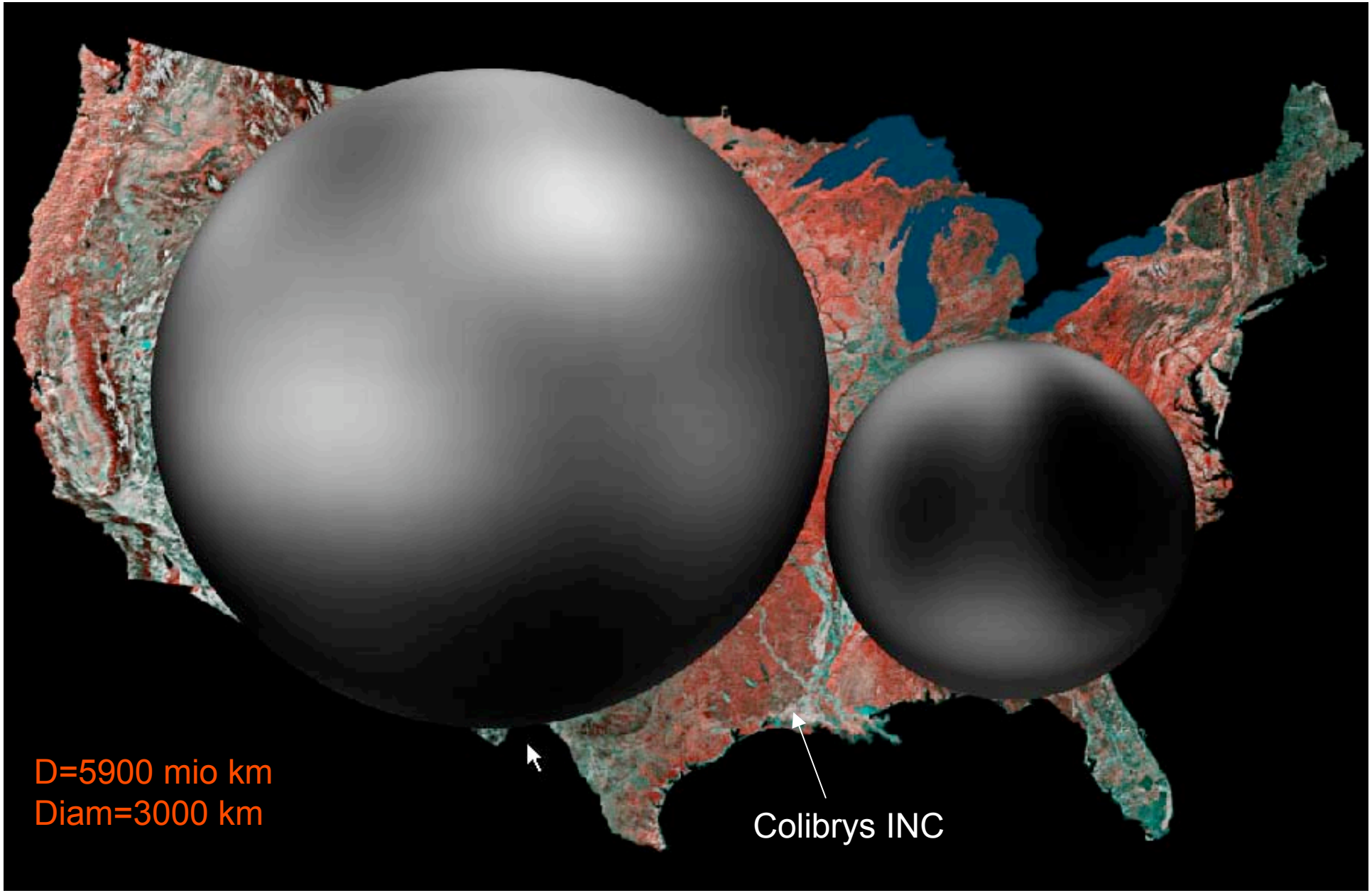
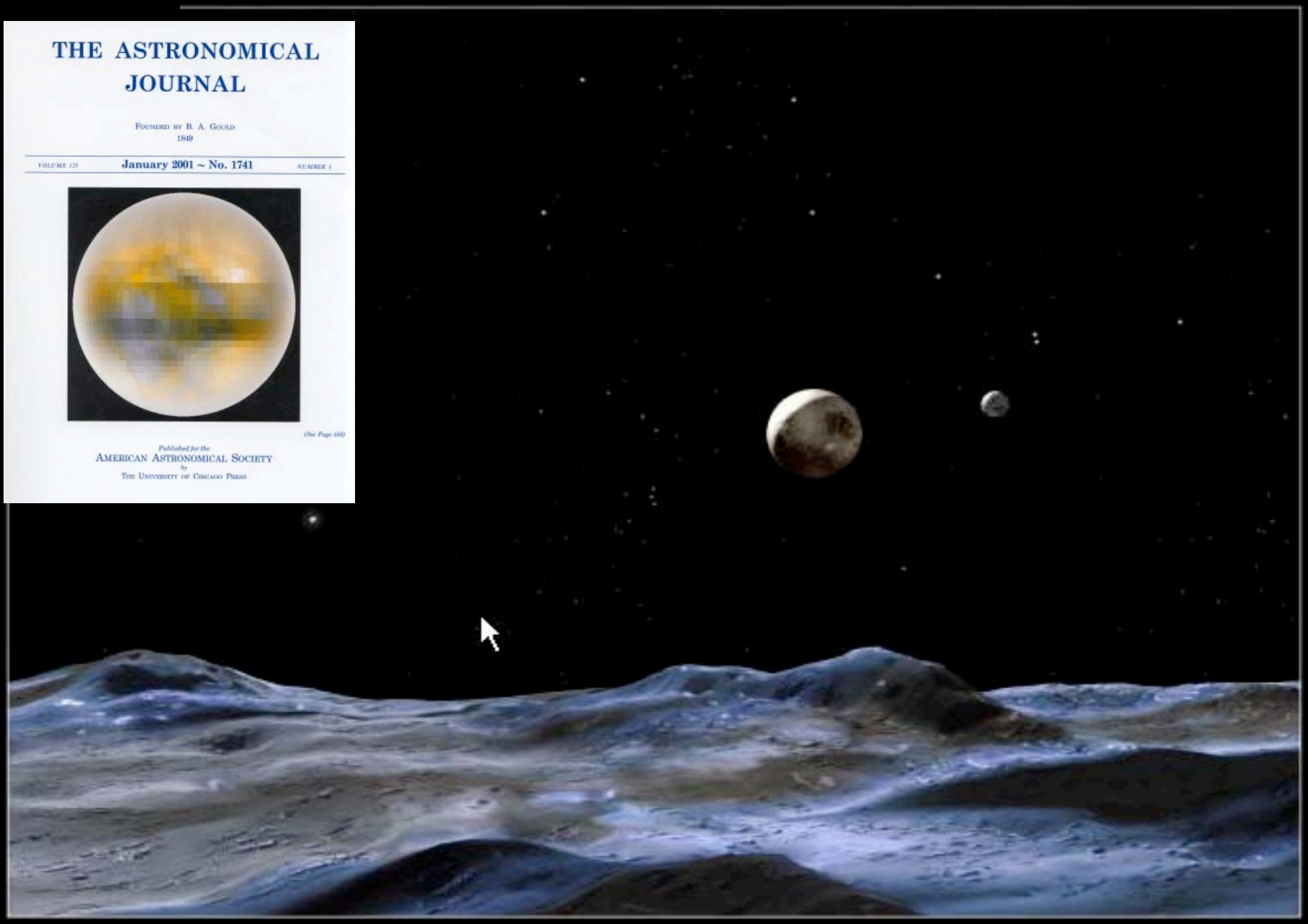
Images brutes Voyager etc..sont disponibles sur le web !!
Reprocessing voir p.ex.David Hamilton
surhttp://www.solarviews.com/




