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PRELIMINARY STUDIES ON DIVERSE THEMES

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NUMBER 07
20/12/2017

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REVISIONAL PRELIMINARY STUDY ON THE CURRENT OVERVIEW OF THE ACCUMULATED KNOWLEDGE ON THE PLUTO NATION PLANET AFTER THE NEW HORIZON SOUND PASSAGE IN JULY 2015.

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Abstract

In January 2006, NASA launched the New Horizons spacecraft to study Pluto, its moons, and one or two other objects from the Edgeworth-Kuipier Belt. After a voyage of 9 years, on January 15, 2015, the spacecraft began to approach the dwarf planet, and by this it passed in a fluttering flight on the date of July 14, 2015. After this approach, much information was e is still transmitted to Earth, which resulted in more realistic modeling, which will be discussed in this article.

Keywords: Edgeworth-Kuipier; Pluto; Charon; sputnik

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I - Introduction

Until the date of July 2015, the dwarf planet Pluto was always an object that raised all kinds of conjectures and speculations. Since its discovery in 1930, the best images obtained so far came from the Hubble telescope, which produced images of up to four pixels in size. Its small size and its distance from the earth generated a blurred image where at most it differentiated clear zones of dark zones in a small sphere. Artistic interpretations have long tried to satisfy the public's curiosity, but the truth is that because of its small size, a clear image was beyond the capacity of more modern telescopes. It was then necessary to make a decision and build a NEW HORIZON spacecraft project that consumed billions of dollars in budget and embarked on an epic voyage of almost 10 years. Only when in July 2016 (already as the fastest man-made object in history) did the probe fly overhead, and an enormous amount of information began to be sent to Earth. And then from these new data we can build a realistic physical model.

II – Physical and orbital characteristics of Pluto.

After the discovery of Pluto (table 1), astronomers of the time began to speculate on the possibility of a population of objects besides Neptune (Freckrick C. Leonard 2017). Kenneth Edgeworth then stated that the material within the primordial solar nebula beyond Neptune was widely spaced and should be inhabited by a multitude of smaller bodies, not planets (Fig. 1).

