



EUROPA

CLIPPER

Dave Doody

Jet Propulsion Laboratory, California Institute of Technology





THE GALILEAN SATELLITES OF JUPITER



CALLISTO

4821 KM DIA



GANYMEDE

5262 KM DIA



EUROPA

3122 KM DIA
(Earth's Moon is 3475)



IO

3643 KM DIA



THE GALILEAN SATELLITES OF JUPITER



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VOYAGER SPACECRAFT
1979 MARCH & JULY



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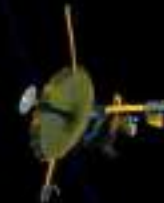


IO

3643 KM DIA



VOYAGER SPACECRAFT
1979 MARCH & JULY



GALILEO SPACECRAFT
1995-2003





Here on Earth / Universe

Gravitation



Here on Earth / Universe

Gravitation
Orbital Mechanics



Here on Earth / Universe

Gravitation
Orbital Mechanics
Geology



Here on Earth / Universe

Gravitation



Orbital Mechanics



Geology



Chemistry



Here on Earth / Universe

Gravitation



Orbital Mechanics



Geology



Chemistry



Water



Here on Earth / Universe

Gravitation



Orbital Mechanics



Geology



Chemistry



Water



Biology

Here on Earth / Universe

Gravitation

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Geology

Chemistry

Water

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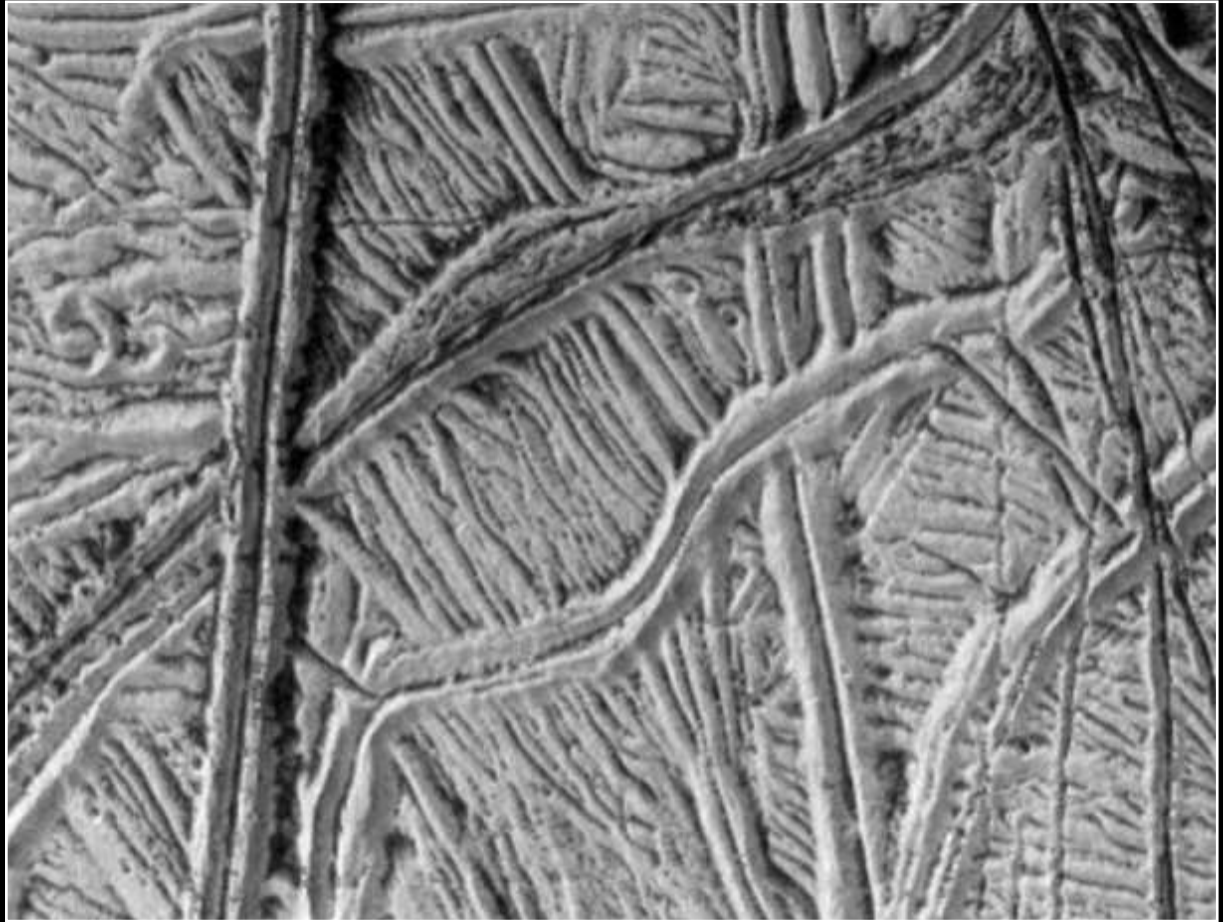
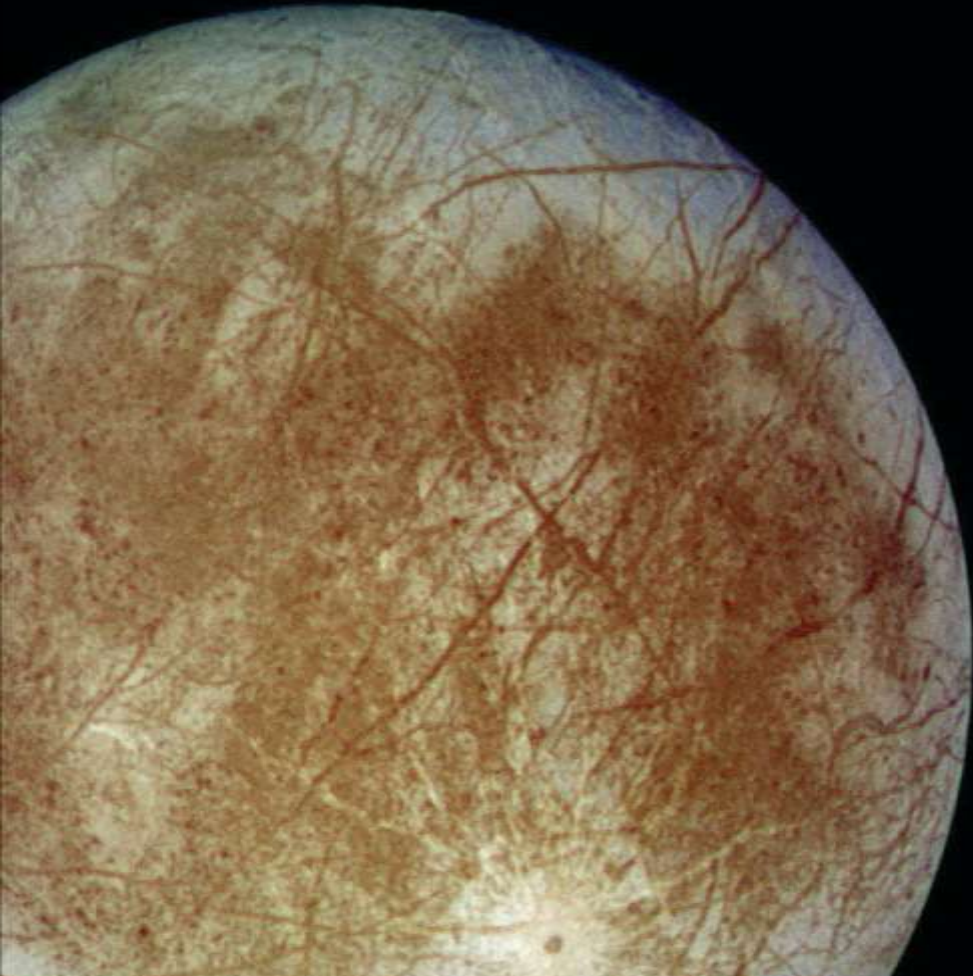