TRITON
34°K..brrr
Credit NASA

Pluto et Charon





Artist's View of the Pluto System

NASA, ESA and G. Bacon • STScI-PRC05-29b

NEW HORIZONS

NASA's Pluto-Kuiper Belt Mission

+ HOME | + OVERVIEW | + SCIENCE | + MISSION | + SPACECRAFT | + EDUCATION | + NEWS CENTER | + GALLERY | + LINKS

Pluto

TIMELINE

- **JANUARY 2006** LAUNCH WINDOW OPENS
- **FEBRUARY 2007** JUPITER GRAVITY ASSIST
- **MARCH 2007-JUNE 2015** INTERPLANETARY CRUISE
- **JULY 2015** PLUTO-CHARON ENCOUNTER
- **2016-2020** KUIPER BELT OBJECT ENCOUNTERS

Image above: Liftoff of the Atlas V carrying spacecraft to a distant date with Pluto! Ima

+ View Launch Page

+ LATEST NEWS

NASA's Pluto Mission Launched Towar

The first mission to distant planet Pluto is un successful launch today of NASA's New Ho from Cape Canaveral Air Force Station, Fla.

+ NEW HORIZONS GROUND TRACK

Find New Horizons from your telescope.
+ Read more

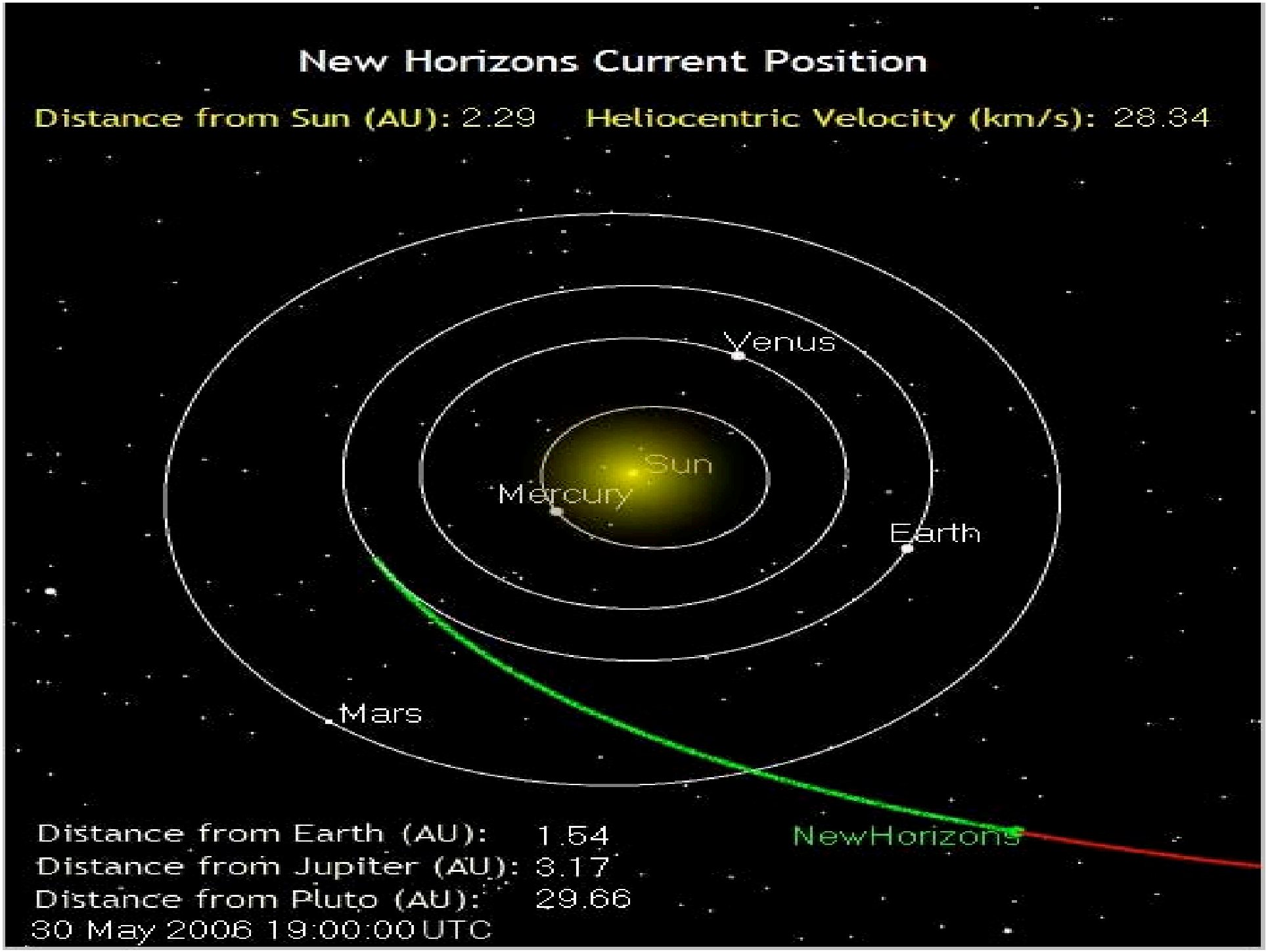
+ TO PLUTO AND BEYOND

New Horizons is the first mission to the last planet - the initial reconnaissance of Pluto-Charon and the Kuiper Belt - sent out to explore the mysterious worlds at the edge of our solar system.

+ LAUNCH PRESS KIT

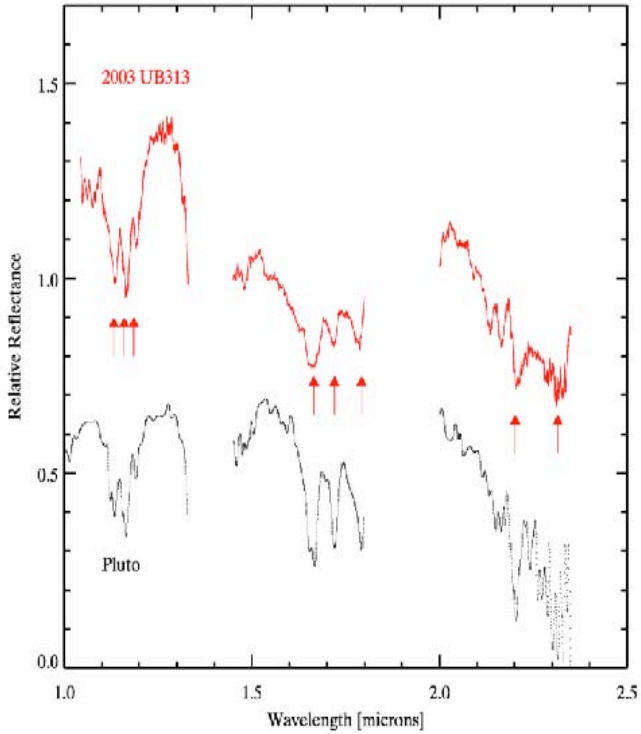
Click here to download the New Horizons launch press kit - updated

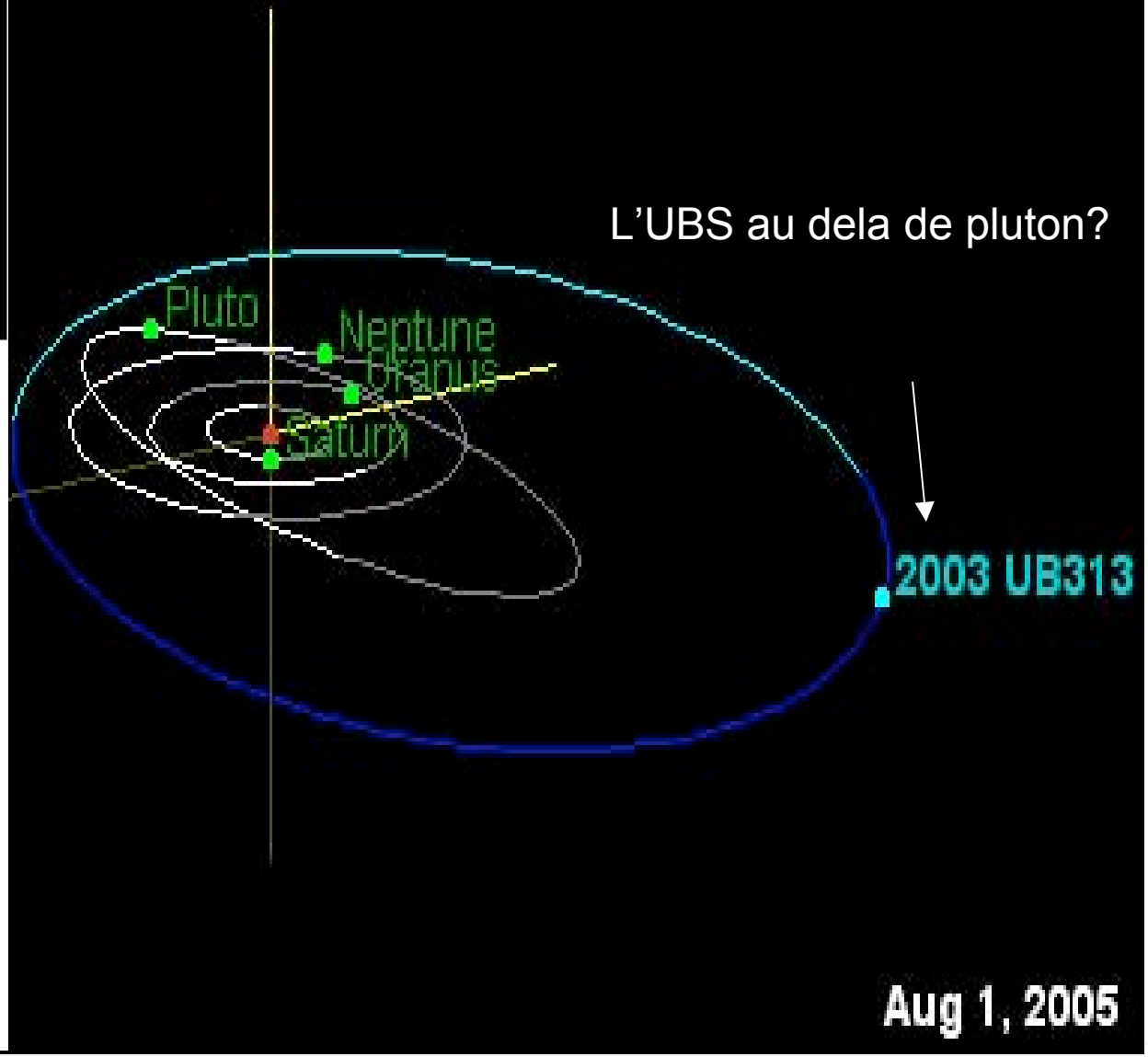
La sonde New Horizons au Kennedy Space Center, où les techniciens sont en train de retirer la couverture protectrice (25 septembre 2005)


