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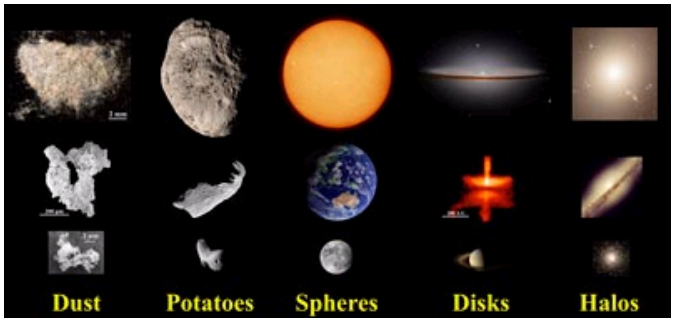
Dwarf planets are not space potatoes

Apr 20, 2010 5 comments



Objects in the universe take on five basic shapes

In 2006 there was an outcry from many astronomers when Pluto was stripped of its planetary status and renamed as a dwarf planet. The aggrieved feel that the distinction is rather arbitrary, especially as it is difficult to distinguish dwarf planets from other bodies in the solar system. Now, however, a pair of researchers are offering a more rigid definition by calculating the lower limit on the size of dwarf planets for the first time.

The IAU's definition of a planet is a celestial body that meets three strict criteria. First, it must be in orbit around the Sun. Second, it must have sufficient mass that its self-gravity overcomes other forces in the rigid body so that it assumes a nearly round shape. Finally, it must also have cleared the neighbourhood around its orbit by drawing in other space material with its gravitational field.

A dwarf planet meets all of these criteria except the last. Indeed, this was the downfall of Pluto, whose orbital path overlaps with other objects such as asteroids and the planet Neptune.

This categorization, however, does not sit happily with many astronomers who point out that Neptune also fails the test because of its overlap with Pluto. Furthermore, there is no agreement on how small dwarf planets can be, making it difficult to estimate the number of dwarf planets in the solar system.

Potato radius

In this latest research, Charles Lineweaver and Marc Norman at the Australian National University address this issue by deriving from first principles a lower limit on the radius of protoplanets. They calculate, using their new equation, that asteroids must have a radius of at least 300 km and icy moons must have a radius above 200 km for self-gravity to dominate and create spherical bodies. Below this radius, a balance between gravitational and electronic forces can create all sorts of shapes referred to as rounded potatoes.

The new categorization increases the number of bodies orbiting beyond those that should now be classified as "dwarf planets". Previously, astronomers had known the size of a lot of these bodies, but not whether they were spherical. "Measuring the shape of objects as a function of size can help us determine how hot these objects were when their shapes were set early in their formation," says Lineweaver.

This research is published on the *arXiv* preprint server.

About the author

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Charles Lineweaver
The potato radius: a lower minimum size for dwarf planets

James Dacey is a reporter for *physicsworld.com*

5 comments

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John Duffield
Apr 20, 2010 12:11 PM
United Kingdom

See en.wikipedia.org…Dwarf_planet re just how small Pluto is, and how there's bigger things out there, like Eris. What I find interesting about the debate is that the planet Mercury is smaller than Ganymede and Titan, which are classed as moons. But if they weren't in orbit around Jupiter and Saturn respectively, and instead were in orbit around the sun, they'd be planets - even though their mass, diameter, etc hadn't changed one jot. And of course some moons are little more than potatoes. See en.wikipedia.org…Deimos_(moon), I swear I peeled something just like this last night! It's an illustration of how people describe something according to how it moves, not according to what it is.

Edited by John Duffield on Apr 20, 2010 12:12 PM.

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laurele
Apr 20, 2010 6:02 PM
Highland Park, United States

Dwarf Planets Are Planets Too

Adding more dwarf planets is in no way another demotion for Pluto. The reason is that in spite of the controversial IAU decision, dwarf planets are planets too. Dr. Alan Stern, who coined the term, intended it to refer to a subclass of planets large enough to be in hydrostatic equilibrium (pulled into a round shape by their own gravity) but not large enough to gravitationally dominate their orbits. He never intended dwarf planets to be designated as not planets at all. And he said he anticipates there being hundreds of these small planets in our solar system.

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Only four percent of the IAU voted on this, and most are not planetary scientists. Their decision was immediately opposed in a formal petition by hundreds of professional astronomers led by Dr. Alan Stern, Principal Investigator of NASA's New Horizons mission to Pluto. Stern and like-minded scientists favor a broader planet definition that includes any non-self-luminous spheroidal body in orbit around a star. The spherical part is important because objects become spherical when they attain a state known as hydrostatic equilibrium, meaning they are large enough for their own gravity to pull them into a round shape. This is a characteristic of planets and not of shapeless asteroids and Kuiper Belt Objects. Pluto meets this criterion and is therefore a planet. Under this definition, our solar system has 13 planets: Mercury, Venus, Earth, Mars, Ceres, Jupiter, Saturn, Uranus, Neptune, Pluto, Haumea, Makemake, and Eris.

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kasuha
Apr 21, 2010 5:53 AM
Prague, Czech Republic

Quote:

> *Originally posted by* ***laurele***
> a broader planet definition that includes any non-self-luminous spheroidal body in orbit around a star.

As far as I know, Jupiter and Saturn produce more light than what they get from the Sun. Wouldn't that make them fall out as not being non-self-luminous?

In my opinion, every planet definition has its problems. The current one is not bad - at least it does not make us rewrite schoolbooks every time astronomers find big enough body in the Kuiper belt.

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John Duffield
Apr 22, 2010 3:53 PM
United Kingdom

Noted chaps. It'll be fun one day when somebody discovers two equal size planets orbiting one another whilst both orbiting a star. Are they two planets? Or are they two moons?

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5

Dileep Sathe
Apr 23, 2010 7:33 AM
Pune, India

Clearing the neighbourhood

Crossing of Pluto's path and that of Neptune is one trouble, no doubt. But there is one more trouble with the third condition of the definition itself. See my Letter to the Editor: "Planetary trouble" in the I.A.U. Commission 46, Newsletter 66, 28 March 2007. Use the new address for more information dvsathe[at] gmail.com

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