

The loss of a planet and the chaos it has caused.

By Samuel George

It has been about a year now since tiny Pluto had its classification as a planet revoked but the arguments over its nature still continue. I do wonder why people are so bothered by this. Okay, yes, we all grew up (well most of us anyway!) with there being 9 planets and I am sure we are all fond of little Pluto, but in what sense does it really matter? The International Astronomical Union's (IAU) definition is sensible, it may seem a bit vague at first and have a few holes in it (mostly around the clearing the neighbourhood bit) but it is an improvement on no real definition. The IAU came up with three main conditions for an object to be considered a planet:

1. The object must be in orbit around the Sun.
2. The object must be massive enough to be a sphere by its own gravitational force. More specifically, its own gravity should pull it into a shape of hydrostatic equilibrium.
3. It must have cleared the neighbourhood around its orbit.

Pluto fails to meet the third condition. In fact on this point Alan Stern, leader of NASA's New Horizons mission to Pluto has been pretty vocal pointing out that Mars, Jupiter and Neptune have so-called "Trojan" asteroids sharing their orbits. Though others, including the discoverer of Eris (Mike Brown) have supported this definition. Some have called this the "Great Pluto War", a funny thought but I guess this is not just about physics. In the wider community a great number of petitions have been produced by the uninformed. I see this as a great and interesting challenge to astronomers. Inform and explain the reasons behind this decision - don't just blame those professionals. Even if you don't agree with the decision this is a great chance to teach the scientific method. In New Mexico it went a bit further. Clive Tombaugh was a resident in the state for a long time and in honour of him discovering Pluto March 13th will now be known as Pluto Planet Day.

Currently Pluto has been classified as a dwarf planet. A dwarf rabbit is still a rabbit, right?

You have to remember that the IAU has never before been called to name a planet never mind declassify one - this decision was not one taken lightly. Though this whole discussion probably would ring bells for any astronomer who had been around when Giuseppe Piazzi discovered, the now dwarf planet, Ceres (in 1801). It was the missing enigma, filling in the gap between Mars and Jupiter that proved according to the Bode's Law (later shown to be specious). It was only a year later that Heinrich Olbers discovered Pallas, at practically the same distance from the Sun. Two more objects were discovered in 1807 and for the next four decades astronomy textbooks listed all four bodies as planets! By this point William Herschel had suggested naming them asteroids, with Heinrich Olbers suggesting that they were probably fragments of a now destroyed planet. Thus the asteroid belt came to be (between 1845 and 1851 the number of asteroids increased to 15) and people forgot all the discussion of this. I reckon if Giuseppe Piazzi or Heinrich Olbers had been at the IAU discussion they would have had some interesting thoughts on the matter.

Pluto is smaller than seven moons in our solar system. Over the past 15 years many objects have been discovered with similar orbital distances as Pluto, revealing that Pluto probably belongs to this vast population of icy trans-Neptunian objects - commonly referred to as the Kuiper Belt.

So what are we left with? 8 planets and 3 dwarf planets (Ceres, Pluto and Eris) - and a lot of rocks. Well to be a bit more technical our solar system includes several distinct populations - the planets, the dwarf planets, satellites, an asteroid belt, the Kuiper Belt, the Oort Cloud....

I have to say I personally like a slightly different definition suggested by Steven Soter - it has a similar idea to the IAU definition. Firstly let's deal with the upper mass limit. I think we would all agree that the onset of deuterium fusion would be reasonable, this is slightly complicated by brown dwarfs - but we can classify them separately (classically the limit of any fusion occurring

has been taken to 13 times the mass of Jupiter). The lower limit is still awkward but if we come up with some definitions then this might make things clearer:

1. A "primary" body is a star or substar formed by core accretion from an interstellar cloud.
2. A "substar" is a body of mass less than 80 times that of Jupiter; this is the lower limit for stellar hydrogen fusion (this includes the sub-division of Brown Dwarfs).
3. A "planet" is an end product of secondary accretion from a disk around a primary body.
4. An "end product" of disk accretion is a body containing more than 100 times the mass of all bodies that share its orbital zone.
5. Two bodies share an "orbital zone" if their orbit cross a common radial distance from the primary and their periods are non-resonant and differ by less than an order of magnitude.

Now to determine if a body of mass say M is the end product of disk accretion we use:

$$\mu = M/m$$

We define m to be the aggregate mass of all bodies that share its orbital zone. If $\mu > 100$ and orbiting around a primary star or substar then the body is considered a planet. If we use this and the accepted values for Pluto, Ceres and Eris then they are not planets. Of course, there are problems with this idea - especially about determining the value of m . I still think it makes a nice and succinct definition and actually works nicely alongside the IAU definition. I actually think this would nicely replace the vagueness that is suggested by the third condition set down by the IAU.

Pluto being a planet has lost any scientific rationale; it is now one for historians. I hate to say that. If we did include Pluto then there is no physical basis to exclude dozens of other candidates and then the term planet would lose any impact or real meaning.

Expect more dwarf planets. When the IAU were originally considering the options of classification no more than 12 other objects including Pallas, Vesta, Hygeia, Senda and Quaoar were to be considered as planetary candidates. I originally took the view of "I do wonder why people are so bothered by this" and I still am. We have lost Pluto as a planet but we have gained a whole new classification. Oh, and remember that there are 8 planets in our solar system but, as I write this, there are 241 extrasolar planets known!

References:

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