Demotion of Pluto relegates the planethood status of Earth

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Abstract— **Planethood means the state or condition of being a Planet. 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". Now Pluto's demotion to "Dwarf Planet" relegates the planetary status of Earth. 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.

Index Terms— **Barycenter, Clearing the neighborhood, Dwarf Planet, Kuiper belt, New Horizon. Relegate**

I. INTRODUCTION

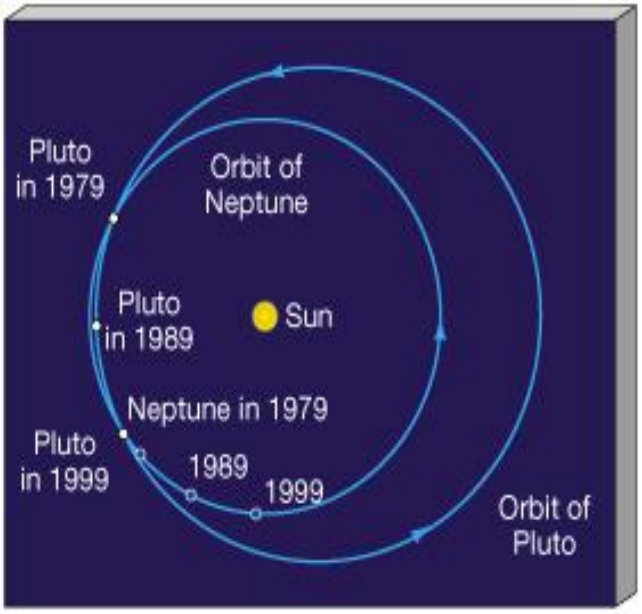
Although Astronomy is as ancient as recorded history itself, it was long separated from the study of terrestrial physics.

In the Aristotelian world view, bodies in the sky appeared to be unchanging spheres whose only motions was uniform motion in a circle, while the earthly world was the realm which underwent growth and decay and in which natural motion was in a straight line and ended when the moving object reached its goal. To get knowledge on properties of celestial bodies, we shall have to know Astrophysics. The branch of Physics which deals with the physical and chemical properties, origin and evolution of the celestial bodies is called Astrophysics. A planet is a celestial body that (a) has sufficient mass for its self-gravity to overcome rigid body forces so that it assumes a hydrostatic equilibrium shape, and (b) is in orbit around a star, and is neither a star nor a satellite of a planet. 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 too demoted from planet status just like Pluto?

Demotion of Pluto relegates the planethood status of Earth– This article provides a readable account of knowledge of the solar system and the concept of what has been considered to be a planet.It conveys information in a conversational tone to engage its readers

II. PROBLEMS WITH PLUTO

In 1992, University of Hawali astronomers David Jewitt and Jane Luu discovered a new object in Pluto's neighborhood, which is beyond the orbit of Neptune. Within one year alone, Scientists identified five more objects in the region of solar system called the kuiper belt and all these new objects made Pluto into trouble. 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.



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III. IS THERE A 10TH PLANET?

Pluto was the only object known in the Kuiper belt until 1992, but since then astronomers have spotted hundreds more faint, icy bodies with orbits beyond Neptune .Astronomers have found a new planet in the outer reaches of the solar system.They 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 as well Earth. 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. These kind of questions compelling the Astronomers to think about the the planetary status of Earth too.

IV. COMPARISON

PLUTO	ERIS	EARTH
1.Mass: $(1.305\pm0.007)\times 10^{22}$kg	1.Mass: $(1.67\pm0.02)\times 10^{22}$kg	1.Mass: $(5.9\pm0.006)\times 10^{24}$ kg
2.Diameter: 2390 km	2.Diameter: 2397km	2.Diameter: 12,756km
3.Density: (2.03 ± 0.06) g/cm^3	3.Density (2.52 ± 0.05) g/cm^3	3.Density (5.52 ± 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

Over the past 15 years, larger and stronger telescopes have given astronomers a better look at the far reaches of the solar system. Over that time, they have discovered an entire new class of objects orbiting the sun well beyond the orbit of Neptune. Some of these objects are bigger than Pluto. These discoveries have forced scientists to think deeply about what it means to be a planetAstronomers 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 NEIGHBOURHOOD

"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 RELEGATES THE PLANETARY STATUS OF EARTH

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. As it turns out, that clutter still isn't remotely enough to cost Earth its planet status, but it's worth understanding just what makes Earth's case different from Pluto's. And to do that, we have to go back to the definition of a planet.

When the International Astronomical Union redefined the term "planet" in 2006, they agreed on three crucial criteria for planet status. The body had to orbit the Sun, it had to be massive enough to assume hydrostatic equilibrium, which essentially means it's big enough to be nearly spherical, and it had to "clear the neighborhood" that made up its orbit. It was this third criterion that Pluto failed to meet, because its orbit is

right in the middle of the Kuiper Belt, full of planetesimals, asteroids, and various other pieces of debris.

That seems simple enough but, as always, the devil is in the details. As Ray Villard over at Discovery News points out, Earth is surrounded by so-called Near-Earth Asteroids. The prototype telescope Pan-STARRS (Panoramic Survey Telescope & Rapid Response System), located in Hawaii, can detect more than a dozen new asteroids on any given night, and some estimates tab as many as 20,000 asteroids in the same orbit as Earth.

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."

This seems like an untenable situation. After all, what sensible definition for a planet would exclude the largest in our solar system (Jupiter), the third-largest (Neptune), and, in Earth, the biggest rocky planet...not to mention the only one to support life?

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. CONTROVERSY

There is a lots of confusion about the planetary status of Planets of our solar system. 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. According to some astronomers a planet is simply a gravitationally rounded object that orbits around a star. It is not necessary for this orbiting body to have gravitationally swept out the debris in its orbit. By this definition Pluto is a planet, no confusion about the planetary status of Earth too. But 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

X. STEVEN SOTERS’ 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. 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 So then, Earth is definitely a planet, and the argument for its relegation rather resoundingly falls apart

XI. 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. 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. Infect the planetary scientists want to promote Pluto back to the status of planet.

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ACKNOWLEDGMENT

I express my deep sense of gratitude and thanks to all those who provided their invaluable guidance and helpful suggestion in making this article entitled “should Earth get demoted from planet status just like Pluto?” for, without whose help my efforts to write this project would have end up in smoke. I specially thanks to Dr. Iris Odyuo, Associate Professor, Sao Chang College , Tuensang; Nagaland for helping me out in all respect. I am extremely grateful to my college Principal and colleagues, for their timely support, guidance and encouragement in making this paper a successful one.

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