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# New Horizons Radio Science Investigations of the Pluto-Charon System

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The New Horizons (NH) Radio Science Experiment (REX) is one of seven instruments enroute to the Pluto–Charon system. REX is designed to determine the atmospheric state at the surface of Pluto and in the lowest few scale heights. Expected absolute accuracies in $n$, $p$, and $T$ at the surface are $4 \cdot 10^{19}$ m$^{-3}$, 0.1 Pa, and 3 K, respectively, obtained by radio occultation of a 4.2 cm-$\lambda$ signal transmitted from Earth at 10–30 kW and received at the NH spacecraft. The threshold for ionospheric observations is roughly $2 \cdot 10^{9}$ e$^{-}$ m$^{-3}$. Radio occultation experiments are planned for both Pluto and Charon, but the level of accuracy for the neutral gas is expected to be useful at Pluto only. REX will also measure the nightside 4.2 cm-$\lambda$ thermal emission from Pluto and Charon during the time NH is occulted. At Pluto, the thermal scan provides about five half-beams across the disk; at Charon, only disk integrated values can be obtained. A combination of two-way tracking and occultation signals will determine the Pluto system mass to about 0.01 percent, and improve the Pluto-Charon mass ratio. REX flight equipment is incorporated into the spacecraft radio transceiver for communications and tracking. Implementation of REX required realization of a new CIC-SCIC signal processing algorithm; the REX hardware implementation requires 1.6 W, and has mass of 160 g in 520 cm$^3$.