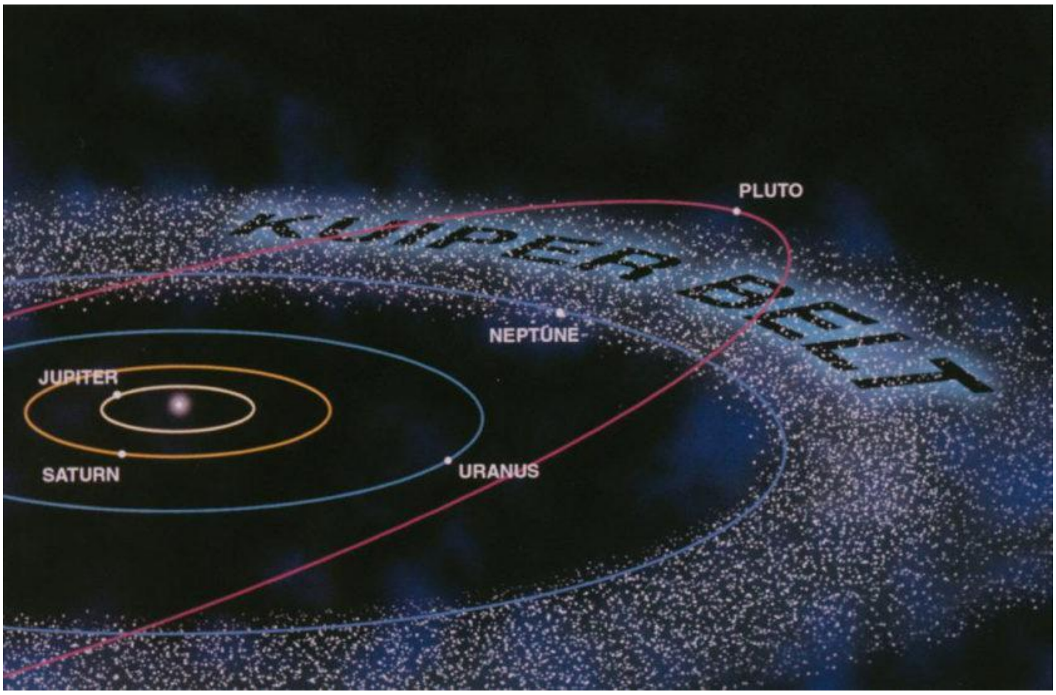

Figure 1: Schematic diagram of the probable orbit of the dwarf planet Pluto and the Edgeworth-Kuipier belt in the solar system (ROMANZOTI 2015)

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Table 1: Pluto Assignments

Discovered by	Clyde W. Tombaugh
Discovery date	February 18, 1930
Designations	
MPC designation	**(134340) Pluto**
Pronunciation	/ˈpluːtoʊ/
Named after	Pluto
Minor planet category	Dwarf planet Trans-Neptunian object Plutoid Kuiper belt object Plutino
Adjectives	Plutonian

III – Images obtained until the year 2015

Due to its small diameter and extreme distance from Earth, the chemical composition of Edgeworth-Kuipier objects is difficult to determine. The best color image / map of Pluto was generated with the Hubble Space Telescope and assembled with the help of computers. These images (figure 2) were constructed from multiple photographs taken from 2002 to 2003. It is not known whether the differences in brightness are mountains, craters or polar ice caps. The set of information obtained by 2015 can be compiled in Tables 2 and 3.

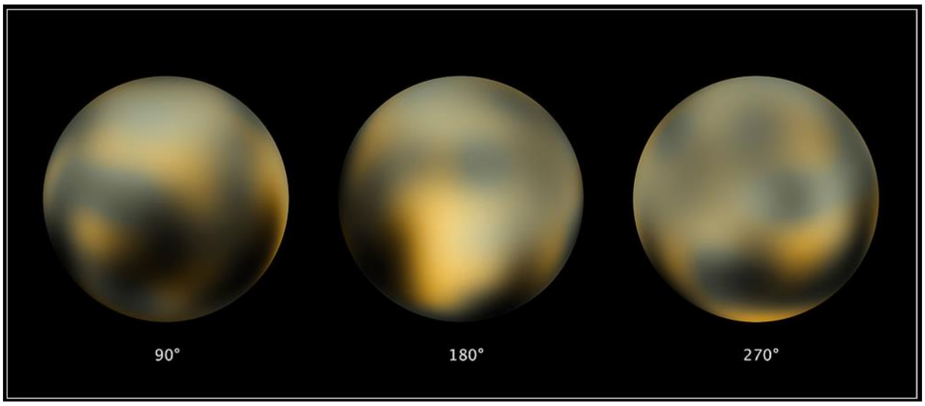

Figure 2: The faces of Pluto – Hubble Space Telescope – ACS/HRC – NASA, ESA e M.BUIE (Southwest Research Institute) – STScl-PRC10-06a. ("Images are courtesy of Marc W. Buie, Southwest Research Institute")

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Table 2: Physical characteristics of Pluto

Physical characteristics			
Mean radius	1,188.3±0.8 km 0.1868 Earths		
Flattening	<1%		
Surface area	1.779×10^{7} km^{2} 0.035 Earths		
Volume	$(7.057\pm0.004)\times10^{9}$ km^{3} 0.00651 Earths		
Mass	$(1.303\pm0.003)\times10^{22}$ kg 0.00218 Earths 0.177 Moons		
Mean density	1.854±0.006 g/cm^{3}		
Surface gravity	0.620 m/s^{2} 0.063 g		
Escape velocity	1.212 km/s		
Sidereal rotation period	6.387230 d 6 d, 9 h, 17 m, 36 s		
Equatorial rotation velocity	47.18 km/h		
Axial tilt	122.53° (to orbit)		
North pole right ascension	132.993°		
North pole declination	−6.163°		
Albedo	0.49 to 0.66 (geometric, varies by 35%)		
Surface temp.	**min**	**Mean**	**Max**
Kelvin	33 K	44 K (−229 °C)	55 K
Apparent magnitude	13.65 to 16.3 (mean is 15.1)		

