

Should Earth Get Demoted From Planet Status Just Like Pluto?

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Abstract: Clyde.W. Tombough discovered Pluto on march13, 1930. From its discovery in 1930 until 2006, Pluto was classified as Planet. In the late 20th and early 21st century, many objects similar to Pluto were discovered in the outer solar system, notably the scattered disc object Eris in 2005, which is 27% more massive than Pluto. On august-24, 2006, the International Astronomical Union (IAU) defined what it means to be a Planet within the solar system. This definition excluded Pluto as a Planet added it as a member of the new category "Dwarf Planet" along with Eris and Ceres.

There were many reasons why Pluto got demoted to dwarf planet status, one of which was that it couldn't clear its orbit of asteroids and other debris. But Earth's orbit is also crowded...too crowded for Earth to be a planet? Earth is indeed in a very crowded orbit, surrounded by tens of thousands of asteroids and other objects. The presence of so many asteroids seems like a serious problem for Earth's claim that it has cleared its neighborhood. And Earth isn't alone in this problem - Jupiter is surrounded by some 100,000 Trojan asteroids, and there's similar clutter around Mars and Neptune. Indeed, one object that Neptune has categorically failed to clear from its orbit is Pluto itself. Alan Stern, the head of NASA's New Horizons mission to Pluto and a critic of the Pluto reclassification, points out quite simply, "If Neptune had cleared its zone, Pluto wouldn't be there." Therefore if we use the definition set forth by IAU, Pluto, Neptune, Jupiter, Mars & the Earth, are not Planets. They are also "Dwarf Planet". So there is a hope that lots of astronomers are not happy with the new definition, and could vote to change the definition of planet hood.

KEYWORDS: Dwarf Planet, Kuiper belt, self-gravity, New Horizon, Clearing the neighborhood.

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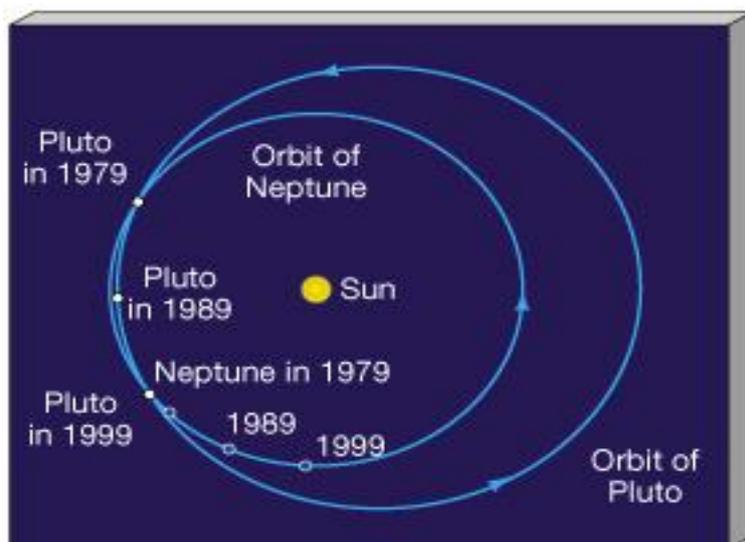
I. Introduction

The branch of Physics which deals with the physical and chemical properties, origin and evolution of the celestial bodies is called Astrophysics. Earth is the third planet from the sun and the fifth largest. It is the only object in the universe known to harbor life. Its name derives from Old English and Germanic. It is the densest major body in the solar system. Earth has only one natural satellite, the moon. It has got many Asteroids and artificial satellites. Earth's gravity interacts with other objects in space especially the sun and moon. Pluto was discovered by Clyde W Tombaugh in 1930 and was originally considered to be the ninth planet from the sun. After 1992, its status as planet was questioned and in 2006 it was reclassified as a Dwarf Planet.

Should Earth get demoted from planet status just like Pluto? - It provides a readable account of knowledge of the solar system and the concept of what has been considered to be a planet.

II. Problems With Pluto

Pluto has strange orbit. It crossed Neptune's orbit Jan 21, 1979, made its closest approach Sept 5, 1989 and remained within the orbit of Neptune Until Feb 11, 1999 i.e. Pluto's orbit overlaps Neptune's orbit, which caused it to be the 8th Planet from the sun during 1979-1999. February -11, 1999 Pluto crossed Neptune's path again and become the 9th planet again.



