

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

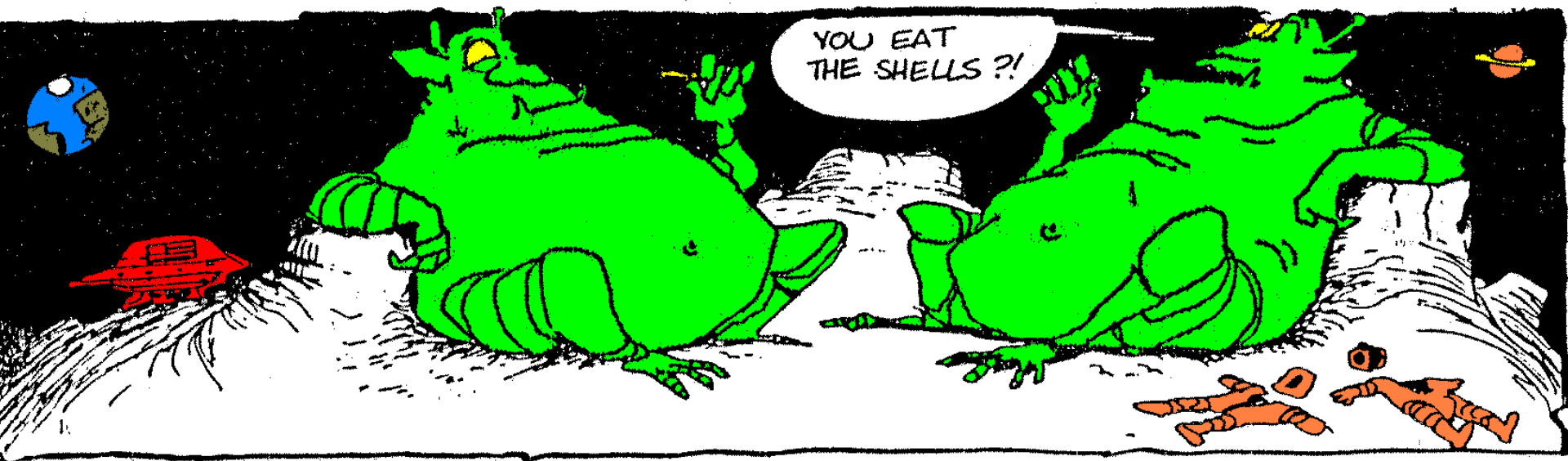
Synopsis: As an avid engineer and amateur astronomer, Mike Lawson presented a perspective on the size of the universe and asked the question, “Where will we go?” This was an entry-level overview for the average space worker who really wanted to understand the size of stars and the distance between objects 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.)

NASA Johnson Space Center
Crew and Thermal Systems Division
EC5 Space Suit and Crew Survival Systems Branch
2101 NASA Parkway
Houston, TX, 77058

jsc-us-spacesuit-knowledgecapture@mail.nasa.gov



How Big are We ?







Jupiter

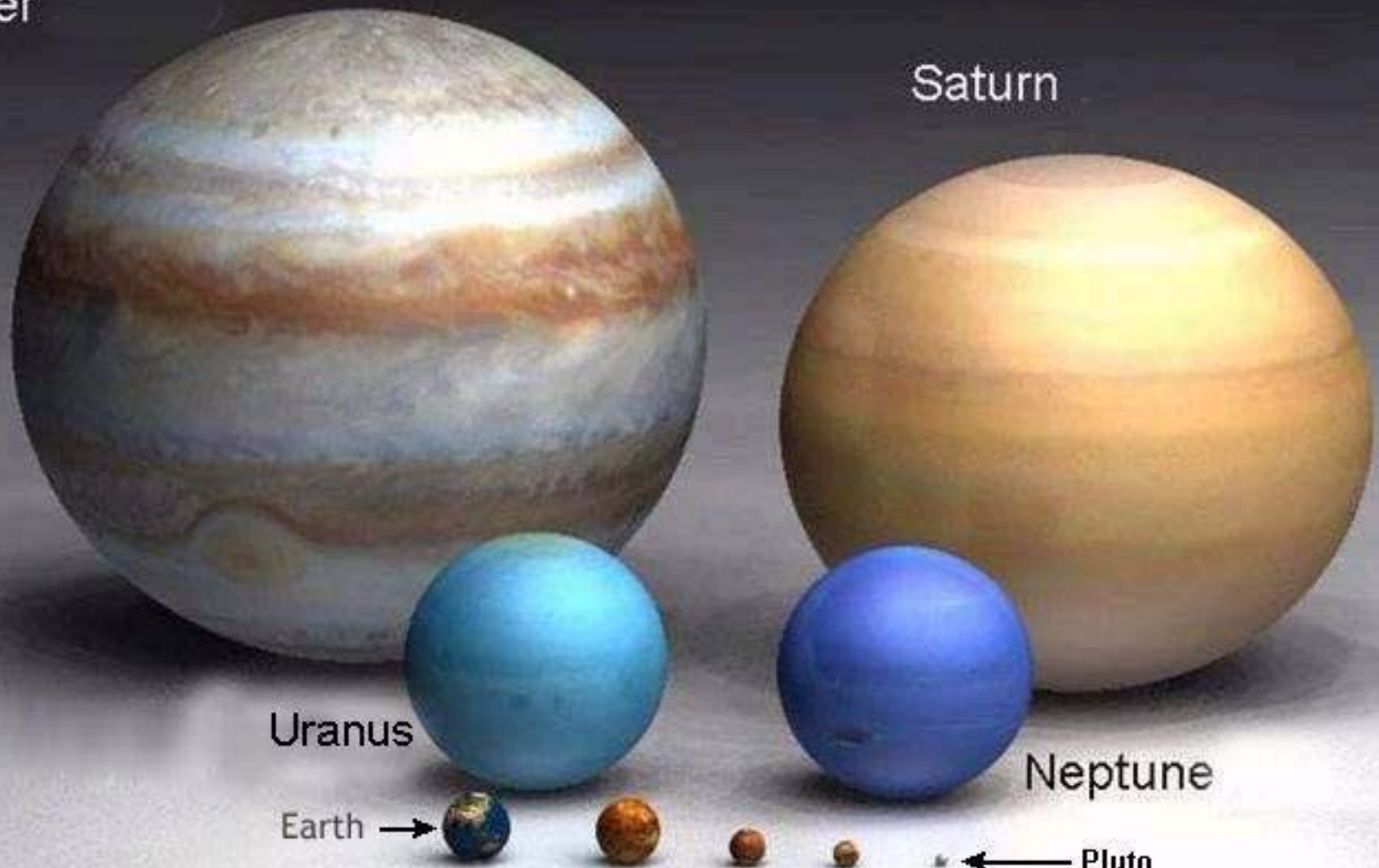
Saturn

Uranus

Neptune

Earth

Pluto



Sun

Jupiter

Earth

Pluto



This diagram illustrates the relative sizes of the Sun and the planets. The Sun is the largest object, shown as a large orange-yellow sphere. Below it, the planets are arranged in a row, showing their relative sizes. Jupiter is the largest planet, followed by Saturn, Uranus, Neptune, Earth, and Pluto. The labels 'Jupiter', 'Earth', and 'Pluto' are placed below their respective objects, with arrows pointing to them. The background is a dark, textured surface.



