

## U.S. Spacesuit Knowledge Capture (KC) Series

**Topic:** The Size of the Universe and Where Will We Go?

This event was recorded June 25, 2010 at NASA Johnson Space Center.

(Video length 57:23)

**Presenter:** B. Mike Lawson

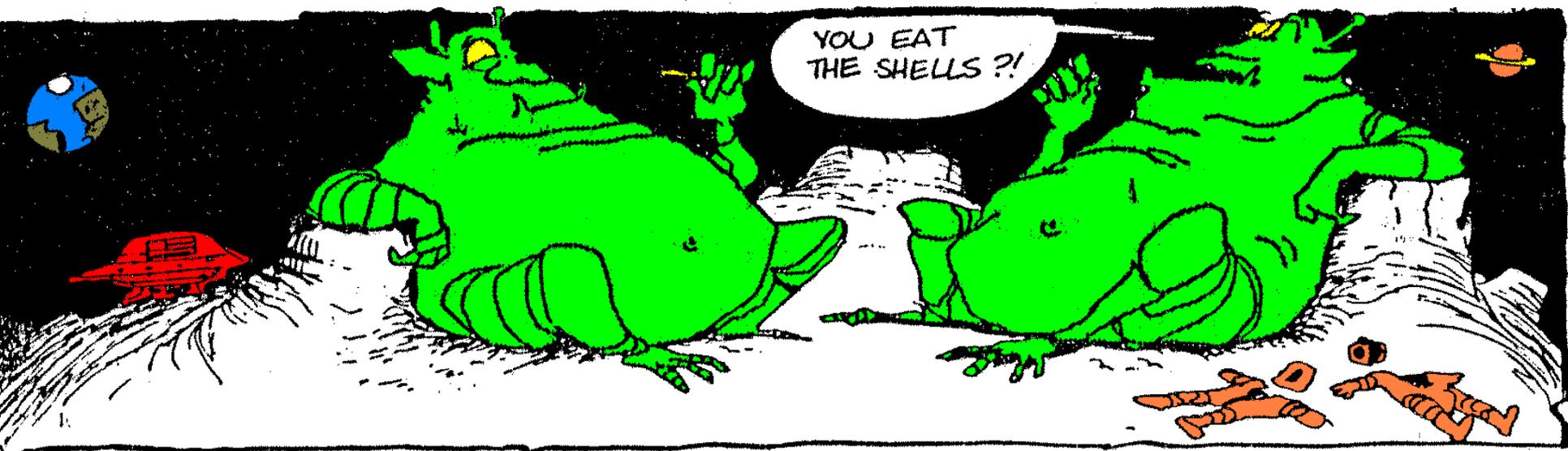
**Synopsis:** As an avid engineer and amateur astronomer, Mike Lawson presented a perspective on the size of the universe and asked the question, “Where will we go?” This was an entry-level overview for the average space worker who really wanted to understand the size of stars and the distance between objects in space. Mike provided information about familiar orbital objects and elaborated more on galaxies during the discussion. He also explored where humans could go in space and the physical limitations of going there.

**Biography:** Mike Lawson graduated from the University of Texas with a master of science in mechanical engineering with an emphasis in heat transfer and thermodynamics. He originally worked for General Dynamics, specializing in the environmental control and heat transfer systems for the F-16 fighter aircraft. He came to work for NASA in 1980 and worked on Extravehicular Activity (EVA), thermal and environmental control, and life support systems.

*(Mike Lawson retired from NASA December 2010.)*

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YOU EAT THE SHELLS ?!

# How Big are We ?







Jupiter

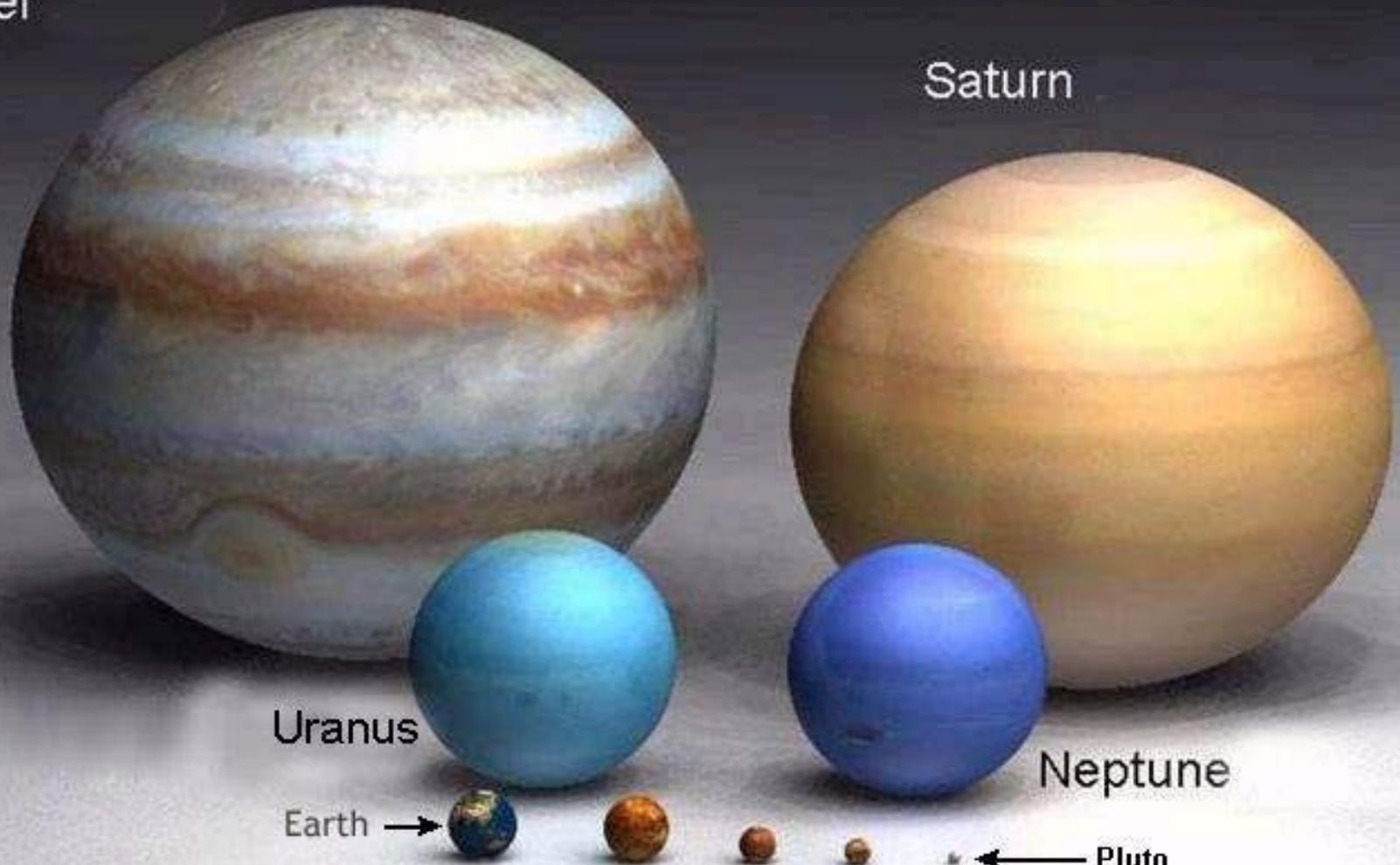
Saturn

Uranus

Neptune

Earth

Pluto



Sun



Jupiter



Earth

Pluto



Sun



Sirius



Pollux



Arcturus

Jupiter is about 1 pixel in size

Earth is invisible at this scale



Betelgeuse



Antares



Rigel

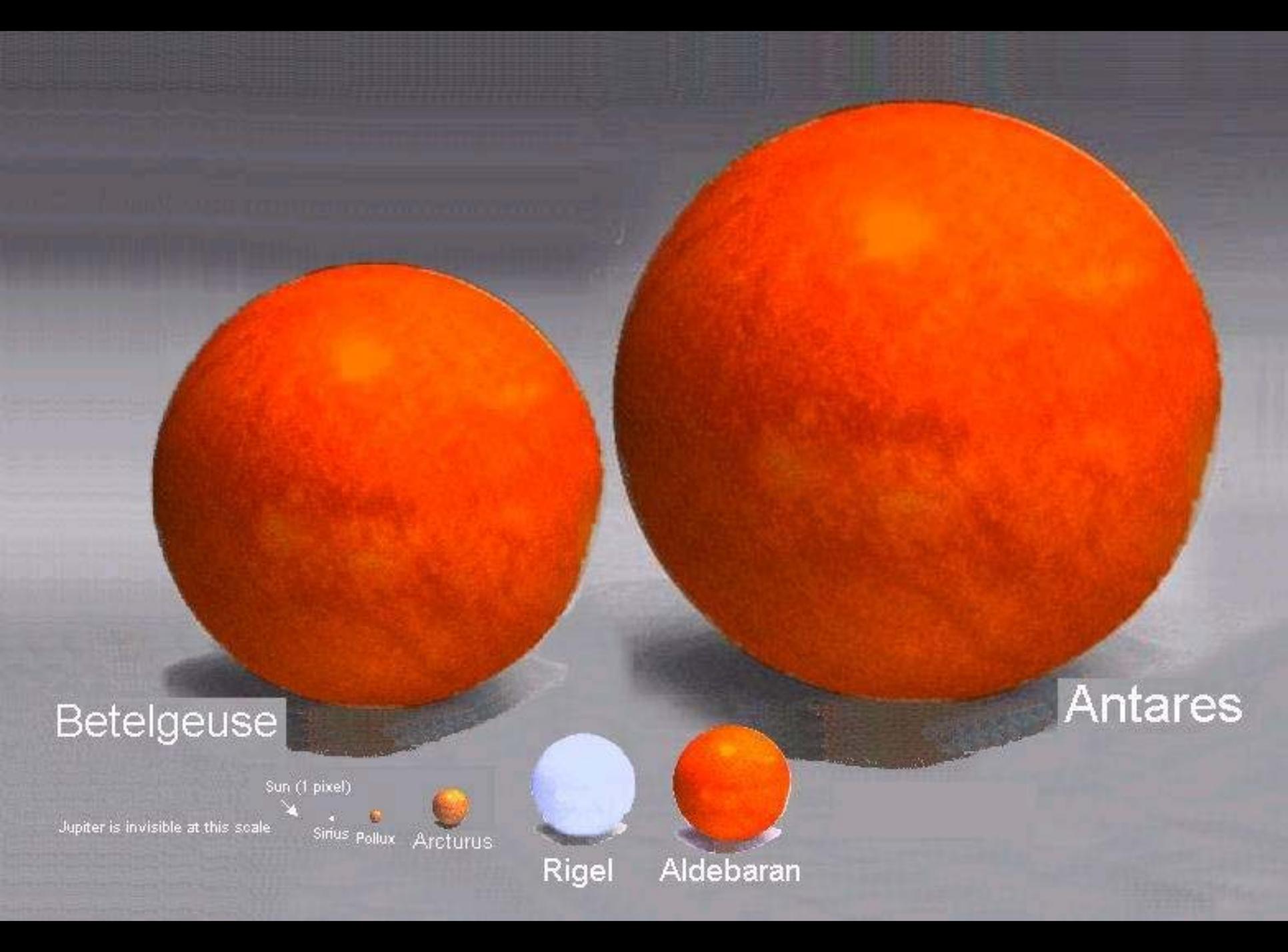


Aldebaran

Sun (1 pixel)