III. Is There A 10th Planet

Astronomers think they have discovered 10th planet. In 2005, Mike Brown and his team discovered an object named Eris. Eris is larger, made of same ice/rock mixture and more massive than Pluto. Finding Eris caused other astronomers to talk about what makes a planet “A PLANET”.

So if Pluto is a planet than there are other objects that may also be PLANETS within the kuiper belt.

IV. Comparison

PLUTO	ERIS
1.Mass:(1.305±0.007)× 10 ²² kg	1.Mass:(1.67±0.02) ×10 ²² kg
2.Diameter:2390 km	2.Diameter:2397km
3.Density:(2.03±0.06) g/cm ³	3.Density(2.52±0.05) g/cm ³

The candidates size-wise: Eris, Pluto, Ceres (and Earth)



V. Dilemma

With Eris being larger, made of the same ice/rock mixture and more massive than Pluto, the concept that we have nine Planets in the Solar system began to fall apart. What is Eris, Planet or Kuiper Belt Object? What is Pluto, for that matter? And also what about earth then?

VI. Astronomer’s Decision

Astronomers decided they would make a final decision about the definition of a planet at the 26th General Assembly of the International Astronomical Union (IAU), which was held from August 14th to August 25th, 2006 in Prague, Czech Republic. The IAU passed a resolution defining planet in such a way as to exclude

Pluto and established a new class of objects in the solar system to be called "Dwarf Planet" which was deliberately designed to include Pluto.

According to them.....

(1) A "**planet**" is 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 neighborhood around its orbit.

(2) A "**dwarf planet**" is 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,
- (c) has not cleared the neighborhood around its orbit, and
- (d) is not a satellite.

(3) **All other objects**, except satellites, orbiting the Sun shall be referred to collectively as "Small Solar System Bodies".

VII. Clearing Up the Neighborhood

"Clearing up the neighborhood" means that the 'Planet' has to be the dominant gravitational body in its orbit around the sun and there are no other bodies of comparable size other than its natural satellites. As planets form, they become the dominant gravitational body in their orbit in the solar system. As they interact with other smaller object, they either consume them or sling them away with their gravity. Pluto is only 0.07 times the mass of the other objects in its orbit. The earth, in comparison, has 1.7 million times the of the other objects in its orbit.

VIII. Pluto's Demotion Knocks the Planetary Status of Earth

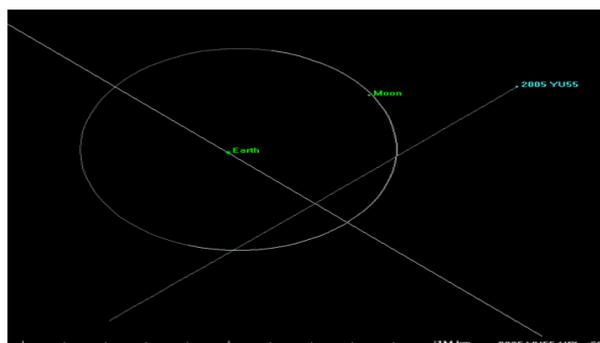
As Pluto does not meet the 3rd criteria of Planet hood, IAU on august-24, 2006 declared Pluto as "Dwarf Planet". Earth is also unable to fulfill all three criteria laid by IAU for planethood like Pluto.. So there is a big question on the planet status of Earth.

IX. Problem with Earth

Earth is indeed in a very crowded orbit, surrounded by tens of thousands of asteroids and other objects. Recently Asteroid 2005 YU55 passed within 0.85lunar distances from the Earth on 8 November 2011 which reflects that Earth fails to clear it's neighborhood. . Asteroid 2016 H03, first spotted on April 27, 2016 by the Pan-STARRS 1 asteroid survey telescope on Haleakala,Hawaii, is a companion of Earth, too distant to be considered a true satellite . As it orbits the Sun, *2016 H03* appears to circle around Earth as well. The object is beyond the Hill sphere of Earth and the Sun exerts a much stronger pull on it than Earth does. Although it is too distant to be considered a true natural satellite of Earth, it is the best and most stable example to date of a near-Earth companion, or quasi-satellite.

Since 2016 H03 loops around our planet, but never ventures very far away as we both go around the Sun, we refer to it as a quasi-satellite of Earth", said Paul Chodas, manager of NASA's Center for Near-Earth Object (NEO) Studies at the Jet Propulsion Laboratory in Pasadena, California

As it loops around Earth indicating that Earth has not cleared the neighborhood around its orbit. Not only this, there are lots of example in support of the above statement.



