

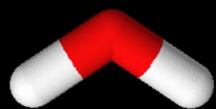
O VODĚ VE VESMÍRU

JAN PÍŠALA

HVĚZDÁRNA A PLANETÁRIUM BRNO

PISALA@HVEZDARNA.CZ

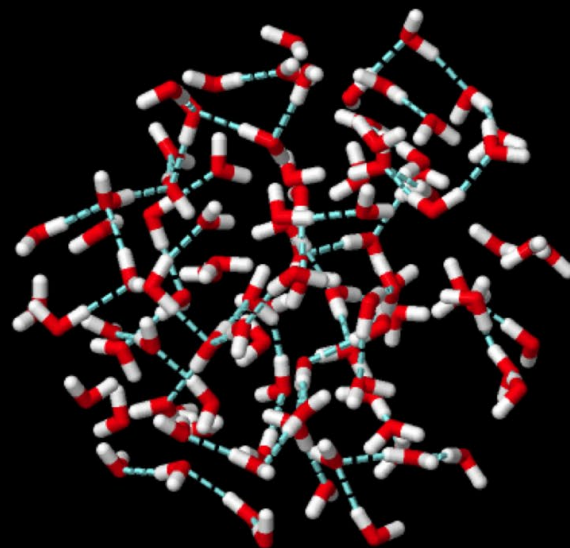
STAVEBNÍ KAMENY



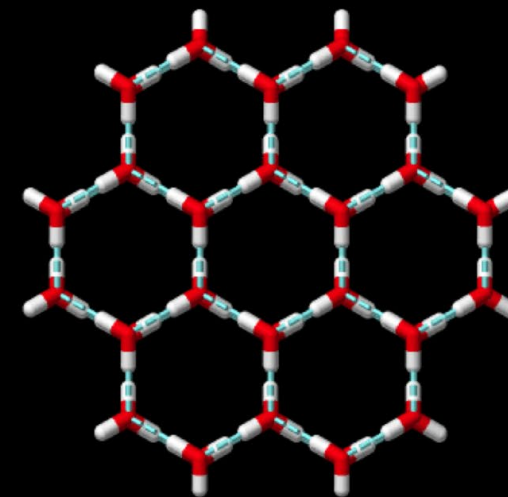
**Molekula
vody H_2O**



**Vodní
pára**



**Kapalná
voda**



**Vodní
led**

1
H
Hydrogen
1.008

3
Li
Lithium
6.941

2
He
Helium
4.003

1 H Hydrogen 1.008																	2 He Helium 4.003
3 Li Lithium 6.941	4 Be Beryllium 9.012											5 B Boron 10.811	6 C Carbon 12.011	7 N Nitrogen 14.007	8 O Oxygen 15.999	9 F Fluorine 18.998	10 Ne Neon 20.180
11 Na Sodium 22.990	12 Mg Magnesium 24.305											13 Al Aluminum 26.982	14 Si Silicon 28.086	15 P Phosphorus 30.974	16 S Sulfur 32.066	17 Cl Chlorine 35.453	18 Ar Argon 39.948
19 K Potassium 39.098	20 Ca Calcium 40.078	21 Sc Scandium 44.956	22 Ti Titanium 47.88	23 V Vanadium 50.942	24 Cr Chromium 51.996	25 Mn Manganese 54.938	26 Fe Iron 55.933	27 Co Cobalt 58.933	28 Ni Nickel 58.693	29 Cu Copper 63.546	30 Zn Zinc 65.39	31 Ga Gallium 69.732	32 Ge Germanium 72.61	33 As Arsenic 74.922	34 Se Selenium 78.09	35 Br Bromine 79.904	36 Kr Krypton 84.80
37 Rb Rubidium 84.468	38 Sr Strontium 87.62	39 Y Yttrium 88.906	40 Zr Zirconium 91.224	41 Nb Niobium 92.906	42 Mo Molybdenum 95.94	43 Tc Technetium 98.907	44 Ru Ruthenium 101.07	45 Rh Rhodium 102.906	46 Pd Palladium 106.42	47 Ag Silver 107.868	48 Cd Cadmium 112.411	49 In Indium 114.818	50 Sn Tin 118.71	51 Sb Antimony 121.760	52 Te Tellurium 127.6	53 I Iodine 126.904	54 Xe Xenon 131.29
55 Cs Cesium 132.905	56 Ba Barium 137.327	57-71	72 Hf Hafnium 178.49	73 Ta Tantalum 180.948	74 W Tungsten 183.85	75 Re Rhenium 186.207	76 Os Osmium 190.23	77 Ir Iridium 192.22	78 Pt Platinum 195.08	79 Au Gold 196.967	80 Hg Mercury 200.59	81 Tl Thallium 204.383	82 Pb Lead 207.2	83 Bi Bismuth 208.980	84 Po Polonium [208.982]	85 At Astatine 209.987	86 Rn Radon 222.018
87 Fr Francium 223.020	88 Ra Radium 226.025	89-103	104 Rf Rutherfordium [261]	105 Db Dubnium [262]	106 Sg Seaborgium [266]	107 Bh Bohrium [264]	108 Hs Hassium [269]	109 Mt Meitnerium [268]	110 Ds Darmstadtium [269]	111 Rg Roentgenium [272]	112 Cn Copernicium [277]	113 Uut Ununtrium unknown	114 Fl Flerovium [289]	115 Uup Ununpentium unknown	116 Lv Livermorium [298]	117 Uus Ununseptium unknown	118 Uuo Ununoctium unknown

57 La Lanthanum 138.906	58 Ce Cerium 140.115	59 Pr Praseodymium 140.908	60 Nd Neodymium 144.24	61 Pm Promethium 144.913	62 Sm Samarium 150.36	63 Eu Europium 151.966	64 Gd Gadolinium 157.25	65 Tb Terbium 158.925	66 Dy Dysprosium 162.50	67 Ho Holmium 164.930	68 Er Erbium 167.26	69 Tm Thulium 168.934	70 Yb Ytterbium 173.04	71 Lu Lutetium 174.967
89 Ac Actinium 227.028	90 Th Thorium 232.038	91 Pa Protactinium 231.036	92 U Uranium 238.029	93 Np Neptunium 237.048	94 Pu Plutonium 244.064	95 Am Americium 243.061	96 Cm Curium 247.070	97 Bk Berkelium 247.070	98 Cf Californium 251.080	99 Es Einsteinium [254]	100 Fm Fermium 257.095	101 Md Mendelevium 258.1	102 No Nobelium 259.101	103 Lr Lawrencium [262]

Prvek	Hmotnostní zlomek	Počet atomů ve vesmíru
Vodík	75 %	92 %
Helium	23 %	7,10 %
Kyslík	1,0 %	0,10 %
Uhlík	0,5 %	0,06 %
Neon	0,13 %	0,012 %
Železo	0,11 %	0,004 %
Dusík	0,10 %	0,015 %
Křemík	0,07 %	0,005 %
Hořčík	0,06 %	0,005 %
Síra	0,05 %	0,002 %



na 1 milion atomů vodíku

10-1000 molekul vody

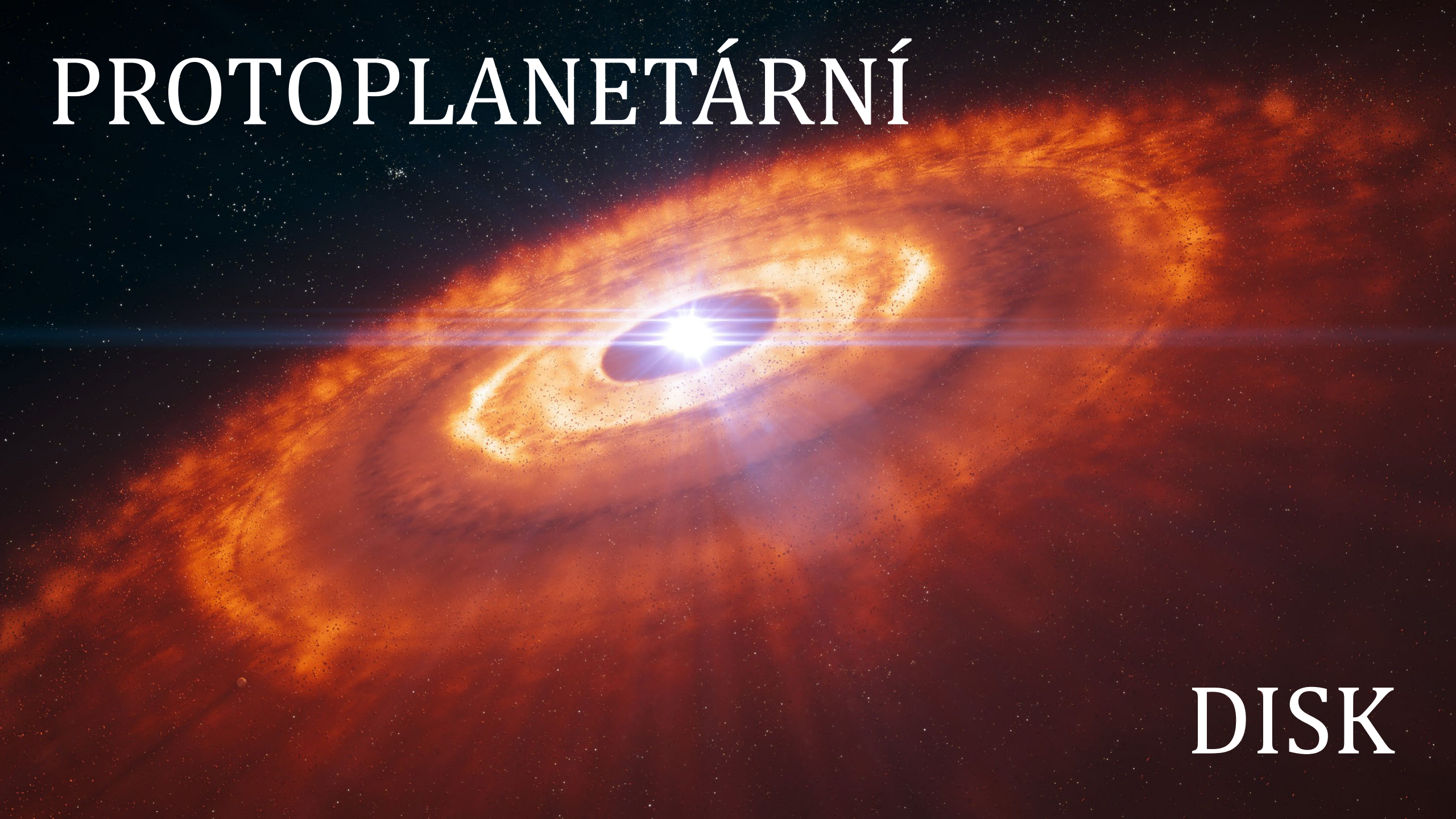


ETA CARINAE

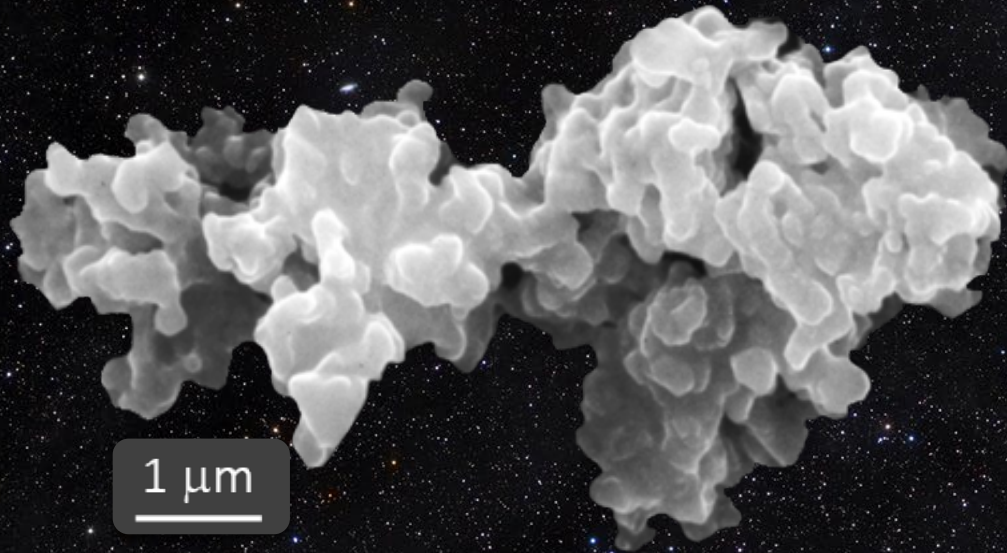


HVĚZDOKUPA

PROTOPLANETÁRNÍ

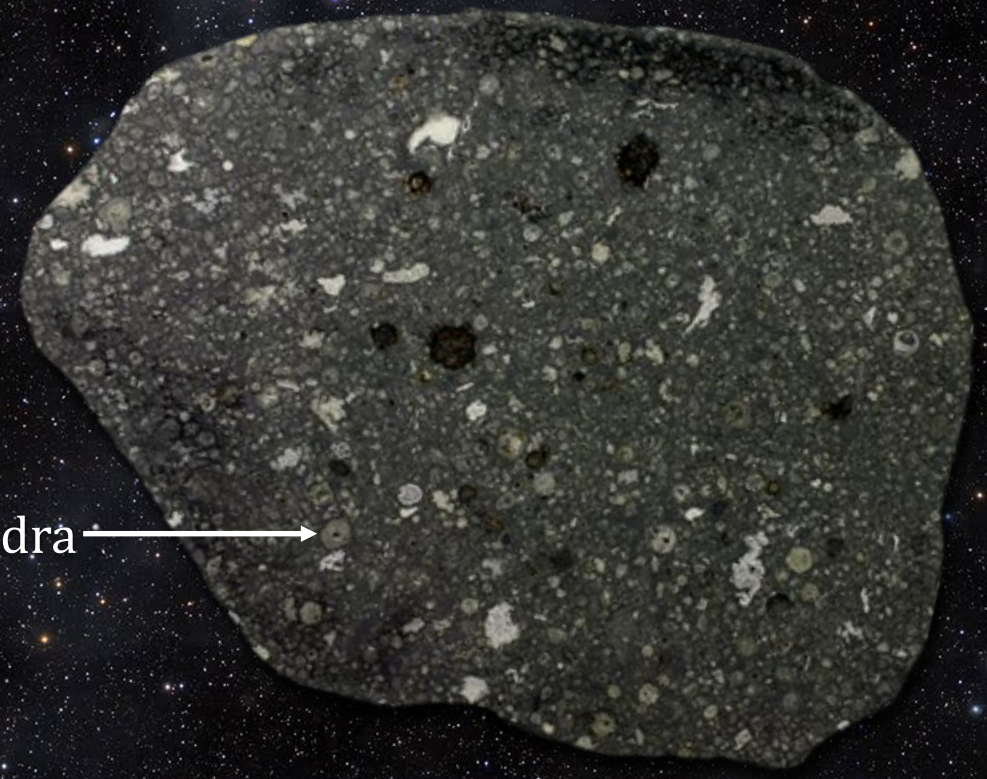
A detailed illustration of a protoplanetary disk (proplyd disk) surrounding a young star. The star is a bright, glowing blue-white sphere at the center, emitting a strong light that illuminates the surrounding disk. The disk is a vast, flat, orange-brown structure composed of gas and dust, with a distinct spiral pattern. The background is a deep black space filled with numerous small, distant stars.

