

PROFESSOR SMARTT'S GUIDE TO THE UNIVERSE

Presented by

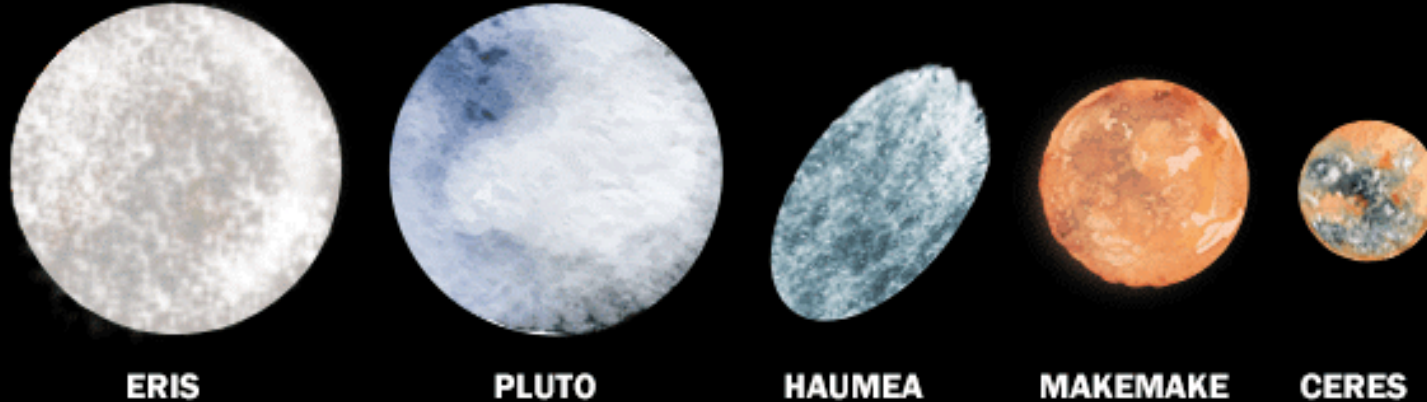
smarttscience



DWARF PLANETS

Remember Pluto? It used to be counted as the 9th planet from the Sun until the discovery of Eris, a body almost the same size as it, prompted scientists to decide whether they would have to list it as a *new* planet, or create a subcategory of planets called **Dwarf Planets**.

All dwarf planets (apart from **Ceres**) reside in the **Kuiper Belt**, a region of ice and rock at the edge of the Solar System.

