Visualizing the Nucleus of Comet 9P/Tempel 1 Using the Deep Impact Images. Dennis D. Wellnitz[1] and the Deep Impact Team, [1]Astronomy Dept., Univ. of Maryland, College Park, MD 20742-2421, wellnitz@astro.umd.edu.

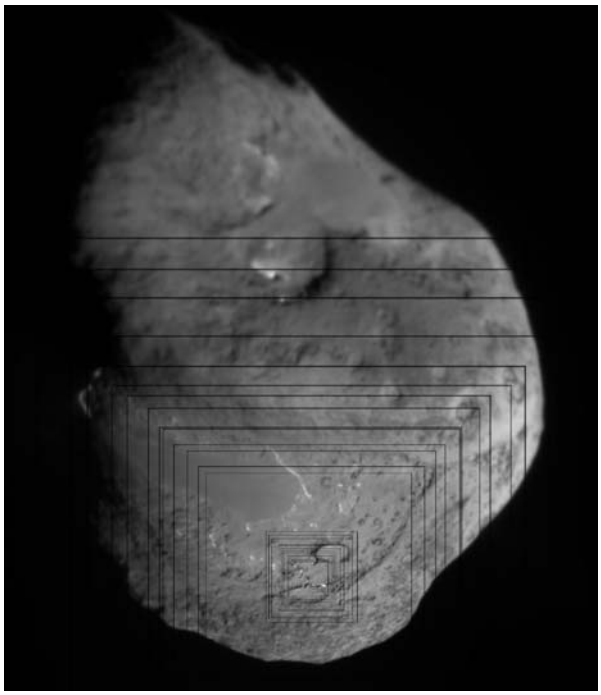

Figure 1. Series of approach images to nucleus of comet Tempel 1, taken by Deep Impact Impactor Targeting Sensor, overlaid on previous images.

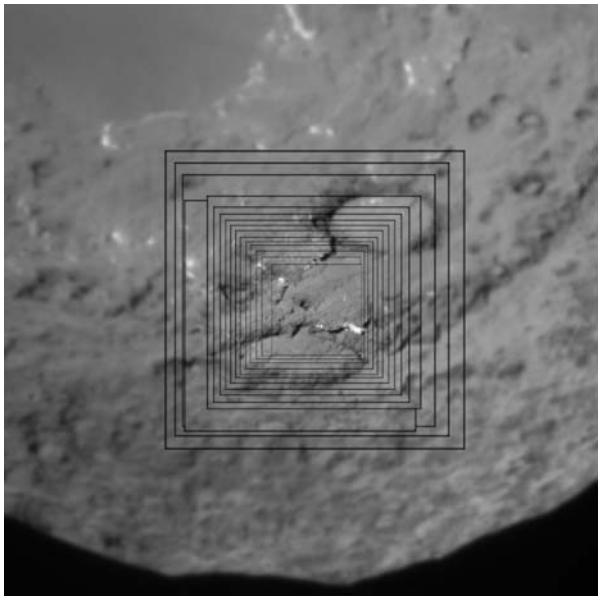

Figure 2. Closer series of approach images to nucleus of comet Tempel 1, taken by Deep Impact ITS, overlaid on previous images.

Introduction: Visualization techniques such as contrast enhancement and edge sharpening can bring out image details that are otherwise difficult to discern. We have developed a variety of visualization techniques for the Deep Impact images that enhance the information available and aid interpretation of the images. We particularly exploit technical details of the sensors and the imaging sequences to enhance resolution, which can be a tremendous aid to interpretation.

Resolution-enhancing techniques: The point-spread function (PSF) of each of the Deep Impact visual instruments and the variation of each PSF over the field of view of each instrument are characterizable by appropriate analysis of the multiple observations of stars done during the in-flight science calibrations performed during the Deep Impact mission. The enhancement of effective resolution of the High Resolution Instrument (HRI) through de-convolution of its de-focused PSF is now widely known, but it is also possible to enhance the effective resolution of the Medium Resolution Instrument (MRI) and the Impactor Targeting Sensor (ITS) using similar techniques.

Additionally, a rapid series of images of a nearly unchanging scene, which describes the nucleus approach series of ITS images, provides successive re-samplings of the intensity distribution of light reflected from the surface of the nucleus. This series of images is amenable to special processing that can extract the sub-pixel light distribution, and thus, in some cases, provide sub-pixel resolution. However, images produced by resolution-enhancing techniques are only pretty pictures unless they also provide additional verifiable information. In this case we have a long series of images of ever-increasing surface resolution covering the same area of the comet nucleus, so resolution-enhancing techniques applied to earlier images can be checked against higher-resolution images taken when the Impactor spacecraft has approached more closely to the nucleus, to evaluate the veracity of the resolution-enhancing technique.

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The composite image overlays shown as Figures 1 and 2 were produced by Alan Delamere and David Stern during the Deep Impact mission.