DISK



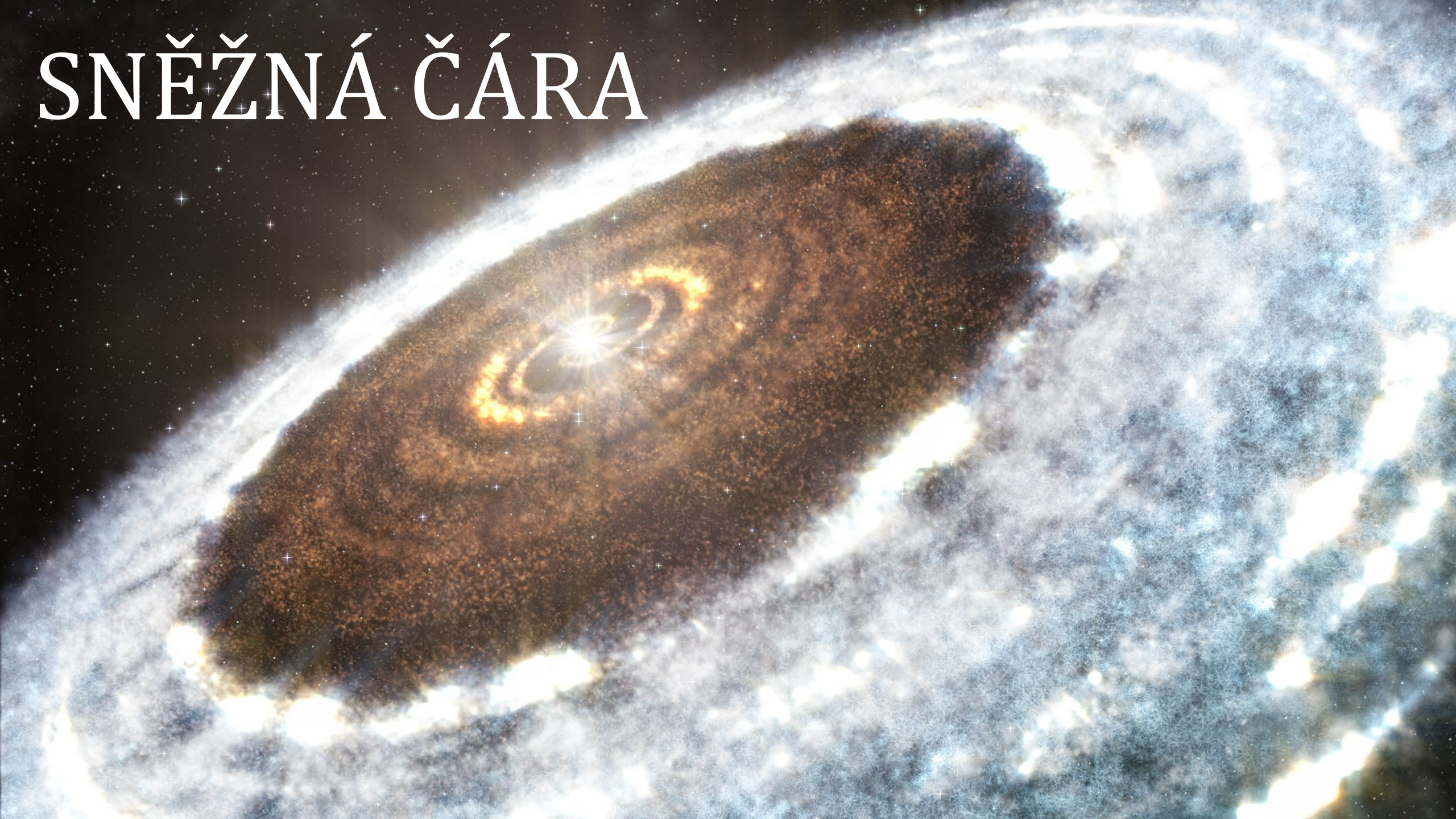
1 μm

AKRECE



Chondra →

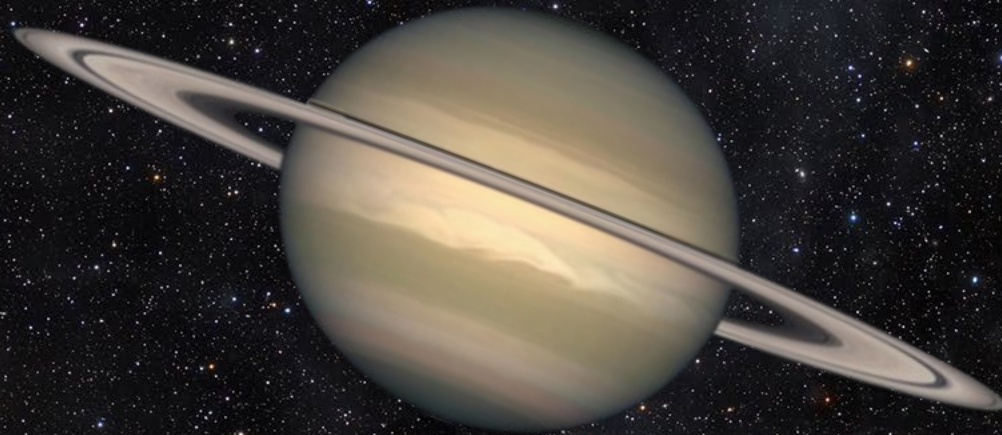
SNĚŽNÁ ČÁRA



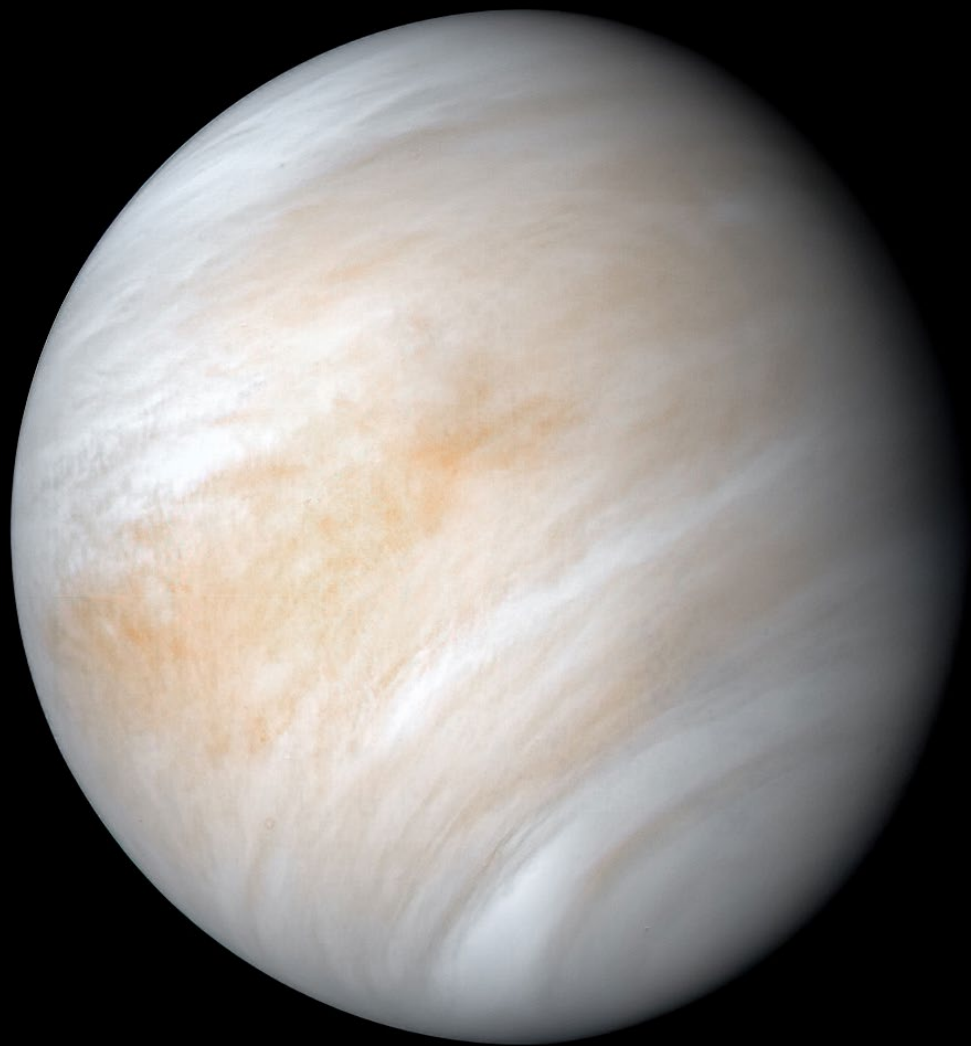
TERESTRICKÉ PLANETY



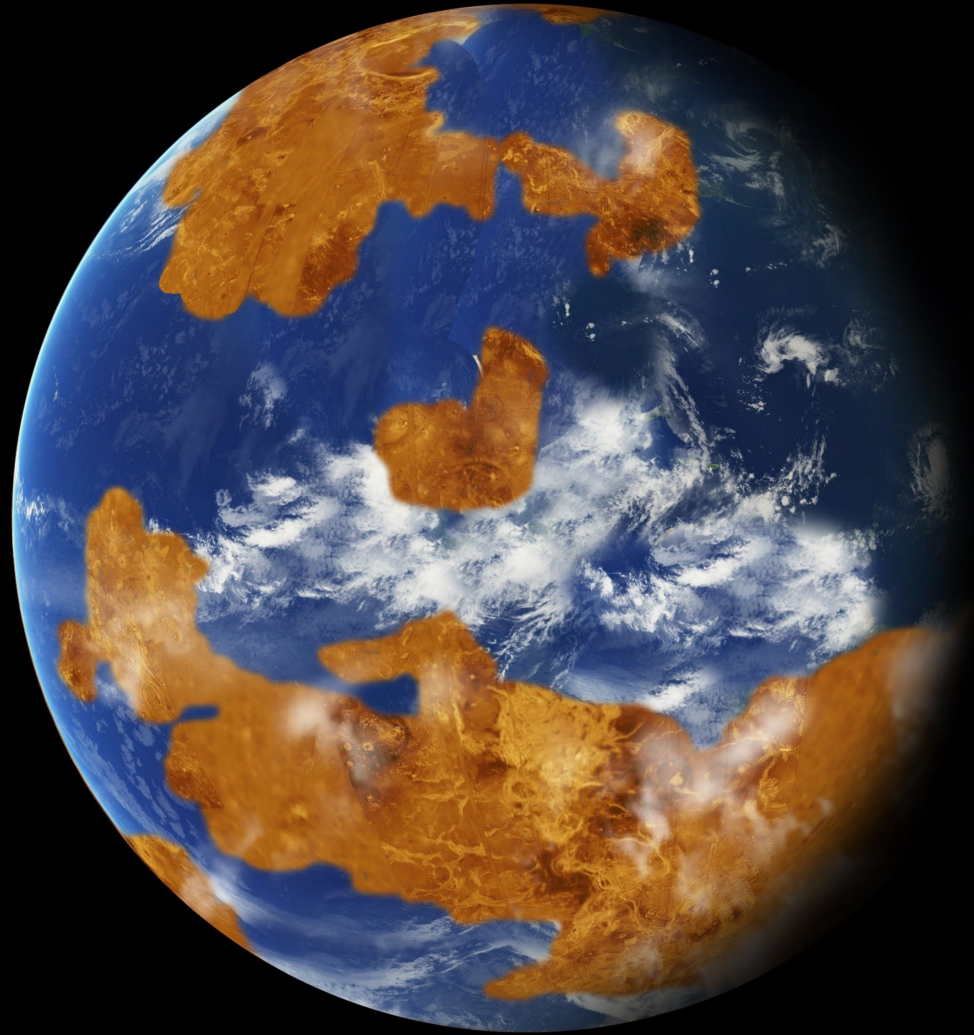
PLYNNÍ A LEDOVÍ OBŘÍ

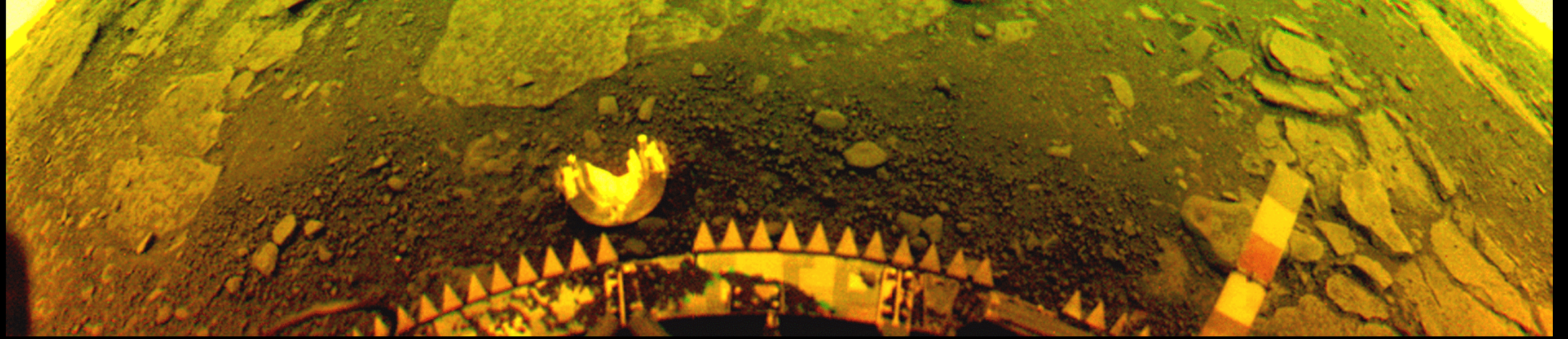


VENUŠE



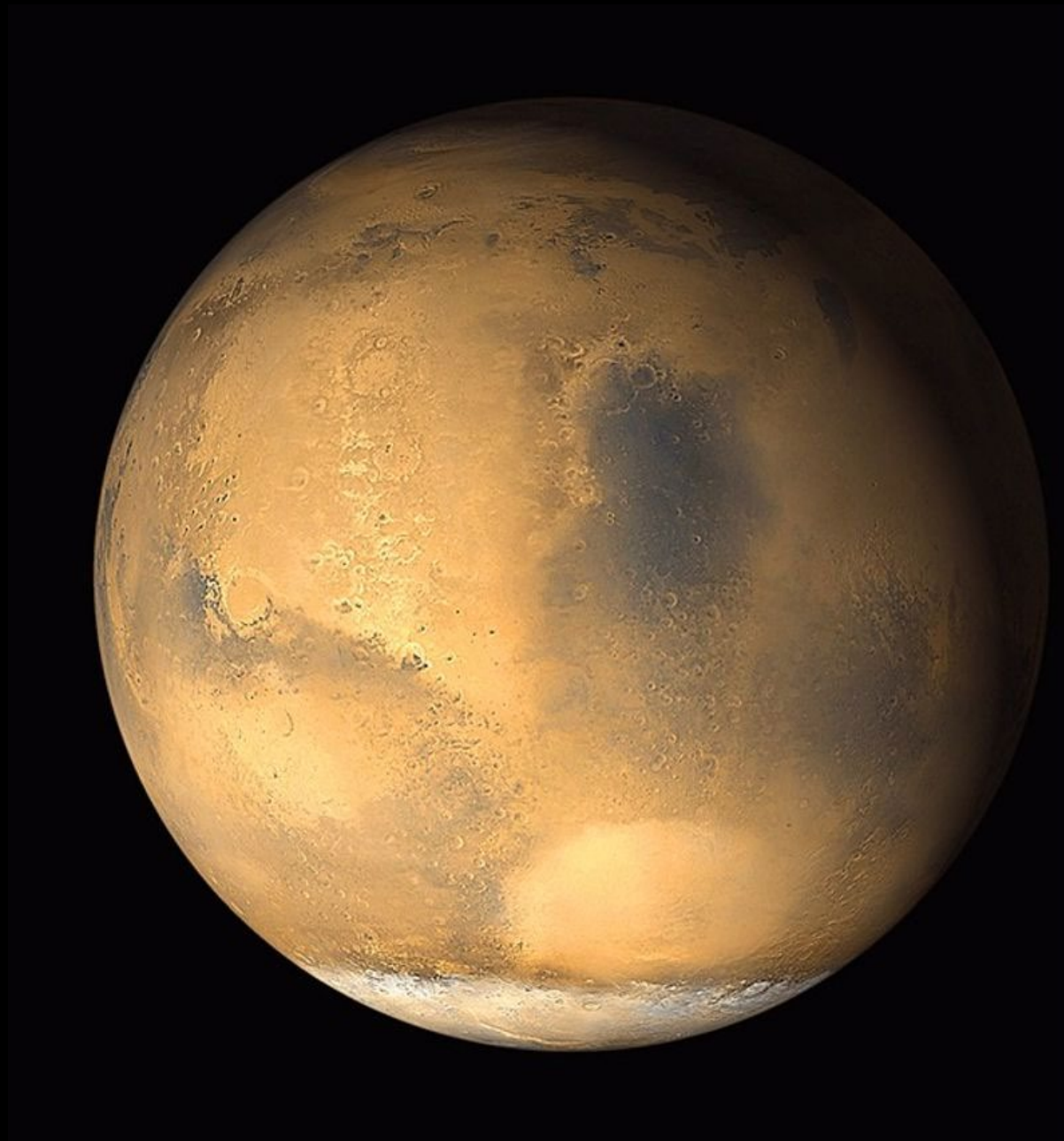
VENUŠE



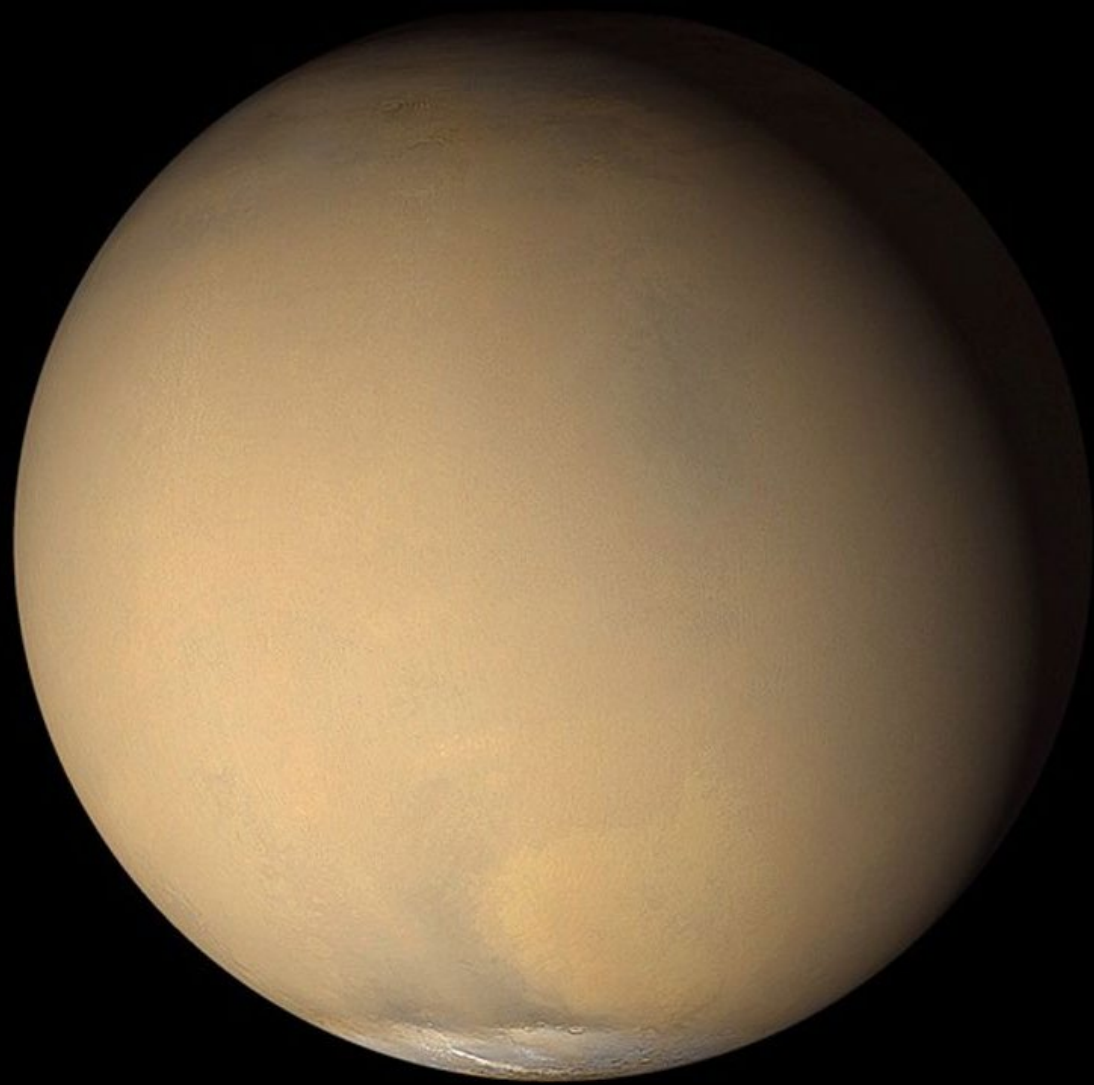




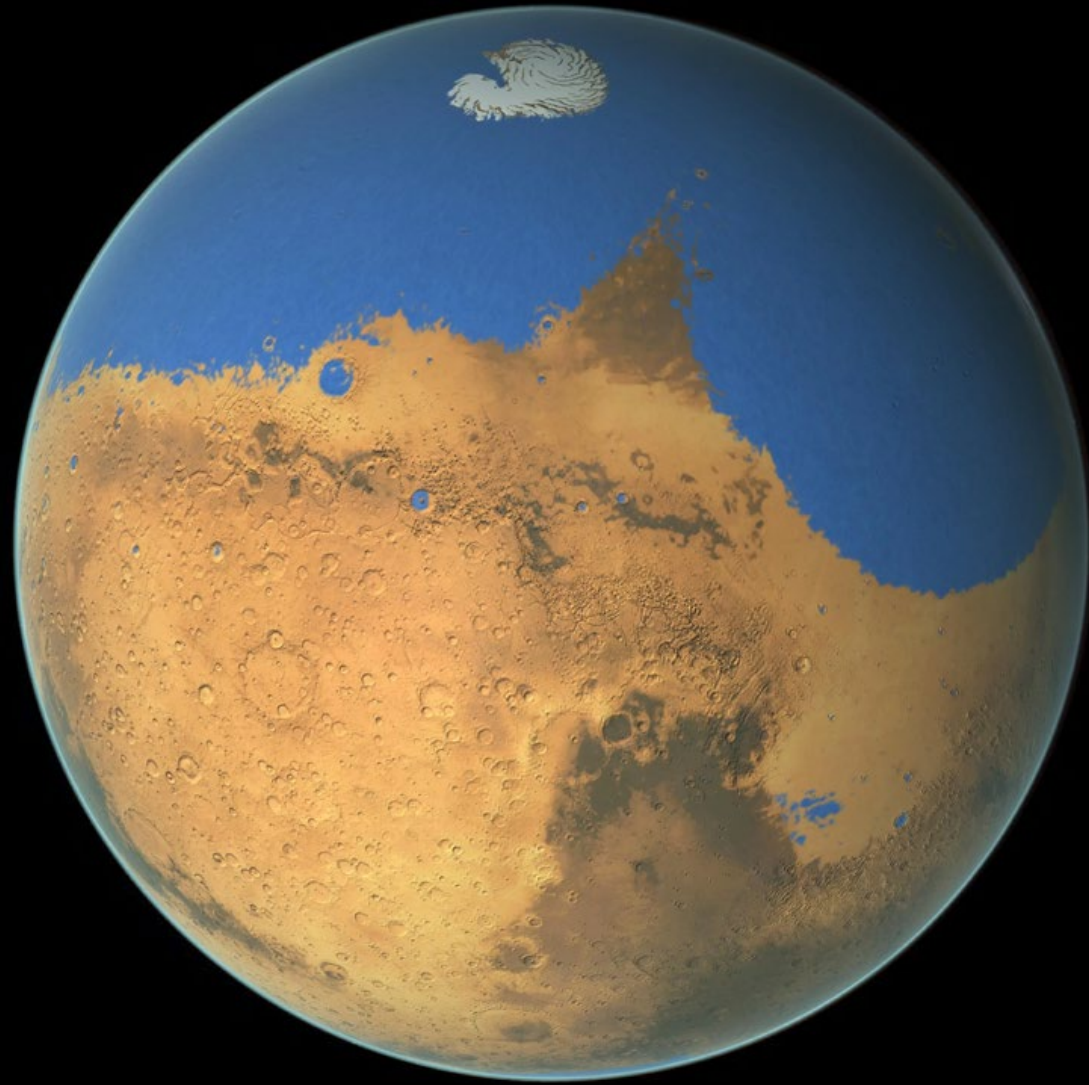
