



Dwarf Planets: Small Size, Big Mystery

What is a dwarf planet?

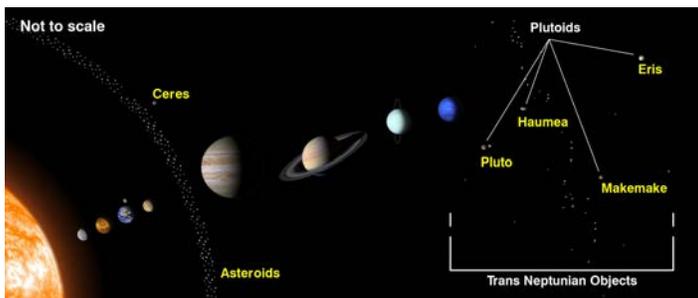
It's much like a regular planet—only smaller. A dwarf planet meets two of the three requirements for planethood. To be considered a planet, an object must orbit the Sun and have enough gravity to assume a nearly round shape and attract the smaller objects and dust sharing its orbit. Dwarf planets orbit the Sun, and unlike smaller objects such as asteroids, they also have enough mass to form a sphere; however they don't have the gravity needed to clear their orbits of other objects and debris.



Many scientists think there could be hundreds of dwarf planets in our solar system, but currently only five are officially recognized—Ceres, Pluto, Eris, Haumea, and Makemake.

Where are they?

Dwarf planets can be found in the asteroid belt as far as 100 times Earth's distance from the Sun. Most dwarf planets can also be classified as something else. The closest dwarf planet, Ceres, is also a large asteroid. Pluto is the most famous dwarf planet. As a tribute to this once-planet, all dwarf planets outside of Neptune's orbit are referred to as plutoids.



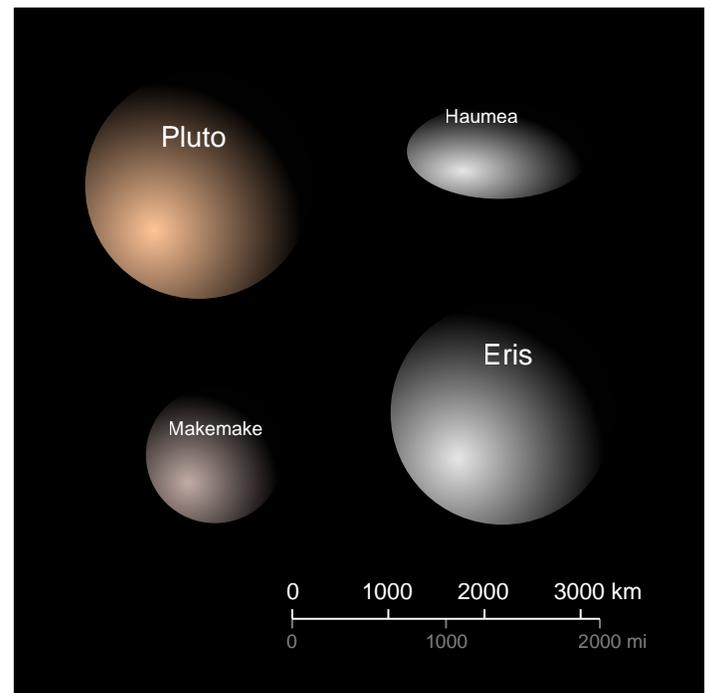
The location of the solar system's planets, dwarf planets, and other objects in order of their average distance from the sun. Note that Pluto's orbit sometimes takes it closer to the sun than Neptune.

What's the deal with Pluto?

People were sad when they found out that Pluto, after 76 years as a planet, was demoted to dwarf planet in 2006. When Pluto was discovered in 1930, it was the only object known in that faraway region of space. It looked like a planet, but scientists became uneasy when more objects were found in the outer reaches of the Solar System.

In 2005, an object with more mass than Pluto was discovered beyond Pluto's orbit. While many declared that this object, Eris, was our 10th planet, astronomers felt that this discovery called for an agreement on what a planet actually is. Many icy objects were in orbits similar to the orbits of Pluto and Eris, so neither of them fit a planet's definition of having a "cleared" orbit. A new term was coined—the dwarf planet.

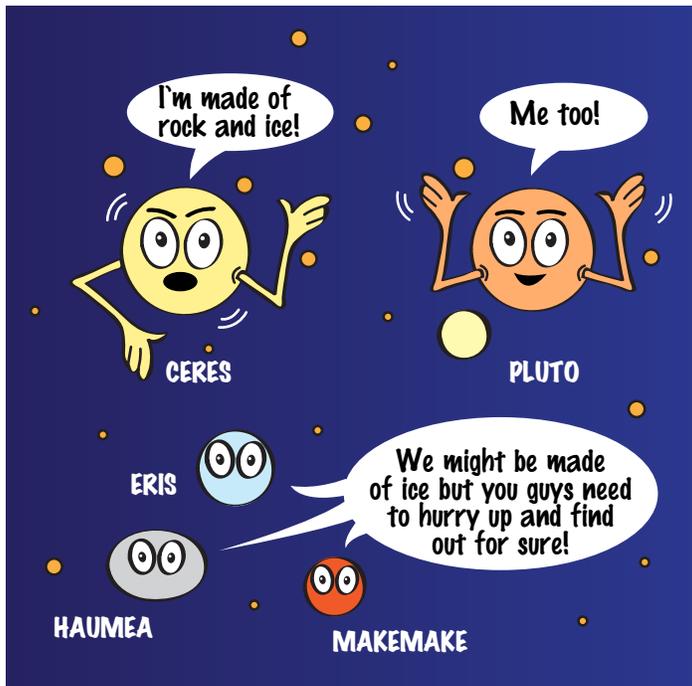
The faraway dwarf planets fit into a larger category of objects called trans-Neptunian objects, which exist in the thousands beyond the orbit of Neptune.



