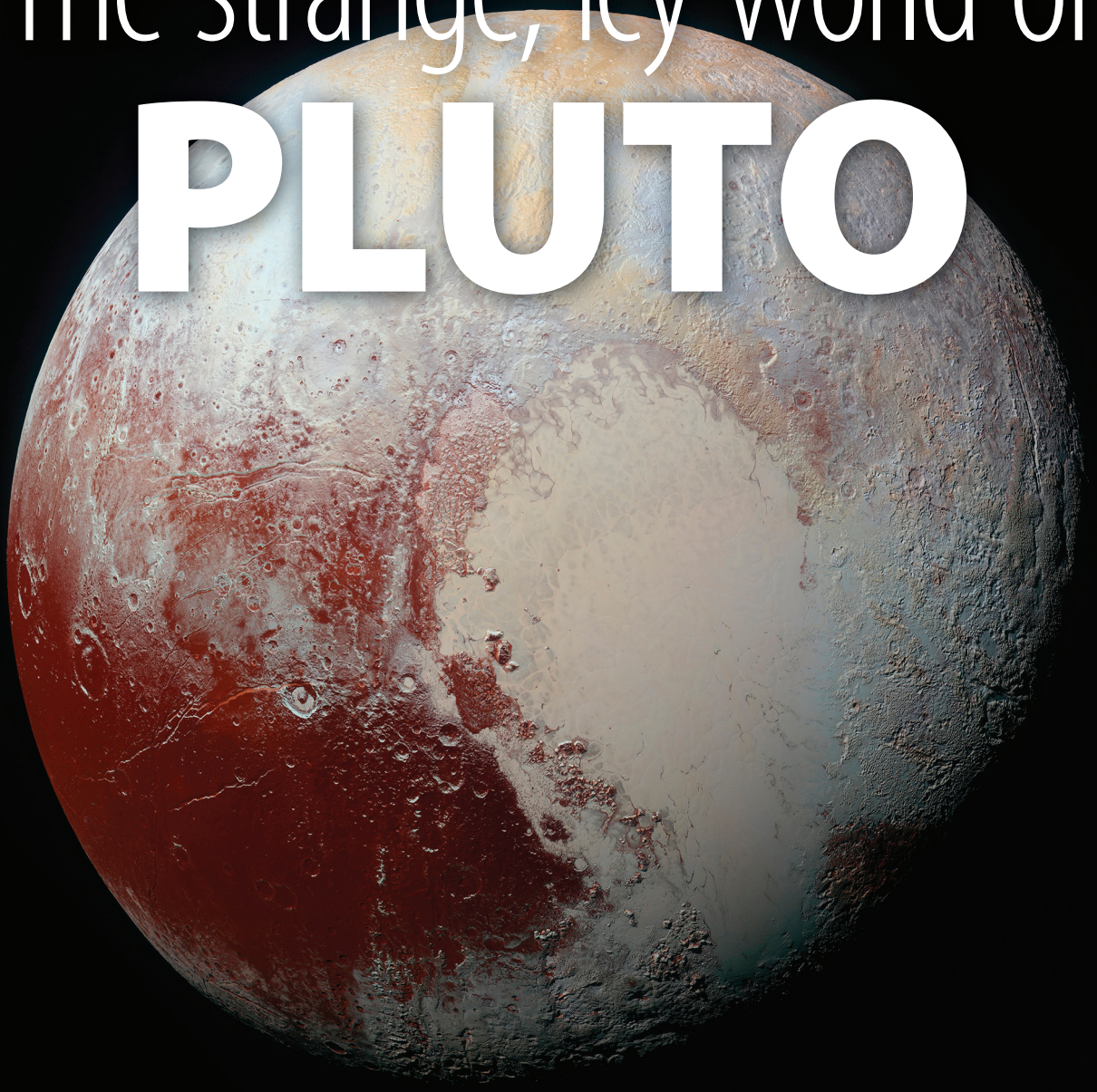
Astronomy magazine

The strange, icy world of PLUTO



New Horizons uncovers a complex, amazing body floating in the outer solar system. Here is the story of Pluto and its moons, along with the amazing saga of how Pluto got its name.

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New Horizons delivers

Pluto's wildly diverse terrain — including its icy heart (lower right), a dark equatorial swath adjacent to it, and the reddish colored north pole — stands out in this enhanced color image. Scientists often exaggerate an image's color to highlight differences in composition and texture.

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The Pluto system EXPLORED!

When a NASA spacecraft flew past this distant planet July 14, it forever changed our view of the previously mysterious system.

by S. Alan Stern

After an epic 9.5-year journey across 3 billion miles (5 billion kilometers) of our solar system, NASA's New Horizons spacecraft culminated a six-month encounter with Pluto and its system of moons July 14 when it skimmed within 7,700 miles (12,400km) of Pluto's surface. The successful reconnaissance resulted in more than 1,000 separate observations by the seven scientific instruments aboard New Horizons. Fears that debris from small moons or rings could pose a hazard to the spacecraft proved not to be an issue. New Horizons is now many tens of millions of miles beyond Pluto, moving ever deeper into the Kuiper Belt. The mission team hopes to fly past a Kuiper Belt planetesimal, a building block of small planets like Pluto, in 2019.

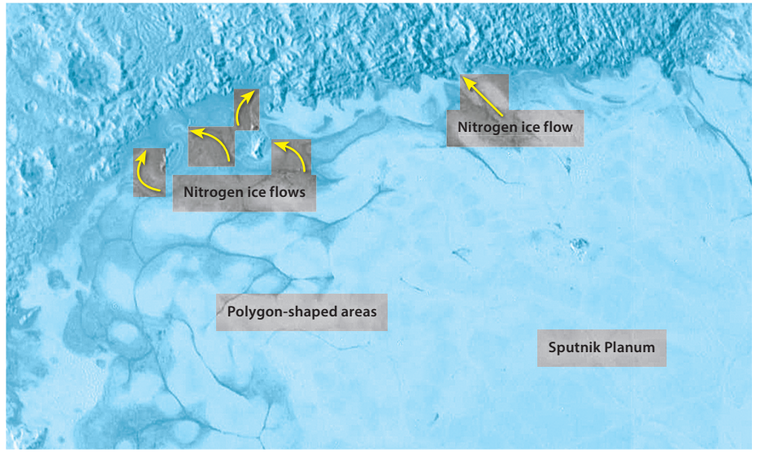
As I write these words in early August, New Horizons is just two weeks past its closest approach to Pluto, and 95 percent of all of its close flyby data — including its best and highest-resolution data sets — are still aboard the spacecraft. Getting these data to the ground will take until late 2016, so you can expect to see many new images, spectra, and other observations filled with fresh discoveries throughout the remainder of 2015 and most of 2016. You also can expect New Horizons to burn its engines in October and November to set it on a course to intercept its hoped-for Kuiper Belt object.

The first results from New Horizons have been simply stunning. These findings, derived from just 5 percent of the close flyby data, already have revolutionized our knowledge of this faraway alien planet, its one large moon, Charon, and its four smaller satellites.

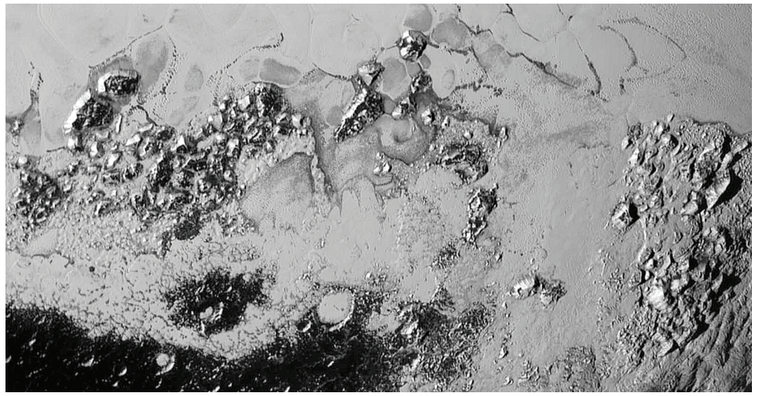
World of complexity

After working over 25 years to see Pluto explored, I have to admit that it exceeded my every expectation. I also can say that I heard the same thing from many other members of the New Horizons science team. We were, as a group, uniformly surprised at how diverse and complex Pluto's surface is and how deeply this world is likely to transform our knowledge of small planets.

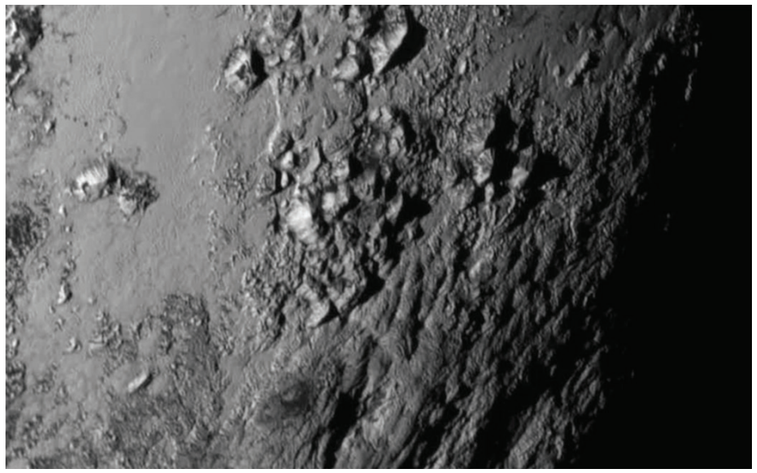
One of the first surprises we found is a vast and highly reflective spot near Pluto's equator that is so large and bright we could see it from almost 100 million miles (160 million km) away! This area later resolved into a ruddy two-lobed structure that resembles a heart. This region corresponds to the location of a concentration of carbon monoxide ices that planetary scientists