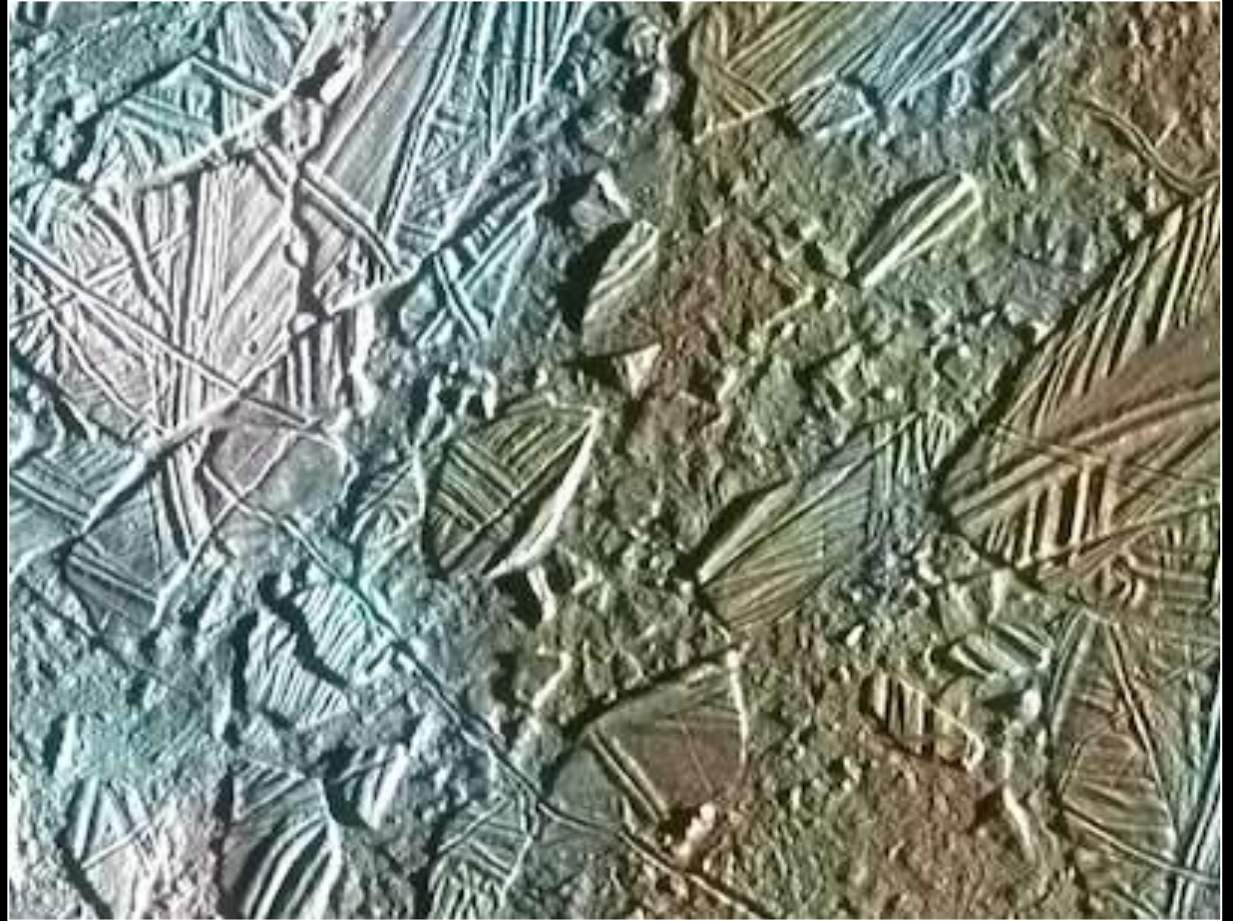
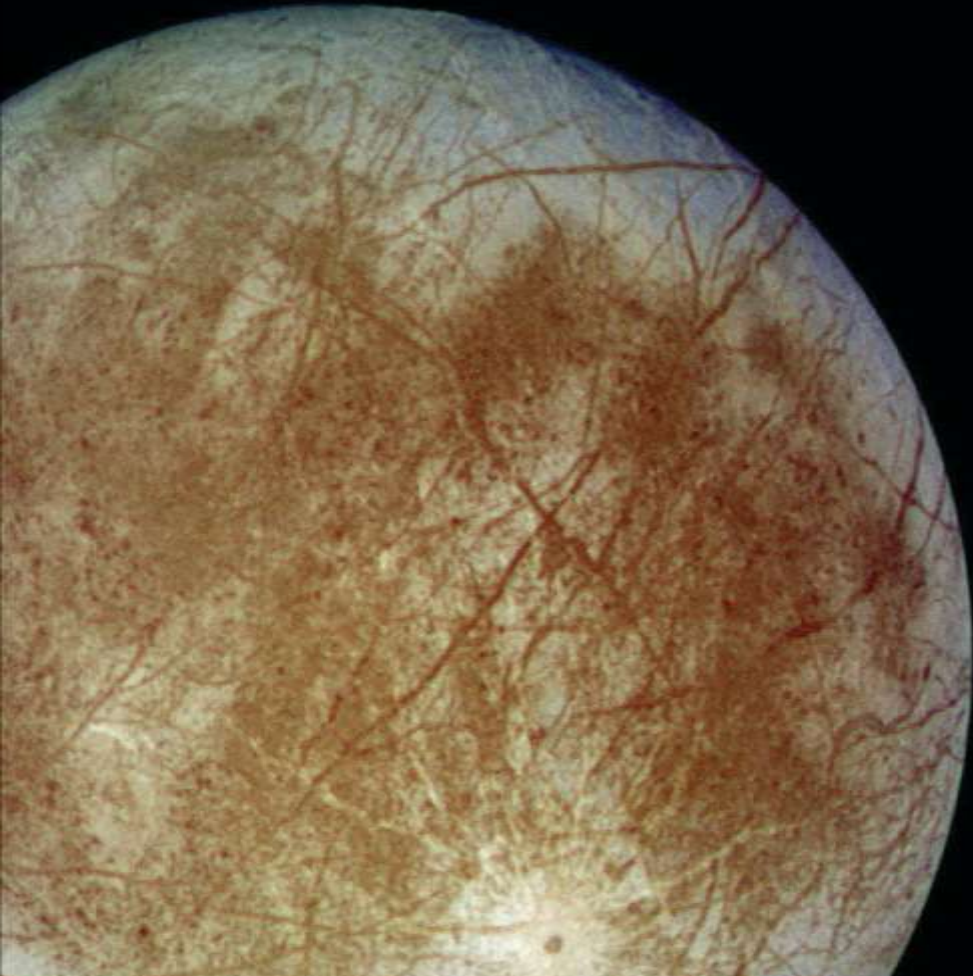
EUROPA'S SURFACE