New Horizons Current Position
Distance from Sun (AU): 2.29
Heliocentric Velocity (km/s): 28.34
Venus
Sun
Mercury
Earth
Mars
NewHorizons
Distance from Earth (AU): 1.54
Distance from Jupiter (AU): 3.17
Distance from Pluto (AU): 29.66
30 May 2006 19:00:00 UTC

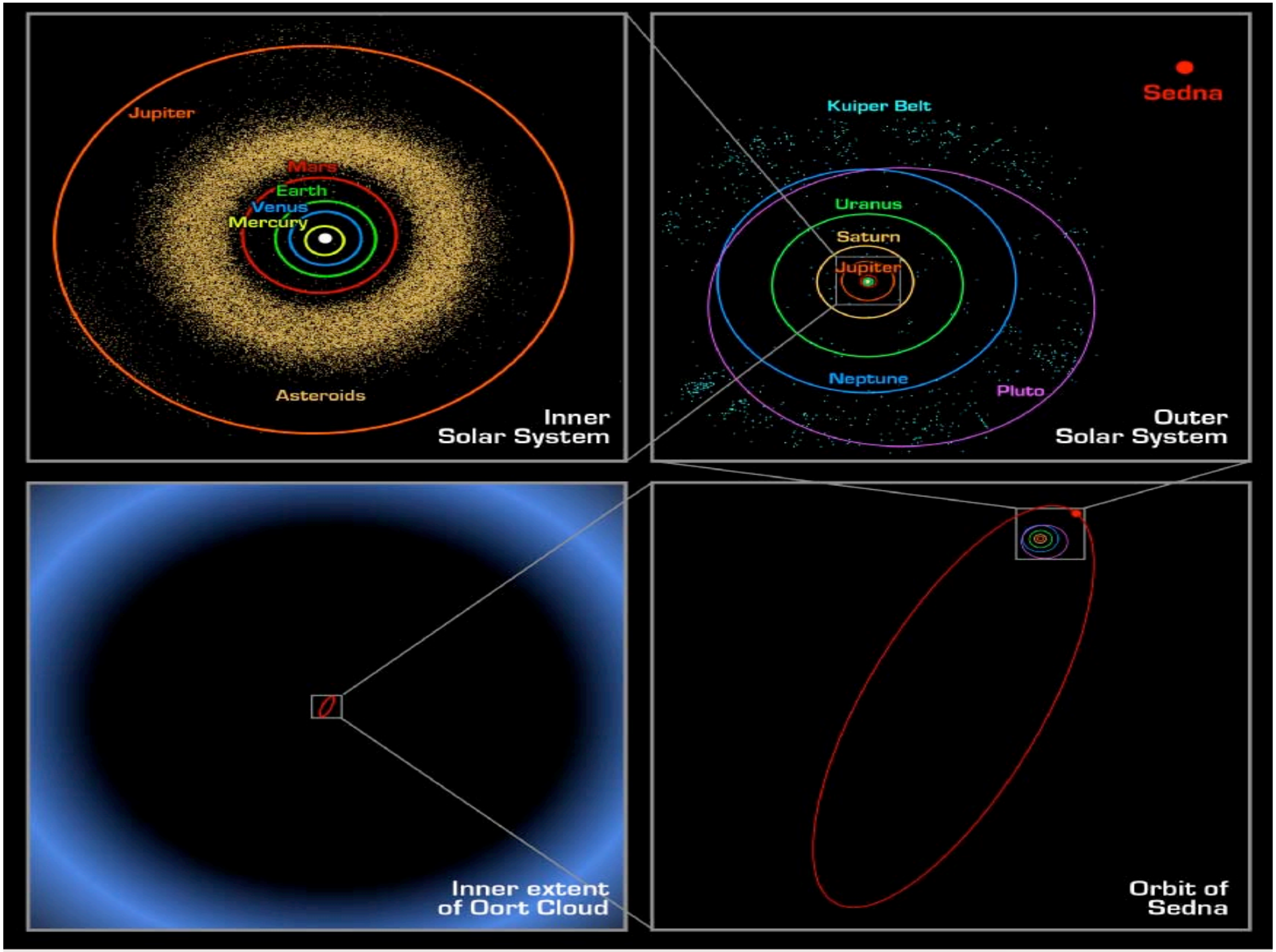
Nouvelles planètes en dehors de l'orbite de pluton et de la ceinture de Kuiper