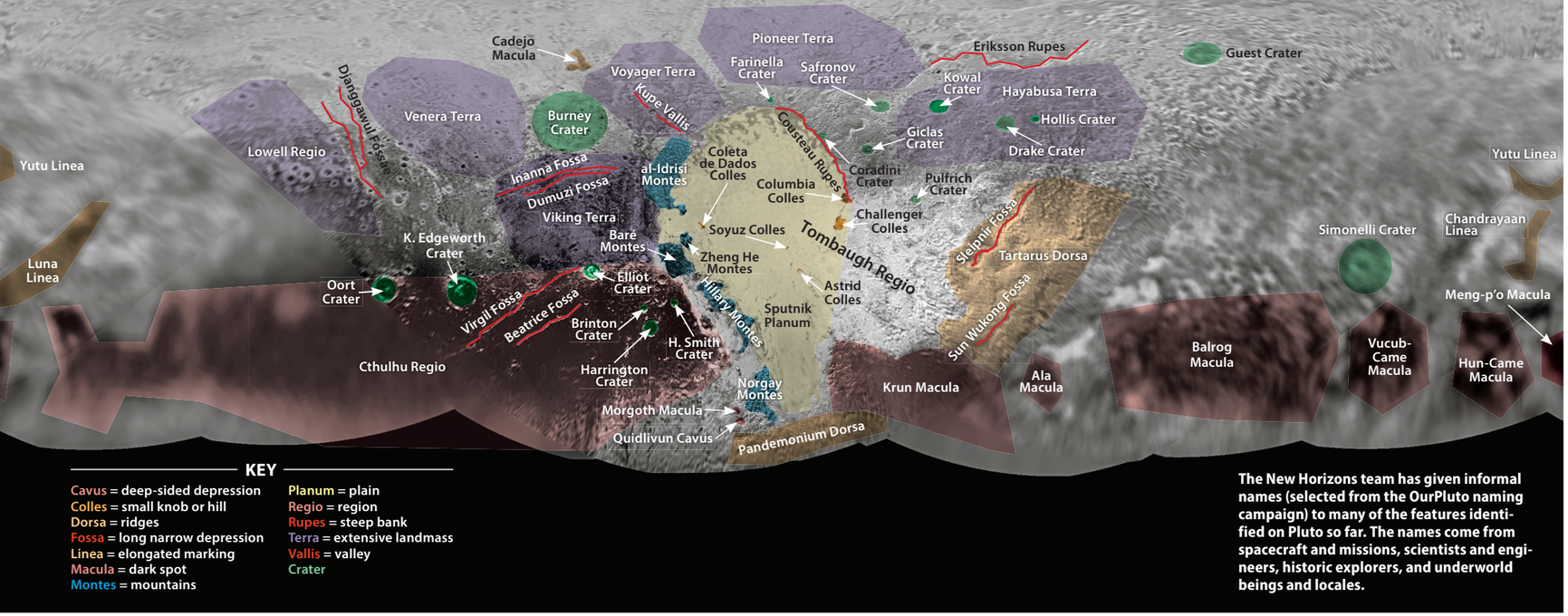
At the northern edge of what mission scientists informally call Sputnik Planum (the left half of Pluto's "heart") lies a region where nitrogen ice appears to have flowed around obstacles and into depressions.



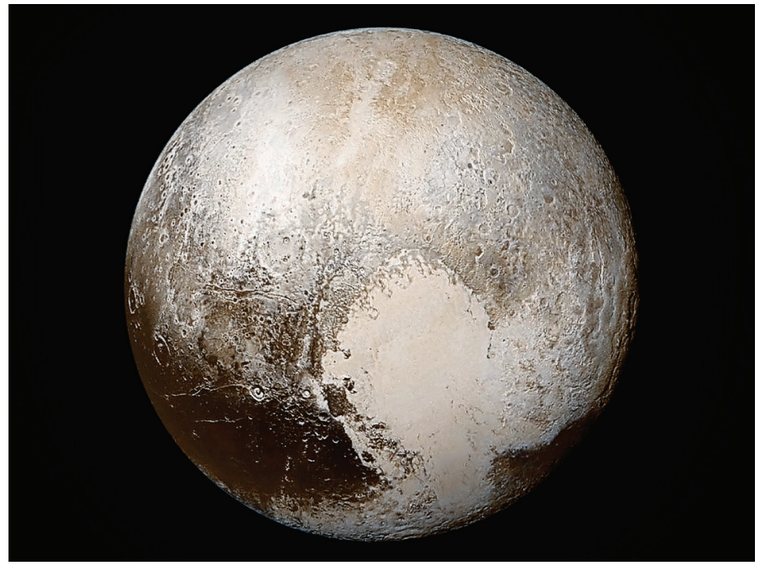
Two mountain ranges — informally called Hillary Montes (left) and Norgay Montes (right) after the first two people to conquer Mount Everest — consisting of rock-hard water ice occupy the southern part of Sputnik Planum.



Norgay Montes — the informal name of a range of water ice mountains that rises some 11,000 feet (3,300 meters) above its surroundings — sits near the southern edge of Sputnik Planum. The complete lack of craters in this region suggests it may be no more than 100 million years old.



The New Horizons team has given informal names (selected from the OurPluto naming campaign) to many of the features identified on Pluto so far. The names come from spacecraft and missions, scientists and engineers, historic explorers, and underworld beings and locales.



Pluto shows its true colors in this four-image mosaic taken July 13 from a distance of 280,000 miles (450,000 kilometers). The photo reveals features as small as 1.4 miles (2.2km) across.

spotted from Earth almost 20 years ago. The New Horizons team has informally named this feature — the most prominent on the planet — Tombaugh Regio in honor of Pluto's discoverer, American planetary astronomer Clyde Tombaugh (1906–1997).

Pluto also turned out to be surprisingly large, near the upper range of estimates made before New Horizons' arrival. Those pre-flyby estimates, based primarily on observations of distant stars as Pluto occulted (passed in front of) them, gave values between about 1,430 and 1,490 miles (2,300 and 2,400 km) in diameter. The reason such occultation measurements could not be more precise is that Pluto's atmosphere prevented occultations from probing all the way down to the planet's surface. But once New Horizons got close, we were able to directly measure Pluto's diameter — 1,475±4 miles (2,373±6km) — from global images.

This discovery has two important consequences. First, it squarely ends the debate about whether the more distant Kuiper Belt object Eris might be larger than Pluto; with a diameter of 1,445±7 miles (2,326±12km), Eris is clearly smaller, making Pluto the largest known object beyond Neptune. Second, Pluto's larger size means it has a larger volume and therefore a lower density

Planetary scientist **S. Alan Stern** *of the Southwest Research Institute in Boulder, Colorado, is the principal investigator of New Horizons.*

After New Horizons flew past Pluto, it looked back and recorded the tenuous atmosphere surrounding the planet as it was backlit by the Sun. The atmospheric haze layers turn out to be several times higher than scientists expected.

than scientists previously had thought. We now know Pluto's density to be 1.86±0.01 grams per cubic centimeter, which in turn means that the world is icier and thus less rocky than thought — likely about 60 percent rock and 40 percent ice. This will have important implications for understanding the smaller worlds from which the Pluto-Charon binary system formed.

Pluto's atmosphere also delivered several surprises. New Horizons discovered that the atmosphere extends much farther than previously thought, stretching at least 1,050 miles (1,700km) above the surface. Earlier measurements from Earth and Earth orbit had not detected an atmosphere more than a couple hundred miles up.

New Horizons also found the atmospheric pressure at the planet's surface to be just 7 to 10 microbars (roughly 0.001 percent of the pressure at sea level on Earth), about half of previous estimates. Additionally, we discovered trace amounts of several hydrocarbon species, including ethylene and acetylene, in Pluto's atmosphere and a global haze layer that reaches altitudes of near 95 miles (150km) whose structure appears to vary with location and perhaps time. Images of Pluto's surface also revealed wind streaks that we will be able to use to help map atmospheric circulation patterns.

An icy wonderland

Although the discoveries of Pluto's size and atmosphere were exciting and in many ways unexpected, all the biggest surprises we've found are on Pluto's surface. The first of these is the sheer diversity of terrain types and surface units (regions possessing distinct properties). From simple differences in reflectivity (albedo), to color and composition variations, to a wildly diverse expression of surface geology, Pluto seems to be at the top of the scale among the planets and satellites in our solar system.

This is one complicated place with an equally complex history. Just imagine — canyons, polar caps, broad equatorial dark units, ice mountains, icy plains, craters large and small, and an equatorial glacier informally called Sputnik Planum the size of Texas!

As of this writing, New Horizons already has returned to Earth images of Sputnik Planum — the western half of Tombaugh Regio — with resolutions as good as 1,300 feet (400 meters) per pixel. These pictures reveal amazing details. One is that the vast interior of this icy, carbon monoxide- and nitrogen-rich plain is laced with polygonal and egg-shaped regions. These features may be the result of convection in the ice caused by an unknown source of heat below the surface.

Even more spectacularly, where the northernmost reaches of Sputnik Planum abut upland terrain that towers some 3,300 feet (1km) or more above the plain, there are clear signs of ice flows. These flows stretch over hundreds of miles and indicate glacial movement around obstacles operating on huge scales. They likely are the result of the soft physical nature of nitrogen ice, which fills Sputnik Planum and may even suggest the presence of liquid nitrogen under the ice, liquefied under the pressure exerted by the weight of the icy plain itself.

New Horizons also discovered mountains on Pluto during its July 14 flyby. These peaks, which tower as high above their surroundings as do the American Rockies, have taught us something crucial about the newly revealed world. They could not maintain their steep relief if they were made of any of the ices — nitrogen, carbon monoxide, or methane — seen spectroscopically on Pluto. Why? Because such ices are weak despite the planet's frigid temperature. So even in Pluto's low surface gravity (about 6 percent of Earth's), they would slump under their own weight.

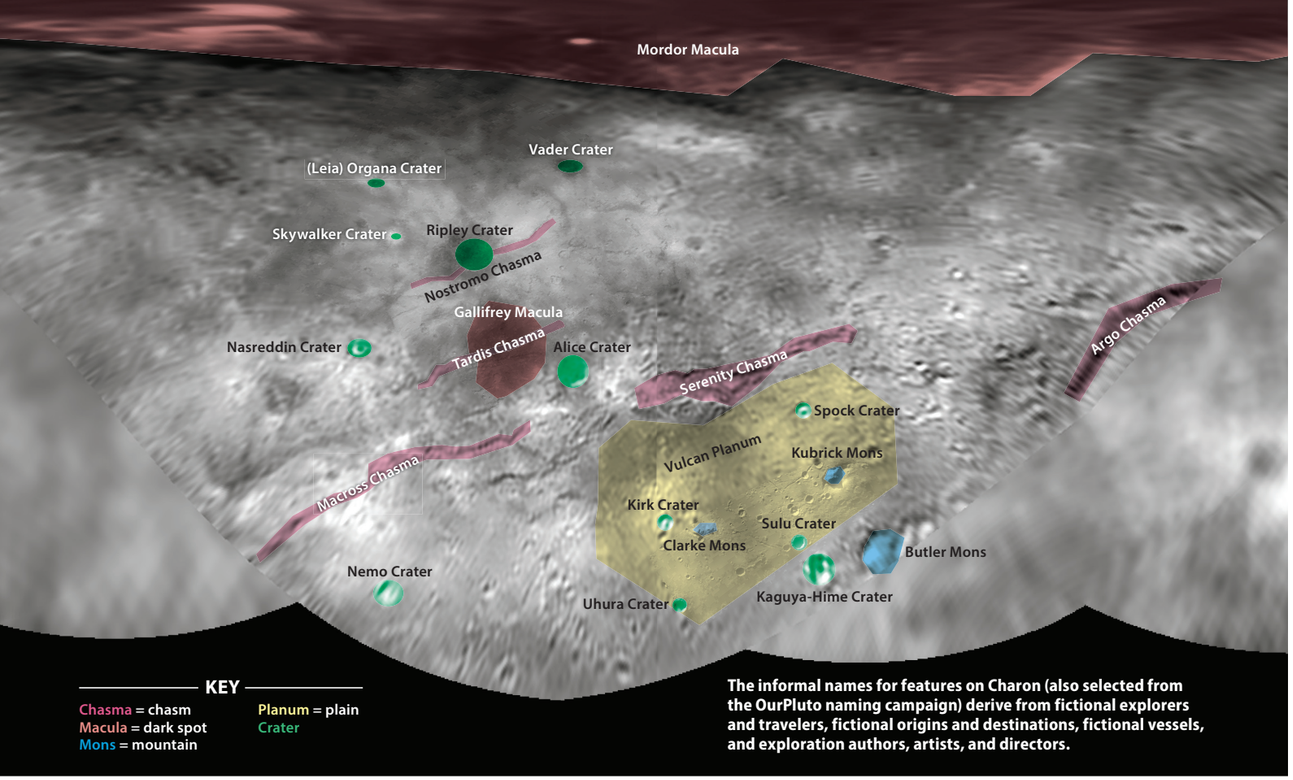
As a result, the existence of mountain ranges like those informally called Norgay Montes and Hillary Montes implies the presence of a much stronger material beneath Pluto's surface. This material almost certainly is water ice, which confirms a long-standing suspicion that this substance is common in Pluto's interior. It also suggests that the ices we do see on Pluto's surface are just a veneer that does not run very deep. If we can confirm this water ice substrate spectroscopically — perhaps New Horizons will find places on the surface where it peeks out — it also will support the idea that Pluto's interior has differentiated into a rocky core below and a water ice mantle above.