MARS

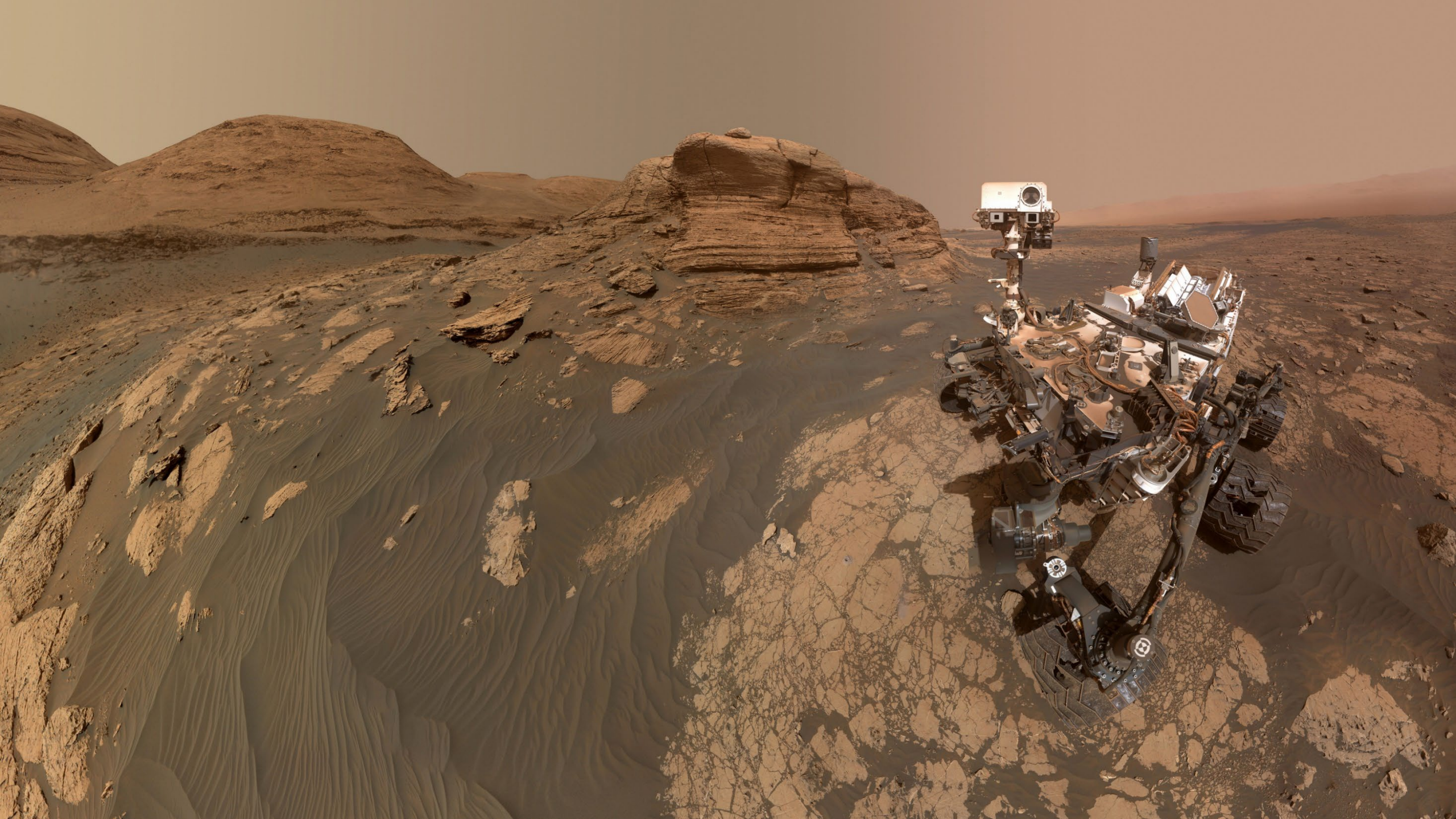


MARS



MARS

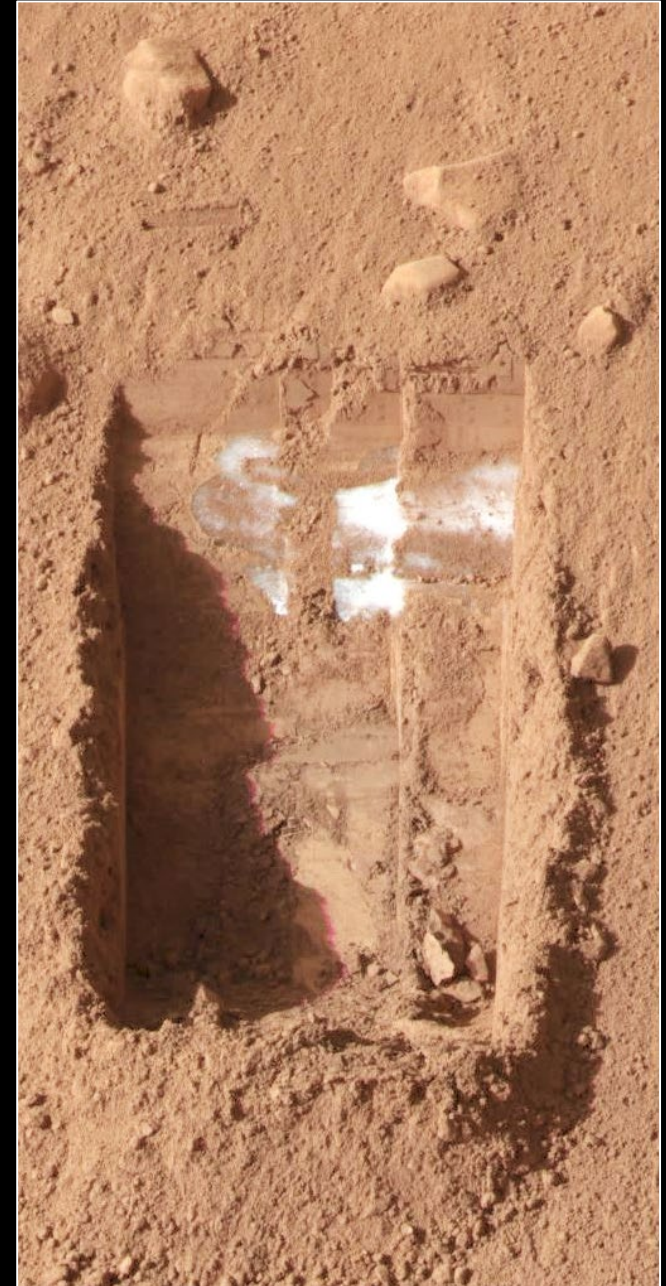






PHOENIX

A LED



PLANETKY



Vesta / 2011



Itokawa / 2005



Bennu / 2018

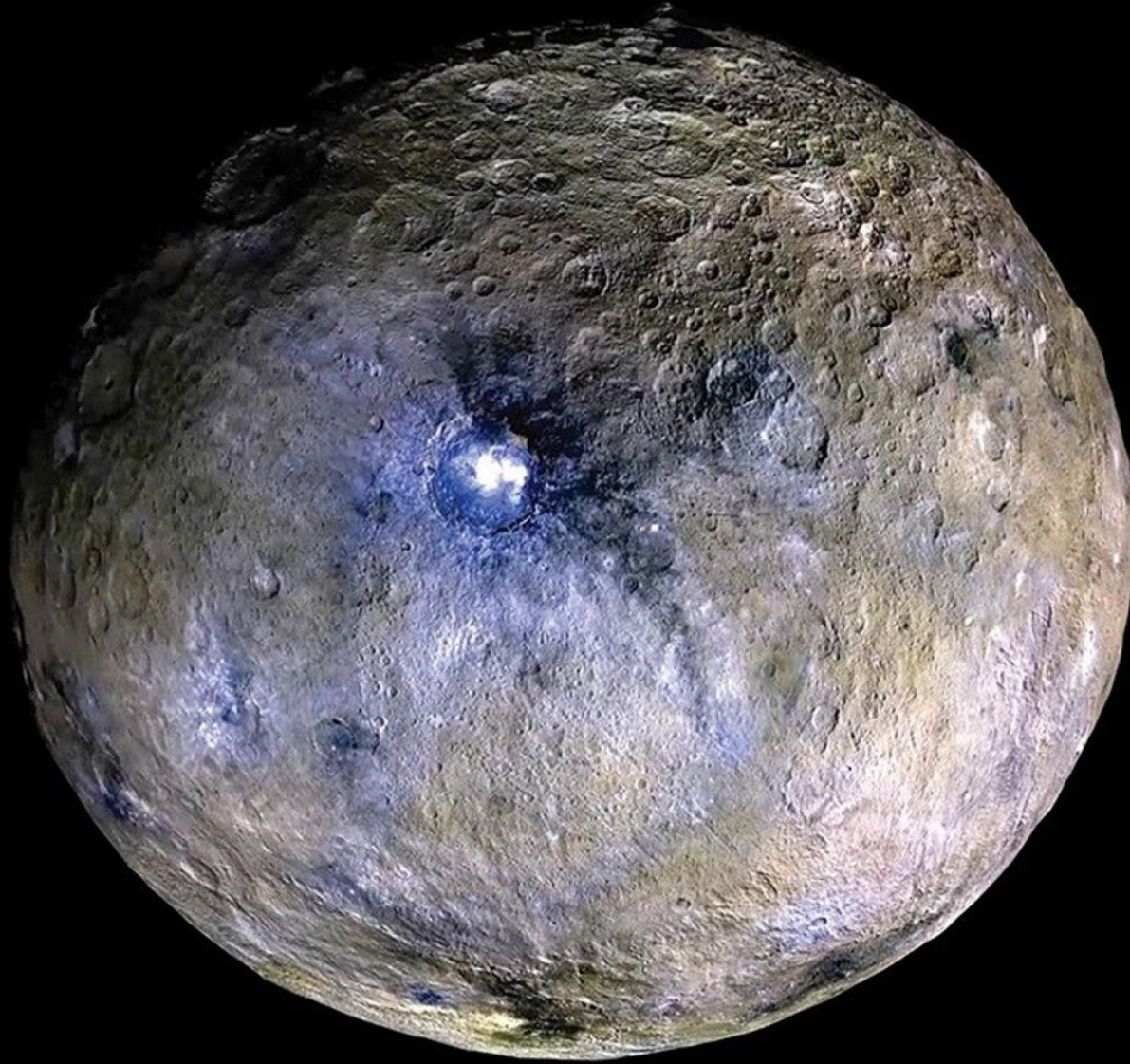


Dinkinesh a Selam / 2023



Ida a Dactyl / 1993

CERES

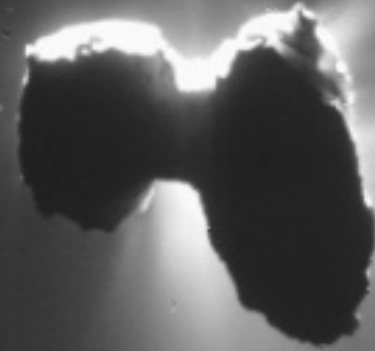




KOMETY



1997
HALE-BOPP



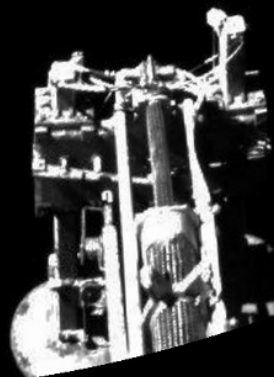
2016