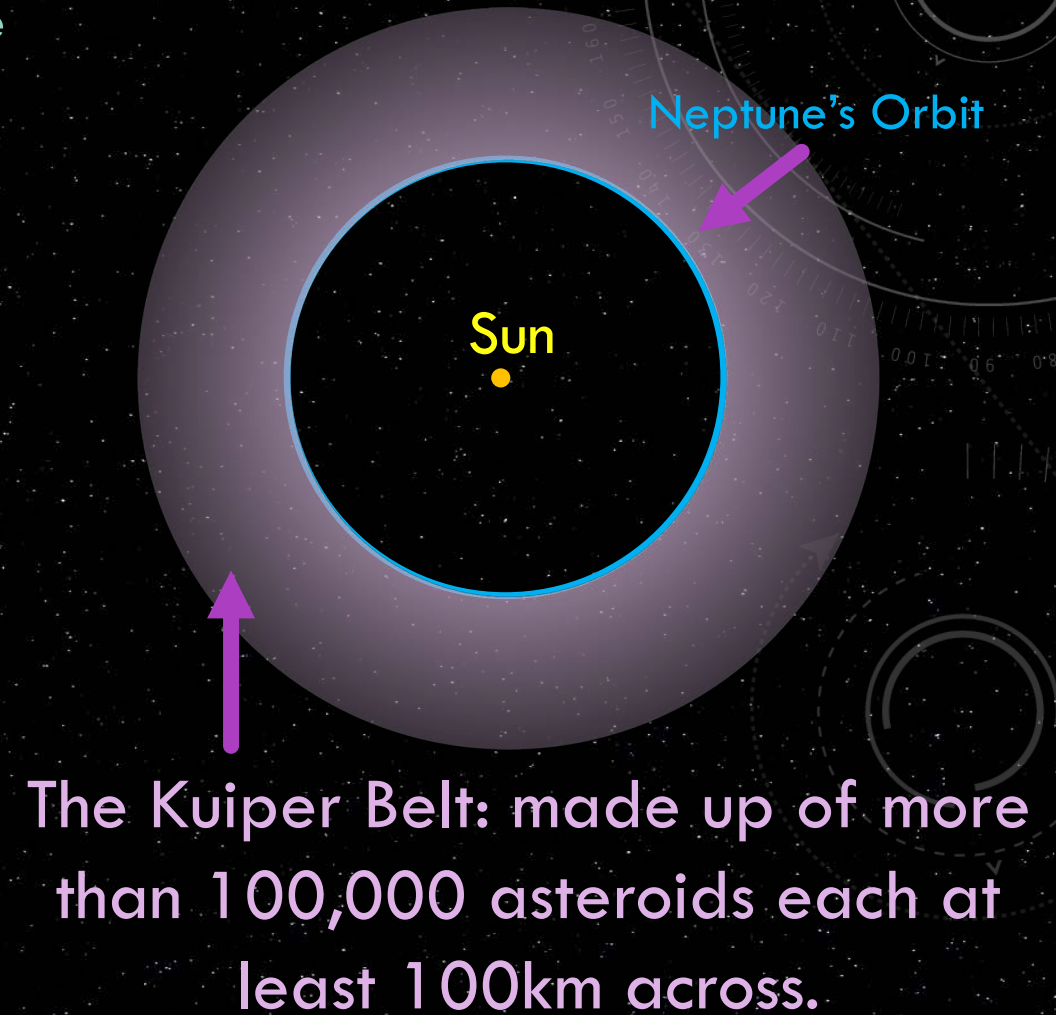
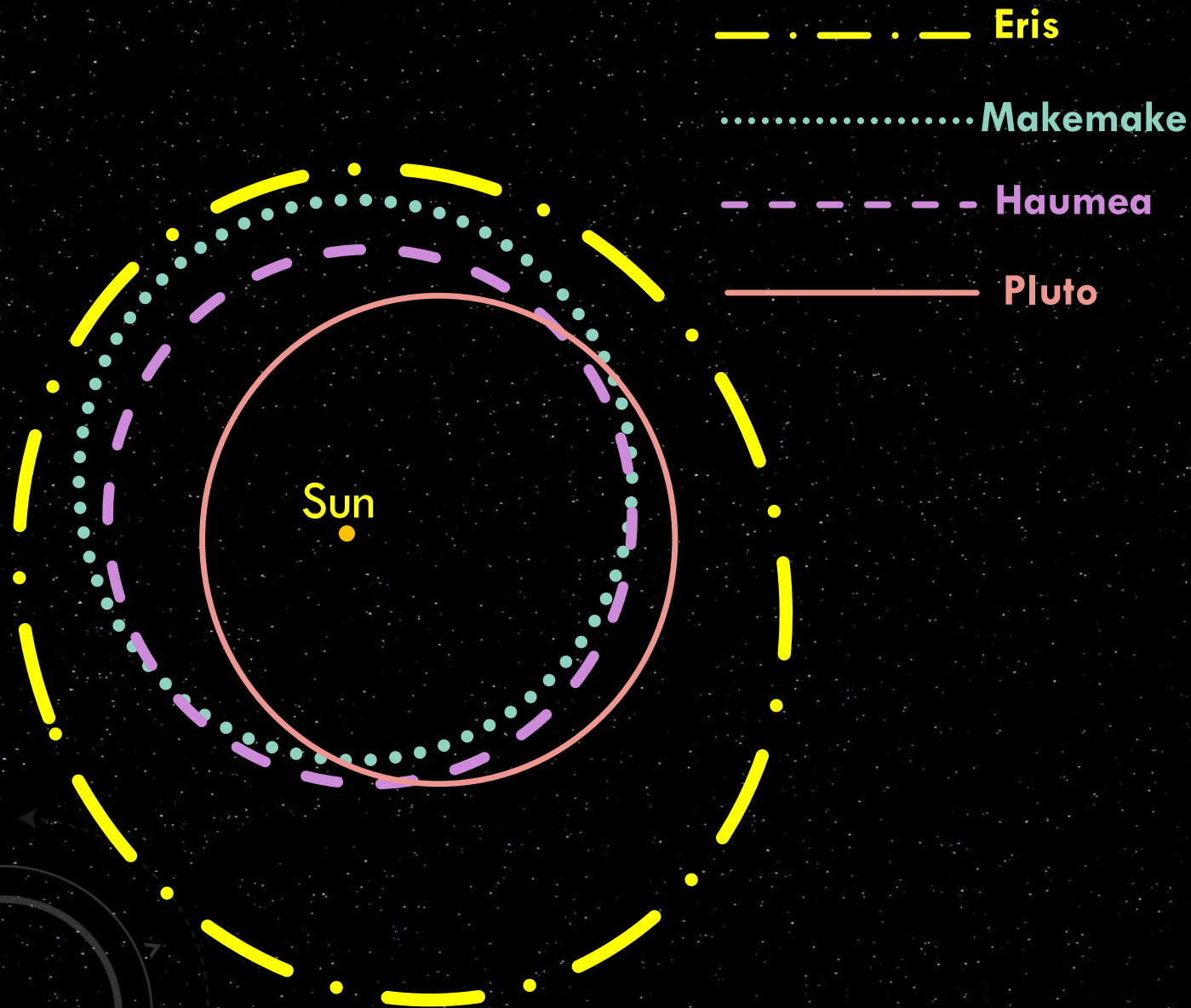


