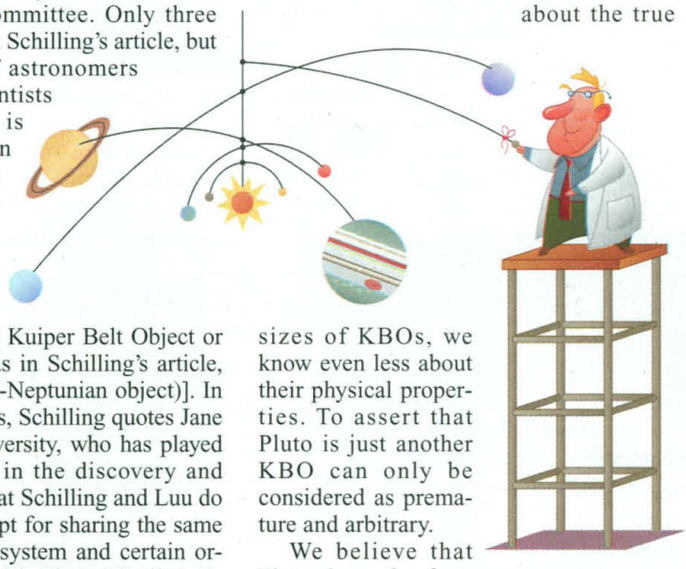
A group of astronomers and planetary scientists defend Pluto's designation as a planet, saying, "we believe that [Pluto] should be considered as the prototype of a third class of planet." Letter writers point out that omnidirectional mirrors have been manufactured for at least 30 years. And an atmospheric physicist warns that great care should be taken in using readings from weather satellites to reach conclusions about global warming and its effects.

Pluto's Planetary Status

Govert Schilling, in his article "Pluto: The planet that never was" (News of the Week, 8 Jan., p. 157), implies that astronomers, through a committee of the International Astronomical Union (IAU), have decided or are going to decide that Pluto is not a planet. Such is not the case, nor is a decision on Pluto's planetary status within the purview of this committee. Only three people are quoted in Schilling's article, but a large number of astronomers and planetary scientists believe that Pluto is fully deserving on scientific grounds to retain its planetary status.

Schilling's main theme is that Pluto is not a planet because it is instead a Kuiper Belt Object or KBO [sometimes, as in Schilling's article, called a TNO (trans-Neptunian object)]. In support of this thesis, Schilling quotes Jane Luu of Leiden University, who has played an important role in the discovery and study of KBOs. What Schilling and Luu do not say is that, except for sharing the same region of the solar system and certain orbital similarities with Pluto (*1*), little is known about the physical properties of KBOs. Schilling indicates that Pluto's diameter is *estimated* to be only 2200 kilometers, while the first-discovered KBO, 1992 QB1, has been *measured* to be 200 kilometers in diameter. In fact, it is Pluto's diameter, and that of its large satellite, Charon, that have been actually measured (*2, 3*). Pluto's diameter is known to be just under 2400 kilometers, while Charon's is between 1200 and 1300 kilometers.

The published sizes of KBOs like 1992 QB1, on the other hand, are estimates arrived at by assuming a reflectivity and calculating a size based on the observed apparent brightness and known distance of the object (*4*). If the assumed reflectivity is wrong, the calculated size is wrong. KBO sizes conventionally quoted by Luu and others, are, by analogy with comet nuclei, calculated by assuming an extremely low reflectivity of 4%. If, on the other hand, KBOs are indeed similar to Pluto and Charon, with reflectivities in the 40 to 60% range, they are only a third to a quarter of the size quoted by Luu and others. Even the largest KBO known today, under that assumption, would be tiny in comparison with both Pluto and Charon. Moreover, as little as we know about the true sizes of KBOs, we know even less about their physical properties. To assert that Pluto is just another KBO can only be considered as premature and arbitrary.



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We believe that Pluto shows far more similarities to the other eight planets than to the KBOs. Pluto, like the Earth, possesses an extended, albeit tenuous, nitrogen-rich atmosphere. It has a satellite of substantial size, as does our own planet. Similarly, Pluto displays polar ice caps and other surface markings that almost certainly change dramatically with the seasons. And, like the terrestrial and giant planets, Pluto is by far the dominant known body in its particular realm of the solar system.

Those who advocate reclassifying Pluto as something other than a planet have made much of Pluto's dissimilarity to the terrestrial and giant planets. But our current understanding of planet formation tells us that the differences between the terrestrial and giant planets result from the different primordial conditions in their respective regions of the protoplanetary nebula. In the inner solar system, temperatures were too high for the lighter gases, hydrogen and helium, to be retained, while further from the sun, where the giant planets formed, these abundant gases were available to be incorporated into planets. By the same token, we believe that Pluto's differences arose naturally as a result of its origin in a still-more-distant region of the protoplanetary nebula. Consequently, we believe that it should be considered as the prototype of a third class of planet. Other such icy bodies, comparable in size to Pluto or larger, may well remain to be discovered in the outer solar system.

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References and Notes

1. Schilling makes the point that Pluto's orbit is "strangely elongated." He neither notes that the eccentricity of Pluto's orbit is scarcely larger than that of Mercury, nor does he mention that a number of the recently discovered extra-solar planets have highly elongated orbits (G. Marcy *et al.*, in preparation). In the case of Pluto and a subset of the KBOs, the high orbital eccentricities result from these bodies' 3:2 orbital resonance with Neptune and are believed to be an indicator of the magnitude of Neptune's outward migration early in solar system history, not an indicator, one way or the other, of planetary status [R. Malhotra, *Astron. J.* **110**, 42 (1995)].
2. D. Tholen and M. Buie, In *Pluto and Charon*, (Univ. of Arizona Press, Tucson, AZ, 1997), p. 193.
3. R. Millis *et al.*, *Icarus* **105**, 282 (1993).
4. D. Jewitt, J. Luu, J. Chen, *Astron. J.* **112**, 1225 (1996).

Response

In my article, I tried to focus on the debate over what formal designation Pluto should get (if any), not on its planetary status. However, although the IAU is not going to decide whether Pluto counts as a planet, that is certainly an issue, because there is no solid definition of a planet, either on the basis of orbital characteristics or on the basis of physical properties. Meanwhile, Pluto discoverer Clyde Tombaugh would be glad to know that astronomers like Millis *et al.* oppose the idea of losing Pluto as a planet, just as two of the three people I quoted in my article do.

—**Govert Schilling**