CHURYUMOV-GERASIMENKO

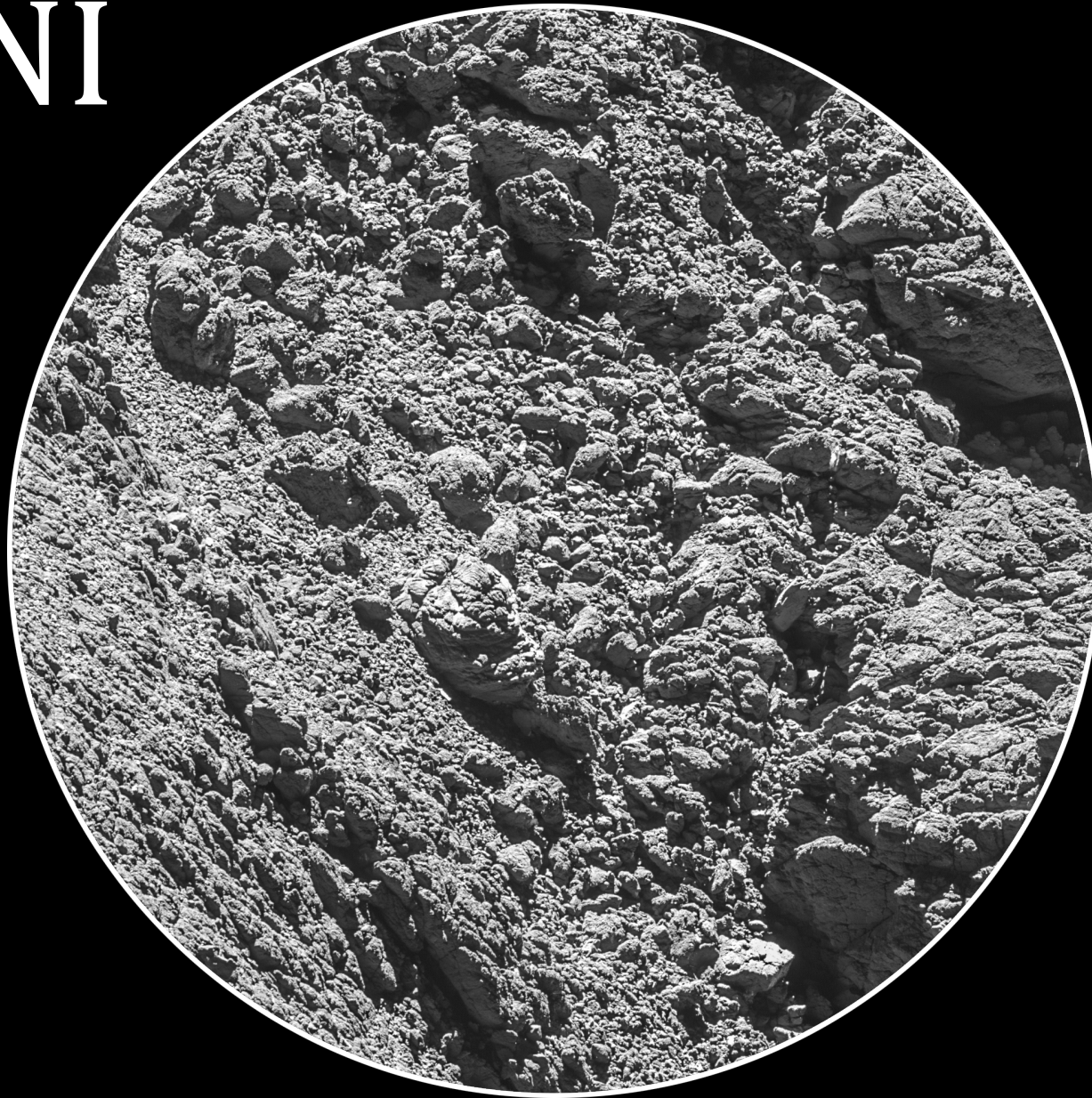
POHLEDEM ROSETTY



POHLEDEM PHILAE



HLEDÁNÍ

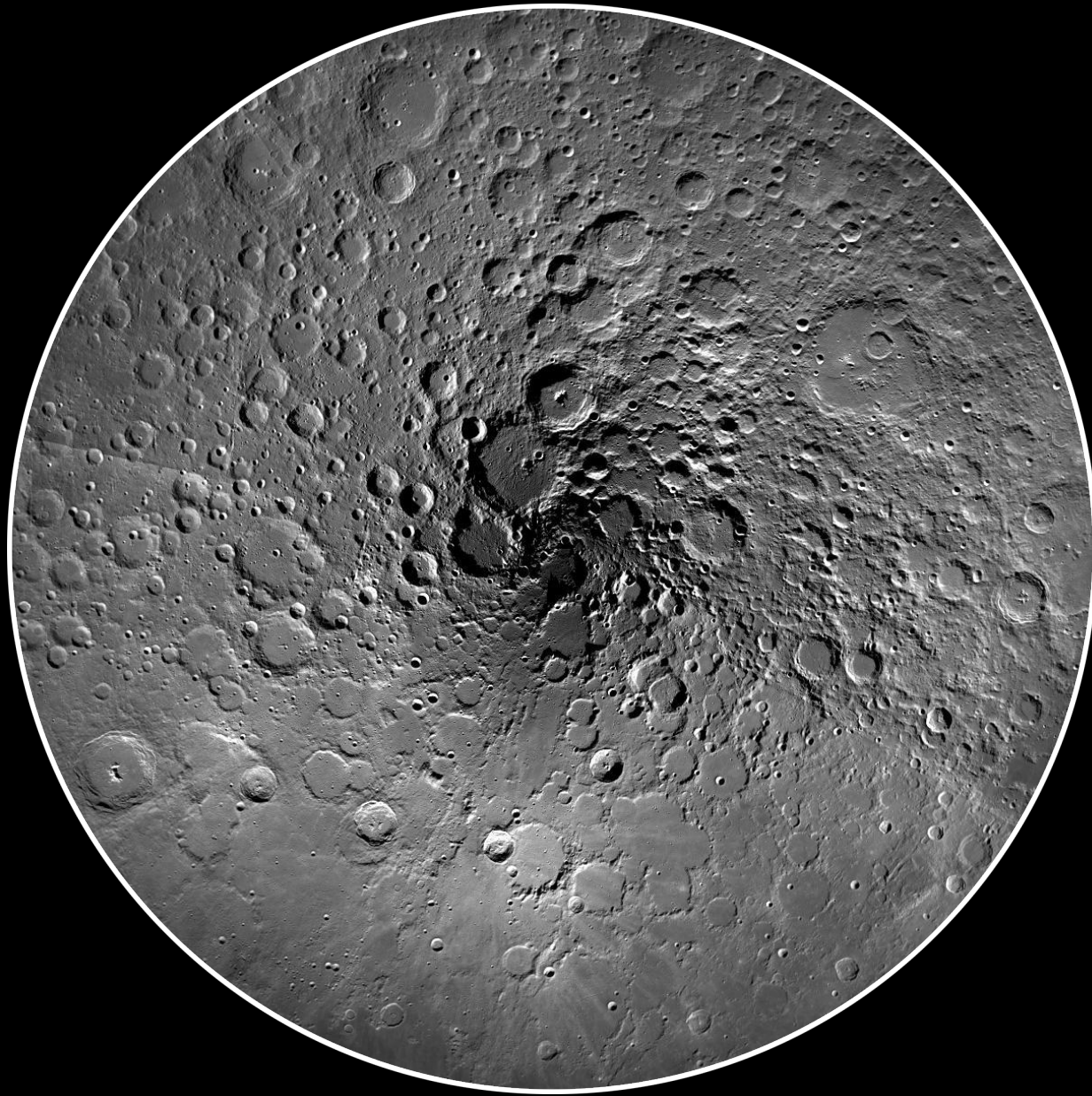


PHILAE

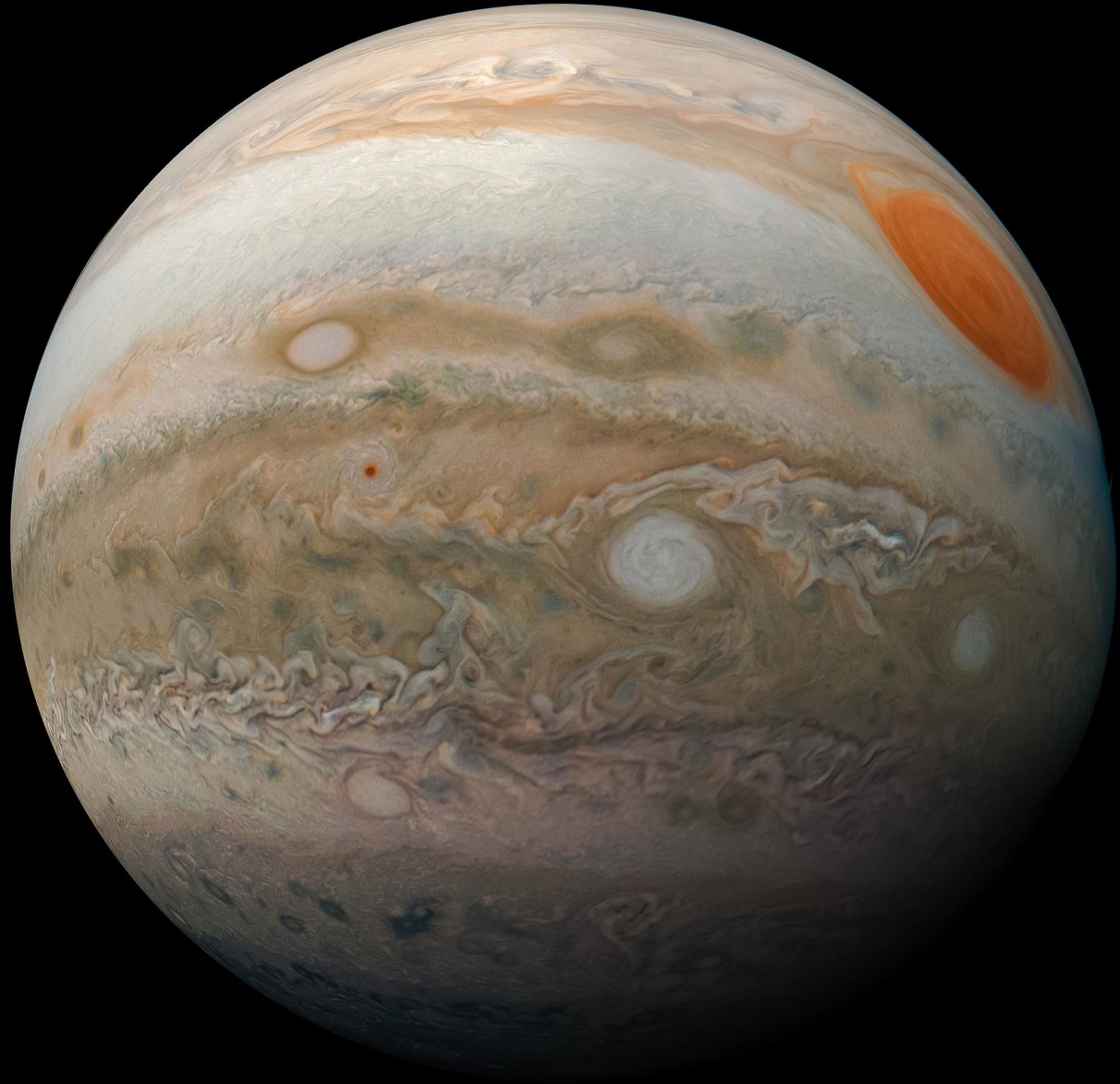
MĚSÍC



MĚSÍC



JUPITER



MĚSÍCE JUPITERU



IO



EUROPA

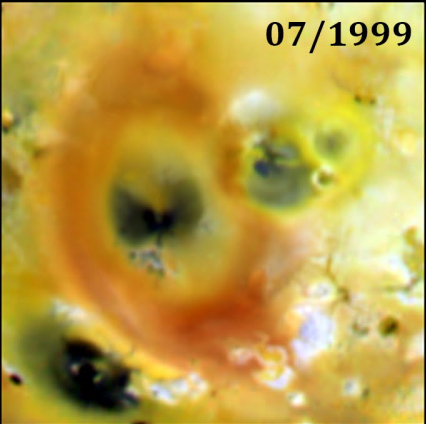
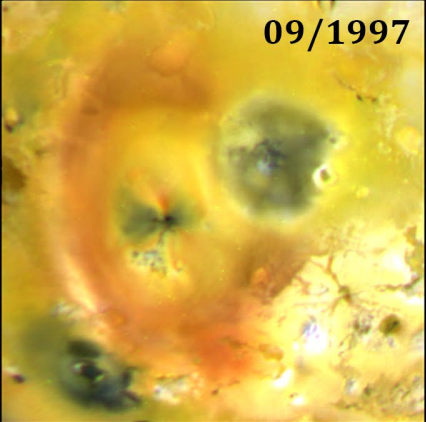
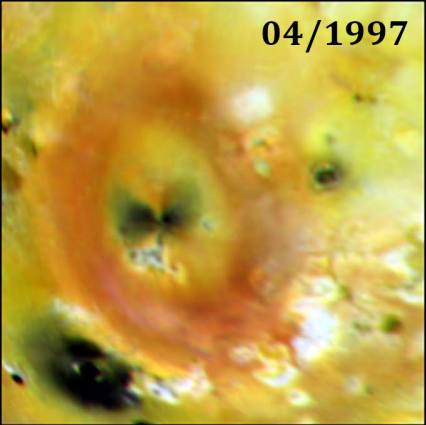
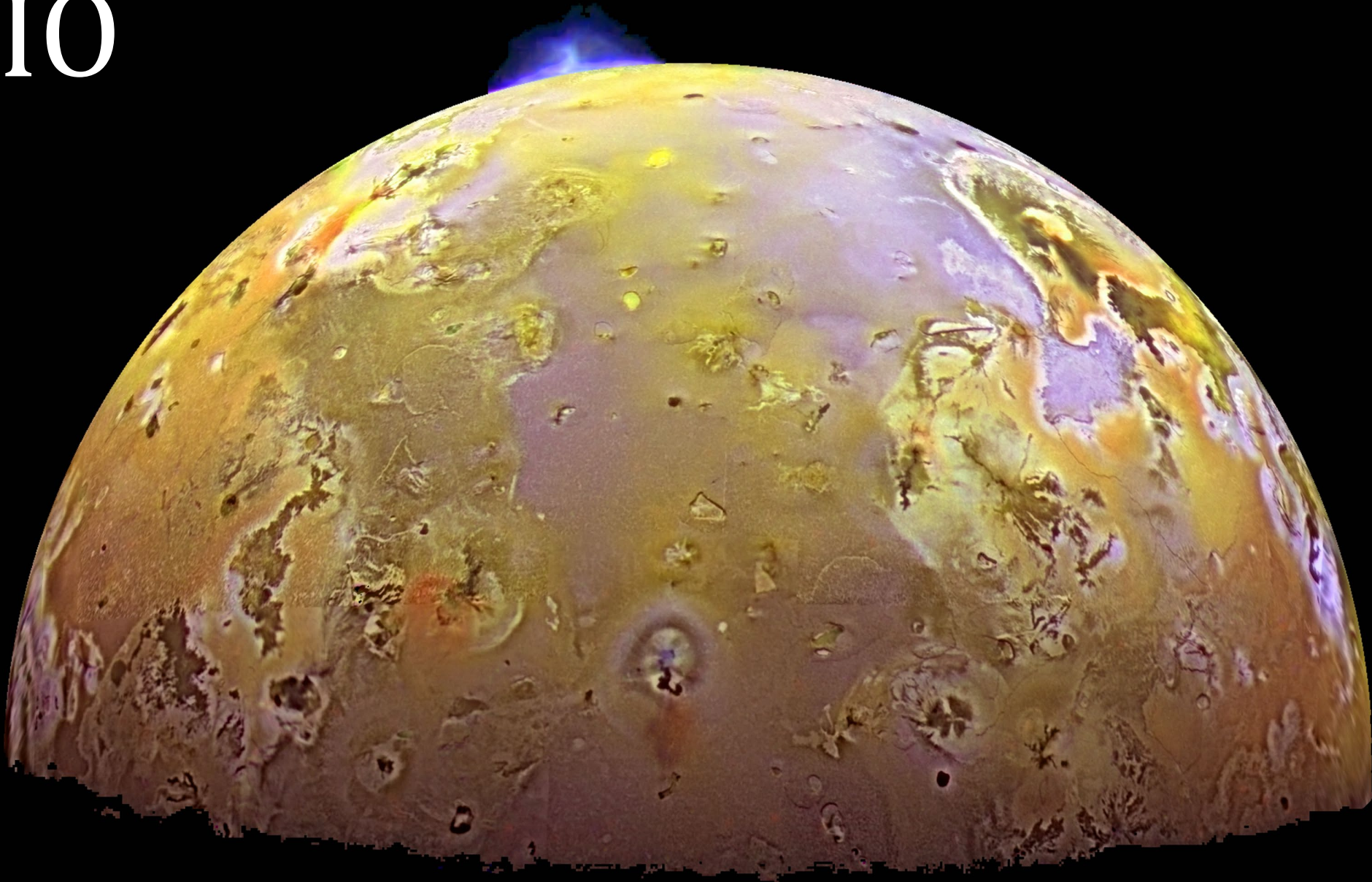


