PLUTO AND CHARON OBSERVED WITH JWST MIRI

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We report on JWST observations of the Pluto-Charon system, including: (1) separate lightcurves of Pluto and Charon in the 15–25.5 μm range using MIRI Imaging, and (2) the composition of Pluto's atmosphere using MIRI MRS spectroscopy.

Measuring thermal emission from icy surfaces at infrared wavelengths provides constraints on surface temperatures, thermal inertia, and both bolometric and spectral emissivities. These properties are key indicators of grain size, porosity, and composition [1], and remain largely unknown on Pluto and Charon. On Pluto, they govern the sublimation and condensation of volatile ices [2,3], and are therefore key to understanding its climate system. On Charon, emissivity- and thermal inertia-dependent polar temperature is critical to explain its distinctive red poles [4].

Previous thermal measurements of the Pluto-Charon system often yielded multiple solutions and ambiguous results due to the inability to resolve the two bodies separately [5-7]. Our new JWST measurements overcome this limitation, providing distinct thermal lightcurves for Pluto and Charon, and offering stronger constraints on their surface properties.

Past spectroscopic studies, including ground-based observations in the near-infrared and sub-millimeter, as well as UV data from *New Horizons*, have revealed complex N_2–CH_4 photochemistry and a Titan-like haze in Pluto's atmosphere [8-11]. Recent modeling suggests this haze may also emit significantly in the mid-infrared [12,13]. However, this portion of Pluto's spectrum has remained unexplored—until now. Leveraging JWST's unprecedented sensitivity, we gain new insights into the composition of Pluto's atmospheric gases and haze in the mid-IR. This is especially important for understanding both the planet's photochemical processes and the thermal balance of its atmosphere.

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