Crédit : Sky&Telescope/Greg Dindermann





Crédit : NASA/JPL


Jupiter
Mars
Earth
Venus
Mercury
Asteroids
Inner
Solar System
Sedna
Kuiper Belt
Uranus
Saturn
Jupiter
Neptune
Pluto
Outer
Solar System
Inner extent
of Oort Cloud
Orbit of
Sedna

Comet 73P/Schwassman-Wachmann 3
Hubble Space Telescope • ACS/WFC

NASA, ESA, H. Weaver (JHU/APL), M. Jäger and G. Rhemann

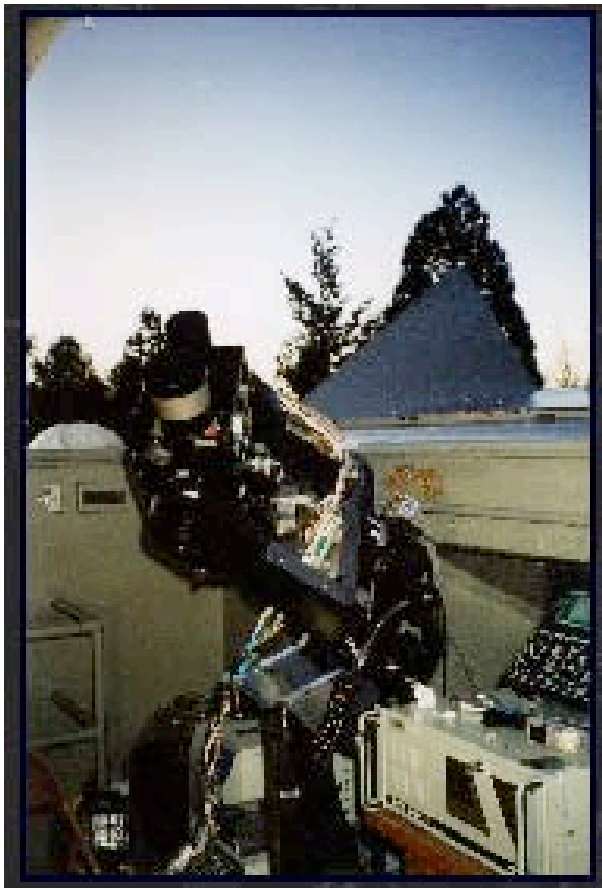
STScI-PRC06-18

LES EXOPLANETES

October the 5th 1995: The first Extrasolar Planet, detected in Orbit around 51 Pegasi with the ELODIE echelle Spectrograph, is announced by Michel Mayor & Didier Queloz during the 9th Cambridge Workshop on Cool Stars, Stellar Systems and the Sun in Florence, Italy

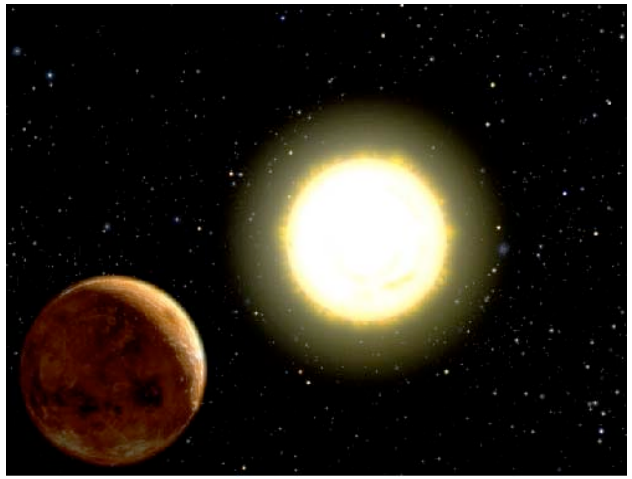
Michel MAYOR et Didier QUELOZ de l'Observatoire de Genève.

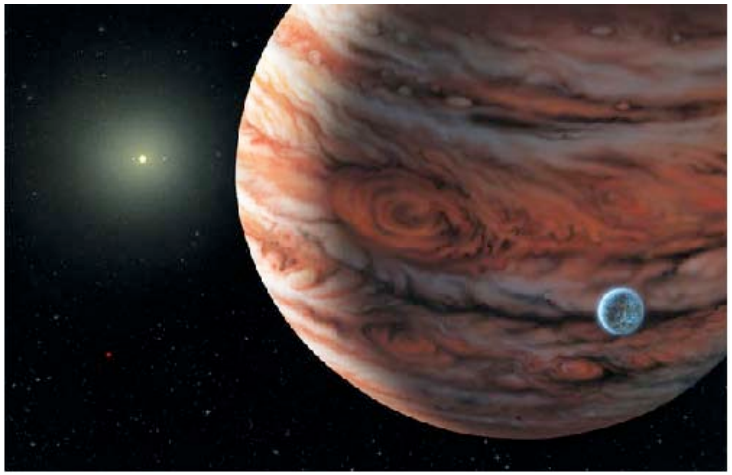
TRES
transatlantic exoplanet survey
(palomar, lowell, teide-îles canaries)