GANYMED

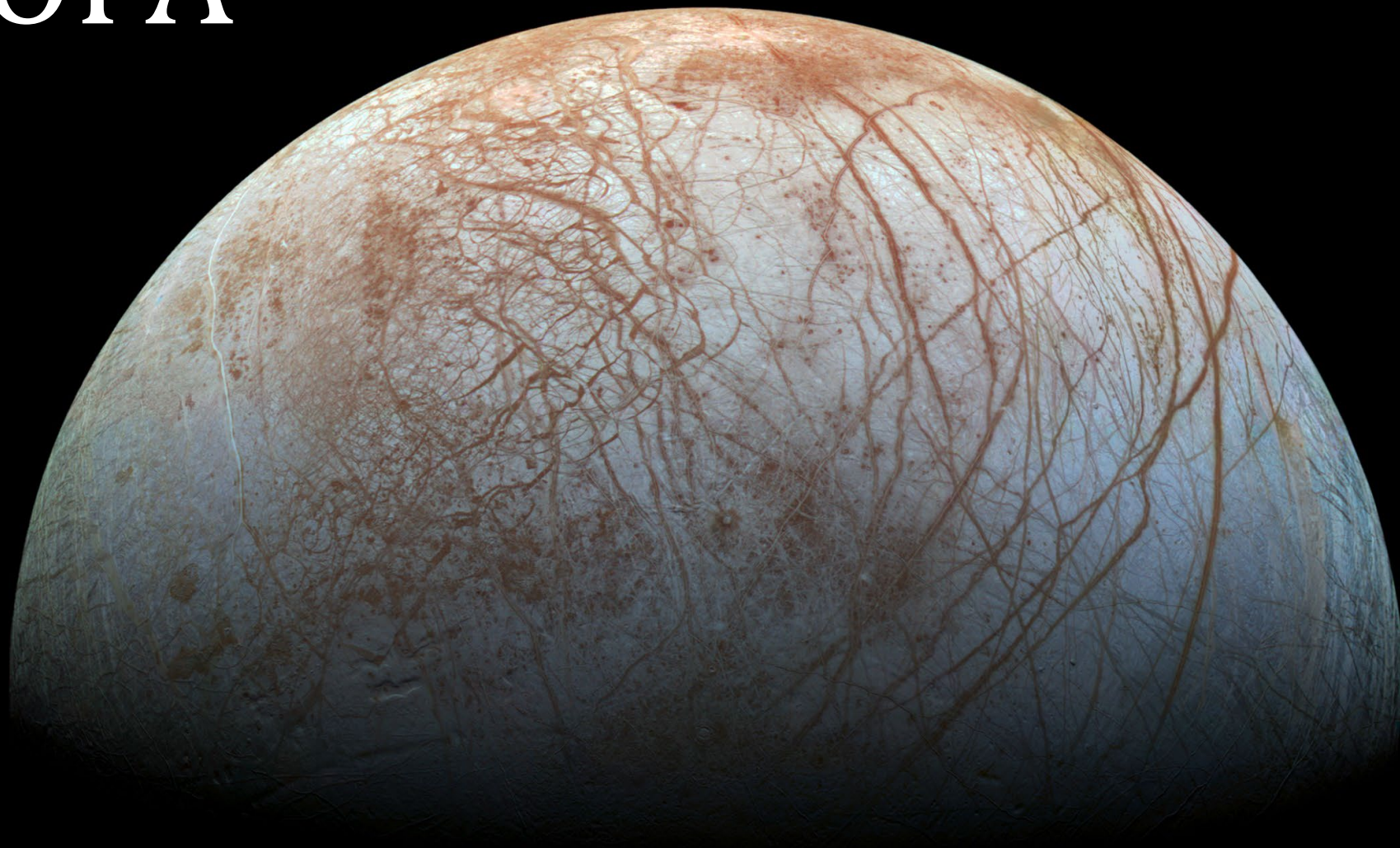


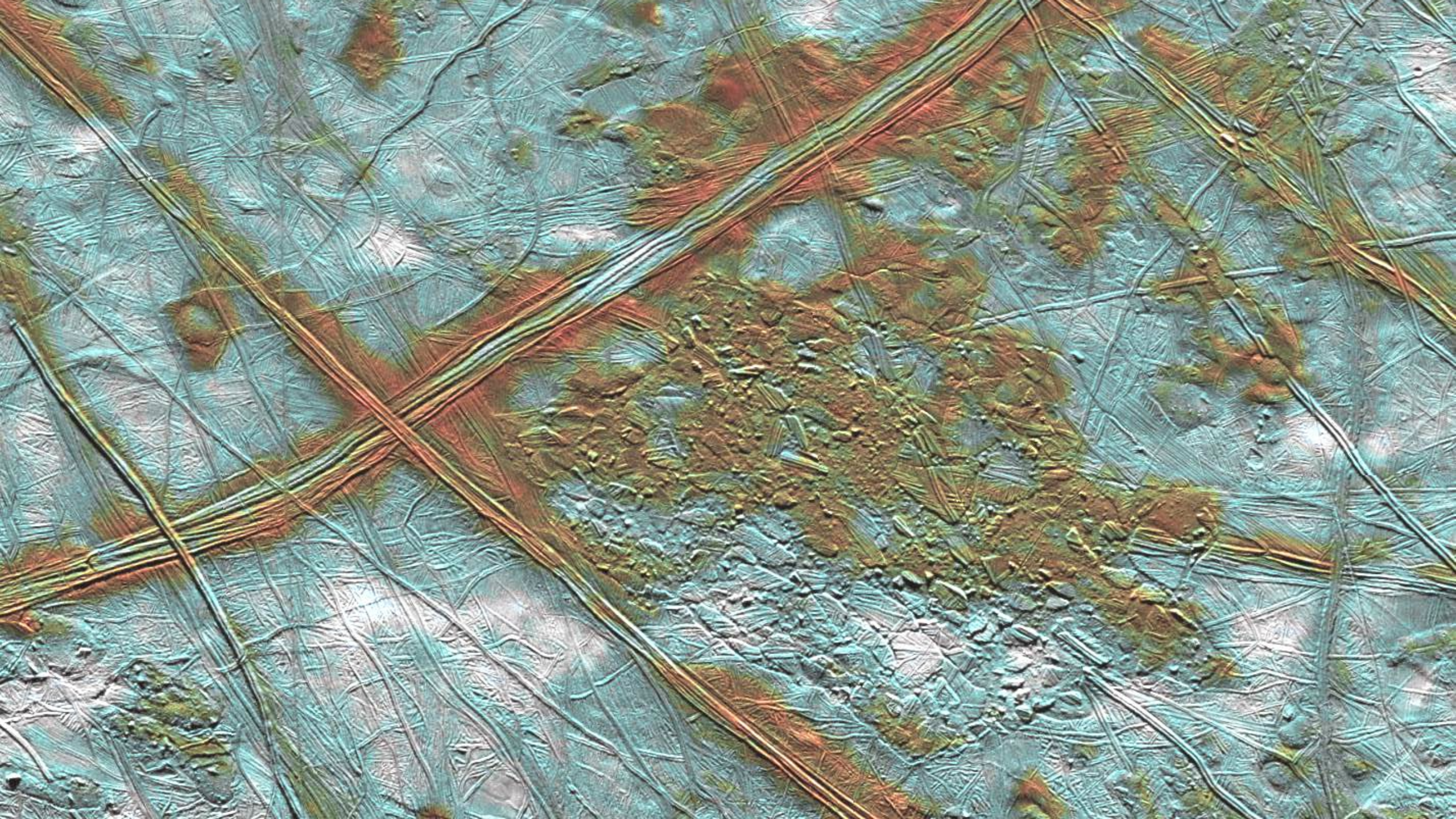
CALLISTO

IO



EUROPA

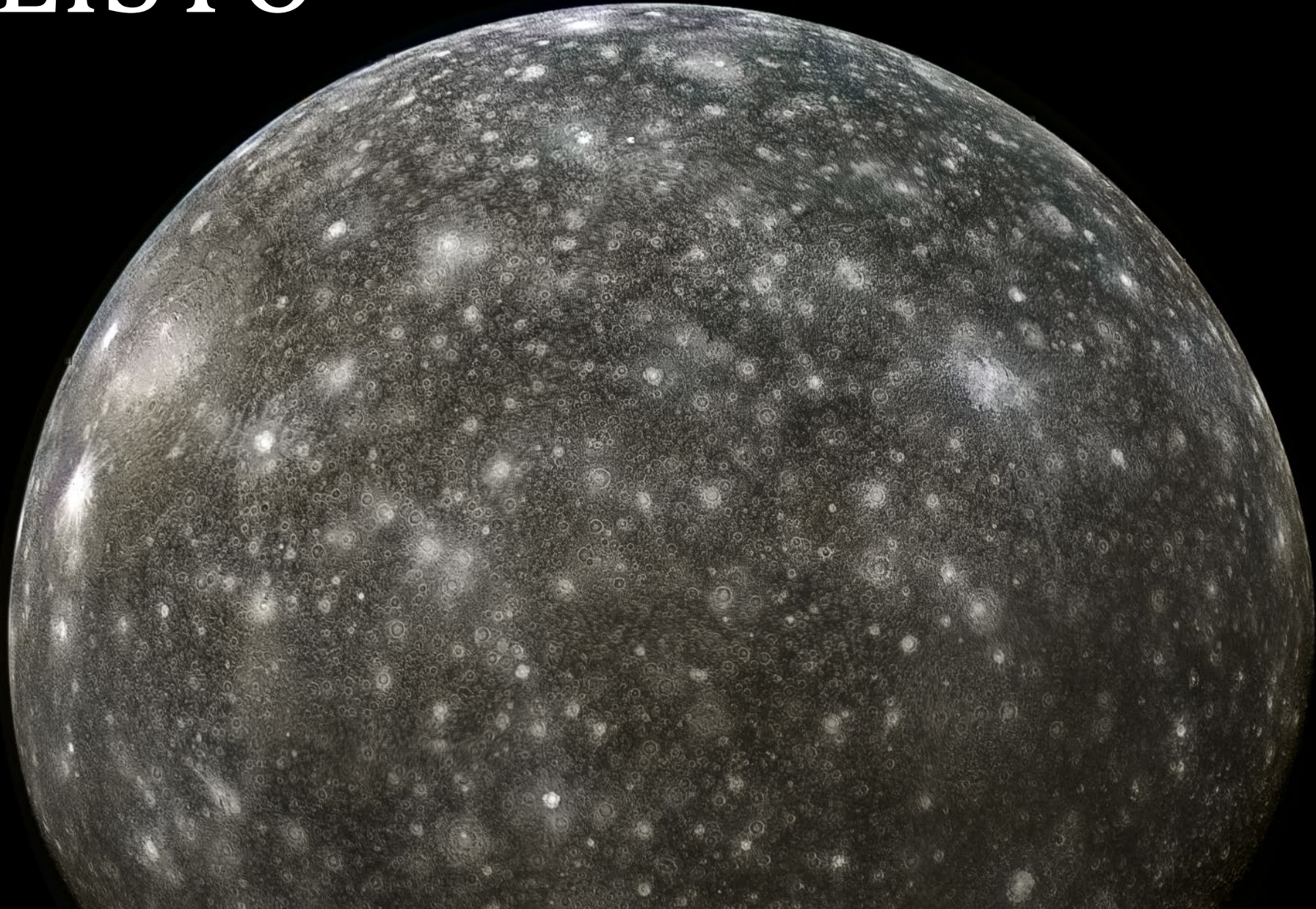




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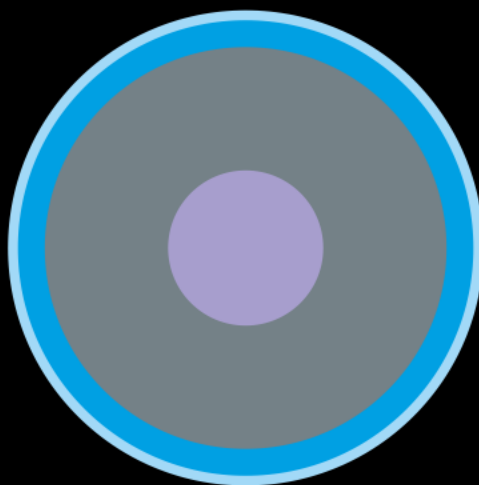