X. Controversy

Every 228 years Pluto crosses inside of Neptune, so technically speaking it does not clear it's neighborhood. But also means that Neptune does not clear its own neighborhood. Mars & Jupiter do not clear neighborhood as they interface with Asteroids and the Earth actually orbits the sun with thousands of Asteroids. So the earth does not clear its own neighborhood.

If we use the definition set forth by IAU, Pluto, Neptune, Jupiter, Mars & the Earth, are not Planets. They are also "Dwarf Planet". So there is a hope that lots of astronomers are not happy with the new definition, and could vote to change the definition of planethood.

XI. Steven Scoters' Idea

Thankfully, there's a very simple way out of this. We've been talking a lot about the sheer number of objects around Earth and Jupiter, but let's instead consider those objects relative to the planets themselves. Pluto, for instance, is just .077 times the mass of all the other objects in its orbit, meaning it makes up roughly 8% of the mass found in its orbit. Earth, on the other hand, is 1.7 million times the mass of all the other objects in its orbit. Earth may be cluttered, but all the asteroids around it amount to less than nothing.

This figure is known as the planetary discriminant, an idea put forward by astrophysicist Steven Soter as a simple way of measure just how clean a planet's orbital neighborhood really is. As it turns out, Earth has the cleanest neighborhood of any planet, with Venus the closest behind with 1.35 million. Jupiter is the next cleanest, with a planetary discriminant of 625,000. As it happens, Neptune has the smallest discriminant, at just 24,000. So then, Earth is definitely a planet, and the argument for its demotion rather resoundingly falls apart.

XII. Conclusion

Even though there is controversy regarding the planethood status of earth but the idea forwarded by Astrophysicist Steven Soter made us understand to happily admit that the Earth should not get demoted from planet status just like Pluto. Also Pluto is not a planet because the barycenter of the Pluto/Charon system is above the surface of Pluto. Therefore Charon has such a large gravitational influence on it that they are actually a binary pair, Earth does not suffer this issue with asteroids 2016 H03, so its status as a planet is safe. The IAU didn't include a strict cut-off for how clean a neighborhood has to be for an object to be considered a planet. Obviously, when the gap between the least clean planet and the cleanest dwarf planet is separated by a factor of more than 72,000, there isn't much need for one. So, barring the discovery of something very unusual in the outer reaches of our solar system (like, for the sake of argument, the Oort Cloud planet Tyche) that would seriously blur the line in terms of what it means to clear one's orbit, we can safely say that Earth is definitely a planet, Pluto is definitely a dwarf planet, and only one of them is capable of keeping its neighborhood clean.