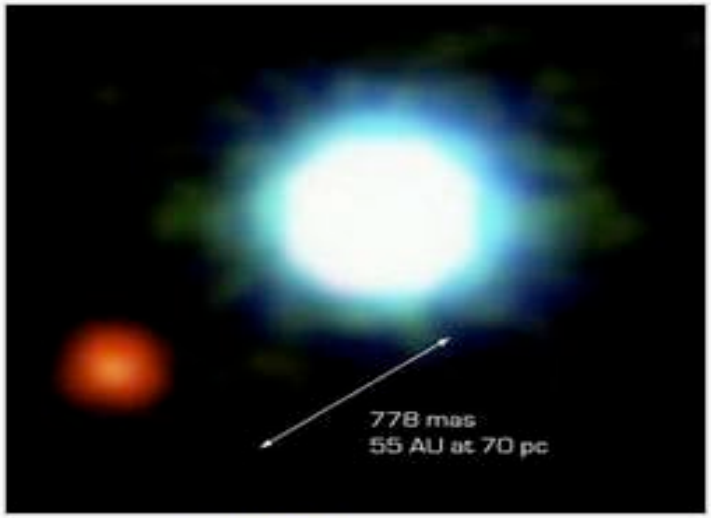


TrES, the Transatlantic Exoplanet Survey, is a network of three small-aperture telescopes (pictured above) searching the sky for transiting planets. The network consists of Sleuth (Palomar Observatory, Southern California), the PSST (Lowell Observatory, Northern Arizona) and STARE (Observatorio del Teide, Canary Islands, Spain).

Exoplanètes :on n’arrive plus à suivre !!







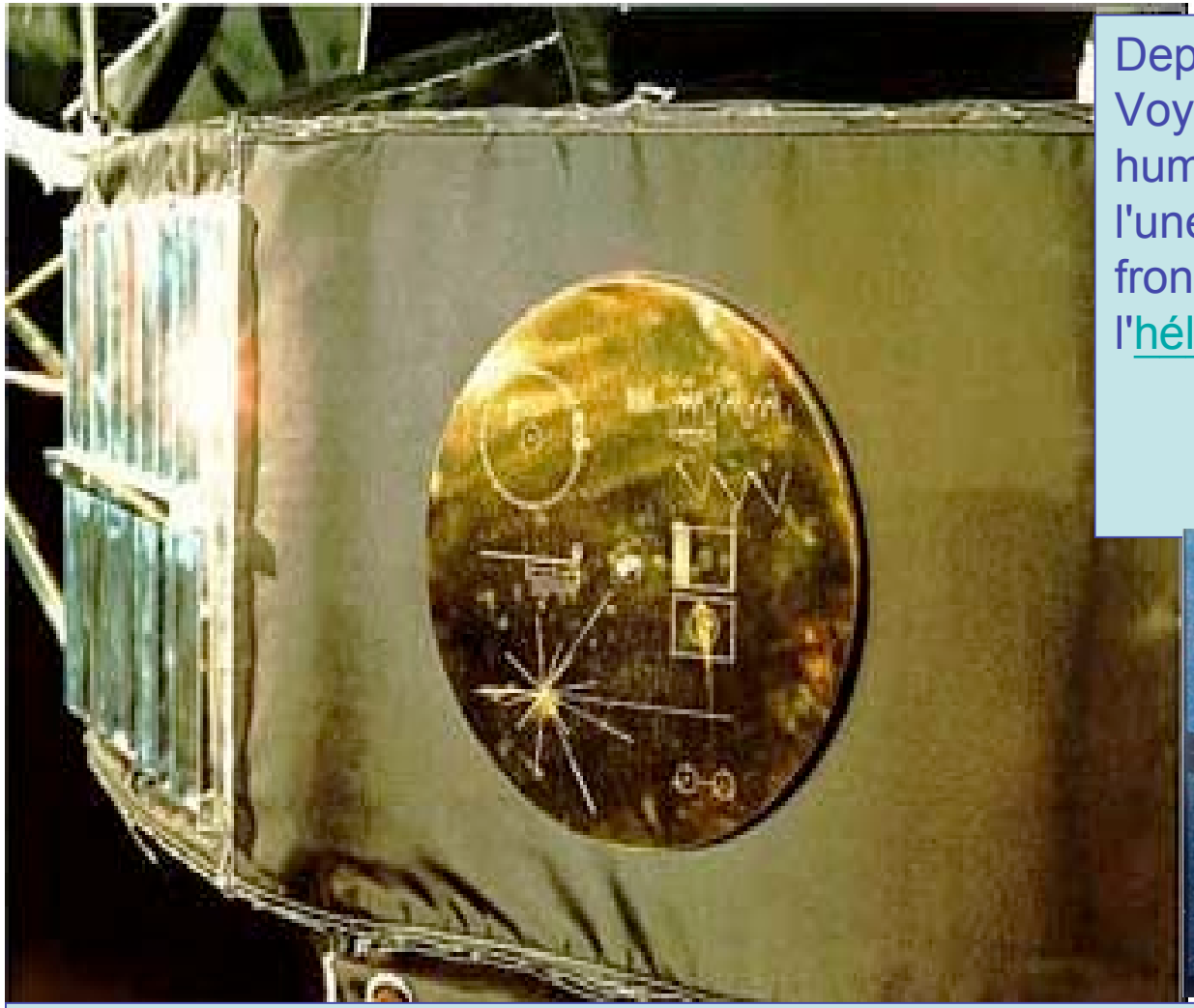
2005 image of 2M1207 (blue) and its planetary companion, 2M1207b, one of the first exoplanets to be directly imaged, in this case from the Very Large Telescope array in Chile.

