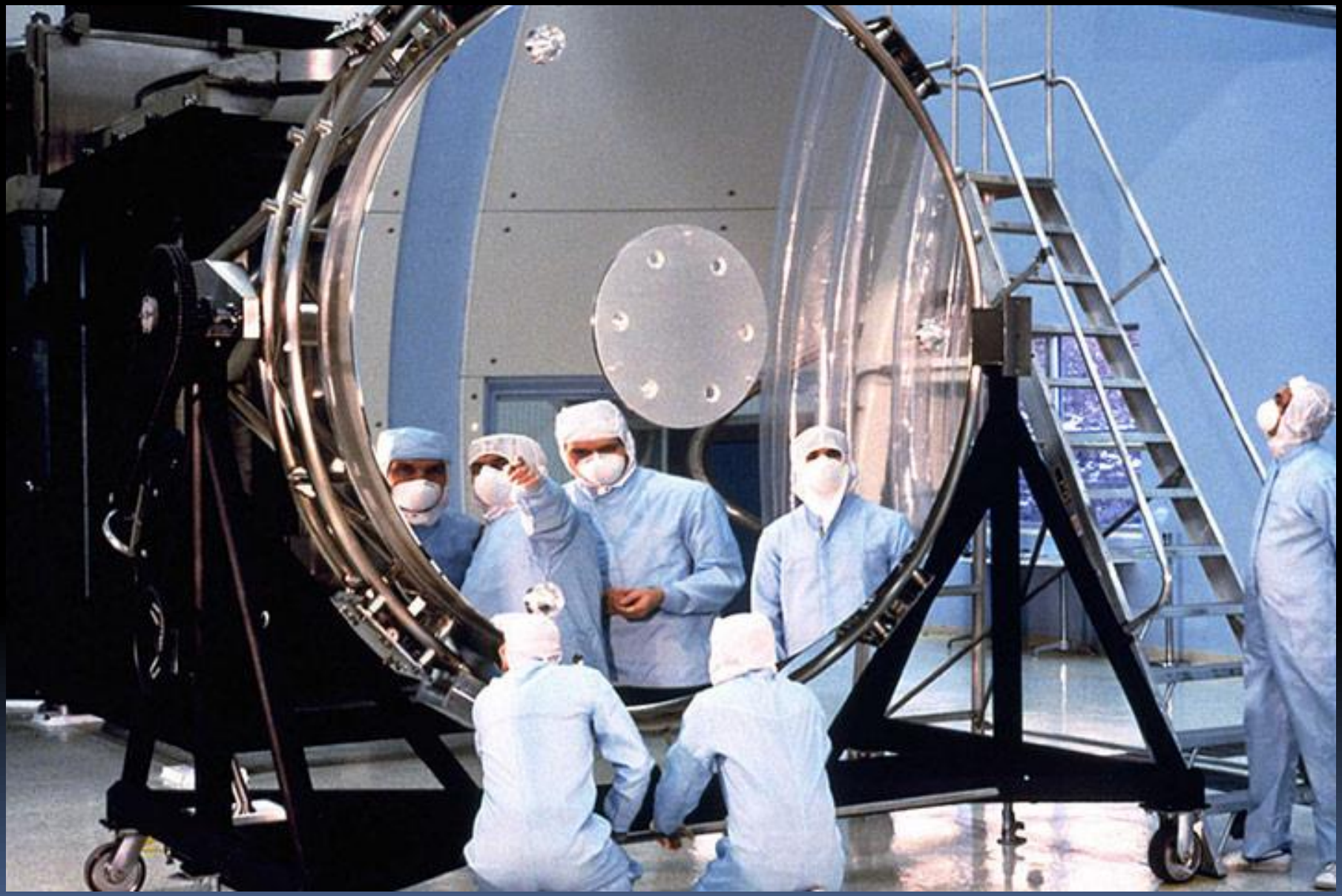
El Sistema Solar

Tabaré, Ayelén y Belén

Facultad de Ciencias

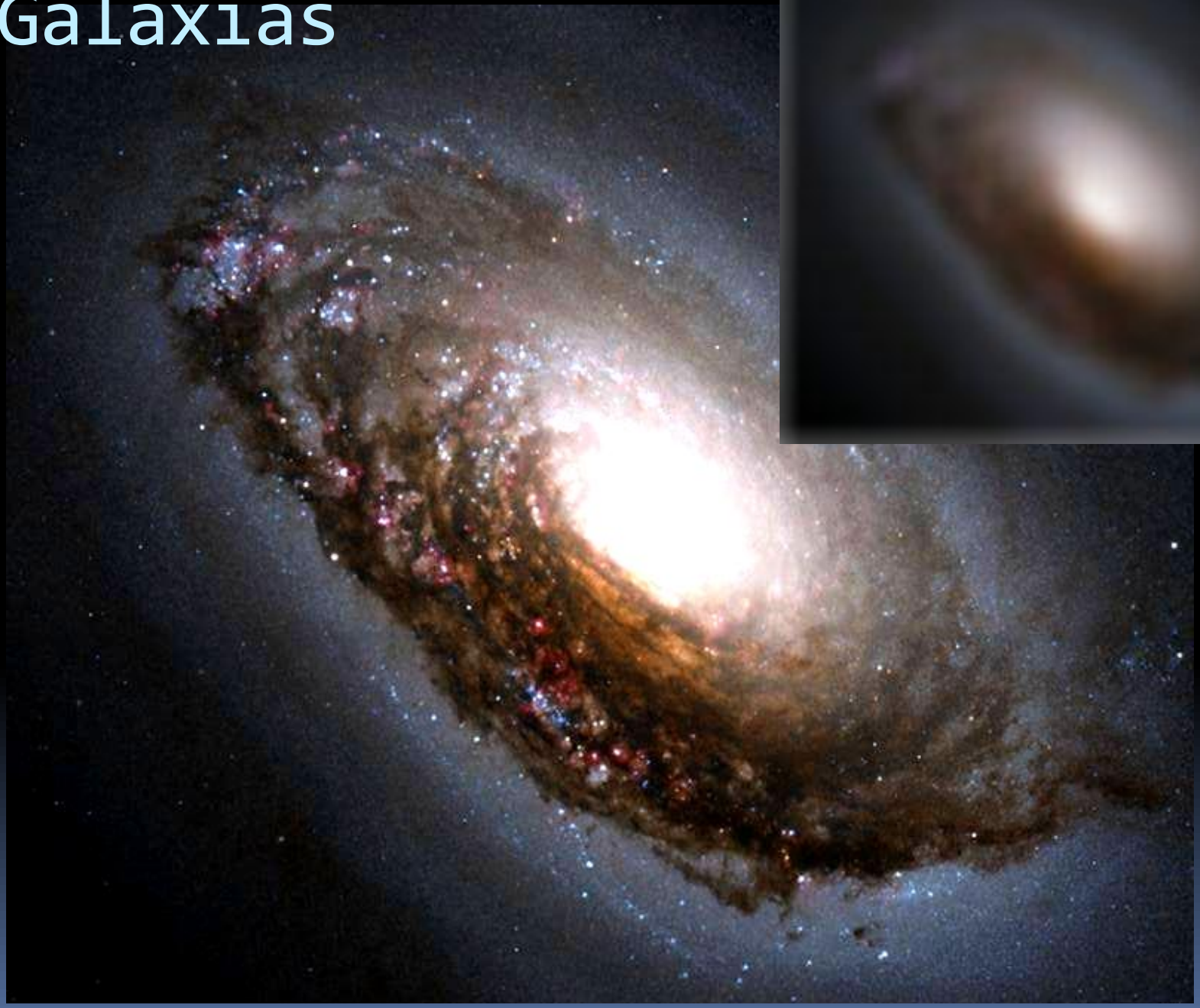
Observatorio

Telescopio espacial Hubble



Edwin Hubble

Galaxias

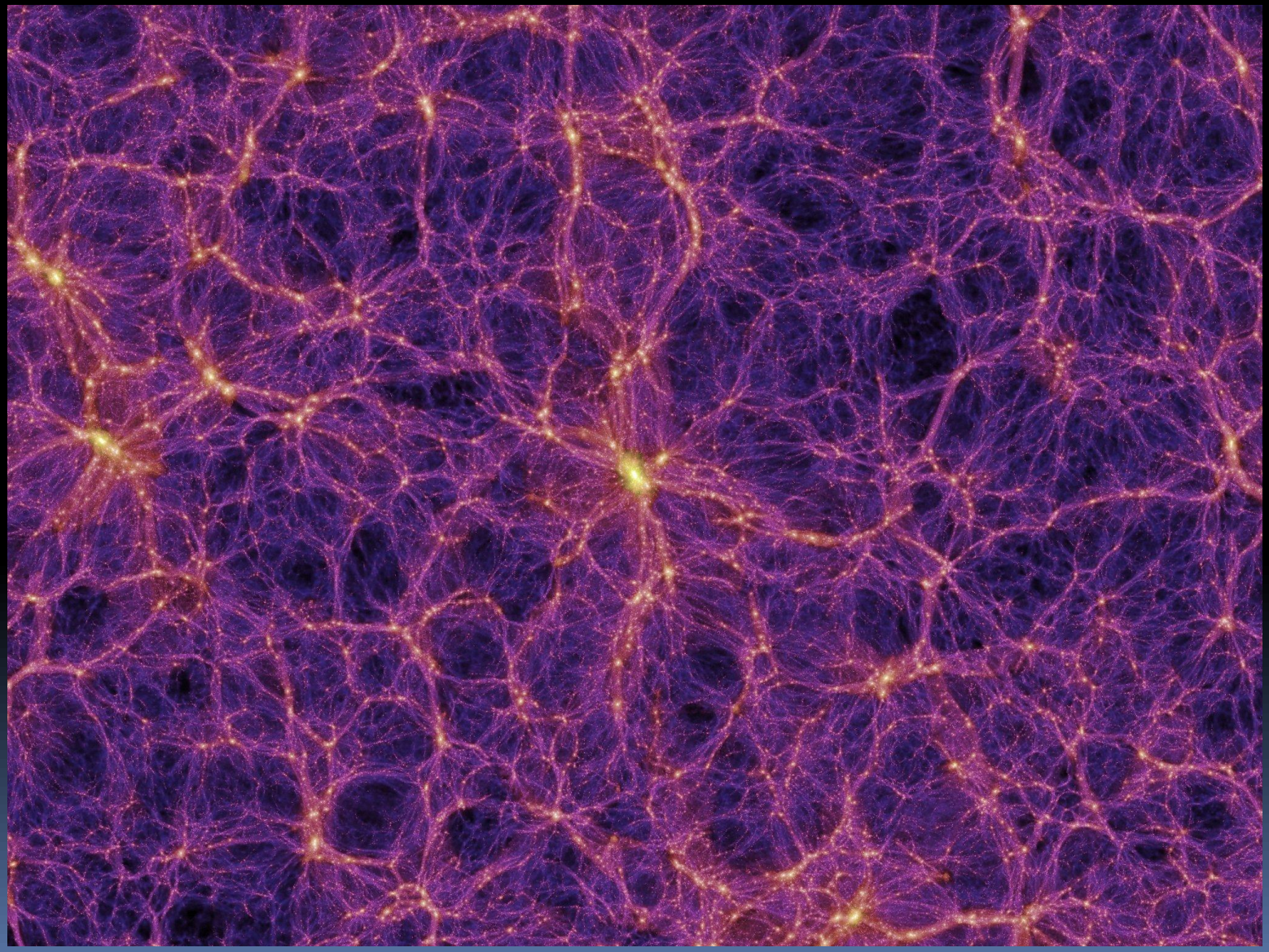


Diámetro: 100.000 años-luz.
Cientos de miles de millones de estrellas + gas y polvo.
TODAS se alejan de nosotros!

EXPANSIÓN del Universo

Estructura en gran escala

Cientos de miles de millones de galaxias.



