NASA's New Horizons Mission To Pluto

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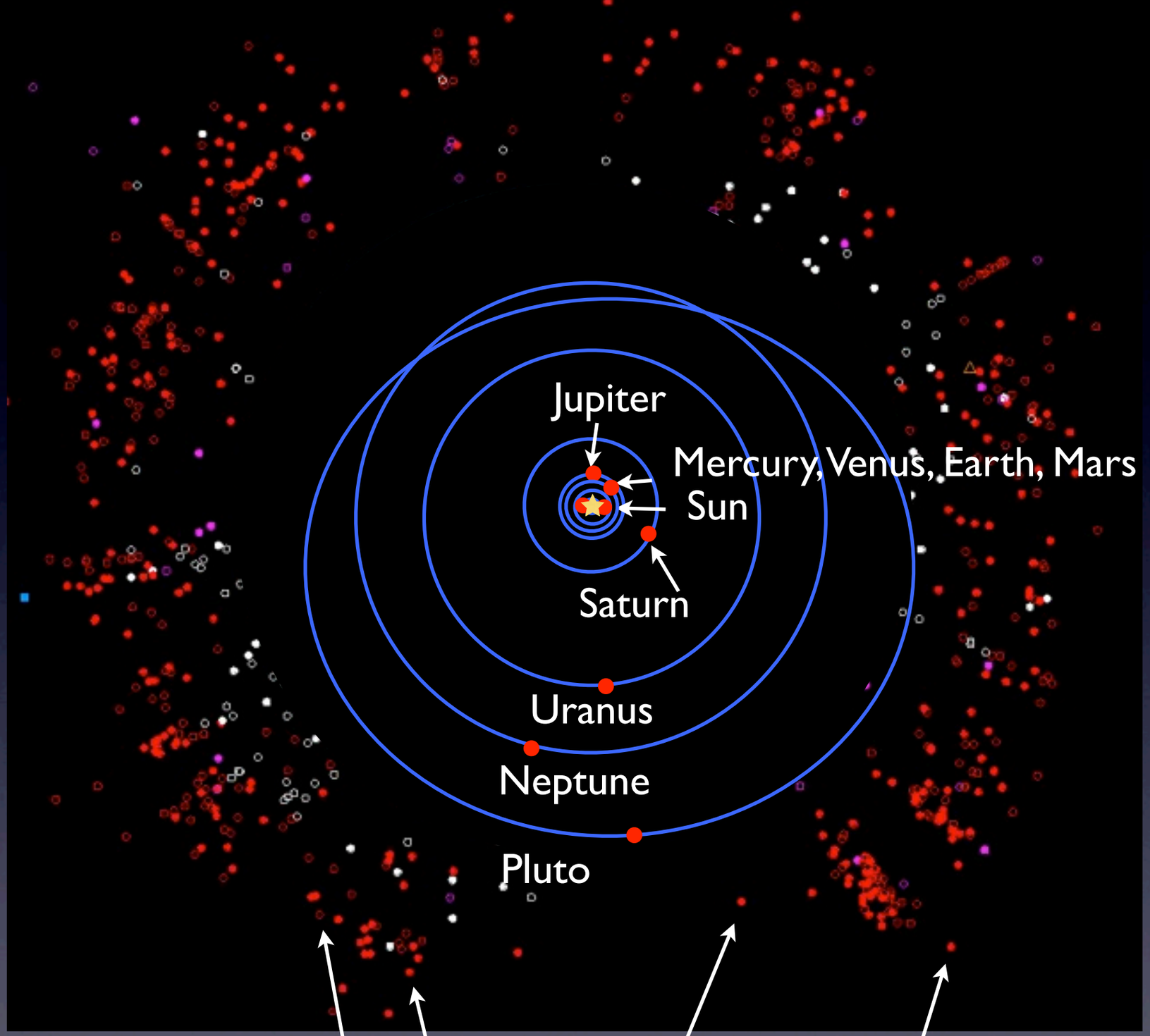
University of Botswana
Gaborone, March 27, 2013


Denver, Colorado

This is a Galaxy. It has 100,000,000,000 stars.

The Sun is just one star in the Galaxy.

Our Solar System



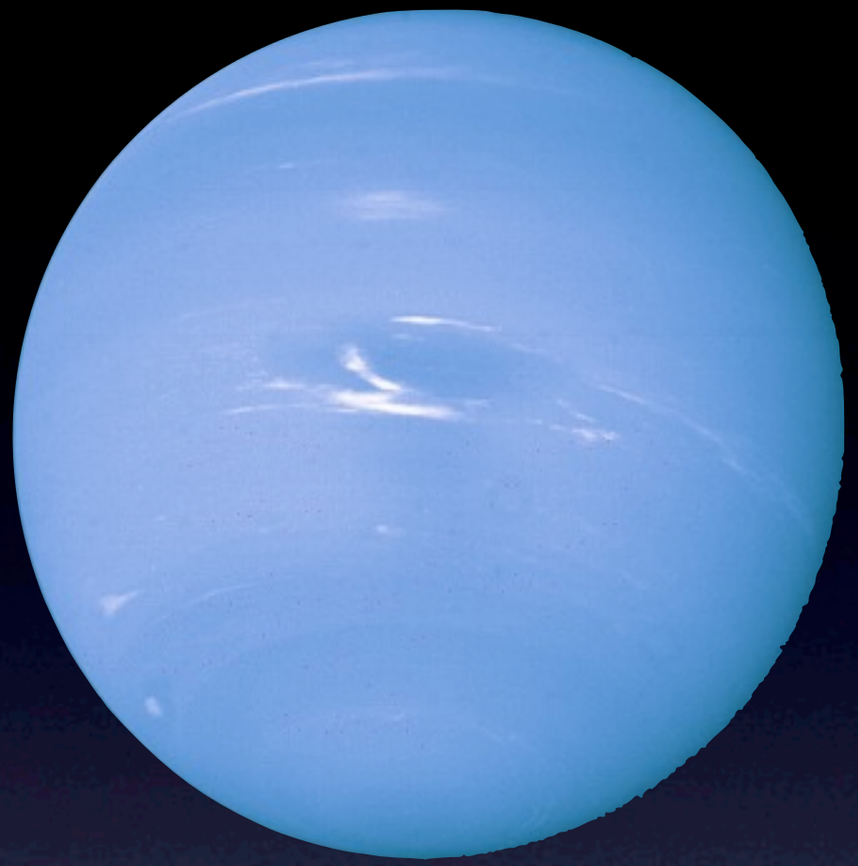
Kuiper Belt

Easy to see:

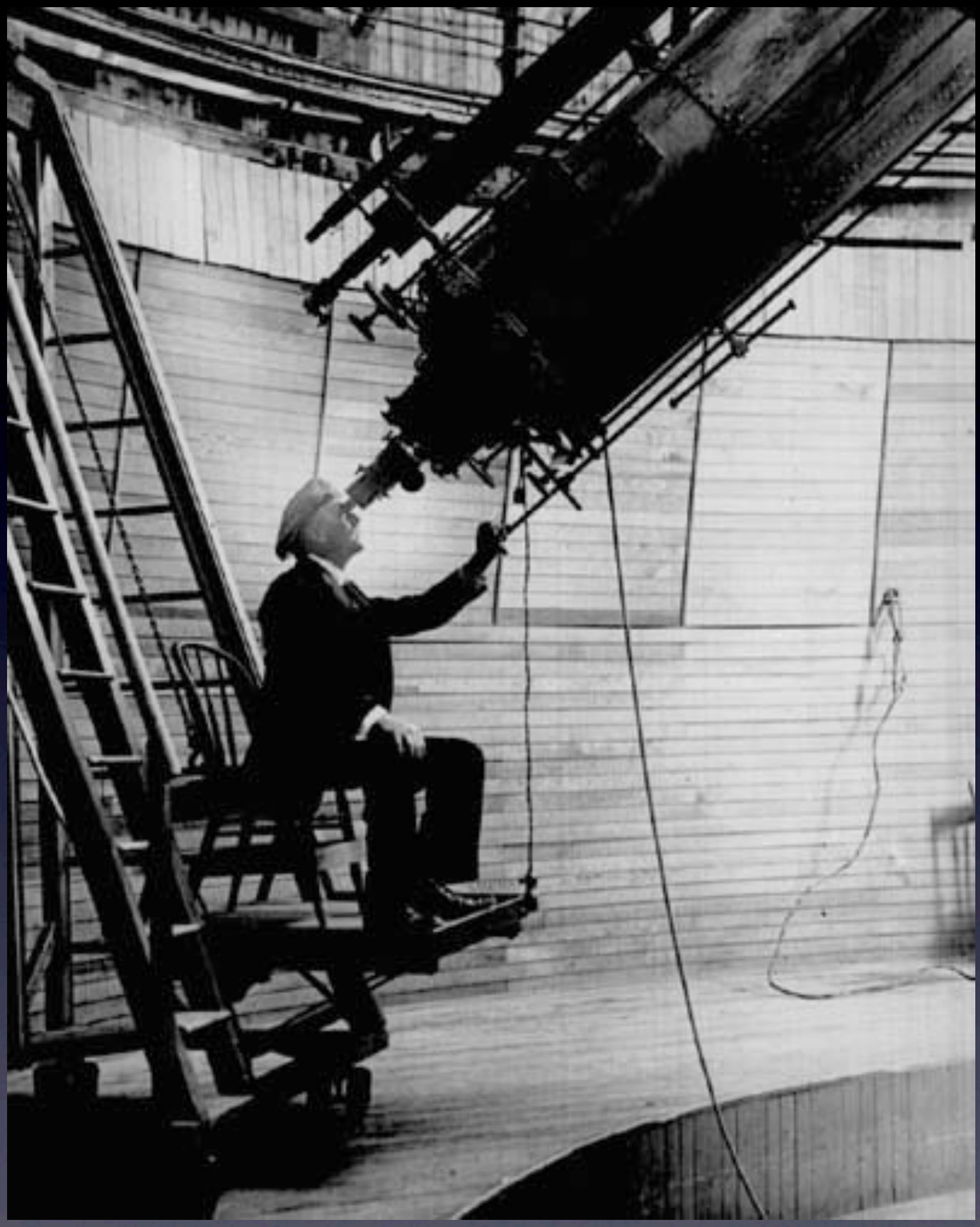
- Sun
- Moon
- Mercury
- Venus
- Earth
- Mars
- Jupiter
- Saturn

Hard to see:

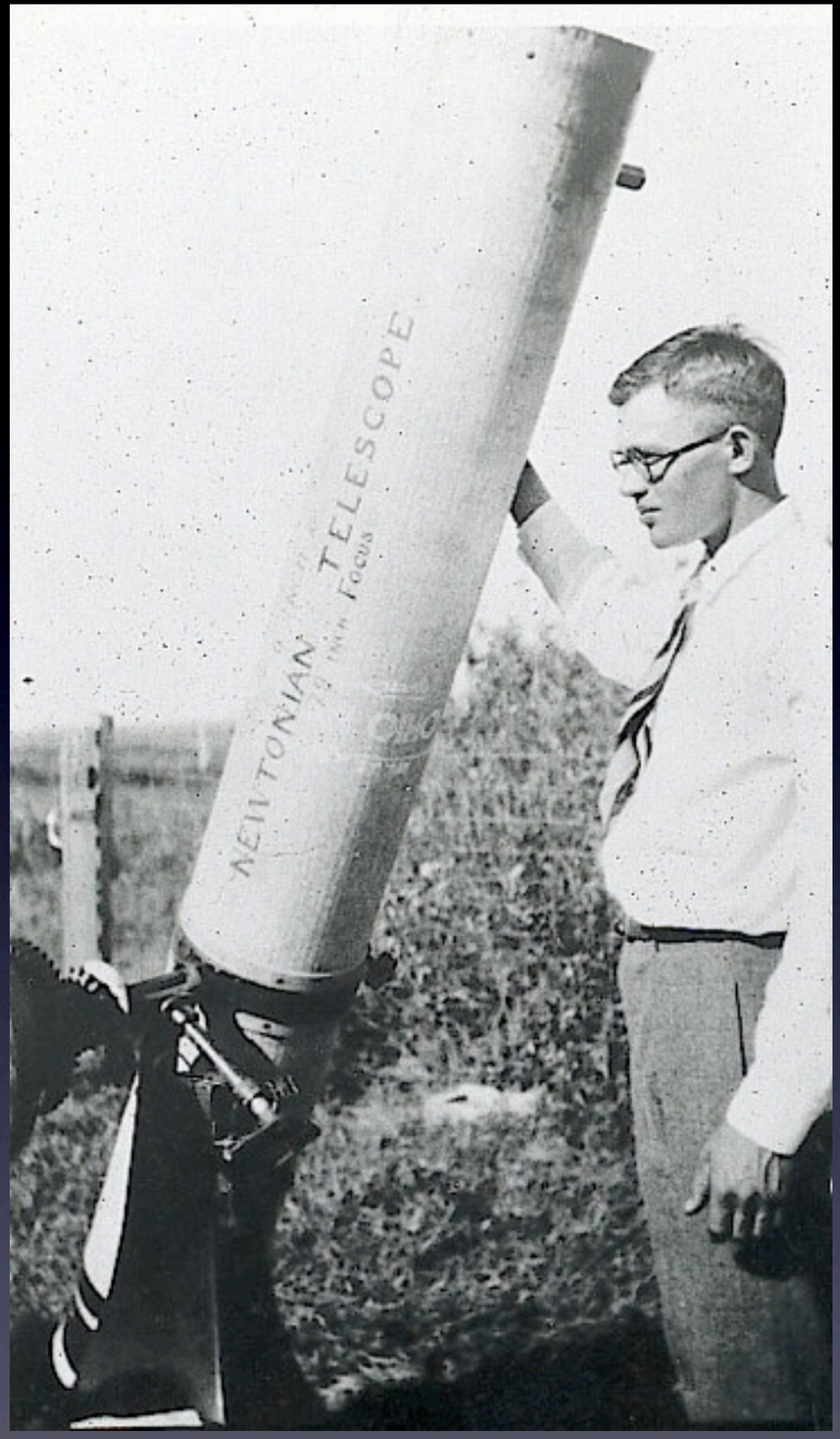
- Uranus
- Neptune
- Pluto
- Asteroids



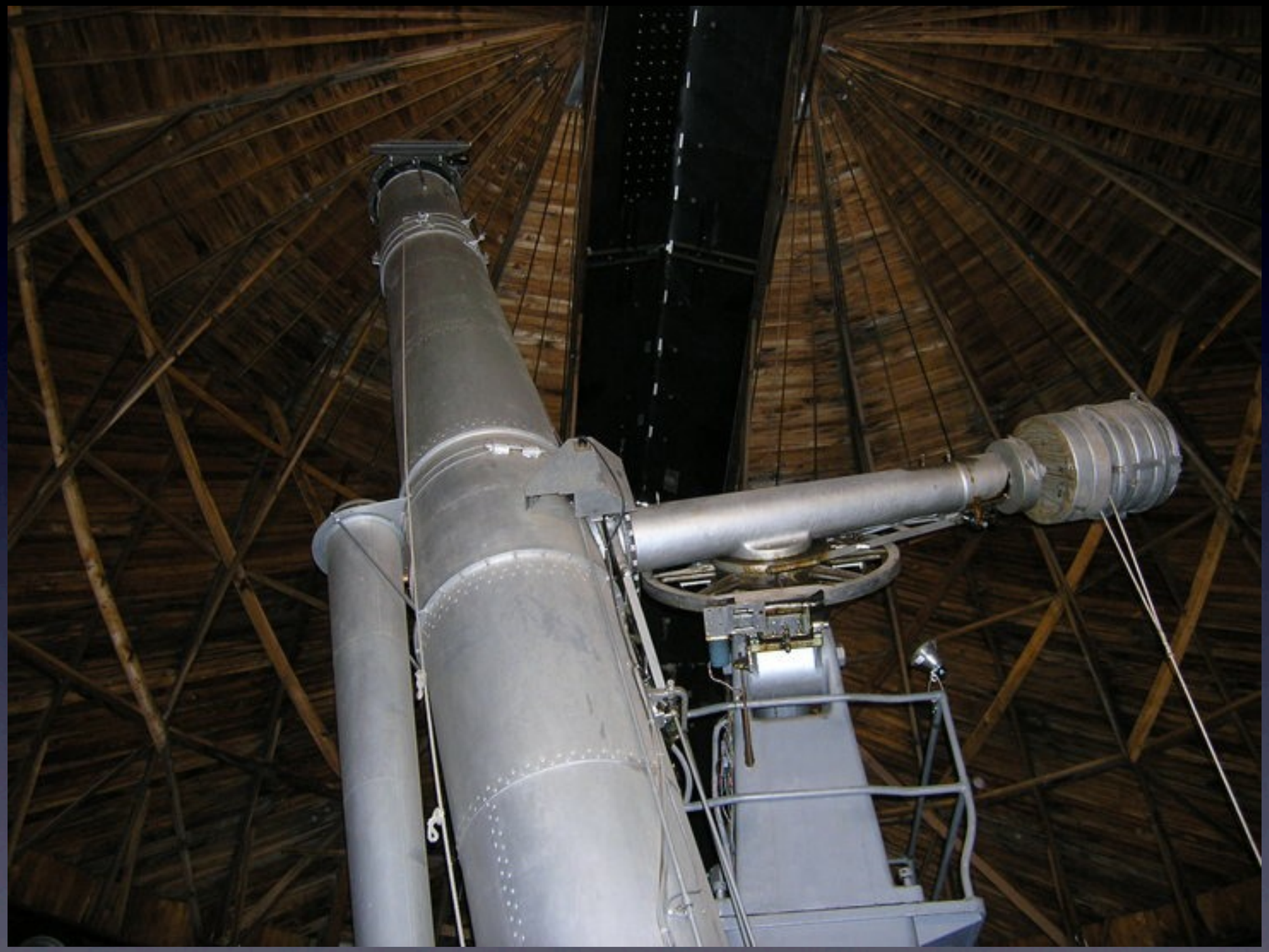
1874: French Astronomer Le Verrier found errors in the position of Uranus, and discovered Neptune the next night.

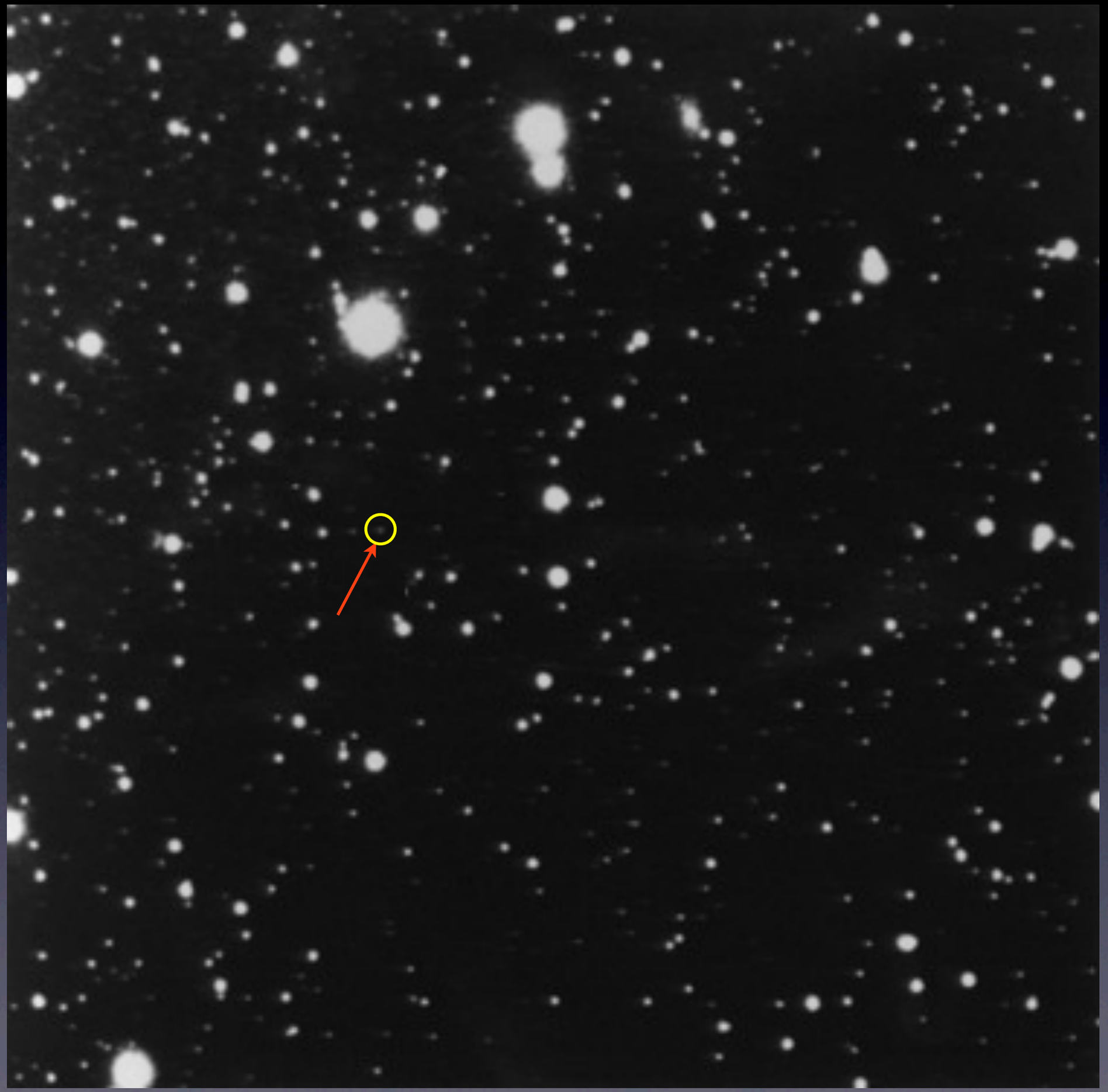


1905: Percival Lowell started the search for ‘Planet X’ at Lowell Observatory, Arizona, USA.