RIDGED PLAINS



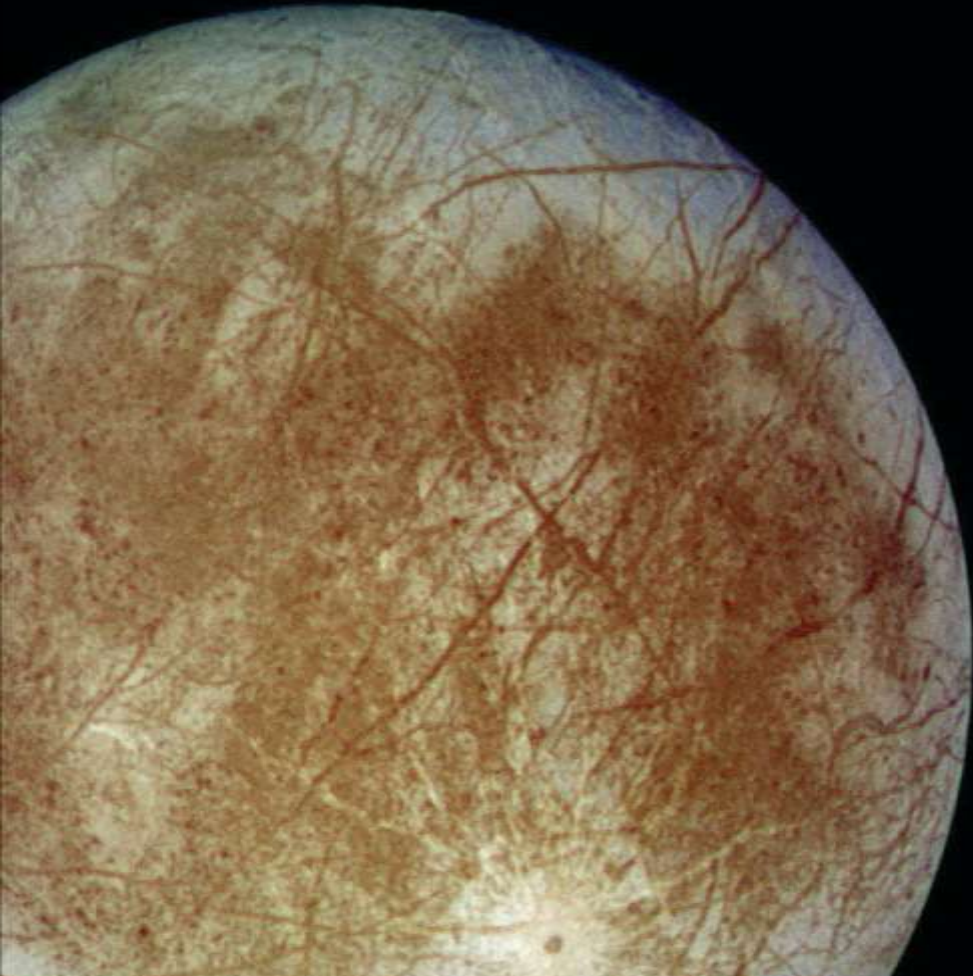
EUROPA'S SURFACE

CHAOS



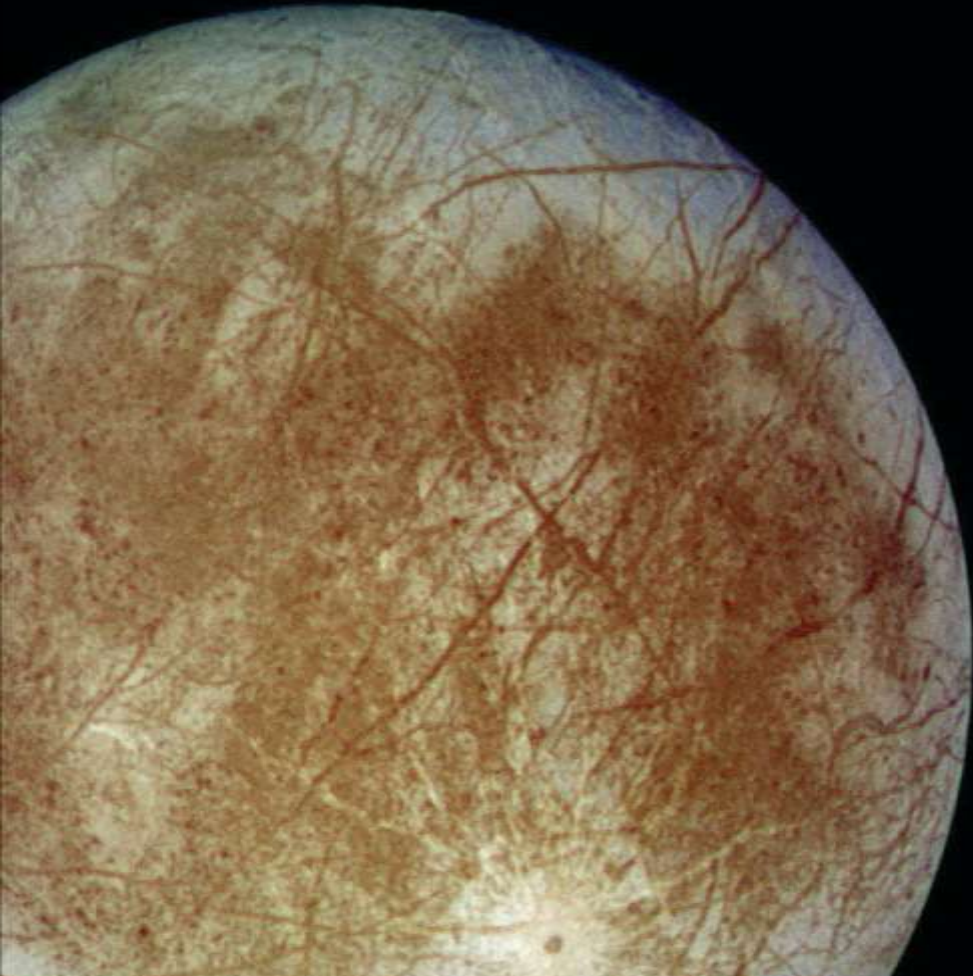
EUROPA'S SURFACE

CRATERS



EUROPA'S SURFACE

LENTICULAE



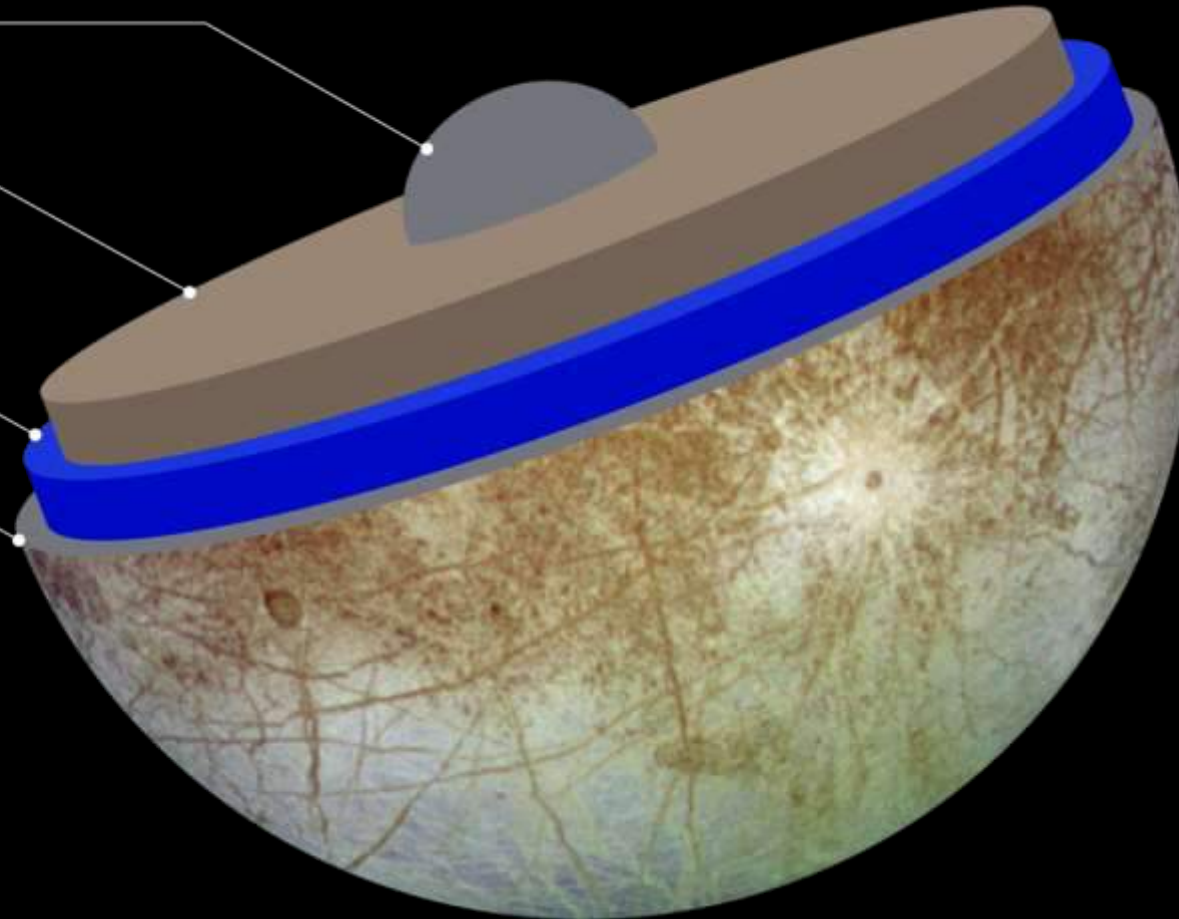
EUROPA'S INTERIOR

METALLIC CORE

ROCK

OCEAN

ICE CRUST

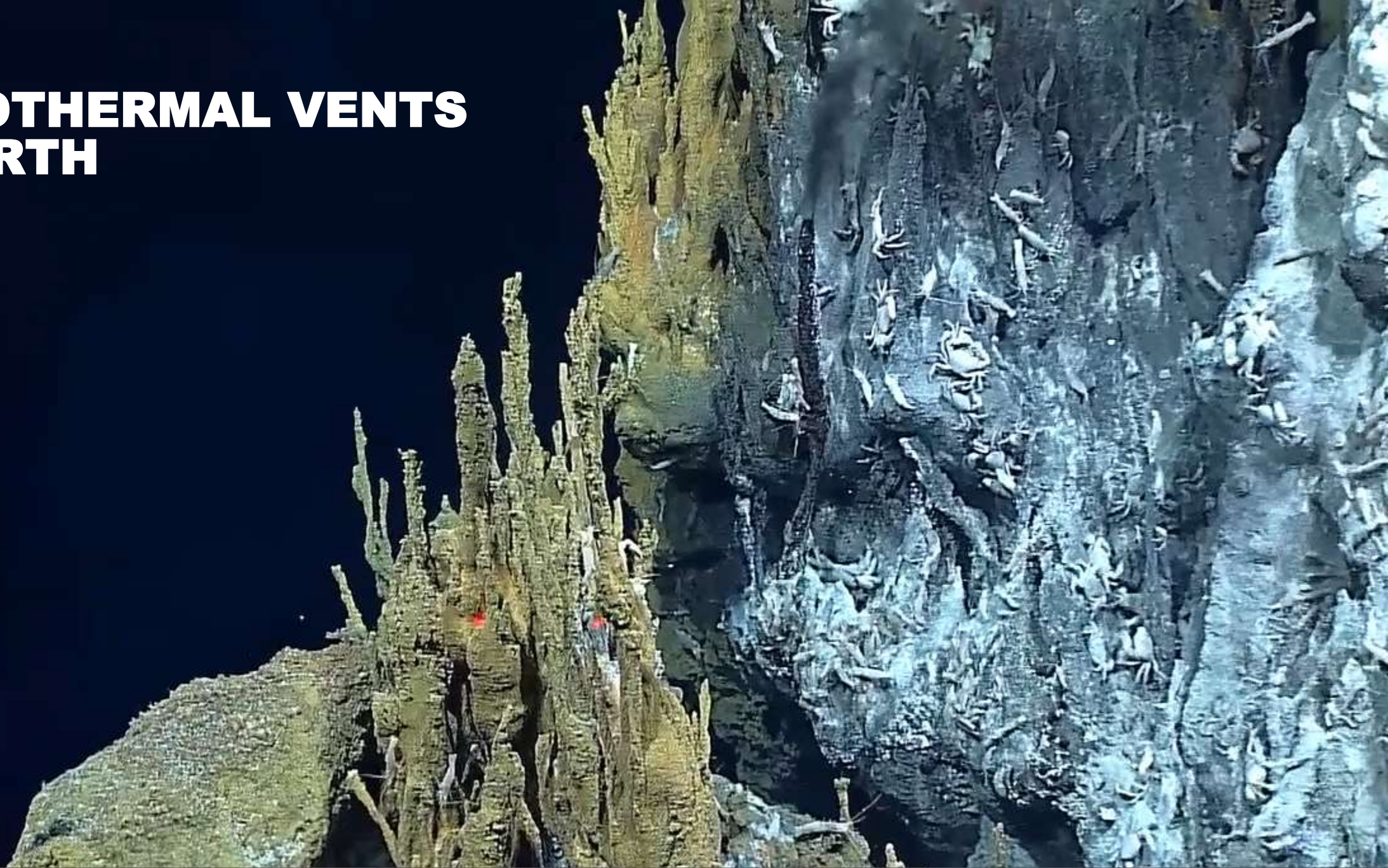


INGREDIENTS FOR LIFE?