Observando el pasado

La luz demora en viajar…

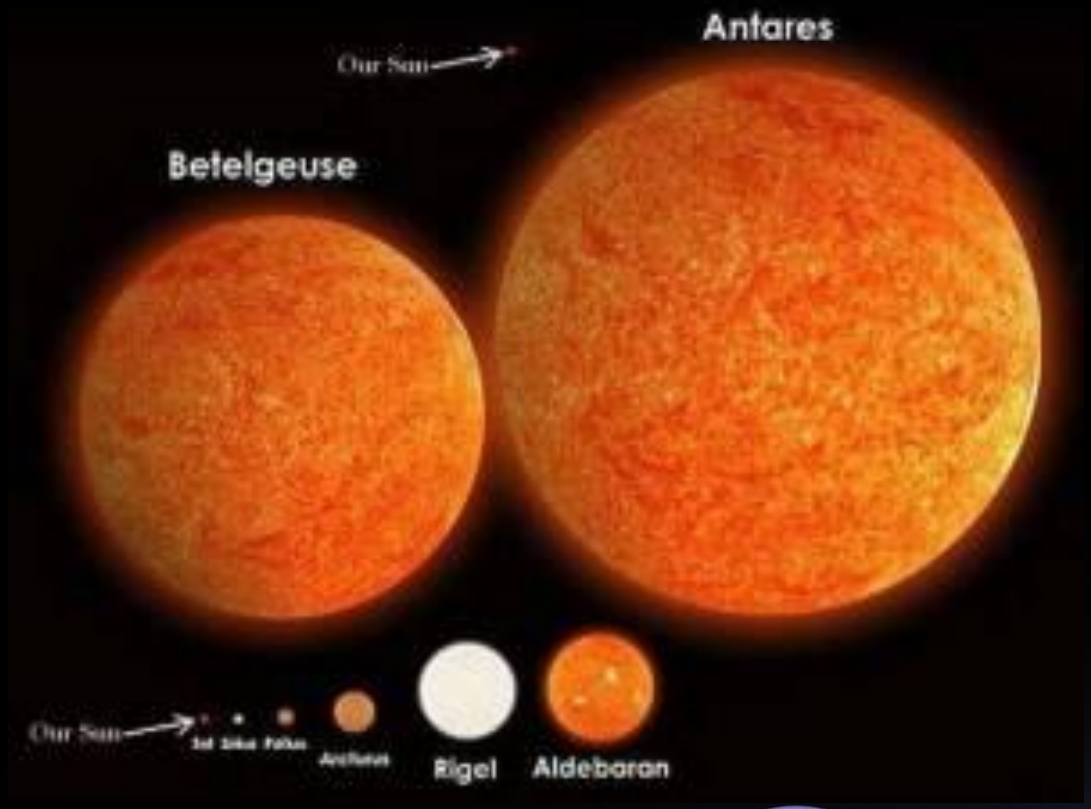
Antigüedad: 2 millones de años

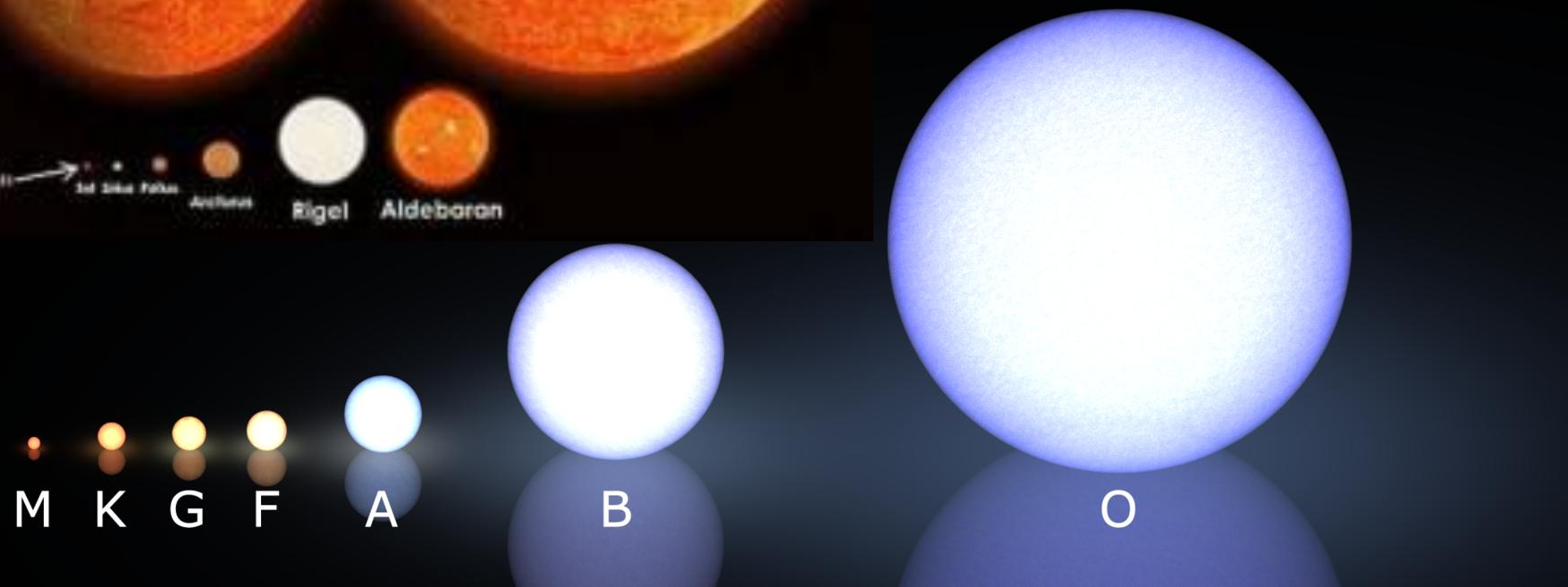
Miles de millones de años

Nuestra galaxia

300.000 millones de estrellas

Tamaños estelares

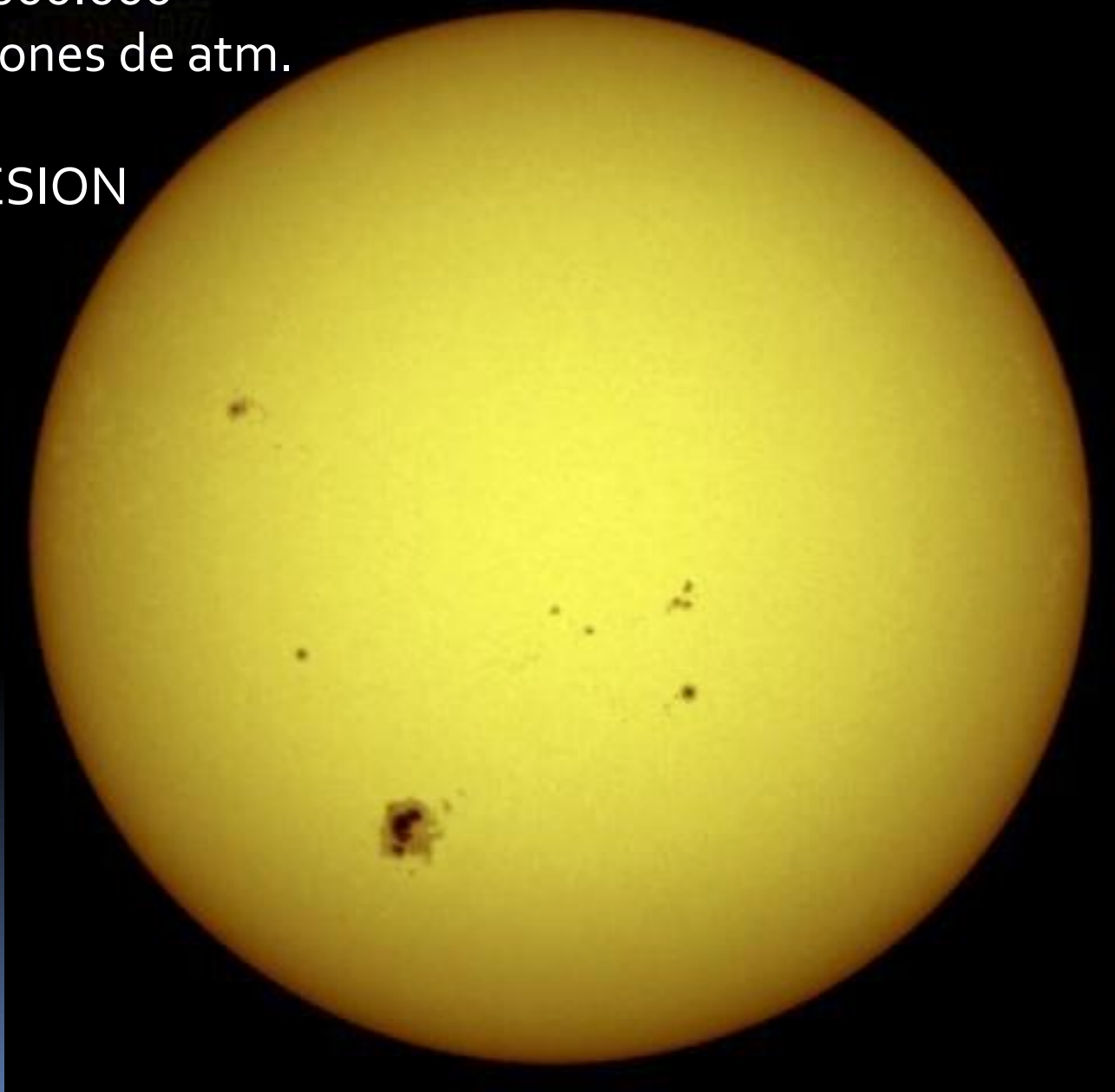




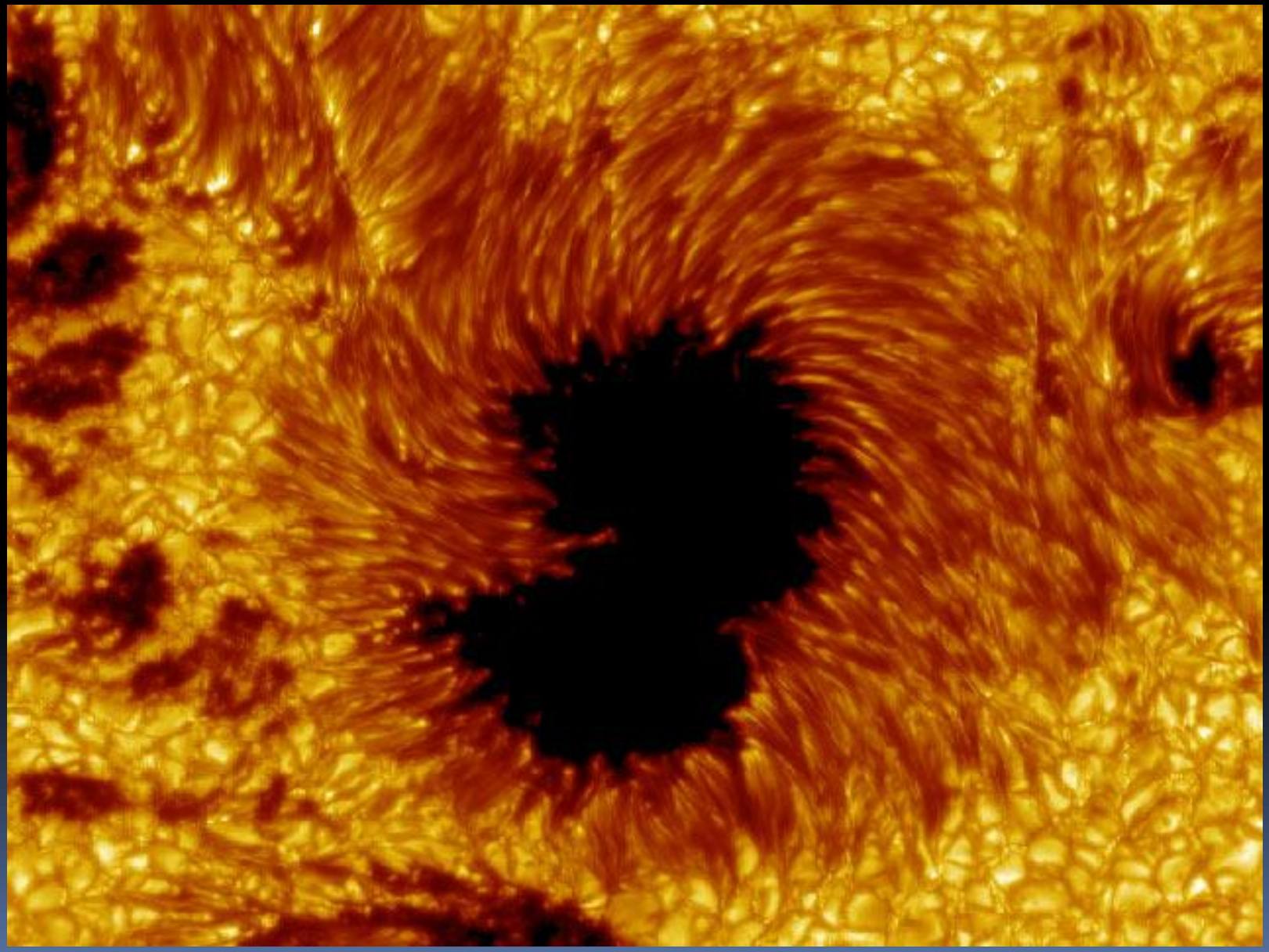
Temperatura sup = 5500 C
Temperatura int = 14.000.000
Presión = 250.000 millones de atm.