Jupiter is invisible at this scale

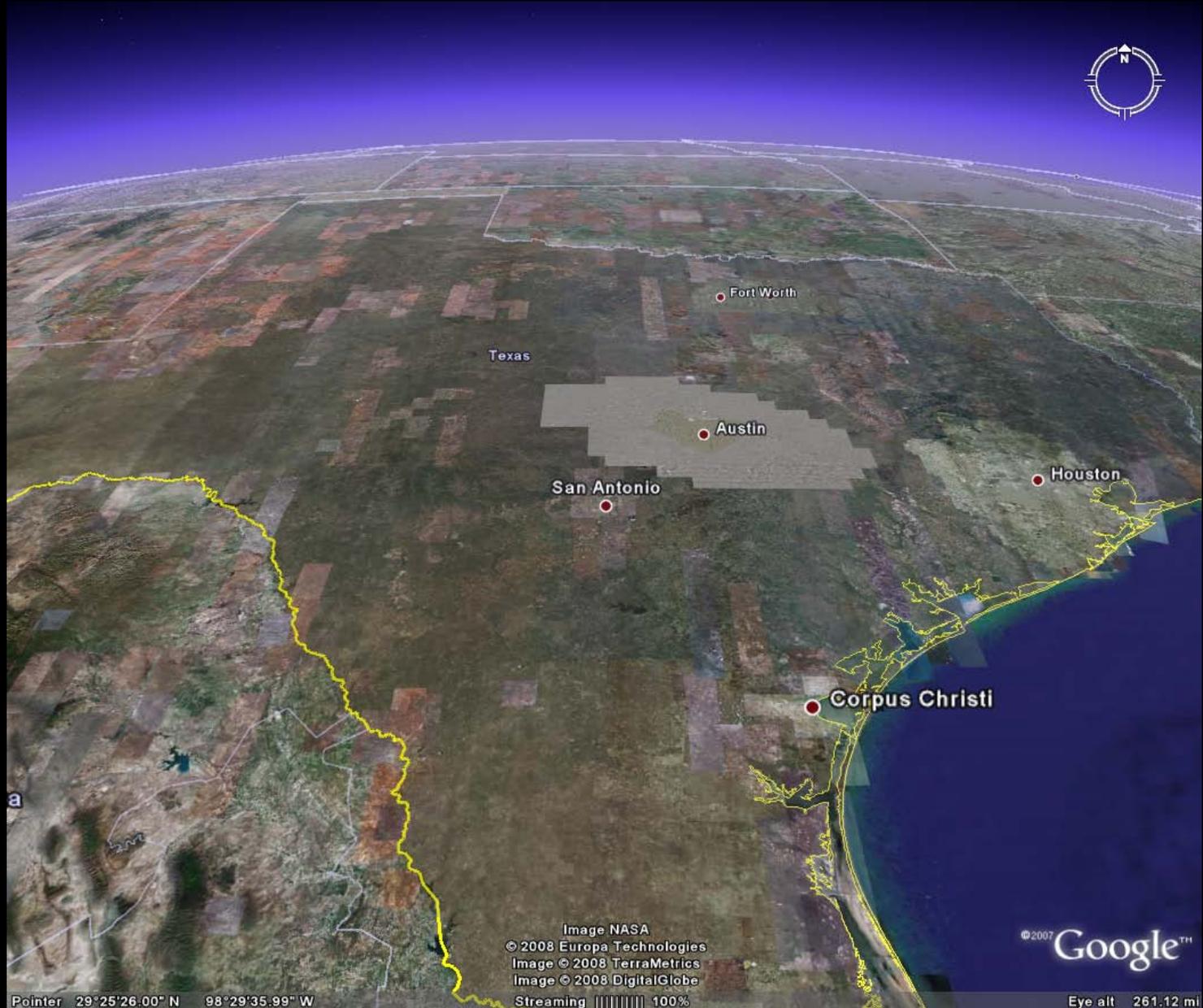
Sirius Pollux Arcturus



# Conclusions

- **We are small !**
- **Our Star is wimpy !**

# Where do we live?





# Earth Travel

LightSpeed

Physical Body Max

Best today

7.5 times  
around the Earth  
In one second

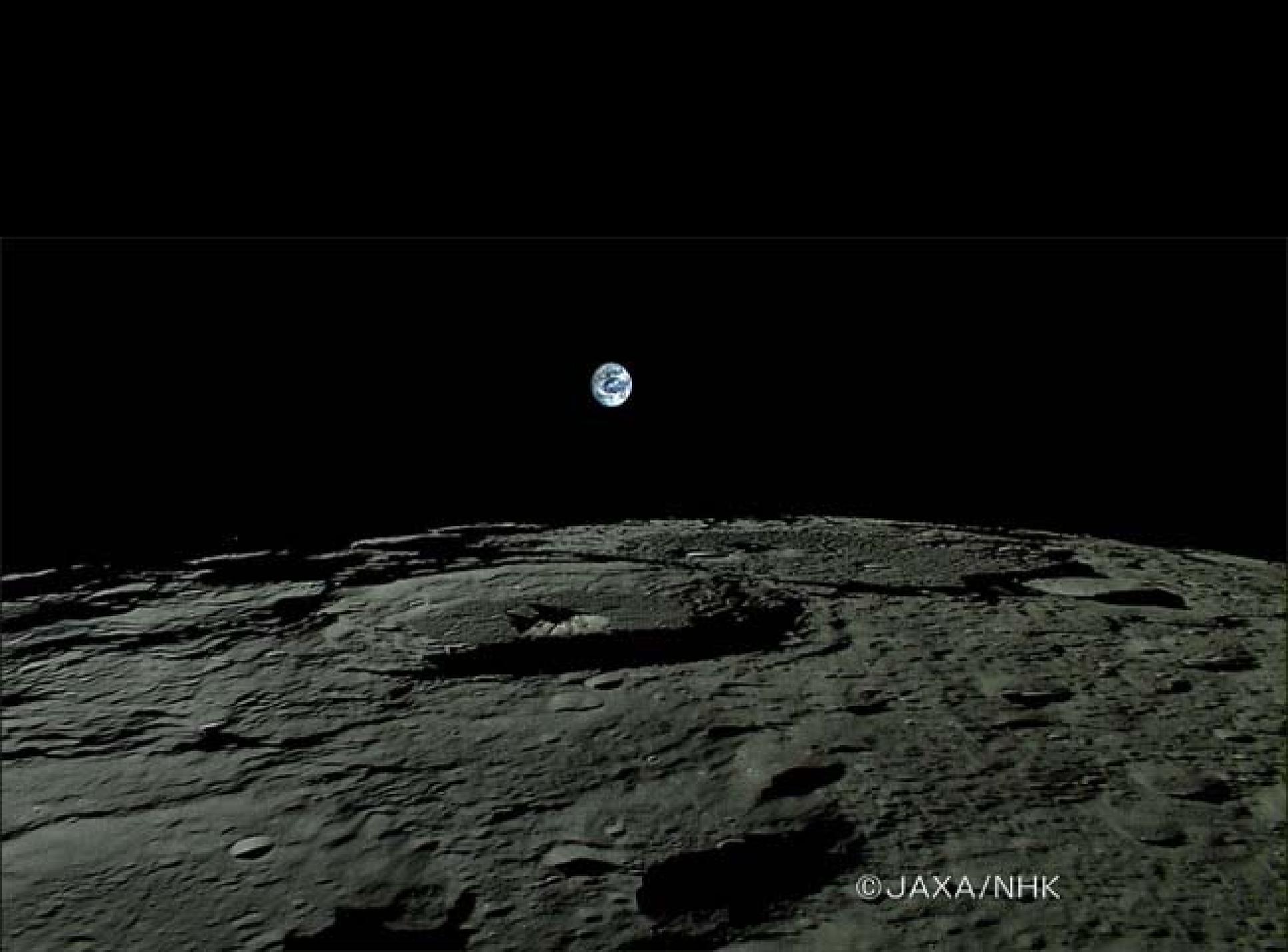
1G      2G  
1.12 Hours    47.8 minutes

2 hours

3 G      5G  
39 minutes    30.26minutes

# Speed of Light

- Earth Orbit .00268 % the speed of light
- Lunar trip .00375 % the speed of light



