OBSERVATIONS OF THE INNER COMA AND ACTIVITY NEAR THE SOUTH POLE ON THE NUCLEUS OF COMET 9P/TEMPEL 1. D. D. Wellnitz[1] and the Deep Impact Science Team, [1]University of Maryland, College Park, MD 20742-2421, USA wellnitz@astro.umd.edu.

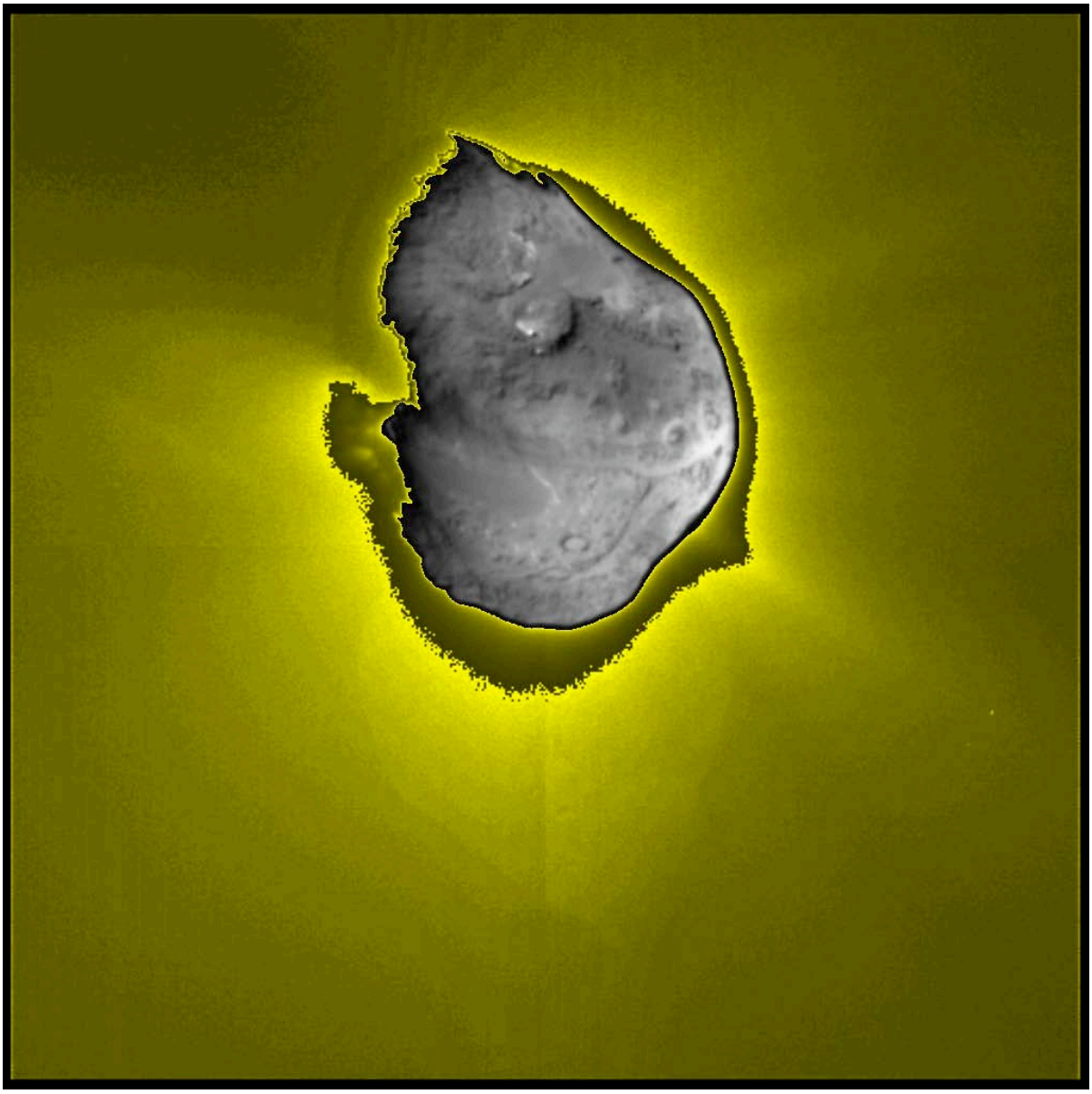

Figure 1. Image iv_1_0173727570_178_9000635_001_radrev_v01.fit, the last 512x512 image from the Impactor Targeting Sensor (ITS), expanded to 1024x1024 pixels by bilinear interpolation. The outer part of the image, showing the inner coma, has been scaled by a factor of 6000, after adding 0.01 to increase visibility in the dimmest parts. The near-nucleus region has been scaled by a factor of 2000, with no offset from zero. The nucleus region has been scaled by a factor of 100, with no offset from zero.

Introduction: The imaging cameras of the Deep Impact spacecraft took high-dynamic-range, high-resolution, high-signal-to-noise images of the nucleus of comet 9P/Tempel 1 during approach and flyby [1]. Appropriate processing of these images can provide unprecedented observations of the inner coma, well registered to the features on the sunlit parts of the nucleus.

Observations: Figure 1 shows the last 512x512 pixel image from the Impactor Targeting Sensor (ITS),

expanded to 1024x1024 pixels by bilinear interpolation. This is a single image displayed with three different stretches to provide unsaturated detail simultaneously on the surface of the nucleus, in the inner coma, and in the boundary region between the two. North is roughly up, and sunlight is coming from the right, from about 23 degrees above the plane of the image. The rotation of the nucleus is towards the camera in the upper part of the image and away from the camera in the lower part of the image, so the upper left terminator is the sunrise terminator, and the lower left terminator is the sunset terminator. Artifacts due to quadrant boundaries are visible, as well as an apparent enhancement in the coma below the nucleus due to incomplete removal of the electronic ghosts of the bright nucleus (symmetric about quadrant boundaries). A couple of bright star-like spots in the coma may be either stars or cosmic rays. Scattered light is minimal, as can be seen by the rapid drop-off of intensity at the limb and at the sunrise terminator. Beyond the sunrise terminator the unilluminated limb of the nucleus can be seen in silhouette against the coma. Near the sunrise terminator, very little if any coma can be seen. Following clockwise around the nucleus, the amount of near-nucleus coma generally increases, perhaps roughly correlated with the amount of time the nearby surface has been in sunlight. At various locations narrow jets are seen superimposed on the diffuse coma.

Surprisingly, one of the largest areas of near-surface coma enhancement appears to be associated with the area near the upper part of the sunset terminator, in the middle-left of the image, near the south rotational pole of the nucleus. In this region beyond the sunset line there are diffuse brighter areas which look like they may be associated with activity on the unilluminated surface. We are currently looking for additional images at different viewing angles to discover the three-dimensional position of these bright areas with respect to the surface.

We currently speculate that these bright areas are due to gas and dust rising into sunlight over near-polar active areas currently on the night side of the nucleus. The south pole of the nucleus was nominally continuously illuminated during the approach of Tempel 1 to perihelion (sun about 10 degrees altitude for a spherical or ellipsoidal surface), but the body surface is quite irregular in shape, so local slopes are very important in terms of illumination at small angles of elevation of the sun.

References: [1] A'Hearn, M. F. et al. (2005) *Science, 310*, 258.

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