CALLISTO

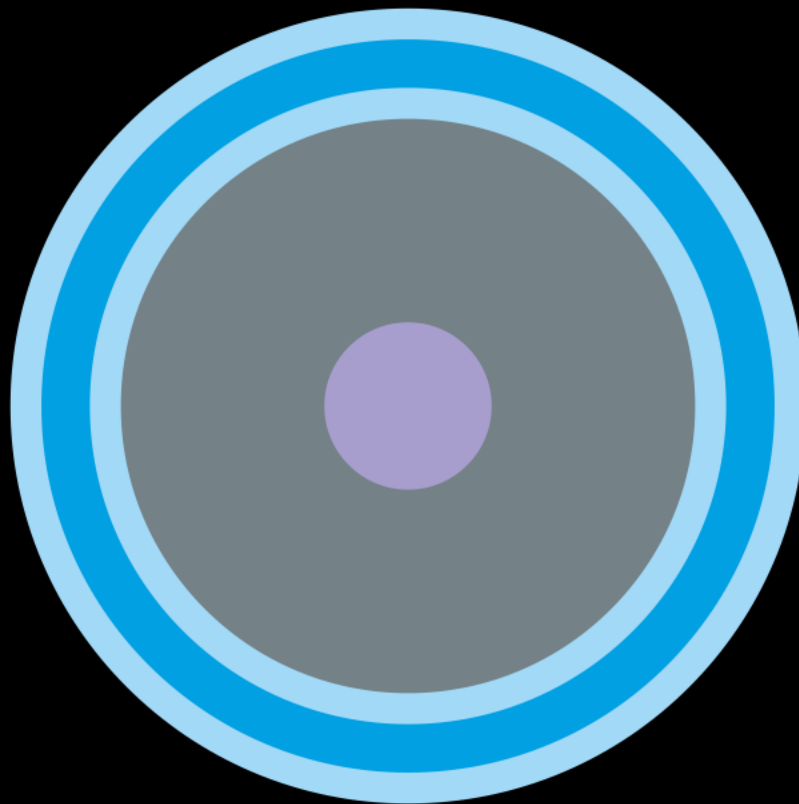


NITRA

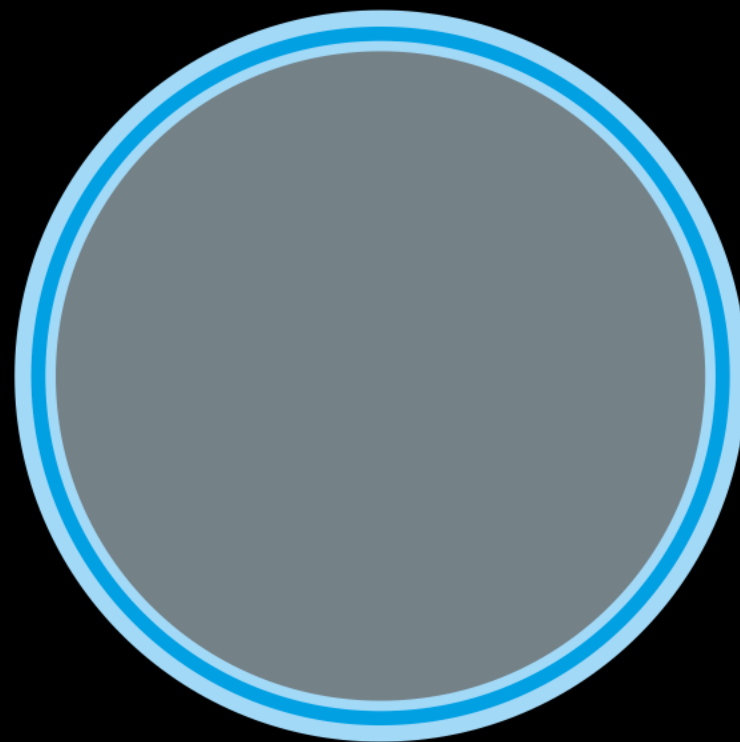
Europa



Ganymed



Callisto



Led



Kapalná voda

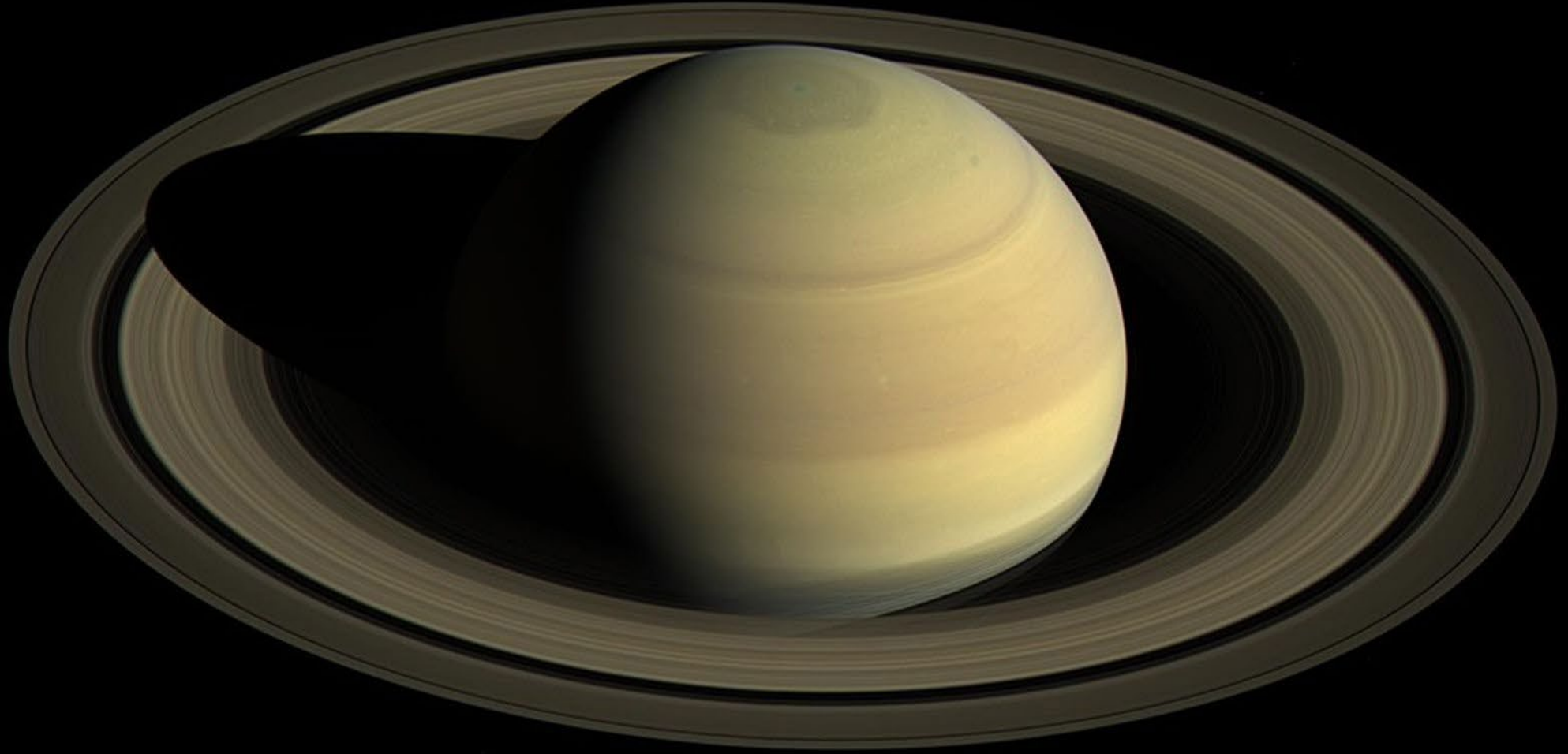


Hornina

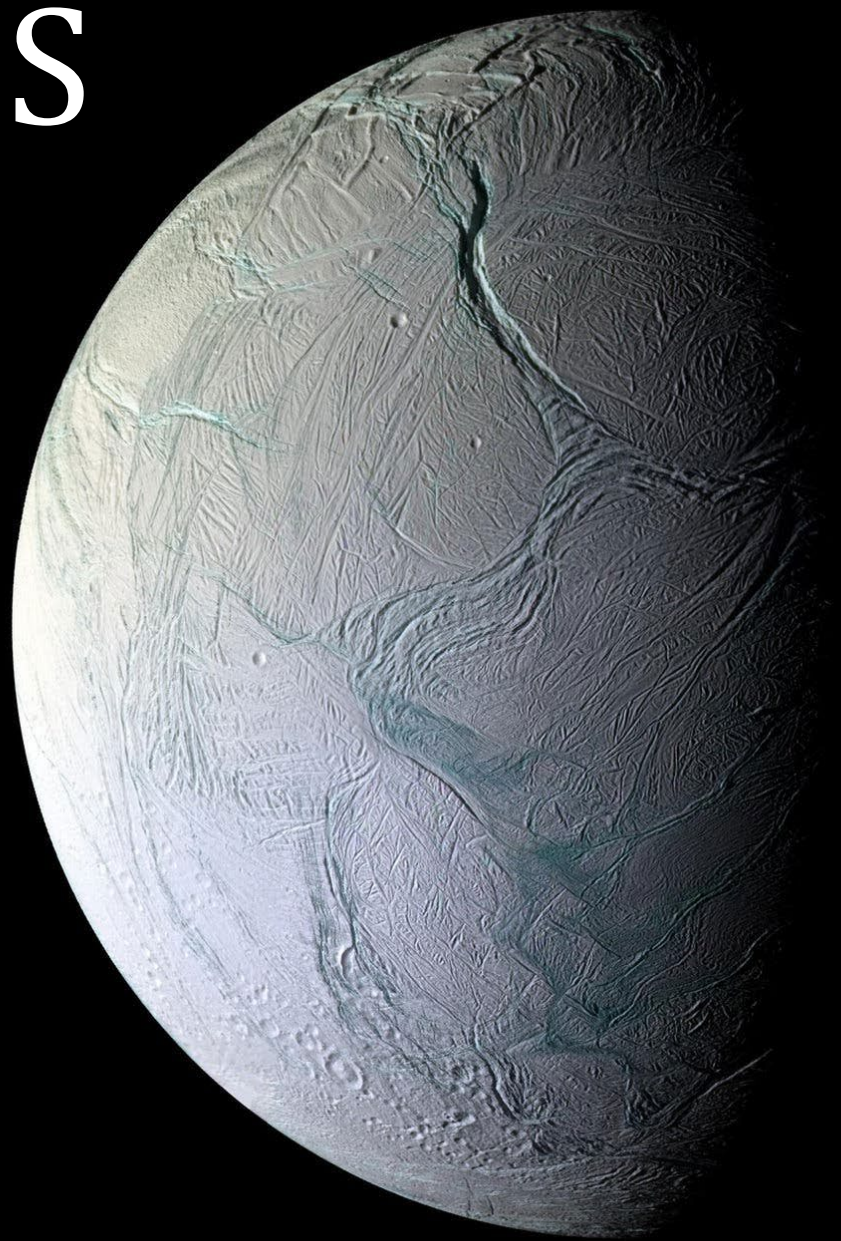


Kovové jadro

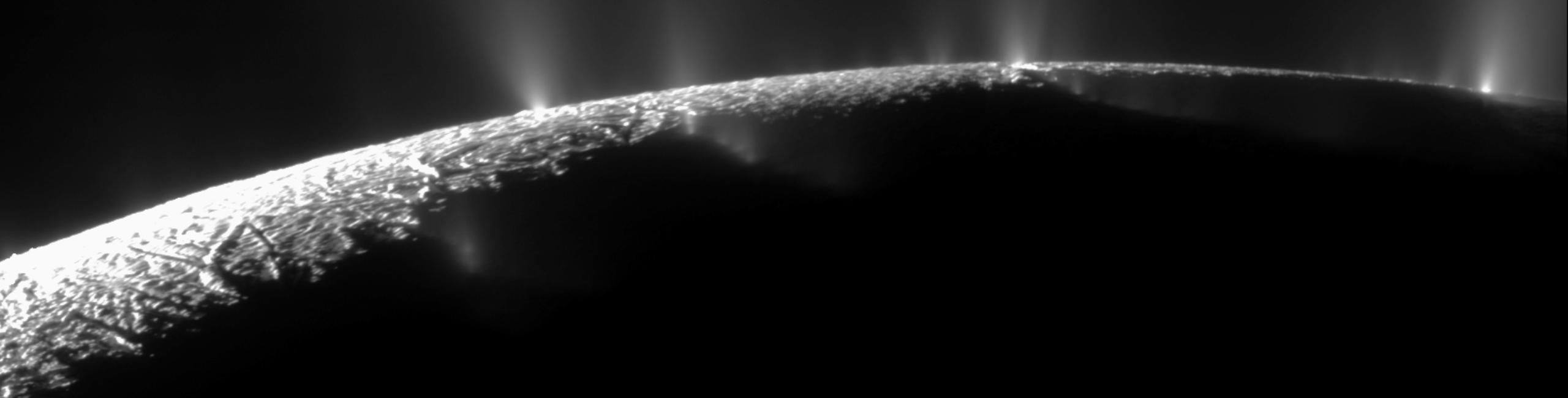
SATURN

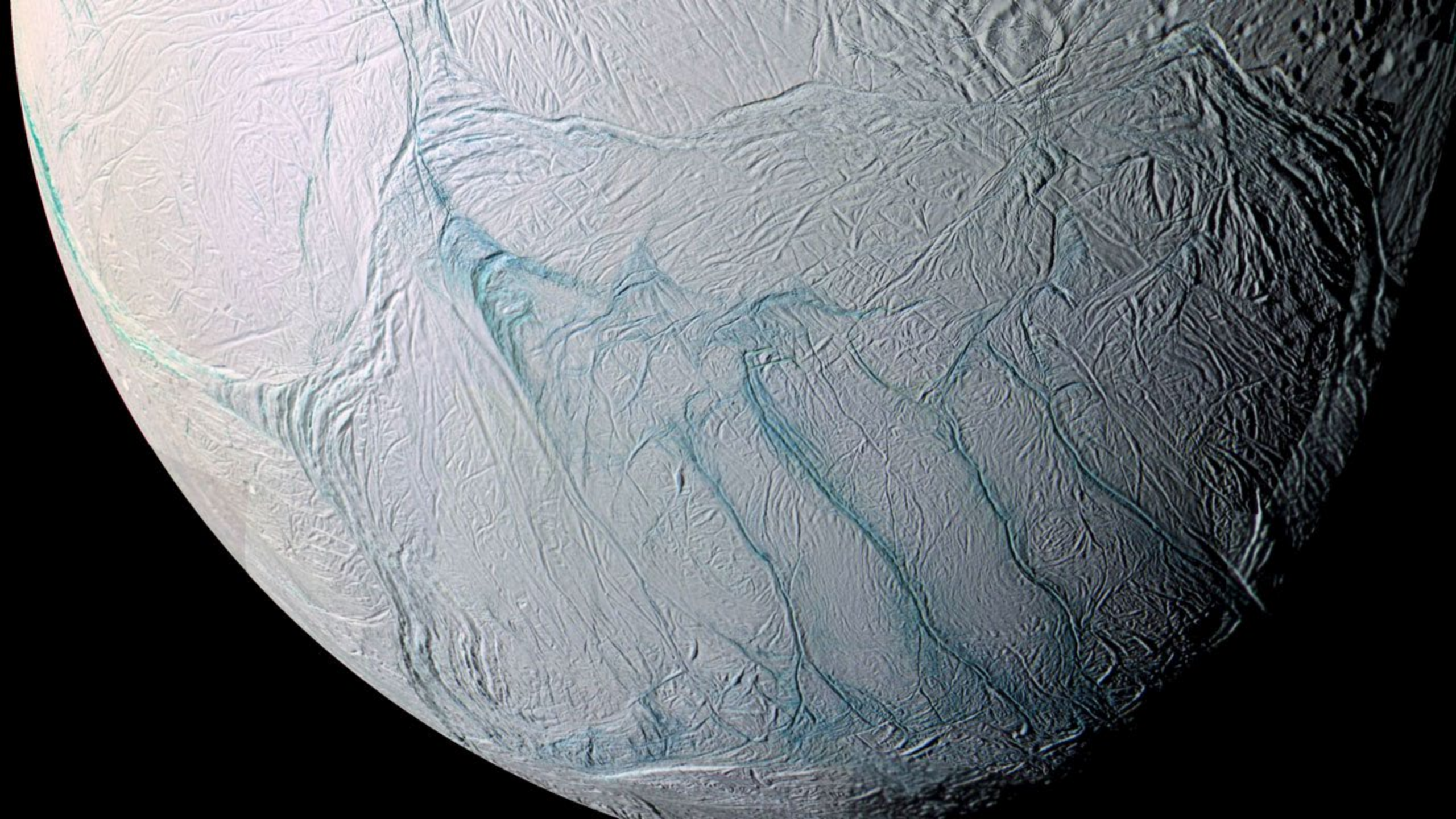


