THE DETECTION AND LOCATION OF ICY PARTICLES SURROUNDING HARTLEY 2. B. Hermalyn[1], P. H. Schultz[1], T. L. Farnham[2], D. Bodewits[2], M. F. A'Hearn[2], and the DIXI Science Team [1]Department of Geological Sciences, Brown University, Providence, RI (brendan_hermalyn@brown.edu), [2]Department of Astronomy, University of Maryland, College Park, MD.

Introduction: The Deep Impact Flyby Spacecraft encountered comet 103P/Hartley 2 on November 4th, 2010 at a minimum distance of approximately 700km [1]. During the encounter, the High Resolution (HRI) and Medium Resolution Instruments (MRI) captured images of a field of debris composed of both fine grain dust and ice (primarily detected in the HRI as presented in [2,3]) and hundreds of discrete larger particles enveloping the comet. These larger particles, interpreted to be composed primarily of ice [3] are detected at a high density near the nucleus (Fig. 1). This swarming of individual grains in the near-nucleus environment is unique to Hartley 2 as it has not been observed in any other comet to date. In this study, we present an analysis of the identification and location of particles present in MRI encounter images.

Determination of Particle Position and Motion: The motion of the spacecraft instruments relative to the comet nucleus (including not only spacecraft velocity but pointing adjustments) provides a metric to reconstruct the distance and displacement of these particles from Hartley 2 by stereoscopic reconstruction of particle locations in successive frames.

Figure 1 reveals a large cloud of particles surrounding the nucleus, composed of noise, background stars, and objects near the nucleus of sizes at or near the point spread function of the instrument. Due to the large number of images taken during the approach (providing a high degree of time resolution), many of the particles are present in multiple frames as the spacecraft flies past, thereby permitting stereo reconstruction of their locations. The selection of particle matches between images (and thus rejection of objects or noise not associated with the comet) is restricted to those that fall on epipolar lines constructed for each image pair.

Particles near the nucleus do not exhibit large displacement between successive views, whereas particles closer to the spacecraft shift significantly more due to reflex motion as the spacecraft tracks the nucleus. The importance of locating the same particles in multiple frames lies not only in the determination of their instantaneous location, but also in the detection of motion, and thus the forces acting upon the particles.

Conclusions: The encounter images of Hartley 2 reveal a high density of not only fine-grained dust and ice but also a large number of discrete, ejected particles surrounding the comet. Analysis of the location and forces acting upon these particles will enhance our understanding of the near-by environment of active comets.

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References:

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Figure 1. MRI clear filter encounter image near closest approach of Hartley 2 (approximately 800 km from nucleus). Image is stretched to illustrate jets and an icy particle cloud. Context view is included in upper left inset. Solar direction is to the right.