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Absolute magnitude *(H)*	−0.7
Angular diameter	0.06″ to 0.11″
Atmosphere	
Surface pressure	1.0 Pa (2015)
Composition by volume	Nitrogen, methane, carbon monoxide

Table 3: Orbital characteristics of Pluto

Epoch J2000	
Aphelion	49.305 AU (7,375.93 Gm) February 2114
Perihelion	29.658 AU (4,436.82 Gm) (September 5, 1989)
Semi-major axis	39.48 AU (5,906.38 Gm)
Eccentricity	0.2488
Orbital period	248.00 years 90,560 d
Synodic period	366.73 days
Average orbital speed	4.67 km/s
Mean anomaly	14.53 deg
Inclination	17.16° (11.88° to Sun's equator)
Longitude of ascending node	110.299°
Argument of perihelion	113.834°
Known satélites	5

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IV - Geomorphological and geological characteristics of Pluto.

Observations of Pluto made by the Hubble telescope estimate a density between 1.8 and 2.1 g / cm3, suggesting an internal composition of approximately 60% of rock and 40% of ice (figure 3). With the eventual decay of the radioactive minerals would heat the ice layer enough for the rocks to separate them. The internal structure of Pluto is expected to be differentiated, with the rocky material stabilized in a dense core surrounded by an ice sheet. The diameter of the core should be about 1 700 km (70% of Pluto's diameter).

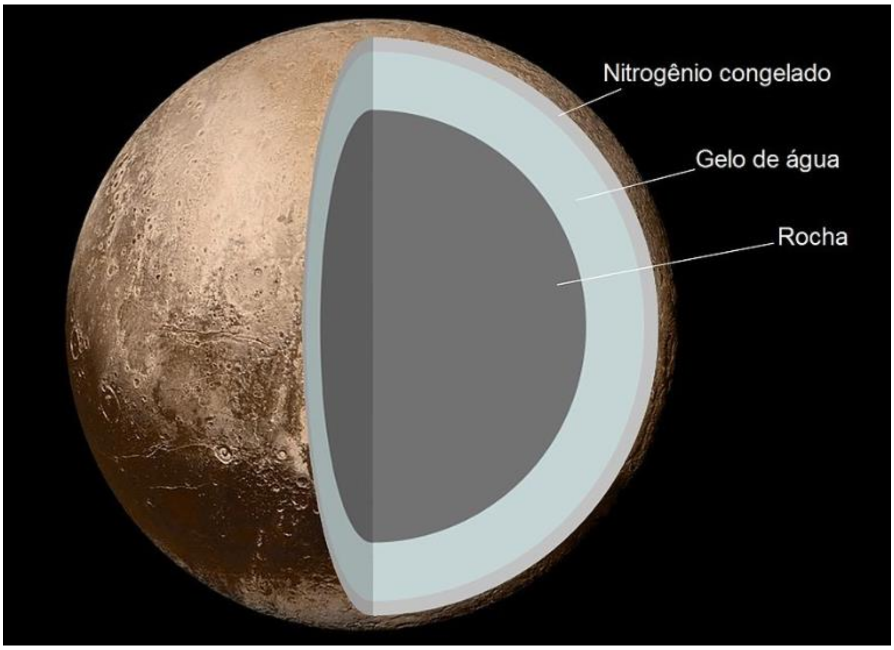

Figure 3: Theoretical structure of Pluto built in (NASA 2006).

Heating is likely to continue today, creating a liquid ocean layer 100 to 180 km deep in the core. The DLR's Institute of Planetary Research has calculated that the density-radius ratio of Pluto is in a transition zone, along with Triton, and between icy satellites like the mid-sized moons of Saturn and Uranus and the rocky satellites like Europe.
Pluto after the New Horizon data arrives is now larger than estimated (it has 2,300 kilometers in diameter), has five moons (Charon, Nix, Hydra, Cerberus and Stygia) and is red (Figure 4).