The last of the early findings about Pluto that bears recounting here may be the most important: Crater counts on the surface show vast areas, including Sputnik Planum but also others, that are devoid of identifiable craters of any size in the imagery available now. Other areas of the planet, however, are heavily cratered. This means that Pluto's surface units have a wide range of ages, some perhaps less than 2 percent of the age of the solar system! Pluto appears to have been geologically active for billions of years and, in fact, may even be active today. How such a small planet can remain active — and what energy source could drive it — is a deep puzzle with immense implications for planetary science and one we will need to solve.

Moon of many facets

While Pluto received the bulk of New Horizons' attention, the spacecraft spent considerable time exploring the planet's five moons. Ever since James Christy and Robert Harrington discovered Charon in 1978, it was known as the dull sister of the Pluto-Charon pair. New Horizons certainly confirmed that Pluto is the more complex and interesting body, but it raised Charon's stature quite a bit by finding the moon's surface to be much more varied and complex than anyone expected.

One of the first things that changed our minds about Charon was the probe's discovery of a dark and red polar region we informally call Mordor. This quasi-circular feature is the most prominent marking we've seen on the moon, with an inner zone about 170 miles (275km) across and a less dark outer zone some 280 miles (450km) across. Early images indicate the feature may be a large impact basin or a complex tectonic structure (caused by motion or distortion in Charon's crust); we hope higher-resolution data still aboard New Horizons will help us determine which.



The informal names for features on Charon (also selected from the OurPluto naming campaign) derive from fictional explorers and travelers, fictional origins and destinations, fictional vessels, and exploration authors, artists, and directors.

One hypothesis for Mordor's reddish color involves the trapping of volatile compounds (those that condense at a relatively low temperature) at Charon's poles during their decades-long winters. Potential sources of such volatiles include capture from Pluto's escaping atmosphere, cometary impacts, or outgassing from Charon's interior. The idea is that radiation striking exposed ices would process them into more complex reddish materials scientists call "tholins" that can remain after the pole emerges back into sunlight. Higher-resolution images and spectral maps of the region to be returned late this year will help us sort this out.

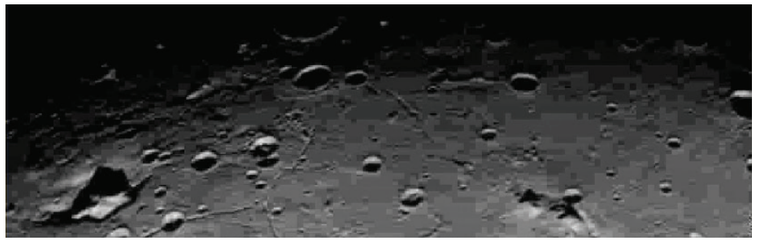
Another significant finding comes from the moon's craters. Charon reveals distinctly different crater densities in different surface units, showing that it remained active for a significant period of time. But what appears most interesting is that some craters have bright rays while others have dark ones. The presence of both types of rays — material ejected during the impacts that formed the craters — may suggest that the moon's subsurface composition varies.

To our surprise, New Horizons also detected tectonic features on Charon. You can see these in the network of fractures and chasms that cuts across most of the moon's Pluto-facing hemisphere. The two largest, which we informally call Macross Chasma and Serenity Chasma, form a belt that extends at least 650 miles (1,050km) across and several miles deep.

Finally, I'll mention that we found a truly bizarre feature on Charon unlike anything ever seen elsewhere in the solar system: Several mountain peaks are surrounded by moatlike depressions 0.6 to 2 miles (1 to 3 km) deep. The most prominent of these, which we informally call Kubrick Mons, is 12 by 16 miles (20 by 25 km) across and 1.2 miles (2km) high. Who ordered that?

Pluto's small satellites

New Horizons also spotted all four of Pluto's small satellites — Nix, Hydra, Styx, and Kerberos — far out on approach.

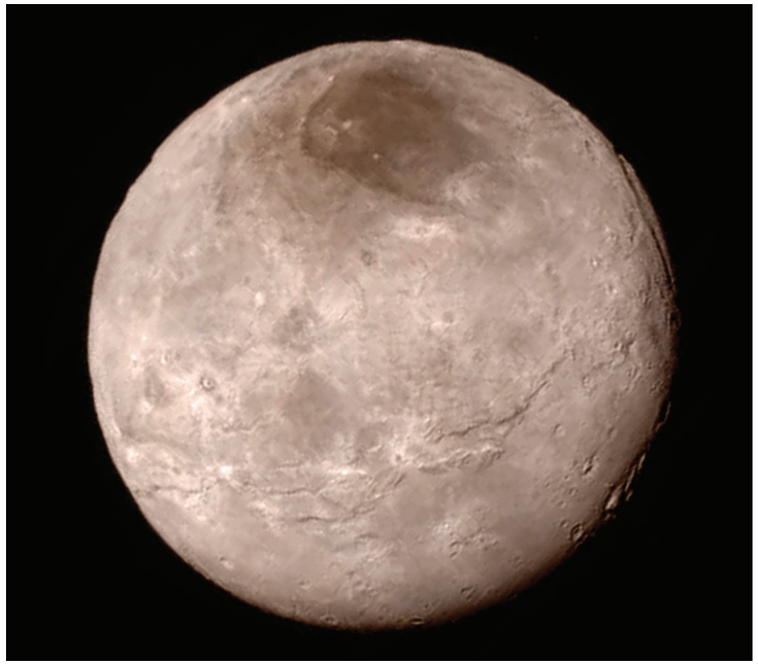


Charon shows a type of feature never seen in the solar system: mountain peaks encircled by moatlike depressions. The most prominent one, informally named Kubrick Mons, appears at lower left.

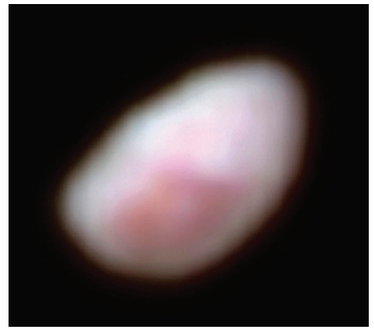
Although we searched for new moons, we found none down to limits some 20 to 30 times dimmer than Styx, Pluto's faintest known moon. For reflectivities like Charon (35 to 40 percent), such brightness limits correspond to sizes no bigger than 0.6 to 2 miles (1 to 3 km).

The spacecraft took literally hundreds of images of Pluto's four small moons before it was close enough to resolve their surface details. We'll use them to improve our knowledge of the orbits and masses of all four satellites; we also can use these images to determine the moons' light curves, rotation periods, and shapes.

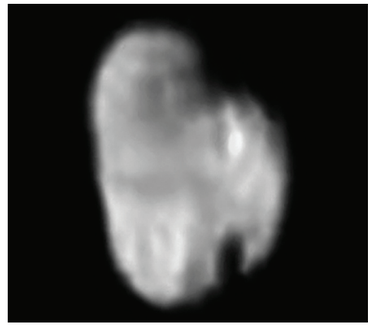
In addition, we captured images and spectra of all four to study their appearances, geologies, and compositions. As of this writing, however, the only returned images that resolve the satellites are of Nix and Hydra. They reveal two very different moons with a common puzzle.



Pluto's large moon, Charon, sports a dark reddish polar region as well as a network of fractures and chasms that spans at least 650 miles (1,050 kilometers) across its Pluto-facing hemisphere.



The small moon Nix has a noticeably reddish region, which may be associated with a crater, in this enhanced color image. New Horizons will return sharper views of Pluto's small satellites by the end of the year.



Black-and-white images of the small moon Hydra show several features that appear to be craters. Like Nix, its surface appears to be covered in bright, clean water ice.

Nix showed itself to be a highly elongated body with an average diameter near 22 miles (35km). Unfortunately, we don't yet have enough imagery on the ground to pin down its true shape and exact dimensions. The images we do have, however, show evidence of a diverse composition that includes a blotchy distribution of red material possibly associated with a crater. We also have learned that Nix has an average reflectivity between 43 and 50 percent. This albedo is higher than we expected and indicates that pristine water ice likely covers Nix.

Our images of Hydra show a blocky, elongated body shaped a bit like a catcher's mitt with dimensions of 27 by 21 miles (43 by 33 km). We see several crater-like features on this moon as well as variations in its surface reflectivity; we estimate its average albedo at 51 percent. So, like Nix, Hydra has a surprisingly reflective surface suggesting relatively clean water ice.

How Nix and Hydra can maintain such bright, clean surfaces over billions of years is a puzzle. It could indicate that both are being coated with something bright falling on them from elsewhere, such as Pluto or Charon. If that is so, we would expect Styx and Kerberos to be similarly bright. We will know if this is the case when New Horizons returns their images to Earth later this year.

What lies ahead

As I said above, as of August 1, 95 percent of all the data New Horizons took during its close flyby of the Pluto system is still aboard the spacecraft. Mission controllers and the science team plan to begin returning these data to Earth in September, after a well-deserved break from the hectic year they just spent finalizing plans for and conducting the first exploration of the Pluto system.

Based on priorities, our general scheme for returning the stored information begins with global geologic, color, and composition maps along with atmospheric spectra, imagery, and escape-rate data sets. Then we'll start bringing home somewhat lower priority but still valuable observations such as high-resolution image strips, stereo imagery so we can reconstruct topography, and data to search in detail for any atmosphere around Charon and an ionosphere around Pluto. The spacecraft then will send back other data including heat measurements, searches for rings, and maps made as the probe departed the system.

I expect we will make many, many more Pluto system discoveries across 2015 and 2016 as these data land — and even more in future years as planetary scientists construct detailed atmospheric, geological, and system-formation models and compare them with New Horizons data.

I've often said that the New Horizons mission will be graded by our ability to use all that scientists learned in the exploration of the planets from Mercury to Neptune to reduce the number of surprises at Pluto. My science team listened, but apparently the Pluto system did not. Given the number of big surprises we've found in just the first 5 percent of the data New Horizons collected during the flyby, I'd say we deserve an A for the exploration accomplished and an F for our predictive abilities — but that may be the sweetest F anyone ever got on a report card. Pluto is simply amazing.