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# Lunar Travel

Light Speed

1.3 seconds

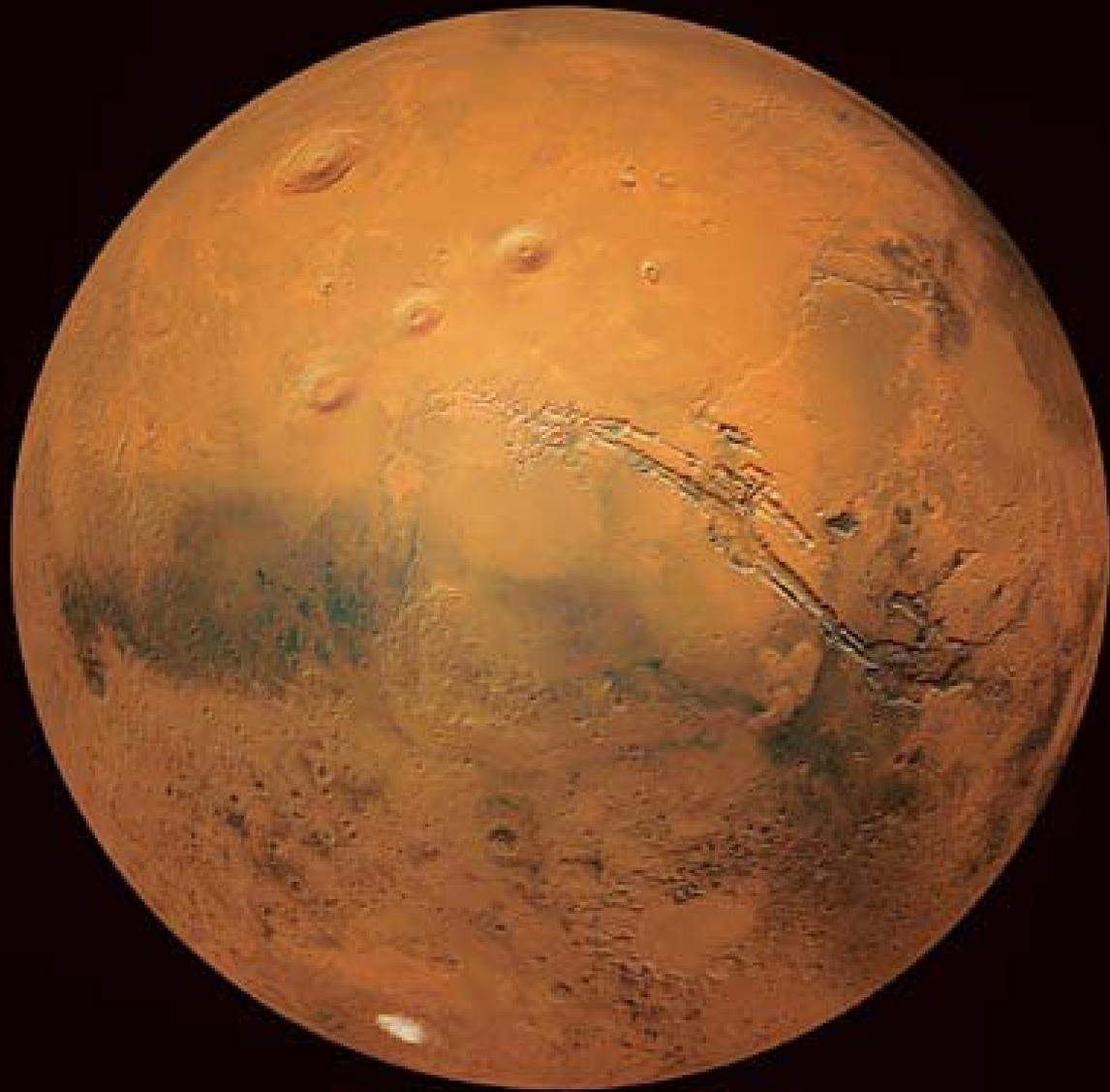
Physical Body Max

1G  
3.56 Hours

2G  
2.46 Hours

Best today

3 days



# Mars Travel

Light Speed	Physical Body Max		Best today
	1G	2G	
12.6 minutes	2.06 days	1.46 days	6 months
4 minutes			
21 minutes			

Jupiter

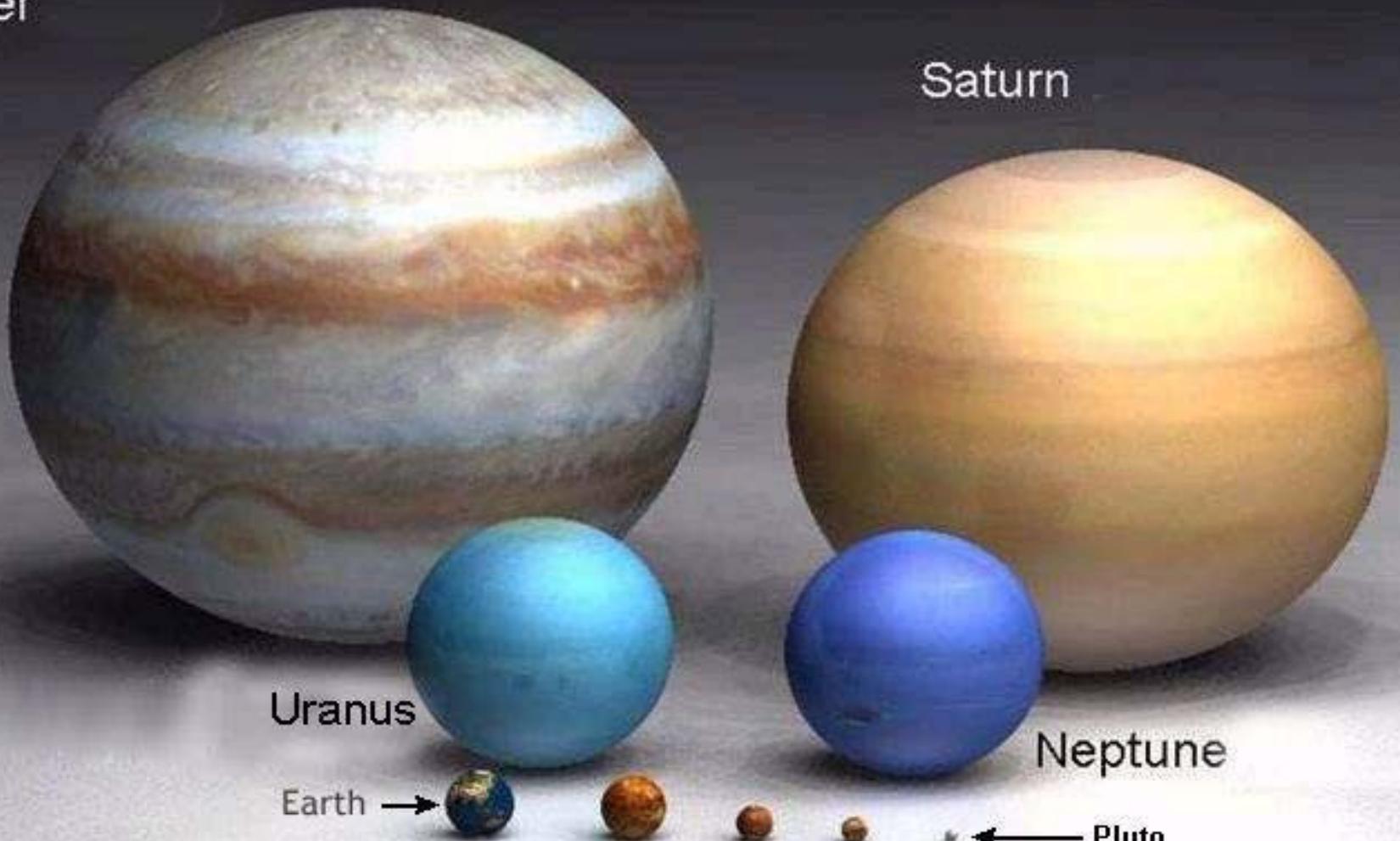
Saturn

Uranus

Neptune

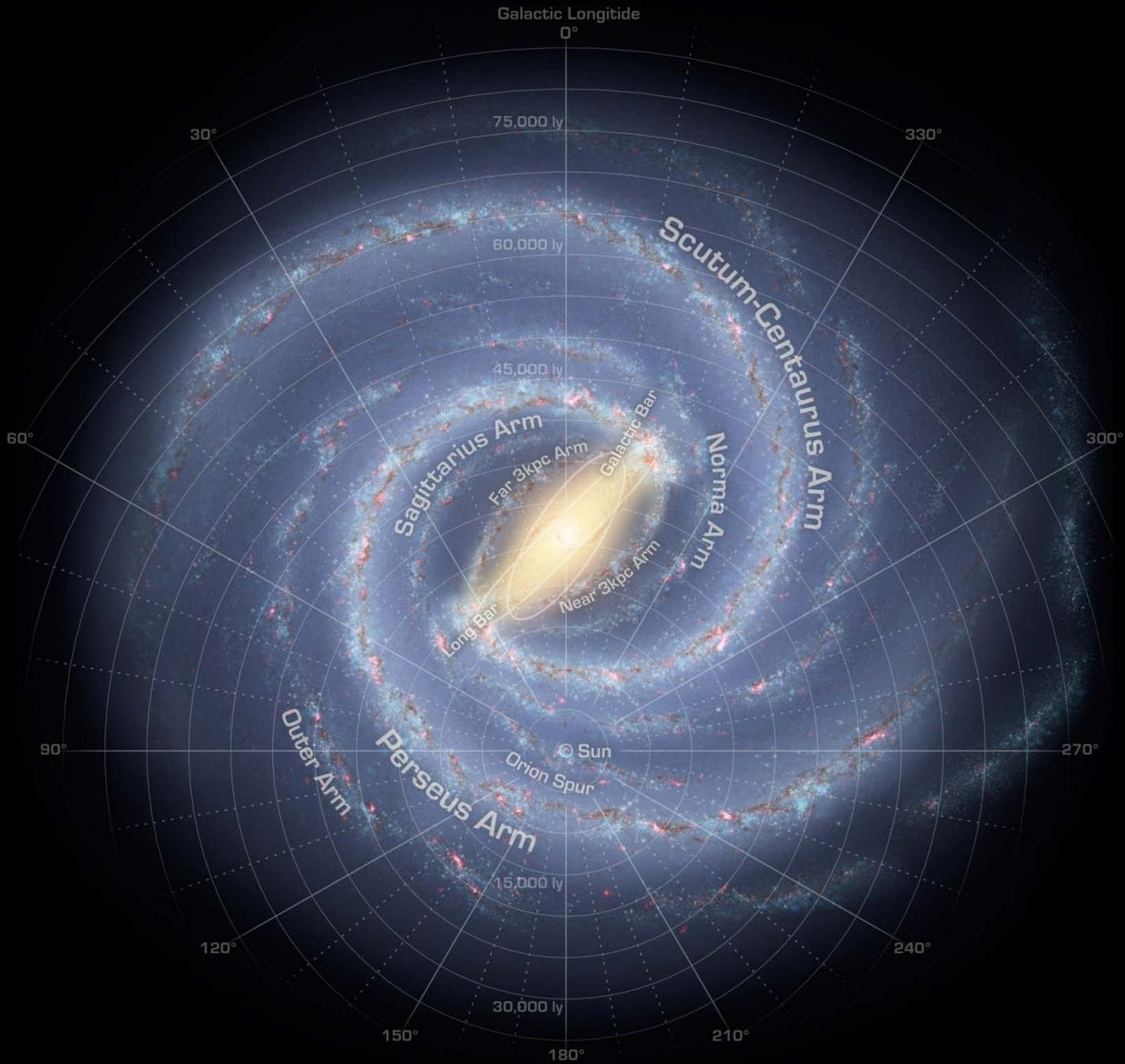
Earth

Pluto



# Outer Solar System Travel

	Light Speed	Physical Body Max	
		1G	2G
Jupiter	43.2 minutes	5.86 days	4.14 days
Saturn	1.3 hours	8.33 days	5.91 days
Pluto	5.5 hours	17.7 days	12.5 days



# Inter-Stellar Travel

Light Speed

Physical Body Max

Nearest Star

4.3 years

Takes 353 days to  
reach near light  
speed\*\*

Nearest Star (life?)

