What is a Planet? DPS Chair's Statement

On August 24, 2006, the IAU passed two resolutions [1] that defined three categories of bodies in the solar system: planets, dwarf planets, and small solar system bodies. A majority of the IAU members gathered at the 2006 General Assembly in Prague voted that a planet is defined as a celestial body that (a) is in orbit around the Sun, (b) is round (i.e., is in hydrostatic equilibrium against rigid body forces), and (c) has cleared the zone around its orbit.

Eight planets retain their planethood by this definition, and a new category of “dwarf planets” is defined: objects that are large enough to be in hydrostatic equilibrium but which have not cleared the neighborhood around their orbits. Ceres gets elevated to the status of “dwarf planet” based on recent published results on its shape. Pluto is specifically recognized as a dwarf planet, and also as the prototype for all Pluto-like planetary objects beyond Neptune. 2003 UB313 joins Pluto in this category, with additional dwarf planets in the “Plutonian” category likely to be announced soon.

Some controversy has arisen over the merit of the definition itself, and the fairness of the process by which the resolutions were passed. Opinions have ranged from “the DPS membership should be encouraged to support the IAU resolutions that were approved by an overwhelming majority” to “the IAU resolution defining the word ‘planet’ is fatally flawed and needs to be replaced by something better.” This discord is not surprising, given the long history of foundered efforts to reach agreement on just what a planet is and the unwillingness of nature to be categorized into neat compartments.

Two years ago, the IAU appointed a committee of 19 planetary scientists (15 of whom were DPS members) to attempt to agree on the definition of a planet, but they could not reach accord. Then, a few months ago, the IAU appointed a seven-member panel of scientists, historians, authors, and educators (three of whom were nominated by the DPS Committee) to take up the task again, guided by the technical findings of the original 19-member committee but charged to take a broader view that accounted for historical, cultural, and educational issues as well.

Just prior to the IAU General Assembly meeting, this panel announced a resolution proposing that planets were celestial objects, in orbit around a star, that were massive enough to be round and that were not satellites. This definition, while subject to dispute, was firmly based on the physical properties of the objects themselves and was applicable to planets around other stars. Recognizing the authority of the IAU to render a decision, as well as the considerable input by DPS members in the process, the DPS Committee endorsed the definition, mindful of the fact that the final decision would be made at the IAU General Assembly after open discussion and debate.

As an eye-witness to the proceedings, I think it would be fair to describe the scene in Prague as intense, highly charged, and dramatic. The original proposal was quickly discarded, and after several iterations, it was replaced by a new set of resolutions (including the two that were finally approved), based not only on the shape of an object but also on its orbital zone. This second criterion tipped the balance against Pluto being classified with the other eight planets, and thus in effect the final vote was about Pluto's status. Of the approximately 400 voters present, a significant majority supported the new definition, leaving eight planets as the only “true” planets while naming Pluto as a dwarf planet and the prototype for its own new class of objects.

Proponents argued that the definition was practicable and that an eight-planet solar system was a sensible one, given what we know of the Kuiper Belt. Critics countered that changes in the resolutions had been made at the last minute, that the IAU had not allowed for sufficient discussion and review of the proposals by the full scientific community, and that basing a definition in part on celestial dynamics was not well-founded or clear. Combined with the loss of familiar Pluto as a planet on equal footing with the other eight, it is not hard to see why the issue is still contentious and opinions are polarized.

Could the IAU have been more open and inclusive? Probably. Would it have resulted in a different result? That is far less certain. Nearly every possible planet definition has been proposed and rejected many times, and there is no single right answer. What is definitely true is that the IAU has the authority to make such working astronomical definitions for its own purposes, that it established a procedure to define a planet in that context, and that it followed its own rules.

All possible definitions have a degree of fuzziness that requires intelligent application: what does “round” really mean? What does it mean to “control a zone”? These are technical issues to be addressed by Division III of the IAU, currently chaired by Ted Bowell, a fellow DPS member. There is still work to be done, too, in constructing a definition that is generally applicable to extra-solar planetary systems. These and other changes, radical or moderate, may well be addressed at the next IAU General Assembly in Rio de Janeiro in 2009. We hope that the DPS community will be involved in all stages of this process.

What is a planet? Ultimately, the true test will come in time through common and scientific usage. In the meantime, let's continue the scientific study of Pluto and all the other beasts in our celestial menagerie, planet, dwarf planet, satellite, asteroid, comet, or mote of dust. We'll surely then be in a better position to decide what it really takes to be a planet.

Richard G. French, AAS DPS Chair

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Links
[1] http://www.iau2006.org/mirror/www.iau.org/iau0603/index.html