There may be as many as 200 more dwarf planets beyond the orbit of Neptune, waiting to be discovered.

WHAT IS THE DEFINITION OF A DWARF PLANET?

- A dwarf planet is a celestial body too small to be considered a planet, but too large to be an asteroid.
- Another difference between planets and dwarf planets – a planet must have cleared its orbit of other debris. Dwarf planets do not have enough gravitational force to either join the intruding objects to themselves, or kick them out of the way.
- On the other hand dwarf planets must be large enough to have formed in a (roughly) round shape – they can't be lumpy potatoes like most asteroids!
- They are all (apart from Ceres) very far from the Sun - let's take a look at their orbits.

ORBITS OF THE DWARF PLANETS



ACTIVITY – FIND A DWARF PLANET.

- Try and find a dwarf planet in some real images from a telescope in Hawaii.
- This telescope surveys the sky every night and searches for moving objects (planets and asteroids) and anything that flashes or changes in brightness.



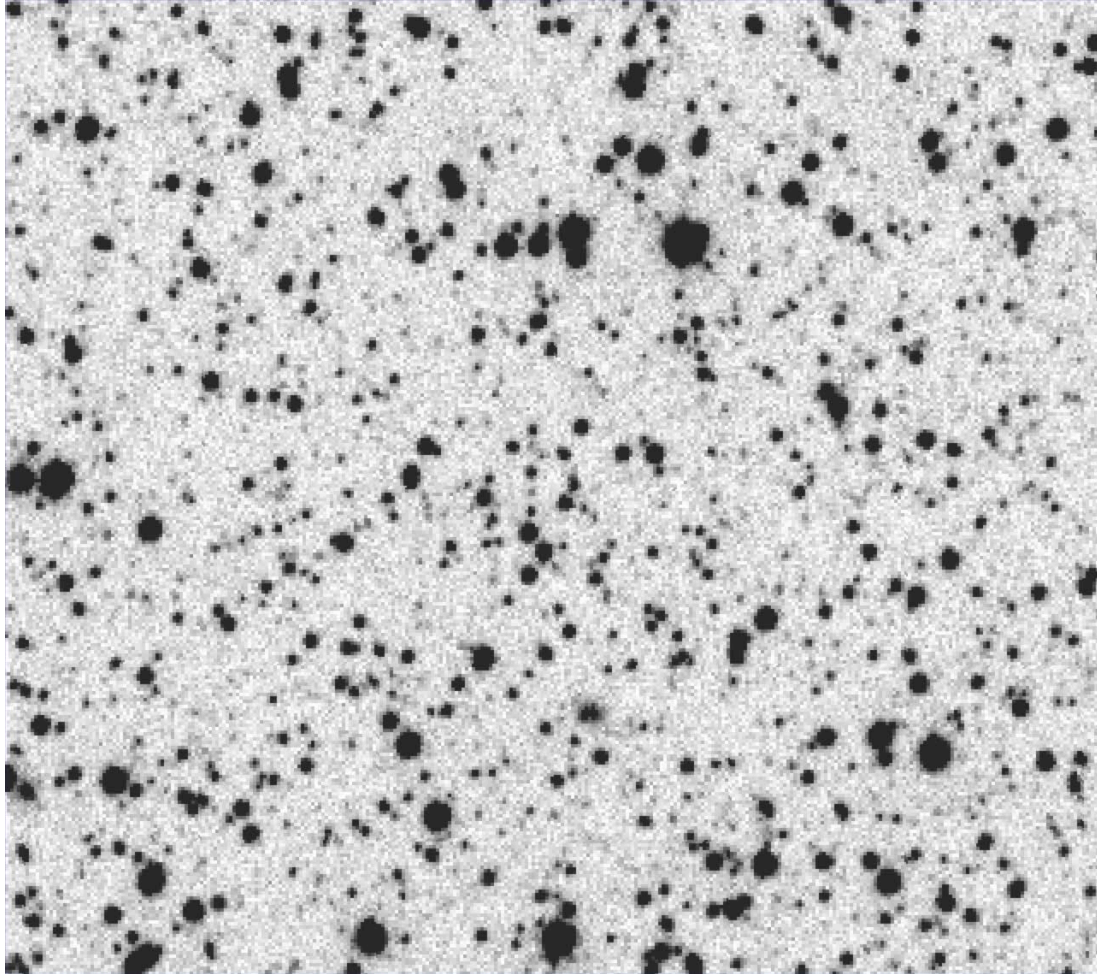
Here's an image from telescopes of the European Southern Observatory in Chile of a patch of sky.