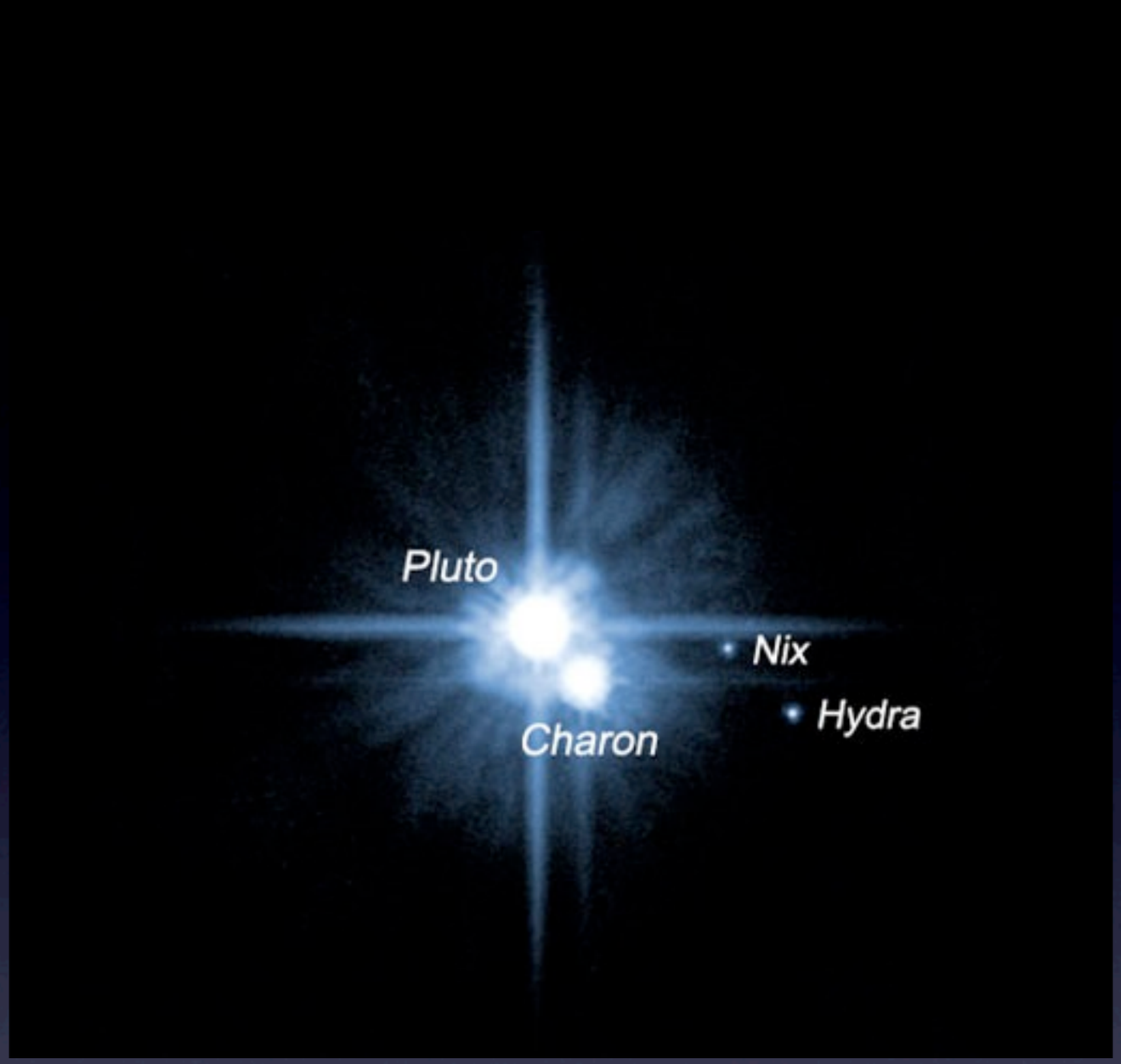
1925: Clyde Tombaugh is hired to search for Planet X at Lowell Observatory in Arizona.



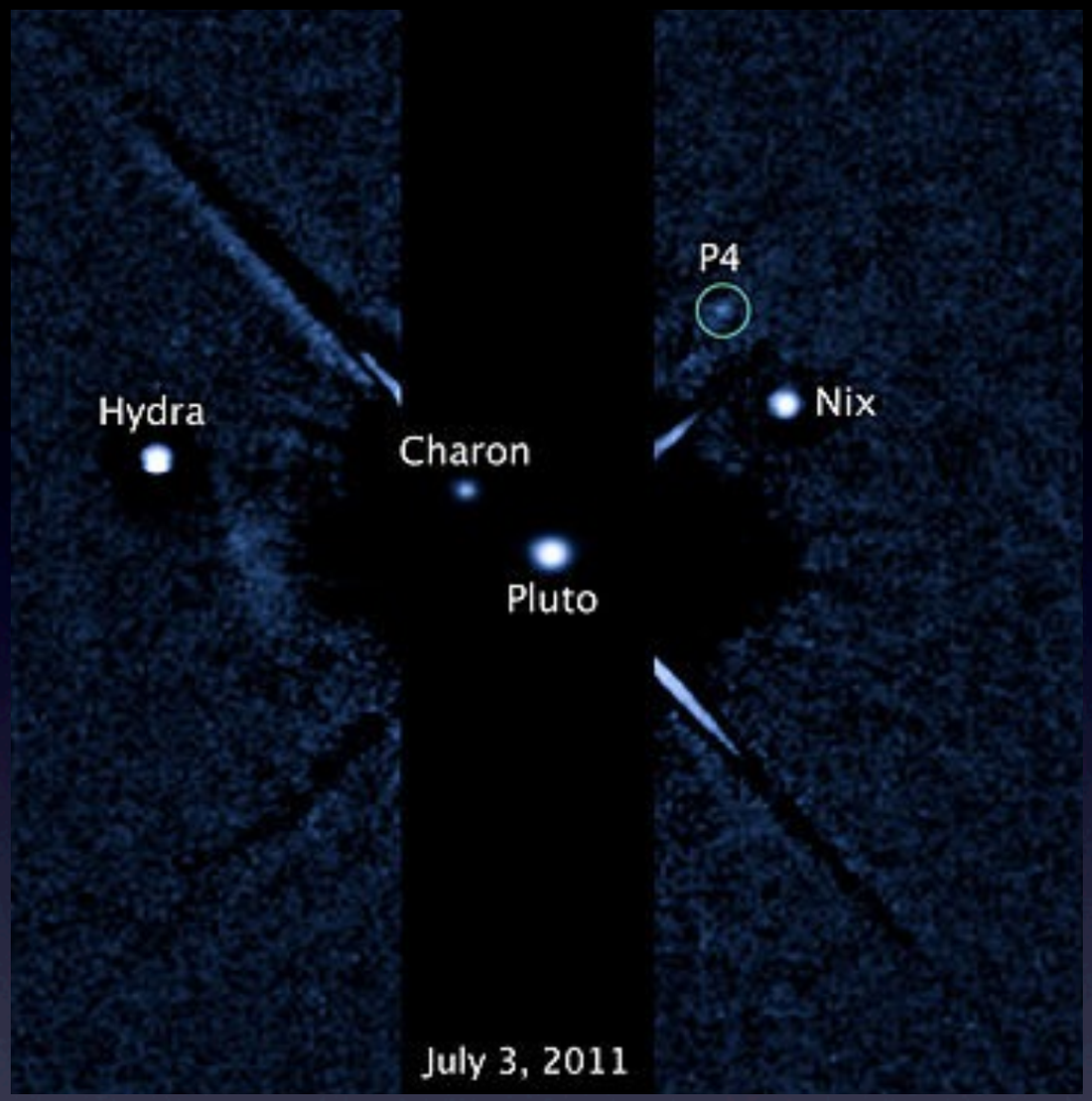


1932: Walt Disney also discovers Pluto

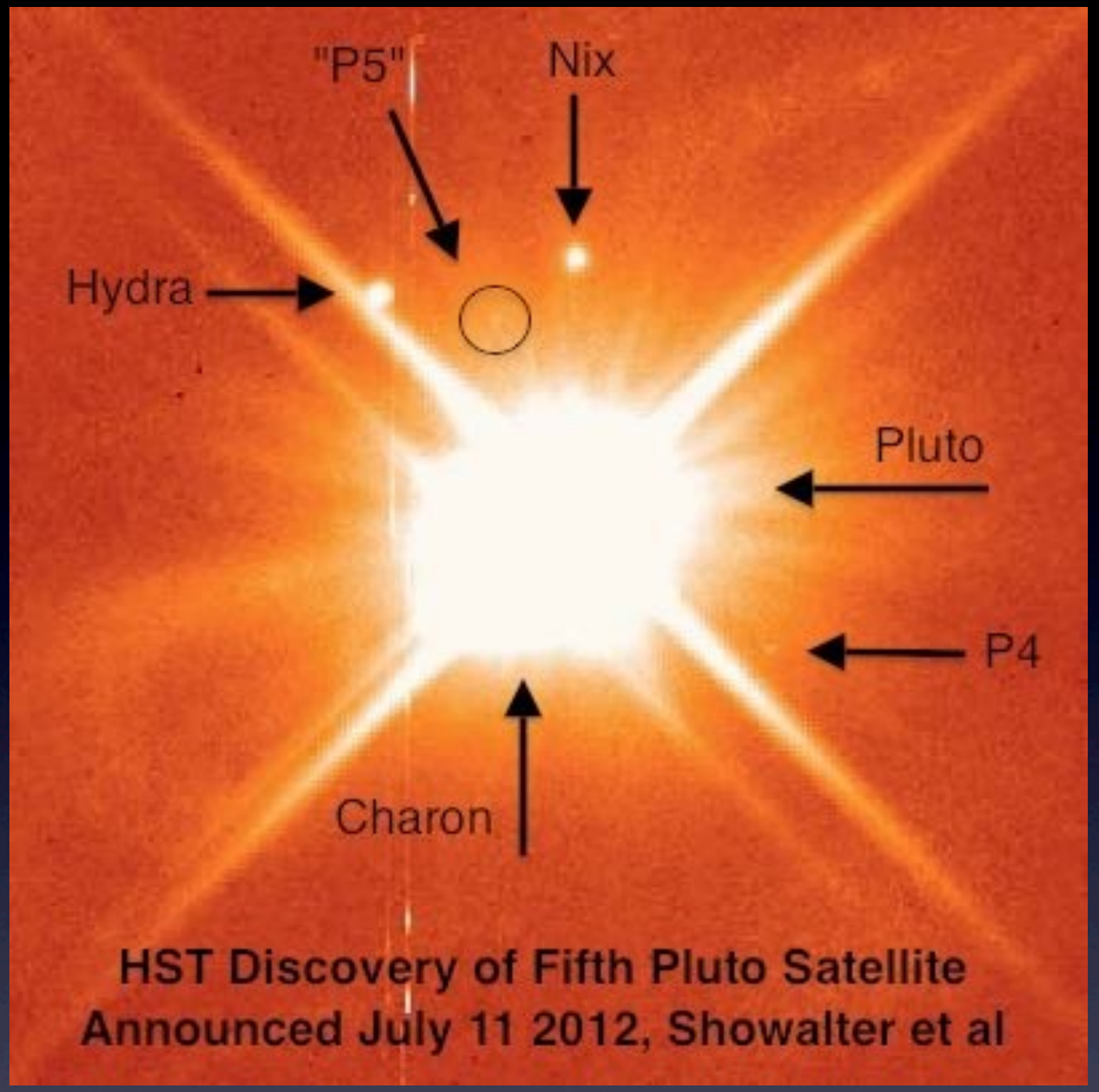
1930: Pluto
1978: Pluto + Charon Discovered



1930: Pluto
1978: Pluto + Charon
2006: Pluto + Charon + Nix + Hydra Discovered



1930: Pluto
1978: Pluto + Charon
2006: Pluto + Charon + Nix + Hydra
2011: Pluto + Charon + Nix + Hydra + P4 Discovered



1930: Pluto
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2012: Pluto + Charon + Nix + Hydra + P4 + P5

Charon

Pluto

Hydra

Nix

P5

P4

Pluto Is...