20-40 years

Edge of our Galaxy

15,000 years

Neighbor Galaxy

2.5 million years

Universe

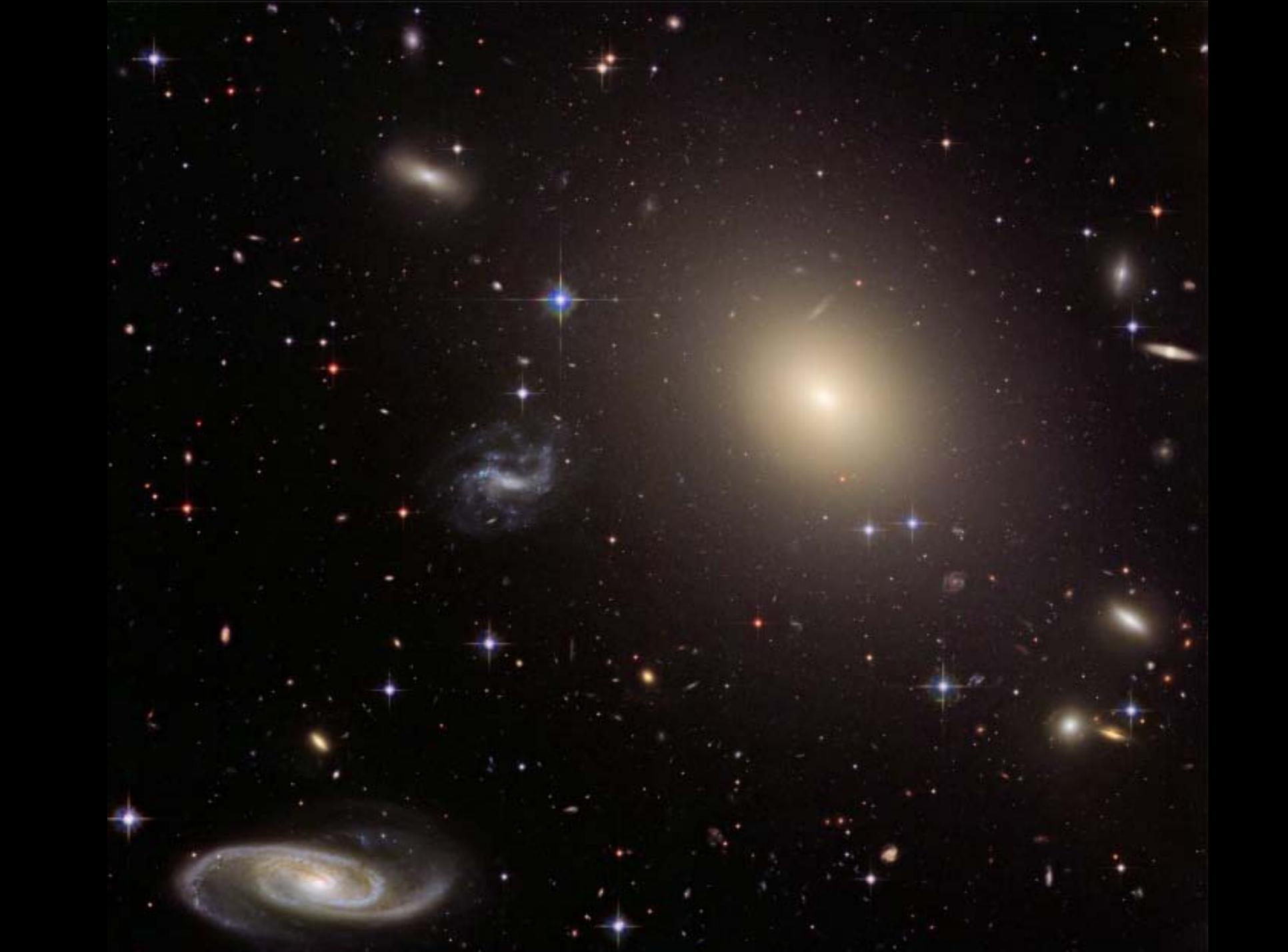
27-45\* billion years

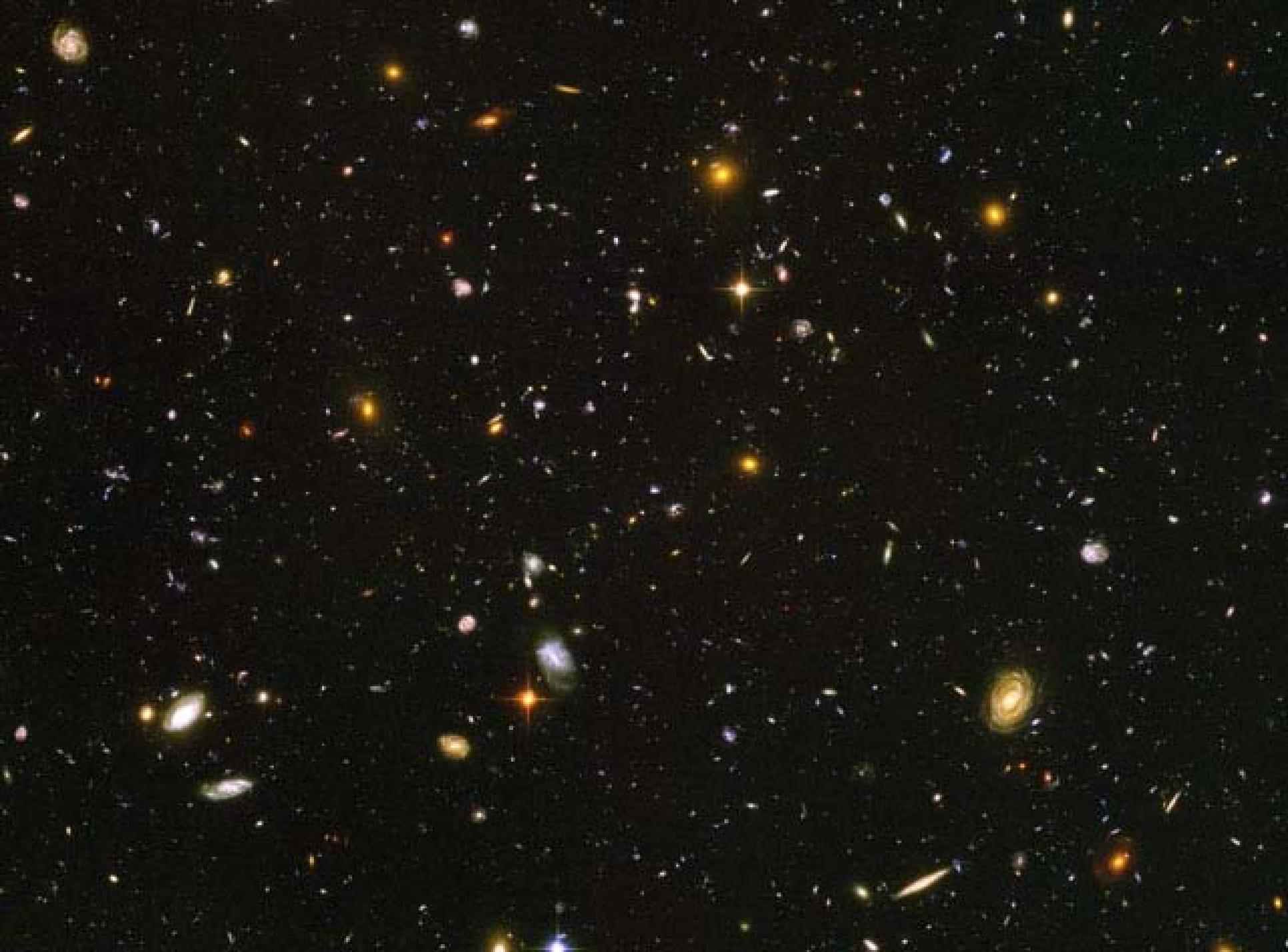












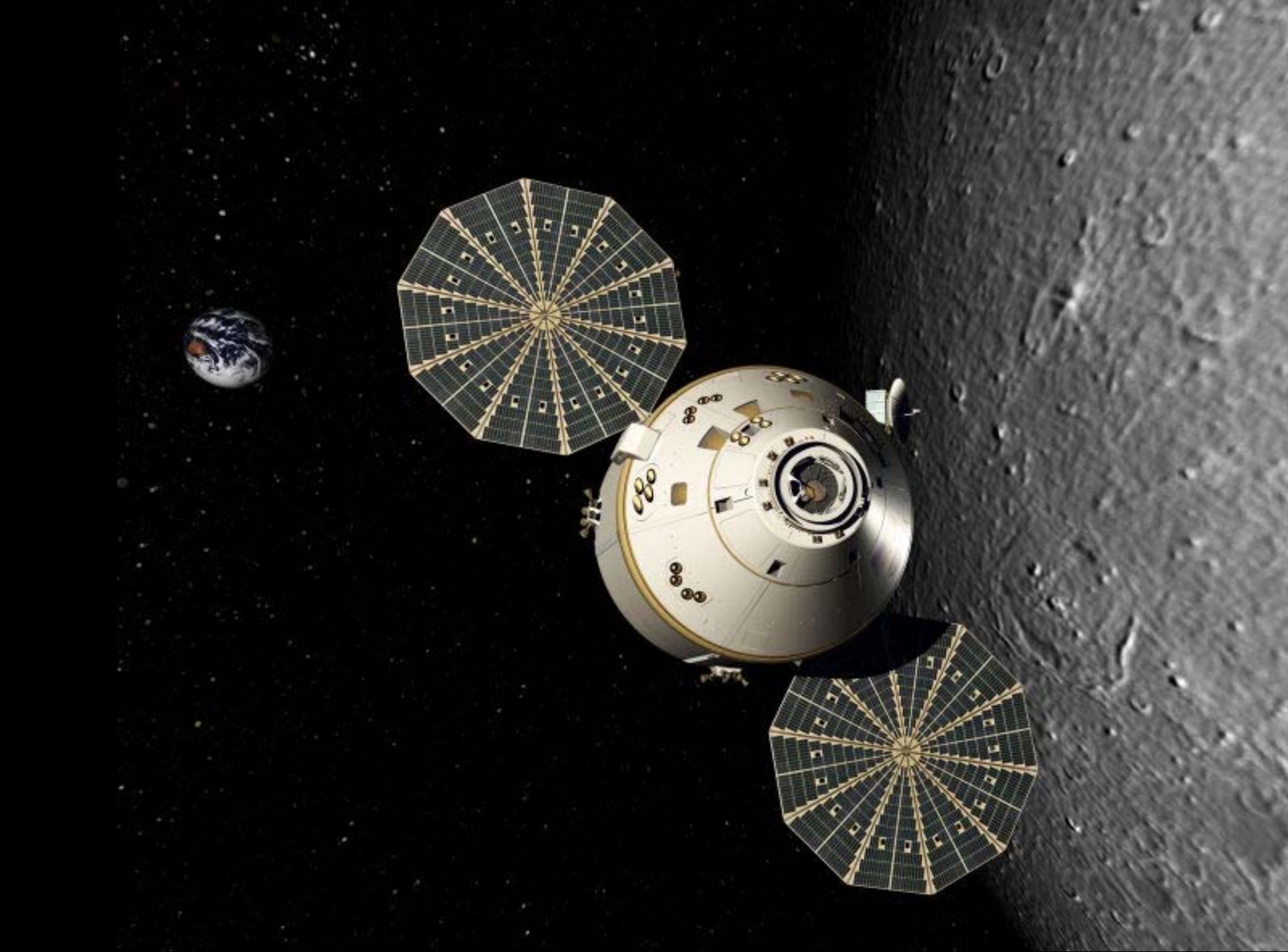


**Is This Universe We live in Big?**

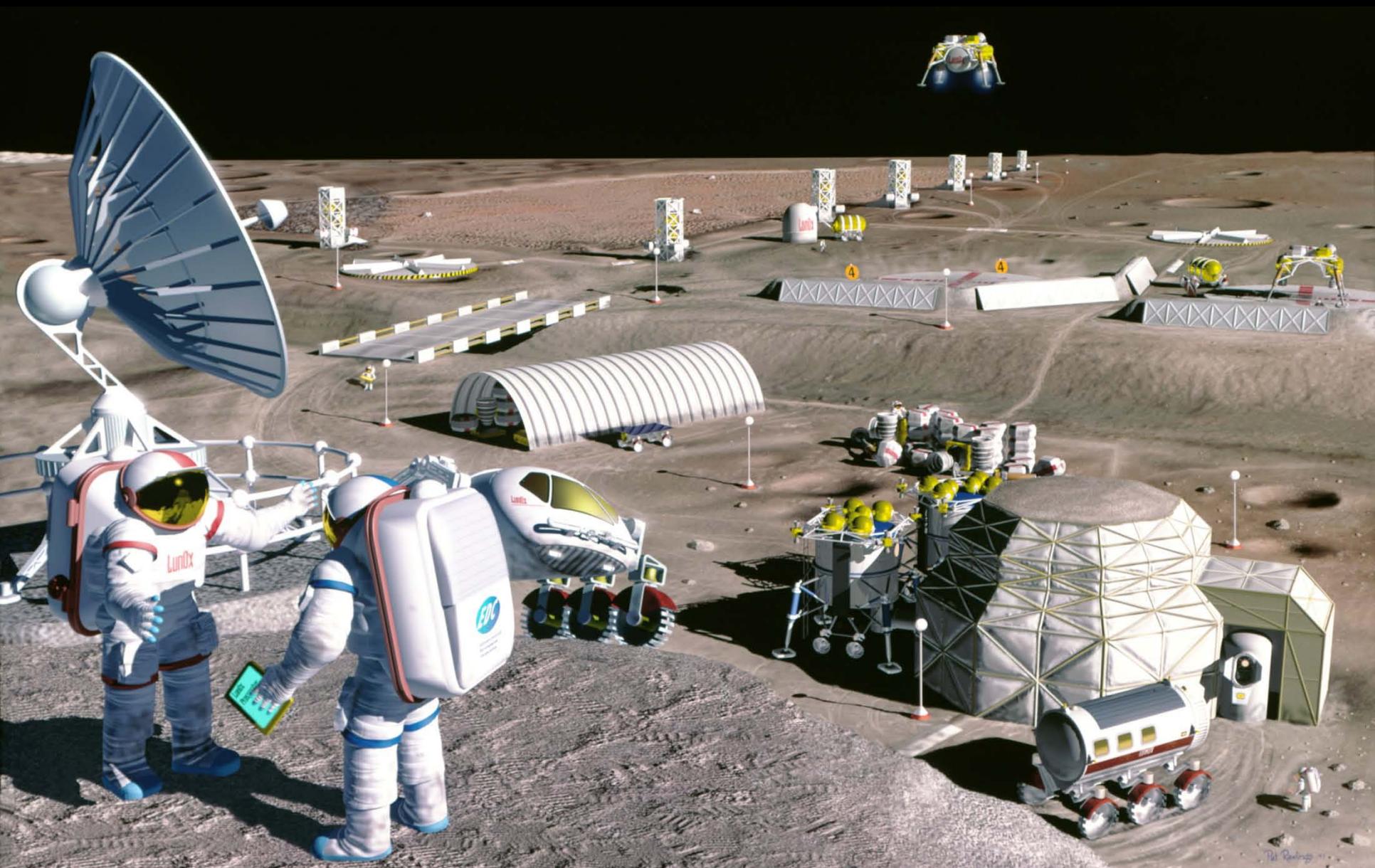