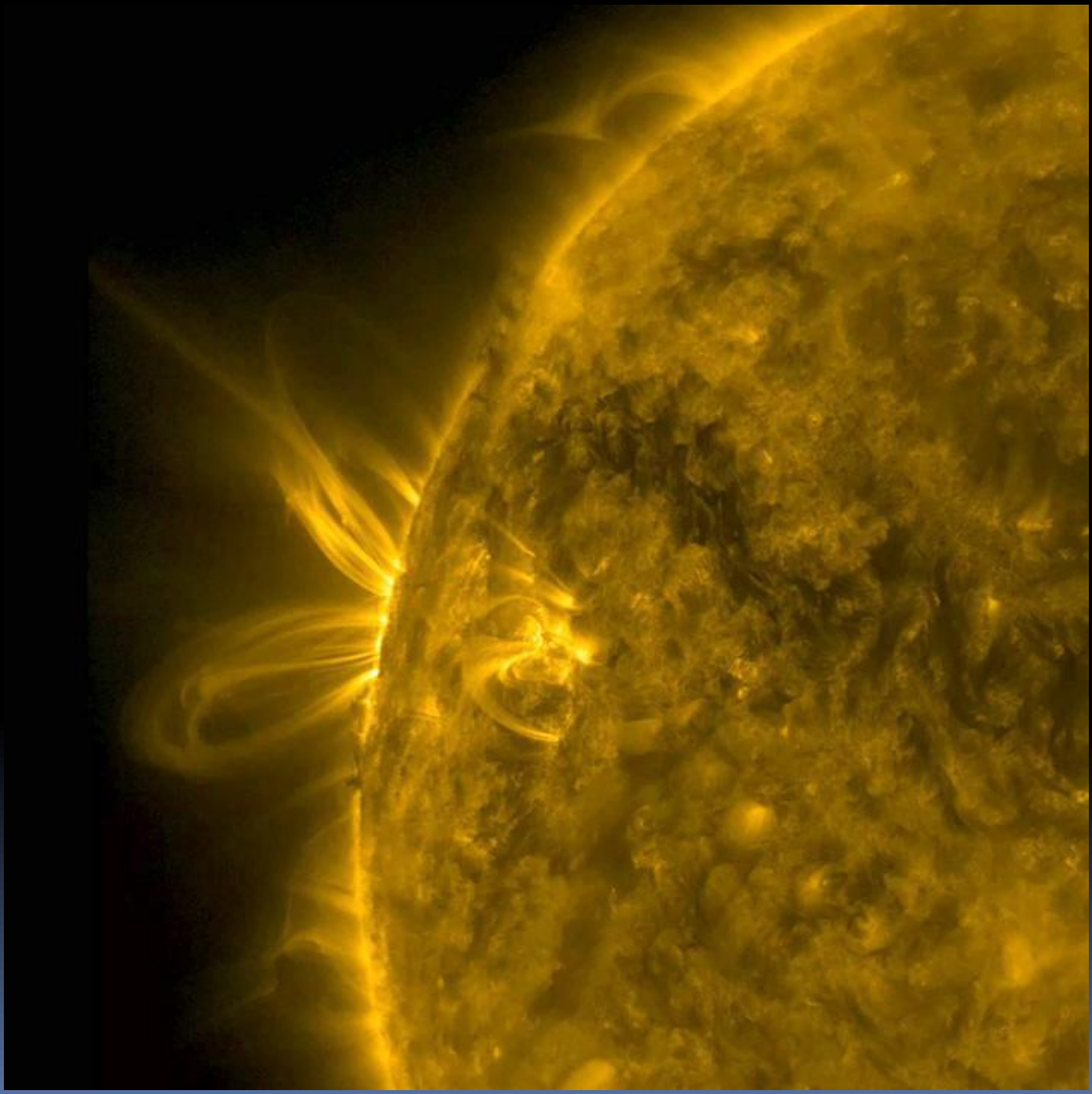
Equilibrio PESO – PRESION

Sol

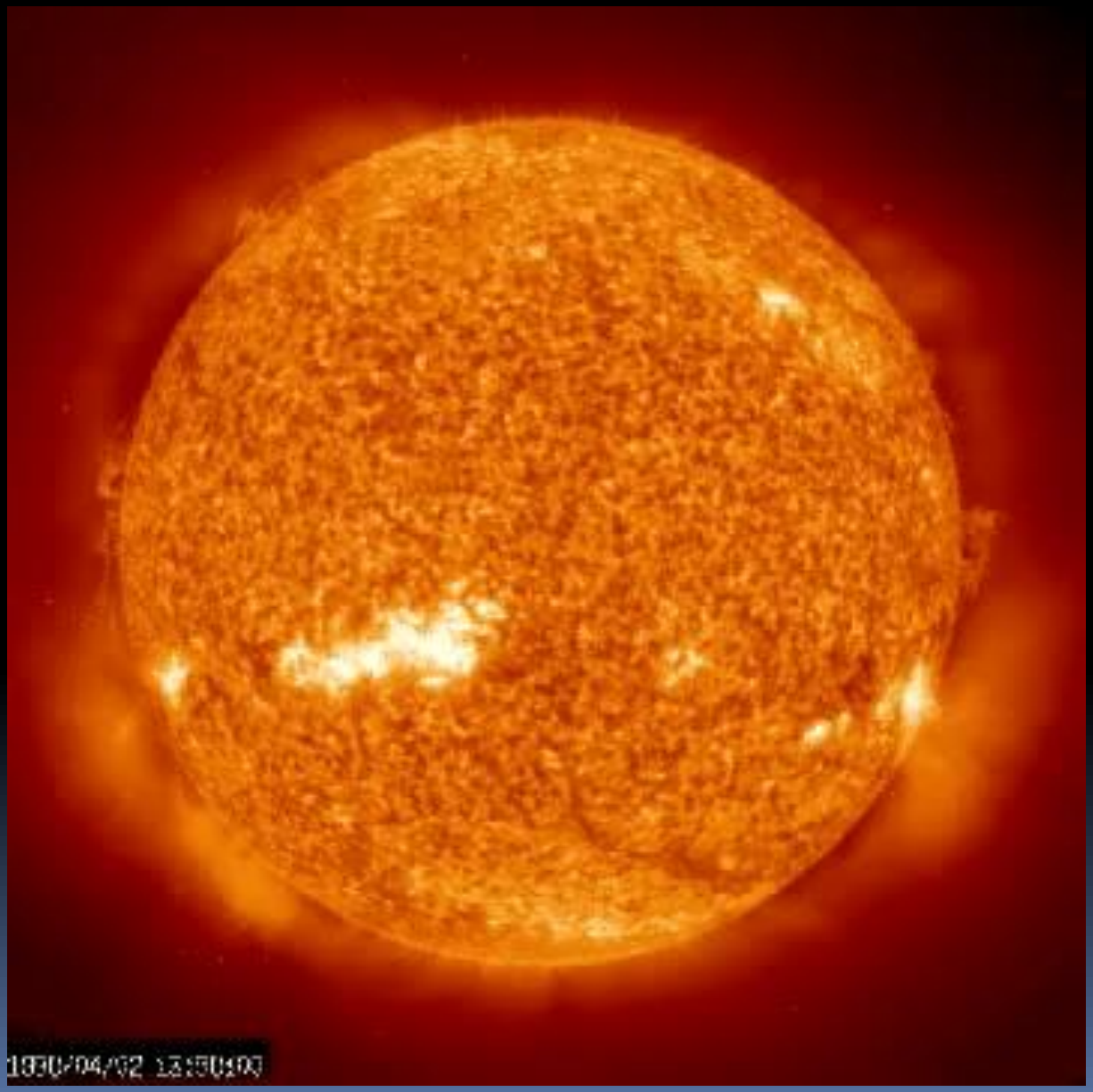


MANCHAS SOLARES: Campos magnéticos intensos

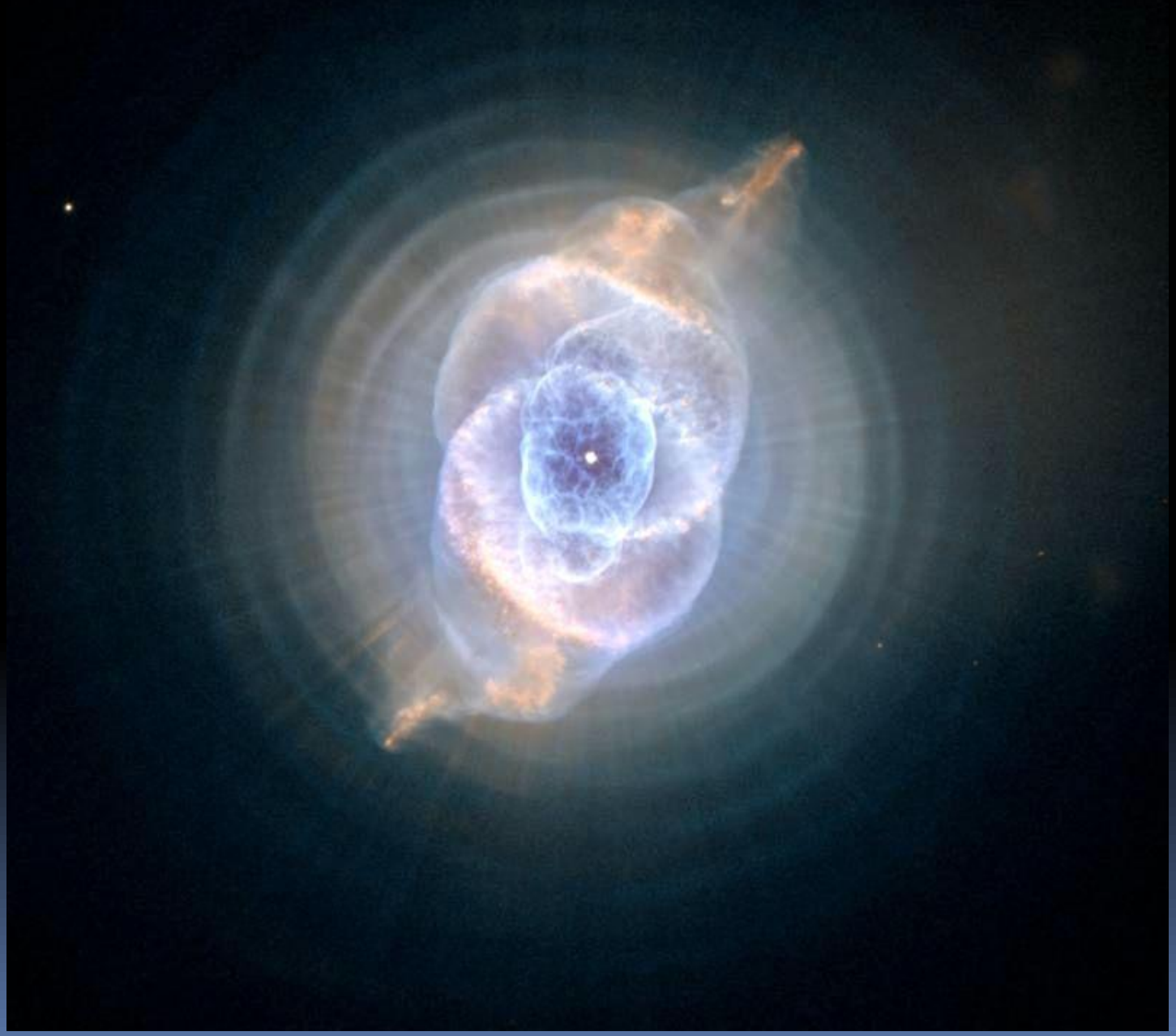




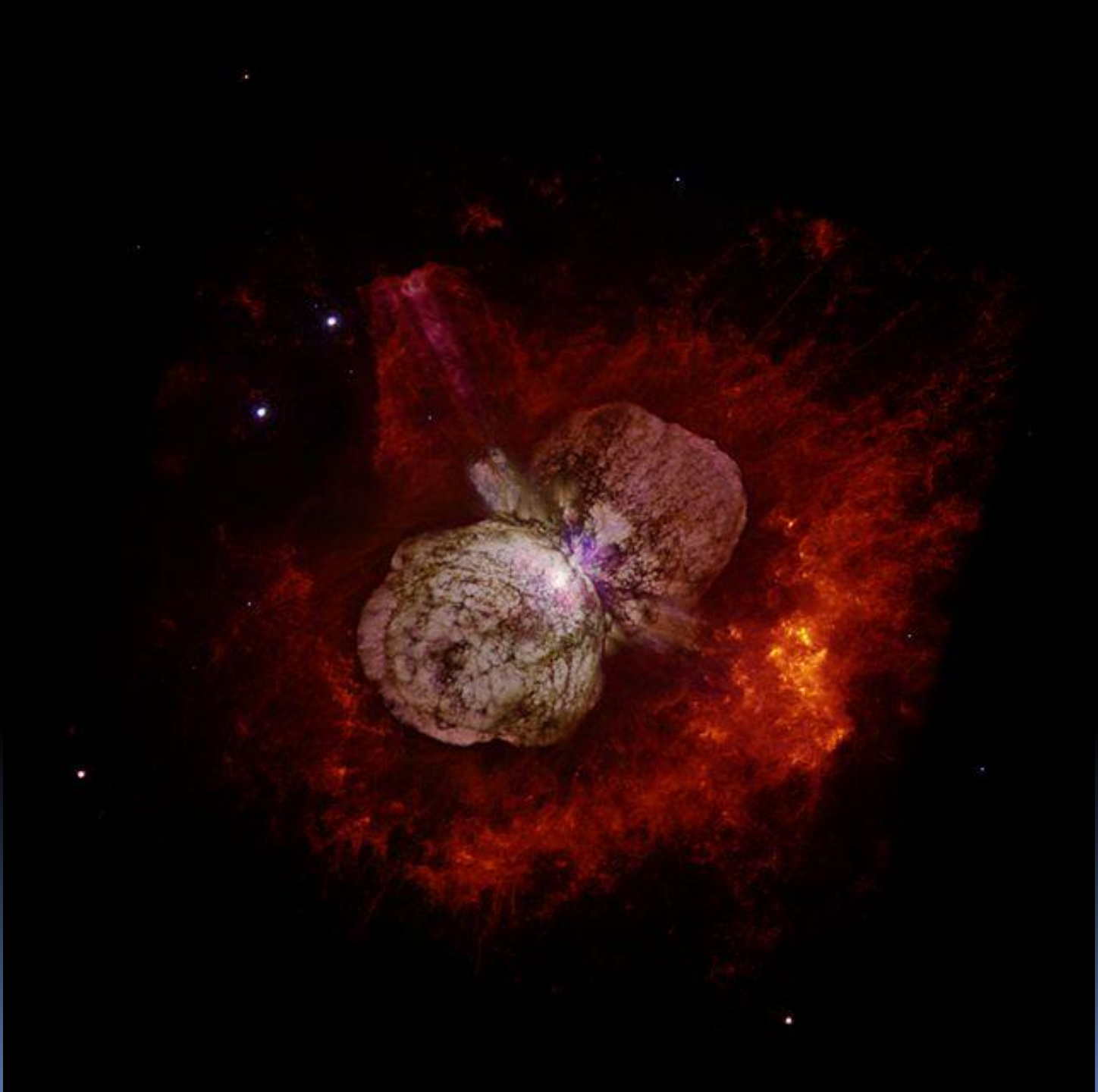
Sol: reactor de fusión



Muerte estelar



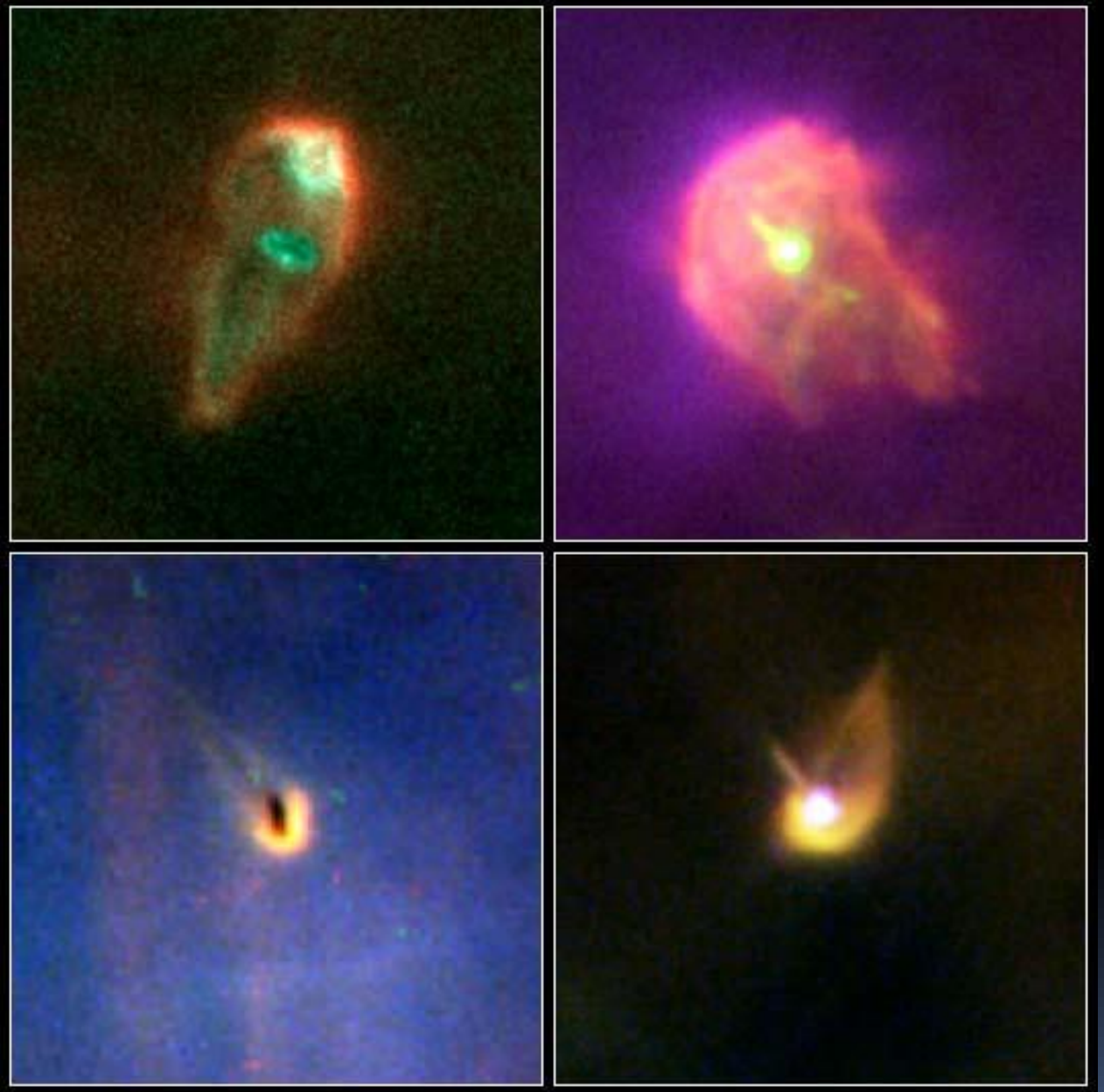
www.hubblesite.org



Medio interestelar enriquecido con “polvo” de estrellas.

Principales elementos en el polvo: CHON

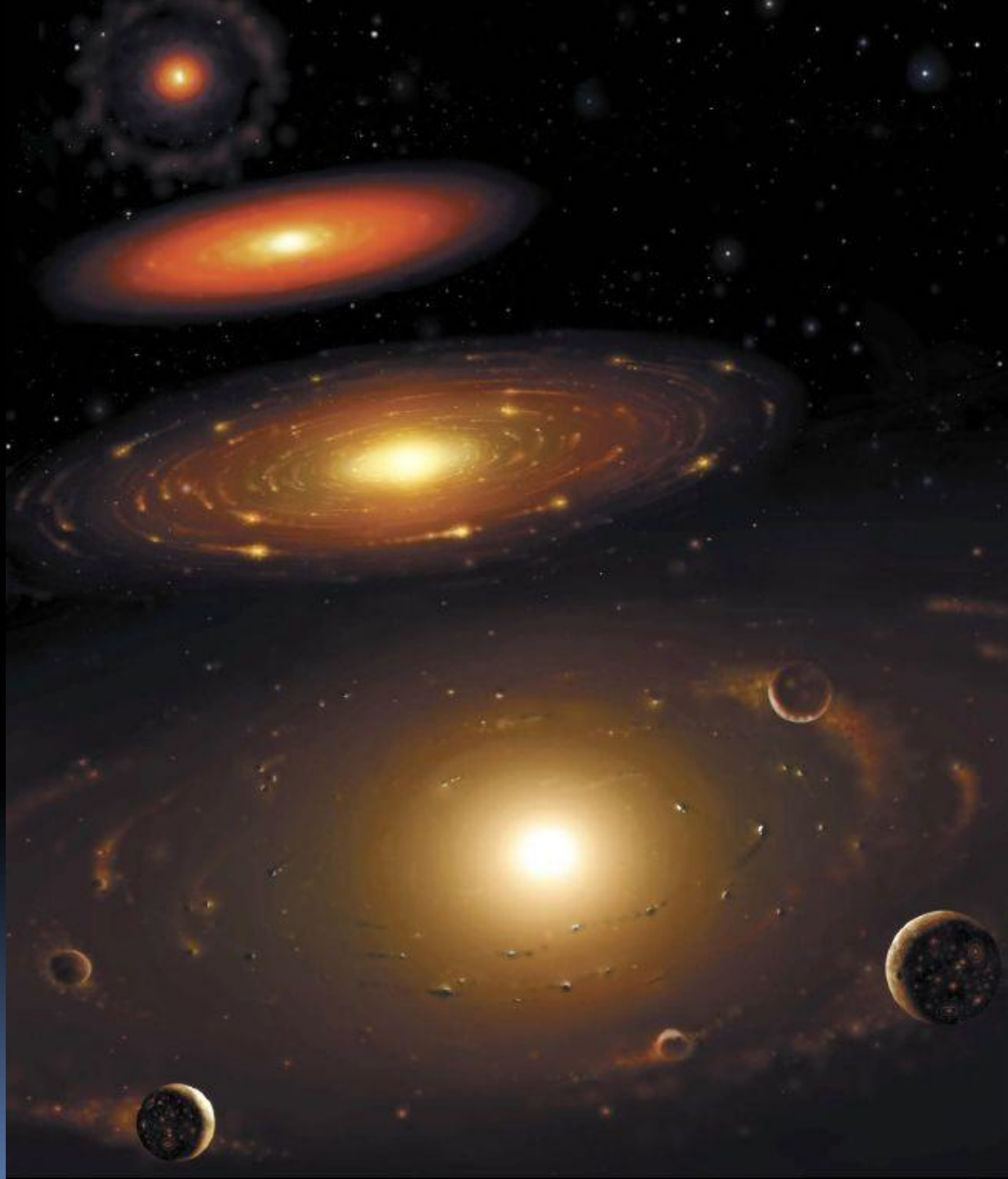
Formación estelar



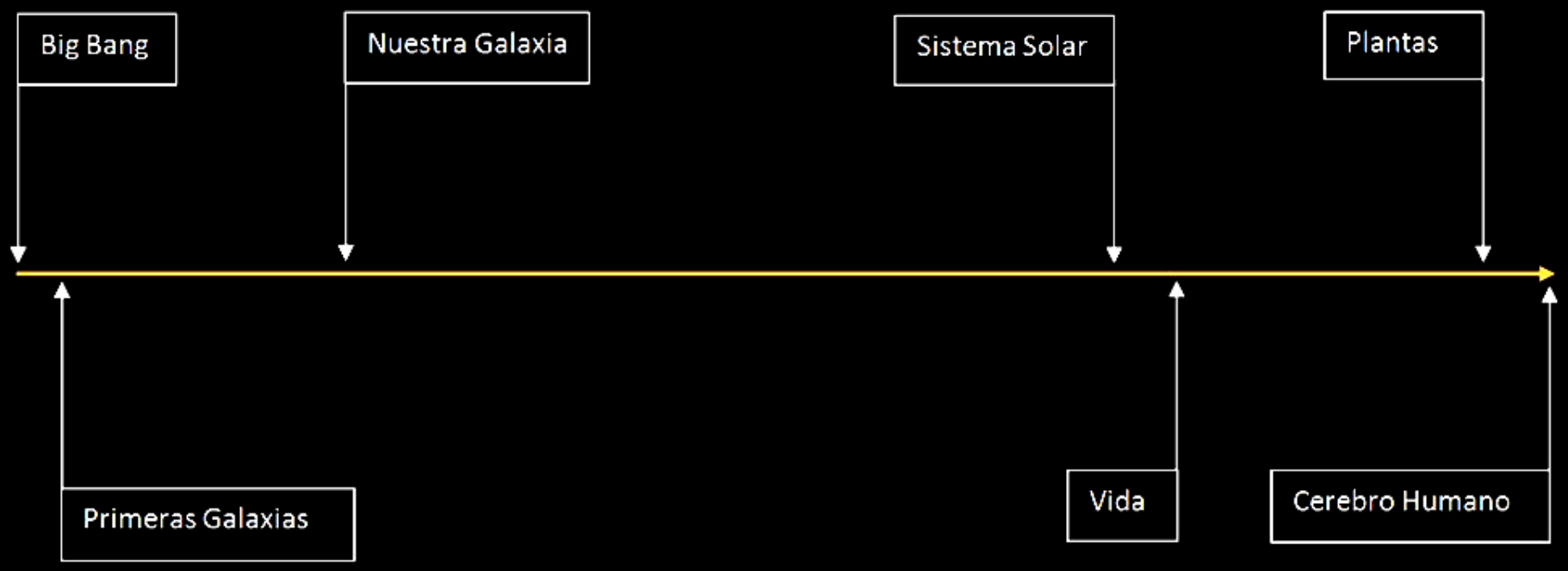
Protoplanetary Disks in the Orion Nebula **HST** • WFPC2

NASA, J. Bally (University of Colorado), H. Throop (SWRI), and C.R. O'Dell (Vanderbilt University) • STScI-PRC01-13

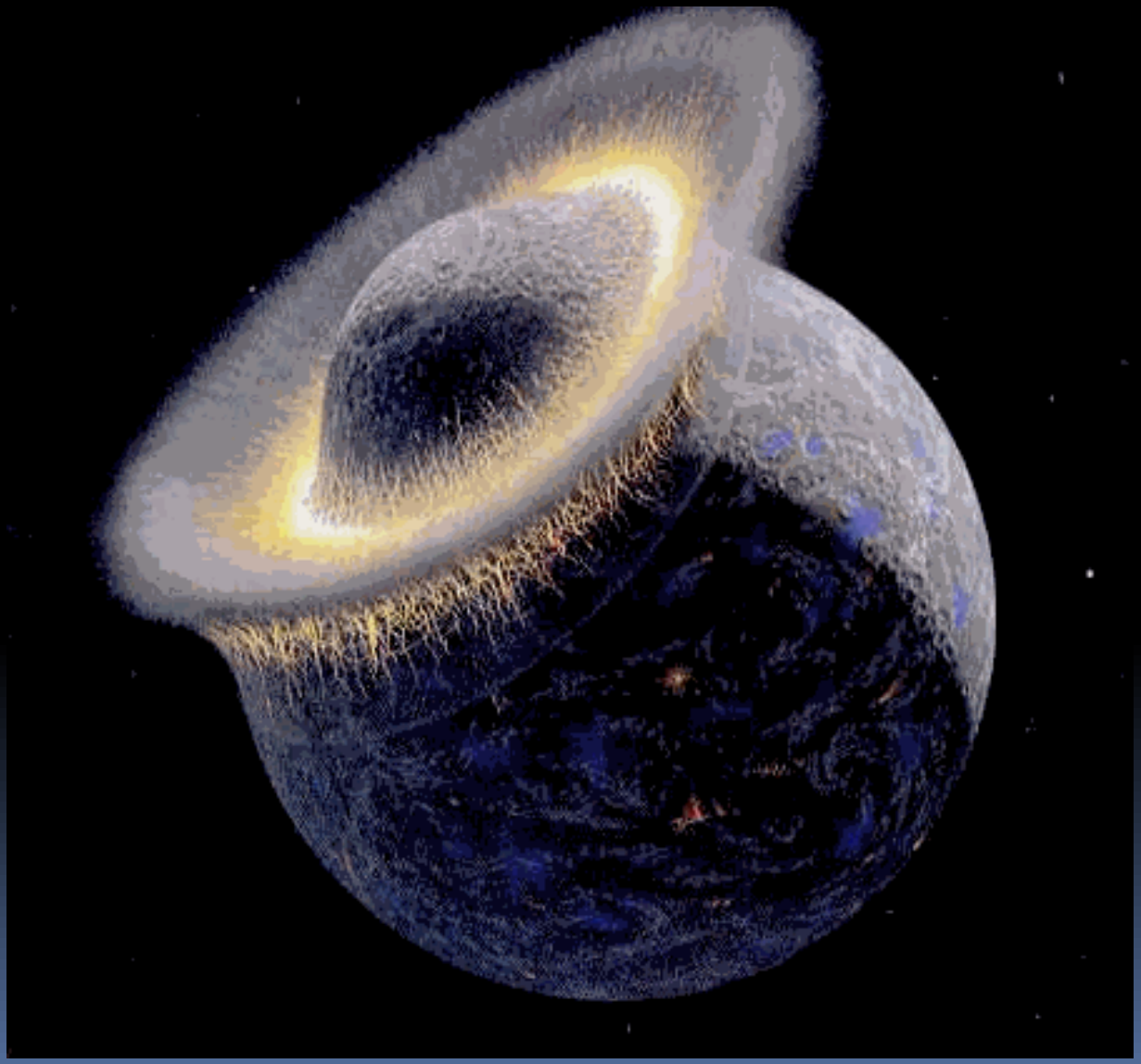
Formación del Sistema Solar



Cronología

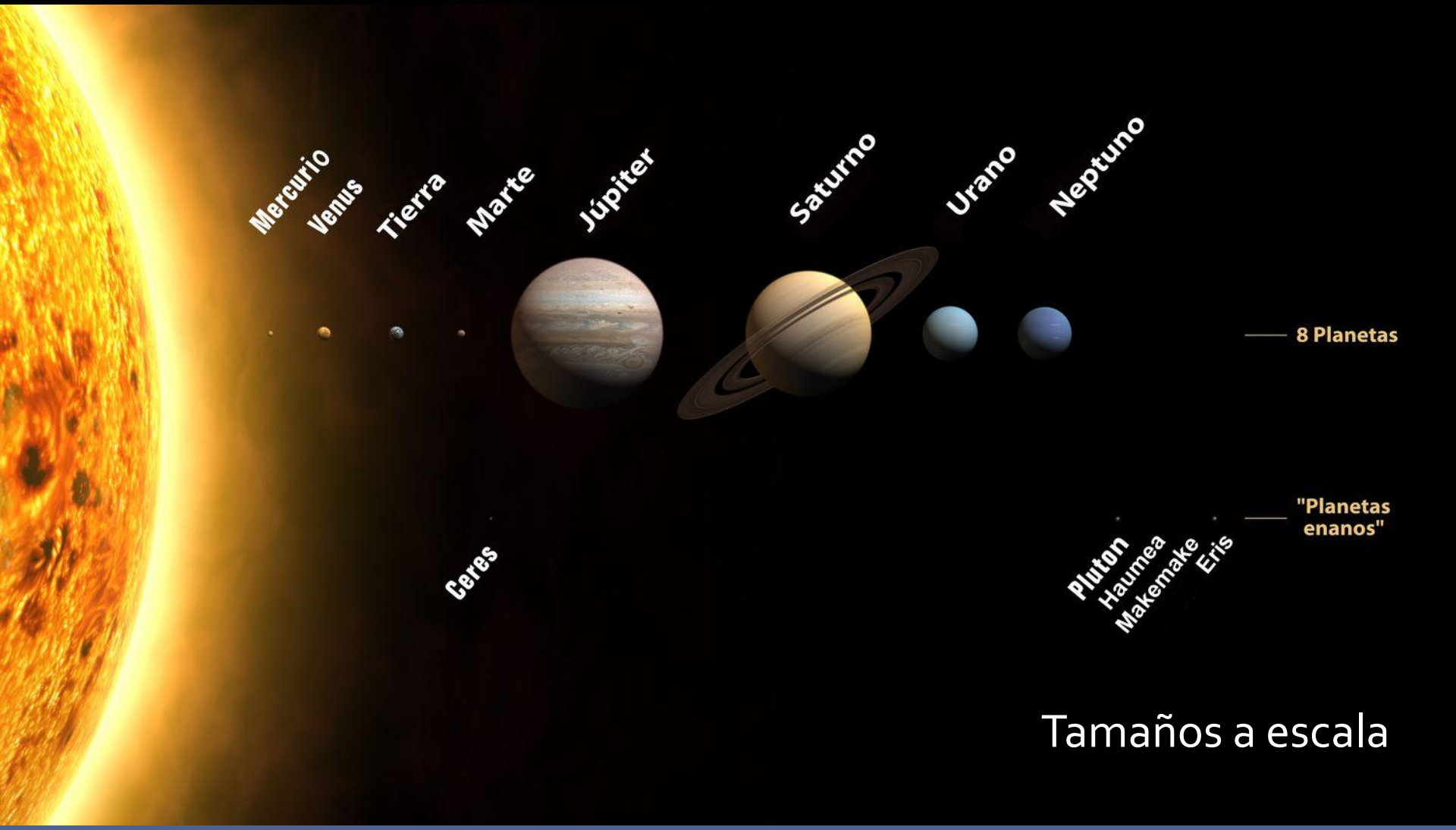

Big Bang
Nuestra Galaxia
Sistema Solar
Plantas
Primeras Galaxias
Vida
Cerebro Humano

