VOLATILE DISTRIBUTION, HETEROGENEITIES, AND EXTENDED SOURCE OF WATER FOR 103P/HARTLEY 2 AS OBSERVED BY THE DEEP IMPACT HRI-IR. L. M. Feaga[1], S. Protopapa[1], S. Besse[1], J. M. Sunshine[1], O. Groussin[2], F. Merlin[3], M. F. A'Hearn[1] and the DIXI Team, [1]Department of Astronomy, University of Maryland, College Park, MD 20742, USA, feaga@astro.umd.edu, [2]Laboratoire d'Astrophysique de Marseille, CNRS and Université de Provence, Marseille, France, [3]Université Paris 7, LESIA, Meudon, France.

Introduction: The Deep Impact flyby spacecraft made its closest approach (~700 km) to the hyperactive comet 103P/Hartley 2, target of the Deep Impact eXtended Investigation (DIXI) mission, on November 4th, 2010 [1]. The HRI-IR spectrometer [2] monitored the coma throughout the encounter, October 1st through November 26th, acquiring frequent spectral scans from 1.05-4.85 µm. Gaseous H_2O and CO_2 at 2.7 µm and 4.3 µm, respectively, were the dominant emission bands detected in these spectra, with more CO_2 escaping this comet than many other Jupiter Family comets, including Tempel 1 [3]. Additionally, abundances maps near closest approach (Figure 1) and lightcurves with longer temporal scales, showed that the distribution of these parent species was determined to be highly asymmetric [1]. Water ice was also detected by the spectrometer in the coma and exposed on the surface [4,5]. We will present continuing analysis of the coma asymmetries, composition, and production rates, in order to better understand the chemistry of the near-nucleus coma, the heterogeneity of the outgassing of the nucleus, the source regions of the outgassing and the processes that drive the activity on Hartley 2.

Spatial and Temporal Study of the Volatiles: The correlation between the asymmetric distribution of CO_2 and solid grains around the nucleus seen in the MRI visible images, much different than the gaseous H_2O distribution (Figure 1), implies that CO_2 and H_2O have different source regions and that CO_2 rather than H_2O drags solid grains with it into the coma as it leaves the nucleus. We will examine correlations in volatile distribution with rotational phase in order to assess the influence of the sun on volatile activity and inhomogeneities within the nucleus.

Source of the Water: Once the water ice has been released from the nucleus into the coma, it is exposed to sunlight and with time will sublimate, providing an extended source of water vapor. This process accounts for the hyperactivity (large production rate per surface area) of Hartley 2. By studying radial profiles of the H_2O vapor, the contribution of the ice particles to the total H_2O production rate for Hartley 2 will be determined.

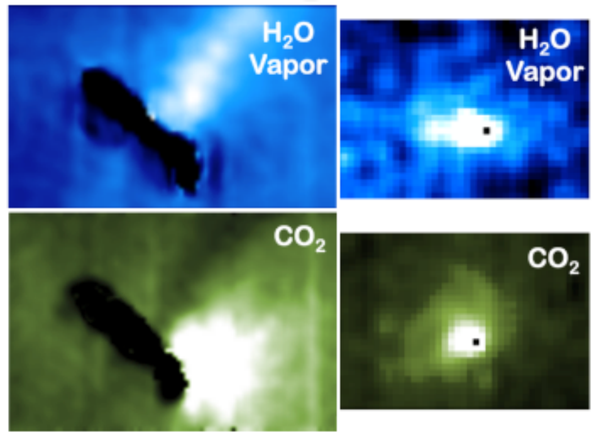

Figure 1. Distribution maps of the H_2O and CO_2 gas in the near-nucleus coma as derived from the DI HRI-IR spectral scans. The left panels, acquired near closest approach (small lobe of the comet sunward), show a sunward enhancement in CO_2. The right panels, acquired ½ a rotation later (small lobe pointing anti-sunward), display an anti-sunward enhancement for both parent volatiles.

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