Sun



Sirius



Pollux



Arcturus

Jupiter is about 1 pixel in size

Earth is invisible at this scale



Betelgeuse



Antares



Rigel



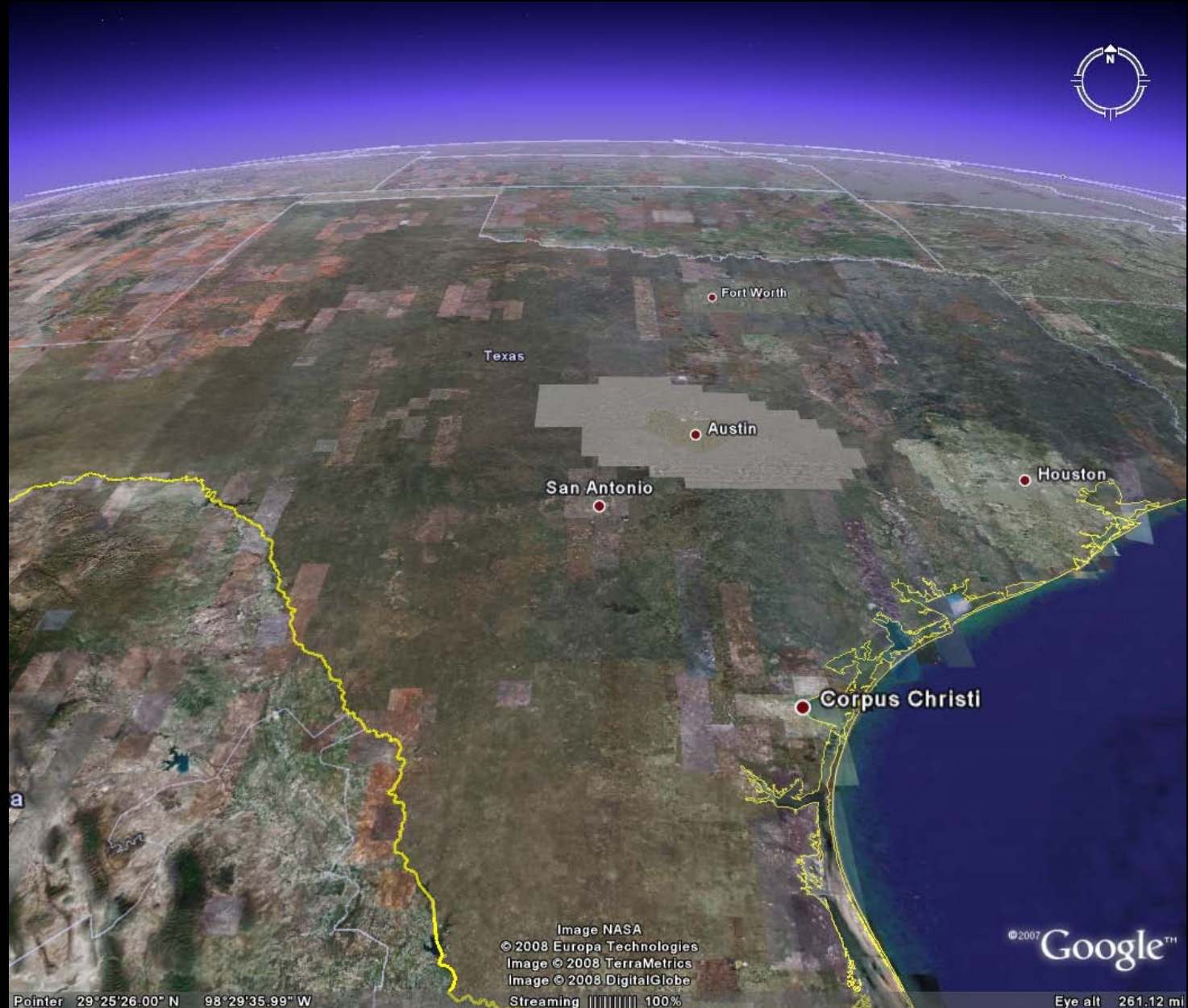
Aldebaran



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

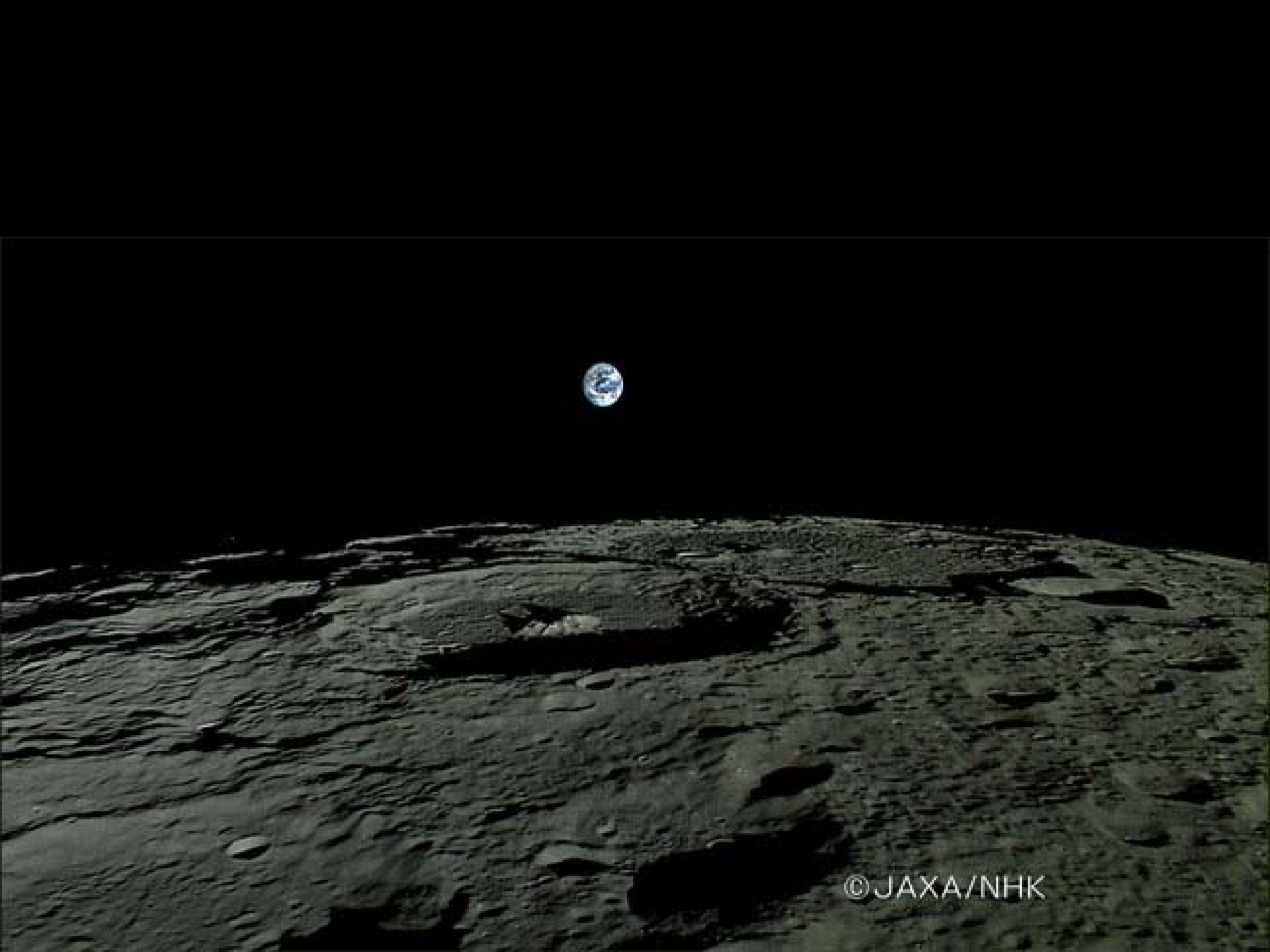
1G	2G
1.12 Hours	47.8 minutes

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