Relative size and shape of the trans-Neptunian dwarf planets.

What are dwarf planets made of?

That depends on how far away from the Sun they formed. Ceres is a rocky, icy object that might, unlike other asteroids, harbor some liquid water. Objects that are farther away like Pluto are also a mix of rock and ice, but they lack liquid water. Those objects even farther away in the outer reaches of our solar system are probably almost entirely ice. Knowing a dwarf planet's composition is very important for classifying it. That's because a dwarf planet needs to be spherical, and icy objects form more easily into spheres than rocky objects. Scientists can only make educated guesses as to a faraway object's shape and composition, which makes it hard to prove an object is a dwarf planet.



Why do we care about dwarf planets?

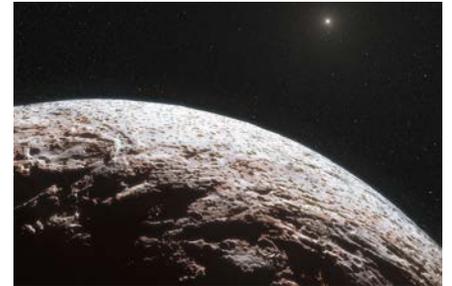
Dwarf planets can teach us a lot about how our solar system formed and how it works. Because they are smaller, dwarf planets change less than planets, essentially freezing the conditions that existed during the earliest stages of our solar system. Not only that, but the discovery of planet-like objects farther and farther away from the Sun means scientists are constantly redefining the Solar System, and our place in it.

Dwarf planets are as exciting as they are mysterious! That's why NASA has two missions to study dwarf planets right now. The New Horizons mission, launched in 2006, is arriving at Pluto in 2015. The Dawn mission has already studied a giant asteroid named Vesta and is now in orbit around Ceres.

What's it like on dwarf planets?

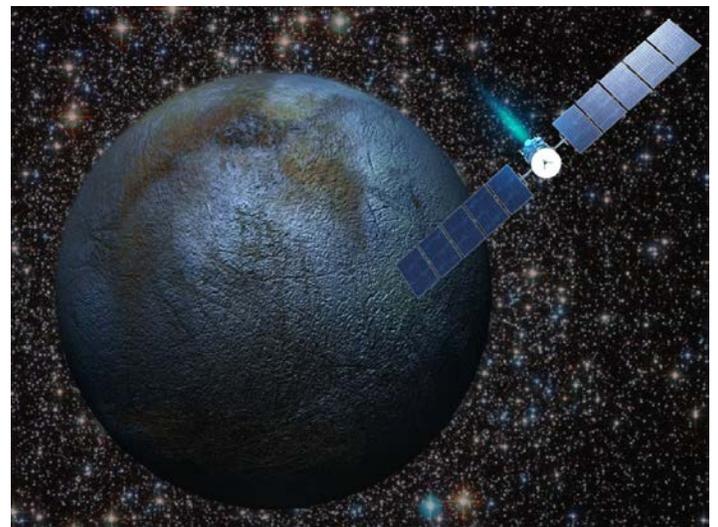
It depends. Things are very different in the asteroid belt compared to the outer edge of the Solar System. Ceres would be your best bet if you were looking for the mildest environment. Not only might it have an extremely thin atmosphere and temperatures reaching a balmy -36 °F, but it's also got a dusty, icy crust covering what may be a liquid ocean. Some scientists think it might even have life.

Life is unlikely on the other dwarf planets, though. Pluto, like many of the plutoids, has an odd orbit that takes it far away from the Sun on one side and much closer on the other. That means its atmosphere freezes into a crust when it is far away and thaws when it returns. More distant Eris takes a full 557 Earth years to complete a trip around the Sun. Its orbit takes it even farther away from the Sun than Pluto, collapsing its



Artist's impression of the surface of the dwarf planet Makemake
Credit:ESO/L. Calçada/Nick Risinger

atmosphere into an icy crust while it reaches temperatures as low as -405 °F. Things aren't any warmer on Makemake, and don't even think about life on Haumea. In addition to being a frigid wasteland, it's one of the fastest rotating objects in the Solar System, making a full rotation every four hours. It spins so fast that its spherical shape has become elongated and distorted!



Artist's conception of NASA's Dawn spacecraft in orbit around dwarf planet Ceres.

More dwarf planet fun:

Learn more about what makes a planet a planet at <http://spaceplace.nasa.gov/planet-what-is>

More info on Pluto: <http://spaceplace.nasa.gov/ice-dwarf>