- Very far away
- Very cold
- Very small
- Very old

... and that is almost all we know!

We know what Earth looks like...

What will Pluto be like?


GUCCI
GUCCI
ONLY

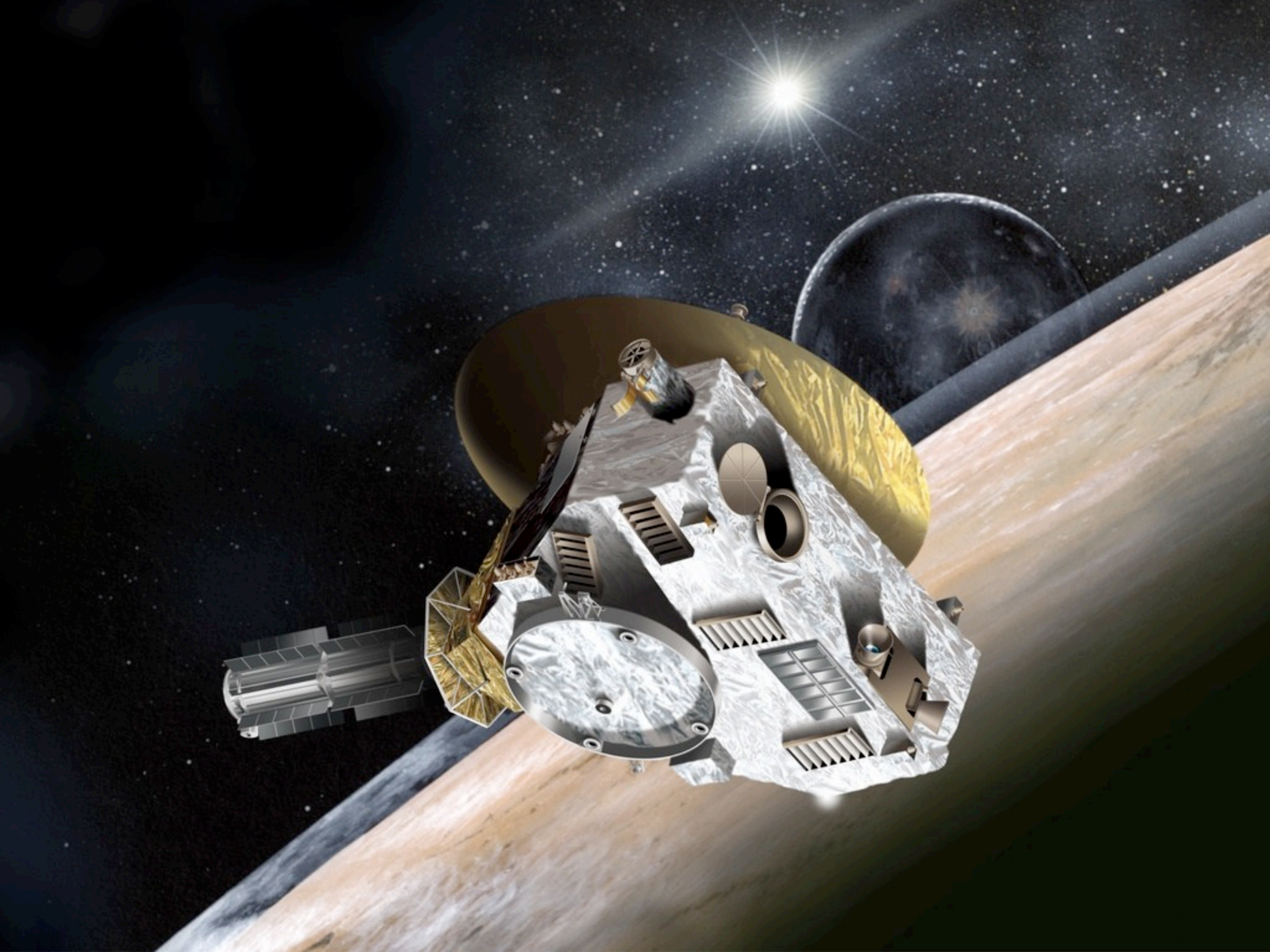
Meteor Crater, Arizona, USA

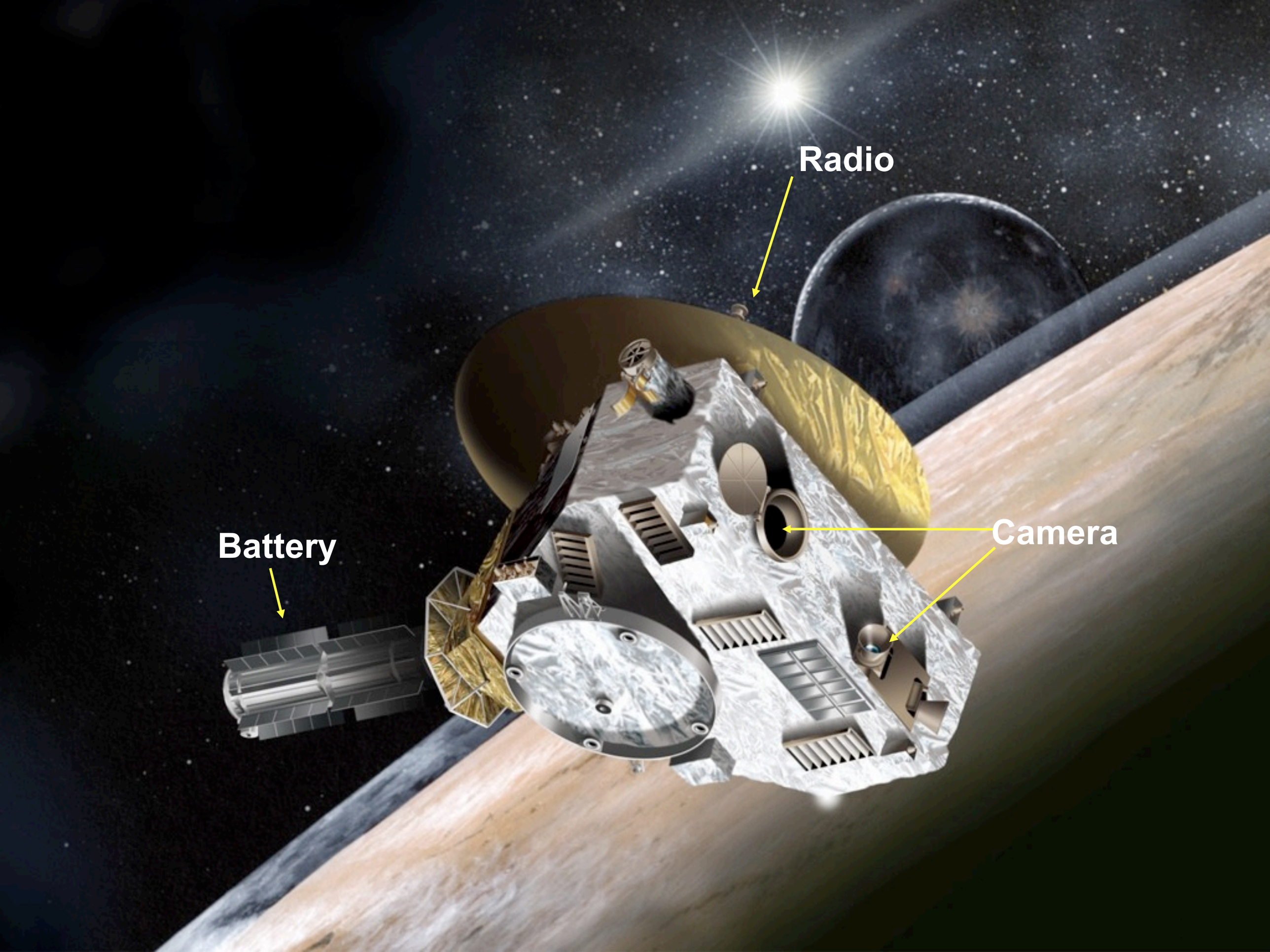
Tswaing Impact Crater, South Africa

Why Study Pluto?

Pluto's surface is probably the oldest in the whole Solar System.

So, studying Pluto tells us what the Solar System was like 5 billion years ago!