©JAXA/NHK

Lunar Travel

Light Speed

1.3 seconds

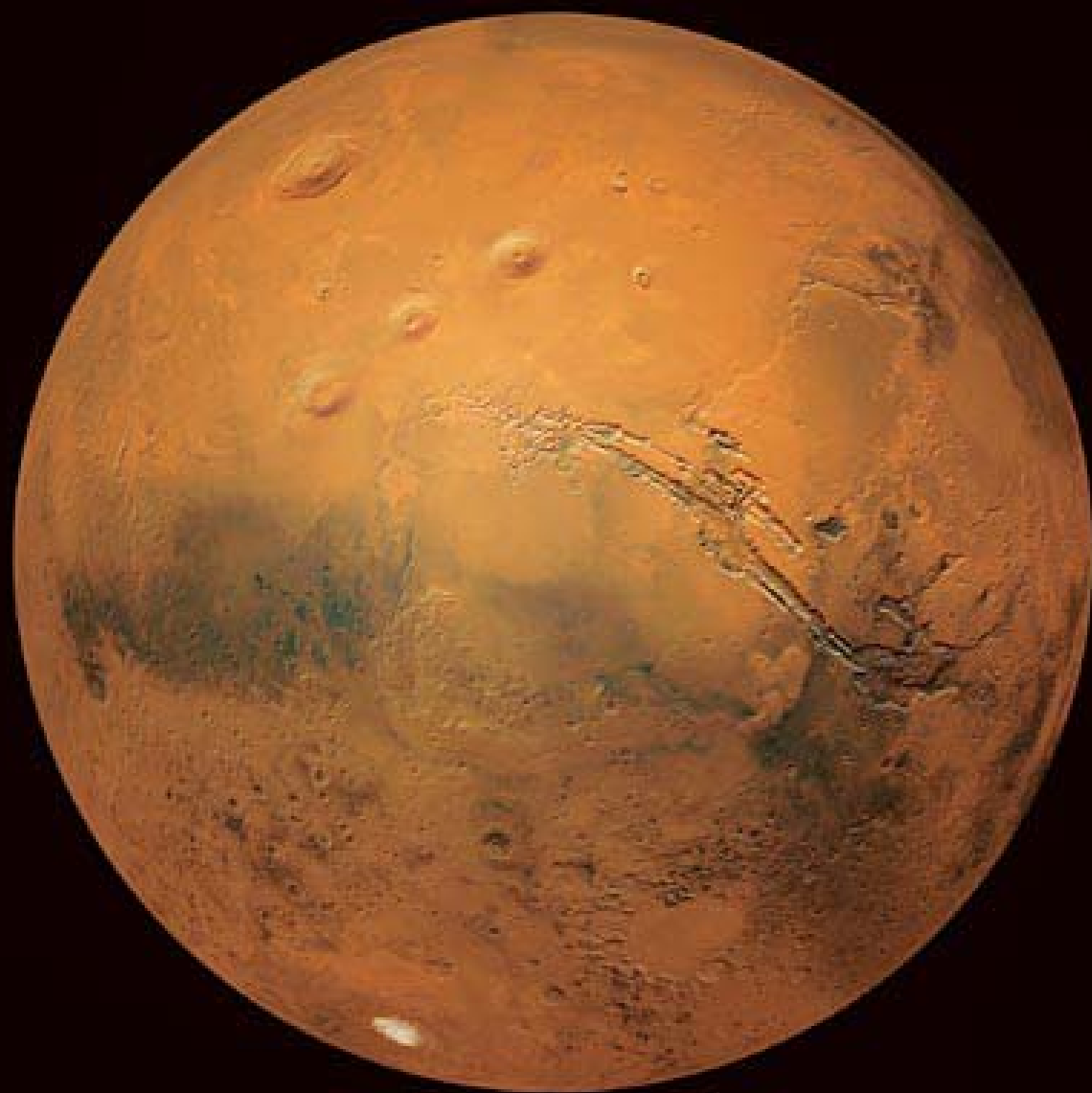
Physical Body Max

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

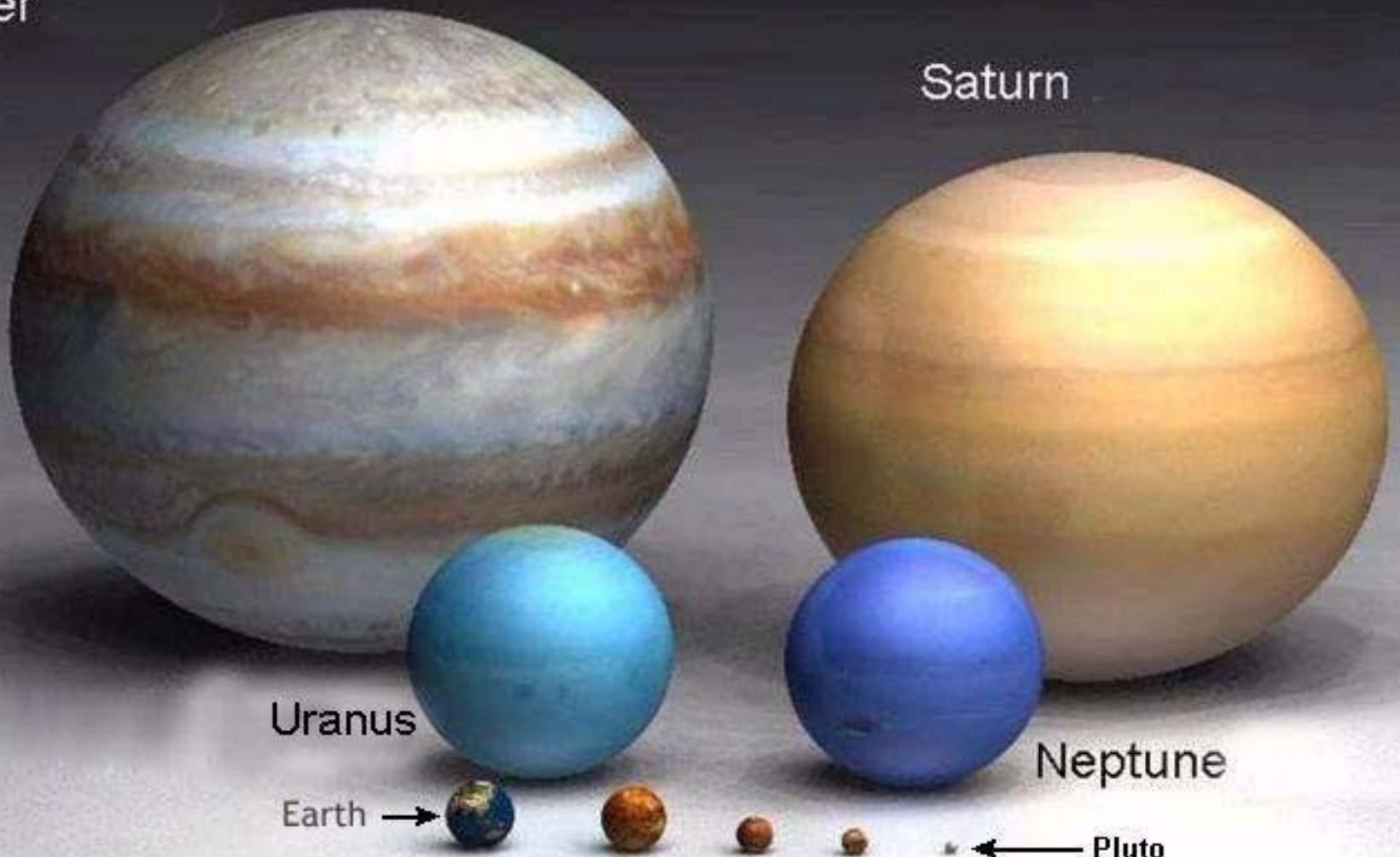
Saturn

Uranus

Neptune

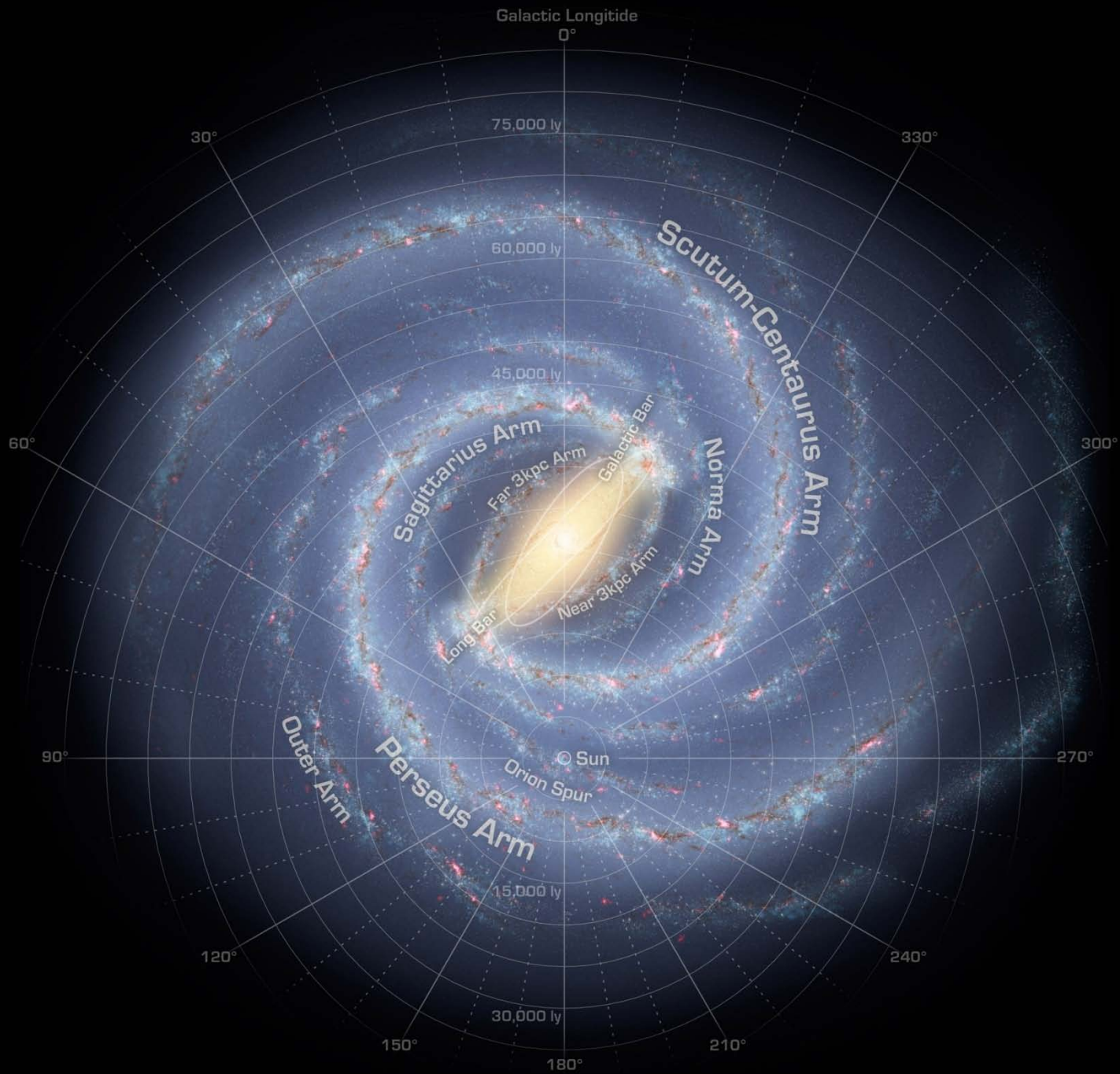
Earth →

← 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

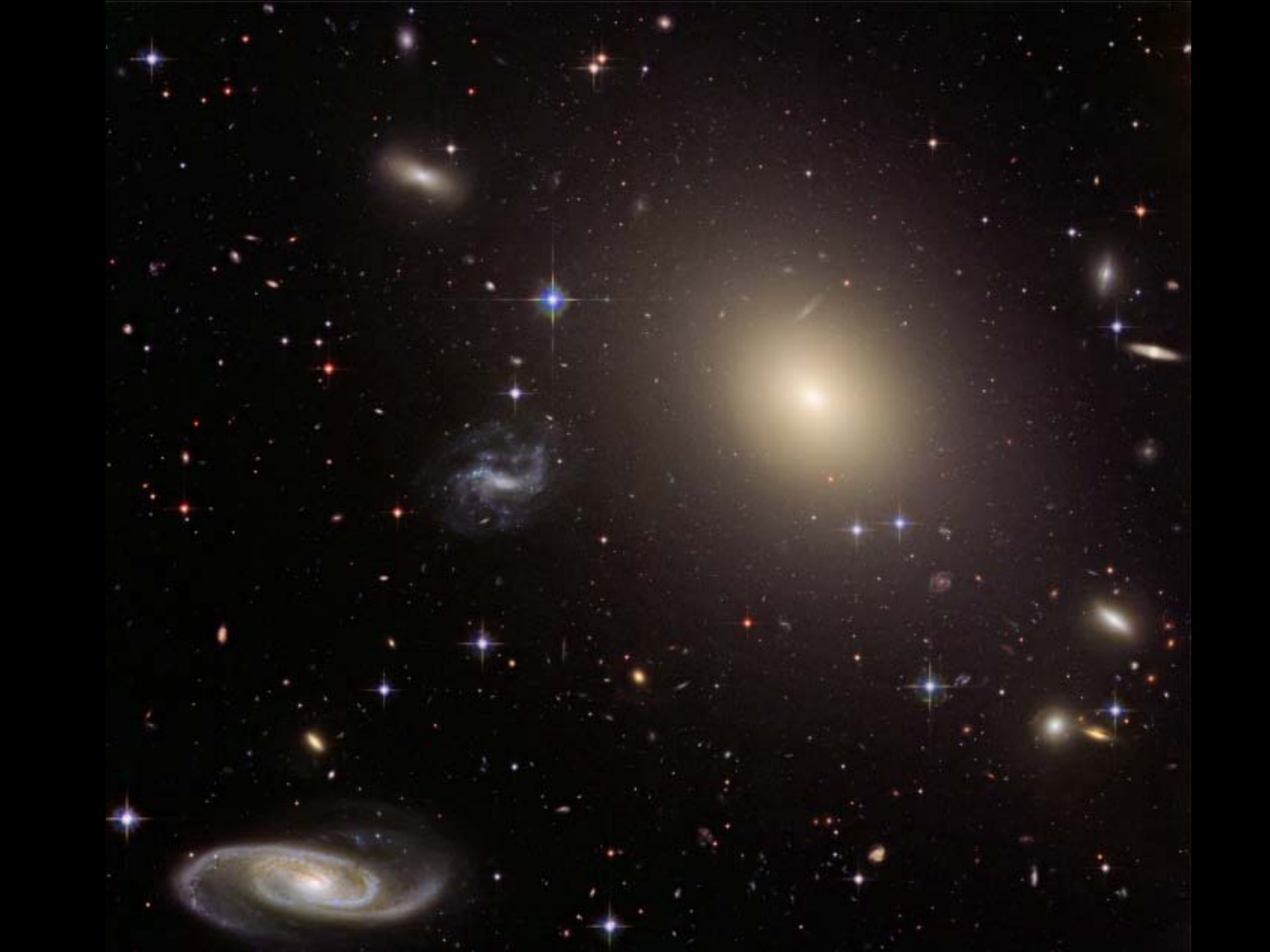