It is covered in stars – how would you go about finding a planet in all this confusion?

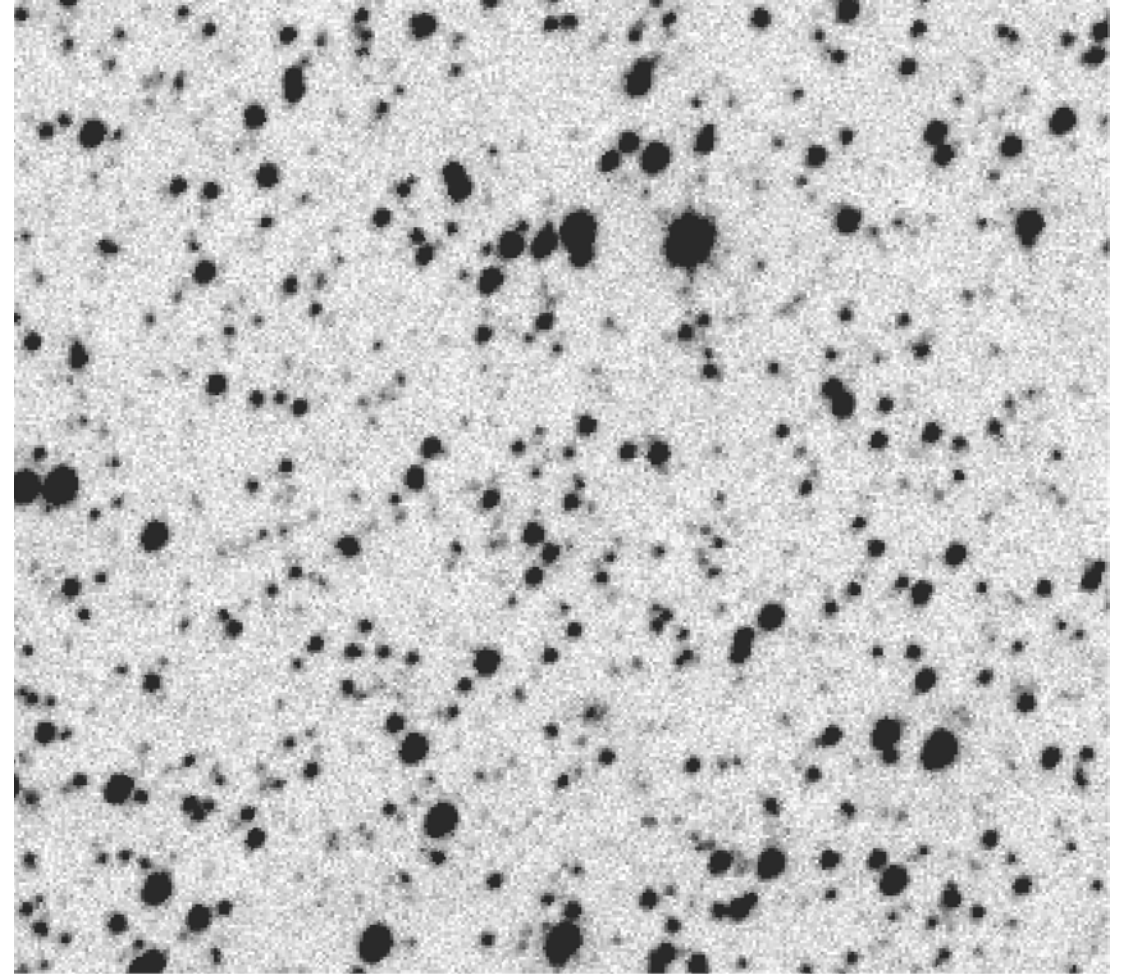
Let's find out.

