



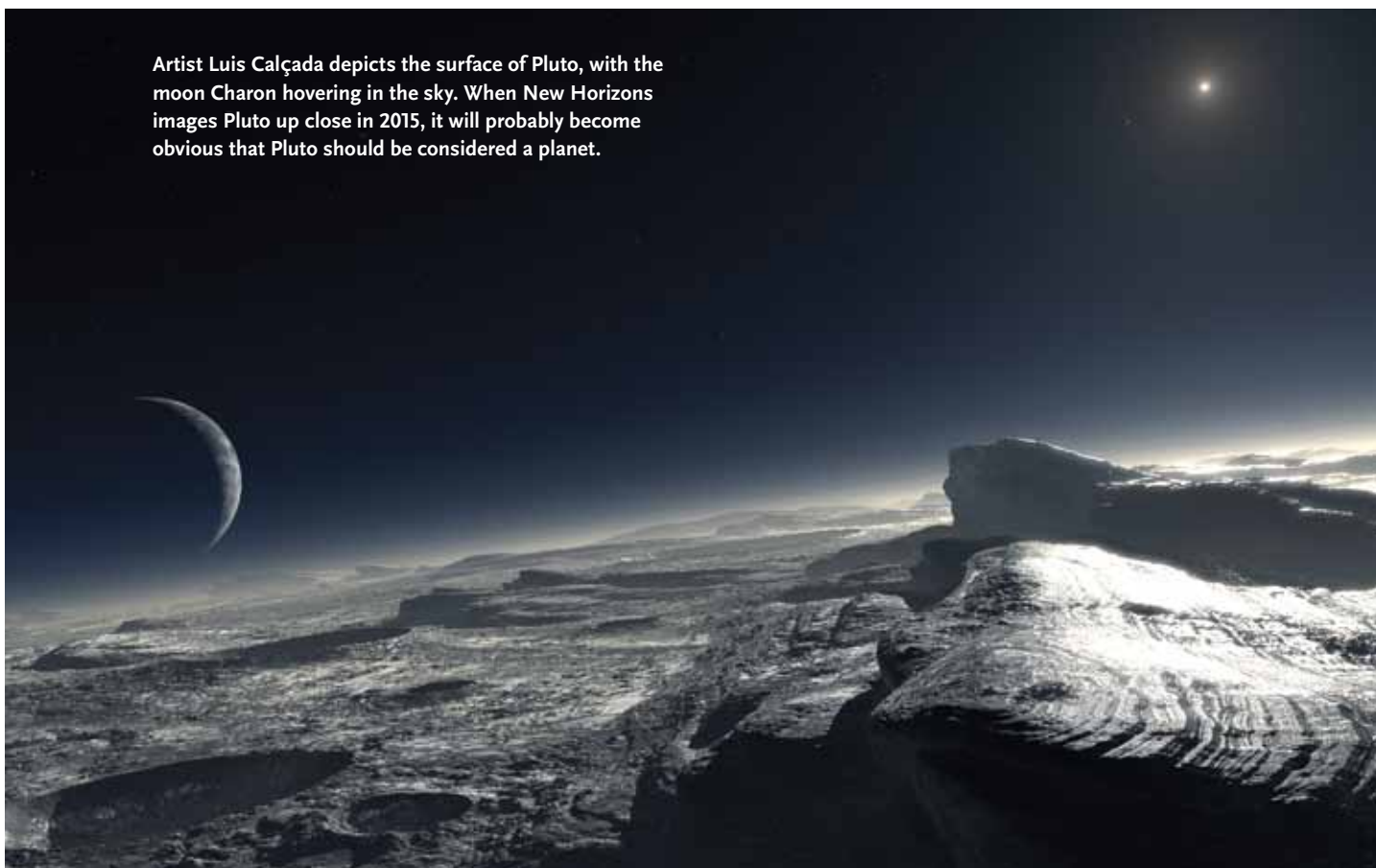
It's Not About Pluto: Exoplanets Are Planets Too!

Recent discoveries have exposed the absurdity of the IAU's planet definition.

IT'S MID-2013 and I can't believe I'm still writing about this. But we need to agree on a definition of "planet" that's not embarrassingly wrong and doesn't ignore the exoplanet revolution. There is dissatisfaction in the universe, a disturbance in the force, because people know that the current "official" definition from the International Astronomical Union (IAU) is incomplete at best and nonsensical at worst. In fact, the reasons why we need a better one loom larger every day.

Exoplanets are being discovered at a furious pace (page 20) and the fact that the current "official" definition defines only planets orbiting our Sun becomes more glaring as our solar system's planets shrink to a completely negligible portion of all there are. Meanwhile, NASA's New Horizons spacecraft is speeding at about 34,000 miles per hour toward its July 2015 rendezvous with Pluto, which will look very planetary — a round and varied world with a thin atmosphere and its own retinue of

Artist Luis Calçada depicts the surface of Pluto, with the moon Charon hovering in the sky. When New Horizons images Pluto up close in 2015, it will probably become obvious that Pluto should be considered a planet.



ESO / LUIS CALÇADA

moons. Schoolchildren and other astute members of the public will again ask, “Why is this not a planet?” Hopefully by then our community will have settled on some slightly more coherent answers.

You can explain to the kids that we discovered many other Plutos out there. They’ll respond, “But why can’t they all be planets? And why do you call it a dwarf planet if it’s not a planet?” Good questions.