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HOT RESULTS from a COOL PLANET

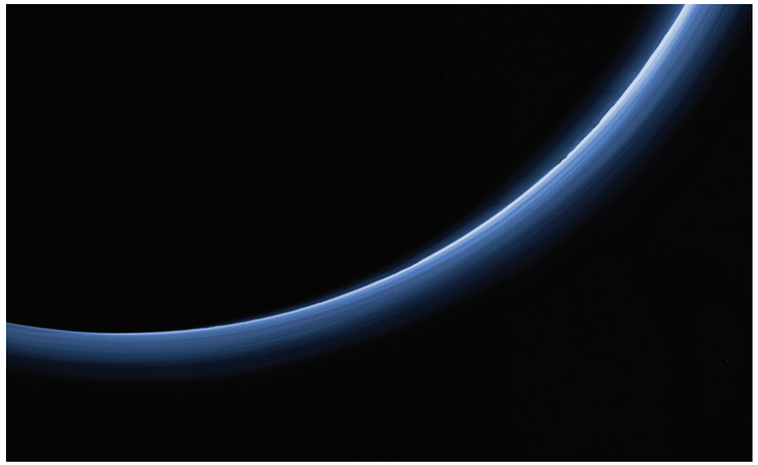
New Horizons reveals Pluto as a world of stark beauty and complex geology that has been active for billions of years. **by S. Alan Stern**

Last summer, NASA's New Horizons mission successfully and spectacularly completed the first exploration of the Pluto system. In just a matter of weeks, Pluto went from a point of light that could be studied only from afar to a planet in all its glory. And with this historic flyby, NASA and the United States concluded the reconnaissance of all the planets known at the time the Space Age began.

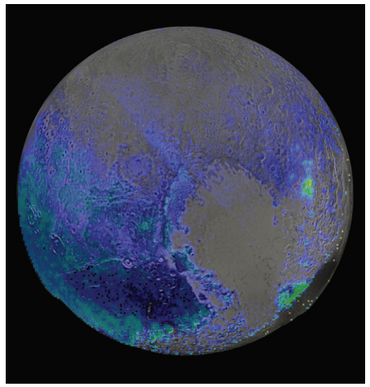
New Horizons collected a rich harvest of color and panchromatic images, spectra that mapped the surfaces at both ultraviolet and infrared wavelengths, and data on particles and plasma that has transformed our knowledge about Pluto and its five satellites. Chief among the findings so far: Pluto has been active over its entire 4.5 billion-year life; small planets can be just as complex as larger worlds like Mars; Pluto's big satellite, Charon, is much more complex than anyone had anticipated; and Pluto's four small moons display behaviors and attributes unlike any other small satellite system previously visited.

Now let's take a detailed look at many of the key discoveries that New Horizons made about Pluto and its family of moons.

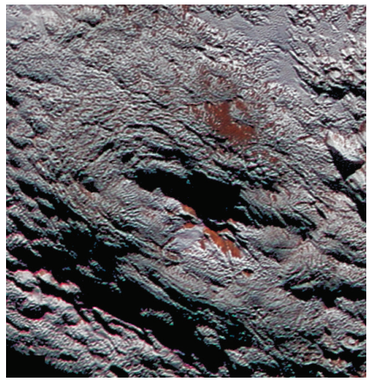
Pluto's geologic diversity stands out in this enhanced color mosaic taken when New Horizons was near closest approach. Scientists often exaggerate an image's color to highlight differences in composition and texture.
ALL IMAGES: NASA/JHUAPL/SwRI



Pluto's atmosphere glows a deep blue, rivaling the beauty of our planet's blanket of air. This nightside view reveals dozens of haze layers that extend up to altitudes of more than 125 miles (200 kilometers).



Water ice forms the "bedrock" of Pluto, with more volatile ices made of nitrogen, methane, and carbon monoxide coating the surface. This map traces the presence of water ice on the surface, with gray having none, blue a little, and green and yellow a lot.



The 90-mile-wide (150 kilometers) Wright Mons appears to be a shield volcano, like Hawaii's Mauna Loa or Mars' Olympus Mons, down to the deep central pit at its summit. Instead of lava, however, Wright Mons would erupt molten ice. All feature names used in this story are informal.

Pluto: icy wonderland

Pluto undoubtedly was the star of the show. It surprised us in more ways than I can count, from its sheer physical beauty to its complex geology, atmosphere, and remarkably varied surface composition. Let me summarize some of my personal favorites for the most important and surprising things the team has discovered so far. And just as a note, all the feature names I mention in this article are still informal ones given by the New Horizons team.

Sputnik Planum — a geologically active impact basin. We first spotted Sputnik Planum (SP), which forms the western half of Pluto's heart-shaped Tombaugh Regio, from more than 100 million miles (160 million kilometers) away, shining like a bright, highly reflective beacon on Pluto's surface. Close-up images later revealed that SP is a gigantic icy plain with a surface area of more than 350,000 square miles (900,000 square kilometers). Those images also revealed SP to be almost perfectly flat and ringed on all sides by mountains jutting 2 to 3 miles (3 to 4km) above its floor. This indicates that the Texas-sized feature may well be a gigantic impact basin formed by an ancient collision between Pluto and a large Kuiper Belt object perhaps 60 to 125 miles (100 to 200km) across.

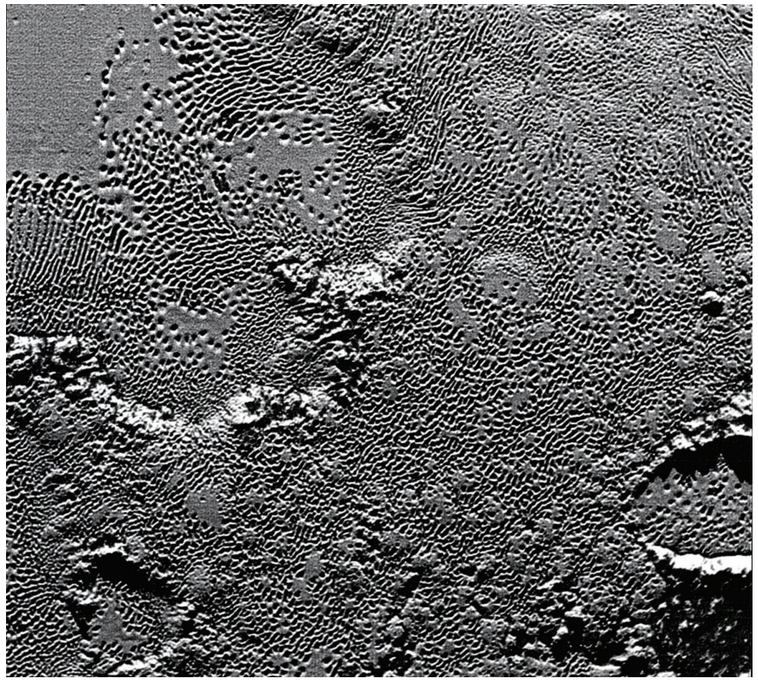
But there's more to SP than its impact origin. The central and northern regions of this expanse display a cellular pattern in the ices, with characteristic cell sizes of 30 to 60 miles (50 to 100km). The cells are bounded by shallow troughs up to 330 feet (100 meters) deep. The southern region and eastern margin of SP do not display this cellular morphology. Instead, these areas appear to be featureless plains with myriad pits up to a few miles long that we interpret to be the result of sublimation, ice turning directly into a gas.

We have not found a single crater anywhere on SP down to the limit of our highest-resolution images, at 230 feet (70m) per pixel. Calculations show that this means the surface is less than 10 million years old. We interpret this young age and the cellular nature of northern and central SP as evidence for thermal convection in its deep ices, but where the energy that drives this heat flow arises remains unclear.

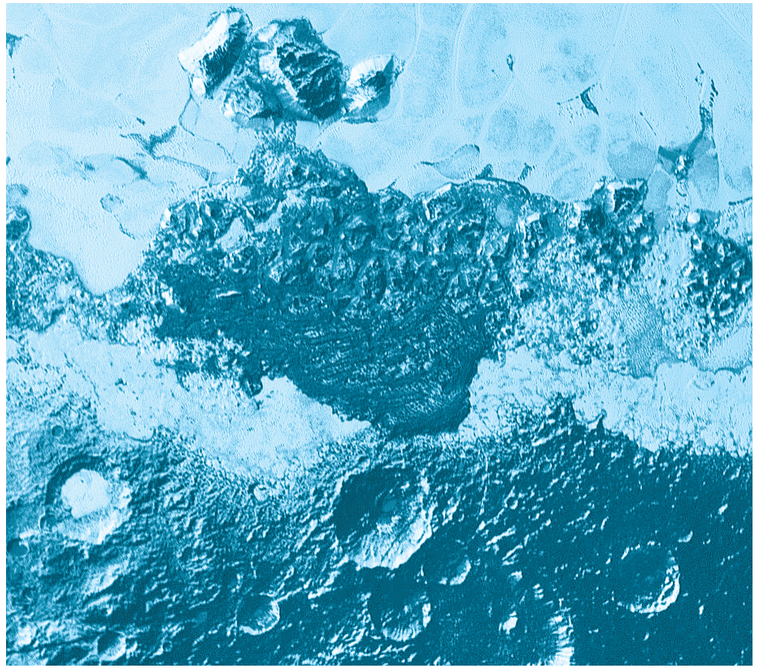
A cold and hazy atmosphere. One of New Horizons' major objectives was to study Pluto's blanket of air. Although scientists had discovered this feature from Earth in the late 1980s, New Horizons upended many of our ideas. For example, it found the upper atmosphere to be tens of degrees colder than expected; prior to the flyby, we thought it was warm enough to drive a prodigious atmospheric escape rate that rivaled those of comets. Instead, we uncovered a very Earth-like escape rate, about 100 to 1,000 times slower than predicted.

And whereas Earth-based experiments stretching over almost two decades had failed to find evidence for hazes and discrete cloud layers in Pluto's atmosphere, New Horizons found both. The team has counted more than two dozen haze layers in New Horizons images that stretch up to altitudes higher than 125 miles (200km) above Pluto's surface. These hazes likely form photochemically as ultraviolet light interacts with the nitrogen, methane, and carbon monoxide that dominate the atmosphere's composition. These haze particles grow to sizes of about 0.1 to 0.5 micron across and eventually silt out of the atmosphere onto the surface. Seen in color at sunset, the haze scatters sunshine and creates a blue tint that produces hauntingly beautiful images of blue skies on a faraway planet. And in a bonus for mapping purposes, we found the hazes cast sunlight hundreds of miles across onto Pluto's

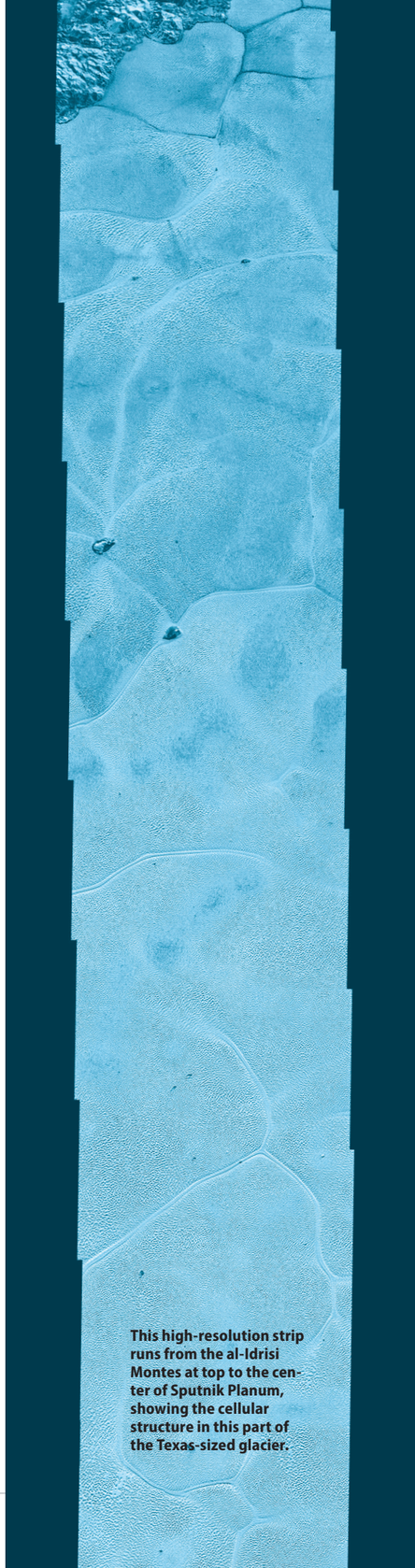
S. Alan Stern *of the Southwest Research Institute in Boulder, Colorado, is a planetary scientist and the principal investigator on the New Horizons mission.*



The southern part of Sputnik Planum resolves into myriad pits in this high-resolution image taken when New Horizons was just 13 minutes from closest approach. Scientists think the pits arise as ice turns directly into gas.