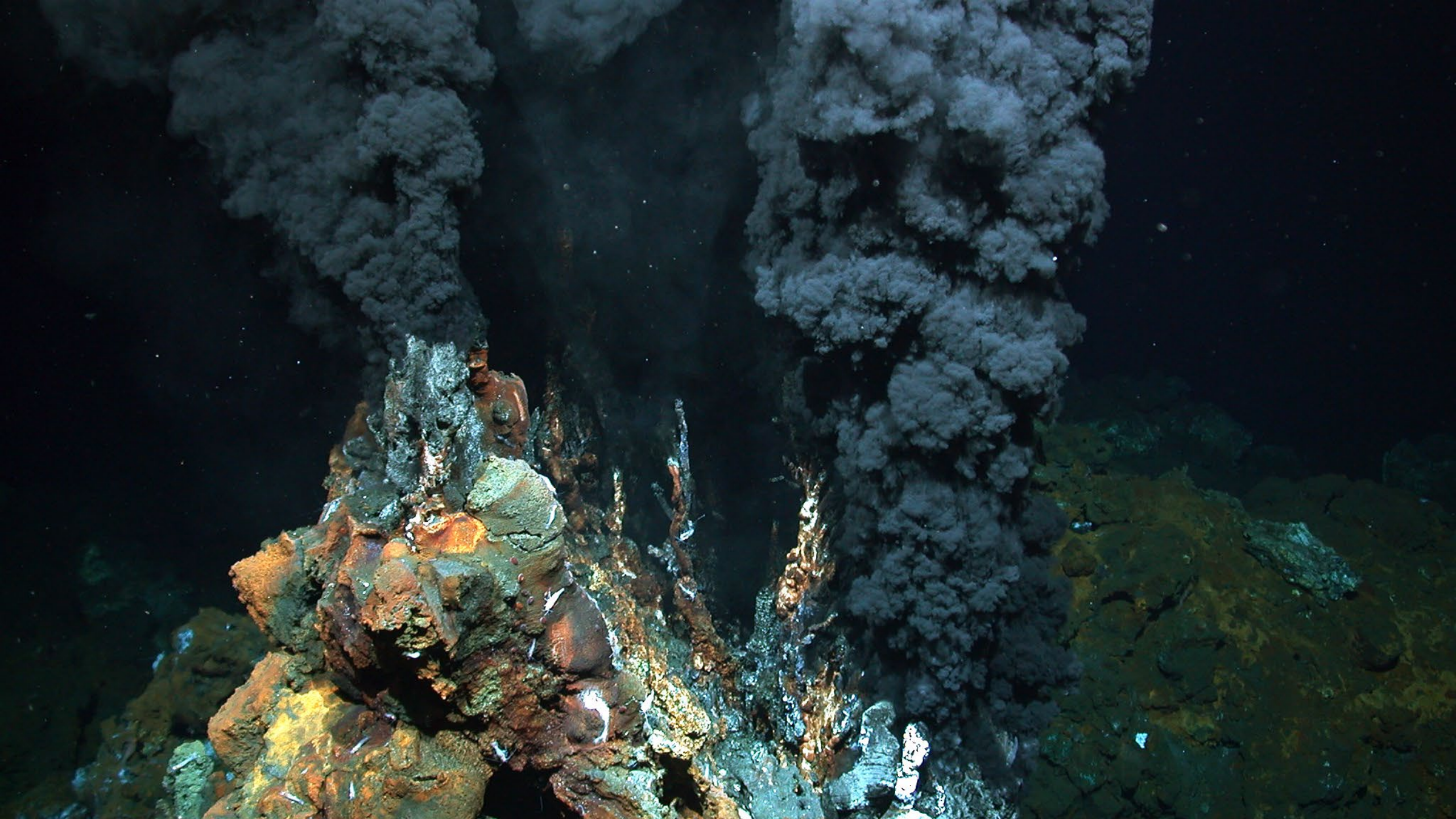
ENCELADUS



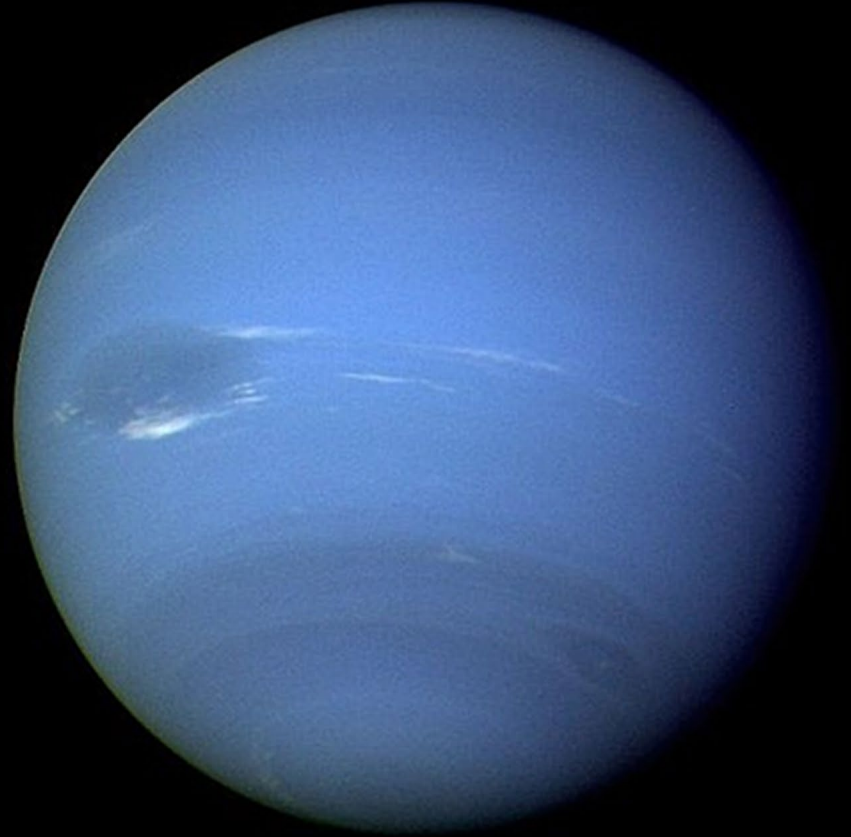
ENCELADUS







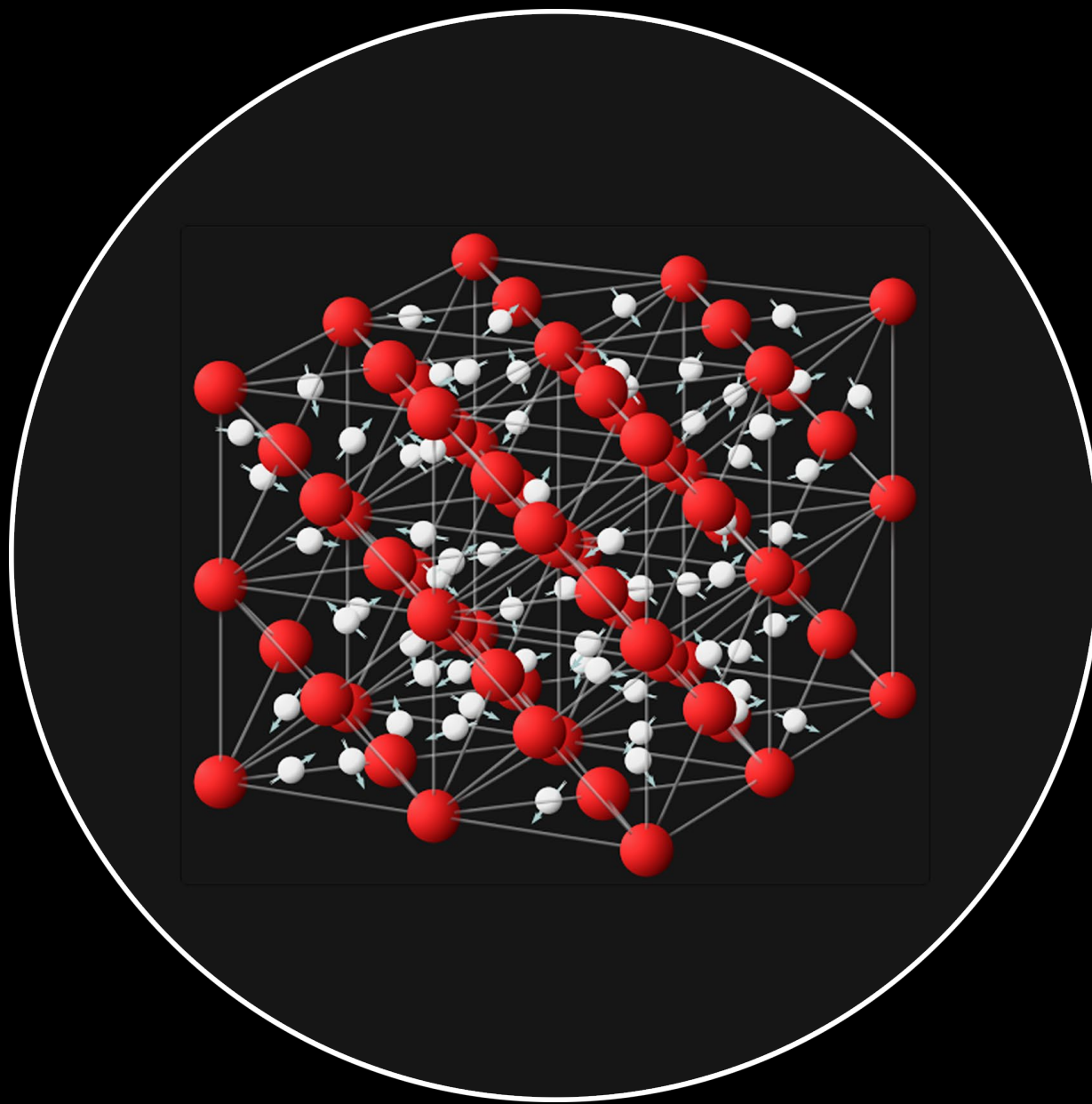
URAN A NEPTUN



URAN A NEPTUN

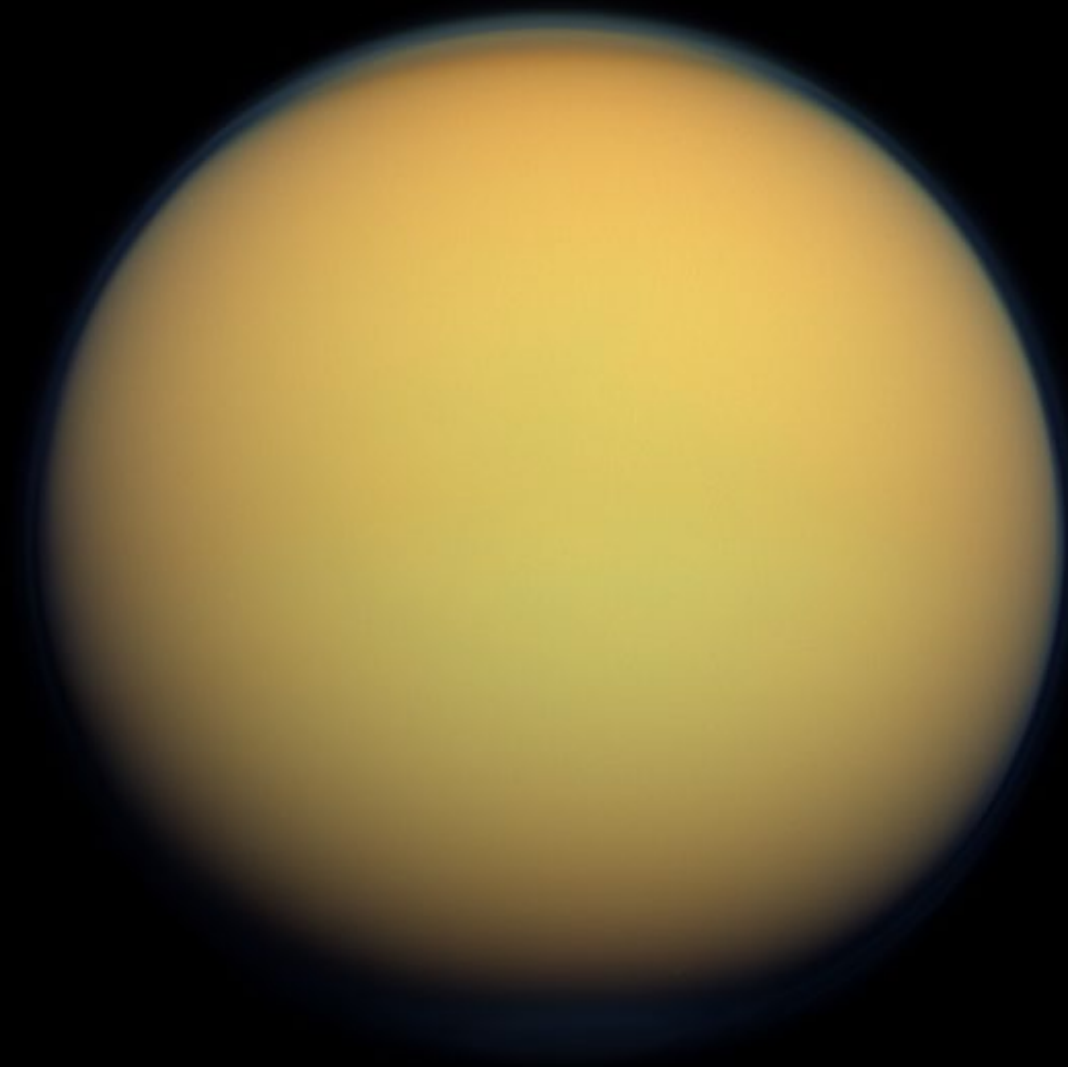


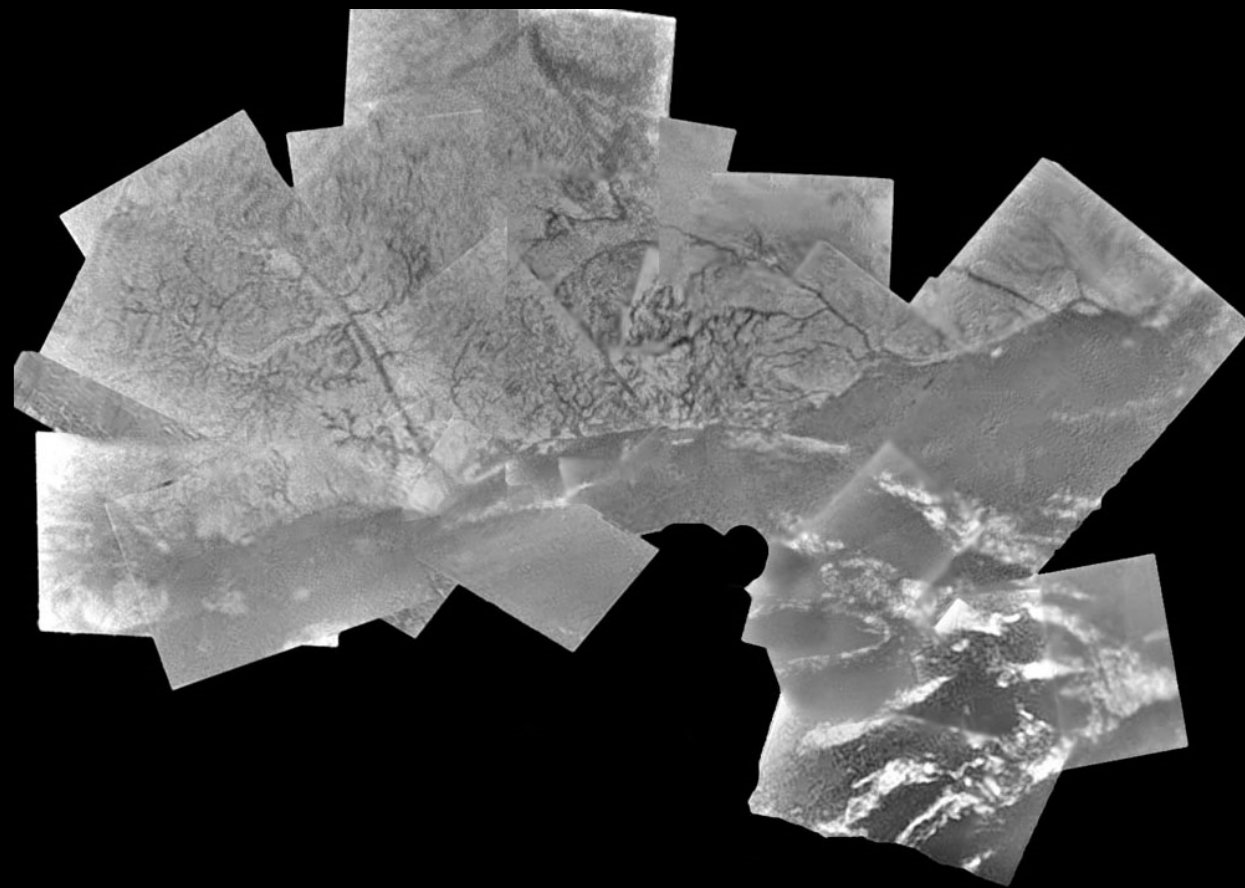
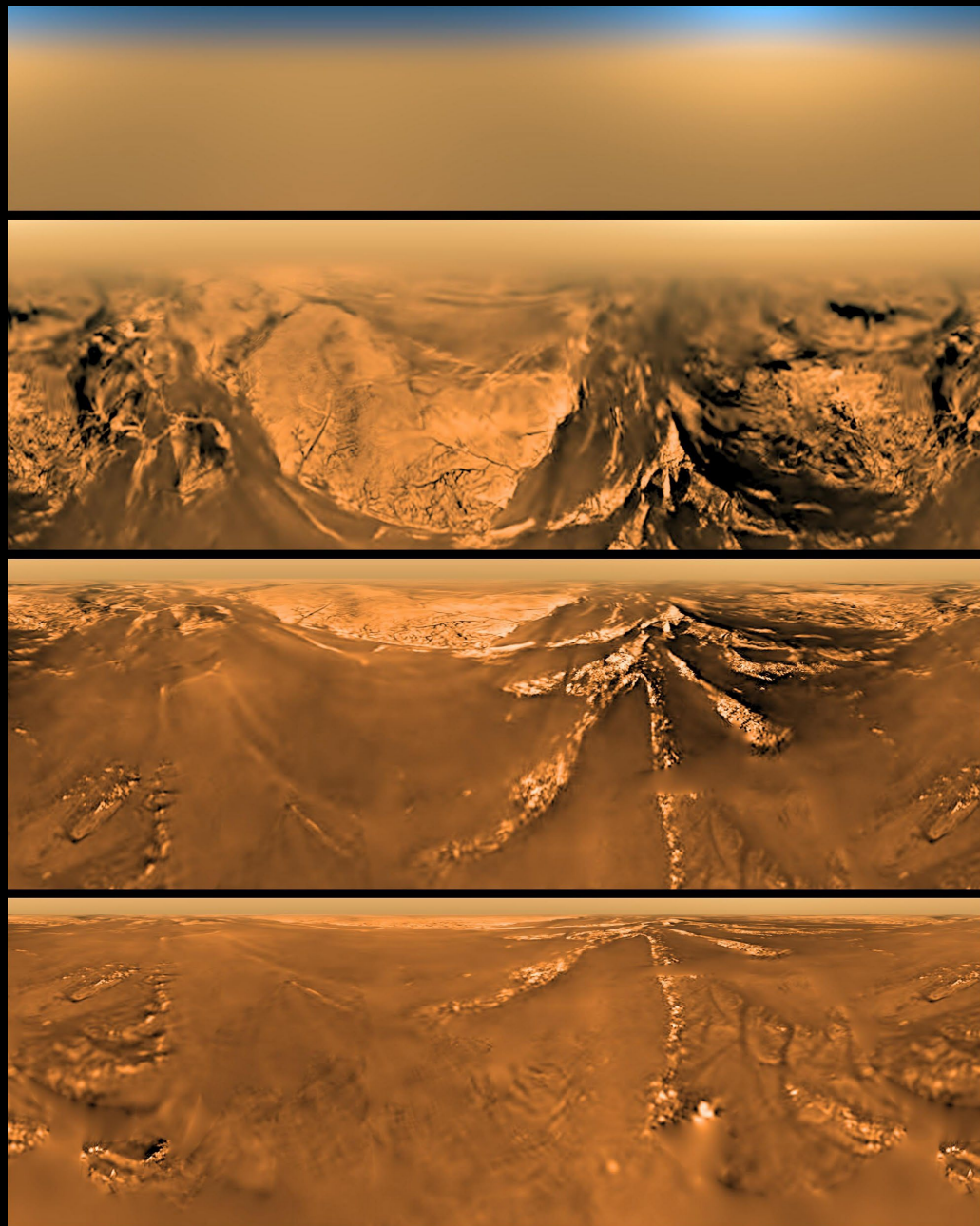
HORKÝ