Find Pluto!

Here are two images taken with the ATLAS telescope on the island of Maui in Hawaii. Astronomers often show the sky in “negative”, so all the black dots (apart from one) are stars. The dwarf planet Pluto is in both images. All the stars are stationary, and Pluto is the only object that has moved. Can you find it? This is how Clyde Tombaugh discovered Pluto, he just spotted the object that moved.

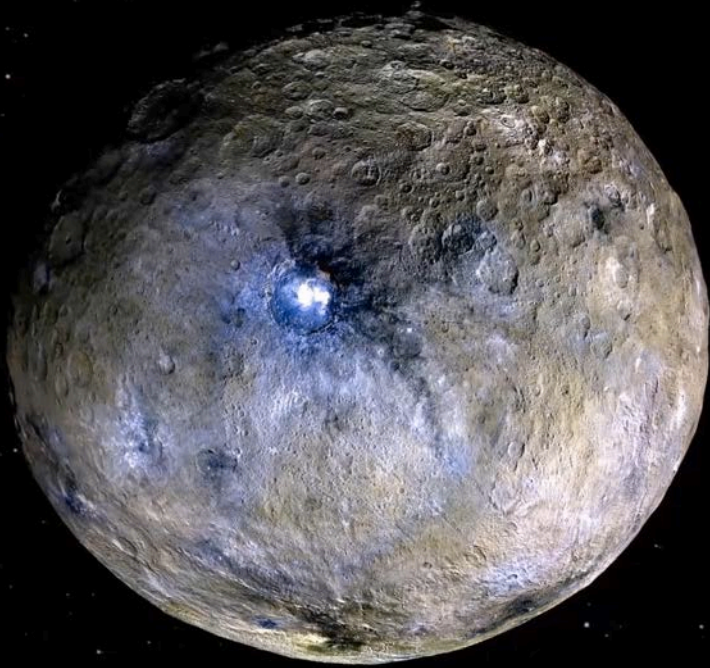


2nd October 2018



14th October 2018

CERES



- The closest dwarf planet to Earth, Ceres' orbit is between Mars and Jupiter, so it is the only dwarf planet not in the Kuiper Belt.
- Ceres is named after the Roman goddess of grain crops and harvests. The word cereal comes from the same name.

NASA/JPL-Caltech/UCLA/MPS/DLR/IDA

PLUTO

- The most famous dwarf planet. Pluto was discovered in 1930 by Clyde Tombaugh and named by Venetia Burney, an 11 year old girl from Oxford. She received £5 as a reward.
- Pluto was demoted from planet to dwarf planet status in 2006, following the discovery of Eris.