	Light Speed	Physical Body Max
Nearest Star	4.3 years	Takes 353 days to reach near light speed**
Nearest Star (life?)	20-40 years	
Edge of our Galaxy	15,000 years	
Neighbor Galaxy	2.5 million years	
Universe	27-45* billion years	

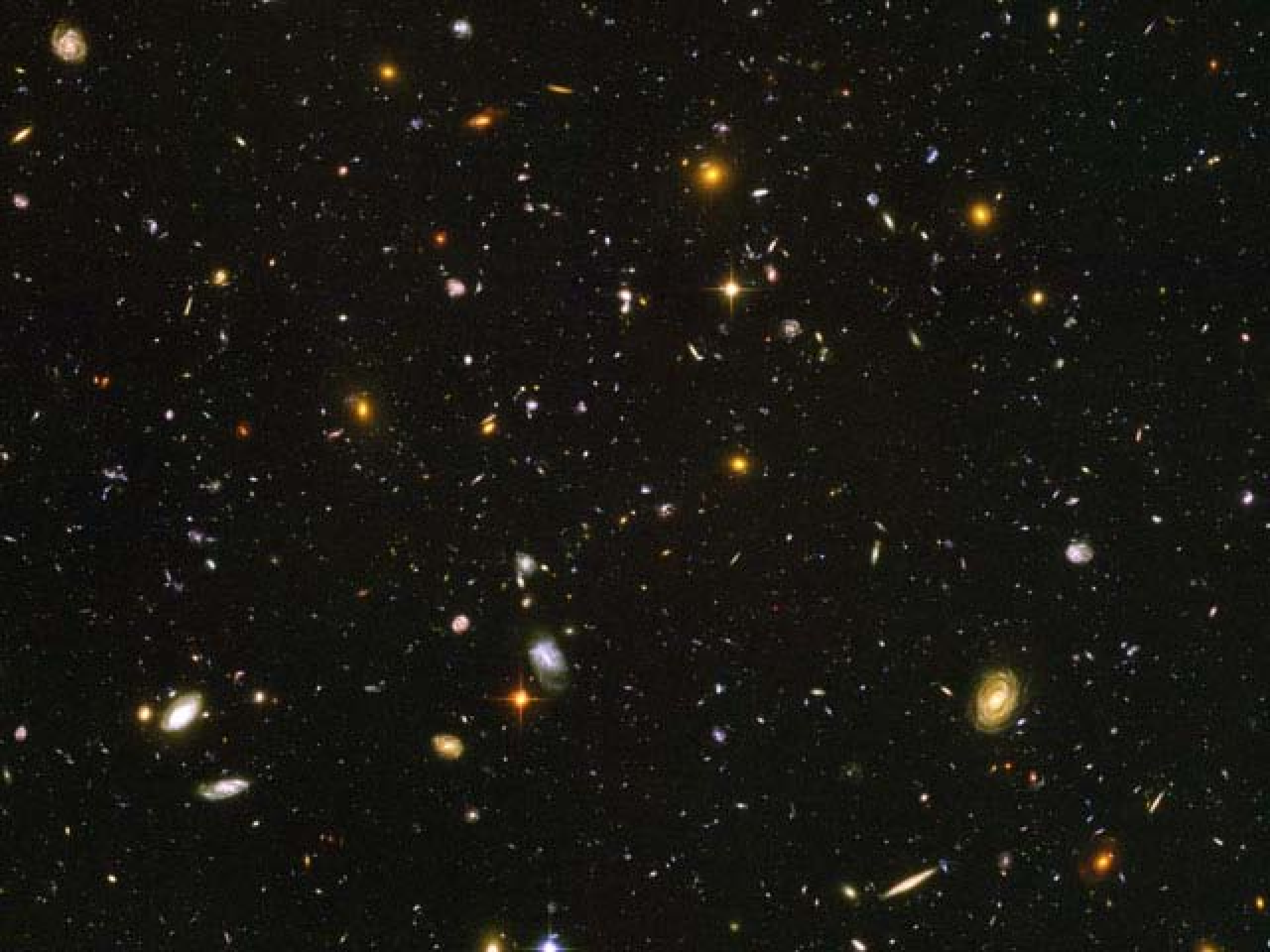












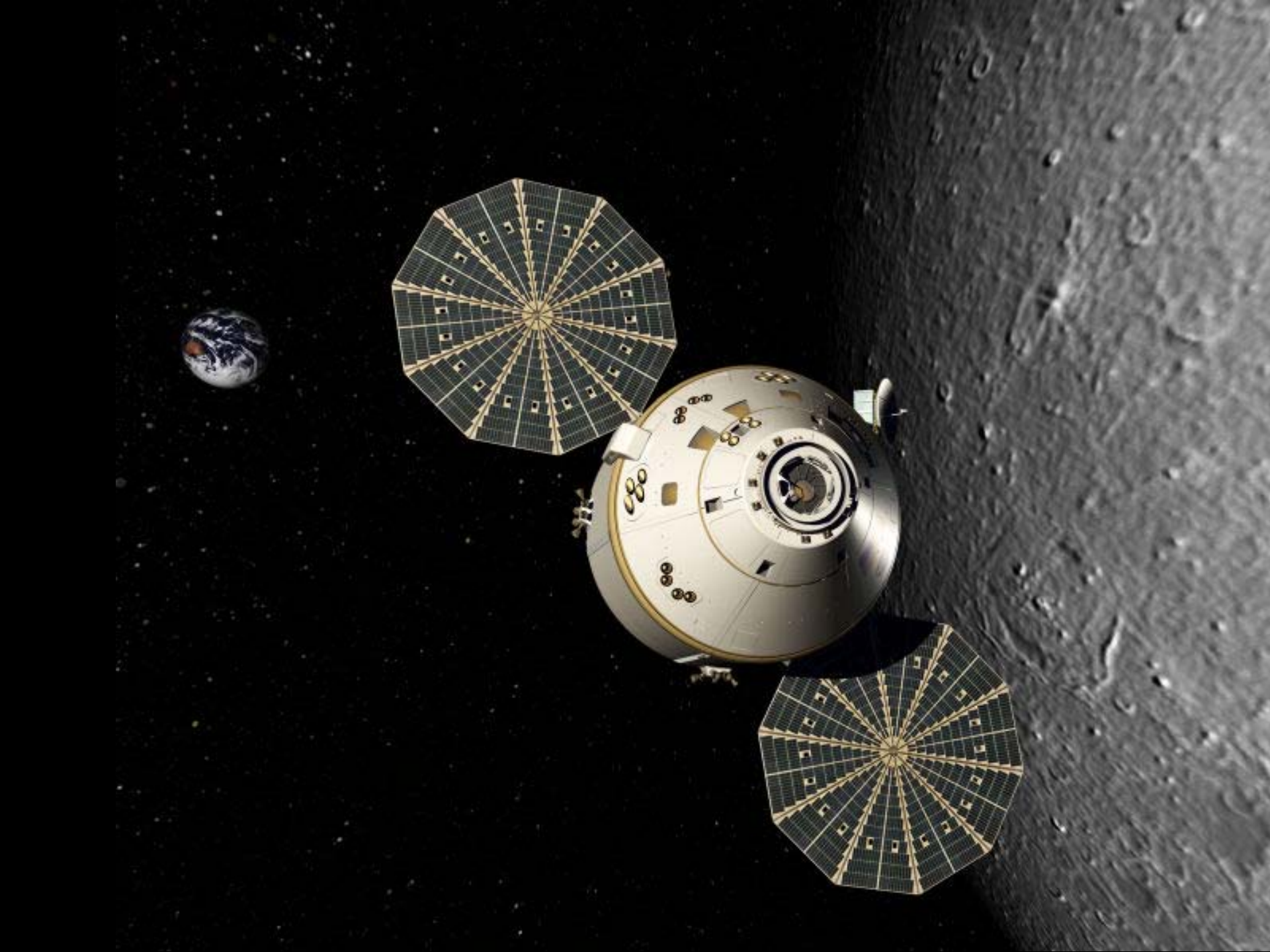


Is This Universe We live in Big?