Formación de la Luna



Sistema Solar

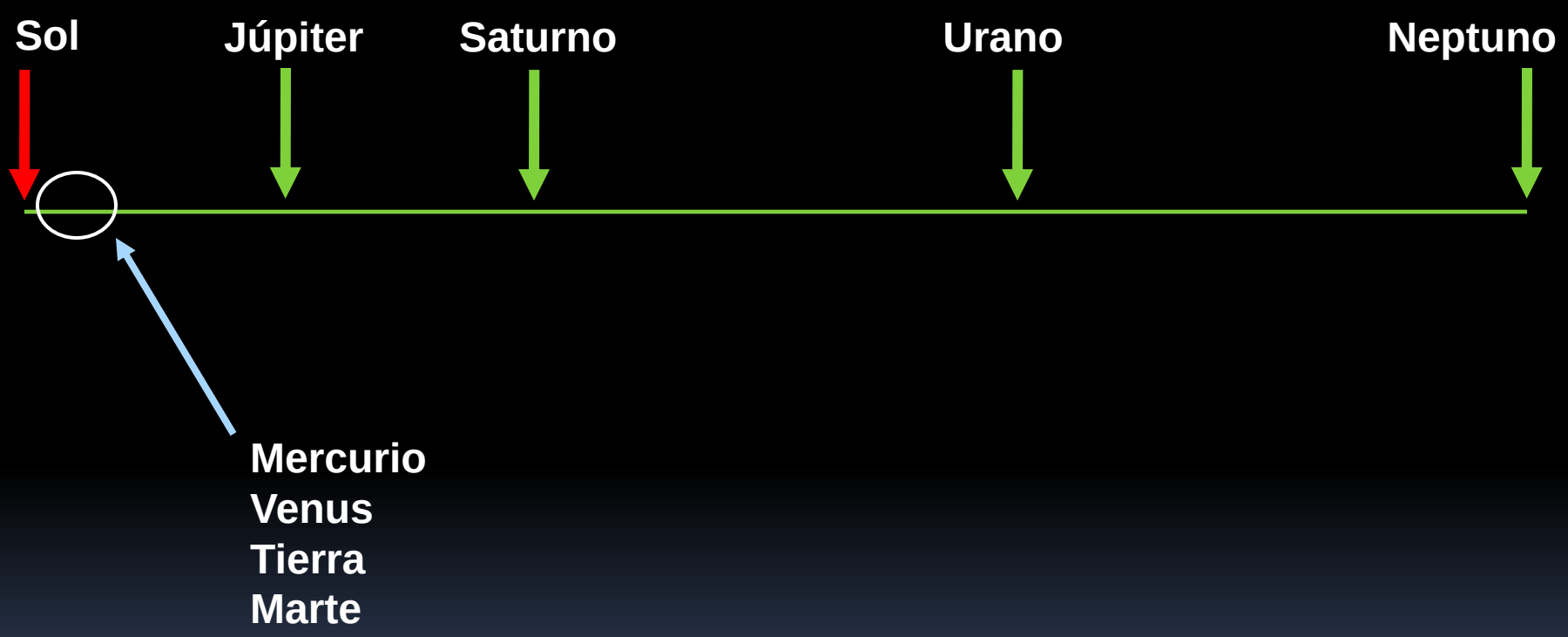
Mundos rocosos, gaseosos y helados



Tamaños a escala

Sistema Solar

Distancias a escala



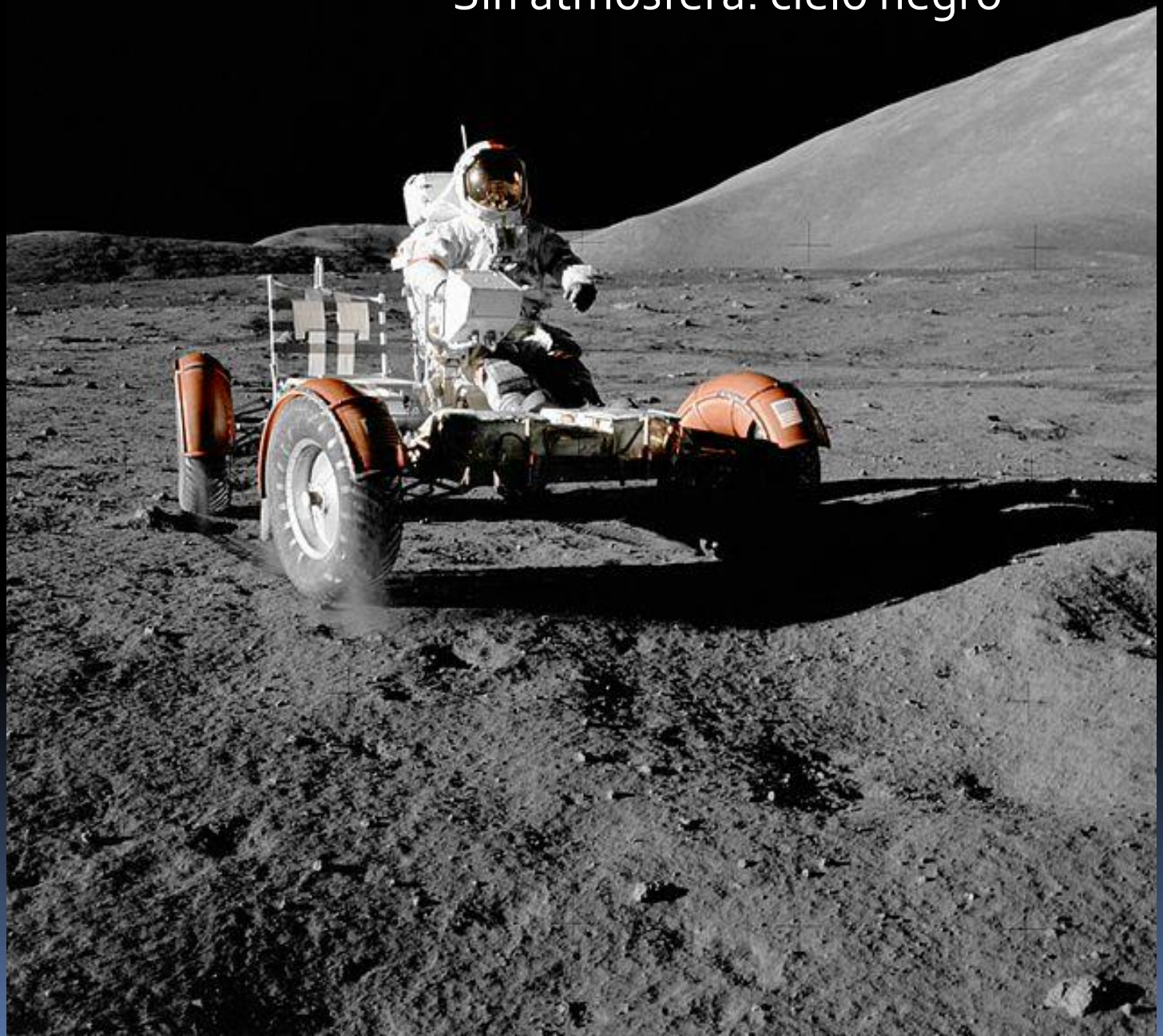
Mercurio

Día = 2 años mercurianos !

-170 C < Temperatura < 400 C

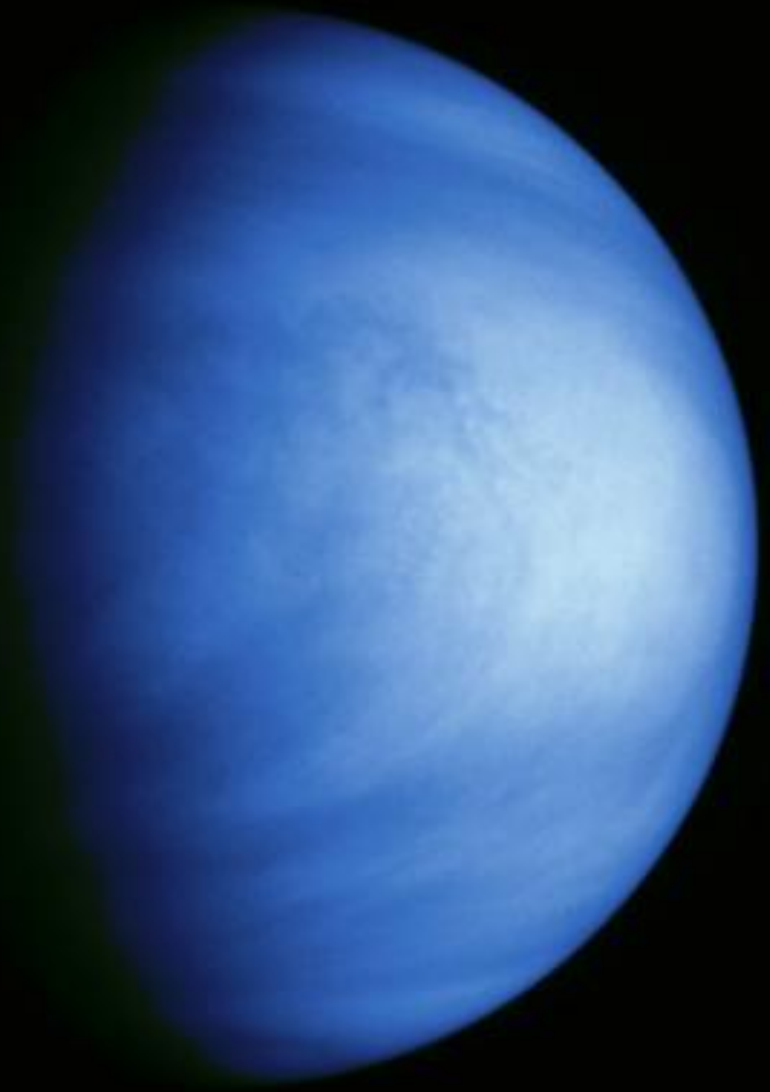
Luna

Sin atmósfera: cielo negro



Venus

Temperatura media = 500 C
Presión = 90 atm.
CO_2
No hay agua

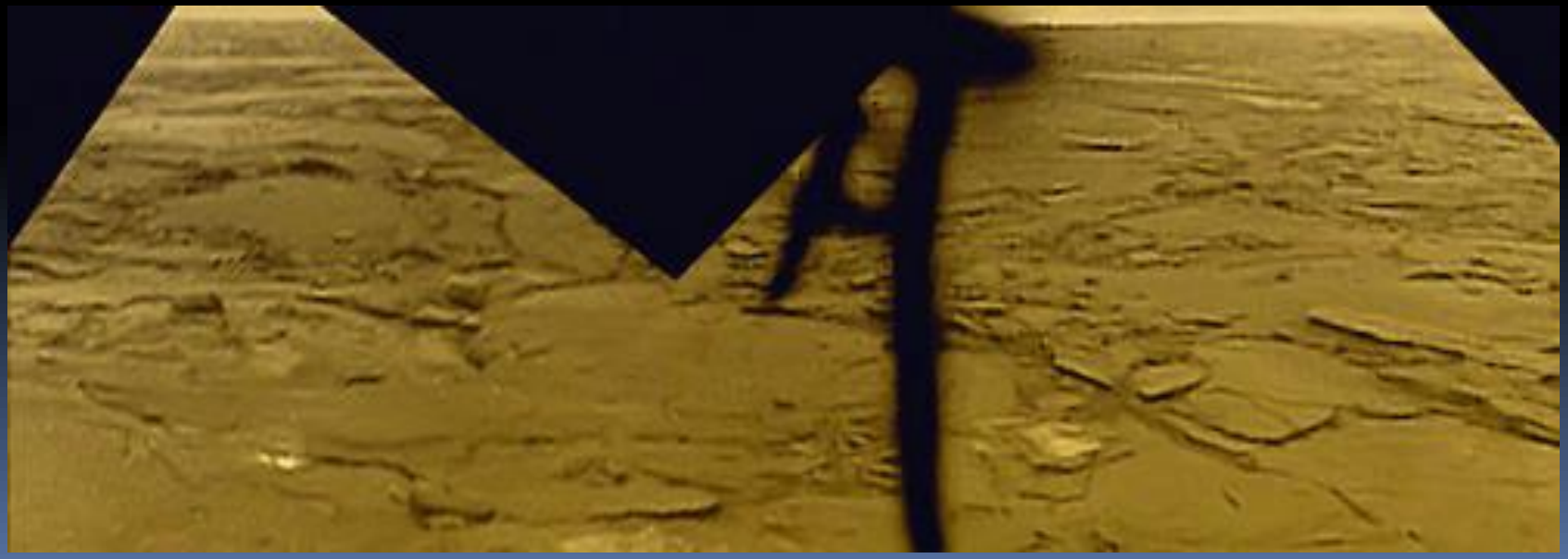


Venus

"panqueques"

Venus

Roca sólida y seca (basaltos)



Agua sólida, líquida y gaseosa.
Única atmósfera rica en Oxígeno: energía y protección UV.

Luna

LROC WAC
No Slew Mosaic
Acquired December 2010
Version 1b
Arizona State University

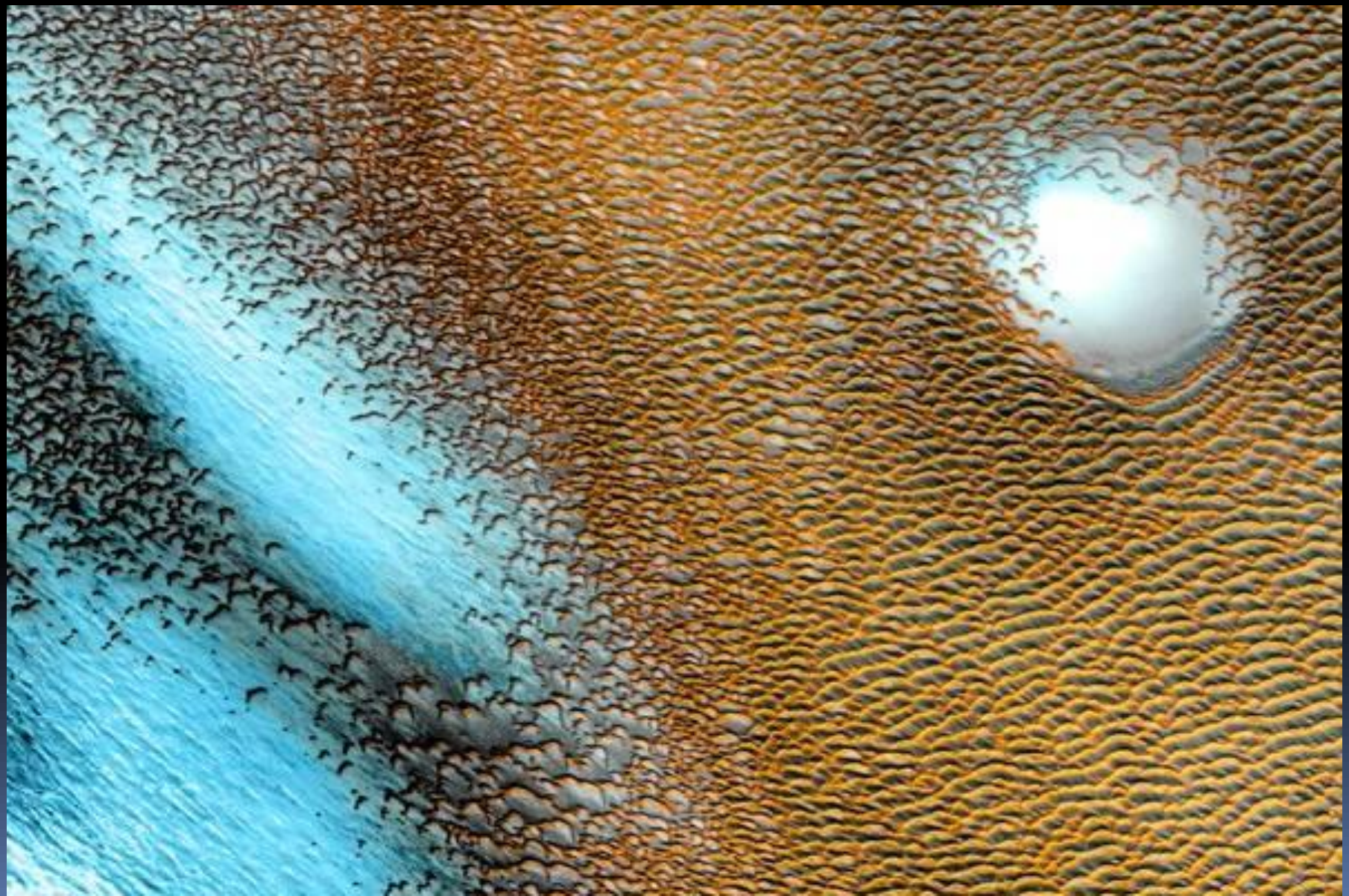
Marte

Marte

Volcanes fosilizados
Erosión por fluidos
Agua en el pasado

Marte

Dunas



Marte

Dunas: actividad eólica

Marte

Tornados

Marte

Dunas cubiertas de CO_2

Marte

Sin agua superficial.

Hielo subsuperficial (permafrost)

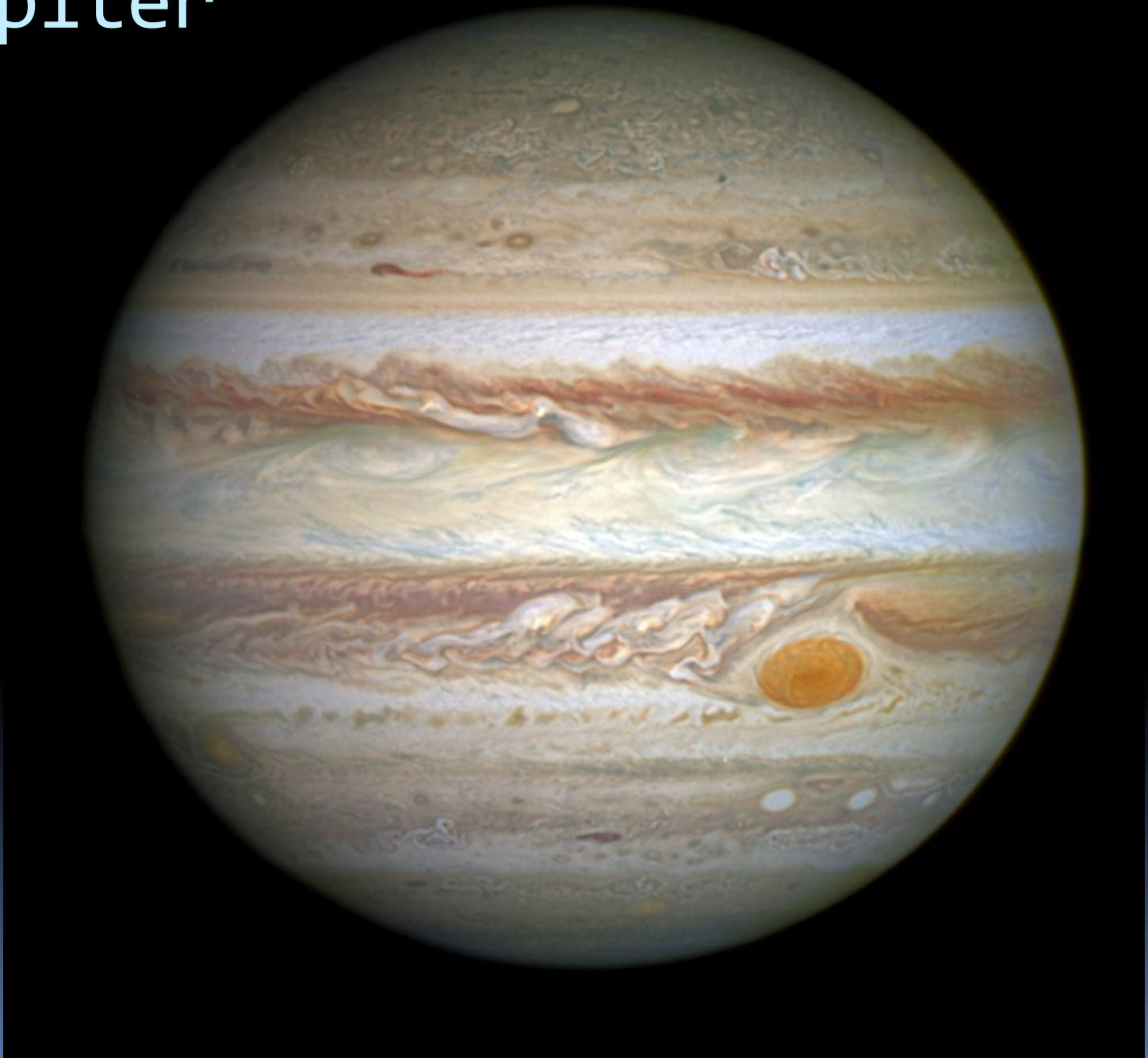
Asteroide Eros

Itokawa

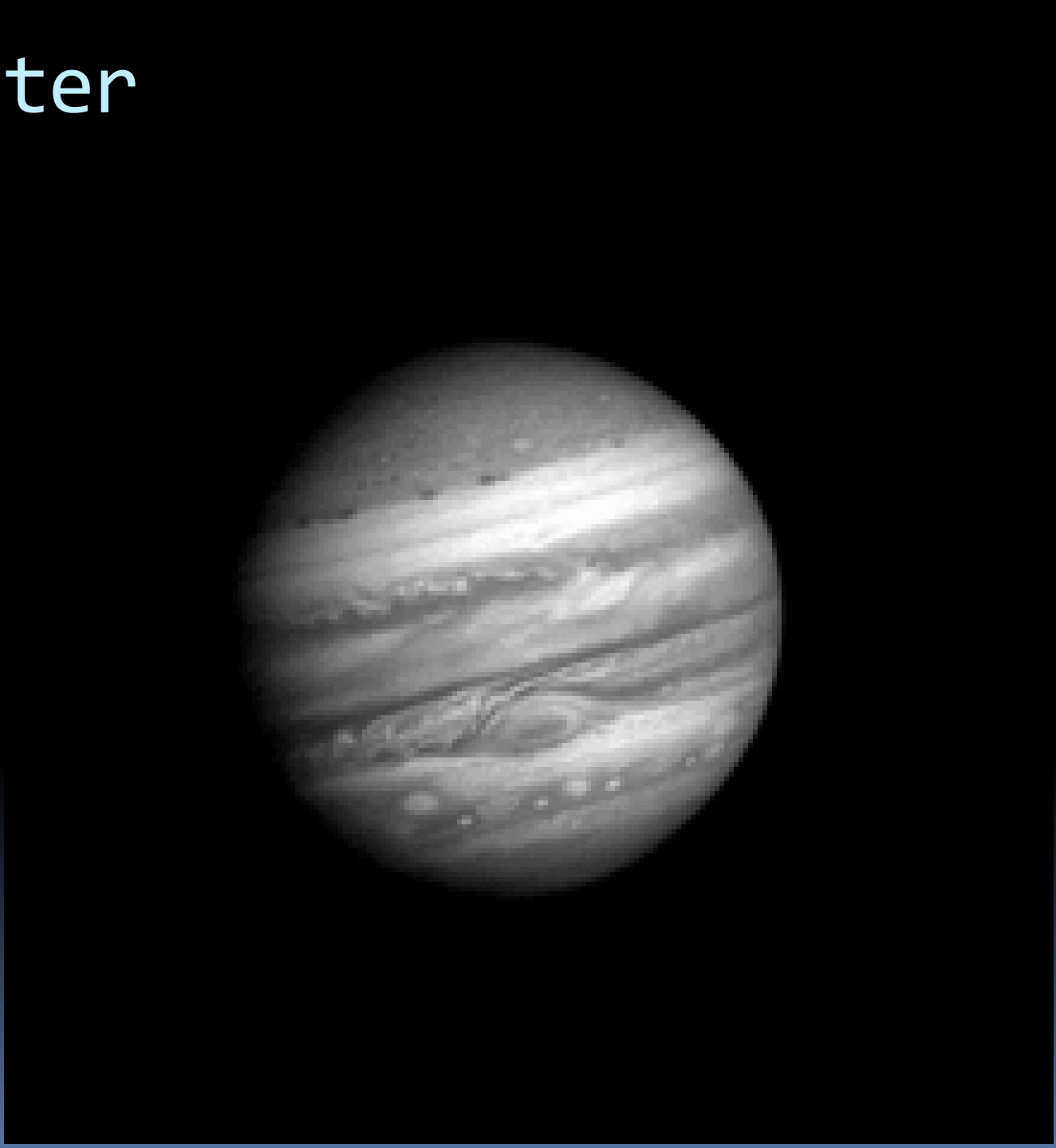
"Pila de escombros"