LED

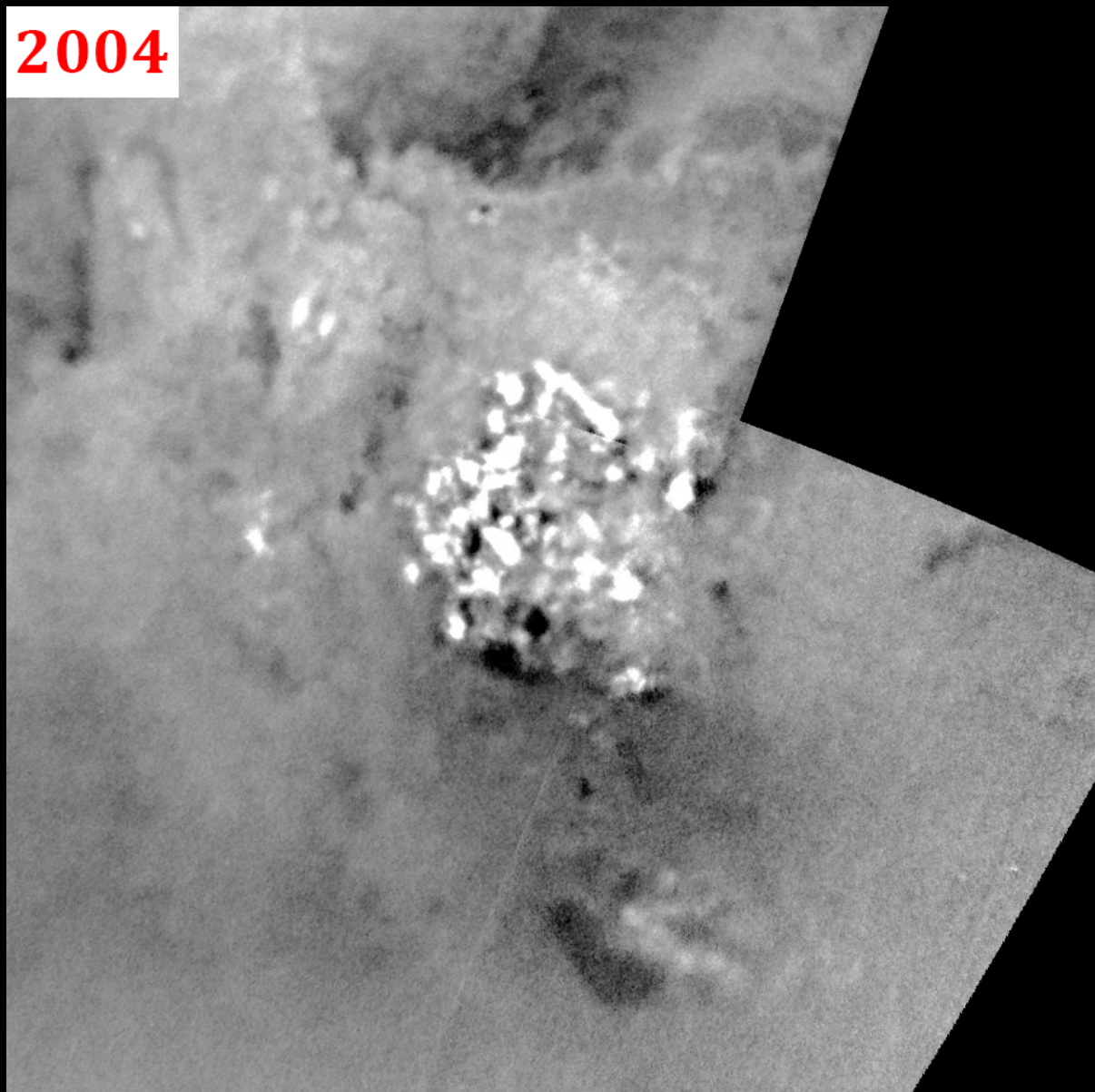
TITAN



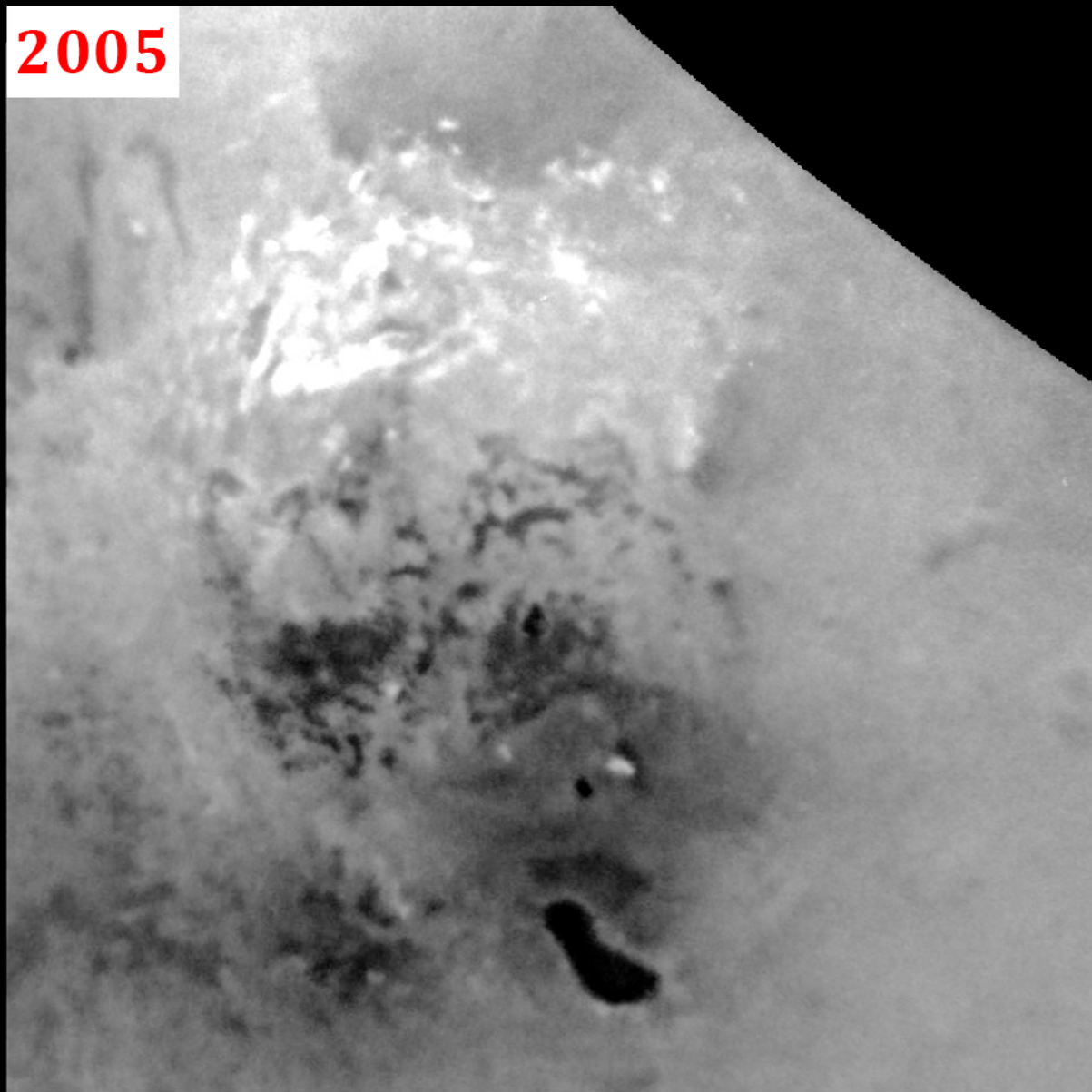


HUYGENS
PŘISTÁL

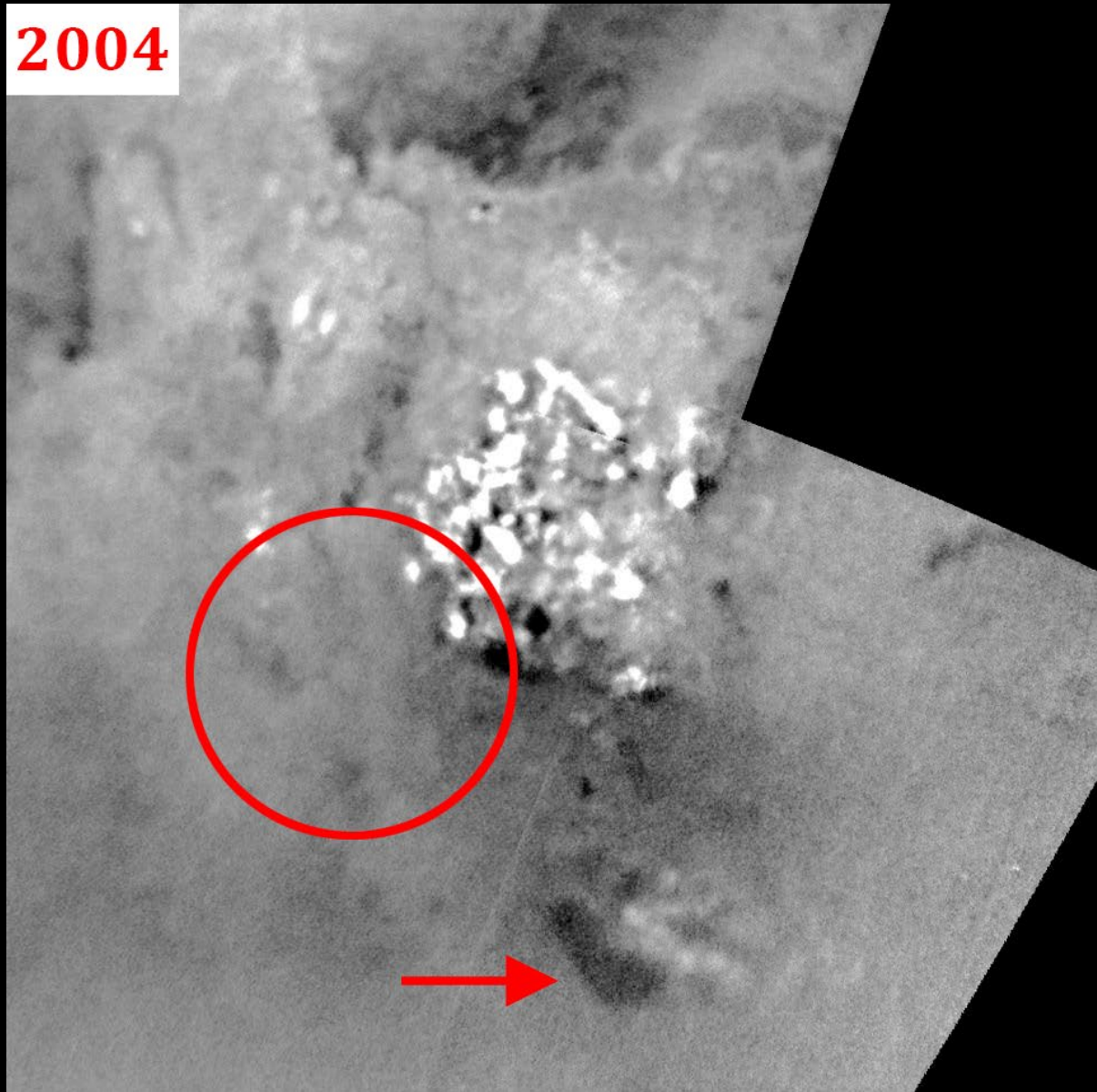
2004



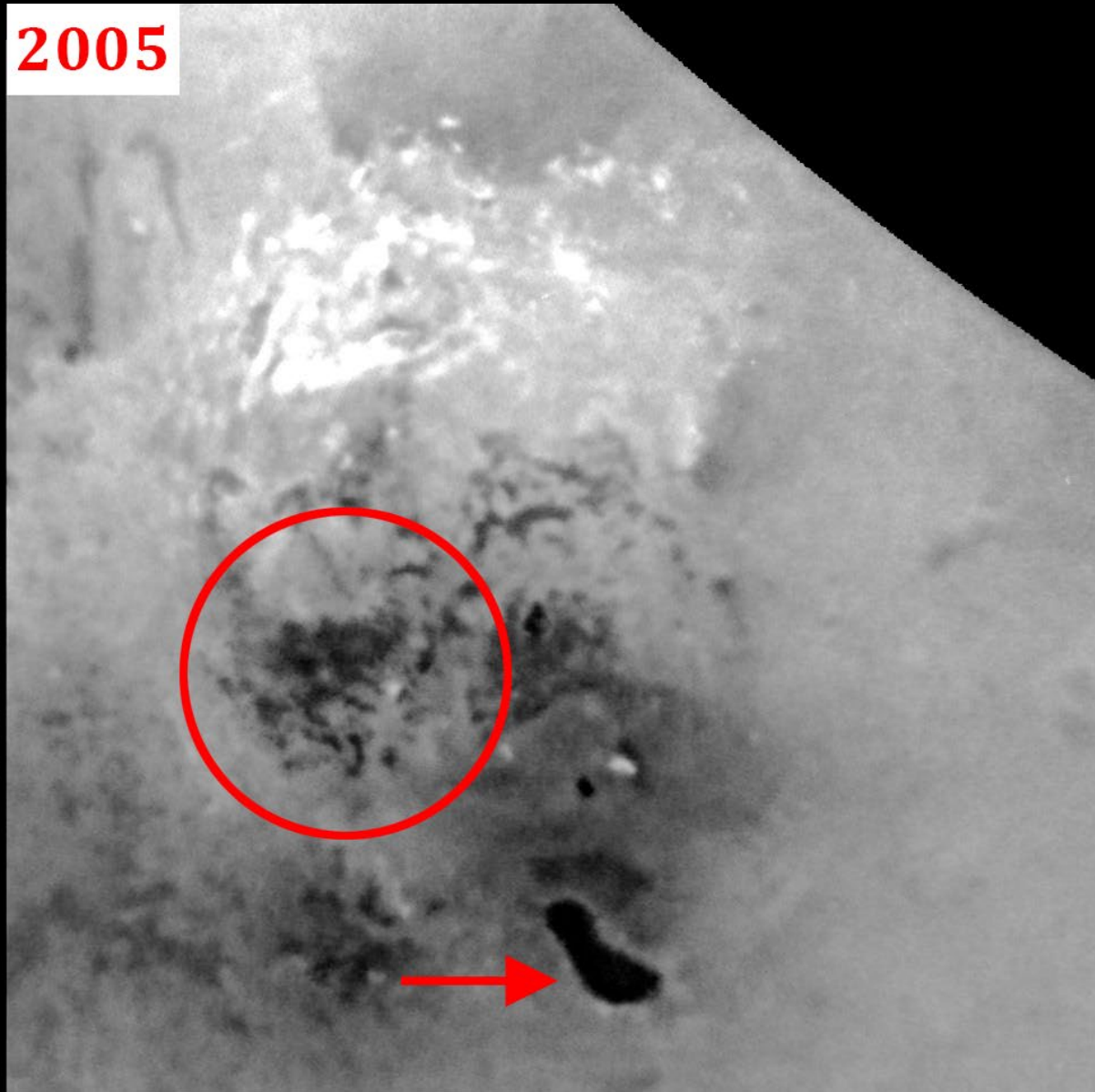
2005



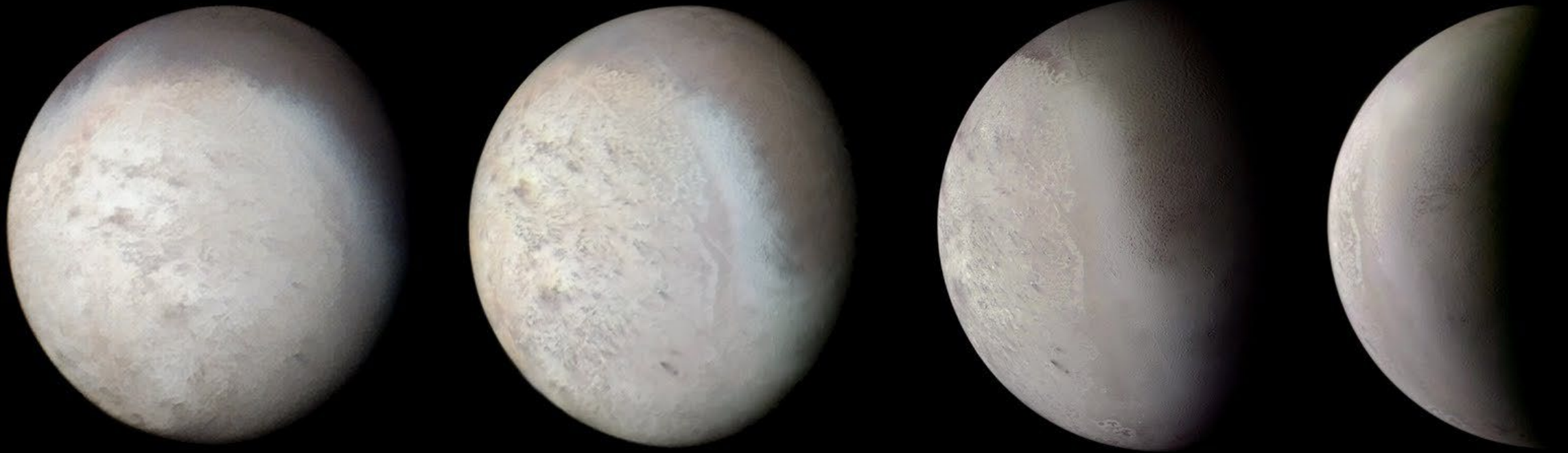
2004



2005



TRITON



EXOPLANET