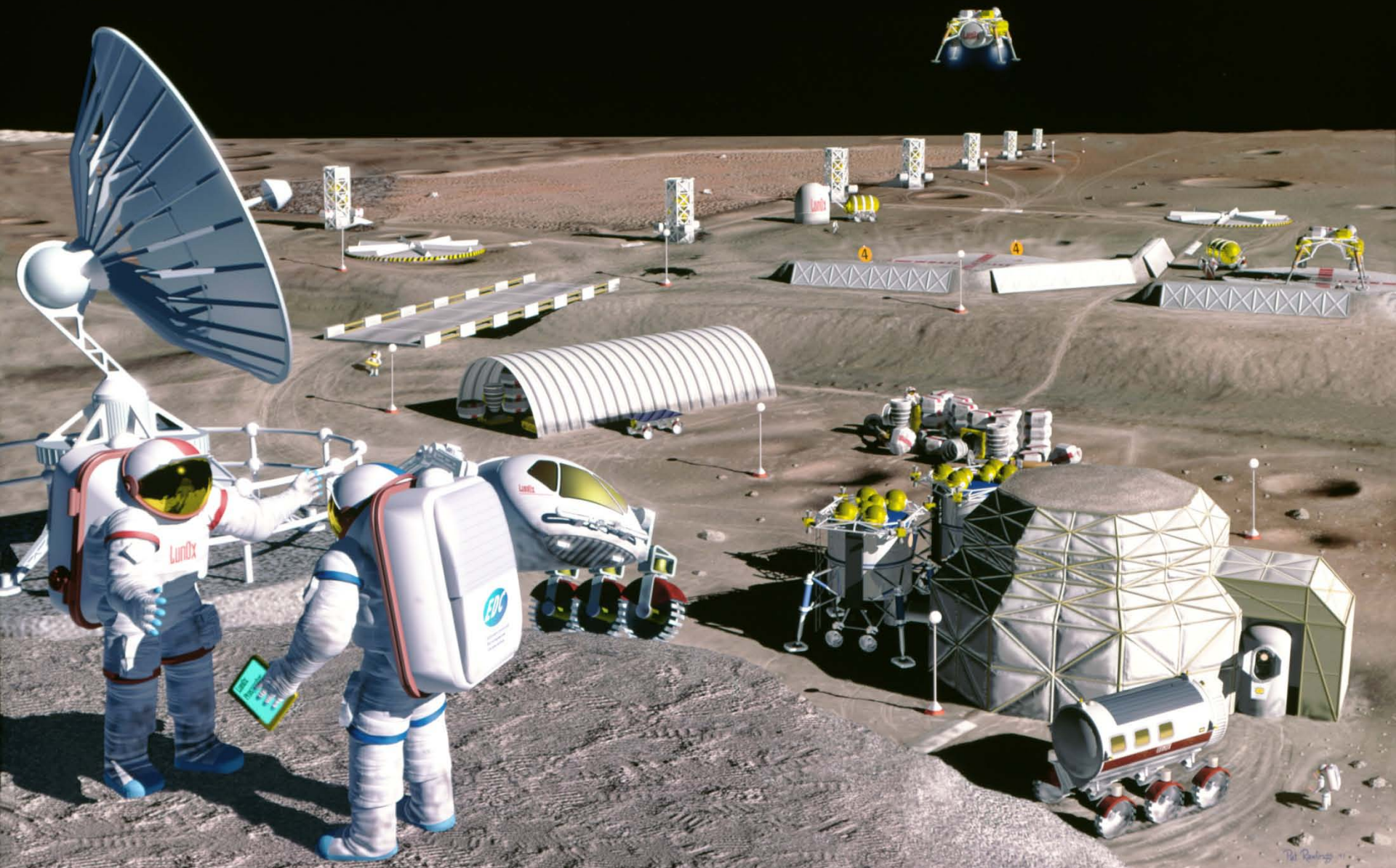
It's Gigantic!

Where will we go ?

