

Annals by Owen Gingerich

Planetary perils in Prague

For astronomers, Prague is a singularly nostalgic city. It was here, in February of 1600, that the young, starry-eyed Johannes Kepler met the imperious, eccentric Tycho Brahe. Brahe brought a priceless trove of precise observations of the planets and stars, the likes of which the world had never seen – singlehandedly he raised the astronomical data bank a hundredfold. As Kepler would later reflect, Brahe had the building materials for cosmology, but he lacked an architect. Kepler became that architect. It was a conjunction fated to alter the course of astronomy.

Last August, Prague was teeming with astronomers, roughly two thousand of them. They came to evaluate an astronomical data bank that in the past few

years has increased by orders of magnitude, an immense expansion factor that only the observations of Tycho Brahe rival in their comparative impact. Telescopes in mountain observatories, plus spacecraft above the atmosphere combined with modern electronics, have reaped a bounteous harvest of exciting new results.

But as seen from the Prague press office of the International Astronomical Union (IAU), the world was fixated on two far more mundane questions: would little Pluto, in the frigid realm beyond Neptune, still be considered a planet; and if so, would some of his icy playmates in that remote zone also be ushered into the exclusive planetary club?

The IAU had gotten itself into this feeding frenzy by a procedural question of nomenclature that only indirectly involved Pluto's status. For this is one of the things international unions do. They follow in Adam's footsteps by credentialing names. The International Union of Biological Sciences, for example, oversees a committee that establishes the rules for the naming of birds and shells and other animals. And the International Astronomical Union, in its very first General Assembly, in Rome in 1922, established the list of eighty-eight constellations accepted today. Committees

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under its aegis assign names to comets, to minor planets, to planetary satellites, and to features on these moons or planetary bodies.

But as for planets, the IAU has never had an opportunity to name one. In 1930 the Lowell Observatory announced the discovery of a planetary body beyond Neptune, and they were delighted when an eleven-year-old schoolgirl in Oxford suggested the name Pluto, because its first two letters were the initials of the observatory's founder, Percival Lowell. The IAU held General Assemblies only every three or four years and didn't have one until 1932, so by then the name was a *fait accompli*.

In 1930 Pluto was assumed to be at least as large as Earth, and maybe a few times larger, for Percival Lowell had presumably predicted its approximate position by its gravitational perturbations on the giant planets Neptune and Uranus. In the decades that followed, however, observations showed that not only was Pluto much smaller – indeed, smaller than our moon – but also the apparent perturbations stemmed largely from the use of an erroneous mass for Neptune in the celestial mechanical computations. Thus, Pluto's planetary status was in some jeopardy. In 2000, when the planet walk was constructed for the new Rose Center and Hayden Planetarium in New York, Pluto was conspicuous by its absence.

Matters came to a head in 2005 when an icy ball discovered far beyond Neptune proved to be as large as or slightly larger than Pluto. Was it, or was it not, a planet? Which committee had the naming rights? Meanwhile, it suffered under a technical designation, 2003 UB₃₁₃, or the nickname Xena from a popular fantasy television show.

As far as the Executive Committee of the IAU was concerned, the situation

would not have been so fraught, except that in 1999 my colleague Brian Marsden, who was directing the IAU's Minor Planet Center, had reached a nice round number in tabulating the asteroids, 10,000, and he suggested it might be reserved for Pluto. Unexpectedly, his rational, practical suggestion created a firestorm, and the IAU officers were bombarded with protests at the apparent threat of Pluto's demotion. Hence, they were understandably nervous. After a large committee from their Planetary Systems Sciences Division not only failed after many months to find a solid consensus, but also seemingly had not considered the public-relations aspects in their debates, the Executive Committee decided to appoint a broader-based 'Planet Definition Committee.' Since I had credentials in both astrophysics and the history of astronomy, I was tapped to lead the way across the minefield.

Many suggestions poured in via the Internet about how to define the word *planet*. Someone suggested it was already defined by its Greek origins: *wanderer*. If it moves against the starry background, let it be a planet. Considering that orbits are already known for approximately three hundred thousand asteroids, not to mention comets, the suggestion was straightaway tossed into the obsolete ideas bin. Others appealed to history: freeze the status quo with its nine planets. But history is a fickle guide, for throughout the ages the number of planets has varied both with cosmology and with discovery.

Meanwhile, the committee had conferred for two days in Paris to craft a scientific, but culturally sensitive, definition. There were two ways, not completely independent, to define a planet scientifically: either by *what* it is, or by *where* it is, that is, by its relationship to its neighbors. Planetary scientists and

geologists are keen on studying planets as physical bodies. Some of them would even cheerfully think of the giant satellites – Jupiter’s Ganymede and Callisto, and Saturn’s Titan, objects that rival or exceed Mercury in size – as planetary bodies. They are definitely in the *what* camp. The dynamicists, on the other hand, find the dominating relationship of a planet on its neighbors particularly fascinating, and for them, *where* is of prime significance.