Unlike “life,” “planet” is not an inherently difficult thing to define. Life is vexing because we only have one example and we don’t know to what extent our limited earthbound outlook might be biasing us to mistake our biosphere’s quirks for universal qualities. Someday, when we have discovered many living worlds, we’ll be able to revisit our definition of life with a broader perspective.

With planets we have crossed that threshold and now we know that our star is not unique in hosting a gaggle of orbiting worlds. In fact, most stars have them. At the same time, new discoveries within our solar system revealed the retinue of objects orbiting the Sun to be larger and more complex than we imagined. Pluto, it turned out, had company in the Kuiper belt, including some fairly large objects. It made no sense to consider Pluto to be a planet and not also admit these newly discovered planets to the club.

So it was certainly reasonable to reconsider the meaning of “planet.” In August 2006 the IAU was bent on solving the perceived Pluto problem. But partisans on both sides — those wanting to protect Pluto and those eager to knock him off — made it a strangely emotional debate, warping the process.

Some scientists, certain that kids could not handle learning a lot more than 9 planets, thought that the line should be drawn at something larger than Pluto. (Some of these people have apparently never actually talked to kids.) Perhaps overly attached to the solar system of their youth, they preferred to react to the discovery of a lot more planets by changing the definition of “planet” to keep the number more or less the same as what they learned in grade school.

After several proposals and votes, the 300 or so exhausted remaining stragglers at the end of a very long IAU meeting in Prague adopted the final proposal. As an alternative, they could have suffered the embarrassment of no agreement.

But in their haste to deal with the Kuiper belt revolution, they punted on the exoplanet revolution. The IAU defined solar system planets separately and left unresolved the question of what exactly might qualify as a planet in other stellar systems; in other words, they ignored essentially the entire universe. Every time anyone

The IAU Planet Definition

At the end of the 2006 IAU General Assembly in Prague, the “members voted that the resolution B5 on the definition of a planet in the Solar System would be as follows:

A celestial body that (a) is in orbit around the Sun, (b) has sufficient mass for its self-gravity to overcome rigid body forces so that it assumes a hydrostatic equilibrium (nearly round) shape, and (c) has cleared the neighbourhood around its orbit.”



To read the IAU’s entire definition of “planet,” visit skypub.com/IAUplanet.

now refers to exoplanets as planets (which includes every article ever written about exoplanets), they simply ignore the IAU definition.

Furthermore, the way the IAU dealt with Pluto-like objects made the new definition of “planet” unworkable for exoplanets. Beyond the surreal statement that “a dwarf planet is not a planet,” the main problem is that the criterion for determining what is a real planet and what is a dwarf involves observing the small-body population in the neighborhood of a candidate planet. But this won’t work for exoplanets, since we cannot know the small-body population in the vicinity of these newly discovered “things that might be planets.” Making matters even more ridiculous, Earth would be considered a planet in one location, but a dwarf if you moved it into the Kuiper belt, where it couldn’t possibly clear out this vast region of space.

Just as Galileo realized that the other known planets are the same kind of body as Earth, we now know that our Earth is but one among a much larger class of similar objects. Indeed, one of the most transcendent revelations made by science in our time, perhaps in all of history, is the fact that these wonderfully diverse objects around distant stars are indeed planets. That is the startling, beautiful, scientifically verified truth.

So it’s particularly silly, in the time of this exoplanet revolution, to proclaim a new definition that cannot be practically applied outside our solar system. After I tweeted this observation, I received a reply from a famous Pluto-assassinating astronomer who said, “I’d say [it’s] silly to have an exoplanet definition until we know more. Don’t make boxes first.” To this I replied, “We should call them ‘exothings’ then. Exoplanets implies we know they have characteristics in common with solar system planets.” But really, are we worried that these objects will turn out not to be planets? I’ll put money on predicting that when we do know more, those exothings will be ... planets!

So let’s fix this definition and put it to rest. I propose something simple like: *A planet is a gravitationally*

rounded object that is orbiting a star. To bound this definition on the large end, we can say that if an object has ever experienced nuclear fusion, it's a brown dwarf and not a planet. On the small end we can say that if it has not gravitationally dominated its surroundings then it goes in a subclass called dwarf planets. And "dwarfs" is just a subdivision of planets that already includes rocky planets, ice giants, and gas giants. When astronomers discover an exoplanet, we're often unsure which of these categories it goes in, but we know it's a planet.


Honorable mention must also be made of rogue planets, objects born in the comfort of a circumstellar disk but in the gravitational tussling of sibling planets somehow ended up being tossed out into the interstellar void. Are these rogues planets too? Sure, why not. Once a planet, always a planet.

And what about large moons such as Titan that would certainly be considered planets if they were independently

orbiting a star? Good question, but we should just let moons be moons since it's clear what they are.

Someone will probably shoot this proposal full of holes and come up with a better one. And as we learn more we'll probably need to revise it. Planets are complex and incredibly diverse, and the exoplanet revolution is surely just beginning. But let's at least have a definition that incorporates where we are and what we know today. Now we know that planets exist in thrilling abundance, the next phase, which has already begun, is to find out what they're really like. And after that, the next step is to find out who's living out there. At that point we won't need a definition that's perfect, just one that won't make us the laughingstock of our galaxy. ♦

Contributing editor and noted book author David Grinspoon is Baruch S. Blumberg Chair of Astrobiology at the Library of Congress. Follow him on Twitter at @DrFunkySpoon.



An artist portrays three Neptune-size worlds orbiting the young star HD 69830. According to the IAU, these objects are not really planets because they're outside the solar system.