Radio
Battery
Camera


Camera
Radio
Battery
BlackBerry
3G
12:21 PM
Fri, May 20
All
space
sym

New Horizons Spacecraft

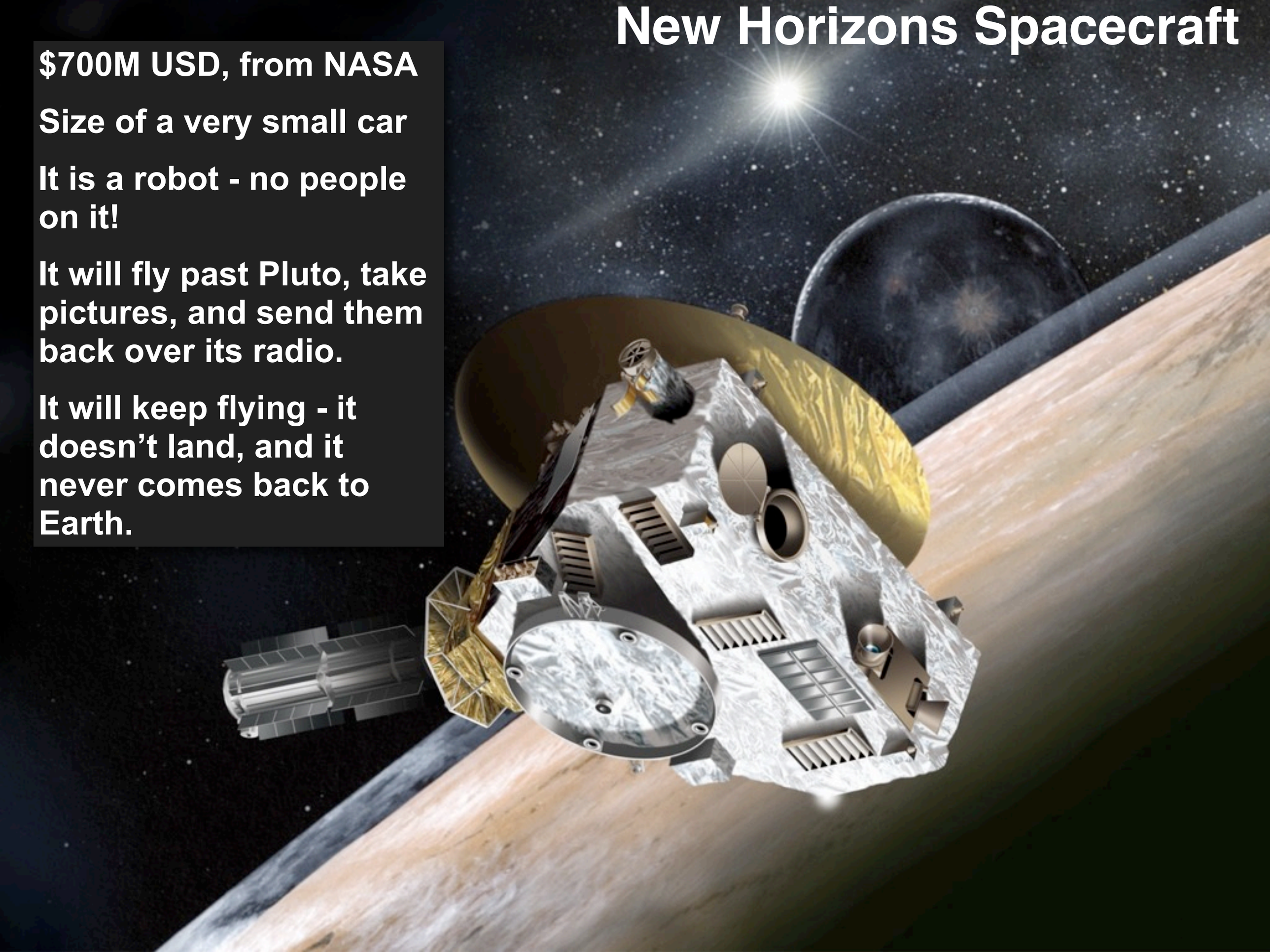
$700M USD, from NASA

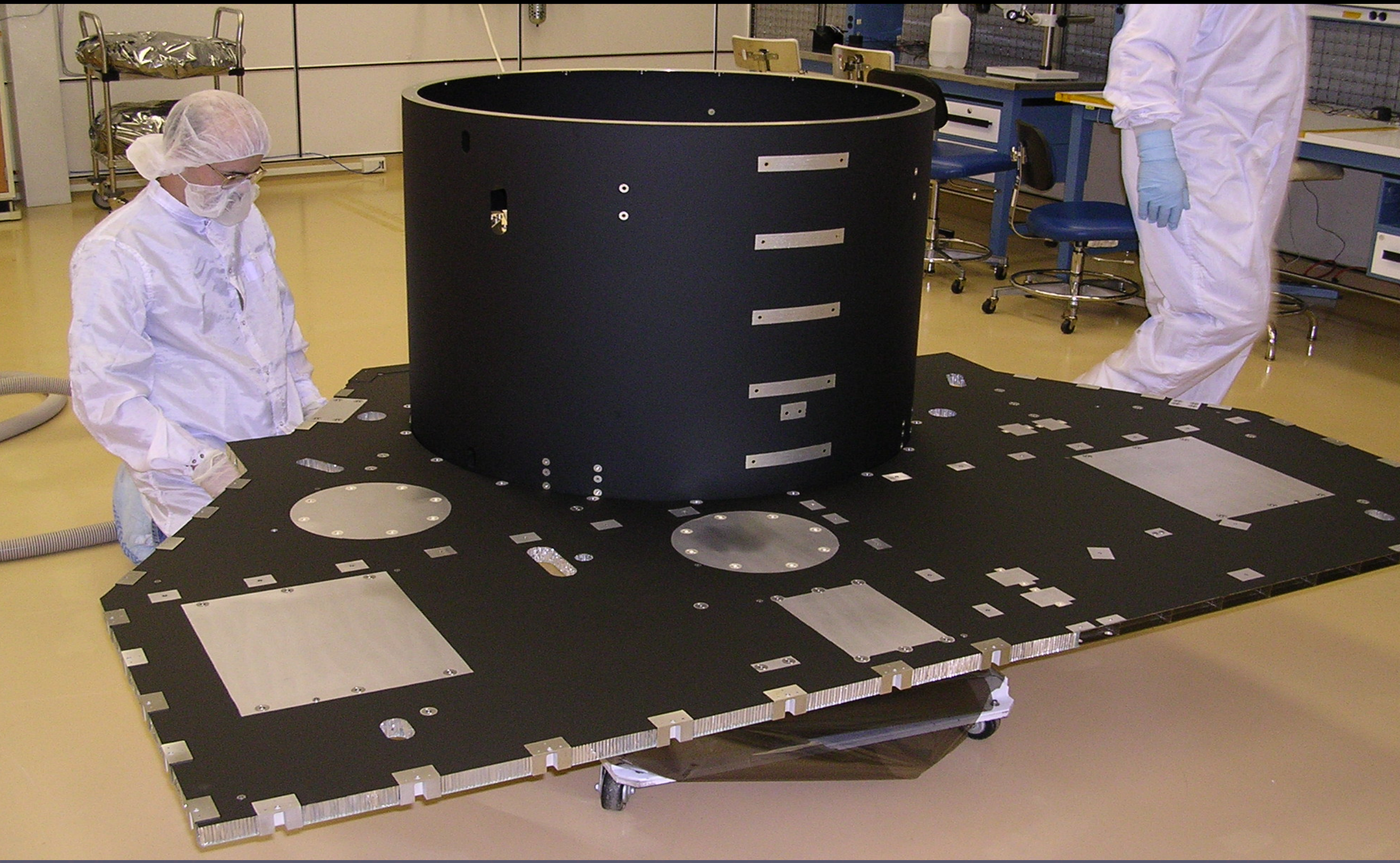
Size of a very small car

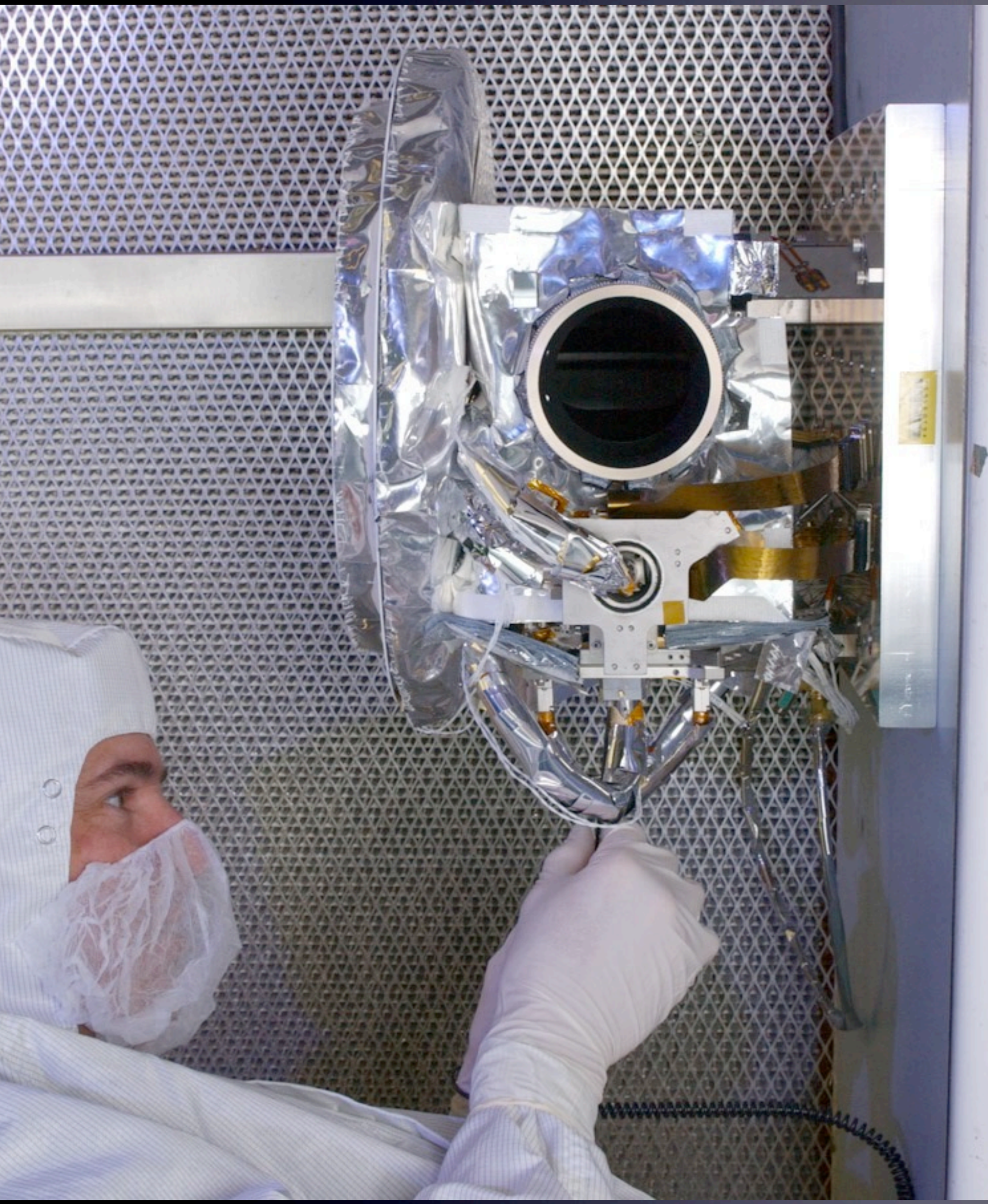
It is a robot - no people on it!

It will fly past Pluto, take pictures, and send them back over its radio.

It will keep flying - it doesn't land, and it never comes back to Earth.





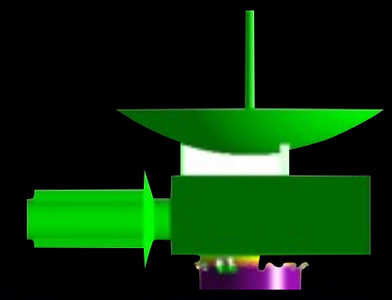


New Horizons Team


OVERSIZE LOAD


KAMAG
KAMAG

Lockheed-Martin Atlas V Rocket



Rocket: 575,198 kg
Spacecraft: 478 kg
Cameras: 20 kg


NASA
LOCKHEED MARTIN
ILS
AV-010
ILS


PLUTO
OR
BUST
NEW HORIZONS


46


DO NOT FEED THE ALLIGATORS
ALLIGATORS BECOME AGGRESSIVE TOWARDS PEOPLE AND WILL HAVE TO BE DESTROYED


PLUTO
NEW HORIZONS
Canon
ET-86
ULTRASONIC
Canon
ILS ILS ILS
Canon


NASA


LOCKHEED MARTIN

New Horizons is the ***fastest*** spacecraft ever launched!

