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The Planet That Disappeared

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What happened to our 9th planet? Did it disappear? Did someone take it way? Yes, that's exactly what happened today, August 24, 2006. Over 2,000 astronomers from 75 countries at the International Astronomical Union (IAU) annual meeting voted on defining "planet" to exclude Pluto. They took away our ninth planet. Indeed, since they noted that the resolution shall only apply to our solar system and not "universally" (no pun intended), it seems as if it was only done to target the removal of Pluto from the exalted ranks of those more robust and prominent bodies. It shall now be known as a "Dwarf Planet," apparently now naming a new category of objects.

Of course, the argument is that it is not actually a planet anyway. There have been numerous debates for a number of years as more and more objects in our solar system are discovered. People like to classify, organize and label things to help us better understand and relate to things around us. Classifications are useful but it can be difficult to differentiate between essential versus incidental characteristics.

To call Pluto a "Dwarf Planet" seems to me to be an odd title for a classification. Therein lies one problem this article shall address. Should not a category of objects differentiate sufficiently its members from the otherwise unqualified? A category such as "Dwarf Planets" seems more like a joke from Monte Python as it suggests further categories to come, such as "Planetoids," "Pseudo-Planets," "Not-so-big-as-other Planets," and of course we're going to need a "Planets that aren't Planets" category as well.

It is the lack of clarity and exclusivity of the category that has made astronomers uneasy with the inclusion of Pluto. However, the whole idea of a limited set of objects being virtually alike is unlikely in its inception. Like a broken glass in a tornado, surely pieces of every shape

and size must be mixed and scattered to and fro as in the accretion from the primordial soup that became our solar system.

Our Neighborhood

As anyone who listens to the news might know, there have recently been a number of discoveries of very large objects, by asteroid or comet standards, beyond the orbit of Pluto. It seems that, while Pluto was always considered a rather strange object among our planets, so long as objects were sufficiently small, our sense of organization wasn't threatened. Until recently, the largest object aside from our nine planets was Ceres, the largest asteroid. Discovered in 1801, it was apparently no threat to the exclusive membership of planetary objects and was classified separately.

Until recently, the distinction seemed clear enough and everything we were taught growing up seemed proper. But, along came *Quaoar*, a Kuiper Belt object discovered in 2002 and, while smaller than Pluto, still significantly larger than even the largest asteroid.

The fact that Quaoar was clearly a member of the Kuiper Belt, the region of icy objects beyond Neptune, might have contributed to resistance to call it a planet. In any event, with the debate about planetary status on the rise, Pluto seemed more like Quaoar than Earth or Jupiter.

Enter *Sedna*, another discovery from the Kuiper Belt. Somewhat larger than Quaoar, the 2003 discovery seemed perhaps worthy of planetary status. But, its orbit is such an extreme ellipse, it seems more comet-like than planetary. Oddly, common arguments against bestowing planetary status seemed less concerned with its orbit and more with its extreme distance.

Perhaps most recently – because there have been numerous Kuiper Belt discoveries – the poorly named 2003UB313 seems to be a most worthy candidate. While it's orbit is also elliptical and quite distant, it is larger than Pluto and even thought to have a moon.

Classifying Objects

The mere fact that objects are distant or smaller or elliptical should not necessarily preclude planetary status. It seems that the most disturbing element to astronomers has been that Pluto and the other Kuiper Belt objects are not like the other eight planets. The debate most usually centers on the issue of difference versus likeness. Like the algebraic notion of creating a

"set" of like things, the issue of likeness seems to be viewed as the main criteria for a classification system.

The problem of classifying things as a planet is that no two are alike. To base a classification system on likeness is not reasonable since all planets are unique. In fact, their differences are more predominant than their similarities.

Consider some of the following unique attributes of each of the planets. Mercury has no significant atmosphere. Venus has no moons. Earth is capable of supporting life and has abundant water. Mars is a solid planet with moons, but small by most planetary standards. Jupiter's composition is almost the same as the sun and contains mostly hydrogen and helium. Saturn's atmosphere is uniquely based more on sulfur. Of course, one cannot miss the predominant rings. Uranus is also unique with its axis tipped over on its side and the south pole facing the sun. Neptune is very much like Uranus but includes the Great Dark Spot, a depression in the atmosphere surrounded by high cirrus clouds.

Next to such diversity among our accepted planets, Pluto's uniqueness seems to fit in as just another unique planet, contrary to the vote by the IAU. The first four planets are small and solid, yet we didn't need a different name or classification for the next four which are large and gaseous. The two groups couldn't be more different and yet there's no controversy.

If a classification scheme cannot be based on likenesses in a unified group of shared attributes, it is important to instead identify essential versus incidental attributes and guiding principles. It is interesting that planets have very few essential attributes and most are incidental. For example, it might be considered essential that a planet orbit a star but the chemical make up of the planet, its density and mass all seem incidental.

Whether a planet's axis is tilted and the direction of rotation, along with its period of rotation and orbital period, all seem to be incidental. That is, such attributes do not seem fundamental to whether an object is or is not a planet.

Orbital inclination and ellipticity, which seem to be of some concern to many astronomers, are clearly accepted as merely incidental if found to be within a minor degree. Clearly, likeness in size cannot be argued as fundamental to the classification scheme. Jupiter is over 2300 times larger than Mercury by volume, yet both are considered planets.