Les engins les plus éloignés actuellement: pioneer 10, 11, voyager 1 et 2 :où sont –ils??

Mars Site
Standing 24 stories tall, the Mars antenna is the largest dish at Goldstone. It was originally built as a 64-meter-diameter (210-foot) antenna and received its first signal from the Mariner 4 mission to Mars.

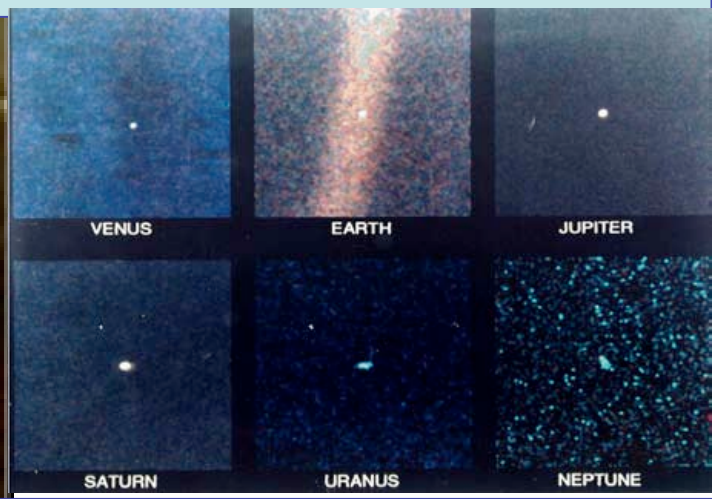
By 1988, the Mars dish, along with the 64-meter antennas in Spain and Australia, was upgraded to 70 meters (230 feet). These 70-meter antennas increase the receiving power of the Deep Space Network.

Voyagers 1 et 2:des « bouteilles » dans l'espace

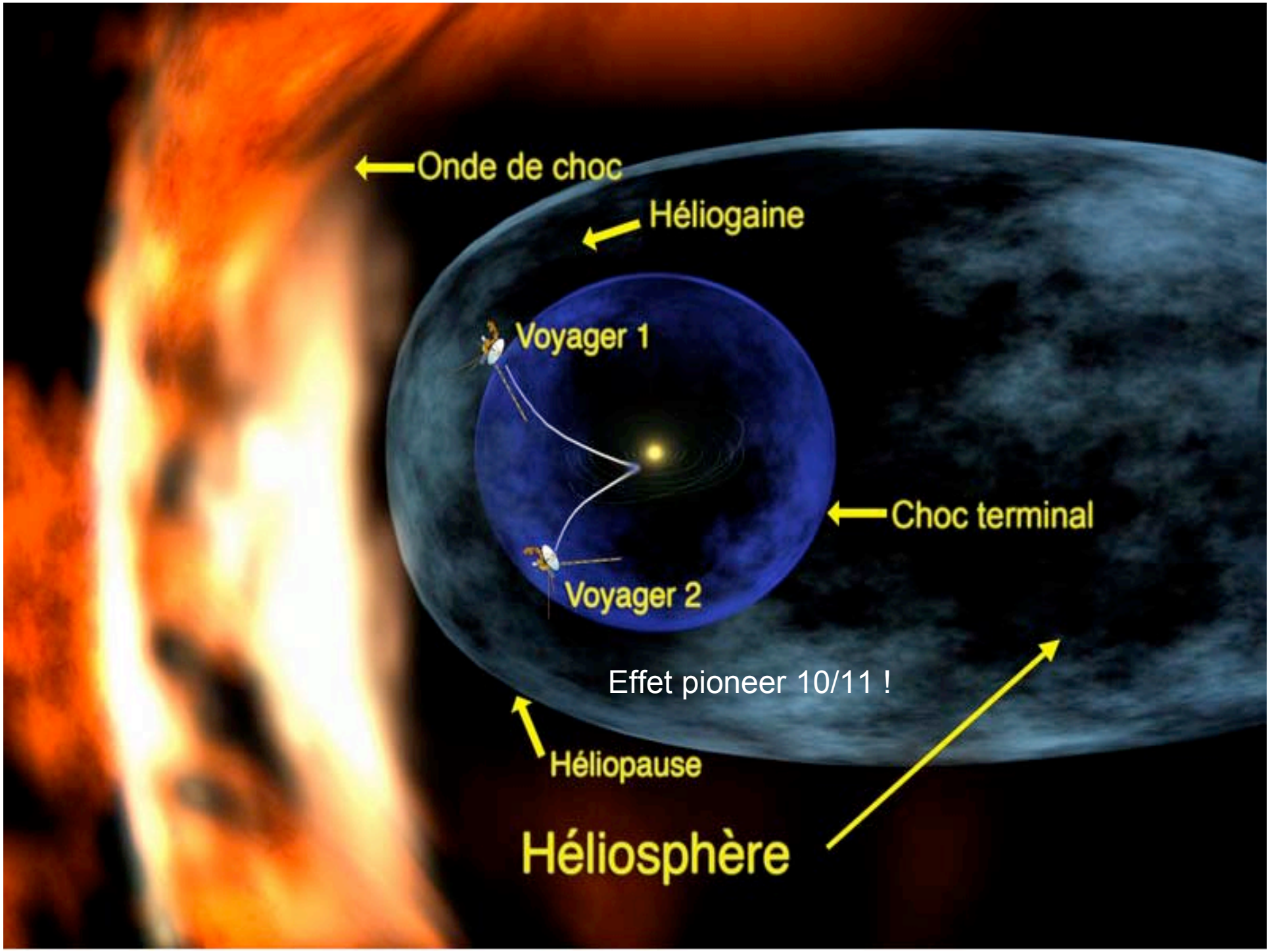


Depuis le 16 décembre 2004, Voyager 1 est la première création humaine à naviguer au-delà de l'une des principales frontières du système solaire, l'héliosphère.