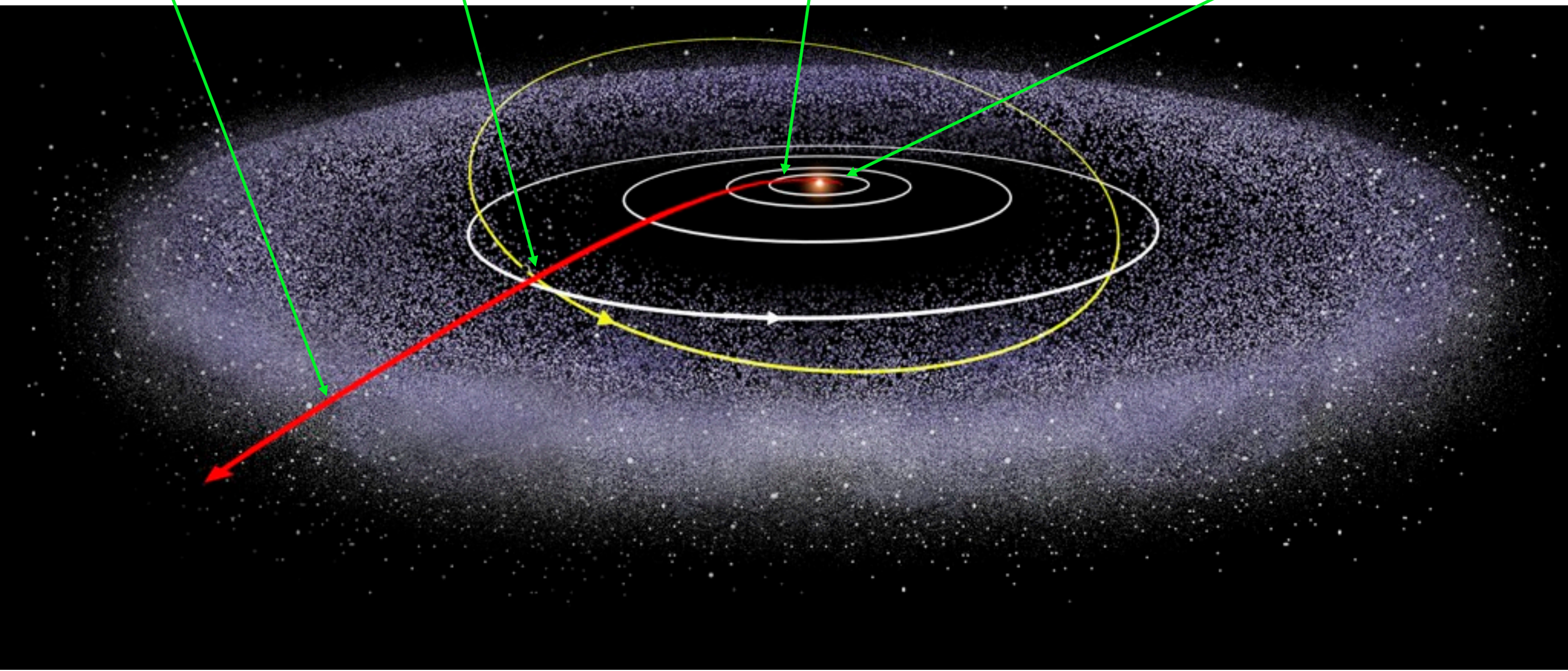
Mission	**Time to get to the Moon's distance**
New Horizons	6 hours
Apollo 11	96 hours