**It's Gigantic!**

# Where will we go ?

1. Moon
2. Asteroid
3. Mars
4. Europa/Ganymede
5. Enceladus/Titan
6. Alpha Centuri

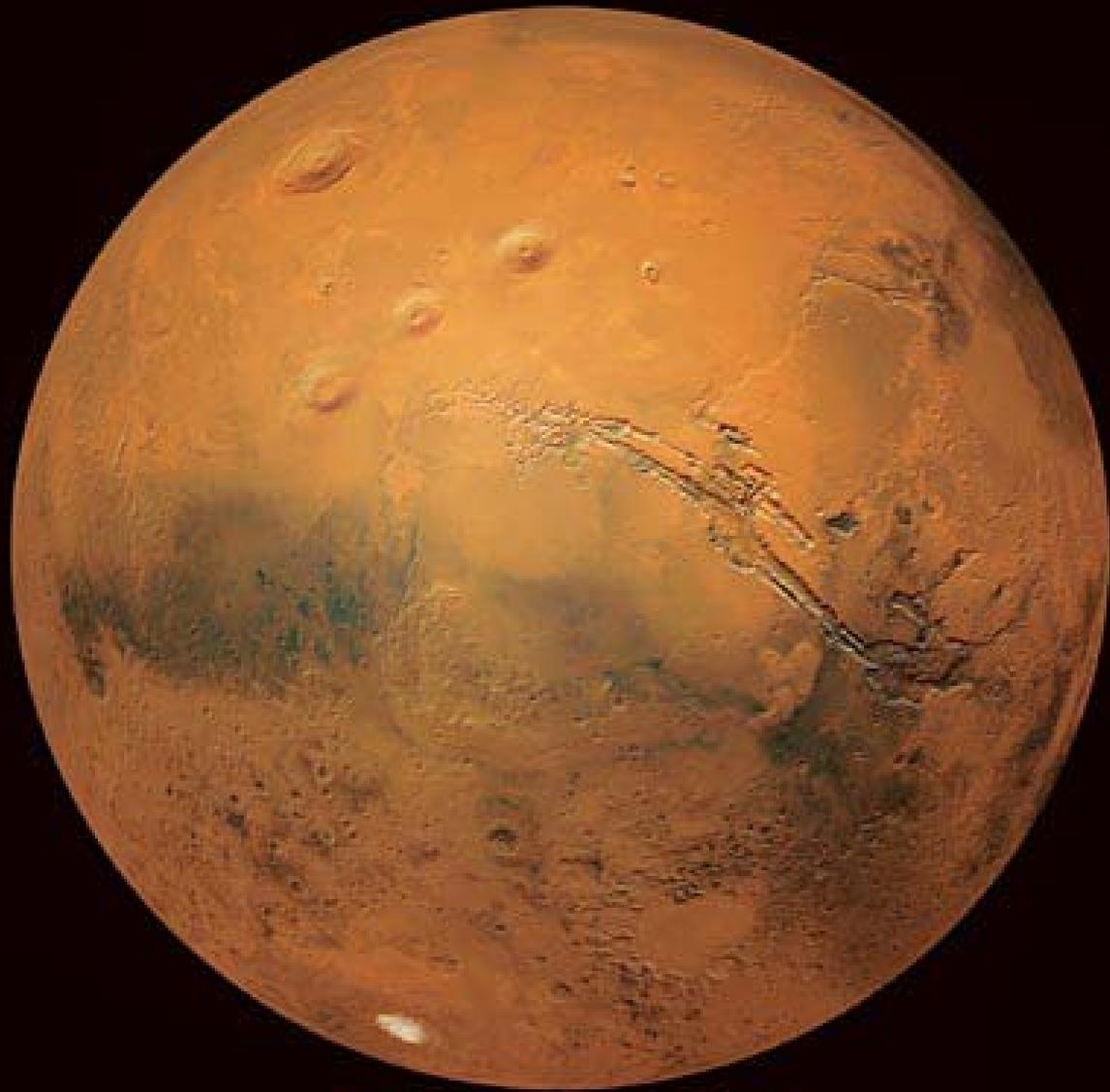


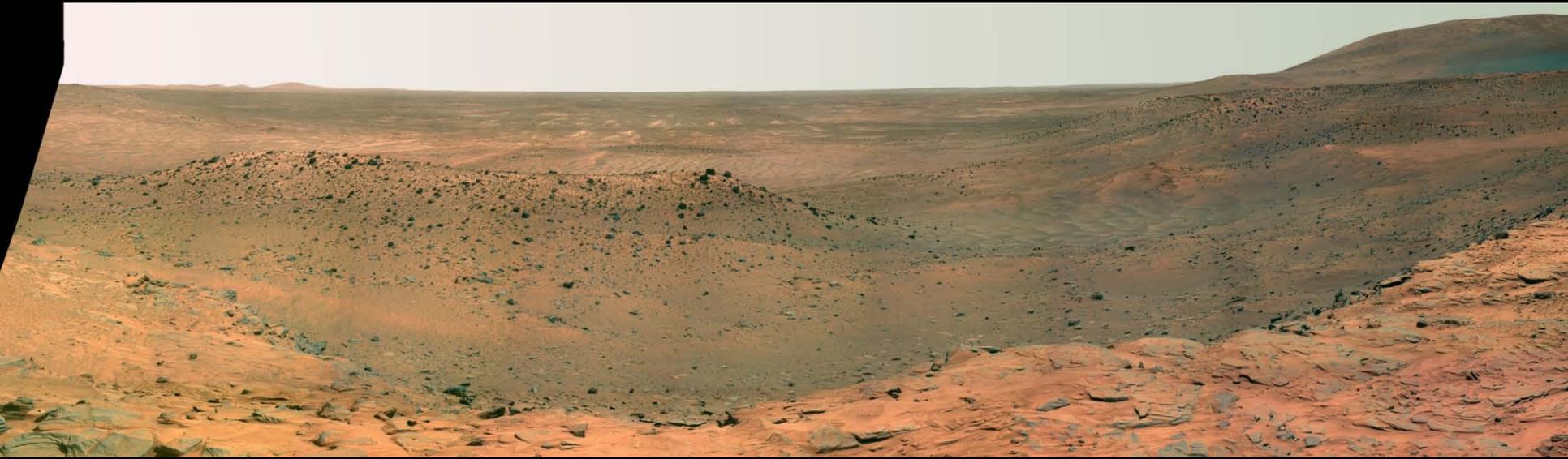




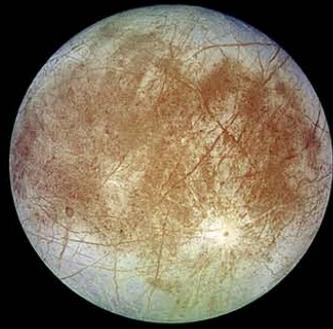
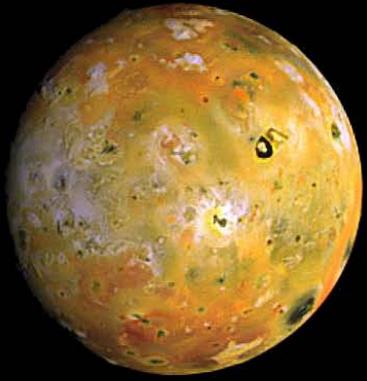


