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Exploration of the Outer Solar System: New Horizons at Pluto and Juno at Jupiter

Even in our wildest dreams none of us on the New Horizons team really expected the July 2015 flyby of Pluto to produce such riches: water ice mountains as big as the Rocky Mountains, glaciers of nitrogen ice, black hydrocarbons covering aging craters, fresh methane frost dusting tops of mountains, pitted landscapes shaped by sublimation, an ice volcano as big as Mauna Kea, and, most bizarre of all, a landscape that resembles the skin of a snake. A solar occultation provided profiles of atmospheric density and composition. The nitrogen atmosphere also included significant amounts of methane and layers of hydrocarbon hazes, the source of the dark materials covering the older ices on the surface below. The upper atmosphere was found to be substantially colder than expected, dropping the rate of atmospheric escape by 2 orders of magnitude. The solar wind interaction with Pluto's escaping atmosphere extended about 5 Pluto radii upstream and over 20 times farther downstream due to mass-loading of the solar wind by the pick-up of ionized atmospheric material. I will describe how New Horizons came to be, how the spacecraft got to Pluto, and how the findings are challenging our understanding of ice worlds in the outer solar system. Turning to Jupiter, our primary example of a giant planet, the Juno mission will provide critical knowledge for understanding the planetary systems being discovered around other stars. After entering into orbit around Jupiter on 4th July 2016, Juno is investigating the existence of a solid planetary core, mapping Jupiter's intense magnetic field, and measuring the amount of water and ammonia in the deep atmosphere. Juno is also the first spacecraft to fly over Jupiter's poles and is measuring both the energetic particles raining down on the planet and the bright aurora they excite.

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