Pluto:
July 2015

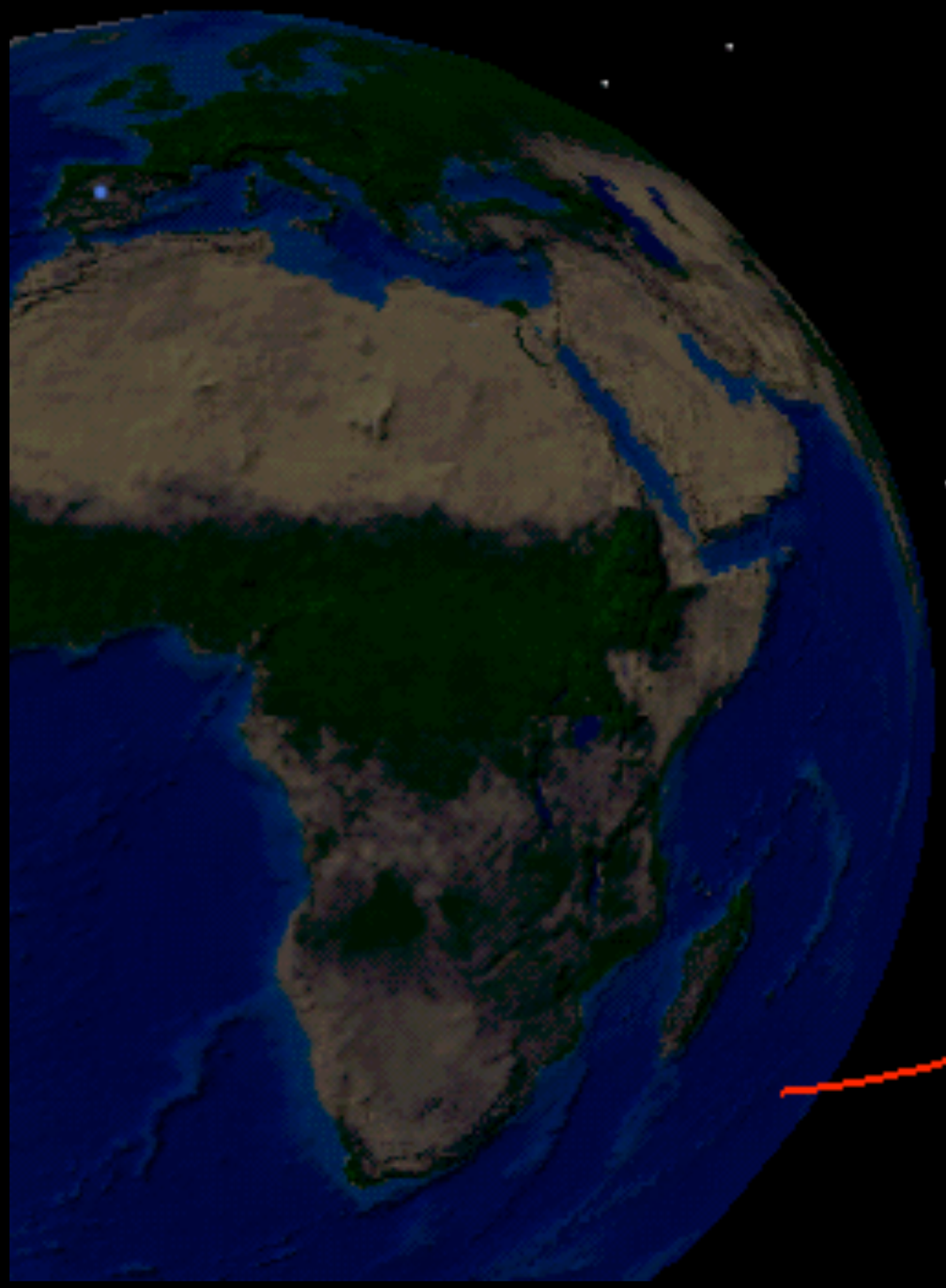
Jupiter:
March 2007

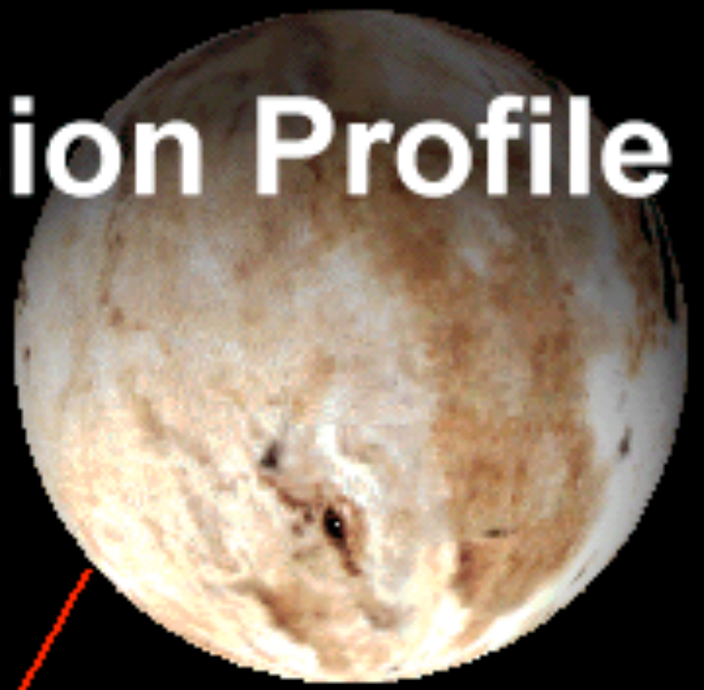
Kuiper Belt:
2016-2020

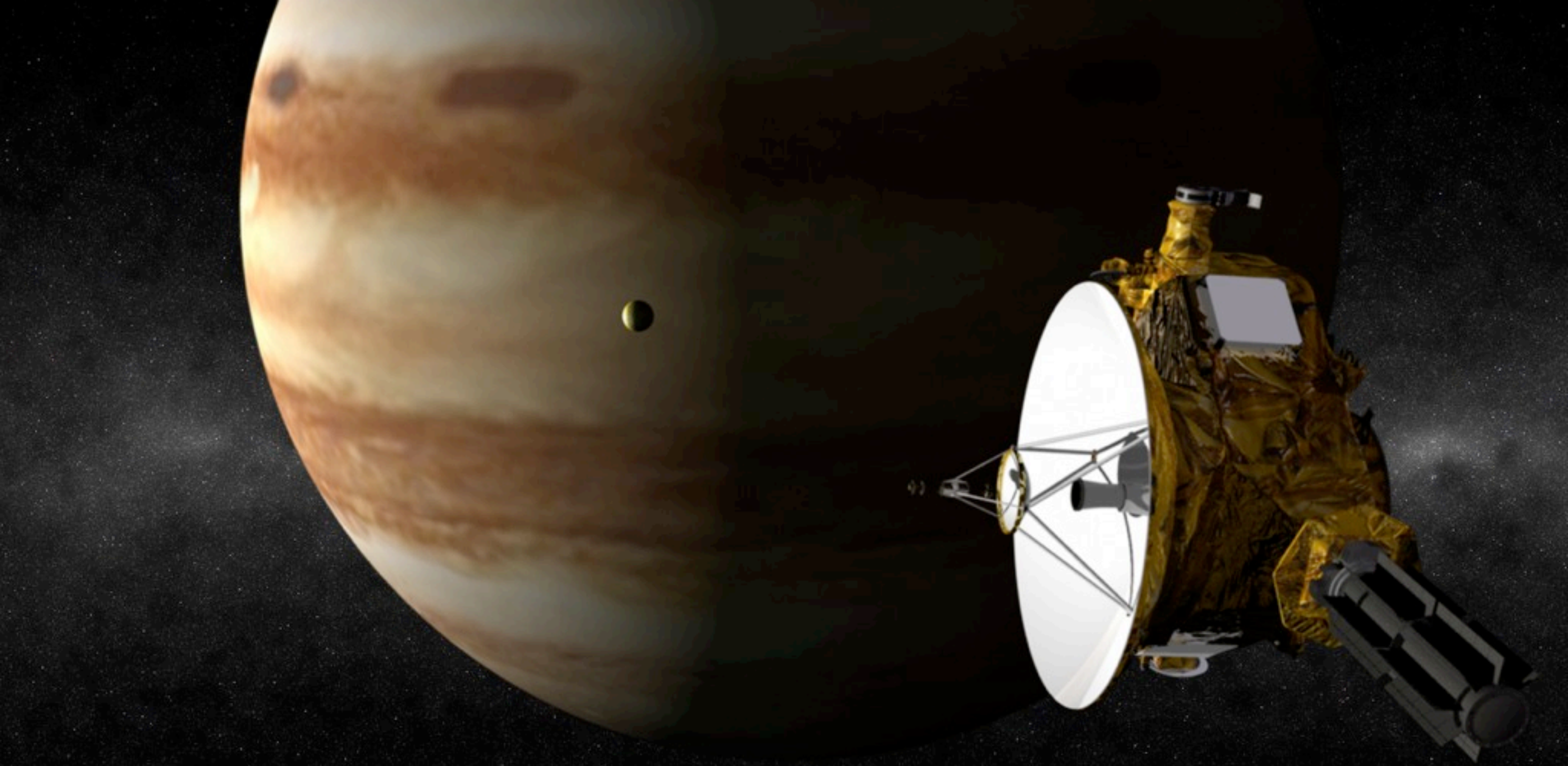
Earth:
January 2006



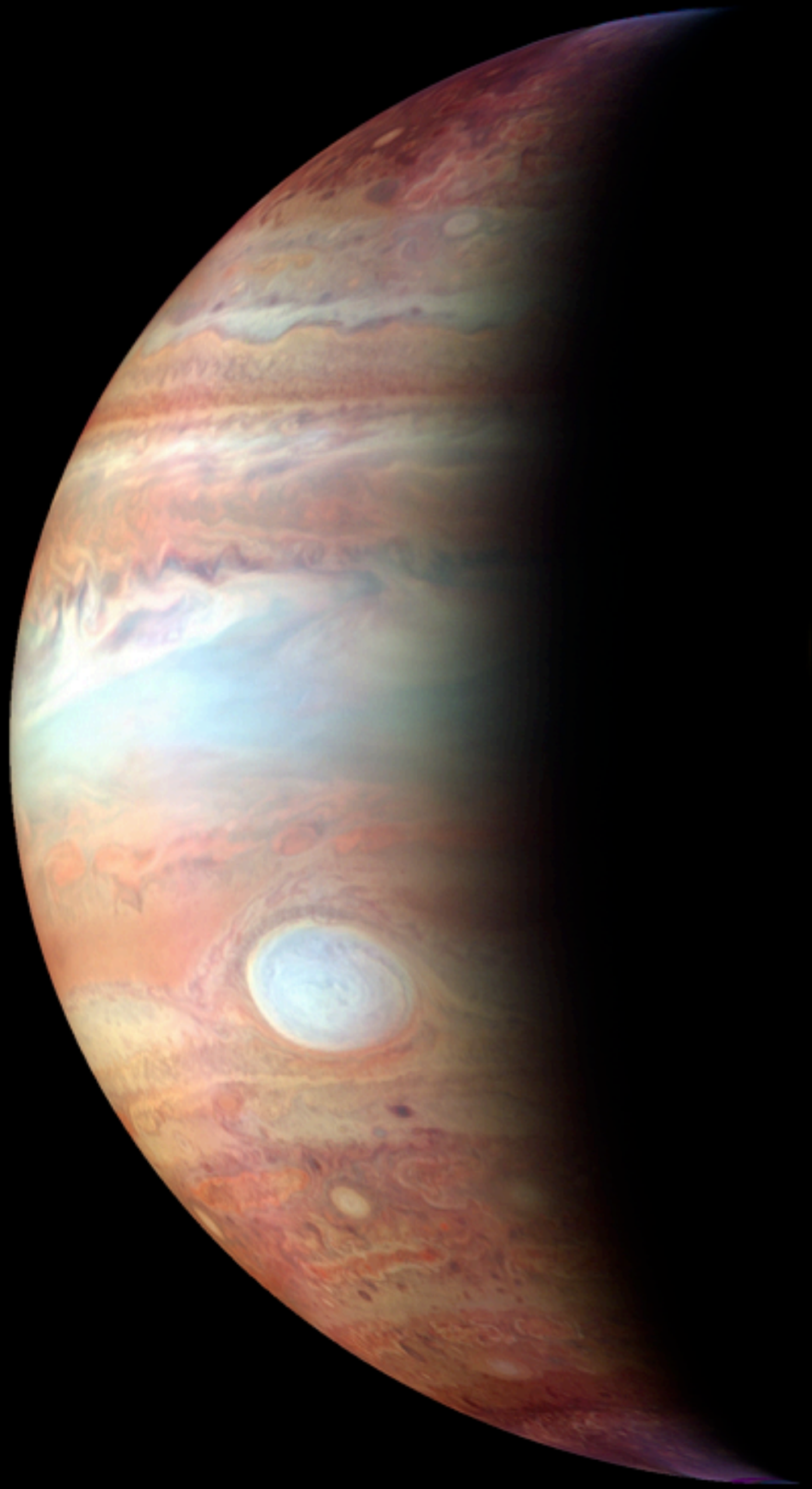
New Horizons
Pluto Kuiper Belt Mission Profile





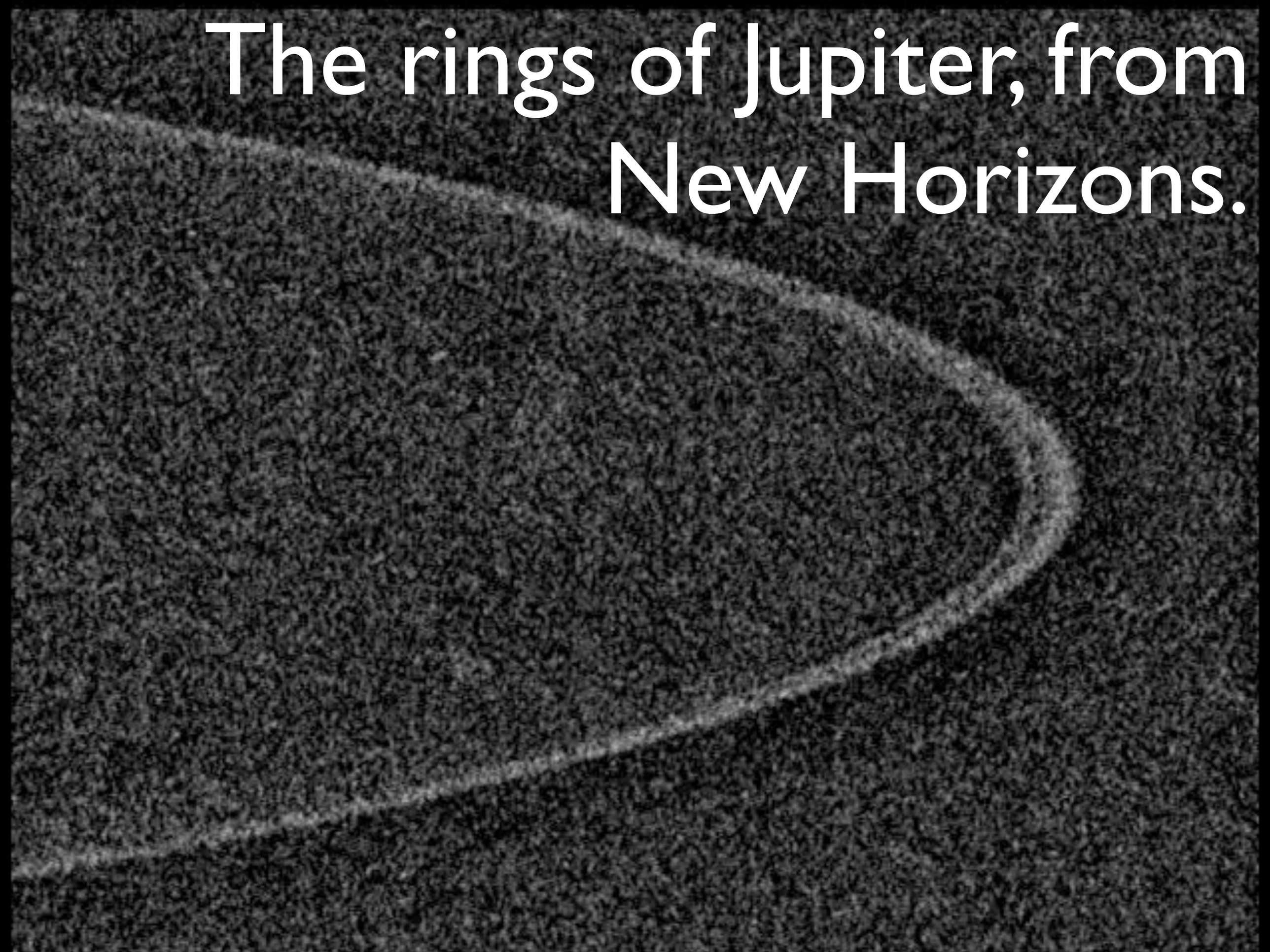


New Horizons at Jupiter: February 28 2007



New Horizon at Jupiter

February 28, 2007


The rings of Jupiter, from
New Horizons.