Ceres(planeta enano)

Júpiter



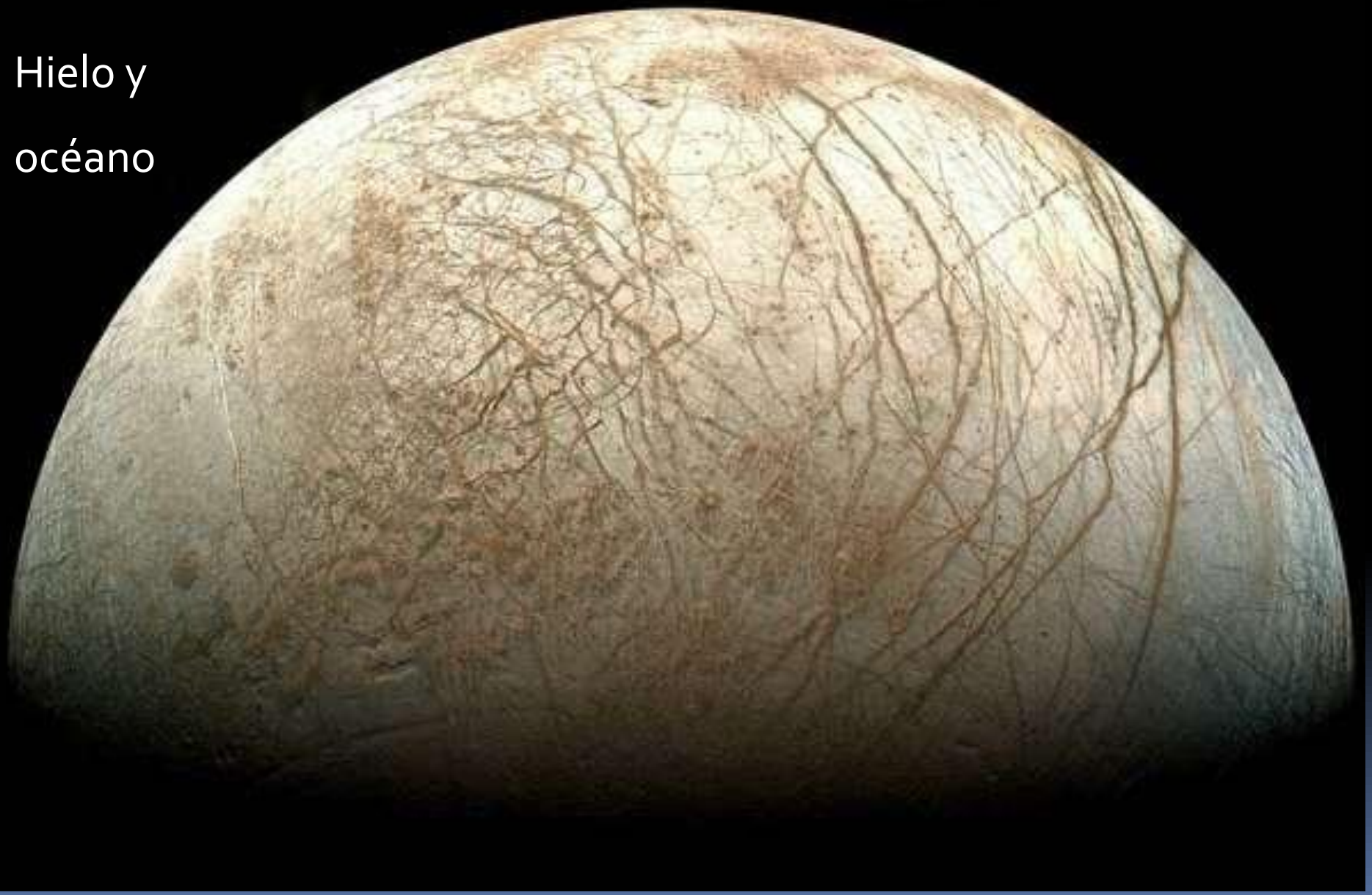
Júpiter



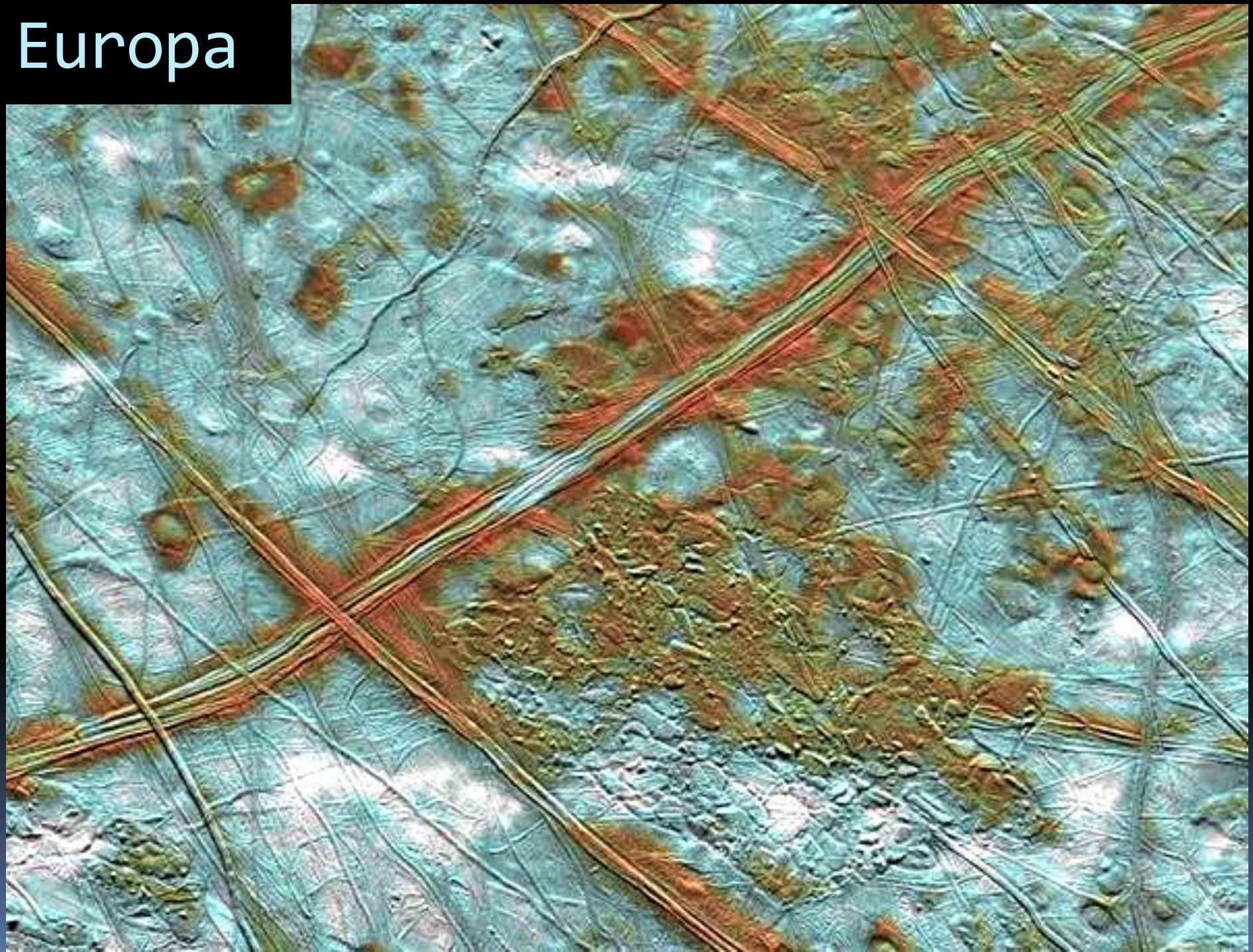
Europa (satélite)