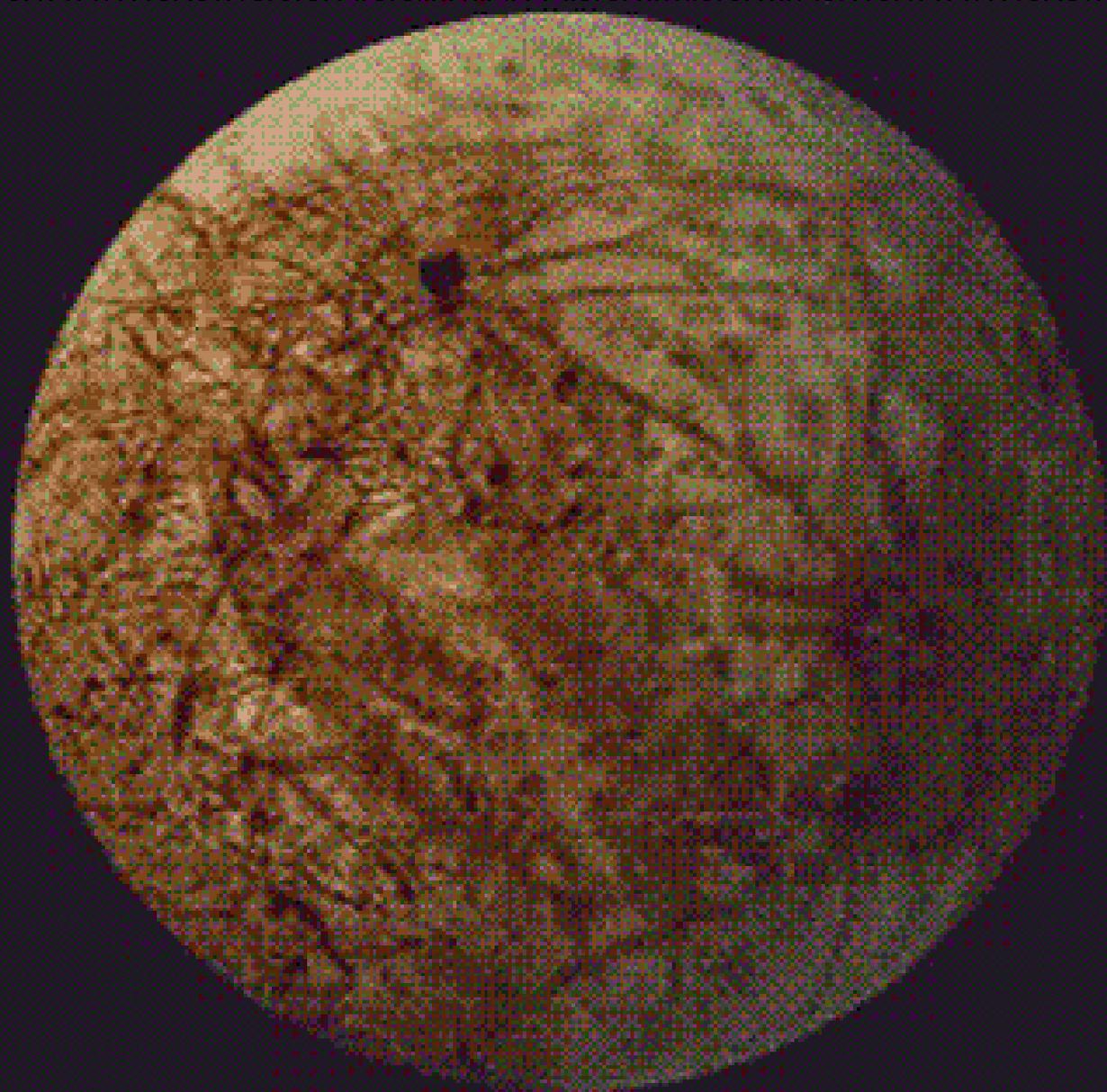


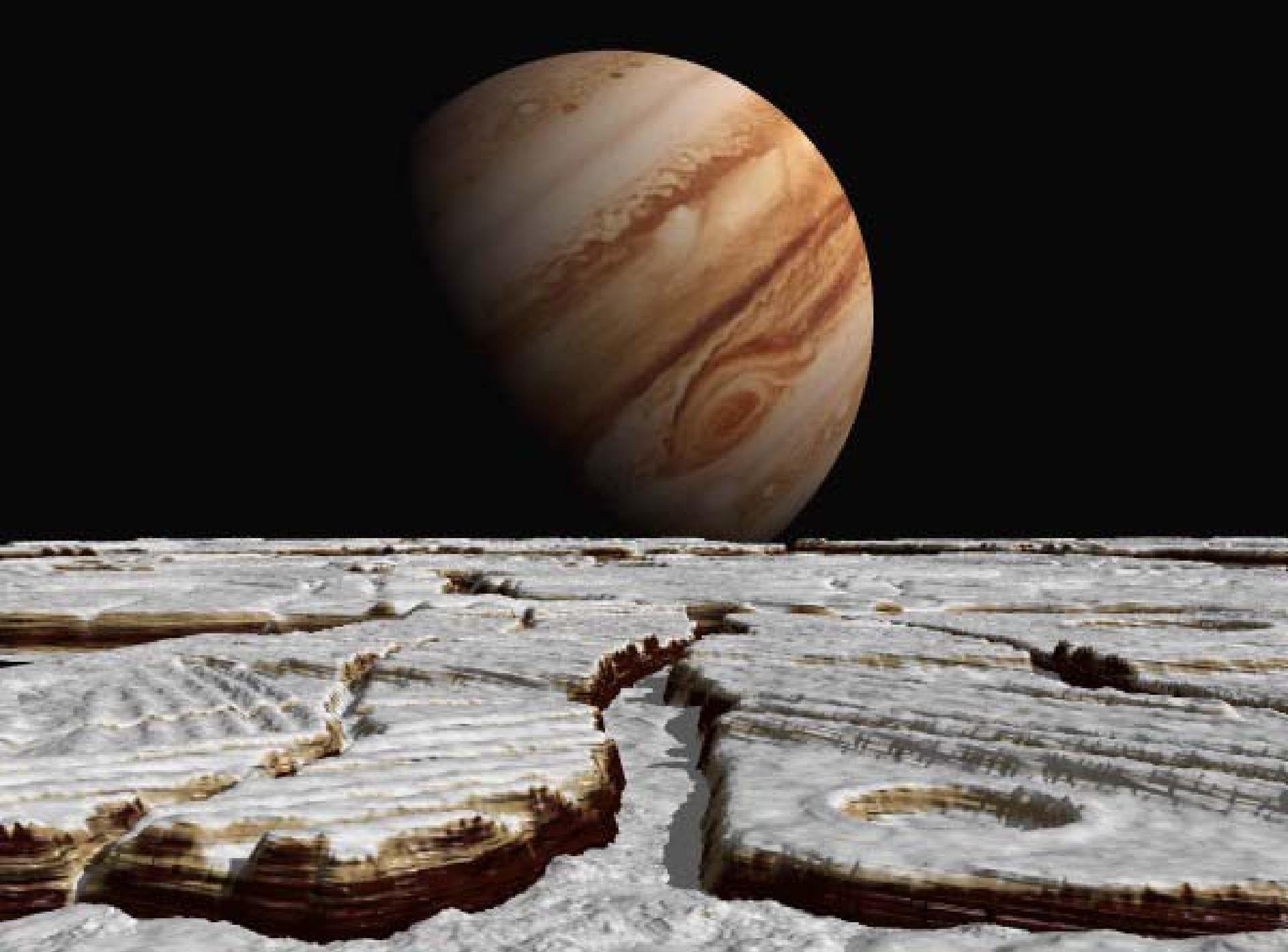






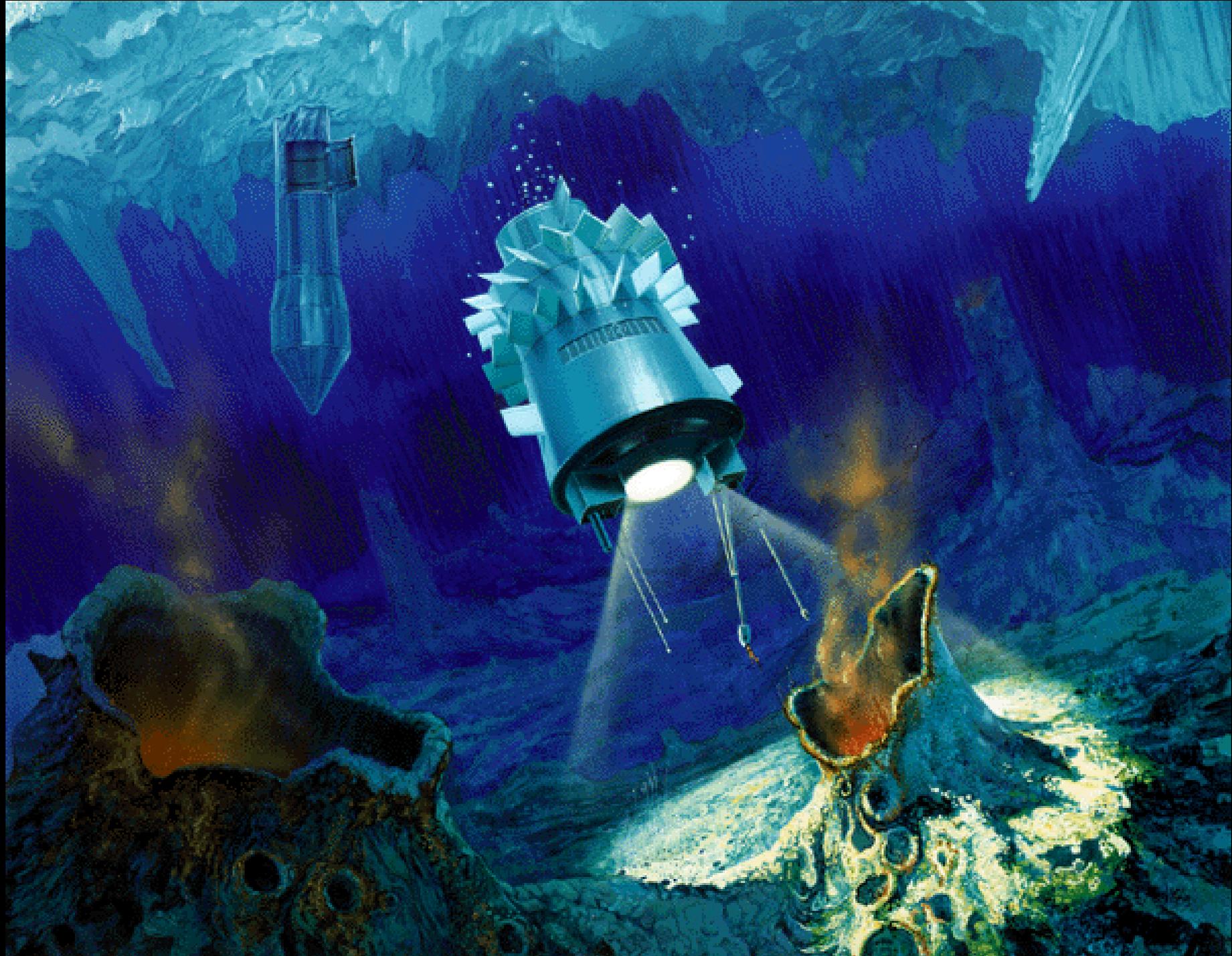