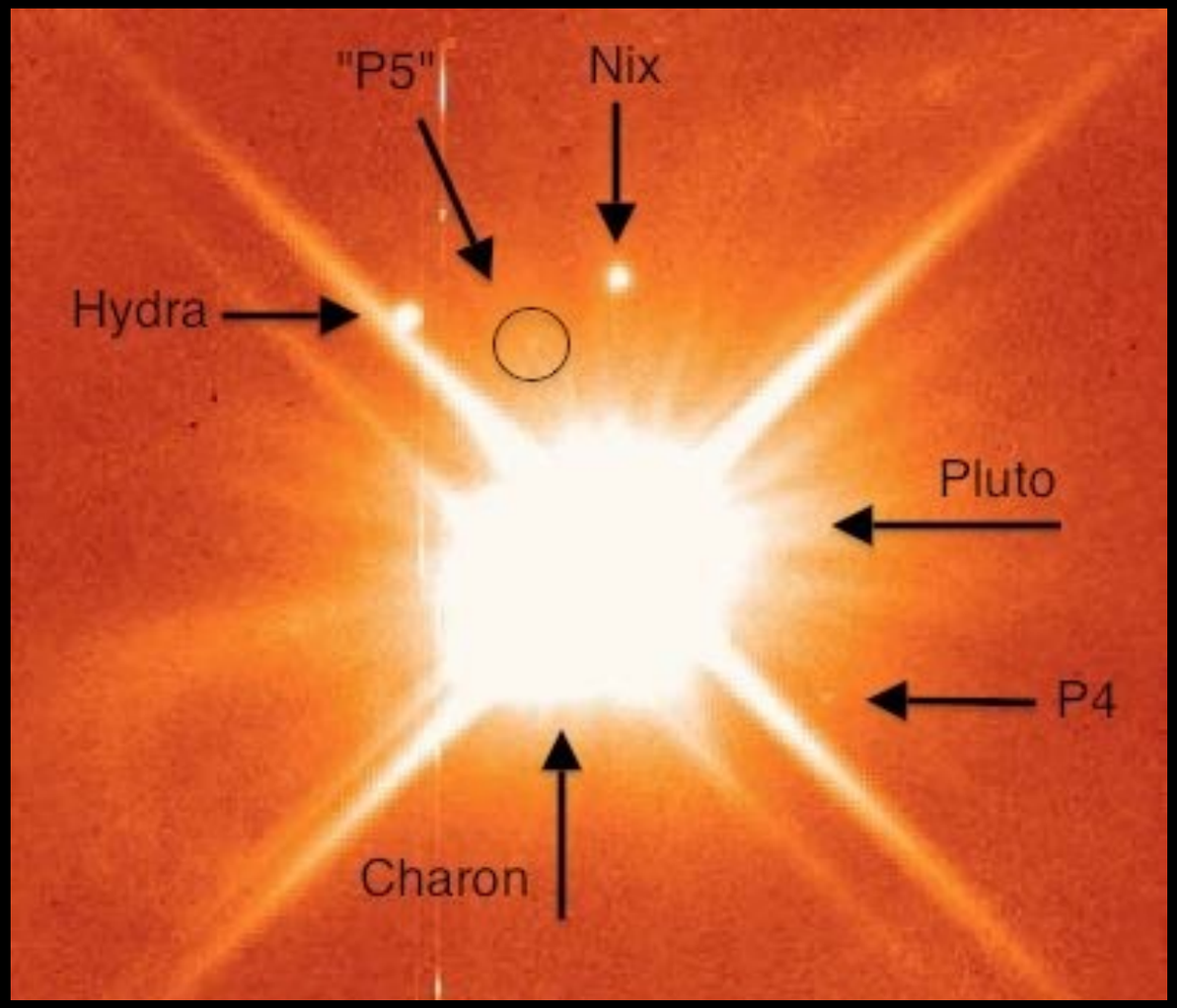
Volcanoes on Jupiter's Moon "Io"

Volcanoes on Io

Five Missions for the Price of One

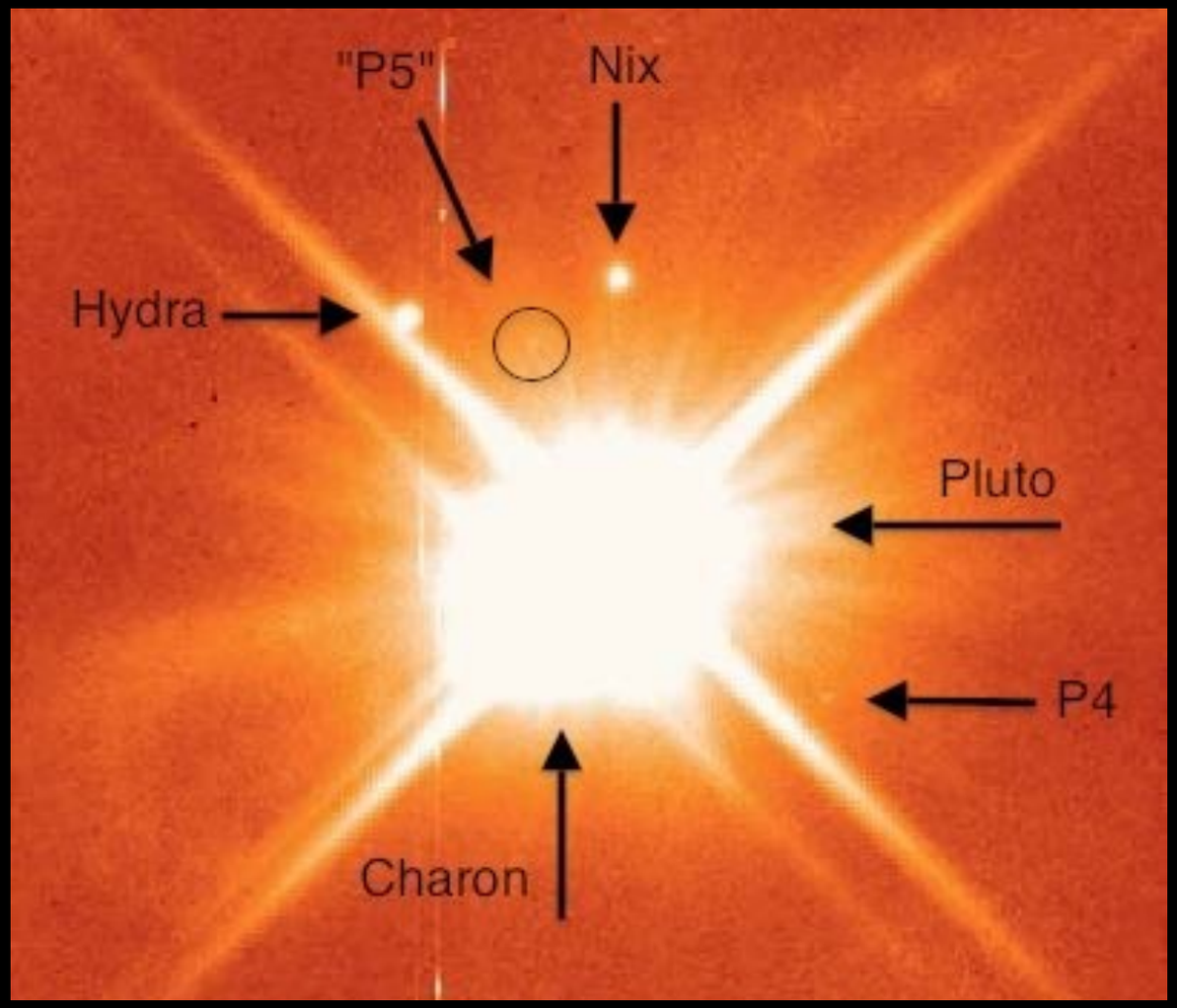
- 2003: When New Horizons was selected by NASA, Pluto had just one known moon, Charon.
- 2005: Two new moons discovered: Nix and Hydra
- 2006: Launch
- 2011: One more moon discovered: P4
- 2012: One more moon moon discovered: P5

All these new moons are great, but they give us a few problems...



1. If there are five moons, there may be more moons, more rocks, more dust that we cannot see... and *that* could be dangerous.

All these new moons are great, but they give us a few problems...



2.What do we call them??

SETI INSTITUTE

Pluto Rocks

Help us name the smallest moons of Pluto

How to names Pluto's moons P4 and P5?

- We conducted one of the internet's largest polls ever at PlutoRocks.com
- Two weeks, 450,000 votes
- 180+ countries including South Africa, Zim, Namibia, Botswana, Lesotho...

Is Pluto a Planet?

Yes !!!

- It orbits the Sun
- It is big enough so that its own gravity makes it into a round ball
- It has five moons
- It has an atmosphere
- We've always called it a planet

No !!!

- It's smaller than the other planets
- Its orbit is egg-shaped and tilted
- It's just like the other 500 Kuiper Belt objects, and we don't call them planets
- If it was discovered today, we would not call it a planet

August 2006: International Astronomical Union, Prague

This group voted to call Pluto a ‘Dwarf Planet.’
But not everyone agrees, and this is how science works.

IAU Definition of Planet

"The IAU therefore resolves that "planets" and other bodies in our Solar System, except satellites, be defined into three distinct categories in the following way:

(1) A "planet" is a celestial body that (a) is in orbit around the Sun, (b) has sufficient mass for its self-gravity to overcome rigid body forces so that it assumes a hydrostatic equilibrium (nearly round) shape, and (c) has cleared the neighborhood around its orbit.

(2) A "dwarf planet" is a celestial body that (a) is in orbit around the Sun, (b) has sufficient mass for its self-gravity to overcome rigid body forces so that it assumes a hydrostatic equilibrium (nearly round) shape, (c) has not cleared the neighbourhood around its orbit, and (d) is not a satellite.

(3) All other objects except satellites orbiting the Sun shall be referred to collectively as "Small Solar-System Bodies".

Problem I: The 800+ extrasolar planets aren't 'planets'?

Problem II: But Jupiter isn't 'rigid'!

Problem III: Saturn isn't round!

Problem IV: Earth, Jupiter, Moon, etc have not 'cleared their neighborhood'!

HELP SUPPORT LOWELL OBSERVATORY

Vote with your wallet
on the question below

What should Pluto be called?

Planet

Dwarf Planet

Other

I don't care! I just want to support Lowell

- What is the difference between a koppie and a hill? It's a fine line...
- Science is a human process and our names will continue to evolve as we learn more about the world around us.

Pluto is a Planet.

Get on with it and Look at the Sky!

You can track New Horizons as it gets ready to arrive at Pluto July 14, 2015...

http://pluto.jhuapl.edu/

throop@psi.edu

Astronomy in Africa

Why Astronomy in Africa?

- Natural resources
  - Dark skies (optical)
  - Quiet skies (radio)
  - Close to equator
  - Undeveloped, and/or protected against development
- Development of local skills and infrastructure can make lasting impact in countries' long-term capabilities.

Why Astronomy?

- It encompasses many sciences: physics, chemistry, biology, maths, computer science, engineering,
- It's a gateway science: Students and learners are inspired by the sky, like Africans have been for millennia.
- It is instantly accessible, but yet addresses the perhaps single biggest question in science: Are We Alone?
- Successful astronomy programs have benefits much broader than just science.

SKA in Africa

Square Kilometer Array is arguably the largest global scientific project ever, anywhere.

Ten member countries, plus eight more in Africa.

$2 billion; three arrays across 3000+ km; 3000 dishes; major sites in South Africa and Australia; construction 2015-2024.

- Botswana is one of 8 SKA Africa partners, with Ghana, Kenya, Madagascar, Mauritius, Mozambique, Namibia, Zambia
- In addition to bursaries and research involvement, Botswana will be the site of three 15 m mid-frequency dishes, improving range and coverage of main antenna array.

"Some people think the SKA will create jobs tomorrow or build houses tomorrow.

That may happen, but ***the SKA's most important impact is the much longer-term impact of changing both our own perception of what's possible and the world's perception of what Africa can do***...

It will also create a significant critical mass of young people and industries with the kind of capabilities that will enable them and [Africa] to play not just a role, but a leading role in global technology."

- SKA SA Director Dr. Bernie Fanaroff

The SKA is like Africa's Apollo mission

American science was revolutionized by exploring the Moon up close, in person.

But the larger benefit is that Apollo inspired a generation of Americans to dream big, to become astronomers and rocket scientists and engineers.

That generation inspired another generation, who are now leading projects at NASA and across the world, exploring the solar system, searching for planets and distant life, and understanding the origins of Universe.