- **WATER:**
Much more than all of Earth's oceans
- **ESSENTIAL ELEMENTS:**
From formation and impacts
- **CHEMICAL ENERGY:**
From above and below
- **STABILITY:**
“Simmering” for 4 billion years

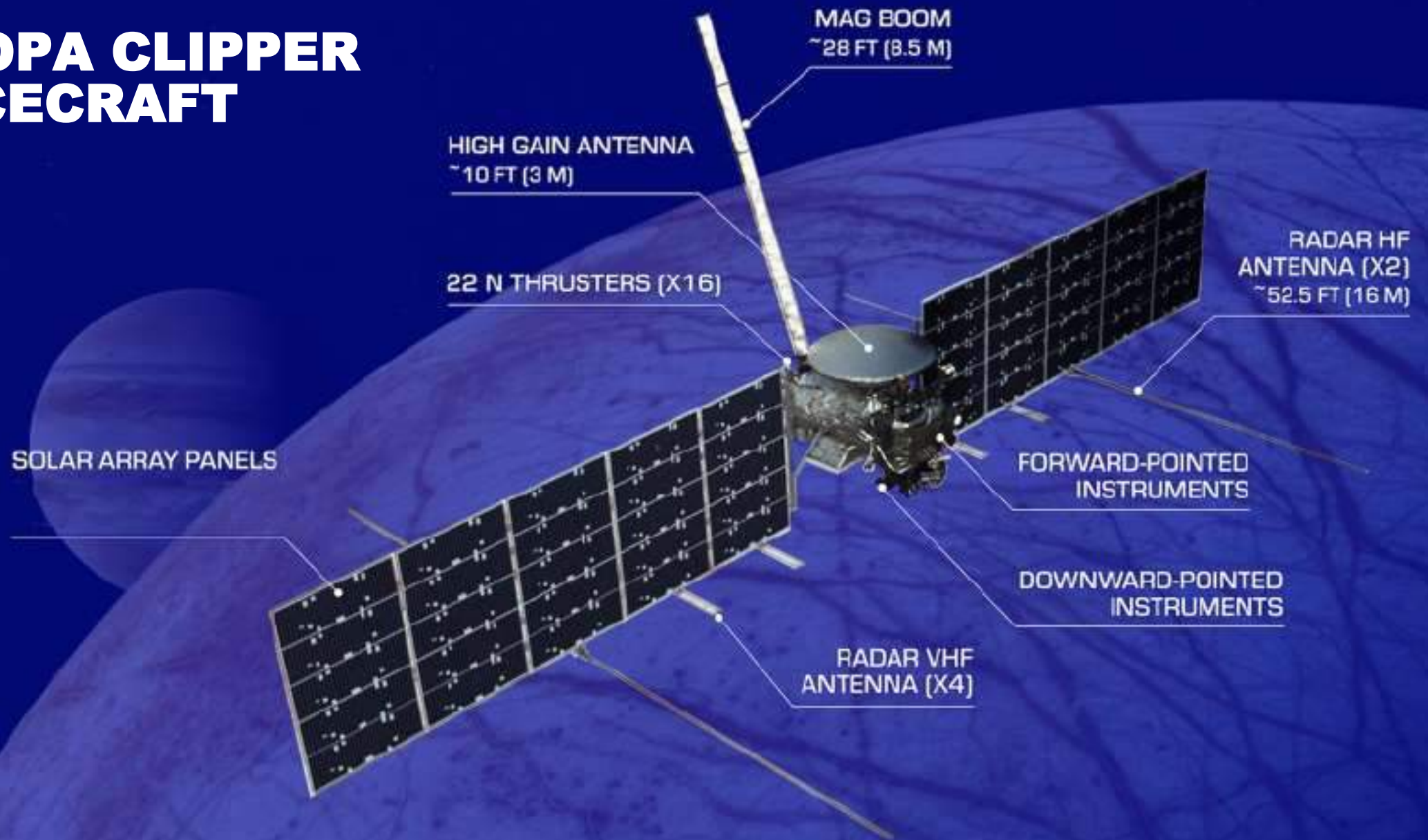


HYDROTHERMAL VENTS ON EARTH





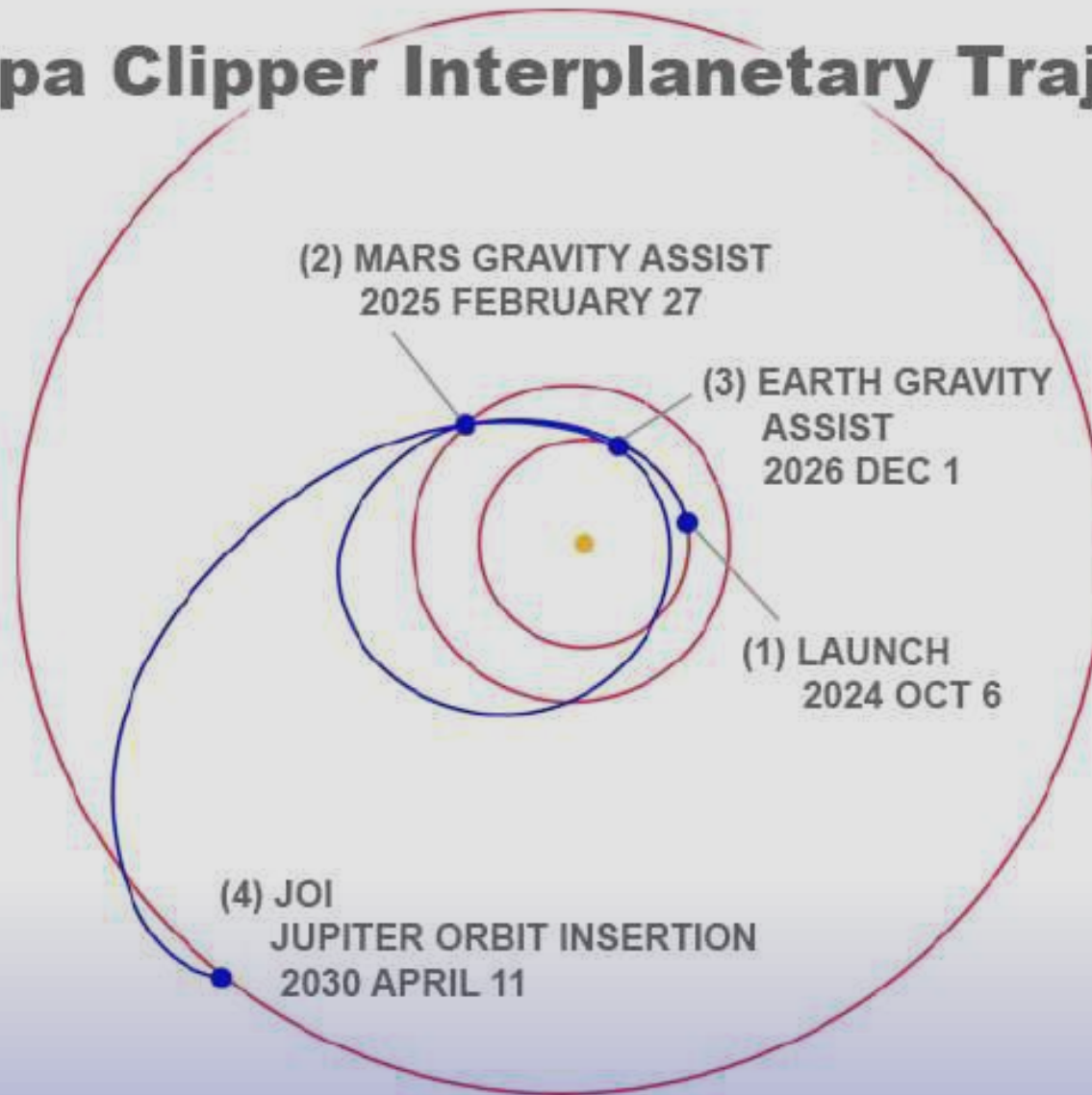
EUROPA CLIPPER SPACECRAFT



Europa Clipper Interplanetary Trajectory

VIEW LOOKING "DOWN"
FROM THE NORTH

(EVERYTHING REVOLVES
COUNTER-CLOCKWISE)