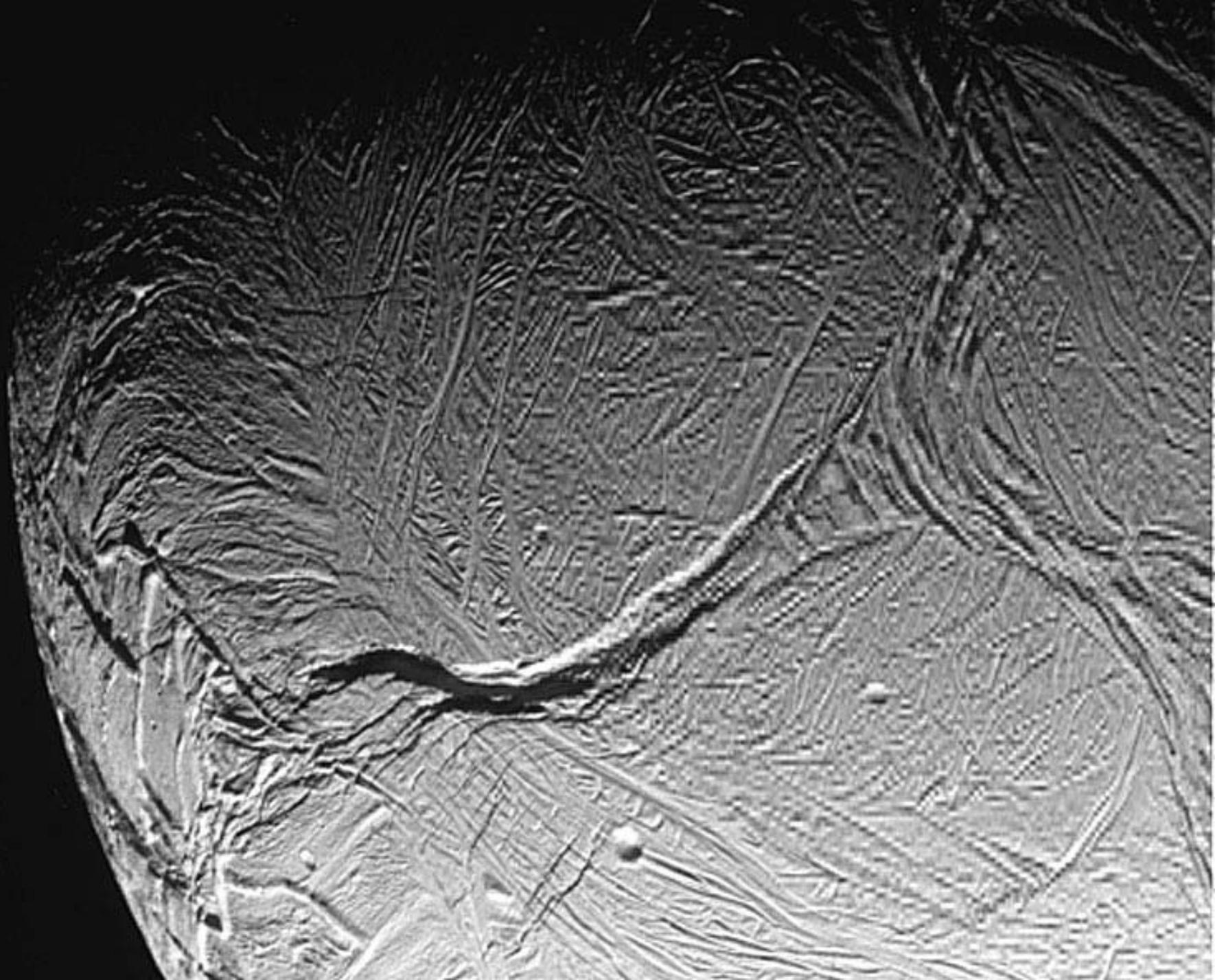
Joe Bergeron © 1997

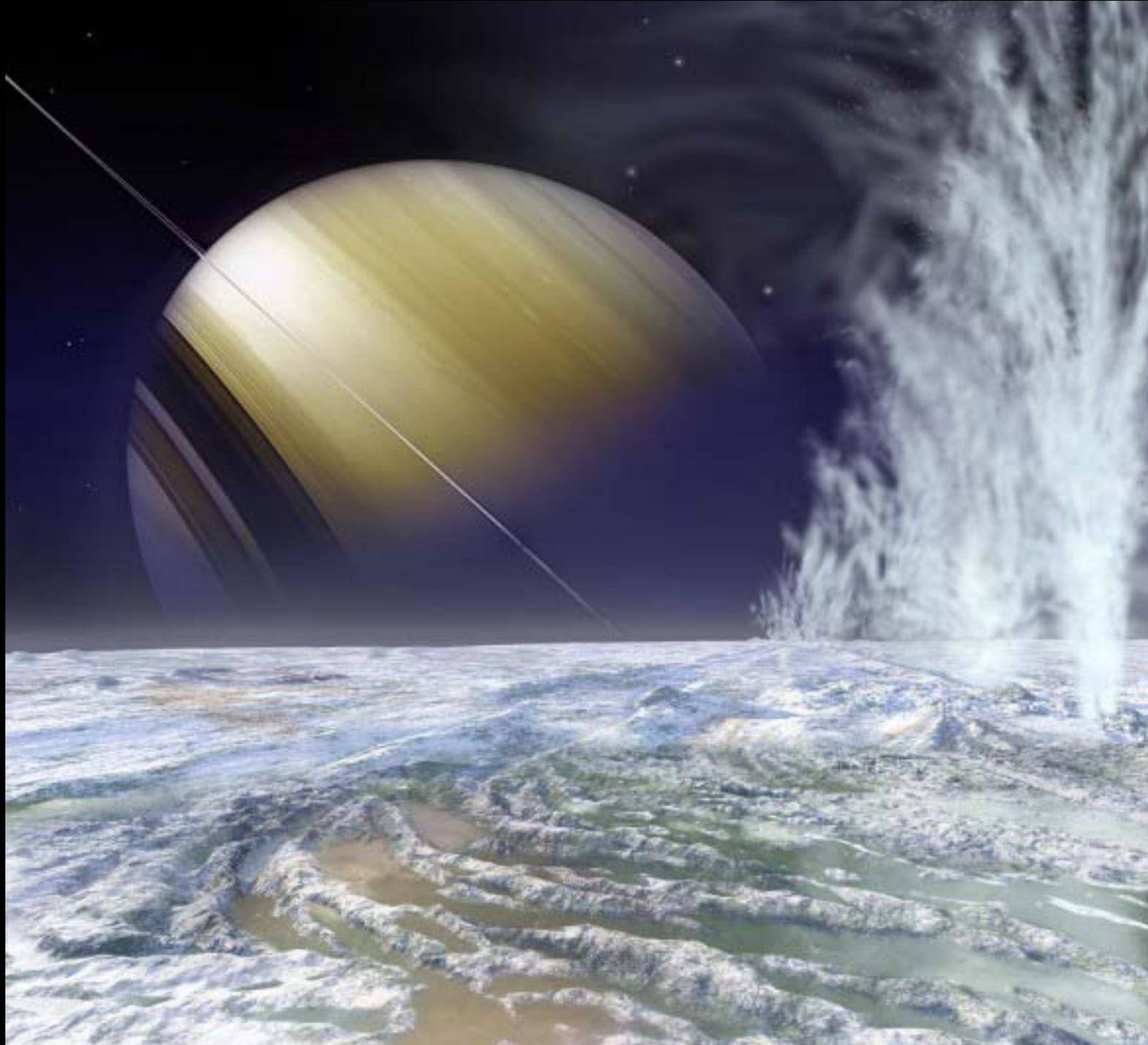






