HETEROGENEITY OF COMET 103P/HARTLEY 2's GASEOUS COMA. L. M. Feaga[1], J. M. Sunshine[1], O. Groussin[2], S. Besse[1], S. Protopapa[1], F. Merlin[3], T. L. Farnham[1], M. F. A'Hearn[1] and the DIXI Science Team, [1]Department of Astronomy, University of Maryland, College Park, MD 20742, USA (feaga@astro.umd.edu), [2]Laboratoire d'Astrophysique de Marseille, [3]Universite Paris 7, LESIA.

Introduction and Observations: The Deep Impact Flyby spacecraft made its closest approach (~700 km) to comet 103P/Hartley 2, the target of the Deep Impact eXtended Investigation (DIXI) mission, on November 4th, 2010 [1]. The HRI-IR spectrometer continuously monitored the coma throughout the encounter from October 1st through November 26th. Infrared spectral scans of the coma from 1.05—4.85 µm were acquired frequently, with no more than one hour separation between scans, in order to study the time varying composition and distribution of the coma and to identify any outbursts or jets during the encounter. The observations include data with spatial resolution as high as 7 m/pixel. Gaseous H_2O and CO_2 at 2.7 µm and 4.3 µm, respectively, were the dominant emission bands detected in these spectra (Fig. 1). At closest approach, the distribution of these parent species was mapped and determined to be highly asymmetric (Fig. 2). Further study of the asymmetries, composition, and production rates as well as their two-month evolution around perihelion, will give insight to the chemistry of the near-nucleus coma, the heterogeneity of the outgassing of the nucleus and the processes that drive the activity on Hartley 2.

Distribution of the Coma, Outgassing and Jets: Analysis of the spectra and distribution maps shows that there is more CO_2 escaping this comet than 9P/Tempel 1. The correlation between the asymmetric distribution of CO_2 and solid grains around the nucleus seen in the MRI visible images, which is much different than the gaseous H_2O distribution (Fig. 2), 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. For more discussion on the solids in the coma and jet activity, see Sunshine et al. [2] and Farnham at al. [3]. For the first time, it is unambiguously shown that the sublimation of subsurface CO_2, a volatile that has been preserved inside the comet since the formation of the Solar System, drives the outgassing activity of a comet's nucleus.

References: [1] A'Hearn, M. F. et al. (2011) *LPSC XLII*, this volume. [2] Sunshine, J. M. et al. (2011) *LPSC XLII,* this volume. [3] Farnham, T. L. et al. (2011) *LPSC XLII*, this volume.

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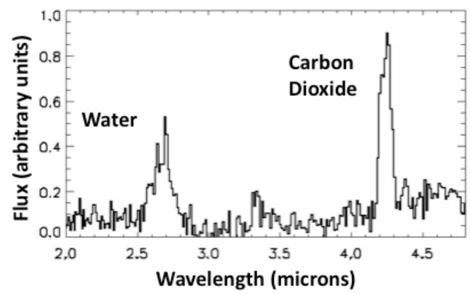

Figure 1. An E-1hr continuum removed spectrum, sunward of the nucleus, showing the relative intensity of the H_2O and CO_2 emission bands.

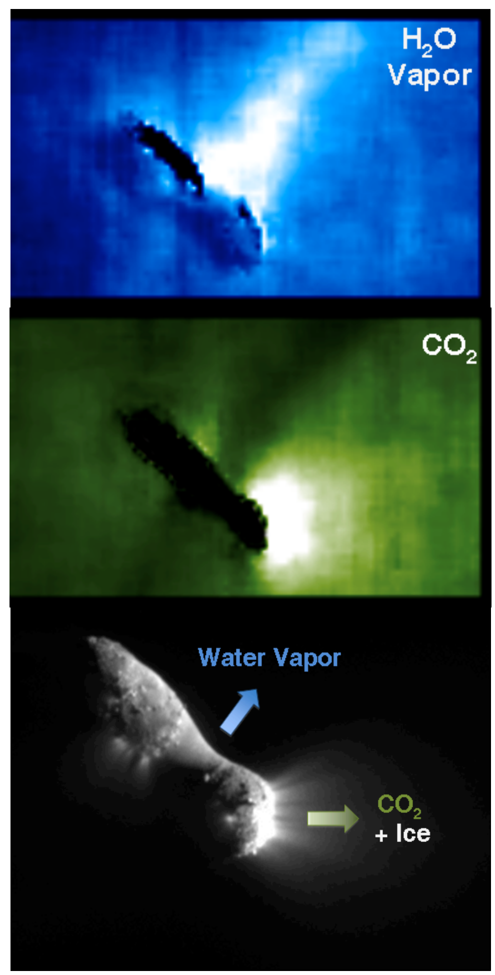

Figure 2. Relative intensity maps of H_2O and CO_2 reveal distinctly different distributions in the coma suggesting different processes govern their outgassing. An MRI visible image of Hartley 2 is included for comparison in the bottom panel. Sun is to the right.