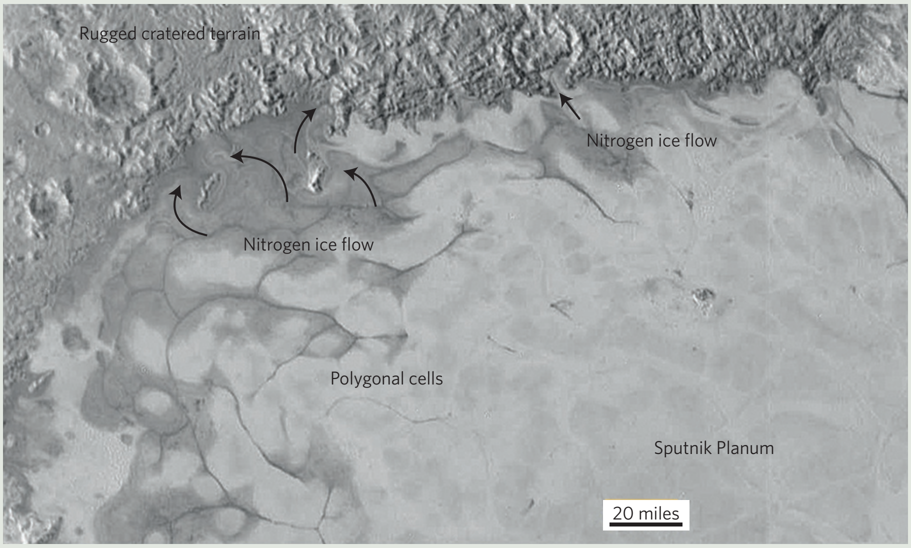
PLUTO

Glaciology's new horizon

When NASA's New Horizons spacecraft flew past Pluto on 14 July, it became the first spacecraft to visit the dwarf planet and its moons. Before New Horizons pointed its cameras and instruments at Pluto from a distance of just 12,500 km, Pluto had only been observed at coarse resolution from much further afar by astronomical telescopes. We knew very little about what Pluto was like from a geological point of view.

The images beamed back to Earth have revealed a surface that is surprisingly young, with few craters. Although Pluto's surface was already known to be dominated by ices (from Hubble Space Telescope observations), Pluto's cryosphere shows surprising signs of activity that may still be ongoing today. Images released by NASA reveal what appears to be an ice sheet that may be flowing (http://go.nature.com/ZhASxk).



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In the centre of the informally named Sputnik Planum, a plain that lies in the western part of Pluto's giant heart-shaped bright region, the images show a smooth, bright surface divided into a polygonal pattern that has been interpreted as a sheet of ice. The ice appears to have flowed over darker, older terrain and filled old craters in a manner similar to glaciers flowing at the edges of ice sheets on Earth.

The chemistry of Pluto's exotic cryosphere is far from Earth-like. Compositional data from New Horizons indicate that Sputnik Planum contains a mix of nitrogen, carbon monoxide and methane ices. Earth's surface is too warm for these compounds to freeze. Pluto's surface, however, is colder than -200 °C, allowing these ices to flow in the same way glaciers made of water ice flow on Earth. There is water ice on Pluto too, but at such frigid temperatures it would be as hard as a rock, explaining the massive ice mountains revealed in other New Horizons images (http://go.nature.com/41lSoT).

Geological activity requires energy, from the Sun or from residual heat from a planetary body's interior, for example. On Earth, glaciers flow because of the annual accumulation of ice that freezes out from the atmosphere as snow. But Pluto receives little solar radiation to drive an analogous hydrological cycle and accumulate a sufficiently thick ice sheet and it is unclear what an internal engine of the small dwarf planet might be. The forces that drive Pluto's glaciers still need to be unlocked.

Data from New Horizons's close encounter are trickling in slowly owing to the vast distance between the spacecraft and Earth. Both eager planetary scientists and the public will have to endure a drip-feed of new images for over a year. Meanwhile, the research field of glaciology has expanded to the outer edge of the Solar System.

TAMARA GOLDIN

PLANETARY SCIENCE

Shepherds of Saturn's ring

Saturn's F ring is chaperoned on both sides by the tiny moons Prometheus and Pandora. Numerical simulations show that this celestial ballet can result from the collision of two aggregates that evolved out of Saturn's main rings.

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Like a flock of sheep grazing 140,180 km from Saturn, the icy particles of the F ring are herded in a narrow band by two shepherds that orbit on either side of the ring, the small moons Prometheus and Pandora (Fig. 1). As a consequence, the F ring is only about 100 km wide. But it remains unclear how this configuration of ring and shepherd moons originated and how the F ring relates to the evolution of the main ring system. Writing in *Nature Geoscience*, Hyodo and Ohtsuki[1] report that collisions of moonlets that orbit just outside the main rings can explain the formation of Saturn's F ring system.

The F ring orbits at the transition between rings and moons. Beyond the F ring, the main moons such as Mimas,