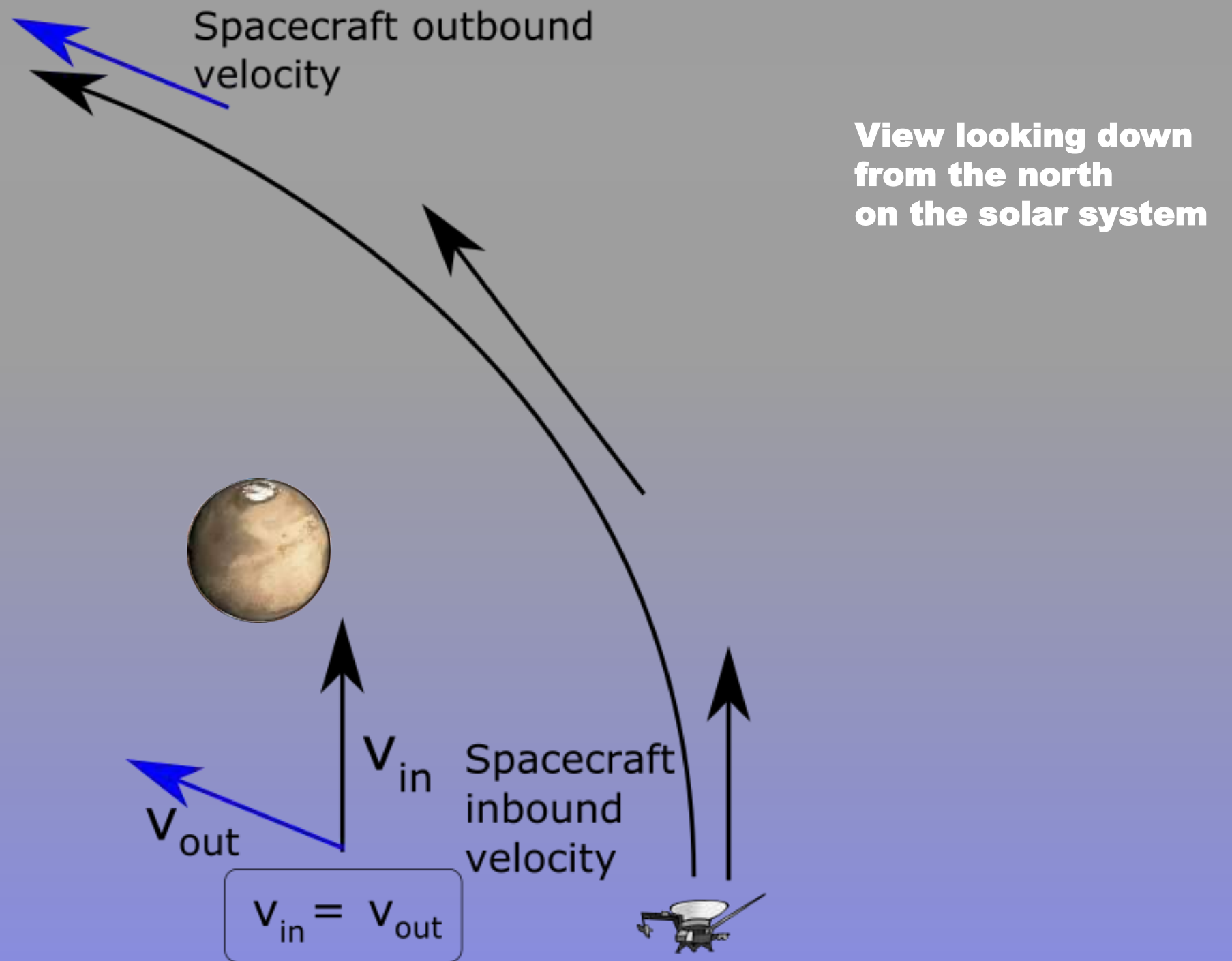


Gravity Assist:

How does that work?

**Gravity temporarily connects your spacecraft
to a planet's orbital momentum.**

And steals some of that momentum.



**View looking down
from the north
on the solar system**

Resultant
outbound velocity

Planet's velocity
relative to the sun



Resultant
inbound velocity

v_{out}

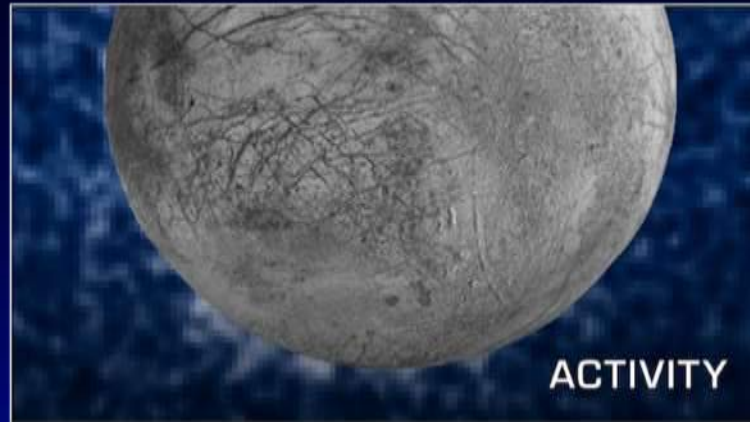
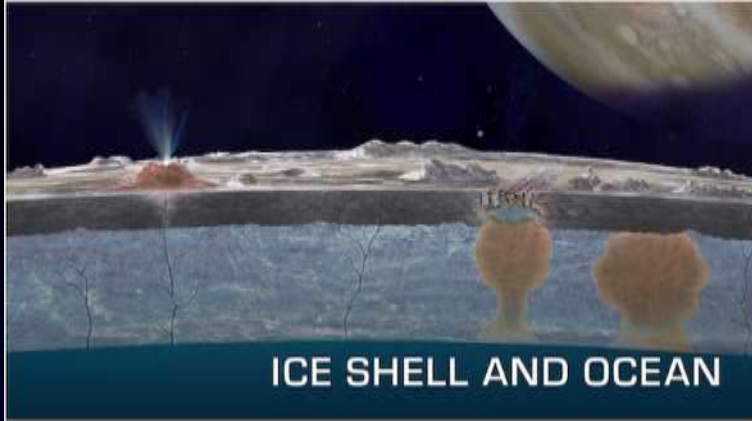
v_{in}

$$v_{in} < v_{out}$$



EUROPA CLIPPER MISSION SCIENCE

GOAL: TO EXPLORE EUROPA AND INVESTIGATE ITS HABITABILITY



IN SITU INSTRUMENTS

DEVELOPMENT IN PROGRESS



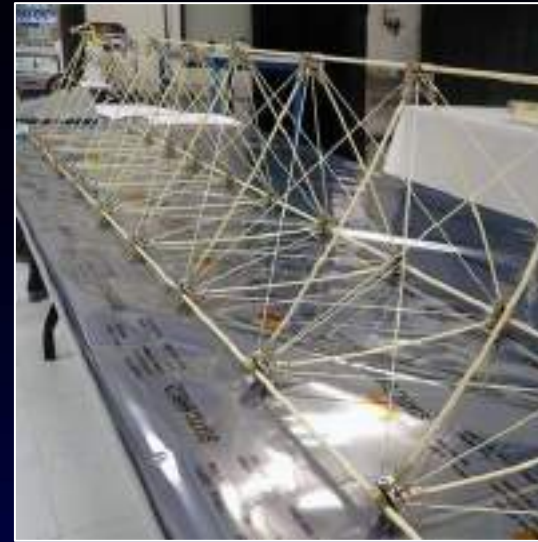
MASPEX
Mass Spectrometer

Source: NASA/ SwRI



SUDA
Surface Dust Analyzer

Source: NASA/ LASP-CU Boulder



ECM
Magnetometer

Source: NASA/ JPL-Caltech

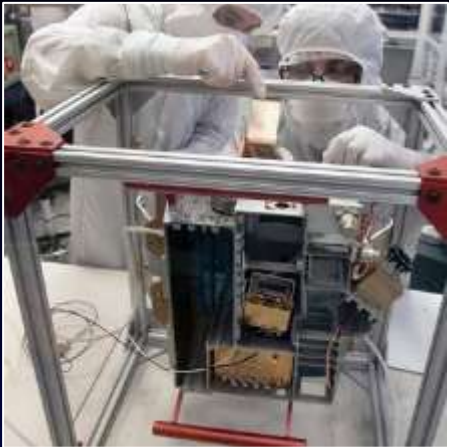


PIMS
Plasma Instrument for
Magnetic Sounding

Source: NASA/ Johns Hopkins APL/ ED
Whitman

REMOTE SENSING INSTRUMENTS

DEVELOPMENT IN PROGRESS



EUROPA UVS

Ultraviolet Spectrograph

Source: NASA/ SwRI



EIS

Imaging System

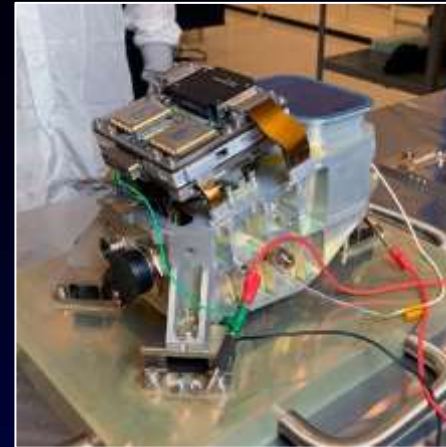
Source: NASA/ Johns Hopkins
APL/ Ed Whitman