While these alternative approaches to defining a planet had ramifications for the status of Pluto, its standing was not a major consideration in the negotiations, and we never inquired where the seven members of the committee stood on that issue. So while Pluto remained the elephant in the parlor, the members pretty much stayed in the kitchen. For my committee, defining a planet as an object seemed simplest and more open-ended, especially considering the current discoveries of large numbers of exoplanets, that is, planetary bodies orbiting distant suns. Furthermore, rather than establishing an arbitrary cut-off in size, we chose the most obvious physical characteristic as the dividing line. If a body had enough mass and therefore enough gravity to pull itself into a ball, let it be a planet. Naturally, there would be an ambiguous boundary zone, but science and scientific taxonomy are full of such debatable cases.

We immediately understood that a *what* definition would open the gates to a dozen more solar-system planets, and maybe as many as thirty or even forty, and that these would primarily be dirty iceballs of the Pluto class, and not major planets like Uranus or Neptune. I therefore proposed that we should describe Mercury through Neptune as ‘classical planets,’ and make Pluto the prototype of a new class of

trans-Neptunian objects, with a name such as ‘plutons’ to recognize the historical role of Pluto. In this way, Pluto would be promoted while being demoted, which, as some analysts smugly noted, was worthy of political solutions inside the Beltway.

The frenzy of the IAU press room in Prague was at first exhilarating, but in retrospect I realize it was a prime source of strategic error. The chief press officer was convinced that reporters would want to know two things: Is Pluto a planet? And how many planets are there? The committee had never counted because we all knew that the number in August would not be the same as the count in December. I tried in vain to convince him that the press release should say, ‘eight classical planets and a growing number of plutons.’ The press, which feeds on controversy, easily found critics who declared the number of twelve planets ridiculously complicated because it included the round asteroid Ceres as well as Charon, a satellite of Pluto that had snuck in through a footnote that wasn’t part of our proposed resolution.

Our recommendations met with enthusiastic approval from the Division for Planetary Sciences of the American Astronomical Society, the largest international group of planetary scientists. Where our proposed resolution ran into vehement and raucous opposition was from the dynamicists, who believed they hadn’t been consulted and who felt stabbed in their psyches because we had not given primacy to their favored *where* definition. Feeding on the discontent of those who felt uneasy about admitting too many dwarfs into the club, they marshaled support for a hastily worded alternative definition.

Our committee met with the leaders of the opposition, and I showed them an

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alternative compromise resolution that began:

The predominant part of the solar system is a dynamically linked suite of eight mutually-interacting planets, Mercury to Neptune. Each of these produces observable perturbations on at least one of its neighbors. The hundreds of thousands of lightweight bodies individually have no observable dynamical effects on the heavyweight planets. We retain this group of classical planets as the essential definition of "planets."

Alas, they would have none of it, claiming that even the asteroid Ceres could perturb Earth by a few centimeters and that eventually our instruments would be sensitive enough to detect that minuscule amount. In the end, somehow, the confusing but defining phrase that a planet was a body large enough "to have cleared its zone" was added to the resolution and was adopted by the final assembly. Appropriately, they voted that Pluto would be considered the prototype body of an unnamed class of dwarf planets, but which by the new definition would not be planets. And by the narrowest of votes they failed to give the name 'plutonians' to the new class of objects for which Pluto stands as the prototype.

In their zeal for science, the voting astronomers in Prague seemed to forget that for the most part they don't own the telescopes, the space probes, and the instruments on which they depend for their researches. It is the taxpayers who own them. And it was American taxpayers who felt they owned the Hubble Space Telescope so much that they made an outcry when NASA officials decided to abandon it. It was our public constituency who forced a change in their plans. It behooves us to pay attention to public relations. The new presi-

dent of the IAU and a member of the Planet Definition Committee, Catherine Cesarsky, made an impassioned and statesman-like plea to this effect, but unfortunately brilliant floodlights blinded those on the stage, and they did not see and recognize her until *after* the vote had been taken. As Kepler wrote to his teacher, Michael Maestlin, "Experts cannot live off themselves or on air. Therefore, let us act in astronomical affairs in such a way that we hold on to supporters of astronomy and do not starve."

Unfortunately, one becomes too soon old and too late wise. I realize in retrospect that the IAU should never have attempted to define the word *planet*. It is too culturally bound, with elastic definitions that have evolved throughout the ages. What the IAU could legitimately have done in its role of naming things was to have defined some subclasses, such as 'classical planets,' leaving the planetary door open not only for plutonians and cereans but for the exoplanets as well. These terms would be eminently teachable and would help students understand the complexity and richness of the solar system that modern science is revealing. And astronomers could have left Prague without muddle on their faces.

In the aftermath of Prague, the IAU committees joined forces to accept an appellation proposed by Mike Brown, the leader of the team that discovered 2003 UB₃₁₃: it is now Eris, appropriately named after the classical goddess of discord and strife.