The geology of Pluto is almost as varied as that of Earth. The data collected by New Horizons show that the planet has several mountains, valleys, volcanoes, craters and plains.
Some of the bumpy parts were likely to result from asteroid impacts and that they are from the same time the dwarf planet was formed about 4.5 billion years ago. Other regions, such as ice volcanoes, probably took a good part of Pluto's history to form.
The surface of the dwarf planet has 98% of nitrogen ice in its composition, with remnants of methane and carbon monoxide. Its surface is filled with shades of blues, yellows, oranges, and darker reds. Pluto has its own colors, which shows the incredible history of geological complexity.

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The highest concentration of nitrogen ice appears in the Sputnik Planum plain (figure 4 and figure 5). This area shows no signs of having impacted asteroids and should not be over 10 million years old, a strong indication that Pluto is still geologically active.

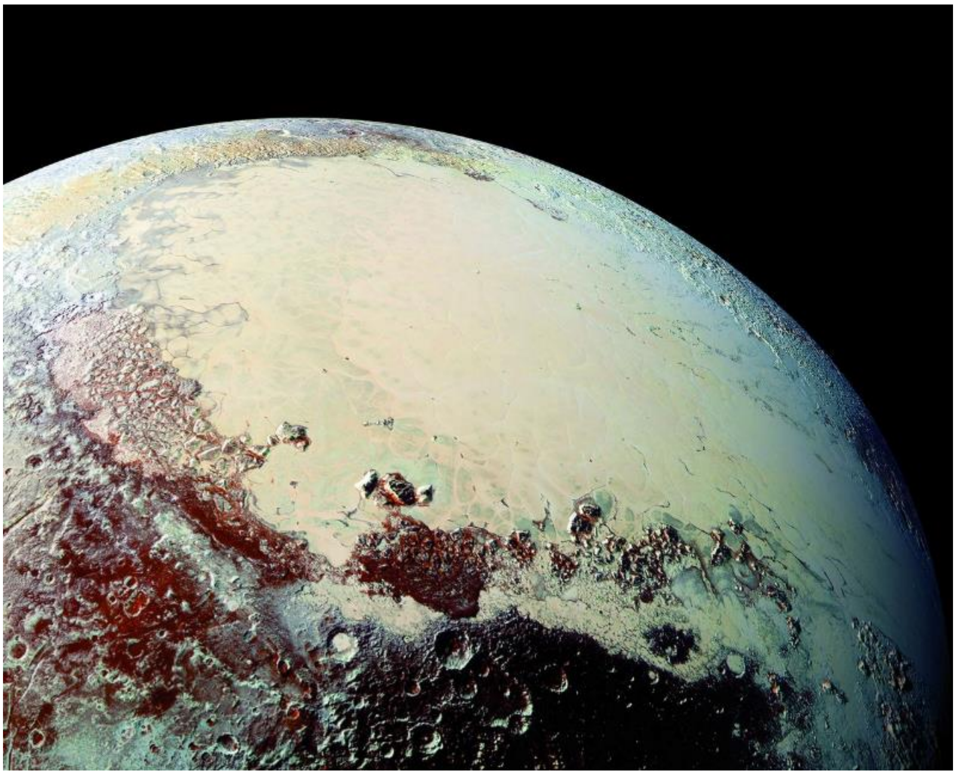

Figure 4: Image of the great Pluto Sputnik Planum plain. (NASA, 2015)

