The shape and geological features of comet 103P/Hartley 2.

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Introduction: The Deep Impact Flyby spacecraft on 4 November 2010 passed ~700 km from comet 103P/Hartley 2 and revealed a bi-lobed object about 2.3 km in maximum length. This comet was of particular interest because of its apparent high activity. The images from the Medium Resolution Instrument (MRI) reached ~ 7 m/pixel and provided excellent stereo viewing at phase angles of 78 - 88° near closest approach. Once again these data revealed a newly investigated comet that is indeed quite different from previous well-examined ones (Halley, Borrelly, Wild 2, and Tempel 1; although due to scale real comparisons can only be made with the latter two). The data needed for the geological investigations were acquired during less than 3 ½ minutes, during which time the comet rotated less than 1.1°. Stereo control is provided by 220 control points with mean solution residuals of ~0.25 pixels. These cover over 40% of the object, and the shape and volume of most of the rest are provided by silhouettes visible over a large arc of the close flyby, thereby providing much better control than in the case of Tempel 1 where imaging near the nucleus was restricted.

Atributes Hartley has a mean radius (spherical volume equivalent) of 0.58 km, very close to that derived previously using Spitzer observations at 22 µm [1]. It has a bi-lobed shape, with the smaller component ~ half the volume of the larger. It has three morphologic styles arranged in four units along the length of the object (Fig. 1). The ends are rough on scales of 10-40 m. The narrow region between lobes is relatively smooth, but does have mottling on horizontal scales of 10-30 m, and some local vertical relief of >10 m. Much of the larger lobe has a surface slightly more varied than the "neck" region connecting the two lobes, with a scattering of bright mounds and darker, smoother areas. The rough end on the larger lobe has some larger trough-like topography. Jets occur in all units, although most are in the small lobe end and part of the variegated region of the larger lobe (Fig. 1) [2].

Context The fast, short flyby precluded a mass and density determination. However, modeling of possible gravitationally-driven processes may allow the unique topography of the "neck" to constrain internal models and the mean density of the nucleus.

The three comets observed with good resolution of nucleus details are all different and display a surprising range of the apparent relative effectiveness of surface sublimation, ejection and flow, regolith formation, and collapse of near-surface materials. These differences may help elucidate the relative histories of these ever more complex objects.

References:

[1] Lisse, C.M.,*et al.*, (2009) *Publications of the Astronomical Society of the Pacific 121*, 968-975. [2] P. H. Schultz *et al.* (2011) LPSC 42 (This volume).

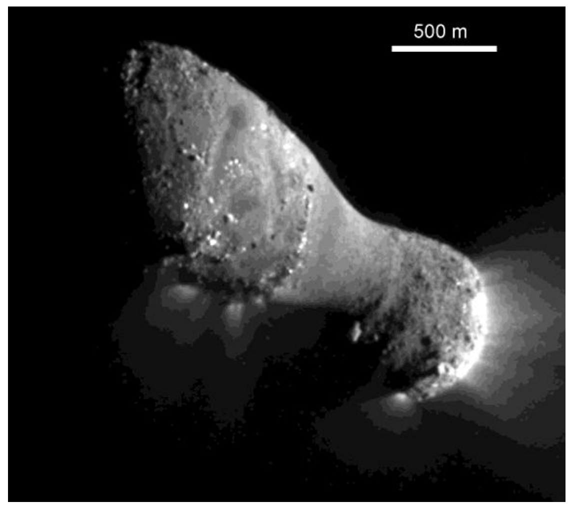

Fig. 1. View of 103P/Hartley 2 near closest approach of the Deep Impact spacecraft. Illumination is from the right.

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