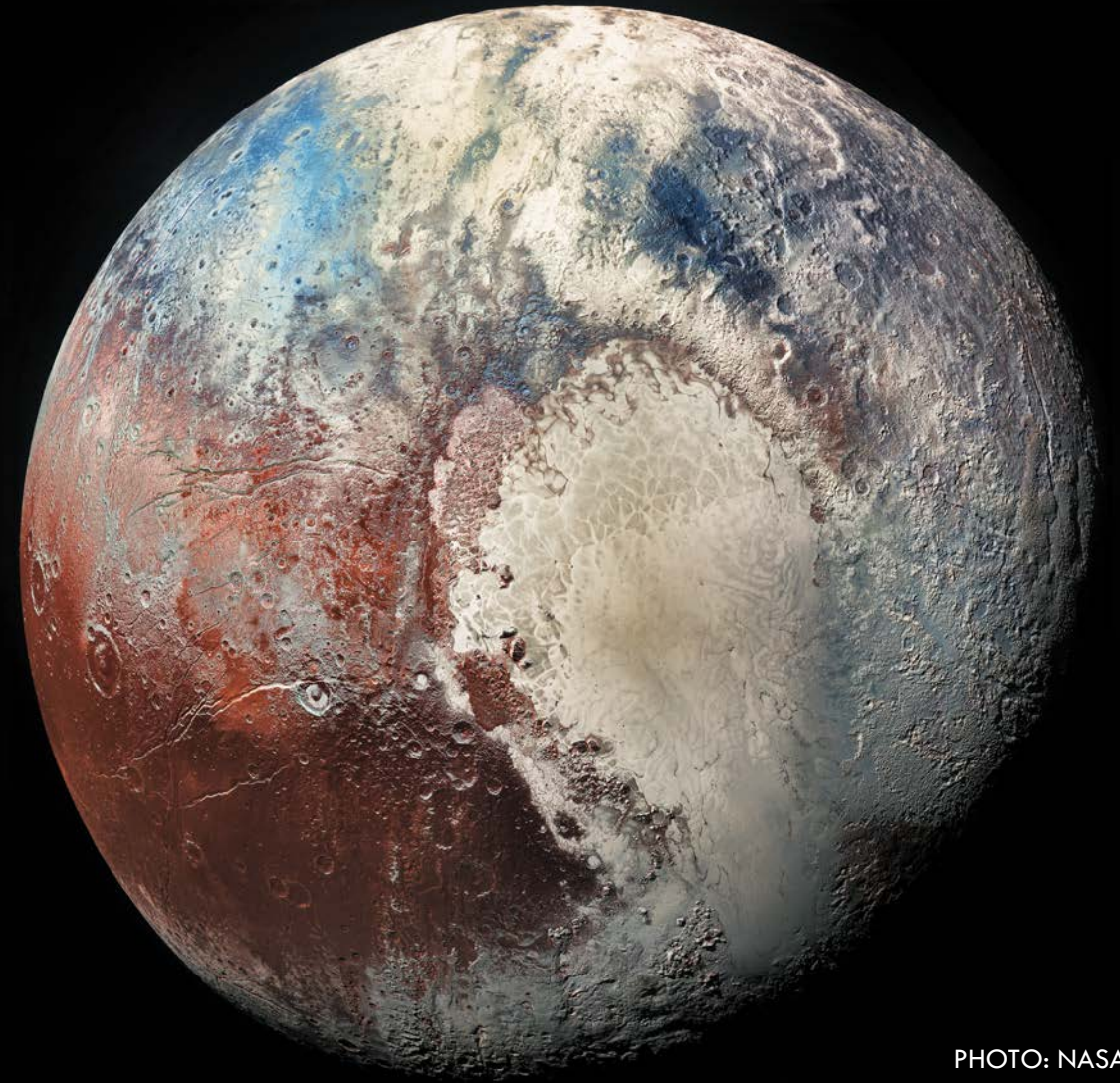


PHOTO: NASA

HAUMEA



Image: Stephanie Hoover

- Haumea is a strange, oval shaped dwarf planet on the outskirts of the Solar System. Its odd shape is thought to be the result of a violent collision with other **trans-Neptunian objects** (objects beyond the orbit of Neptune), coupled with its extremely fast rotation. A day lasts only four hours.
- Haumea even has a ring, like Saturn and Uranus.



Credit: IAA-CSIC/UHU

MAKEMAKE

- Very little is known about the mysterious dwarf planet Makemake.
- It is two-thirds the size of Pluto, and also contributed to its demotion and the creation of a new classification of dwarf planets.
- Makemake was named after the chief god of the Rapa Nui tribe on Easter Island.
- Makemake, along with Eris and Pluto, all reside in the **Kuiper Belt**.



Image: NASA

ERIS



- Eris is the furthest known dwarf planet in the Solar System.
- When it was discovered, it was thought to be bigger than Pluto - one of the main reasons for Pluto's demotion and the creation of the dwarf planet class.
- We now know it is almost exactly the same size as Pluto.
- It takes 25 hours to rotate on its axis, making its day similar to ours, but it takes 561 Earth years to orbit the Sun.

THREE MORE FACTS ABOUT THE DWARF PLANETS

- They have moons, such as Pluto's **Charon** and Eris's **Dysnomia**.
- There may be up to 200 dwarf planets on the edge of the Solar System.
- Pluto has an average surface temperature of around -228°C . When the **New Horizons** spacecraft passed Pluto in 2015, scientists spotted ice features similar to Earth's **penitentes**, except that while the penitentes on Earth reach only 5 metres in height, Pluto's may reach up to 500 metres.



Earth's penitentes.
Pluto's may be 100
times taller.

ACTIVITY

Test your knowledge with the question sheet on
the Dwarf Planets.

PLANETARY MNEMONICS, INCLUDING DWARF PLANETS

As the dwarf planets were discovered, longer planetary mnemonics were created to help remember their order.

As there may be up to 200 dwarf planets on the outskirts of the **Kuiper Belt**, it will become harder and harder to think up new mnemonics!

Can you remember the order of all the planets, including dwarf planets?

- My Very Educated Mother Cannot Just Serve Us Nine Pizzas - Hundreds Must Eat!
- My Very Educated Mother Can Just Scream Until Nine Planets Haunt My Encyclopedia.

ACTIVITY

Fill in the question sheet.