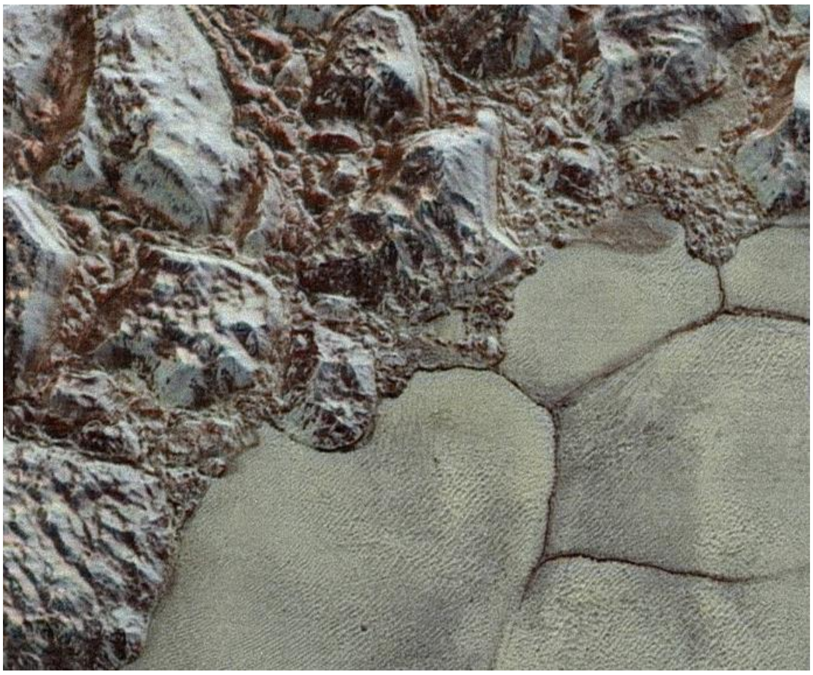

Figure 5: Image of the border of the Great Plain Sputnik Planum with the mountainous region of Pluto. (NASA, 2015)

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The atmosphere (figure 6) of Pluto probably consists of nitrogen with methane, acetylene and ethylene. It is even colder than expected: near the surface of the planet the temperature reaches -197.2ºC. Farther from the atmosphere, the temperature increases a bit because of methane, reaching -127.2 ° C. The gases - mainly hydrogen cyanide - cool the outside, making the temperature reach -167 ° C.

The fact that the dwarf planet's atmosphere is so cold causes less gas to escape into space. Pluto also has a kind of blue mist, (Figure 6). A blue sky is usually the result of the dispersion of sunlight into very small particles. On Earth, these particles are very small molecules of nitrogen. On Pluto they appear to be larger, particles that look like soot which are called the tolins. "Tollate particles are believed to form in the atmosphere, where ultraviolet sunlight breaks and ionizes the nitrogen and methane molecules, allowing they react with each other.In this process, charged ions are formed positively and negatively.When combined, they form complex macromolecules.As they combine and grow, they become small particles, volatile gases condense and cover the surface with ice before they have time to fall through the atmosphere to the surface, where they make Pluto a red color.

Figure 6: Image of the blue-colored halo of Pluto's tenuous atmosphere. (NASA, 2015)

V - The moons of Pluto

Thus with Pluto its moon Charon (figure 7) surprised because its surface is presents / displays mountains and gorges (evidence that its geological past was turbulent).