MISE

Mapping Imaging
Spectrometer

Source: NASA/ JPL-Caltech



E-THEMIS

Thermal Emission
Imaging System

Source: NASA/ Arizona State
University

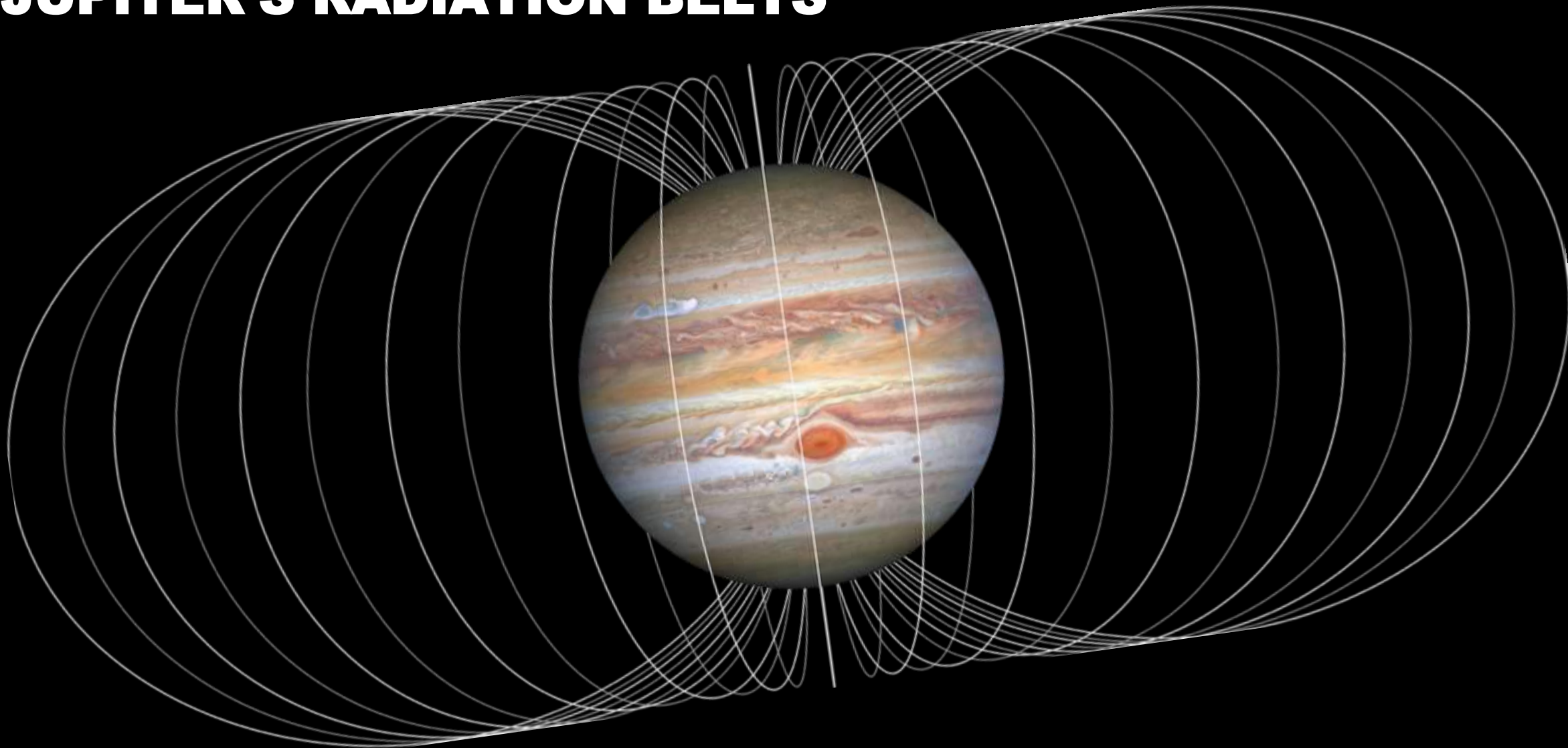


REASON

Ice-penetrating Radar

Source: NASA/ JPL-Caltech

JUPITER'S RADIATION BELTS



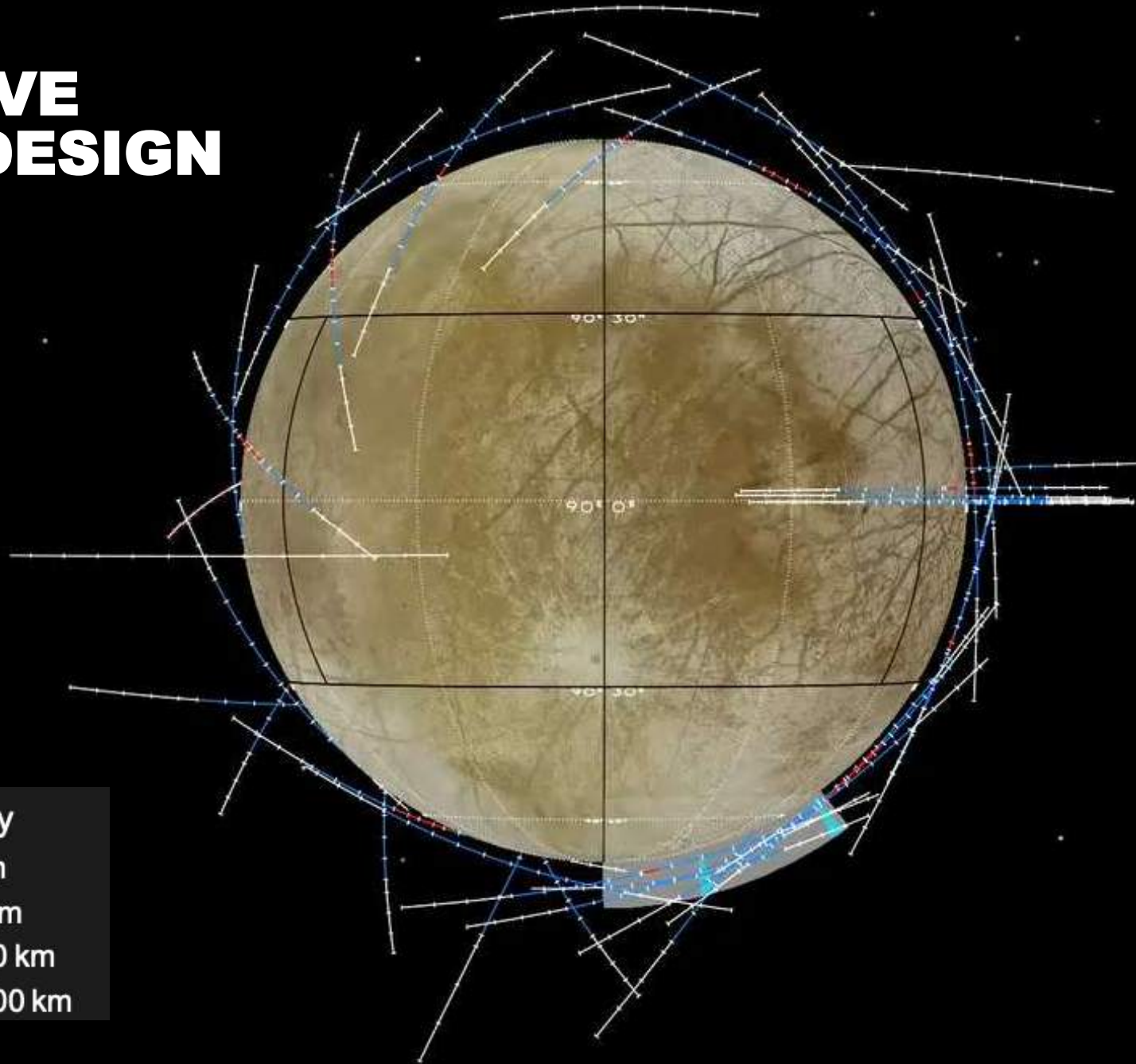
SPACECRAFT RADIATION DOSAGE



Clipper → Jupiter
Distance: 192,450 km
Relative speed: 7.03 km/h



INNOVATIVE MISSION DESIGN



The Deep Space Network

Tracking for navigation



The Deep Space Network

Tracking for navigation

Telemetry for science data
and spacecraft data



The Deep Space Network