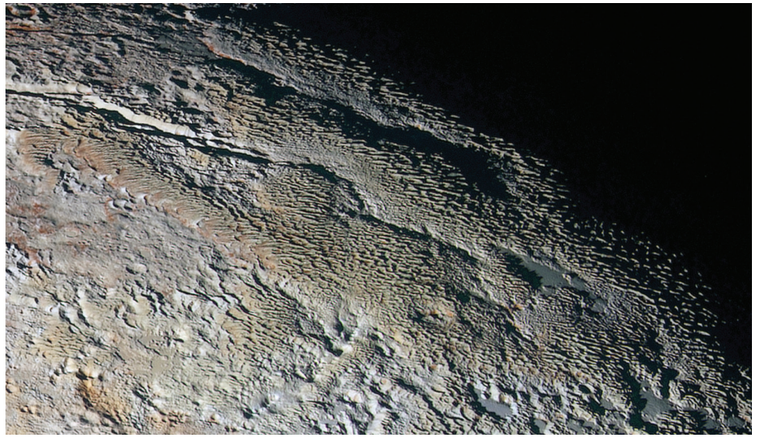


The ancient, heavily cratered Cthulhu Regio at the bottom of this image appears to be more than 4 billion years old, yet it lies adjacent to the ice-rich plains of Sputnik Planum at top, which likely is less than 10 million years old.

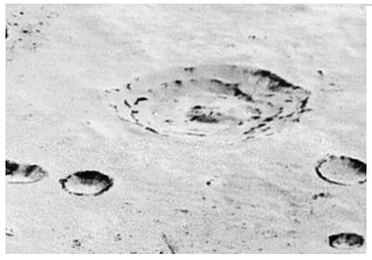


This high-resolution strip runs from the al-Idrisi Montes at top to the center of Sputnik Planum, showing the cellular structure in this part of the Texas-sized glacier.

This 50-mile-wide (80 kilometers) strip combines images that stretch from a "badlands" type of region at top across al-Idrisi Montes to the cellular patterns seen in the ices of the northwestern part of Sputnik Planum.



As New Horizons swept by Pluto, it captured this view of the oddly textured mountains called Tartarus Dorsa along the day-night terminator. Scientists don't know what causes the snakeskin-like terrain.



Distinct layers show up in several of the craters in this image, most noticeably the one above center. Typically, such layers indicate either a change in composition or the rate at which material was deposited, but scientists don't know yet what caused these features on Pluto.

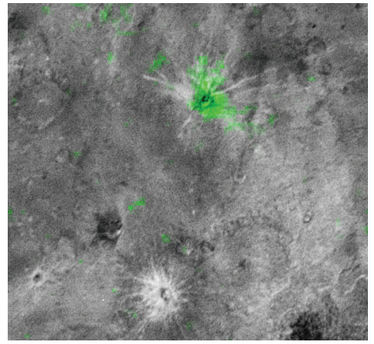
nightside, allowing us to use "hazeshine" to map terrains we never thought we'd see at close-approach resolution.

Activity across billions of years. Although SP has an estimated age of just 10 million years (much less than 1 percent the age of the solar system), other regions on Pluto have strikingly different ages. West of southern SP lies Cthulhu, a region that is large, dark, and volatile-poor (meaning it lacks substances that vaporize at relatively low temperatures). Cthulhu contains some of the most heavily cratered and ancient terrains on Pluto. We have dated these rugged areas at more than 4 billion years — the ancient opposite of SP!

Even more amazing are terrains on the eastern lobe of Pluto's heart. This region, known as Eastern Tombaugh Regio, has an intermediate age of just 1 billion years. Together, SP, Cthulhu, and Eastern Tombaugh Regio paint the picture of a planet that has been geologically active throughout its entire 4.5 billion-year history. We still don't know how a small planet like Pluto powers such activity over such an expanse of time.

Tectonics, and volcanoes, too? The hemisphere New Horizons saw best at closest approach shows numerous extensional tectonic features — those that form as the surface spreads apart — in varying stages of degradation. Most dramatic is the 2- to 3-mile-deep (3 to 4km) V-shaped trough we call Virgil Fossa, which runs unbroken for more than 125 miles (200km). Numerous other tectonic features testify to past geologic activity on Pluto. But even more dramatic and surprising was the discovery of two 95-mile-wide (150km) mountains with deep central pits at their summits. These features, called Wright Mons and Piccard Mons, bear a strong structural resemblance to shield volcanoes such as Mauna Loa and Mauna Kea on Hawaii. The lack of craters on their flanks suggests they have been active in the past billion years. No such large volcano-like features have been seen anywhere else in the solar system except among the inner planets!

Layering in Pluto's surface. High-resolution images of Pluto's surface also reveal distinct layering in some places. We first detected this exciting and unexpected feature in the large mountain blocks of al-Idrisi Montes. But the science team later found more layering inside craters and canyons to the northwest of these mountains. Are we seeing variations in the composition of Pluto's crust with depth? Or are we seeing the result of time variations in the sedimentation rate of atmospheric soot? We do not know.



▲ The ammonia-rich ejecta (shown in green) that surrounds the impact crater Organa on Charon shows it to be a relatively young feature. Compare its ejecta with that surrounding Skywalker Crater below, which, like the rest of the moon, is rich in water ice.

◄ Pluto's large moon, Charon, sports a dark reddish polar region as well as a network of fractures and chasms that spans at least 650 miles (1,050 kilometers) across the equatorial region of its Pluto-facing hemisphere.

Water, water everywhere. As soon as the science team saw steep mountains and canyons on Pluto in the earliest high-resolution images, we knew this implied that the planet's crust is made of water ice, as we had expected. We knew this because the volatile nitrogen, methane, and carbon monoxide ices across Pluto's surface that scientists had detected from Earth are too weak to support such steep topography. So, knowing that water ice is common across the outer solar system, and having inferred its presence indirectly from measurements of Pluto's interior density that indicated up to one-third of the planet's mass was H_2O, we felt pretty confident of the water-ice crust prediction.

High-resolution compositional spectroscopy later vindicated that expectation when it revealed many places on the surface where water ice is directly exposed. Although it remains a mystery as to why Earth-based telescopes never spotted these signs, the signatures of water ice are unmistakable. Pluto's water-ice crust peeks out at hundreds of locations across its disk.

Charon: multifaceted moon

New Horizons confirmed some of our expectations about Charon. These include the moon's diameter — 754 miles (1,214km) — which is barely different from ground-based measurements, the lack of exposed volatile ices on the surface, and no evidence of any atmosphere. But close-up data revealed many other details about Charon that have enriched its story and make it an amazing world in its own right.

Perhaps chief among these is the wide variety of geologic features on Charon's surface. From heavily cratered terrains in the northern hemisphere to ice-flooded terrains indicating a complex early history in the south, Charon clearly was geologically alive at some point. The surface also displays strange pitted terrains, bright- and dark-rayed craters, and an equatorial extensional tectonic belt so large that it dwarfs the Grand Canyon and rivals anything else in the solar system except Valles Marineris on Mars. The science team thinks that Charon once might have had a subsurface ocean of water; when it froze, the surface expanded and created the system of faults.

Strangely, however, we have dated all of the terrains on the hemisphere we viewed at closest approach to about 4 billion years or older, meaning all these features were born more or less together in a brief flurry of internal activity shortly after Charon itself formed.

We also found deposits rich in ammonia peeking out of some craters and low-level concentrations of ammonia or ammonium hydrates scattered widely across Charon's predominantly water-ice surface. No ammonia-rich terrains are seen on any other icy satellite in the solar system. Why Charon alone sports this unique compositional telltale is a mystery.

Another enigma is wrapped up on Charon's north pole, which sports a dark reddish cap a few hundred miles across. High-resolution images reveal that these dark red polar deposits are apparently a stain draped over the pole's topography. A leading theory for this material's formation is that it originated as volatile substances that were transferred from Pluto's atmosphere and condensed on Charon's cold polar terrains. Radiation exposure then darkened and reddened it into non-volatile hydrocarbons and heavier molecules called tholins. If this idea is correct, then Charon's south pole — hidden from us at flyby — should sport a similar stain. No doubt future space missions to Pluto will be eager to check this out, for that also could confirm a long-held speculation that Pluto's atmosphere sometimes expands sufficiently to be shared by Charon.

Small satellite shockers

Pluto's smaller moons also provided real surprises. Between 2005 and 2012, New Horizons team members discovered four small satellites using the Hubble Space Telescope. We named them Styx, Nix, Kerberos, and Hydra in order of their distance from Pluto. New Horizons imaged all four during the flyby and found them to range in size from about 6 miles (10km) to about 30 miles (50km) across. We expected to find still more satellites when we got closer to Pluto, and we searched for them

NEW HORIZONS: CURRENT AND FUTURE PLANS

New Horizons is now several astronomical units (AU; one AU is the average Earth-Sun distance, about 93 million miles or 150 million kilometers) past Pluto, plunging ever deeper into the Kuiper Belt. The spacecraft is healthy and operating on its primary systems, with backup systems still held in reserve.