References

- [1]. Steven Soter (2007). "What is a Planet?" *The Astronomical Journal* 132 (6).
- [2]. Williams, David R. (1 September 2004). "Earth Fact Sheet" NASA Retrieve 9 August 2010
- [3]. Pidwirny, Michael (2 February 2006) "Surface area of our planet covered by oceans and continents (Table80-1).University of British Columbia, Okanagan. Retrieved 26 November 2007.
- [4]. Allen, Clabon Walter; Cox, Arthur N(2000). *Allen's Astrophysical Quantities*. Springer.p.296.ISBN 0-387-98746- 0. Retrieved 17 August 2010.
- [5]. "Age of Earth" U.S. Geological Survey.1997. Archived from the original on 23 December 2005. Retrieved January 2006
- [6]. "IAU 2006 General Assembly: Result of the IAU Resolution Votes". IAU 24 August 2006. Retrieved 2009-10-23.
- [7]. Staff (7 August 2007). "Useful Constants" International Earth Rotation and Reference Systems service. Retrieved 23 September 2008.
- [8]. Robert Roy Britt (August 24, 2006). "Scientists Decide Pluto's no longer a Planet". MSNBC .Retrieved 2007-09- 08.
- [9]. Hamilton, Calvin J.(February 12,2006) "Dwarf Planet Pluto" . Views of the Solar system. Retrieved January 10, 2007.
- [10]. Crosswell,Ken (1997). *Planet Quest: The epic Discovery of Alien Solar Systems*. New York: the free Press. P 43. ISBN 978-684-83252-4.
- [11]. "Planetary Linguistics" archived from the original on December! 7, 2007. Retrieved June 12, 2007.
- [12]. Thérèse, Encrenaz (2004).*The Solar System* (Third ed.). Springer. pp. 388–390. ISBN 3-540-00241-3.
- [13]. Zeilik, Michael A.; Gregory, Stephan A. (1998). *Introductory Astronomy & Astrophysics* (4th ed.). Saunders College Publishing. p. 67. ISBN 0-03-006228-4.
- [14]. Moskowitz, Clara (2006-10-18). "Scientist who found '10th planet' discusses downgrading of Pluto". *Stanford News*. Retrieved 2008-08-23
- [15]. "Pluto loses status as a planet". BBC. 2006-08-24. Retrieved 2008-08-23.
- [16]. Burchfield, Joe D. (1990). *Lord Kelvin and the Age of the Earth*. University of Chicago Press. pp. 13–18. ISBN 978-0-226-08043-7
- [17]. Arnett, Bill (16 July 2006). "Earth". *The Nine Planets, A Multimedia Tour of the Solar System: one star, eight planets, and more*. Retrieved 9 March 2010.
- [18]. Russell, Jeffrey B. "The Myth of the Flat Earth". *American Scientific Affiliation*. Retrieved 14 March 2007.;
- [19]. Choi, Charles Q. (27 July 2011). "First Asteroid Companion of Earth Discovered at Last". *Space.com*. Retrieved 27 July 2011.
- [20]. Connors, Martin; Wiegert, Paul; Veillet, Christian (27 July 2011). "Earth's Trojan Asteroid". *Nature*. **475** (7357): 481–83. Bibcode:2011Natur.475..481C
- [21]. Whitehouse, David (21 October 2002). "Earth's little brother found". *BBC News*. Retrieved 31 March 2007.

- [22]. Lambeck, Kurt (1980). *The Earth's Variable Rotation: Geophysical Causes and Consequences*. Cambridge University Press. . 367. ISBN 978-0-521-67330-3
- [23]. "Age of the Earth". U.S. Geological Survey. 1997. Archived from the original on 23 December 2005. Retrieved 10 January 2006.
- [24]. Robertson, Eugene C. (26 July 2001). "The Interior of the Earth". USGS. Retrieved 24 March 2007.
- [25]. Brown, W. K.; Wohletz, K. H. (2005). "SFT and the Earth's Tectonic Plates". Los Alamos National Laboratory. Retrieved 2 March 2007.
- [26]. de Pater, Imke; Lissauer, Jack J. (2010). *Planetary Sciences* (2nd ed.). Cambridge University Press p. 154. ISBN 0-521-85371-0.
- [27]. Agle, DC; Brown, Dwayne; Cantillo, Laurie (15 June 2016). "Small Asteroid Is Earth's Constant Companion". Jet Propulsion Laboratory. Retrieved 19 November 2017.
- [28]. "LCDB Data for (469219)". Minor Planet. Info — ALCDEF Query. Asteroid Light curve Database (LCDB). Retrieved 19 November 2017
- [29]. "(469219) = 2016 HO3". Minor Planet Center. IAU. Retrieved 19 November 2017
- [30]. O'Neill, Sean (2005). "Your top 10 names for the tenth planet". *New Scientist*. Retrieved June 28, 2008.
- [31]. Brown, Mike (2006). "The discovery of 2003 UB313 Eris, the largest known dwarf planet". Retrieved May 3, 2007
- [32]. IAU (August 24, 2006). "Definition of a Planet in the Solar System: Resolutions 5 and 6" (PDF). IAU 2006 General Assembly International Astronomical Union. Retrieved January 26, 2008.
- [33]. "Dwarf Planets and their Systems". Working Group for Planetary System Nomenclature (WGPSN). July 11, 2008. Retrieved July 2008.
- [34]. "Free the Dwarf Planets!". Michael Brown. August 24, 2011. Retrieved August 24, 2011.
- [35]. Mager, Brad. "Pluto Revealed". *discoveryofpluto.com*. Retrieved January 26, 2008.
- [36]. Bowell, Ted. "The Asteroid Orbital Elements Database". Lowell Observatory. Retrieved February 12, 2008.
- [37]. M.E. Brown, 2013, "On the size, shape, and density of dwarf planet Makemake"
- [38]. Brown, Michael E. "The Dwarf Planets". California Institute of Technology, Department of Geological Sciences. Retrieved January 26, 2008

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