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

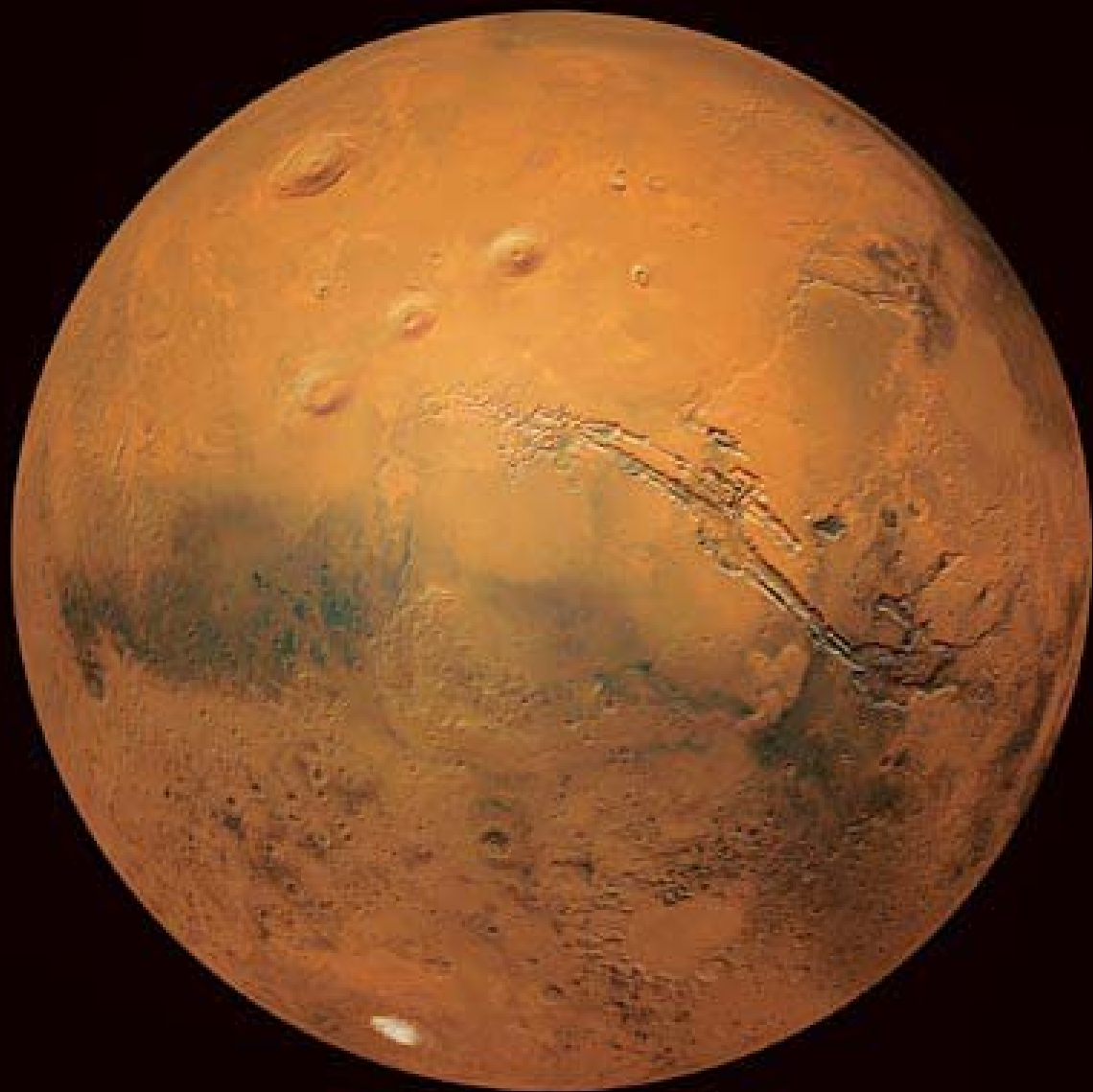


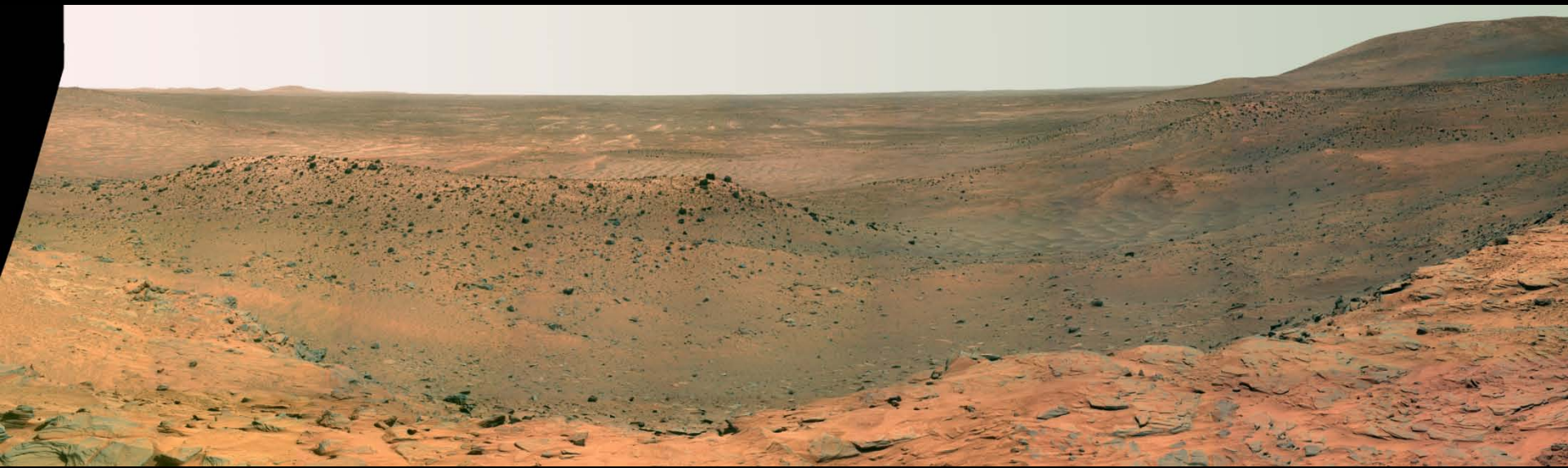




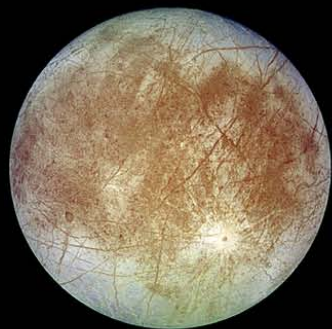
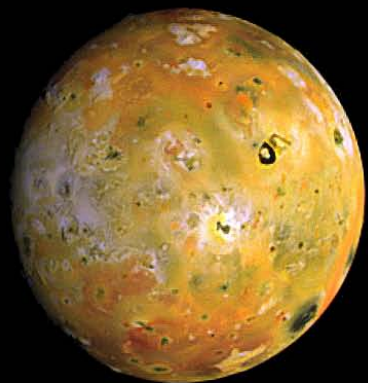