Hielo y

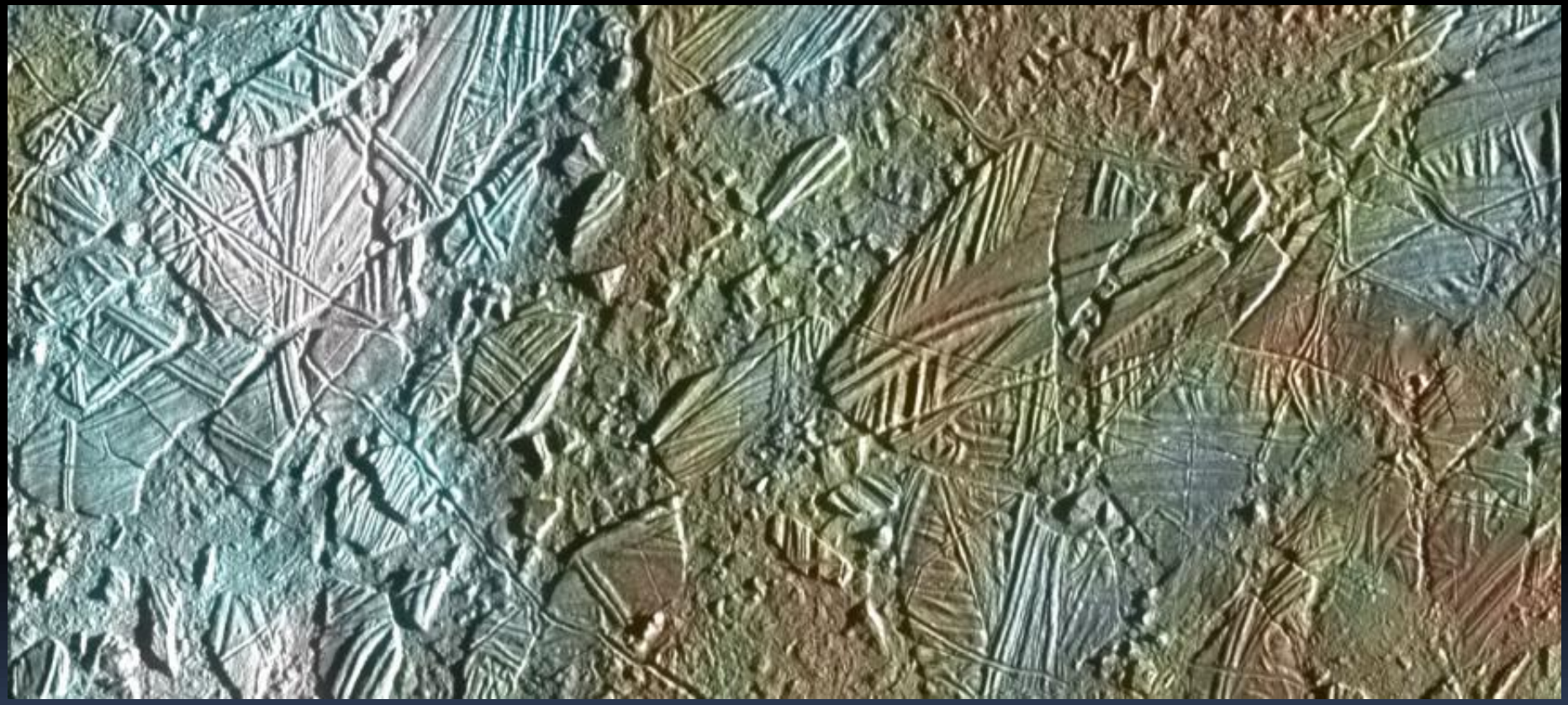
océano

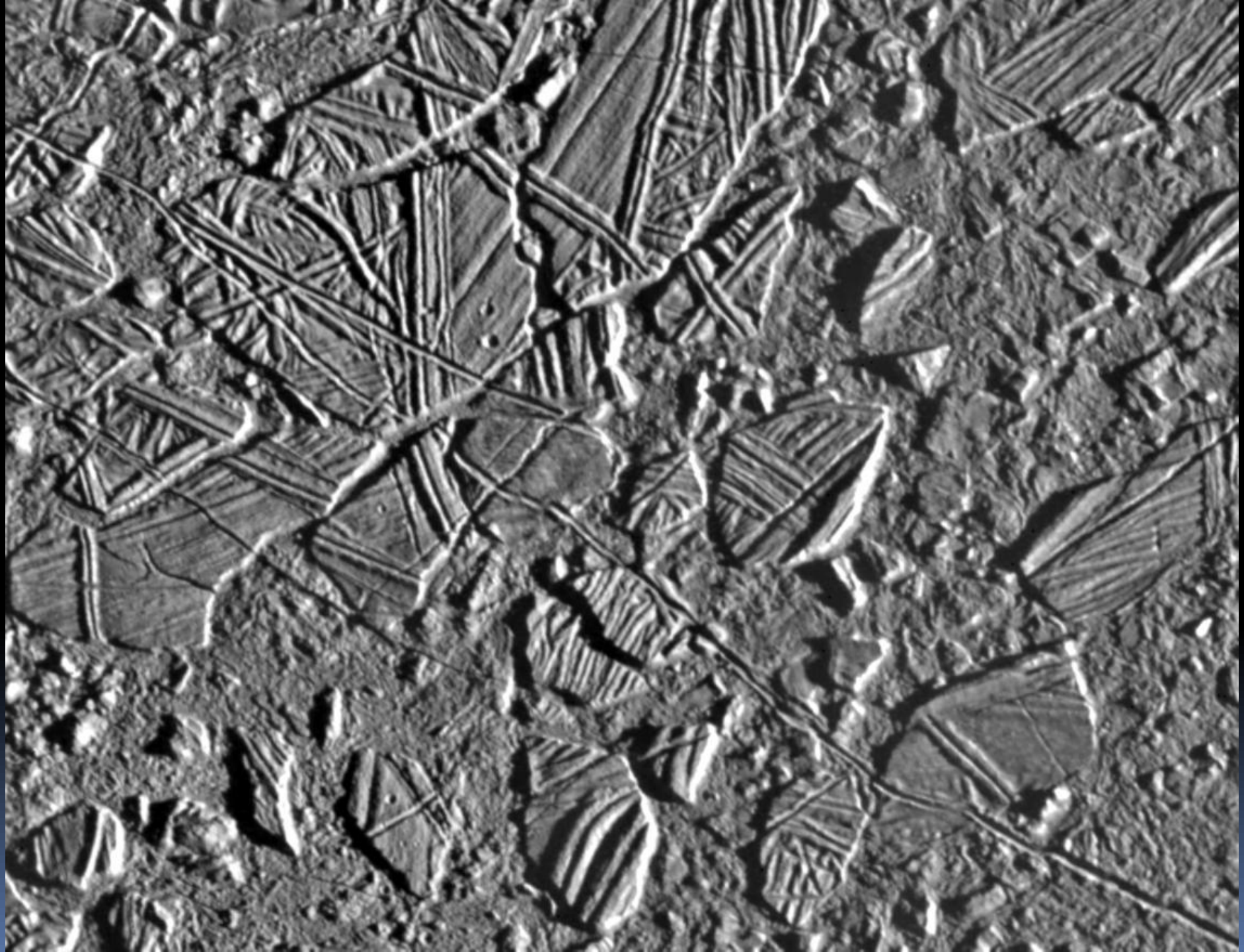


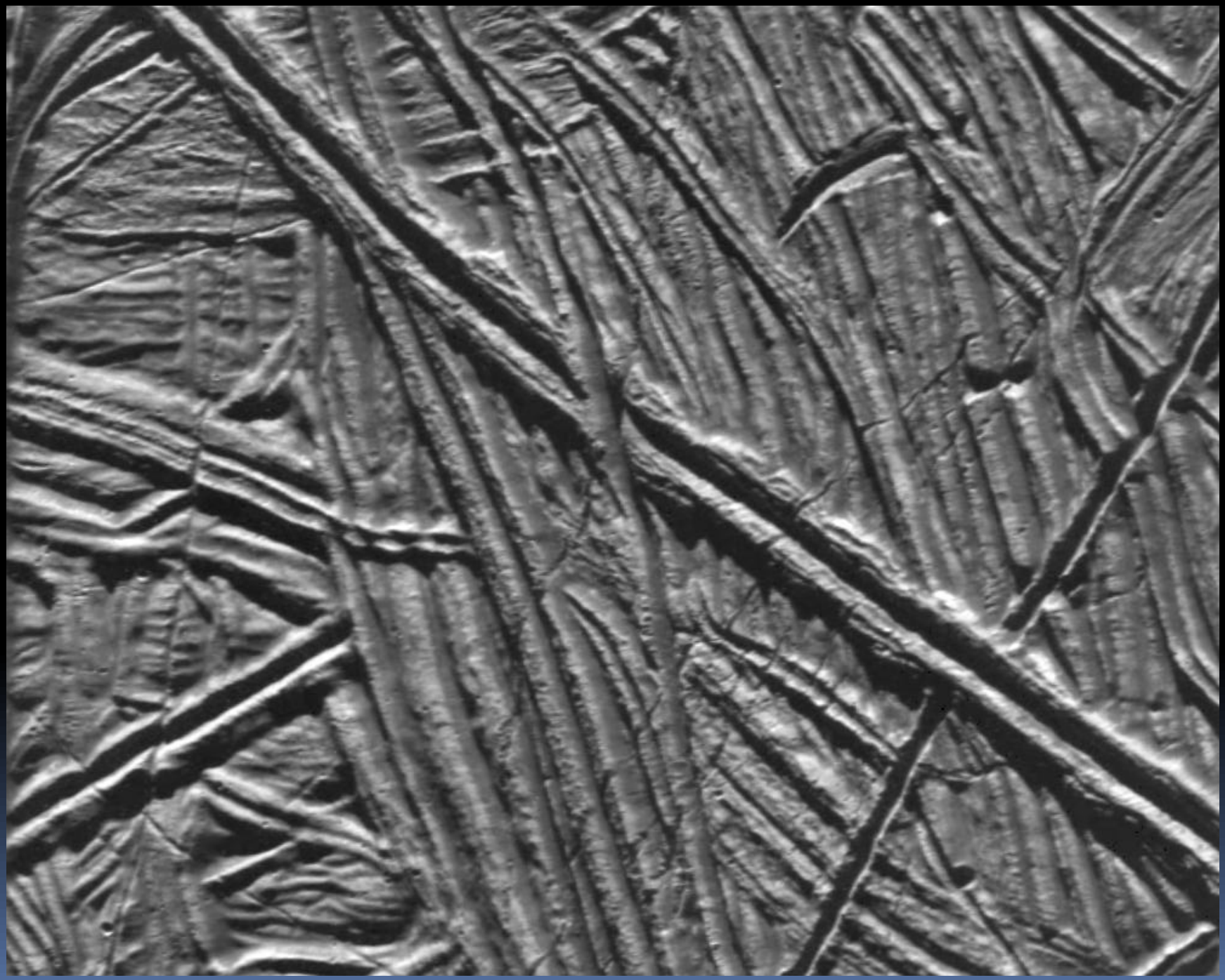
Europa



Europa

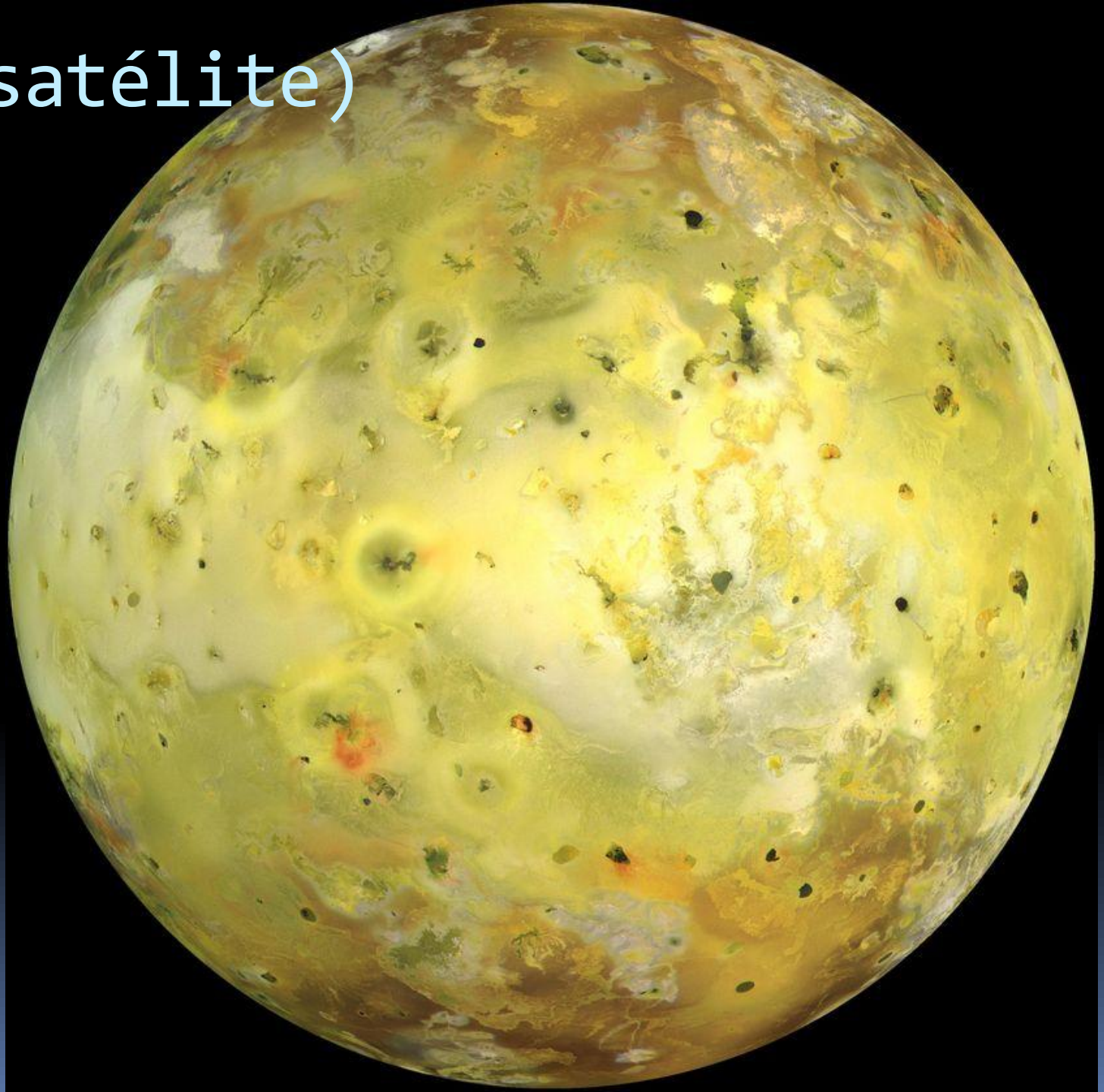




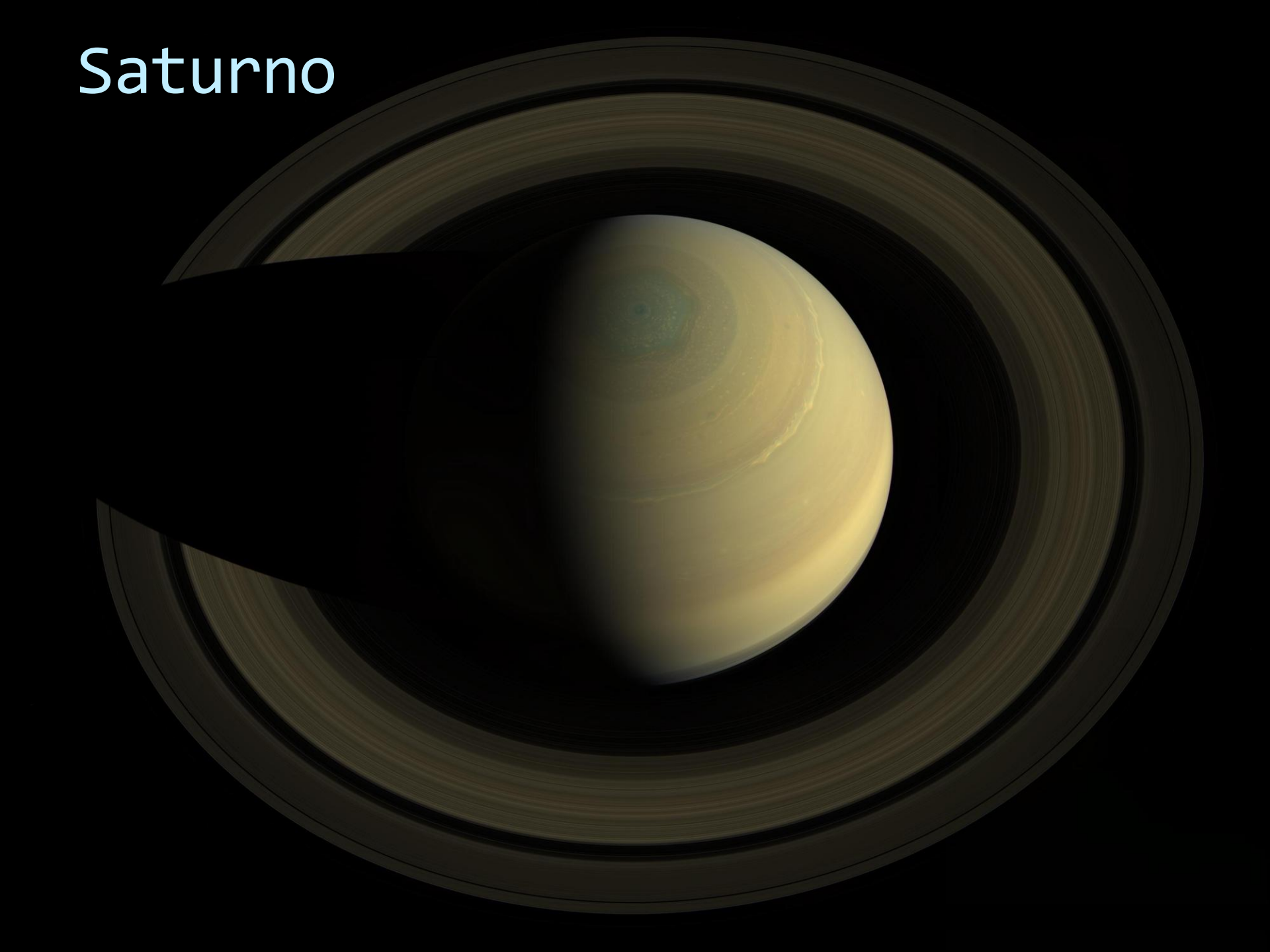


Io (satélite)