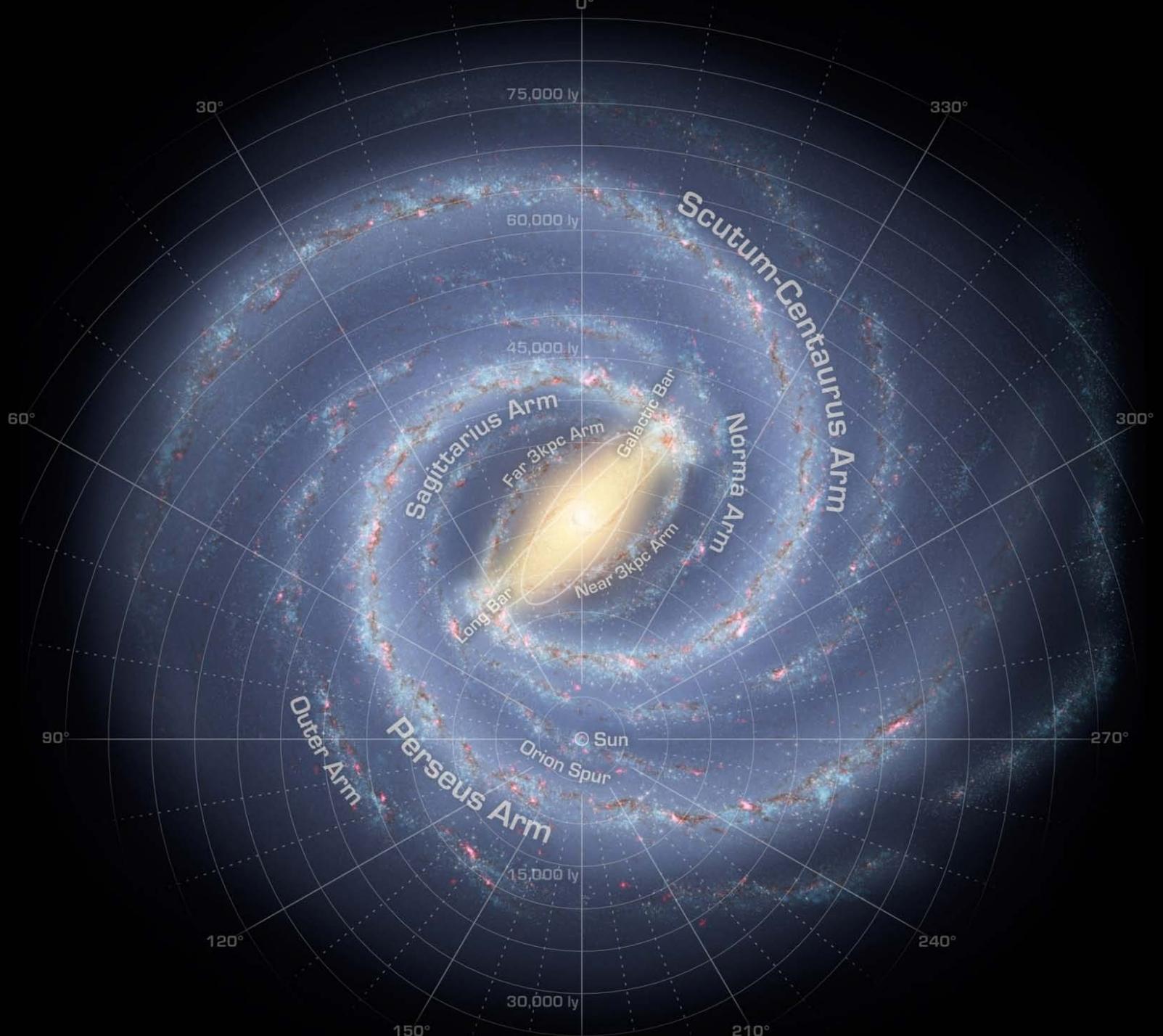


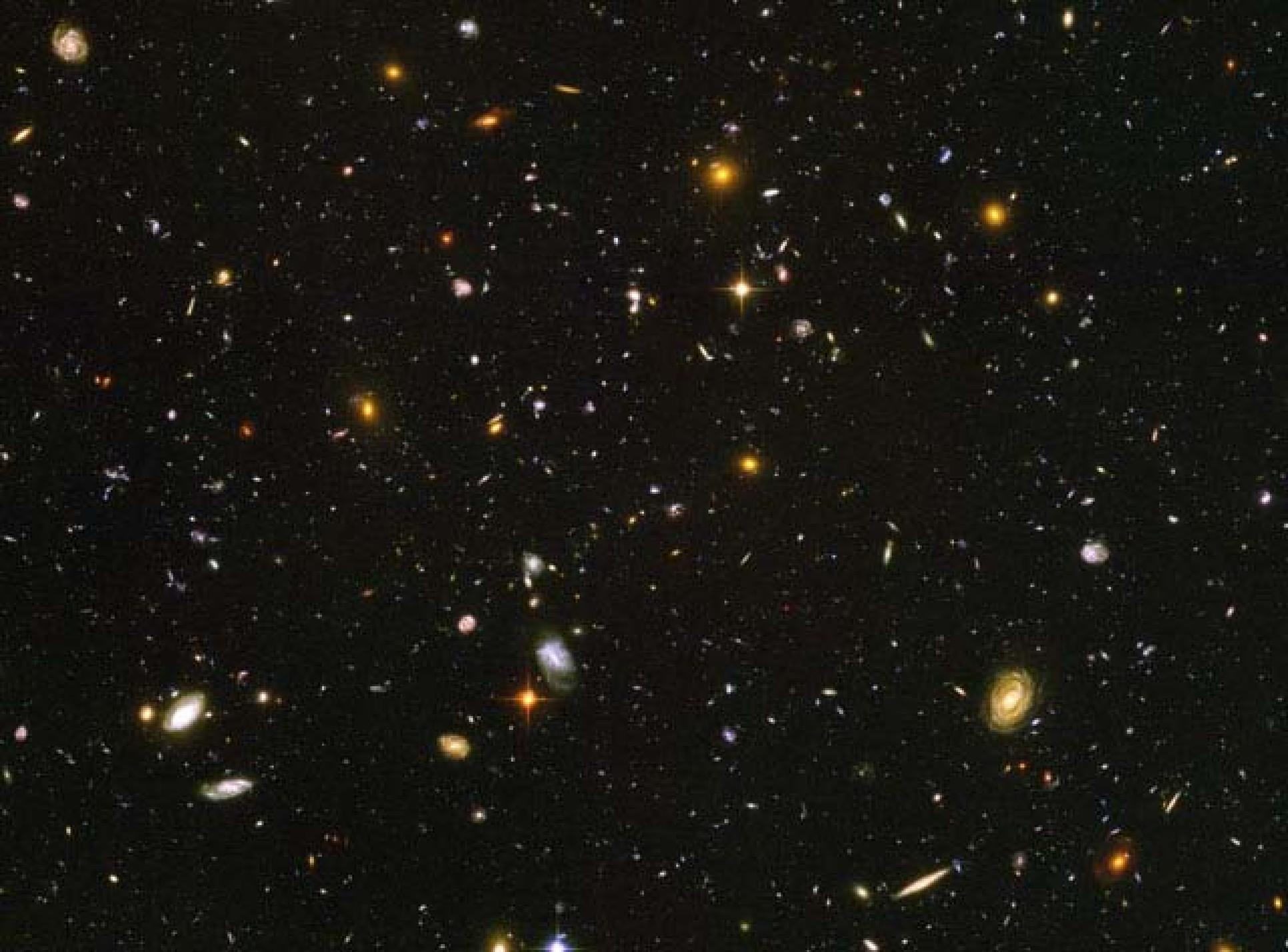
















NASA Budget .55%

United States Budget