Neil deGrasse Tyson (2006) also reviews some unique features of Pluto and concludes that it should not be considered a planet. This argument seems to imply that the other eight

planets are alike. Ultimately, the argument or the case against Pluto seems less scientific than political. It might be reasonably argued that Pluto is "more different" and it seems that makes astronomers uncomfortable. Too, with new discoveries perhaps forcing the issue, it seems astronomers are uncomfortable sharing the title of "planet" with anything else that might be discovered. That is, by making Pluto disappear from the planet roster, they can better ensure that the label won't be used for other objects. Unfortunately, however, their new classification scheme as they noted cannot be reasonably applied to other solar systems. To this author, that alone is a fundamental flaw in the new classification scheme and the decision to exclude Pluto.

Arguments Pro and Con

So, what are the arguments against Pluto? There is, commonly, a discussion of Pluto's various attributes. For example, it is considered small and some argue against Pluto because it is smaller than some moons in our solar system. Of course, so is Mercury. Most discussions focus on attributes that seem, at least on the surface, as incidental to planetary status. For example, the inclination of Pluto's orbit is most commonly noted along with the elliptical nature of the orbit taking Pluto inside the orbit of Neptune. Rarely, are such attributes argued to be essential or fundamental to planetary status and a case of exclusion is never offered because of any one attribute. For example, it is usually noted that Pluto is easily identified as a member of the Kuiper Belt objects. Why planets cannot be also members of the Kuiper Belt "region" is never addressed.

Some have argued in favor of planetary status for Pluto simply because of tradition and historical reference. Since Pluto has always been classified as a planet it should continue to be so. This sounds unscientific but one should remember that a sound classification system is ours to invent. That is, it is not a matter of discovering whether or not Pluto is a planet. We are not trying to determine whether it is or not. A lot is known about Pluto and the issue is a matter of the classification scheme used to identify planetary status. Before today's vote, the IAU as previously declared that Pluto is a planet (Bill Nye, 2006). Apparently, the IAU has no problem changing its collective mind. We can develop a classification scheme as we see fit and it is suggested that a logical system, as described below, can be developed that is scientifically sound.

The Preponderance Model

It is suggested that there are not enough essential and consistently shared attributes on which to base a succinct definition, per se. However, there are attributes many of which are very important. It is further suggested that a classification scheme be based on a preponderance of attributes. Much like a criminal verdict being based on a preponderance of evidence, this model details a number of attributes and calls for a sufficient number in order to qualify as a planet. Furthermore, to differentiate between essential versus incidental characteristics, the first two would both be considered required for planetary status.

Consider the following list:

1. **Must orbit a star** – *this is a required element and seems fundamental to the concept.*
2. **Cannot support or sustain fusion reactions** – *also required, the object cannot be a star.*
3. **Any Moons** – *a common element of many but not all planets.*
4. **Within a Minimum Size** – *worthy of debate, but this author suggests using Pluto as the minimum.*
5. **A shape within a degree of roundness** – *where to draw the line is debatable but it can be expressed by comparing the shortest axis with the longest. For example, perhaps the shortest diameter must be within 10 percent of the longest.*
6. **Roundness determined by gravity, not cohesion** – *a gravitational field sufficient to shape the planet.*
7. **Formed in original Accretion Disk or Proto-Planetary Member** - *a structure formed by material falling into a gravitational source.*
8. **Orbit within range of roundness vs. ellipse** – *could also be expressed in similar terms to number 5 above. Shortest diameter within a percentage of the larger. This author again suggests the orbit of Pluto as an elliptical limit.*
9. **Orbit within range of Ecliptic Plane** – *perhaps within a tilt of 5 to 10 degrees off of the main solar system disk. This would exclude Pluto at about 17 degrees, but remember that qualification depends on a preponderance of attributes.*

A simple score could determine planetary status. This author suggests that a score of 6 out of 9 would be sufficient for planetary status. While this standard is also worthy of debate, the

principle of this form of classification scheme is the important point. However, while professional astronomers might bring a greater expertise to judging such attributes, consider this author's scores shown in Table 1.

Table 1. This author's scores based on the *Preponderance Classification Model*

ATTRIBUTE	PLUTO	SEDNA & QUAOAR	2003 UB313	Asteroids	Comets
1. Orbit a Star	✓	✓	✓	✓	✓
2. No Fusion	✓	✓	✓	✓	✓
3. Moons	✓	✗	✓	✓ & ✗	✗
4. Min. Size	✓	✗	✓	✗	✗
5. Roundness	✓	✓	✓	✗	✗
6. Rnd. by Grav.	✓	✓	✓	✗	✗
7. Accr. Disk	✗	✗	✗	✗	✗
8. Round Orbit	✓	✗	✓	✓ & ✗	✗
9. Ecliptic Plane	✗	✗	✗	✓ & ✗	✗
Score:	**7**	**4**	**7**	**2 – 5**	**2**
Planet ?	**Yes**	**No**	**Yes**	**No**	**No**

This system and these scores suggest that, not only should Pluto still be a planet, but 2003-UB313 is actually our 10th planet. This system is clearly a scientific system and is not overly influenced by popular opinion, politics nor meaningless tradition. It is a positive thing, however, that it does keep history intact. It even illustrates how the historical reference to Pluto as a planet, recognized by the IAU in 1999, has scientific merit.

This system does satisfy public perceptions and fits well with what the general public understand a planet to be. It tends to include objects viewed as planet-like and tends to exclude objects that are viewed as "other." It should satisfy scientific interests for future use and application to as yet undiscovered objects. Likewise, the model should apply well enough to other planetary systems too.

The IAU has changed its position before although they're not likely to do so at this time. Nevertheless, the reader can use this discussion and this model to make their own judgments and reach their own understanding of what objects are and what they are not.

References

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