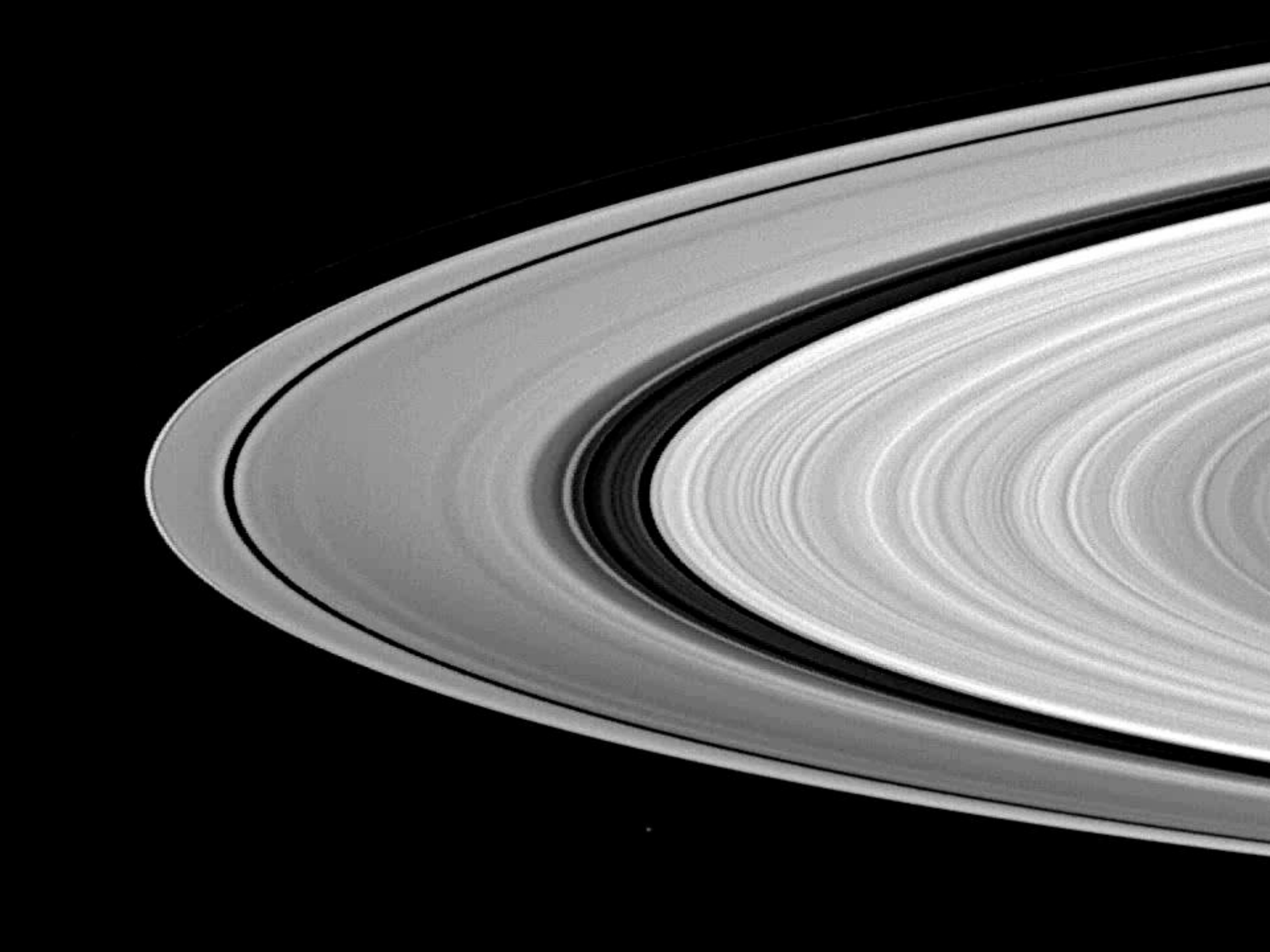
volcanes



Saturno

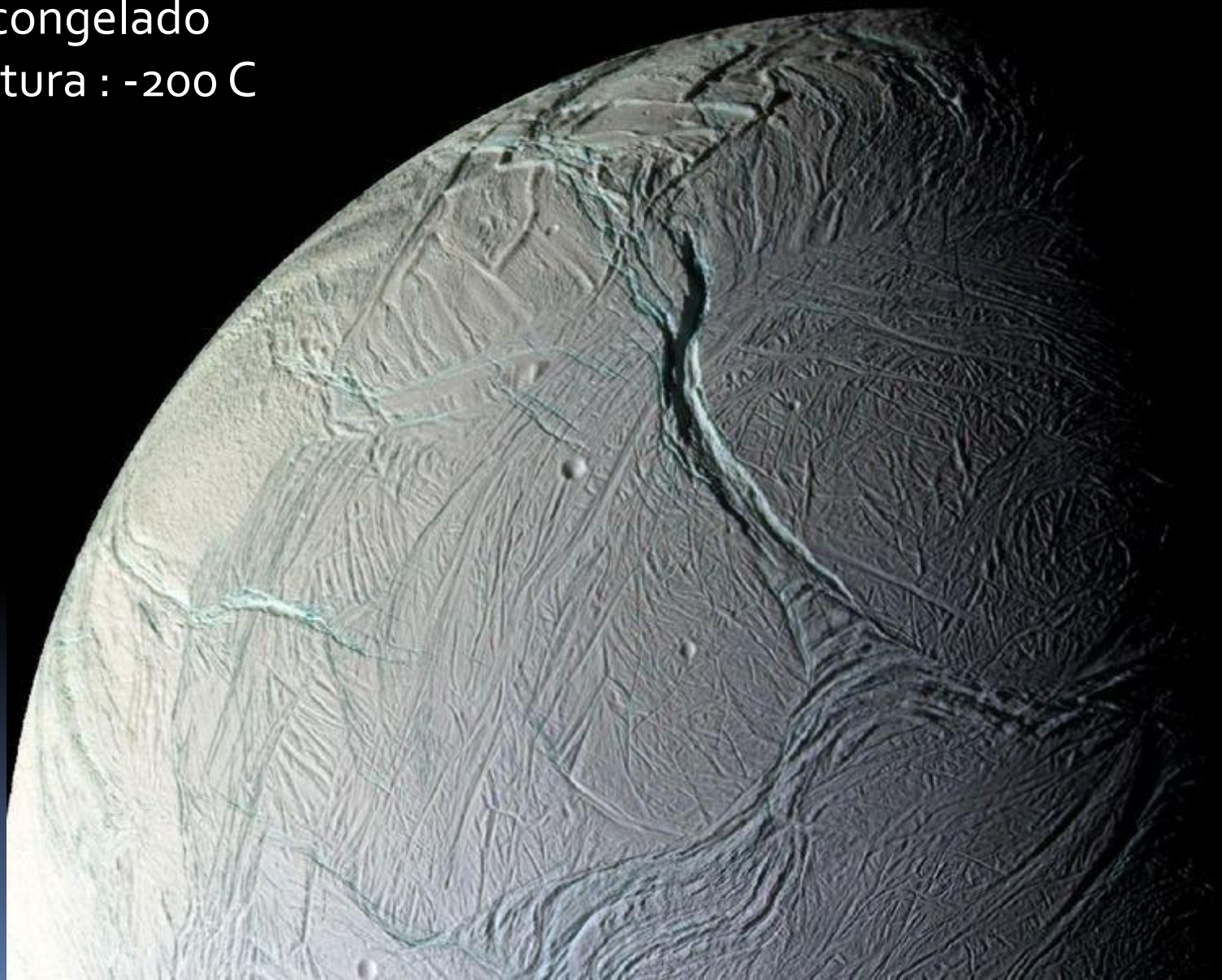


Saturno



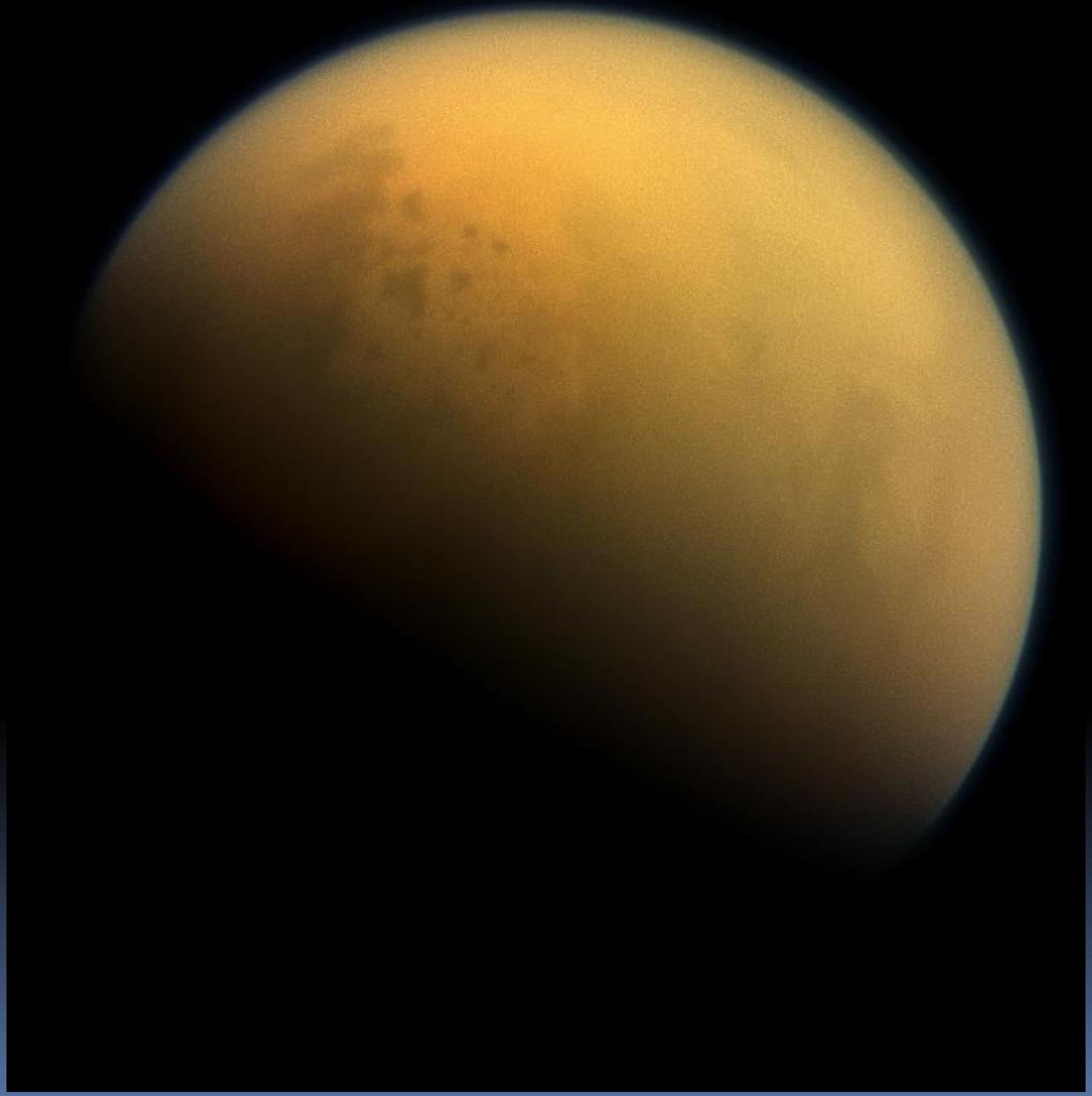
Encelado

Océano congelado
Temperatura : -200 C



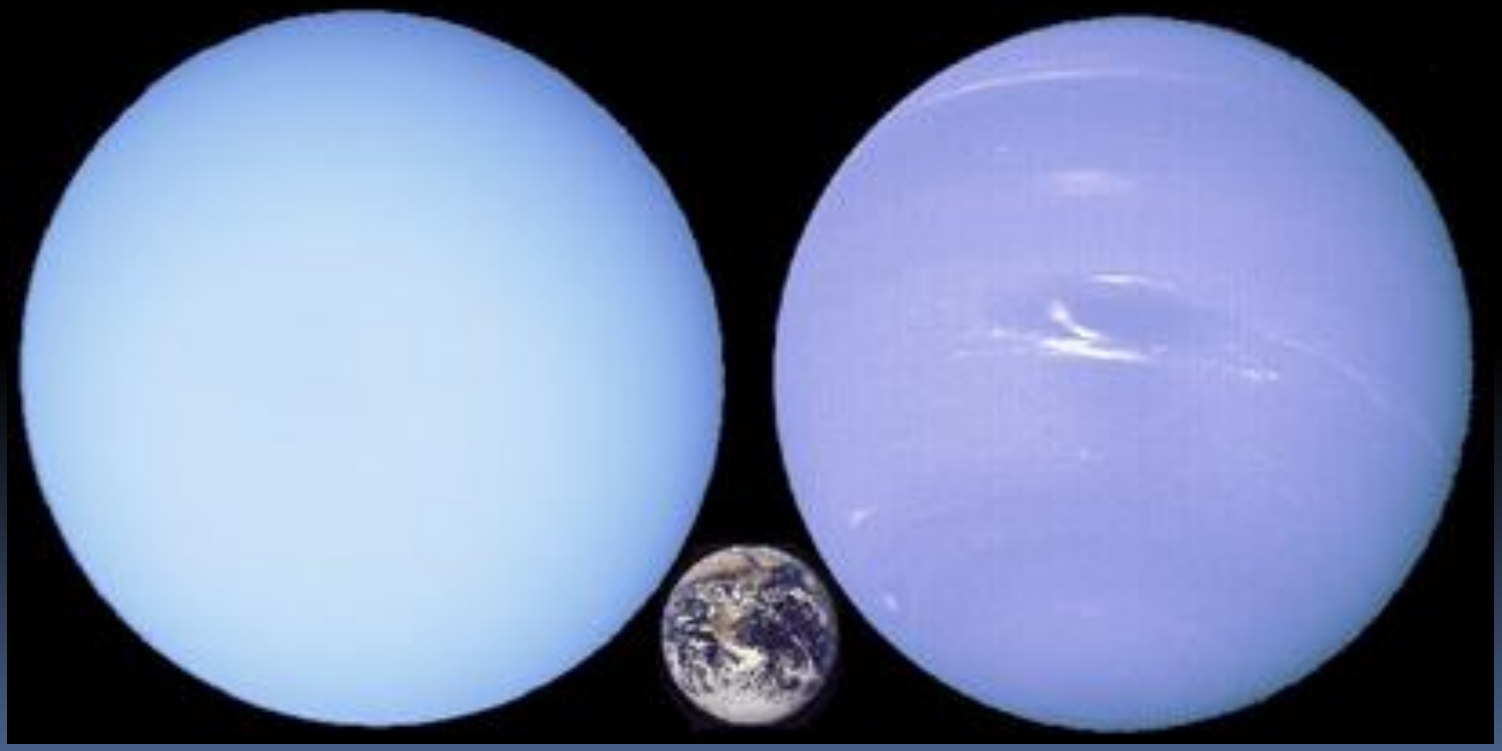
Encelado

Titán

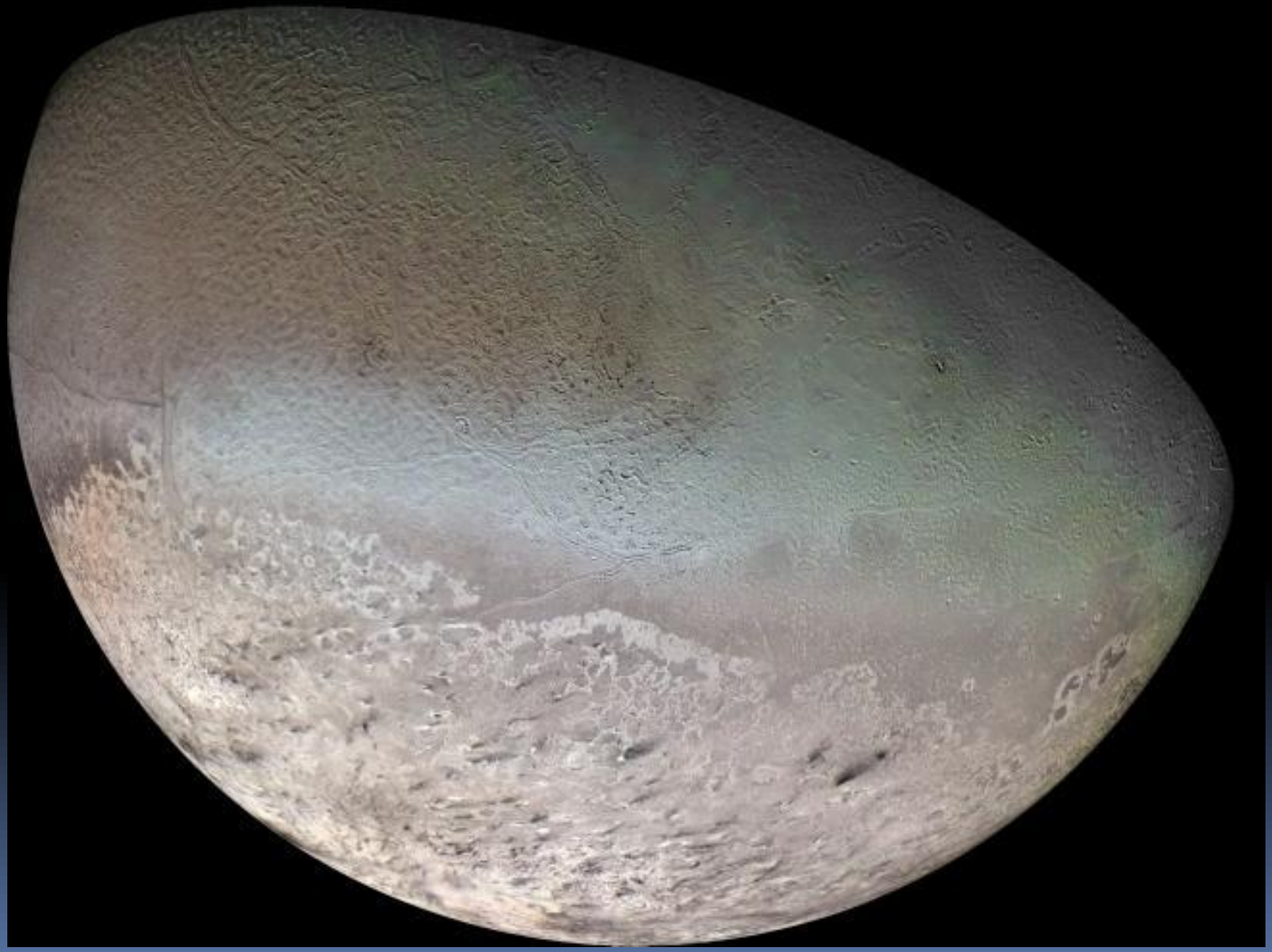


Urano y Neptuno

$CH_4 + NH_3$
Temp: -220 C



Tritón

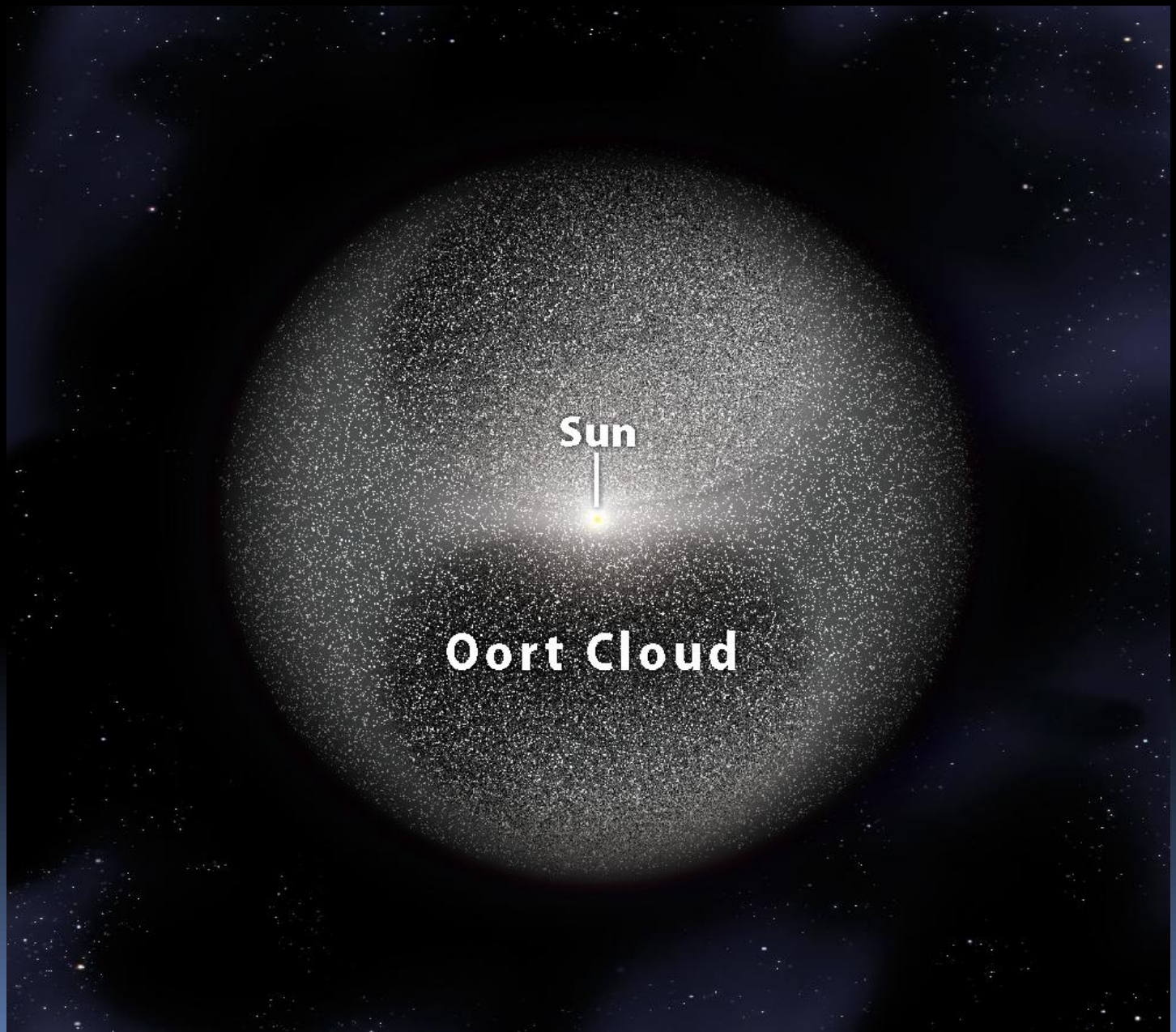


Plutón y Caronte

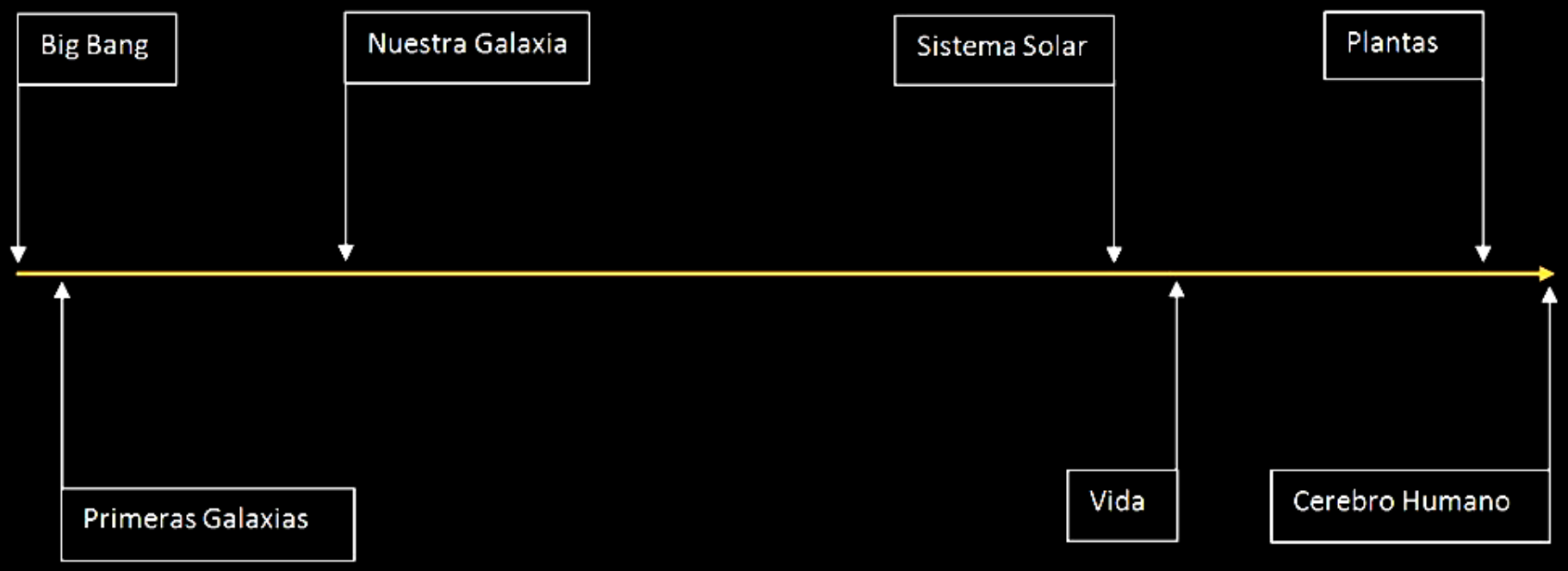
Cometas

Núcleo cometario

Nube de Oort

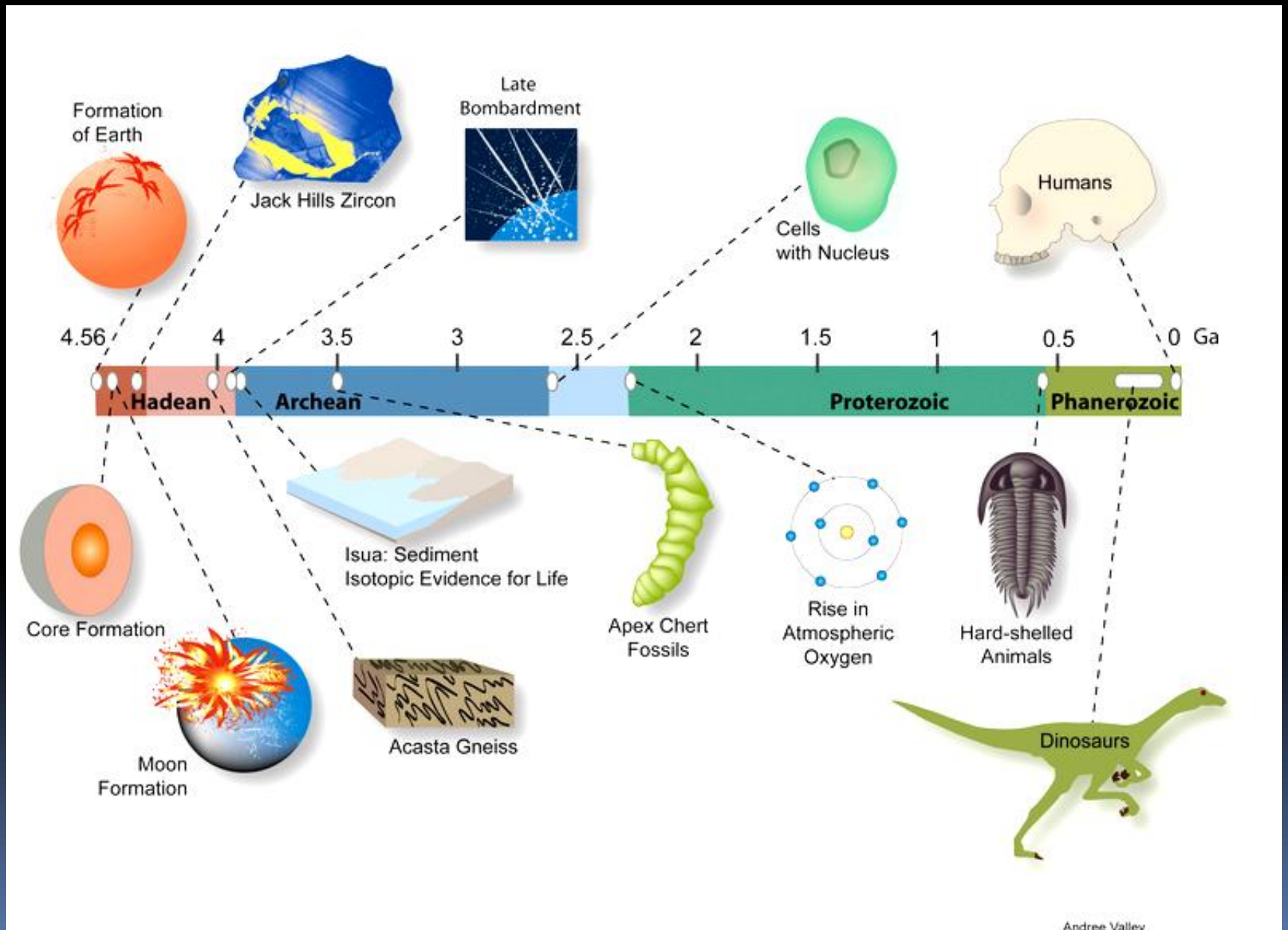


Cronología



Big Bang: hace 13.700 millones de años

Evolución de la Tierra



ESTROMATOLITOS: 3500 millones de años

SETI:
Search Extra-Terrestrial Intelligence

Allen Telescope Array

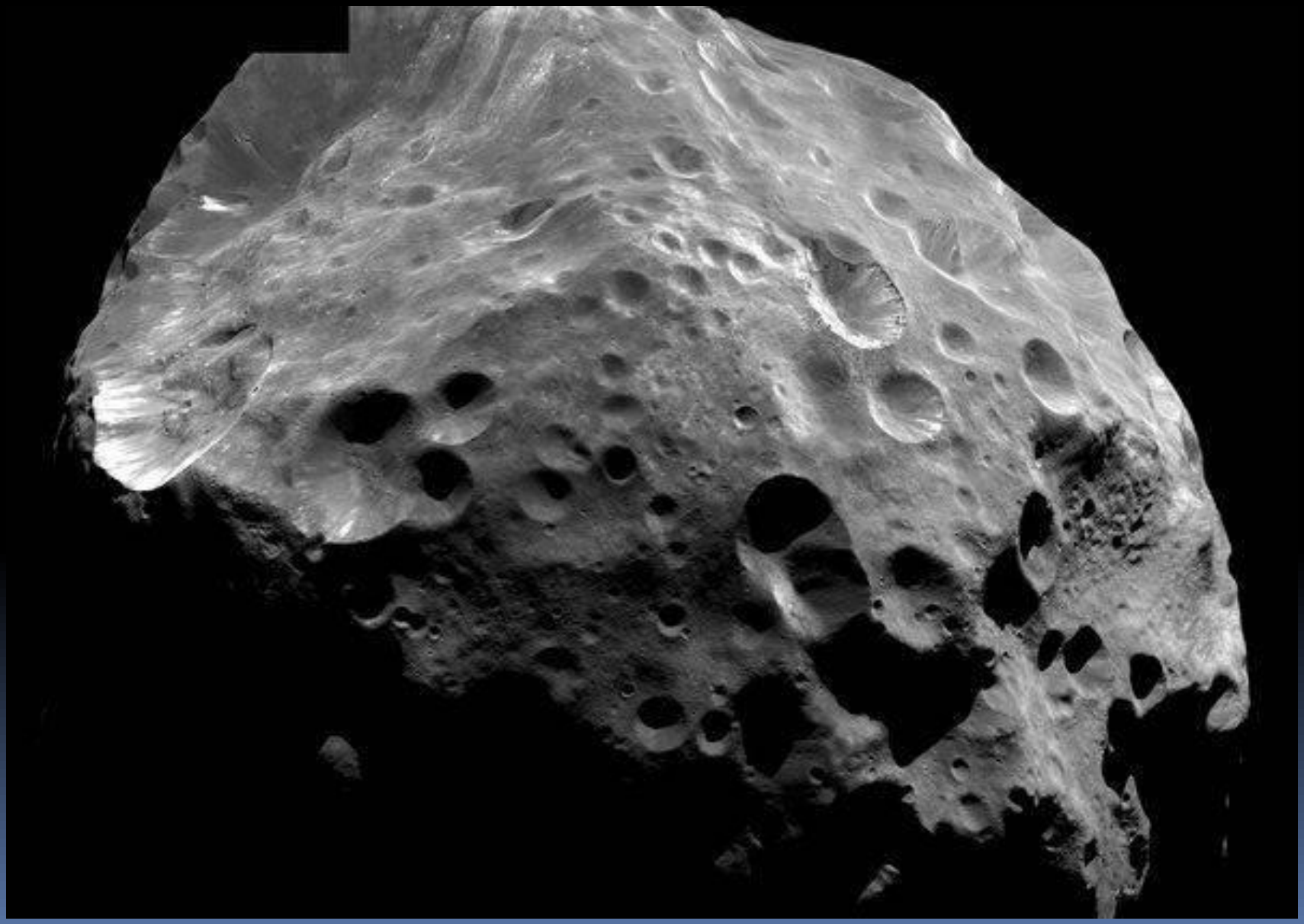
Astrobiología, objetivos:

- Naturaleza y distribución de los entornos habitables
- Cómo emerge la vida a partir de los planetas u otros entornos (¿nubes?)
- Cómo evoluciona
- Límites ambientales para la vida
- Mecanismos que determinan su futuro
- Cómo detectar trazas de vida en otros mundos