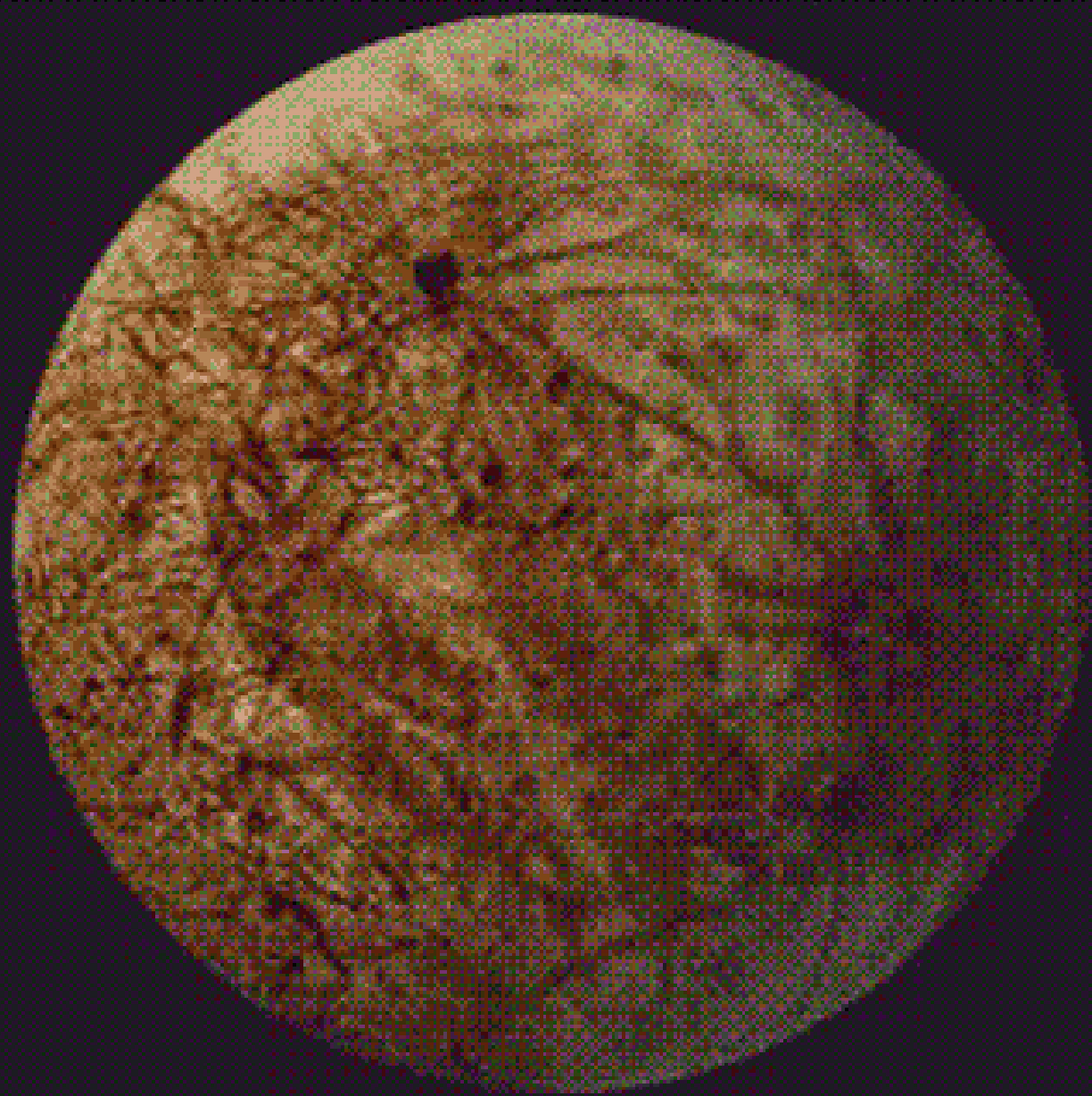


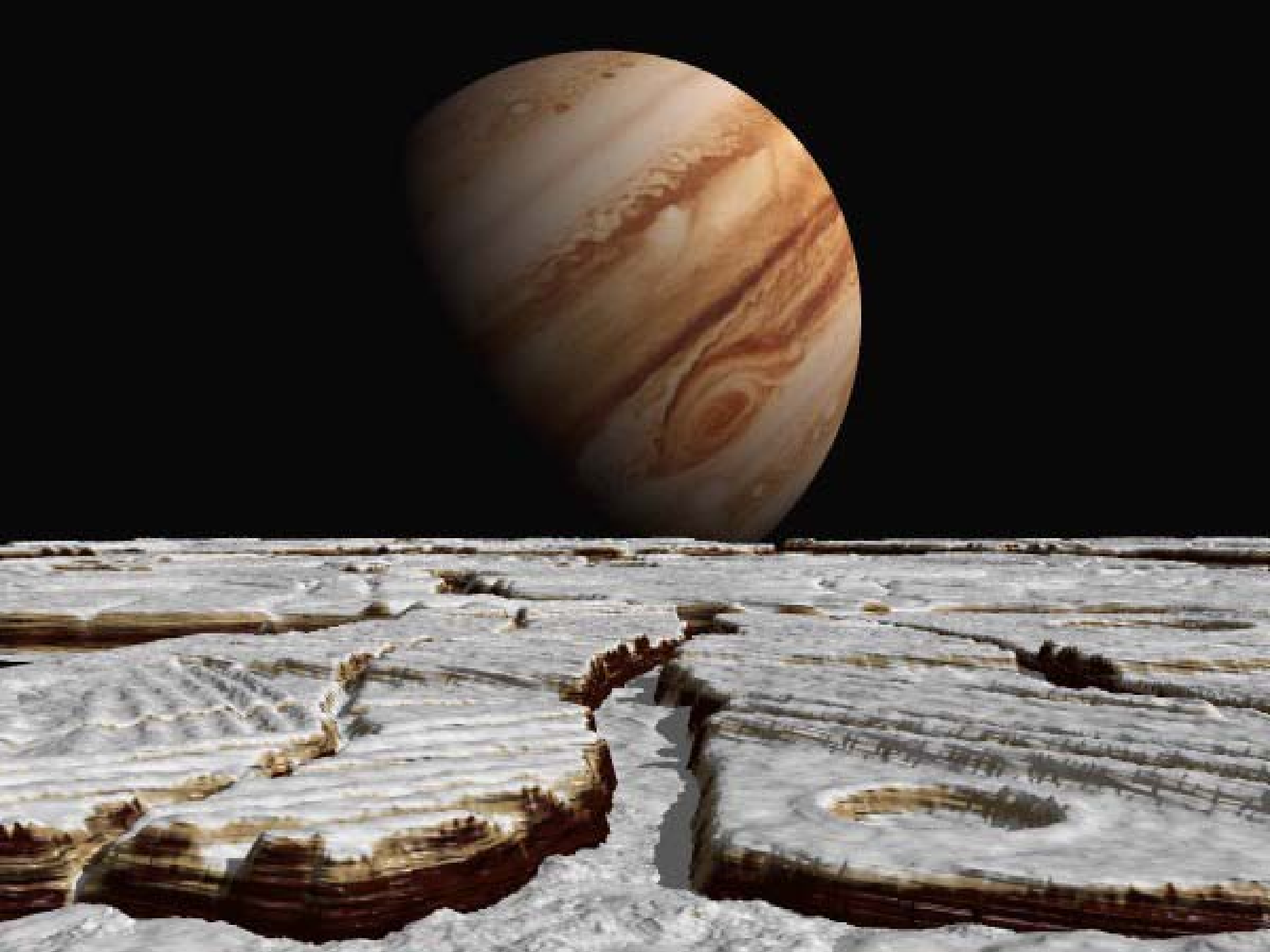






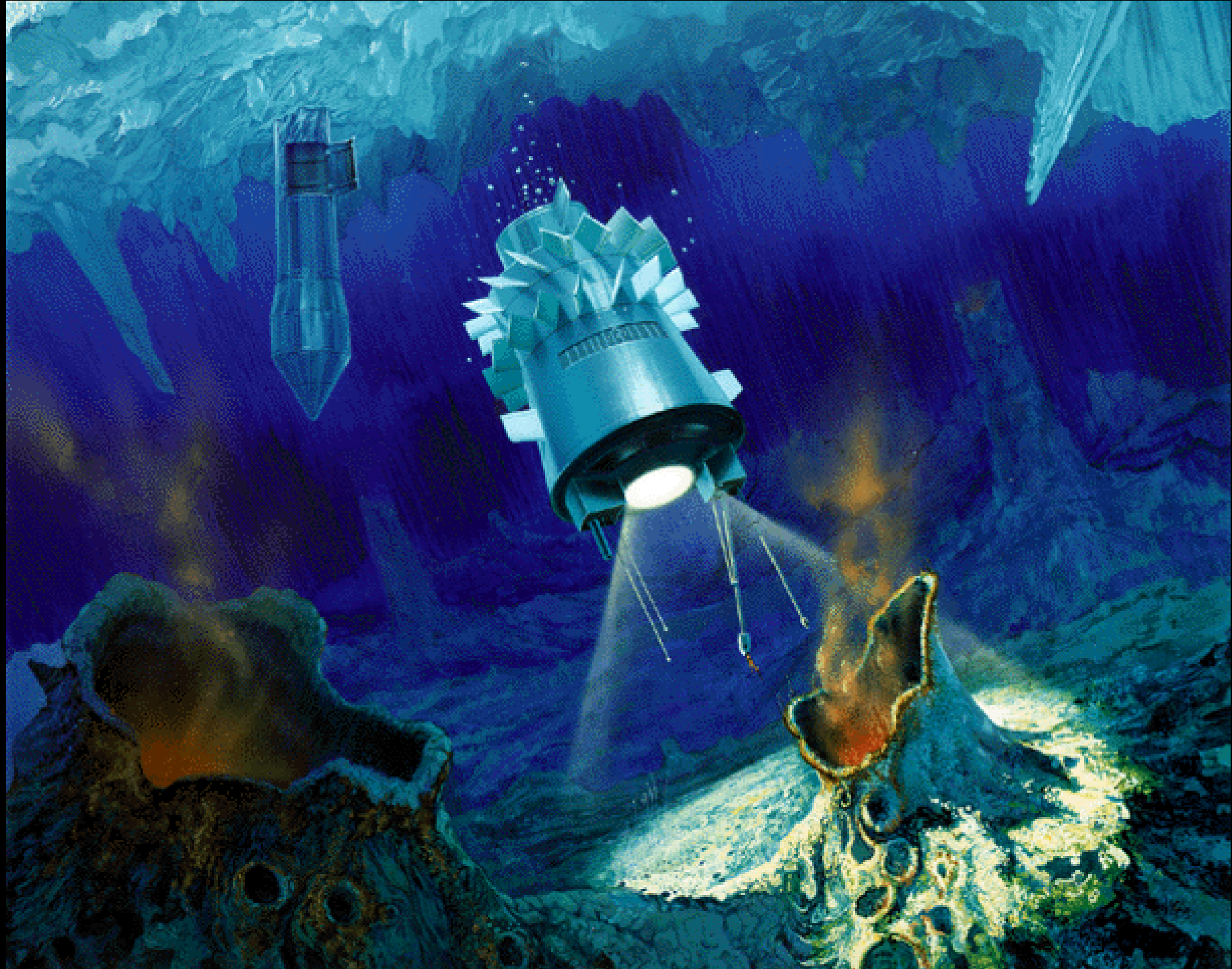








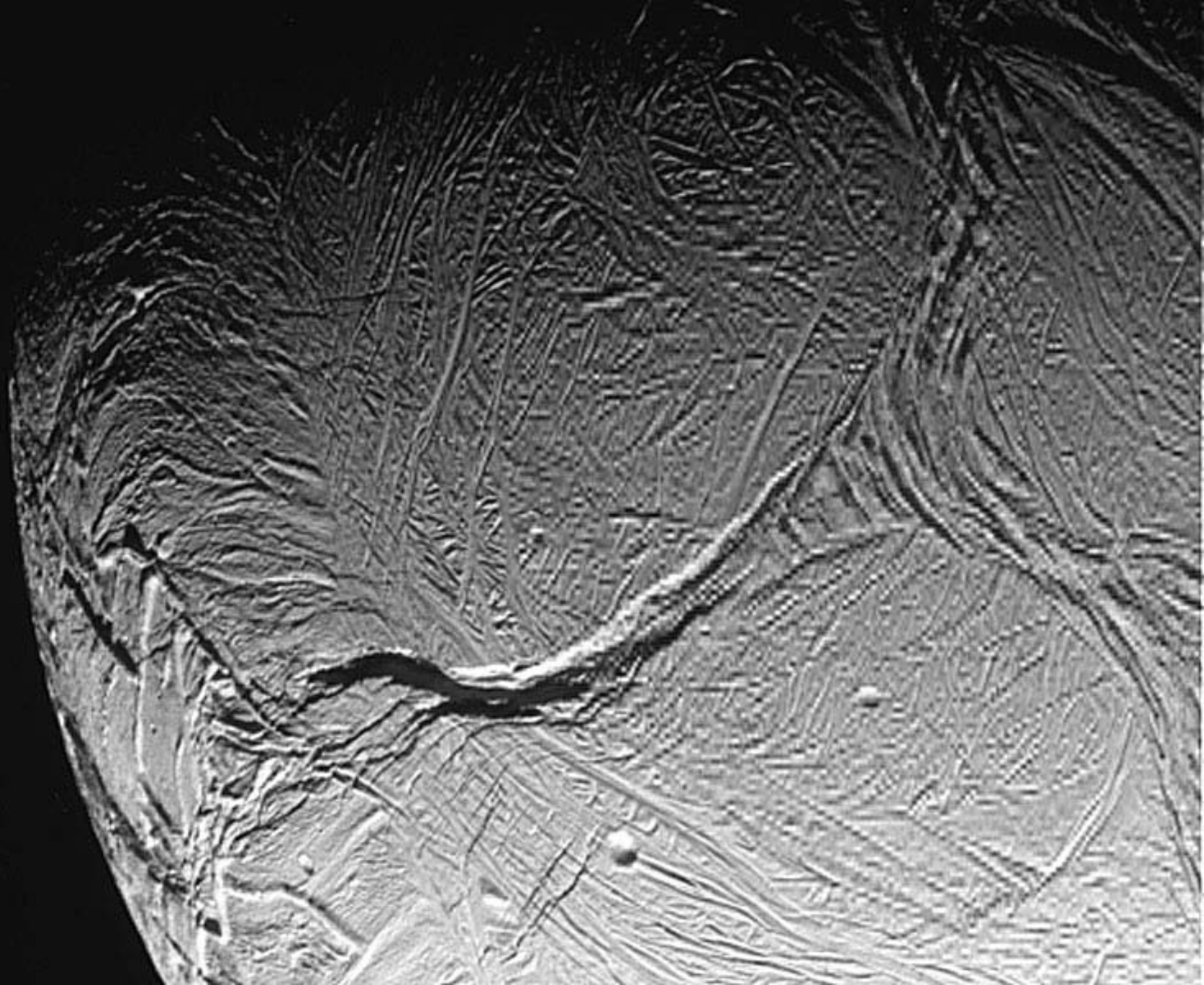
Joe Bergeron © 1997