DWARF PLANETS

1. Which dwarf planet is the closest to Earth, and resides between Mars and Jupiter?
 - a. Eris
 - b. Haumea
 - c. Ceres
2. Put these in order of their size, from the biggest to the smallest.
 - a. Eris
 - b. Our Moon
 - c. Ceres
 - d. Pluto
3. Though there may be up to 200 dwarf planets in our Solar System, how many have been officially classified as dwarf planets so far?

4. What year was Pluto stripped of its planet status and officially made a "dwarf planet"?
 - a. 1930
 - b. 2006
 - c. 2016

5. Draw the rough shape of the dwarf planet Haumea.



6. How long is a day on Eris?
 - a. 24 hours
 - b. 25 hours
 - c. 48 hours
7. What is the name of the region at the edge of the solar system where most dwarf planets reside?
 - a. The Hyper Belt
 - b. The Viper Belt
 - c. The Kuiper Belt
8. What dwarf planet was named after the chief god of the Rapa Nui tribe on Easter Island? (Hint: it is the only dwarf planet we haven't mentioned on this sheet so far).

Score: / 8

BONUS ACTIVITY

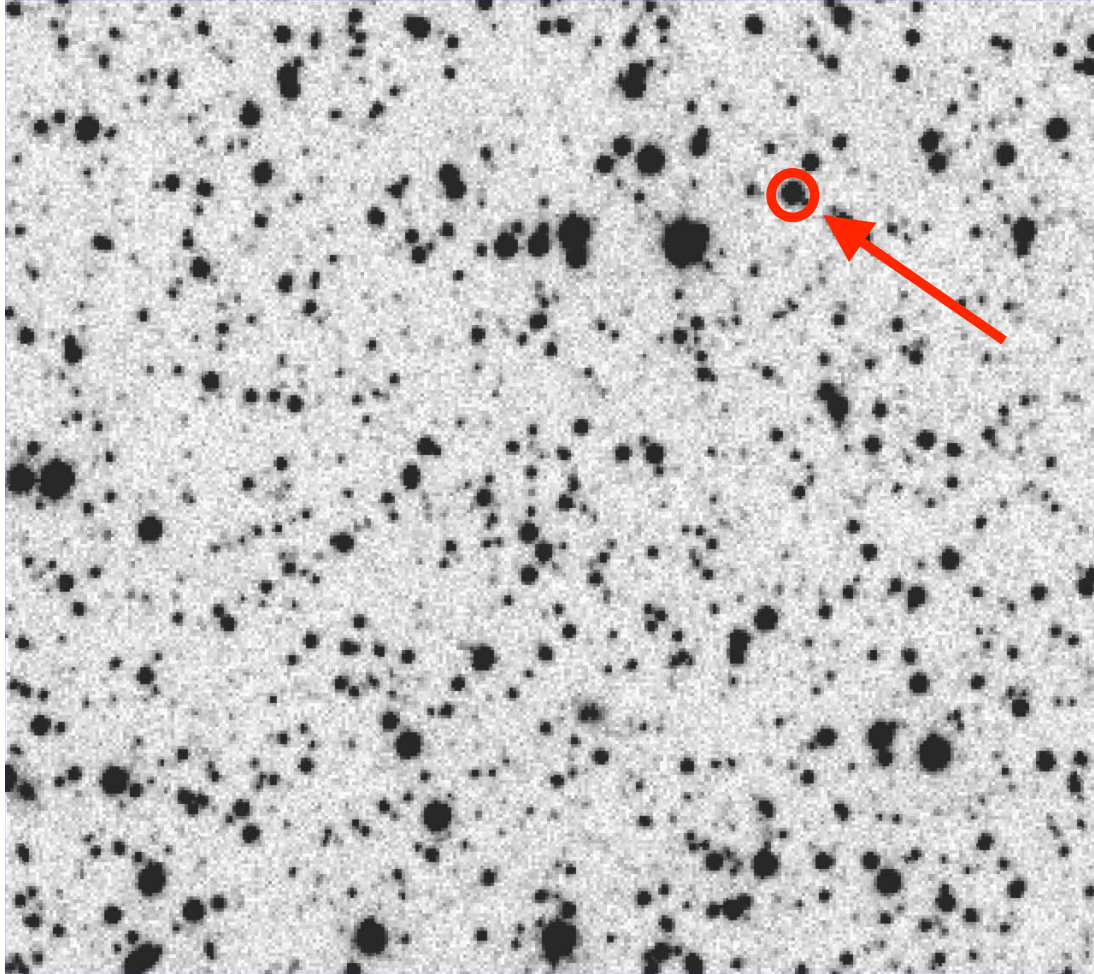
As a class, come up with some questions about the Solar System and tweet them to Professor Smartt.