Fin

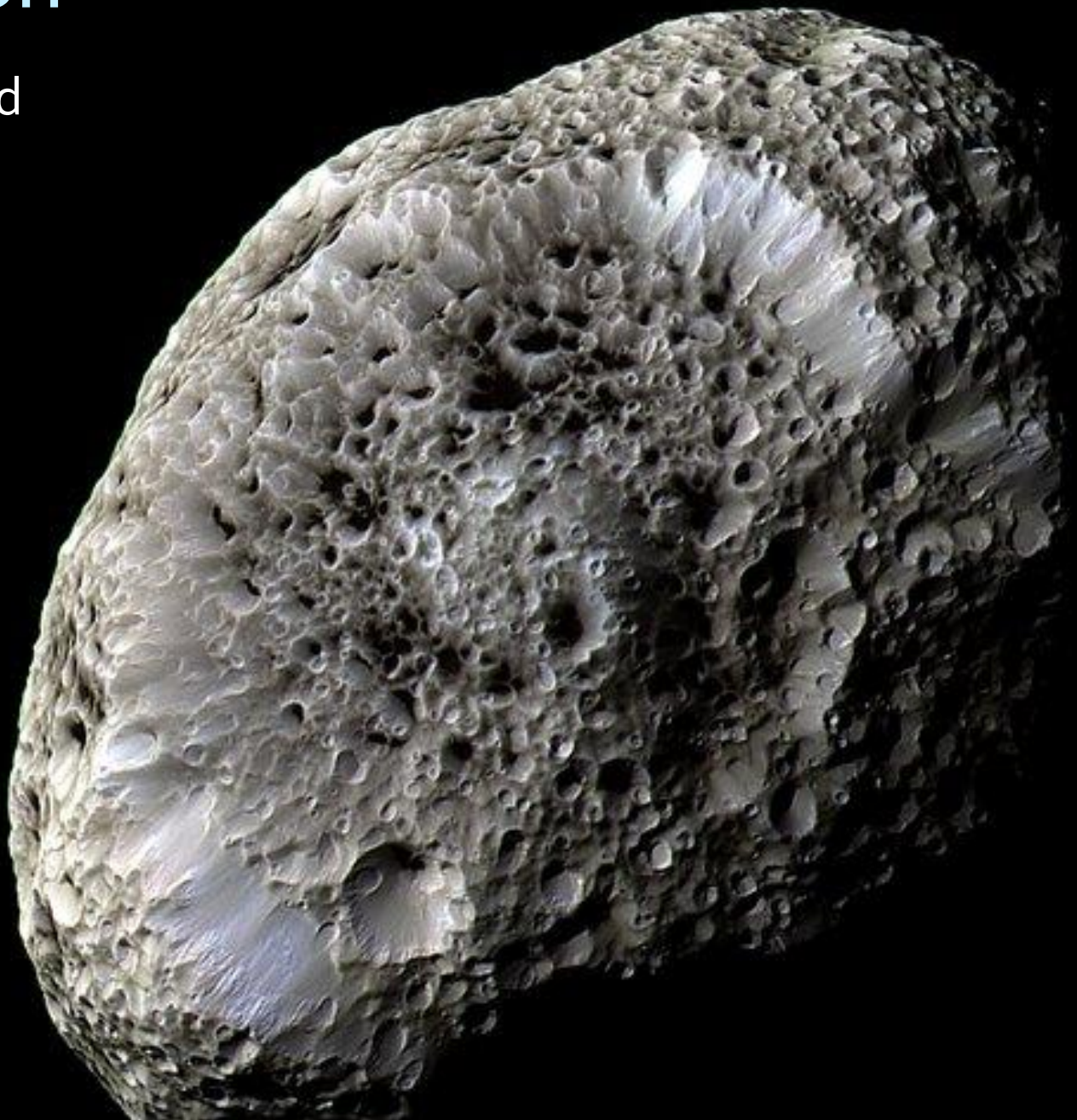
- www.astronomia.edu.uy/sistemasolar
- www.hubblesite.org
- photojournal.jpl.nasa.gov

Phoebe



Hiperion

Alta porosidad



Cinturón de Kuiper

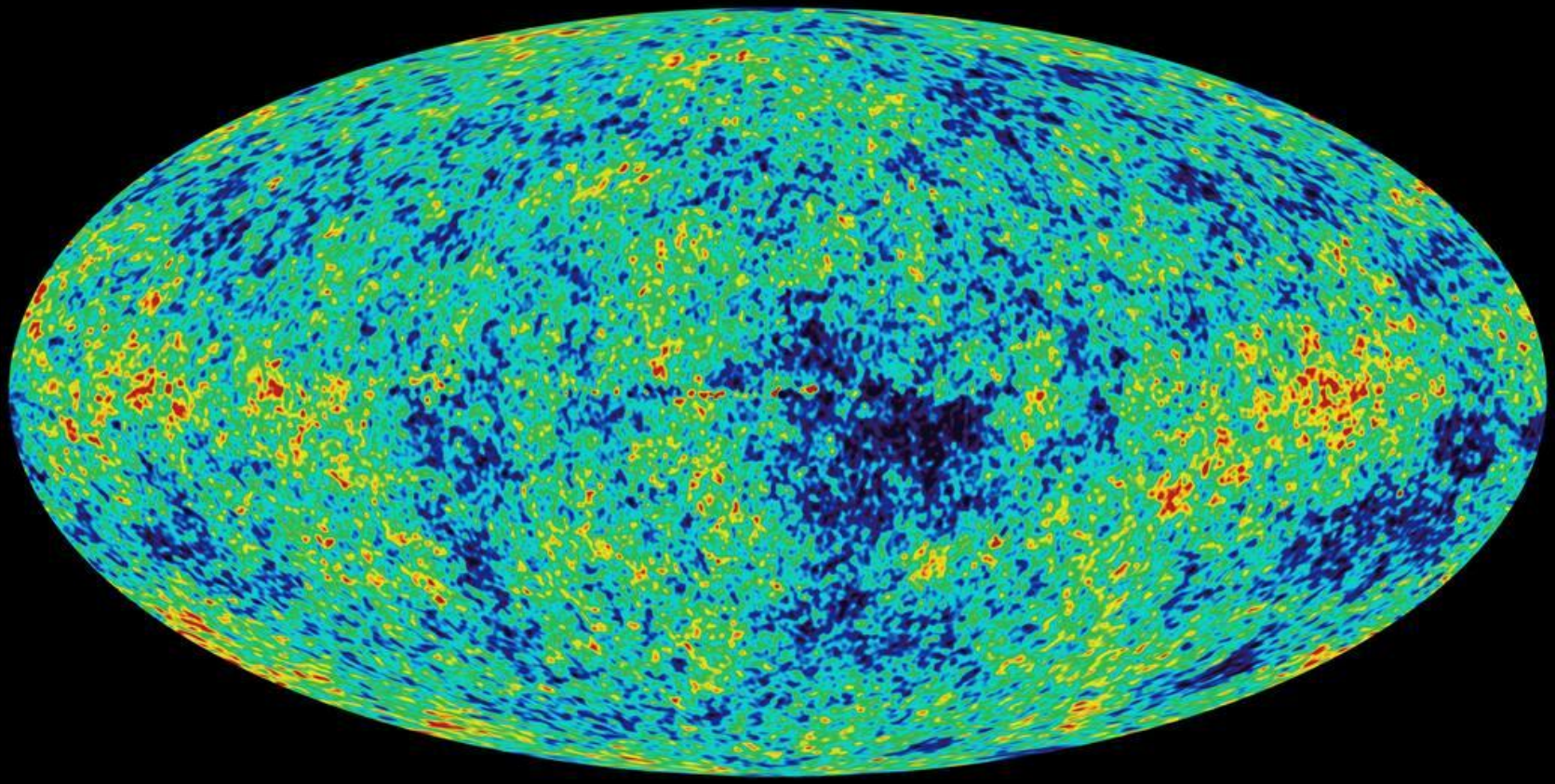
Núcleo cometario

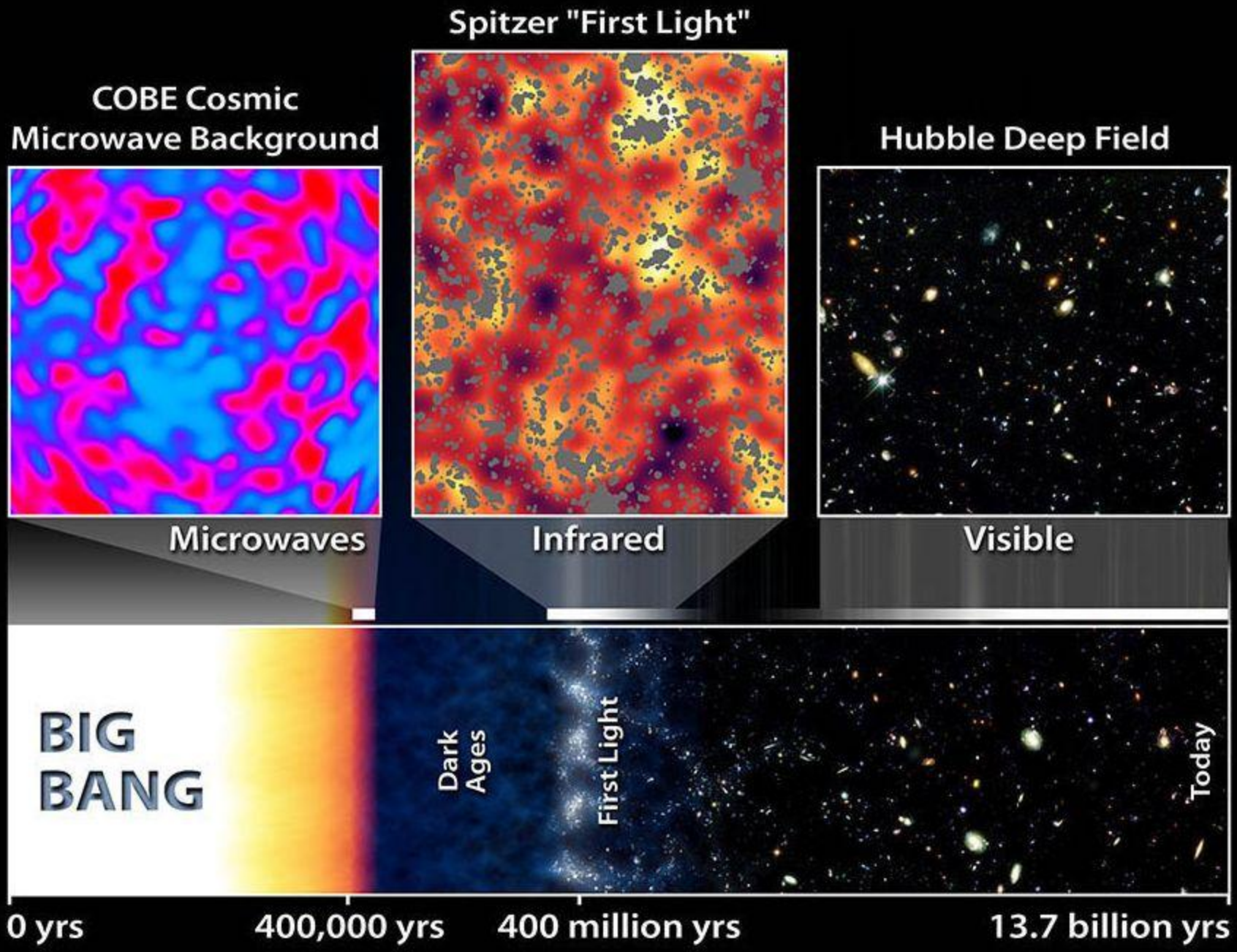
EXPANSIÓN del Universo

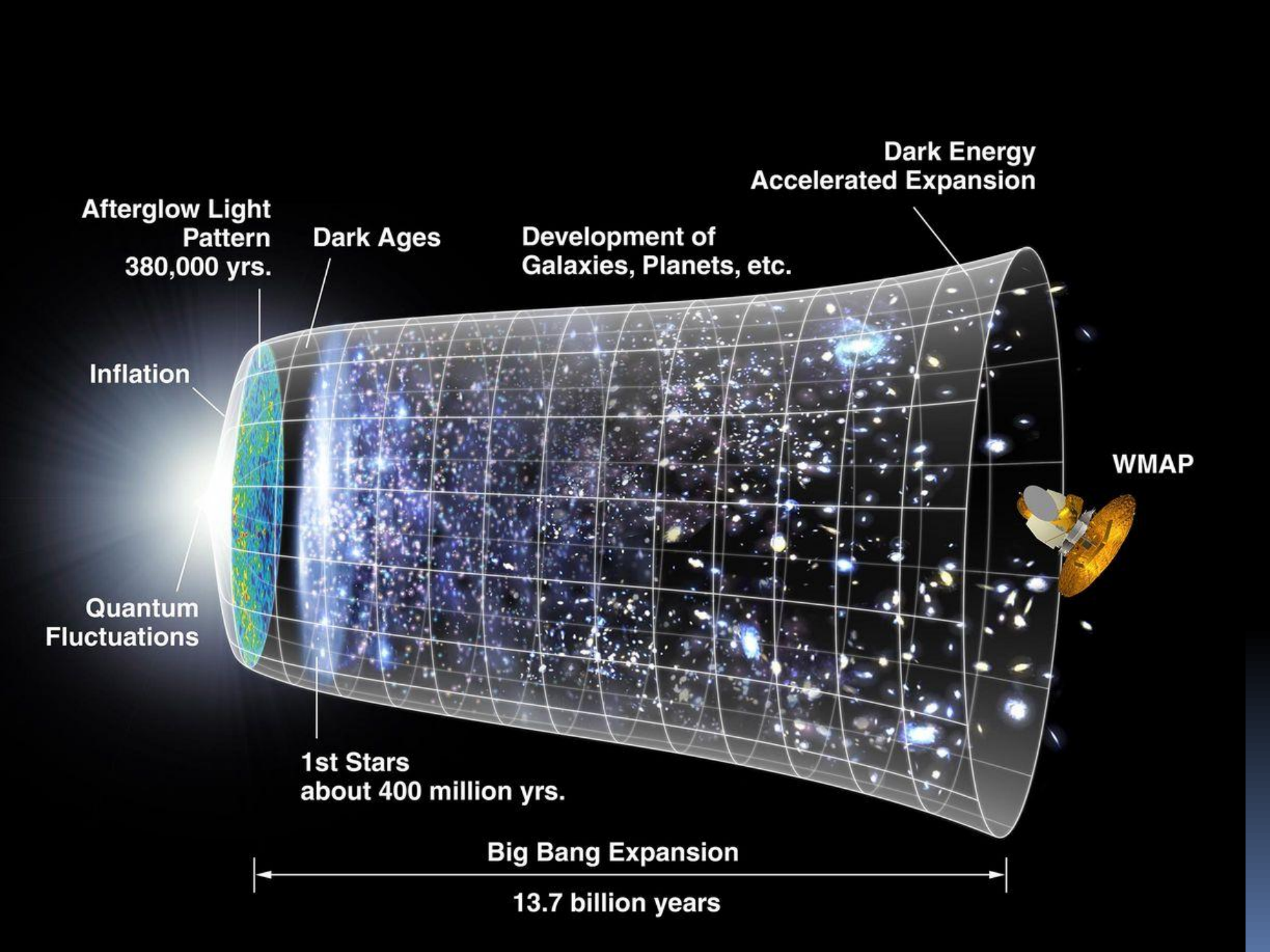
Si vamos hacia atrás en el tiempo… Big Bang!

- Todo el Universo estaba contenido dentro de un volumen microscópico
- Densidad, temperatura y presión enormes
- La materia no podría existir en forma de átomos
- Instante cero: hace 13.700 millones de años

Radiación Cósmica de Fondo




Spitzer "First Light"
COBE Cosmic Microwave Background
Hubble Deep Field
Microwaves
Infrared
Visible
BIG BANG
Dark Ages
First Light
Today
0 yrs
400,000 yrs
400 million yrs
13.7 billion yrs


Dark Energy
Accelerated Expansion
Afterglow Light
Pattern
380,000 yrs.
Dark Ages
Development of
Galaxies, Planets, etc.
Inflation
WMAP
Quantum
Fluctuations
1st Stars
about 400 million yrs.
Big Bang Expansion
13.7 billion years

Tierra Bola de Nieve

Evolución de la Vida

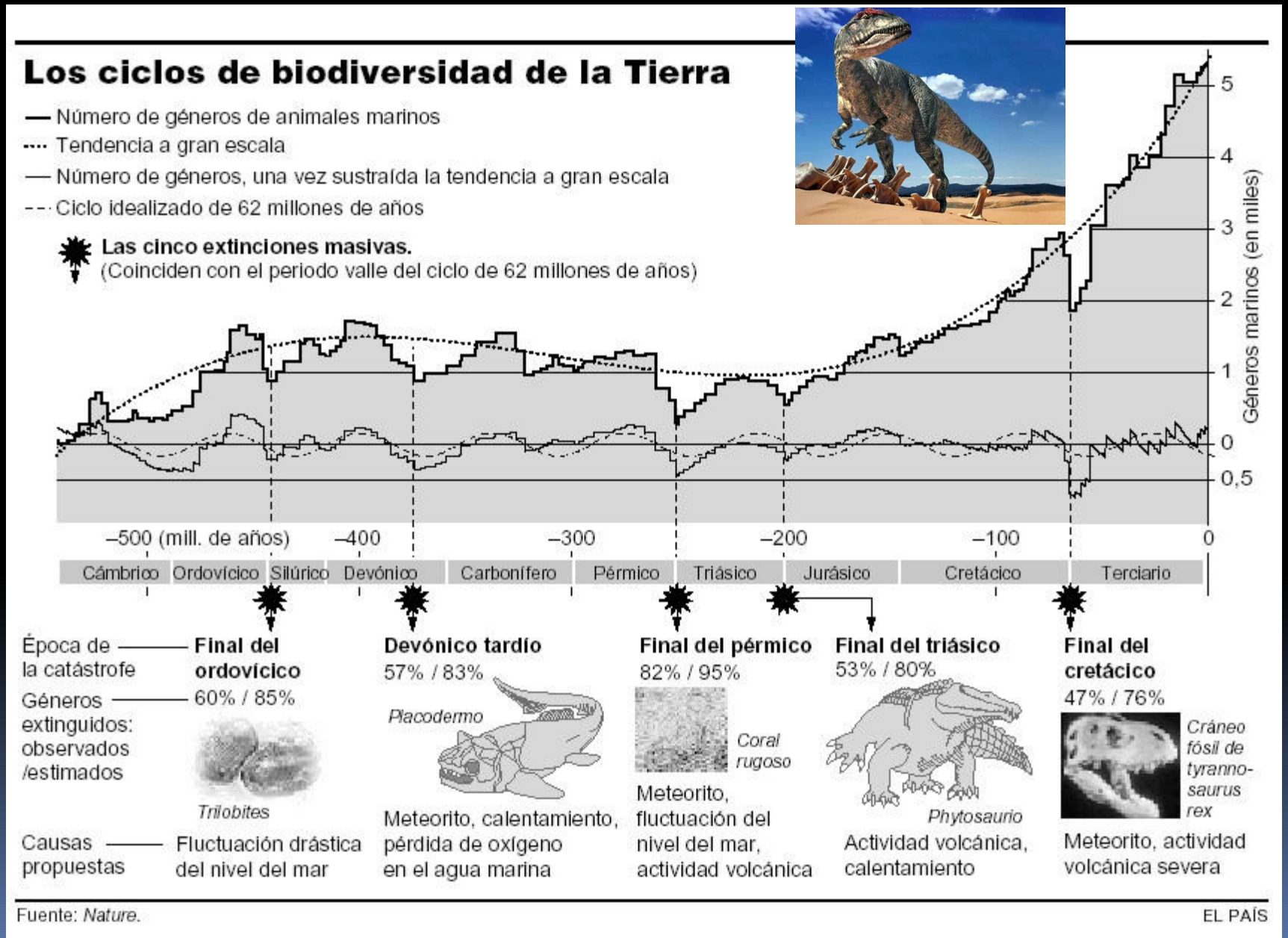
- Pluricelulares y mezcla de ADN: en los últimos 1200 MA
- Colonización de la superficie: hace 500 MA
- Animales que se alimentan de plantas
- Animales que se alimentan de animales

Evolución de la Vida

- Surgió "rápidamente"
- ¿Contribución de meteoritos?
- En los océanos (protección UV)
- Unicelulares: durante 2000 MA. Extraen CO_2 y liberan oxígeno

OXIGENO:
energía y protección UV

Extinciones masivas



Frecuencia de impactos actual

- Asteroide de 1km cada 1 millón de años
- Catástrofe regional
- “Invierno nuclear” durante algunos meses