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Pluto Wags its Tail: New Horizons Discovers a Cold, Dense Region of Atmospheric Ions Behind Pluto

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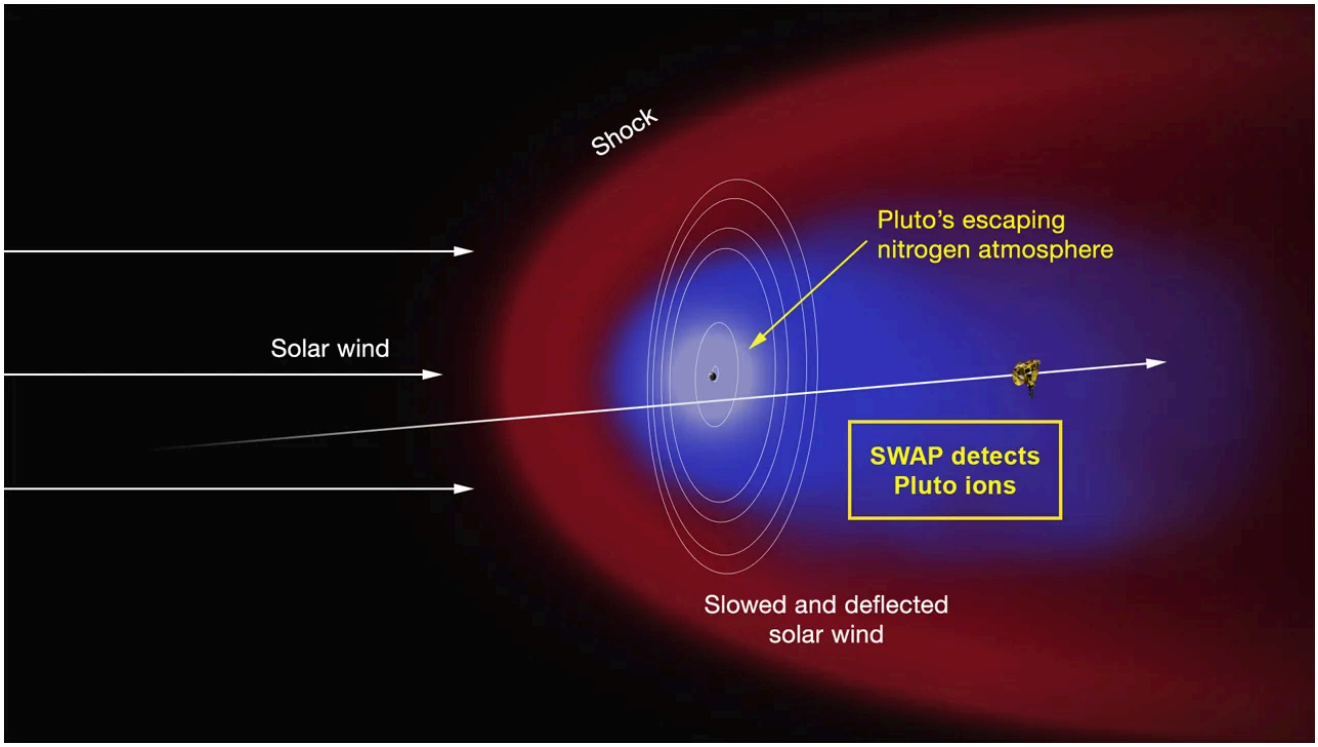
ARTICLE



Artist's concept of the interaction of the solar wind (the supersonic outflow of electrically charged particles from the Sun) with Pluto's predominantly nitrogen atmosphere. Some of the molecules that form the atmosphere have enough energy to overcome Pluto's weak gravity and escape into space, where they are ionized by solar ultraviolet radiation. As the solar wind encounters the obstacle formed by the ions, it is slowed and diverted (depicted in the red region), possibly forming a shock wave upstream of Pluto. The ions are "picked up" by the solar wind and carried in its flow past the dwarf planet to form an ion or plasma tail (blue region). The Solar Wind around Pluto (SWAP) instrument on the New Horizons spacecraft made the first measurements of this region of low-energy atmospheric ions shortly after closest approach on July 14. Such measurements will enable the SWAP team to determine the rate at which Pluto loses its atmosphere and, in turn, will yield insight into the evolution of the Pluto's atmosphere and surface. Also illustrated are the orbits of Pluto's five moons and the trajectory of the spacecraft.

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New Horizons has discovered a region of cold, dense ionized gas tens of thousands of miles beyond Pluto — the planet's atmosphere being stripped away by the solar wind and lost to space. Beginning an hour and half after closest approach, the Solar Wind Around Pluto (SWAP) instrument observed a cavity in the solar wind — the outflow of electrically charged particles from the Sun — between 48,000 miles (77,000 km) and 68,000 miles (109,000 km) downstream of Pluto. SWAP data revealed this cavity to be populated with nitrogen ions forming a "plasma tail" of undetermined structure and length extending behind the planet.

Similar plasma tails are observed at planets like Venus and Mars. In the case of Pluto's predominantly nitrogen atmosphere, escaping molecules are ionized by solar ultraviolet light, "picked up" by the solar wind, and carried past Pluto to form the plasma tail discovered by New Horizons. Prior to closest approach, nitrogen ions were detected far upstream of Pluto by the Pluto Energetic Particle Spectrometer Science Investigation (PEPSSI) instrument, providing a foretaste of Pluto's escaping atmosphere.

Plasma tail formation is but one fundamental aspect of Pluto's solar wind interaction, the nature of which is determined by several yet poorly constrained factors. Of these, perhaps the most important is the atmospheric loss rate. "This is just a first tantalizing look at Pluto's plasma environment," says co-investigator Fran Bagenal, University of Colorado, Boulder, who leads the New Horizons Particles and Plasma team. "We'll be getting more data in August, which we can combine with the Alice and Rex atmospheric measurements to pin down the rate at which Pluto is losing its atmosphere. Once we know that, we'll be able to answer outstanding questions about the evolution of Pluto's atmosphere and surface and determine to what extent Pluto's solar wind interaction is like that of Mars."

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