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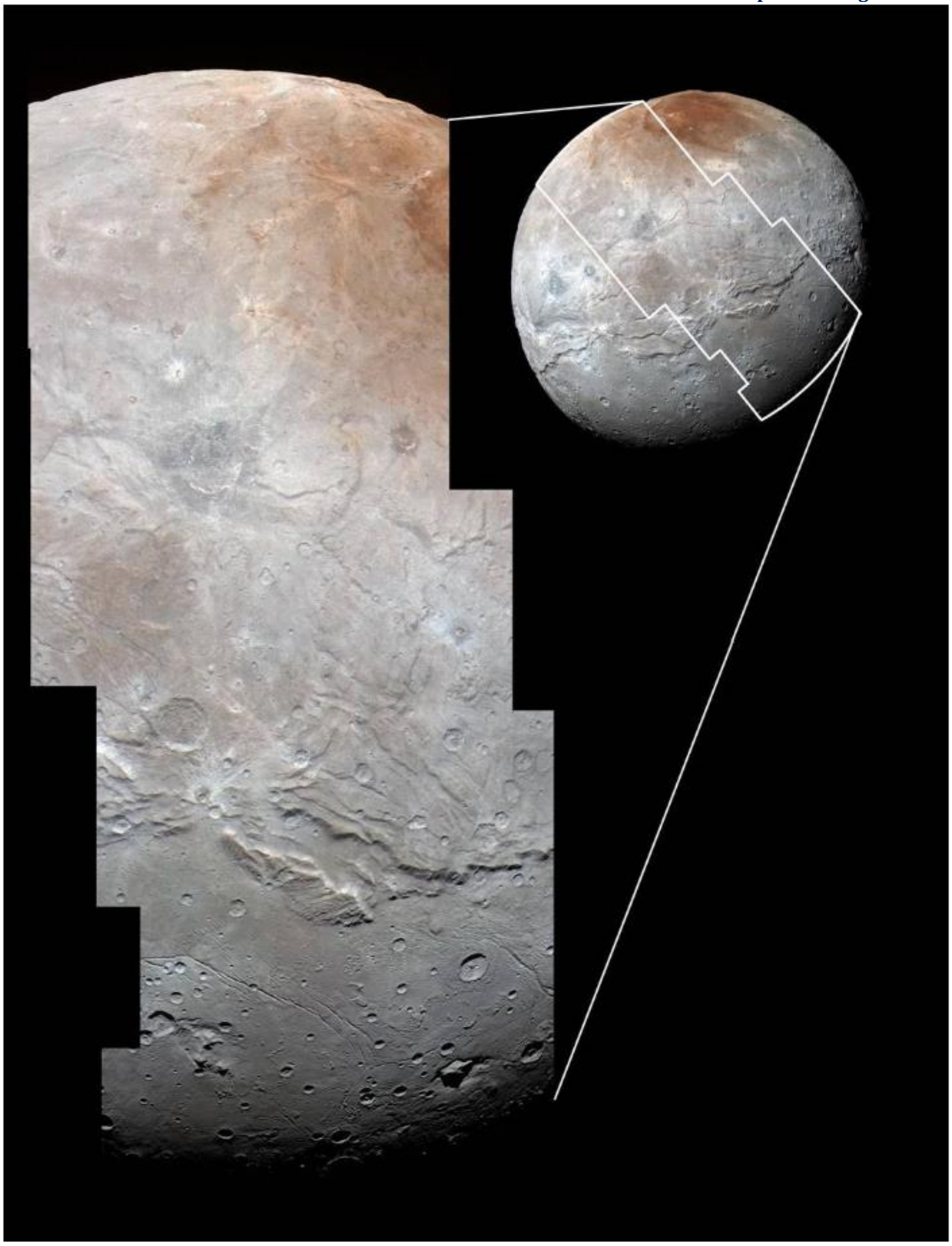

Figure 7: Image of Charon's surface in detail. (NASA, 2015)

The New Horizons spacecraft on July 11, 2015 (Figure 8) obtained the image of Pluto and Charon where it is possible to see that Pluto and Charon exhibit an impressive contrast of color and brightness. This image is composed from July 11, showing images of the Long Range Reconnaissance Imager (LORRI) high resolution black and white colored with Ralph data collected from the last rotation of Pluto. The color data being returned by the spacecraft will now refresh these images, bringing color contrast to a sharper focus.

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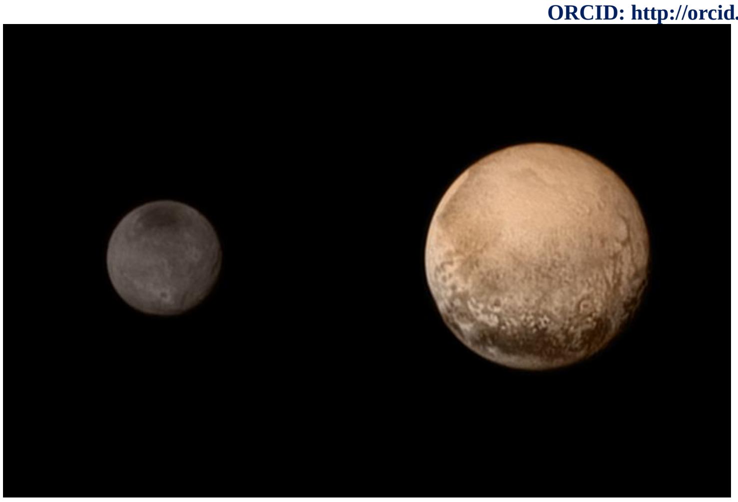

