

Study of the thermal properties of Pluto's satellite Charon with ALMA

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Pluto's satellite Charon has a diameter more than half that of Pluto. Despite their similar sizes, their surface compositions differ significantly. Pluto's surface is primarily covered with nitrogen and methane ices, while Charon is largely composed of water ice (Grundy et al. 2016). This makes Charon an intriguing target for studying the surface environments of small icy bodies in the trans-Neptunian objects (TNOs). However, the small angular separation between Pluto and Charon (a maximum of 0.9 arcsec) makes it difficult to distinguish the two objects using the Earth-based observational facilities. As a result, most observational studies to date, particularly in the thermal infrared and microwave regions, have treated Pluto and Charon as a single system without separating them. For example, Lellouch et al. (2016) derived the thermal inertia of Pluto and Charon from the Herschel Space Telescope data but adopted a single value of 0.7 for the emissivity of the Pluto-Charon system. Additionally, they conducted a comprehensive analysis, incorporating other past observations at different wavelengths, and showed that the system's emissivity varies with wavelength. However, with the exception of data obtained from the Submillimeter Array (SMA), Pluto and Charon are not spatially resolved in those past observations. Given the differences in the surface compositions of Pluto and Charon, as well as the fact that the Bond albedos derived from the New Horizons spacecraft are significantly different (0.72 ± 0.07 and 0.25 ± 0.03 for Pluto and Charon, respectively; Buratti et al. 2017), it is important to derive the emissivities of Pluto and Charon separately for further studies of these two objects.

A major advance is provided by the Atacama Large Millimeter/submillimeter Array (ALMA), a ground-based interferometer capable of achieving an angular resolution of 0.015 arcsec at a wavelength of 1 mm. Previous ALMA observations of Pluto in 2017 successfully resolved Pluto and Charon with an actual spatial resolution of about 0.025 arcsec. In this study, we report the derivation of the thermal properties of Charon using the previously obtained ALMA images.

Buratti et al. 2017, *Icarus*, 287, 207

Grundy et al. 2016, *Science*, 351, 6279

Lellouch et al. 2016, *A&A* 588, A2

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