

Topography of the 81P/Wild 2 Nucleus from Stardust Stereoimages

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In January 2004, the Stardust spacecraft obtained 72 images of the nucleus of comet 81P/Wild 2, with a best resolution of 14 m/pixel [1]. A handful of images near closest approach gives useful stereo coverage of the entire illuminated part of the nucleus. A detailed shape model containing >5000 surface points was constructed from these images by using methodology previously applied to images of the 19 P/Borrelly nucleus from the Deep Space 1 mission [2].

The surface is well fitted by an ellipsoid with semiaxes 2.71x2.00x1.35 km, slightly smaller than previously estimated [1]. Relief relative to the ellipsoid ranges from –400 to 250 m with RMS 86 m. Surface slopes are steep, up to 75° in places, with 25° typical. The main topographic features resolved in stereo are flat-floored quasi-circular depressions that are substantially deeper than impact craters on other small bodies, suggesting that they have another origin or have been modified, e.g. by erosive processes. Once the images are radiometrically calibrated, we will study surface photometric properties and map small relief features by shape-from-shading.

Keywords: Comets, Wild 2, topography; photogrammetry; stereo

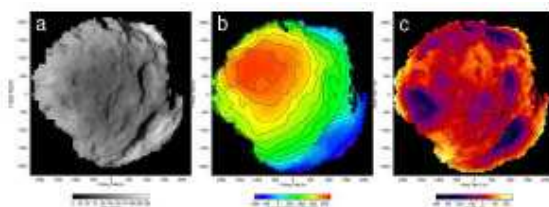


Figure 1: Maps of Wild 2 nucleus as seen from direction of closest approach. (a) Orthorectified image, highpass filtered. (b) Color-coded contour map of Z coordinate (toward closest approach) from –1000 to 2500 m with 200 m interval emphasizes overall rounded shape with minor local variations. (c) Color-coded elevations from –400 to 250 m normal to best-fit ellipsoid clearly show major surface depressions as well as highstanding areas between. Graticule with 15° latitude, 30° longitude interval is also shown.

References

- [1] D. E. Brownlee et al., *Science*, **304**, 1764 (2004).
- [2] R. L. Kirk et al., *Icarus*, **167**, 54 (2004).