Figure 8: Image of Pluto and Charon obtained by the New Horizon spacecraft on 07/11/2015 (NASA-JHUAPL-SWRI, 2015).

Figure 9 shows the group of Pluto moons. In this composite image shows a large moon blade of Pluto, Charon and all four smaller moons, as obtained by the Long Range Reconnaissance Imager (LORRI) mounted on the New Horizons probe. All moons are displayed with a common intensity stretch and a spatial scale (see scale bar). Charon is the largest of Pluto's moons, with a diameter of 1,212 kilometers. Nix and Hydra have comparable sizes, approximately 40 miles in their largest dimension above. Kerberos and Styx are much smaller and have comparable sizes, approximately 10-12 kilometers in their largest dimension. The four small moons have highly elongated shapes, a characteristic characteristic of small bodies in the Kuiper Belt.

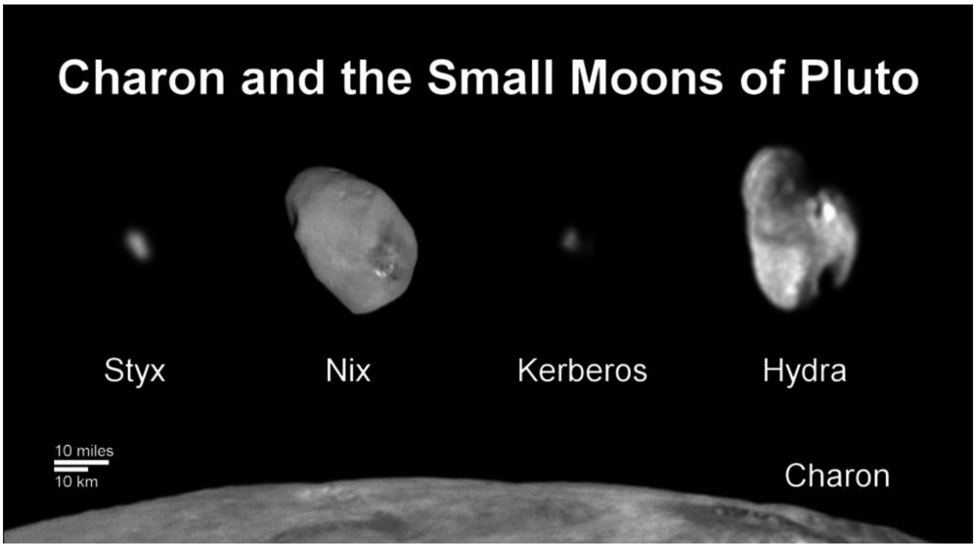

Figure 9: A comparison of size between the moons of Pluto. (NASA / JHUAPL / SwRI, 2015)

VI - Conclusions

Pluto is a dwarf planet that presents a superficial geomorphology where it is possible to perceive a high recycling rate (as presented by Earth). We did not find extensive and ancient surface crater like those found on the moon. There is a heart-shaped surface, high albedo, and absolutely smooth (Sputnik Planum plain). In the mountainous regions it is possible to perceive volcanic cones in shield (similar to Mount Olympus on Mars.) Pluto is a system composed of a dwarf

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planet and five moons Pluto forms with its moon Charon a binary pair similar to that of the Earth - Moon pair This dwarf planet has a 5-moons system, Pluto has many colors, predominantly the red, and is an interesting dwarf planet that should be revisited in the future.

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