BYE BYE !!



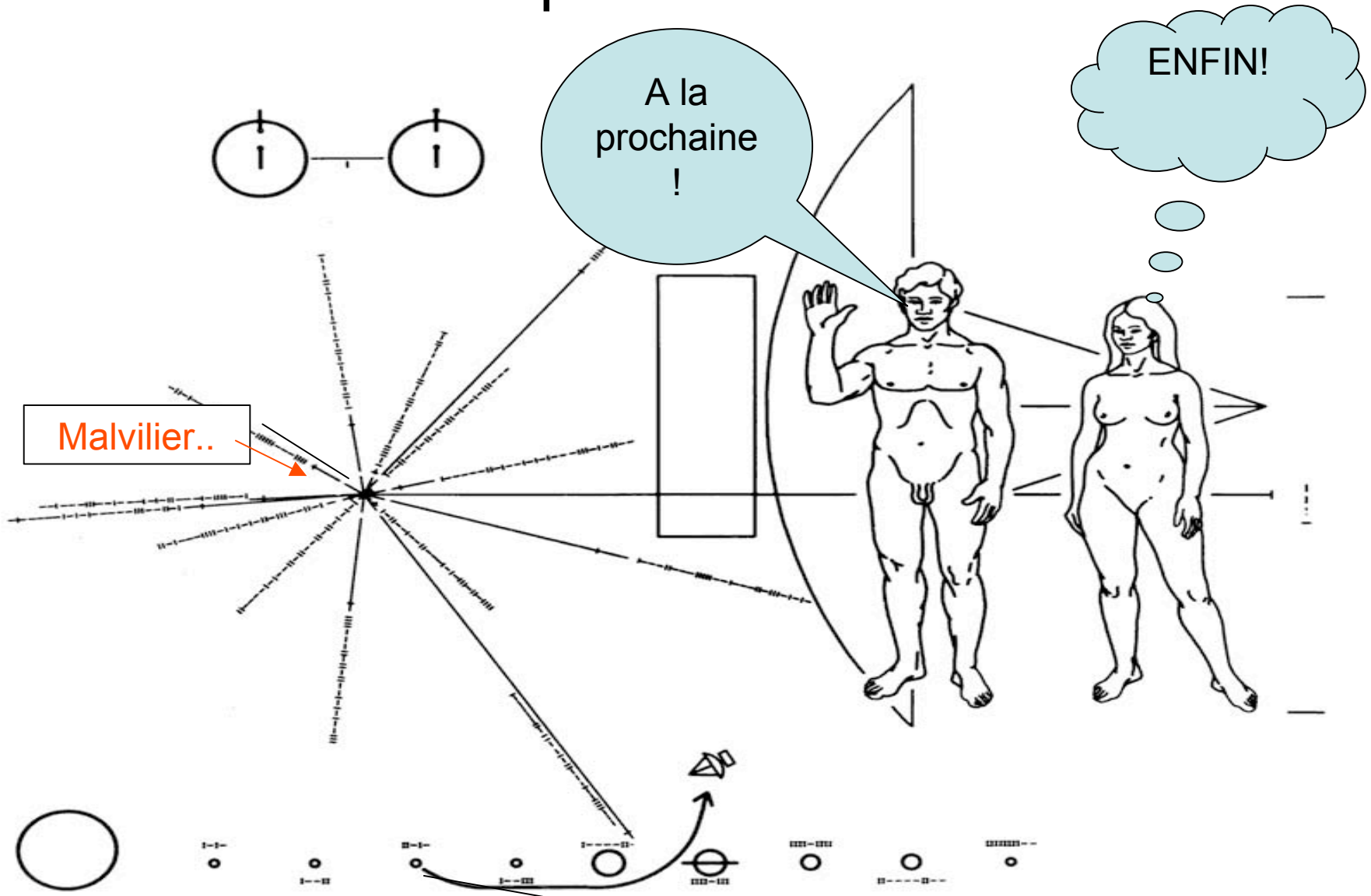
Le disque comporte aussi les salutations des Terriens en cinquante-cinq langues, un message du président américain Jimmy Carter, un autre du secrétaire général des Nations unies, Kurt Waldheim, ainsi que les murmures et grondements de notre planète : pluie, vent, tonnerre, feu, grenouilles, oiseaux, tracteur, décollage d'une fusée, bruits de pas, battements de cœur, rires, vagissements de bébé, etc.


Onde de choc
Héliogaine
Voyager 1
Choc terminal
Voyager 2
Effet pioneer 10/11 !
Héliopause
Héliosphère

Proxima Centauri : la plus proche étoile

THE
SOUNDS
OF
EARTH
UNITED STATES OF AMERICA
PLANET EARTH

Je vous remercie pour votre attention!



Plaque_de_Pioneer_10.png (19Ko, type MIME: image/ png)

Cercle de la voile HERE

References et remerciements

- JPL, jet propulsion laboratory http://www.jpl.nasa.gov/
- David Hamilton http://www.solarviews.com/
- NASA space science data center http://nssdc.gsfc.nasa.gov
- Noaa/sec http://www.sec.noaa.gov
- Keck observatory http://www.keckobservatory.org
- Prof.P.Paillou http://www.obs.u.bordeau1.fr/planetologie/paillou/paillou

avec nos remerciements:

- Ted Stryk,USA http://img333.imageshack.us/img333/9218/cpnwweb0gj.jpg,
- P.Vercoutter,B http://www.digilife.be/club/Philippe.Vercoutter/
- Dominique Dierick,B http://users.pandora.be/create/