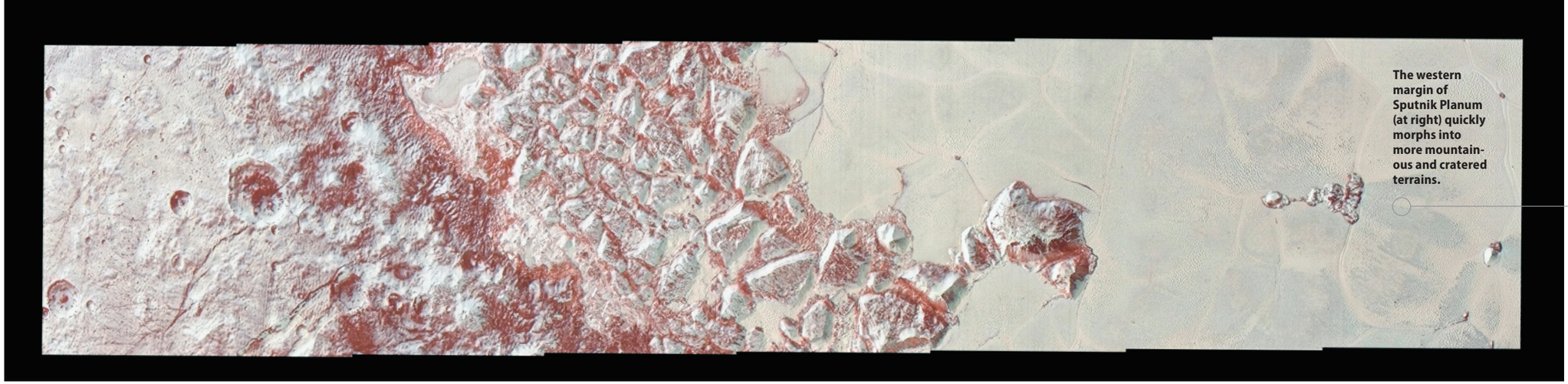
The New Horizons team designed the spacecraft to function out to at least 55 AU from the Sun, a distance it won't reach until late 2022, and there is no reason that it can't actually operate much farther out than that. In fact, if the vehicle remains healthy, our flight team believes we have the power and fuel to keep going into the mid-2030s, at which point New Horizons will be near the 100 AU distance marker, about where Voyager began to cross the heliopause and escape the Sun's magnetic influence.

In late October and early November 2015, with NASA's go-ahead, our mission team conducted a series of four engine burns to send New Horizons toward a new Kuiper Belt object (KBO). The flyby target, discovered by the Hubble Space Telescope in a search performed for New Horizons, is called 2014 MU_{69}.

This object is about 25 miles (40km) across and circles the Sun on an orbit 44 AU away. It is a "cold classical" KBO, meaning it almost certainly formed near where it is now and contains valuable information about the chemical and physical environment of the ancient Kuiper Belt. In fact, 2014 MU_{69}, which the Sun has never warmed above temperatures of about 50 to 60 kelvins, is the most primitive specimen of the early solar system ever targeted by any space mission.

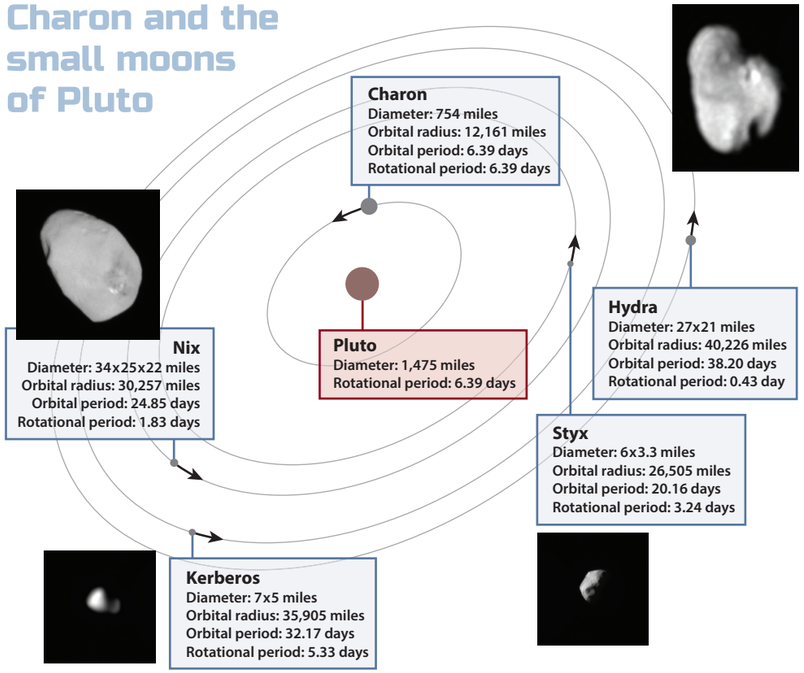
On January 1, 2019, New Horizons will pass very close to MU_{69} — much closer than we flew by Pluto — where we can study its geology and composition, search for and study any small satellites it may have, and hunt for evidence of a comet-like coma.

We have proposed the flyby exploration of MU_{69} as the centerpiece of an extended mission for New Horizons lasting into 2021. That mission is called the New Horizons KBO Extended Mission, or KEM. In addition to the MU_{69} close flyby, KEM also proposes to gather other kinds of unique and valuable Kuiper Belt science that can't be obtained from Earth or Earth orbit. These would include close-in satellite searches and photometry for another 20 or so small KBOs, and studies of the plasma, neutral gas, and dust environment of the Kuiper Belt out to 50 AU. NASA expects to let us know if KEM is approved and funded by this summer. — *S. A. S.*



The western margin of Sputnik Planum (at right) quickly morphs into more mountainous and cratered terrains.

Charon and the small moons of Pluto



Close-in Charon, which is tidally locked to Pluto, is by far the planet's largest and best-studied satellite. In contrast, the four small outer moons all rotate faster than they revolve around the planet, making this satellite system unique in the solar system. These moons also are far more reflective than scientists expected, and two of them — Styx and Hydra — appear to have formed from the mergers of two even smaller moons. (To convert miles to kilometers, multiply by 1.61.) *ASTRONOMY:* ROEN KELLY

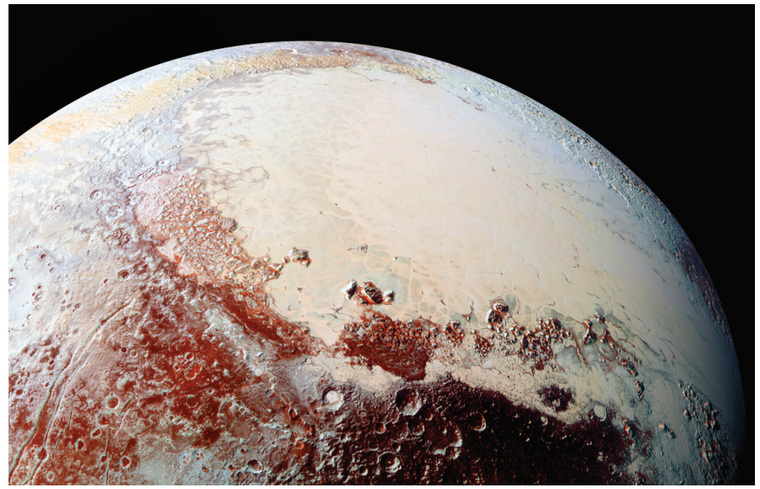
long and hard. But we didn't find any down to sizes of just 1 or 2 miles (2 or 3km) across. This was a big surprise — but it wasn't all.

We also found that while all four of the small moons are elongated, the quartet seems to break into an inner and outer pair, each containing one small and one larger satellite. At least two of them — Styx and Hydra — appear to be bilobate, as if they formed from mergers of still smaller moons that once orbited Pluto. Nothing like this has been found anywhere else among the planets.

Perhaps even more puzzlingly, though, images of the small satellites show that they all reflect much more light than we'd expected. Rather than showing a surface reflectivity similar to Charon's, about 35 to 40 percent, they all have reflectivities closer to 70 to 80 percent. In fact, somehow all four are, on average, more reflective than Pluto! We suspect this happens because each moon has a bright, icy surface, and we'll find out for sure later this year when we get compositional spectra of them to the ground. But whether they are icy or not, we do know that all four must be pelted by cometary debris from the Kuiper Belt. And that debris, if similar to comets, must be very dark. So why aren't Pluto's four small companions dark after this rain of impactors? It's a mystery.

We also don't understand the rotation rates for these small worlds. It turns out that all four rotate much faster than their orbital periods. Conventional wisdom, backed up by dynamical calculations, predicted that each one should be tidally locked to Pluto so that its rotation period matches its orbital period (which range from 20 to 38 days). Charon has done so, but its smaller siblings have not. Their rotation periods range from 5.3 days down to just 0.4 day — that's just 10 hours!

What keeps these rotation rates so high? Again, we don't know. We also don't know why all four have rotation poles that are oriented 80° or more from the poles of Pluto and Charon. Both their rapid rotation and this puzzling dynamical configuration have sent orbital dynamicists back to the drawing board. As with just about everything else in the Pluto system, we are amazed, we are surprised, and we remain puzzled.



This perspective view shows what you would see from 1,100 miles (1,800 kilometers) above Pluto's equator. The view looks northeast over the dark, cratered Cthulhu Regio toward the smooth, bright, icy plains of Sputnik Planum.

Pluto needs an orbiter

The long-anticipated exploration of Pluto and its system of moons is at long last complete. And although data will continue to come to Earth for many more months, no doubt bringing new surprises, some things already are clear. Chief among them is the complexity of Pluto's story — from the origin of its satellites to the perplexing degree of expression in the surface geology to the even more mystifying ongoing geologic activity we see on the planet's surface.

But the mysteries don't stop there. Both Pluto's atmospheric structure and how it generates those haze layers are puzzling, as is the complex interaction among the glacier-like movement of snows on the planet's surface, the atmospheric dynamics, and many of the landforms across the globe. Everywhere we look to solve mysteries in the data sets we have, we find we need more data.

We need to see beneath the surface. We need to see how the planet evolves from season to season. We need thermal maps, and we need still-higher-resolution imagery. We also need direct measurements of Pluto's winds and the composition of its atmosphere and haze. And we long for higher-resolution maps that reveal the hemispheres of Pluto and its satellites that New Horizons saw only from afar.

Put simply, the Pluto system has revealed itself to be too complex to unravel with a single flyby, even one with the sophisticated instruments that New Horizons carried. We need an orbiter. The buzz for this is already alive and growing in the scientific community, and every time I give a public talk, I hear laypeople asking when we will go back. It won't be long, I predict, before studies of just such a mission will be on drawing boards.

How Pluto got its name

The public's suggestions for naming the new planet ranged from the scientific to the personal, revealing a glimpse into the social mind-set of the day. **by Kevin Schindler and Lauren Amundson**

ILLUSTRATION BY KELLIE JAEGER; ALL PHOTOS COURTESY OF LOWELL OBSERVATORY'S PUTNAM COLLECTION

The staggering media attention lavished on New Horizons' flyby of Pluto last July demonstrated the public's ongoing fascination with all things Pluto. This distant neighbor from the dark and remote regions of our solar system may be physically diminutive compared with other planetary worlds, but it outshines many of them in terms of public interest and sentiment. This captivation dates back to Pluto's discovery in 1930 at Lowell Observatory, when a spellbound public overwhelmed observatory staff with letters and telegrams offering congratulations and often colorful suggestions of what to name the new planet, known only as Planet X.

This correspondence, much of it now preserved in Lowell's new Putnam Collection Center, offers invaluable insight into the issues and prevailing thoughts of the day while also revealing an intimate glimpse at the personalities of many of the individuals who submitted ideas.

One of those suggestions came from Venetia Burney, a schoolgirl from England who enjoyed learning about mythological characters. On the morning of March 14 while Venetia ate breakfast, her grandfather read to her a newspaper account of the planet's recent discovery. After thinking about the news and reflecting on her knowledge of mythology, she said Pluto, the god of the distant, cold underworld, was an appropriate name for this dark and gloomy place. Her grandfather sent her suggestion, unknown to Venetia, to the British astronomer H. H. Turner, who in turn shared it with Lowell Observatory.