Tracking for navigation

Telemetry for science data
and spacecraft data

Commanding



The Deep Space Network

Tracking for navigation

Telemetry for science data
and spacecraft data

Commanding

Radio Science



The Deep Space Network

Tracking for navigation

Telemetry for science data
and spacecraft data

Commanding

Radio Science

VLBI



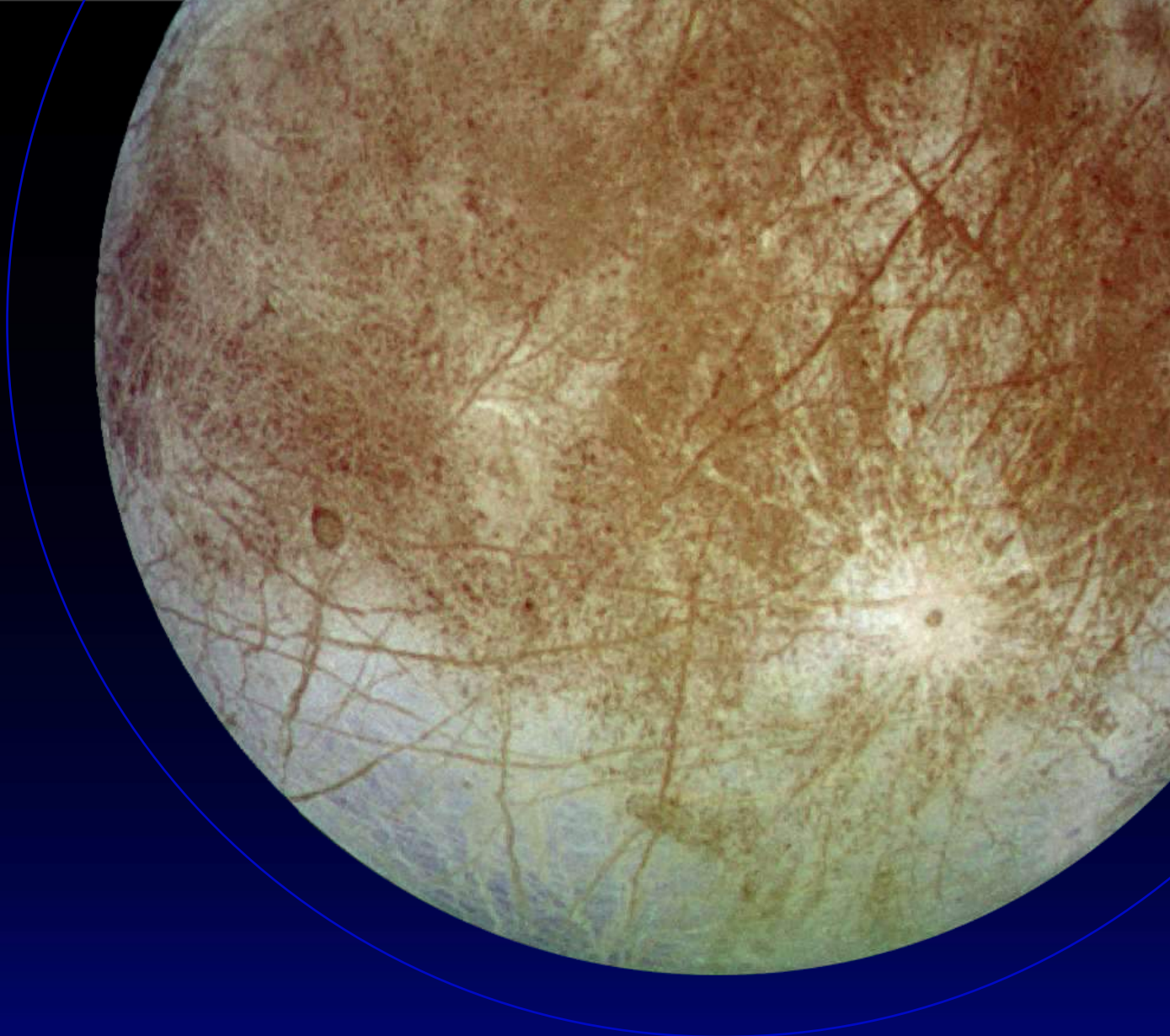
GET INVOLVED

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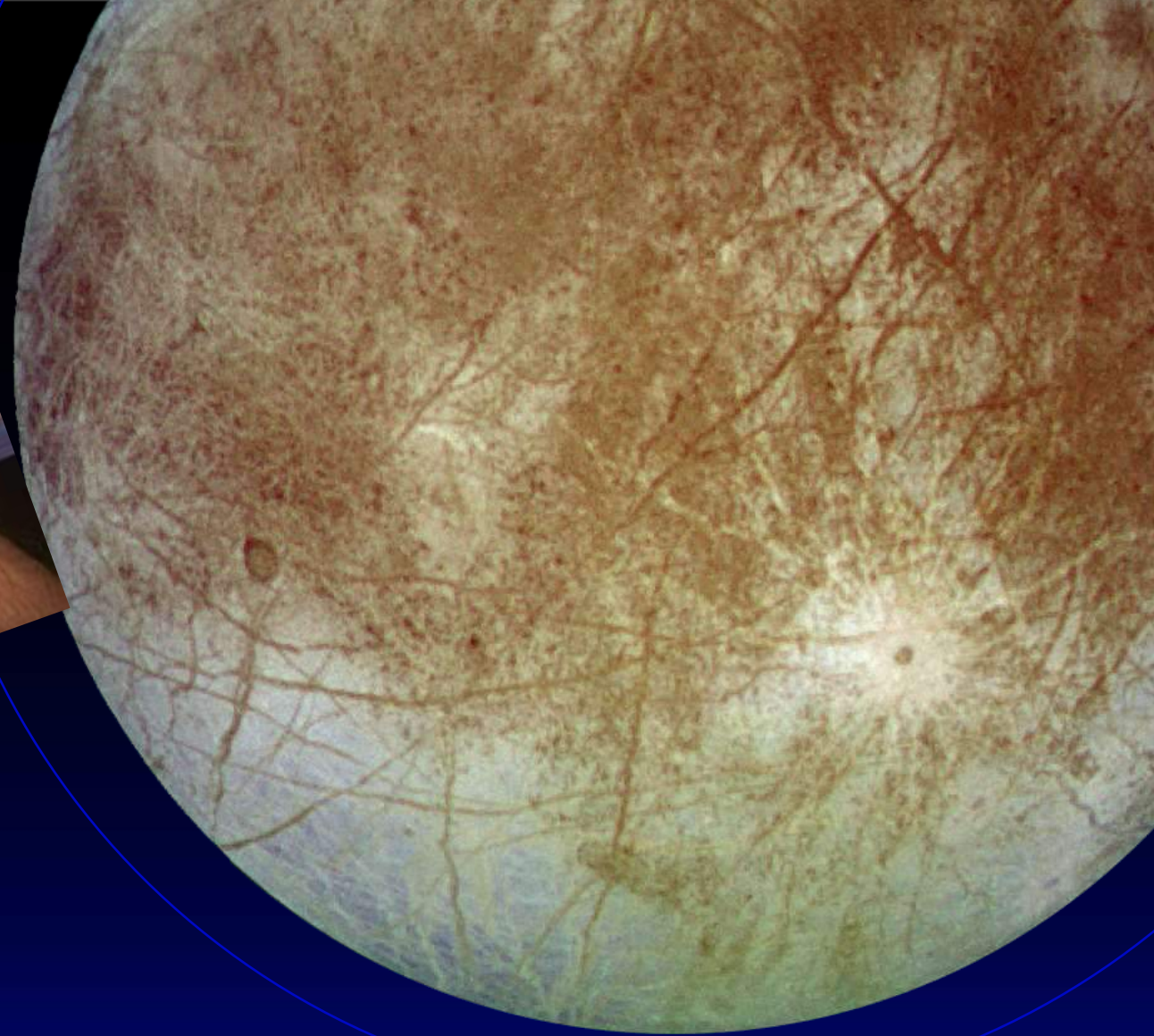
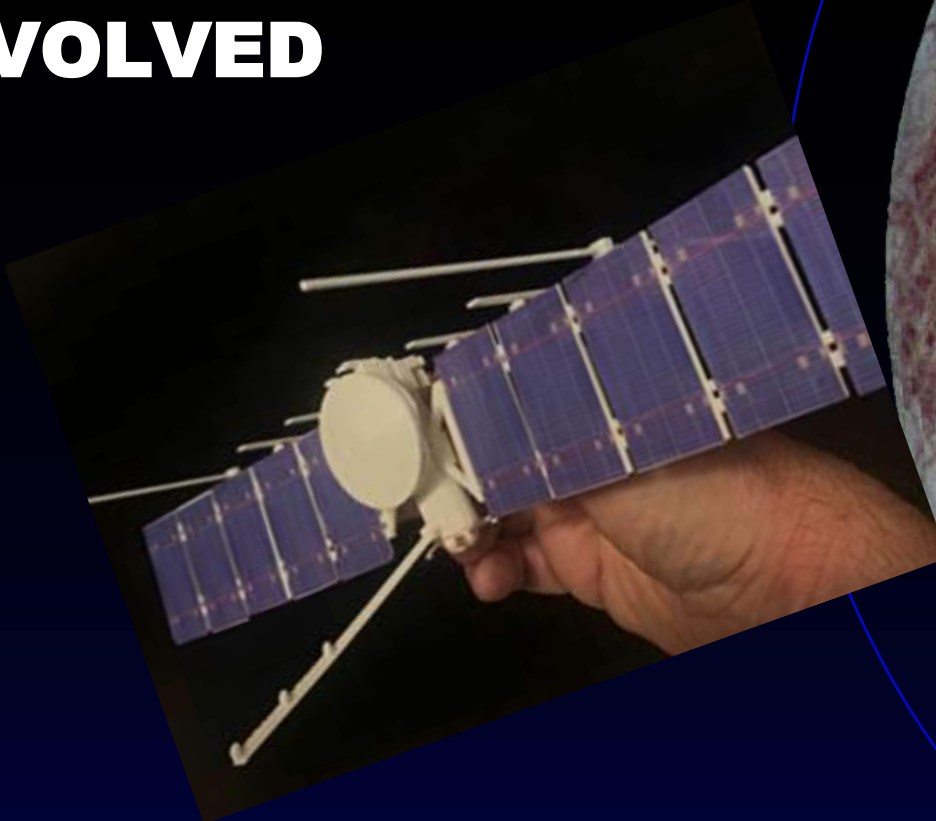
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GET INVOLVED



