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In-situ thermal observations of the nuclei of comets 103P/Hartley 2 and 9P/Tempel 1

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Abstract

The Deep Impact spacecraft flew by comet 103P/Hartley 2 on November 4, 2010 (EPOXI mission) [1] and comet 9P/Tempel 1 on July, 4, 2005 (Deep Impact mission) [2]. During the two flybys, spatially resolved infrared (1.05-4.85 μm) spectra of the surface of the nucleus were acquired by the HRI-IR instrument. The analysis of these two datasets, obtained by the same instrument, offer a unique opportunity to understand, compare and contrast the surface thermal properties of these two comets. For this paper, we use two hyperspectral cubes with a spatial resolution of $\sim$25 m/pixel for 103P/Hartley 2 and $\sim$160 m/pixel for 9P/Tempel 1. We present and discuss the temperature maps derived from these data. The nucleus thermal emission at all resolved spatial scales differs from that of a grey body with a constant infrared emissivity of 0.9-1.0, the discrepancy being more important for larger incident angles. This results from projected shadows, which play an important role as expected for a rough surface, and we indeed demonstrate that the nucleus thermal emission can be well reproduced using a rough, fractal, terrain model.

References

[1] A'Hearn, M. F., et al., 2011, EPOXI at Comet Hartley 2, Science, in press

[2] A'Hearn, M. F., et al., 2005, Deep Impact : Excavating Comet Tempel 1, Science 310, 5746