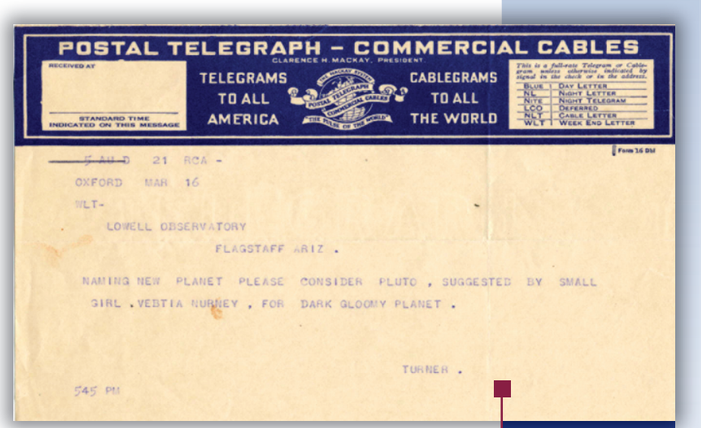
This note would be one of hundreds received by the observatory but stands alone in importance, as indicated in the last paragraph of the May 1, 1930, *Lowell Observatory Circular* that served as Pluto's christening announcement to planet Earth. Lowell Director Vesto Melvin (V. M.) Slipher wrote, "It seems time now that this body should be given a name of its own. … Pluto seems very appropriate and we are proposing to the American Astronomical Society and to the Royal Astronomical Society that this name be given it. As far as we know Pluto was first suggested by Miss Venetia Burney, aged 11, of Oxford, England."

One of many

That part of the naming story is well documented in history books and often encompasses the whole tale. However, it is only the misleadingly brief and streamlined conclusion. In fact, the seven weeks between the March 13 announcement of the planet's discovery and the May 1 naming declaration were frenetic for Slipher and his colleagues. While they tried to focus on astronomical issues relating to the new planet, such as an orbit determination, the public distracted them with surging demands of what to call it.

Media bombarded Lowell staff with inquiries about the name while letters and telegrams poured in from individuals and organizations with often strongly opinionated proposals. This interest spiked even higher when a reporter misquoted Lowell trustee Roger Lowell Putnam as saying the observatory would welcome suggestions for the name. Publications from the *Boston Herald* to the *San Francisco Daily News*, *Popular Science Monthly* to *The Christian Science Monitor* carried this story, prompting even more people to join the planet-naming craze.

Newspapers and other entities also began holding contests. Monckton Dene of South Haven, Michigan, wrote four different letters to the observatory hoping to enhance his odds of winning a $5 prize. The Paramount Theater in New Haven, Connecticut, ran a naming contest in conjunction with the local paper. Paramount's advertising manager, Ben Cohen, wrote a more self-aware letter to the observatory: "The sponsors were not so presumptuous as to promise that the winning name would be given to the new planet. They did promise, however, that the winning names would be forwarded to you for your consideration. Therefore, we respectfully submit to you the contest-winning name for the new planet representing the choice of 200,000 people: Minerva." Meanwhile, Delia Grace Valancourt of Champaign, Illinois, informed the observatory that she had won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TELEGRAMS TO ALL AMERICA — CABLEGRAMS TO ALL THE WORLD

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LOWELL OBSERVATORY

FLAGSTAFF ARIZ .

NAMING NEW PLANET PLEASE CONSIDER PLUTO , SUGGESTED BY SMALL GIRL .VEBTIA NURNEY , FOR DARK GLOOMY PLANET .

TURNER .

545 PM

This telegram shows the original suggestion of the name Pluto, conceived by schoolgirl Venetia Burney and submitted via by her grandfather to Lowell Observatory.

(above transcript)
Oxford, Mar 16
WLT —
Lowell Observatory
Flagstaff, Ariz.

Naming new planet please consider Pluto, suggested by small girl Vebtia Nurney [sic], for dark gloomy planet.

Turner.

MEMORY LANE

More than two dozen of the Pluto-naming letters and telegrams, along with other Pluto-related documents and photographs from the Lowell Observatory Archives, are available for browsing in the Year of Pluto Collection at the Arizona Memory Project at **azmemory.azlibrary.gov**.

Roger Lowell Putnam was instrumental in pushing for the discovery of "Planet X," which, though predicted for erroneous reasons, nonetheless became reality with Pluto's discovery.

Kevin Schindler *has been talking Pluto for the past 20 years at Lowell Observatory, where he recently took on the role of historian.* **Lauren Amundson** *is the Lowell archivist and has handled hundreds of Pluto documents stored in the observatory's Putnam Collection Center.*

(at right transcription)
March 15, 1930.
Mr. Roger Lowell Putnam,
Springfield, Mass.

My dear Mr. Putnam,

Just another note of congratulation and one more suggestion toward a name for planet "O".

It occurred to me that inasmuch as the planet has already been styled planet "O" that to name it "OSIRIS" would be an easy and a happy solution.

Understanding "O" to be the letter, of course, and not the cypher.

Practically all of the Greco-Roman names are used up, as you know, naming the planets and planetoids — and it seems to me that it would be quite appropriate too, to name it after the long-lost Egyptian hero-divinity.

Believe me,
Yours very truly
Walter M. Wynne,
Lieutenant Commander,
U.S. Navy

P.S. — Please do not bother to acknowledge this note. Have written to Mrs. Lowell and Lowell Observatory.

UNITED STATES NAVY YARD
PHILADELPHIA, PA.

March 15, 1930.

Mr. Roger Lowell Putnam,
Springfield, Mass.

My dear Mr. Putnam:

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Believe me,

Yours very truly

Walter M. Wynne,
Lieutenant Commander, U.S.Navy.

P.S. -- Please do not bother to acknowledge this note. Have written to Mrs Lowell and Lowell Observatory.

Though his reasoning was flawed, astronomer William Pickering did predict the existence of a "Planet O" orbiting past Neptune ("Planet N"), similar to Lowell's Planet X.

a similar challenge held by the *Chicago Herald and Examiner* for her suggestion of Athena, Minerva's Greek counterpart as the goddess of wisdom.

The proposers

Urged on by the papers and contests, the suggestions swelled. The precise number of letters and telegrams that swamped Lowell is lost to history. But the observatory received hundreds of them, with some 150 offering the name Pluto, according to a note preserved from Lowell's secretary, though most of these are nowhere to be found in the archives. With the circus-like atmosphere surrounding the naming, one can imagine much of this correspondence was simply thrown away.

More than 250 letters remain. Many of their authors added fragments of biographical information, so we know they ranged in age from 11 to 78 and included at least 117 men and 86 women. The pool of proposers consisted of students and teachers from elementary school through college, attorneys, ministers, a United States senator, and even a lieutenant commander in the U.S. Navy.

The letters and telegrams came from 37 of the then-48 states (plus the Alaskan territory), with the most from Massachusetts (49), New York (36), and Pennsylvania (24). Suggestions also arrived from Canada, Germany, Korea, England, and Mexico. They proposed a total of 171 different names, with 13 listed at least five times. Ancient deities dominate this list, following the tradition of planet naming. Of these, six are male and four are female. Many of the latter suggestions came from the increasingly vocal female population, whose status in society was enjoying dramatic improvement at the time. One letter suggested six possibilities (Athena, Juno, Psyche, Circe, Cassandra, and Atalanta) and was signed, "Star-rover, She is not a Feminist." The author wrote, "For ages men have been the Lords of Creation. Now that women are striving for the top o' the world it would be regarded as a compliment to the sex to give the new planet a feminine name. It might encourage further exalted aspirations."

English schoolgirl Venetia Burney was just one of many to suggest a name for the newly discovered Planet X, and not even the only person to suggest the name Pluto.

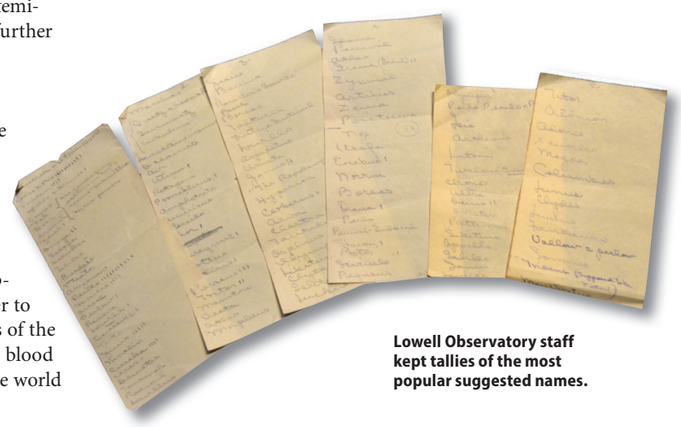
A new era

Another theme of the times, the pursuit of peace, stands out thanks to the multiple suggestions of Pax and Peace. Walter Niehoff, a student at Lafayette College in Easton, Pennsylvania, compellingly captured this sentiment in his letter to the observatory: "The centuries of the past have been stained with the blood of many dreadful wars. Now the world is experiencing a great change. We are in the beginning of an era that shall be known to our posterity as the beginning of the solution for perpetual world peace. The eyes of all men are now looking toward that goal with a hope as never before."

Some names referred to recent technological advances. Florence Wolf of Philadelphia wrote, "Why not give it a modern name? The other planets are mostly named for the ancient gods and were discovered in ancient time. As this is a modern discovery why not name it for the greatest force of the modern age, electricity?" Florence Howie of Houston offered the name Mazda to commemorate the 50th anniversary of Thomas Edison's invention of the lightbulb. William von Arx of Brooklyn liked Aeronautis because astronomers had worked to find Planet X during the era of flight. Meanwhile, Dr. E. K. Collier of Bowie, Texas, went a step further and suggested Percival-Lindbergh or Percival-Lind in honor of Percival Lowell, who spurred the hunt for Planet X, and American hero Charles Lindbergh, who still garnered headlines three years after his historic flight across the Atlantic.

Literature, both ancient and modern, inspired some suggestions. Ralph Magoffin of New York City hearkened back centuries with Vergilius, in honor of 1930 being the 2,000th anniversary of the Roman poet Virgil's works. From more contemporary times, T. Horan of Dalton, Georgia, proposed the awkward-to-pronounce Poictesme, from James Branch Cabell's then-popular but since-faded book, *Life of Manuel*.

Perhaps the most fascinating look into the public consciousness of 1930 can be seen in the hodgepodge of names that defy any other classification. Howard Carter's 1922 discovery of the tomb of King Tutankhamun was still in the mind of Josephine T. of Harbert, Michigan, when she suggested Shu, the Egyptian god of the atmosphere, "as recently found by Mr. Howard Carter in the annex of the Tutankhamun tomb." Even Prohibition, begun in 1920 but winding down by 1930, made an appearance in the name game. Philip Bowman of Annapolis, Maryland, suggested Bacchus, the Roman god of wine-making, as "typical of the age we live in." *The Literary Magazine* suggested, "For this notable cosmic catch completing the big-league planetary nine, it would be fitting to call the starry outfielder Babe Ruth." Ruth was then near the end of his baseball career but still a larger-than-life figure.