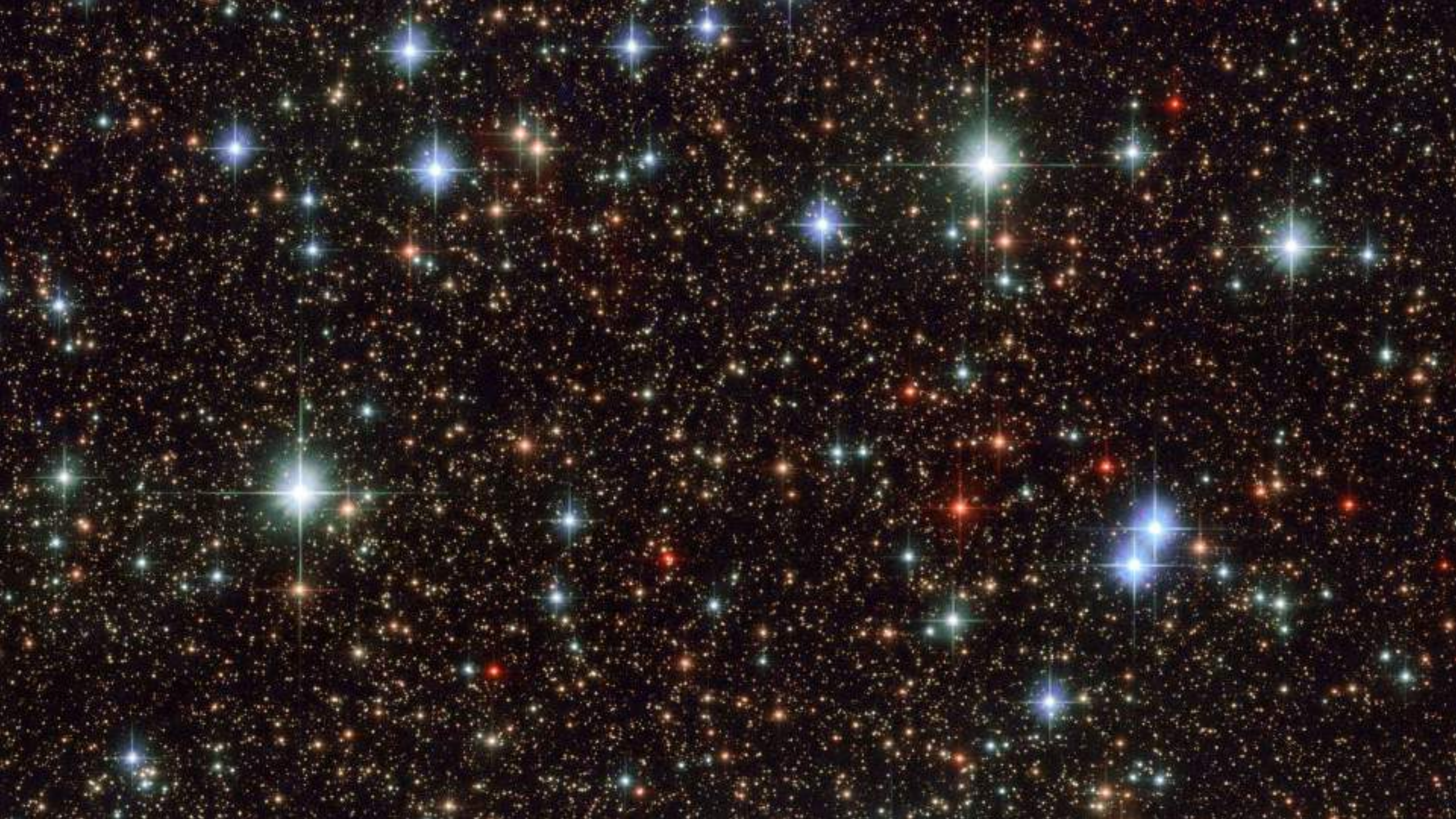
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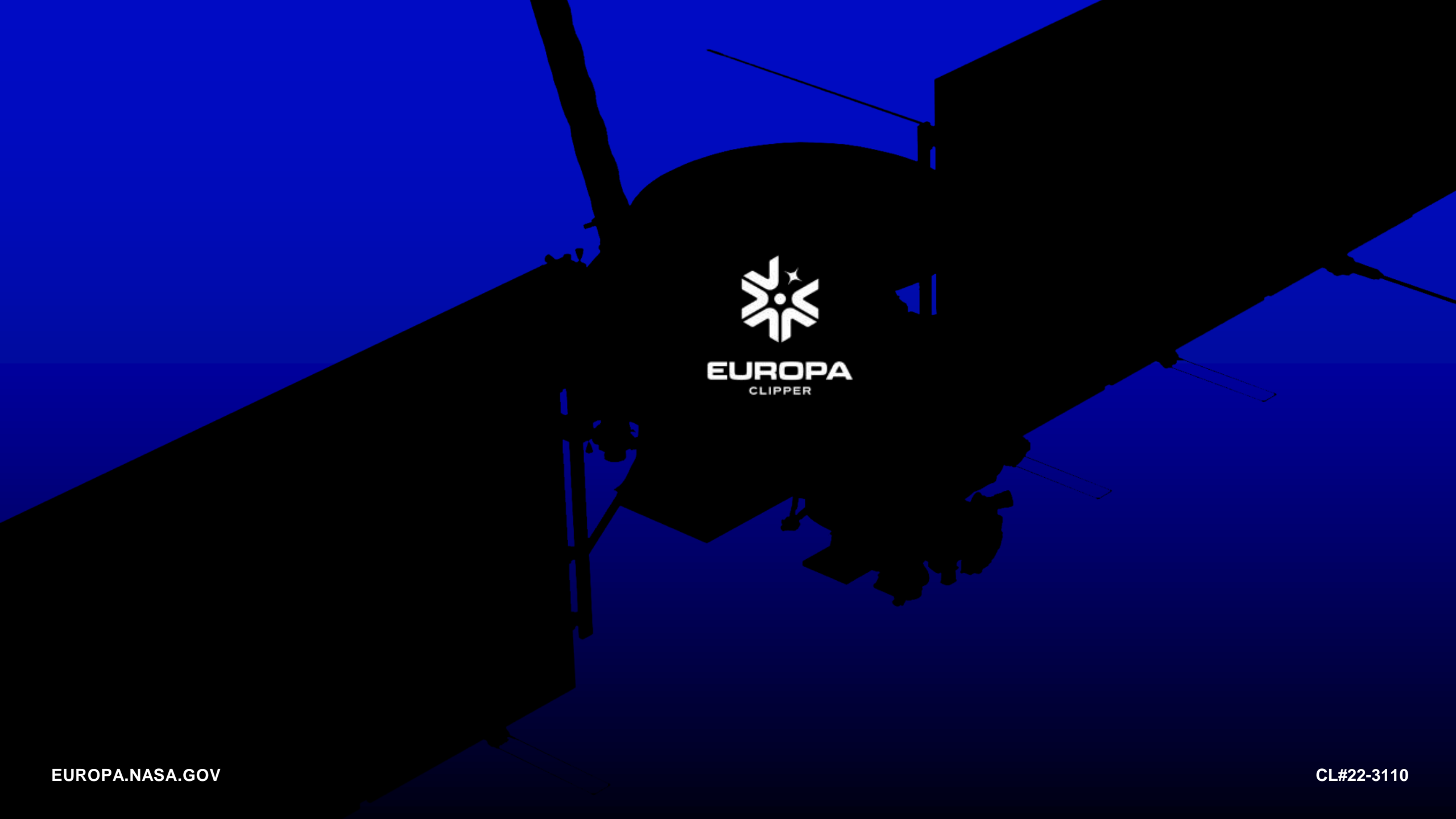
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