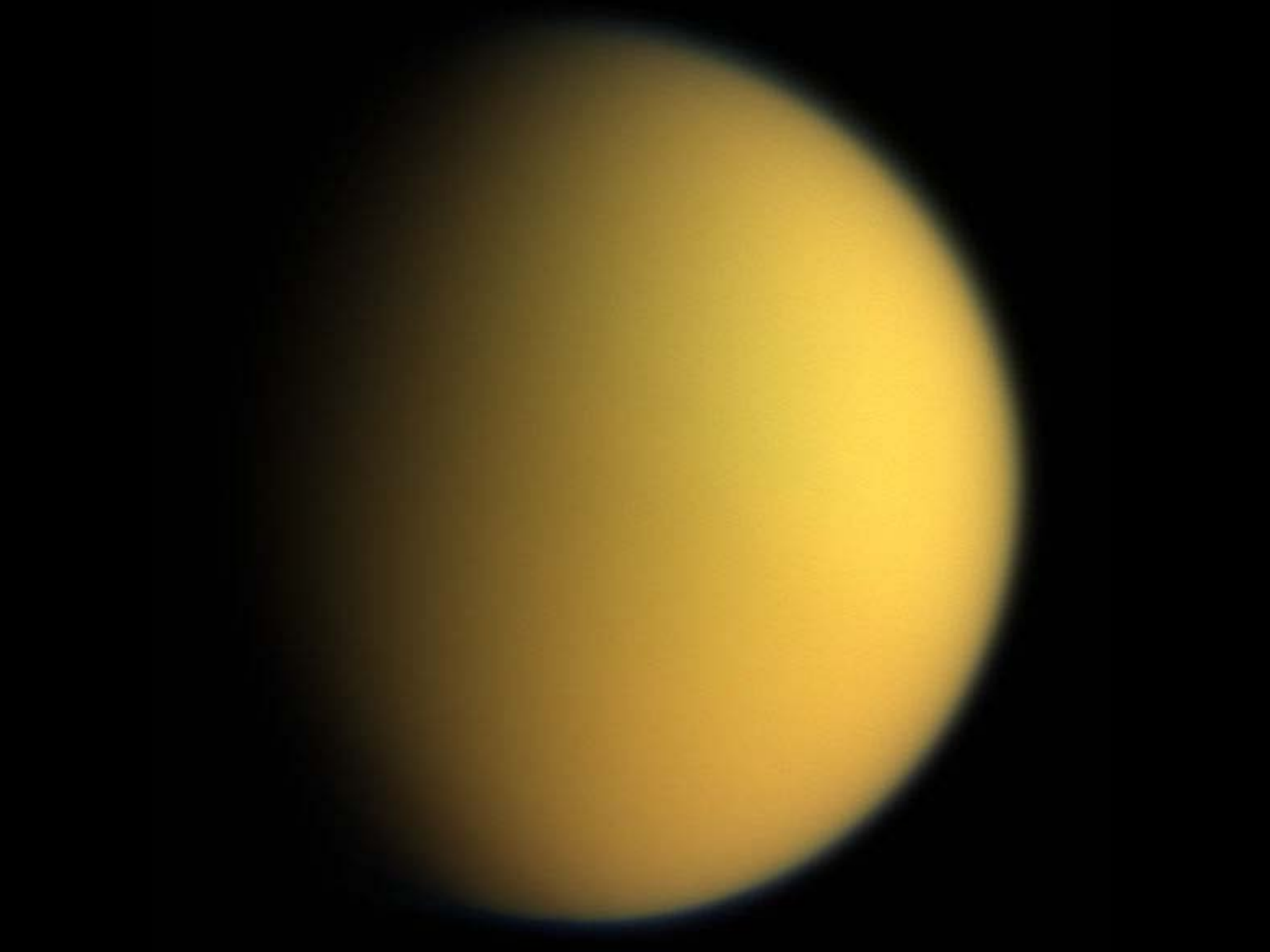




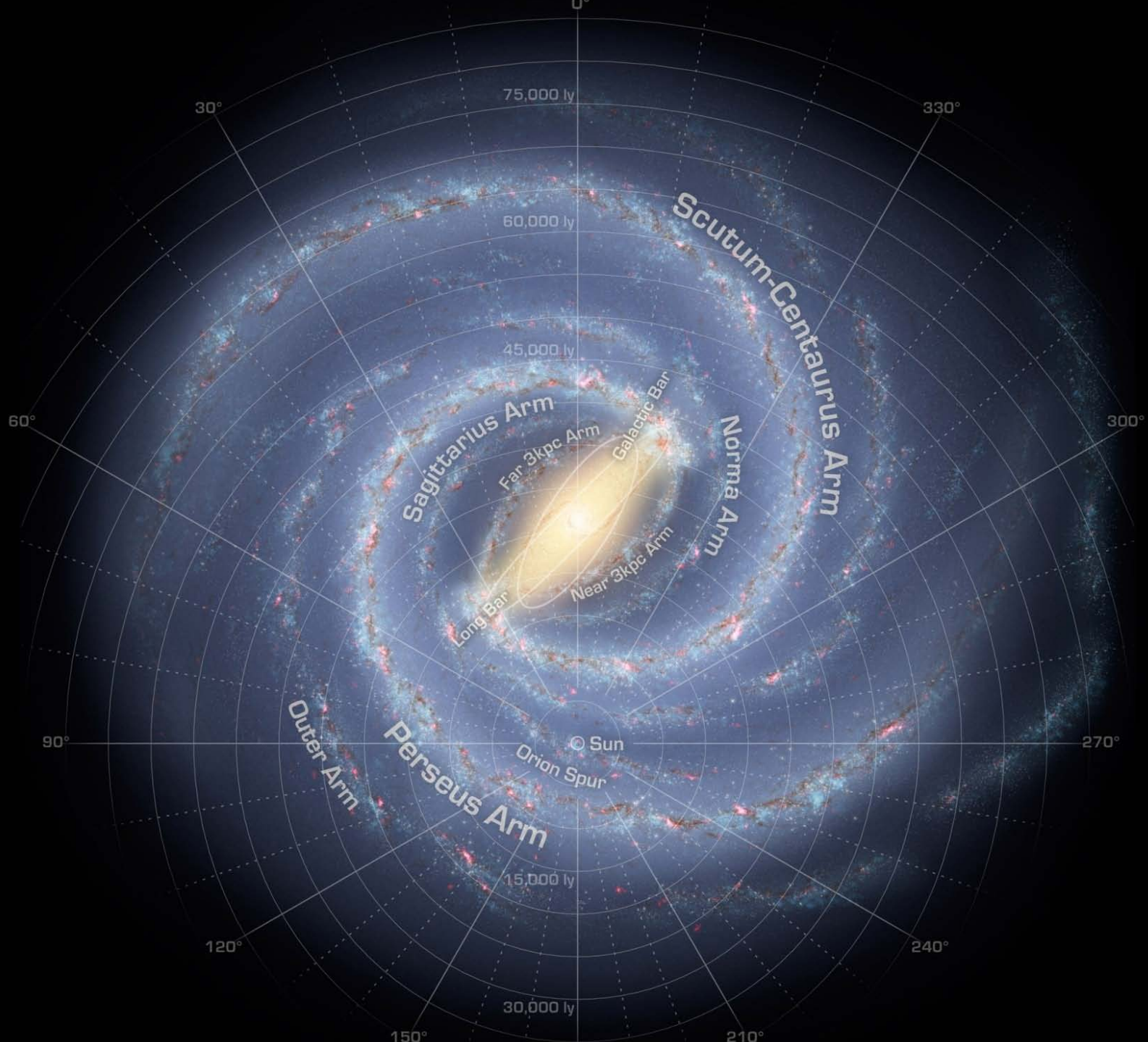


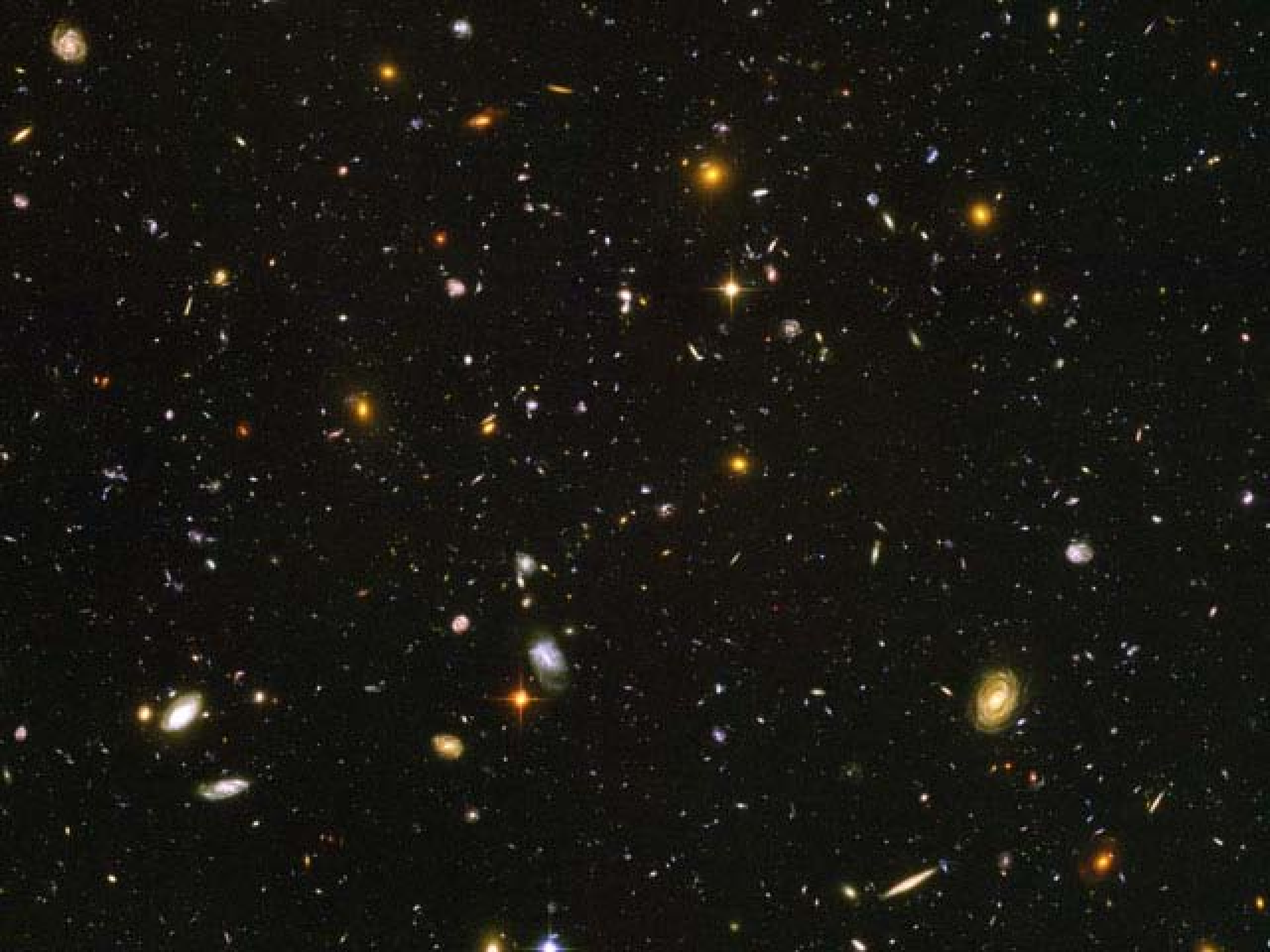














NASA Budget .55%

United States Budget