@smarttscience

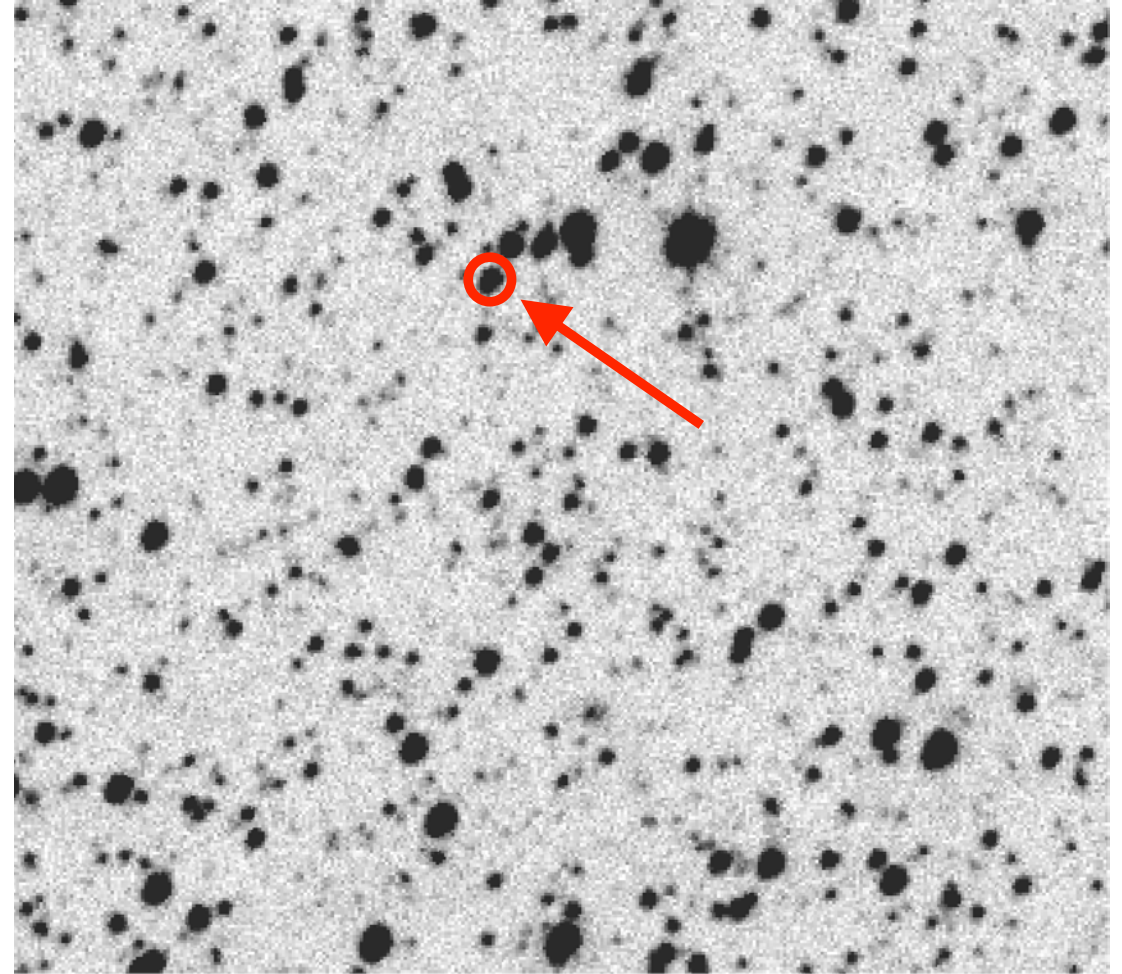


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2. Put these in order of their size, from the biggest to the smallest.

- a. Eris. 2
- b. Our Moon 1 (biggest)
- c. Ceres. 4 (smallest)
- d. Pluto. 3

Note that Eris is just a little bigger than Pluto

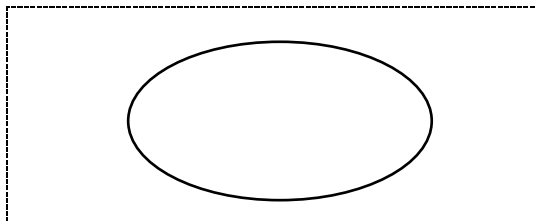
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5

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