Lowell Observatory staff kept tallies of the most popular suggested names.

Many of the names honored individuals associated with Planet X, particularly Lowell. These include simply Lowell or Percival but also combinations such as Percilo, Perlo, and Perlow (the first letters of his first and last name), and Percius (Percival and his country, the United States). Gale Dismukes of Juneau, Alaska, wanted to honor the discoverer of the new planet, Clyde Tombaugh, with the name Tom Boy. She even included a poem:

"The Planet Speaks"

"Tom Boy" "Tom Boy"
Let it be my name
Surely Mr. Tombaugh
Beats in this game.

Playing "Hide and seek"
I often have thought
I, should like to be
discovered
By one self-taught.

Let the joyous tidings
Ring the world around
"Tom Boy" "Tom Boy"
The latest Planet found."

TALLY OF THE GODS (AND OTHERS)

The following represent the **names and number of nominations** preserved in the Lowell archives, a mere fraction of the total received.

- 25 **PLUTO** Roman god of the underworld
- 17 **MINERVA** Roman goddess of knowledge
- 14 **PAX** Roman goddess of peace
- 13 **JUNO** Roman queen of the gods
- 11 **VULCAN** Roman god of fire and metalworking
- 8 **HERCULES** Roman hero
- 6 **APOLLO** Greek god of truth and music
- 6 **EREBUS** Greek god of darkness
- 6 **EUREKA** as in, "Eureka, I found it"
- 6 **PEACE**
- 5 **ATHENA** Greek goddess of knowledge
- 5 **OSIRIS** Egyptian god of the afterlife
- 5 **PERCIVAL** after Percival Lowell, who predicted the existence of the new planet

The POOR RICHARD CLUB *of*
PHILADELPHIA
Thirteen Nineteen Locust Street

March 22, 1930

Lowell Observatory
Flagstaff, Arizona

Gentlemen:

As long as there is quite a little discussion and uncertainty as to the proper name to hang on to the new planet, here is a suggestion - for what it is worth:

In view of the fact that this planet was discovered by United States observers in the United States of America, why not combine the first letters of these words and call the planet "Usofa". The pronunciation could be broken after the "U" and after the "f" and that would carry out, to a certain degree euphoniously, the pronunciations of the names of many of the other planets.

Just a suggestion along with the hundreds of others which you doubtless have received.

Very truly yours,
Jack Lutz, President

P. S. I am wondering whether you have had the pleasure of meeting Gilbert K. Gable, who is a Poor Richard of long standing and, as you may recall, was on the "in" with the Dinosaur discovery in Arizona?

Since it was the only planet discovered in the United States, some contributors were driven to patriotic suggestions.

(at left transcription)
Lowell Observatory
Flagstaff, Arizona

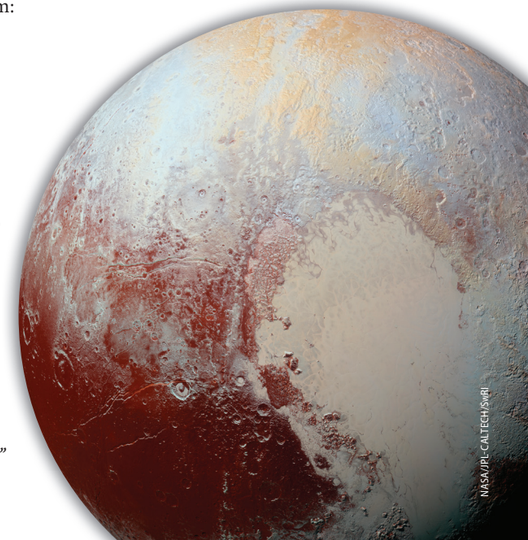
Gentlemen:

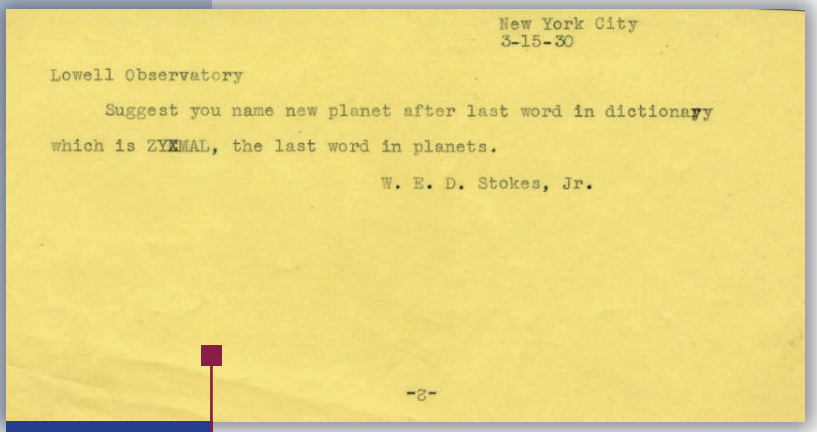
As long as there is quite a little discussion and uncertainty as to the proper name to hang on to the new planet, here is a suggestion — for what it is worth:

In view of the fact that this planet was discovered by United States observers in the United States of America, why not combine the first letters of these words and call the planet "Usofa". The pronunciation could be broken after the "U" and after the "f" and that would carry out, to a certain degree euphoniously, the pronunciations of the names of many of the other planets.

Just a suggestion along with the hundreds of others which you doubtless have received.

Very truly yours,
Jack Lutz, President





New York City
3-15-30

Lowell Observatory

Suggest you name new planet after last word in dictionayy which is ZYXMAL, the last word in planets.

W. E. D. Stokes, Jr.

-2-

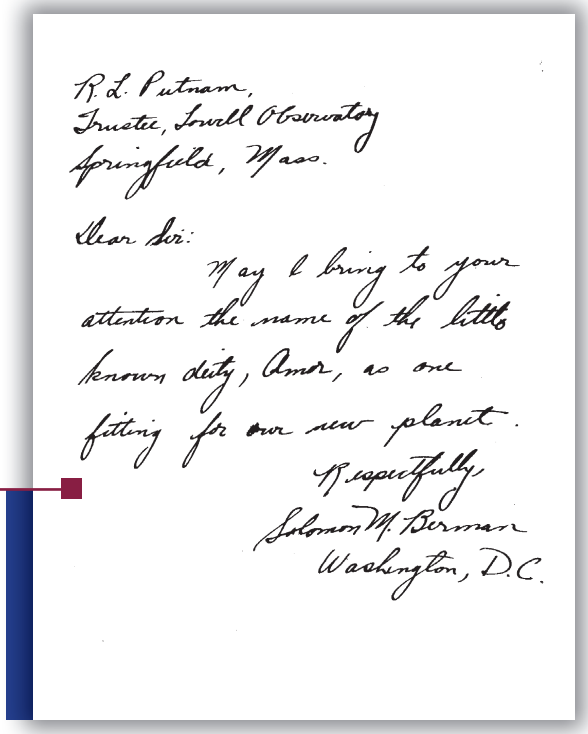
Some contributors offered clever ideas.

(above transcript)
New York City
3-15-30

Lowell Observatory

Suggest you name new planet after last word in dictionary which is ZYKMAL, the last word in planets.

W. E. D. Stokes, Jr.



R. L. Putnam,
Trustee, Lowell Observatory
Springfield, Mass.

Dear Sir:

May I bring to your attention the name of the little known deity, Amor, as one fitting for our new planet.

Respectfully,
Solomon M. Berman
Washington, D.C.

A prescient suggestion, given the newly discovered heart shape on Pluto, came from Solomon Berman.

(at left transcript)
R. L. Putnam,
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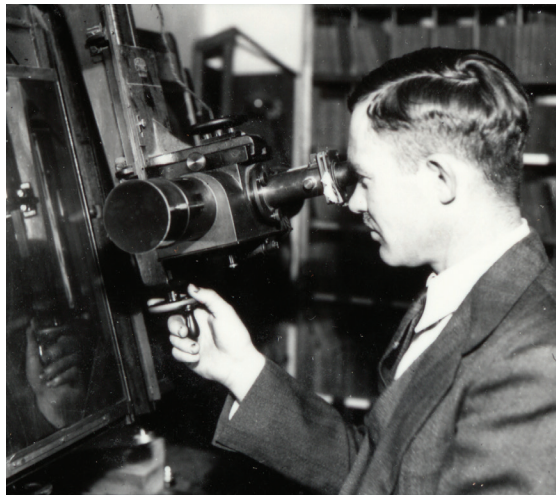
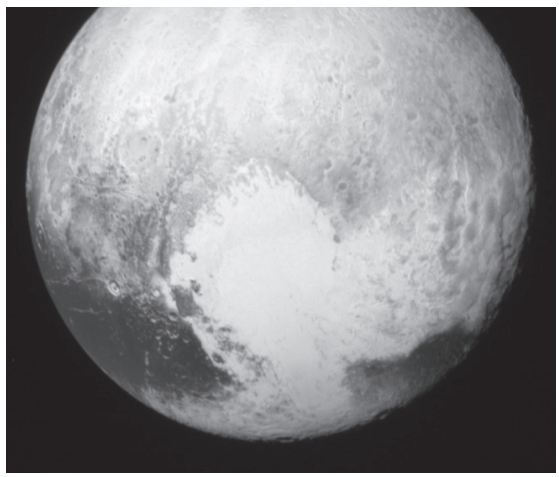
One of the cutest ideas came from Karl Underhill of New Hampshire. He wrote, "If I had discovered the new trans-Neptunian planet I would name it Jean after my two-year baby girl. I do not know the definition of the name Jean but it means everything to me. This letter is not a crank."

Making the call

While many of these suggestions undoubtedly made for good reading, the Lowell staff ultimately chose Pluto. Putnam gave a press statement explaining the decision to go with a Roman god, in accordance with the other planets. He said, "There have been many suggestions which have been weighed and sifted, and suitable ones were narrowed down to three — Minerva, Cronus, and Pluto." Minerva was the staff's first choice but since an asteroid already bore the goddess's name, they decided on Pluto, "the god of the regions of darkness where X holds sway." Putnam pointed out that Pluto's two mythological brothers, Jupiter and Neptune, were already represented by solar system planets. "Now one is found for him [Pluto] and he at last comes into his inheritance in the outermost regions of the Sun's domain."



Clyde Tombaugh, Pluto's discoverer, peers through the "blink comparator" he used to identify tiny, dim Pluto on the photographic plates.



Astronomers found more to love about Pluto in the detailed images captured during the July 2015 flyby, including the heart-shaped Tombaugh Regio. NASA/JPL-CALTECH/SwRI

Eighty-five years after Pluto's discovery and naming, public fascination with this icy body remains strong. These days, instead of suggesting names for the body itself, people are thinking of names for Pluto's geographical and geological regions, again pulling ideas from mythology, pop culture, and the real scientists and visionaries involved with the Pluto system. What will future generations glean from the current wave of naming choices? Whether because Pluto was long considered the only planet discovered in the United States, or because so many people regard it as an underdog, it remains beloved in the hearts of many in the population. Given this warm regard, plus the heart-shaped region the New Horizons team imaged and later dubbed "Tombaugh Regio," perhaps Solomon Berman of Washington, D.C., writing to the observatory in 1930, offered the best and most prescient name: Amor.