MAPPING THE COMA OF COMET 103P/HARTLEY 2 WITH AN INTEGRAL FIELD SPECTROGRAPH AT MCDONALD OBSERVATORY. A. L. Cochran[1], D. M. Pierce[2], C. M. Vaughan[2] [1]The University of Texas, McDonald Observatory, 1 University Station, C1402, Austin, TX, 78712 USA (anita@astro.as.utexas.edu), [2]Mississippi State University, Department of Physics and Astronomy, P.O. Box 5167, Mississippi State, MS, 39762 USA (dmp149@msstate.edu, cmv24@msstate.edu).

Introduction: Ground-based observations of comets can only detect the coma, not the nucleus. However, the morphology of the coma is influenced strongly by the nucleus. Rotation, nucleus shape, placement of active regions, jets and obliquity all leave a signature on the distribution of gas and dust in the coma. Thus, we can use the morphology of the coma to lend constraints on nuclear properties.

We used spectral observations obtained with a moderate resolution integral field unit (IFU) spectrograph to map the distribution of the gas in the coma of the EPOXI target 103P/Hartley 2 during its 2010 apparation. With spectra, we can isolate several molecular gas features. The IFU enables simultaneous observations of several regions of the coma. While photometric observations can observe to lower abundance levels than spectra, they lack any spatial information and cannot be used to detect weak features such as CH. Imaging through comet filters allows for spactial information but also cannot be used on weak features.

Observations: The observations were obtained with the Vissible IFU Replicable Unit Spectrograph – Prototype (VIRUS-P) [1] on the 2.7m Harlan J. Smith Telescope of McDonald Observatory on 9 dates in 2010. For all but three of those dates, the spectral resolving power was 850 and the spectra covered the bandpass from 3600 - 5700Å. For 14-16 September, we used a grating with resolving power 4500 centered on CN to study the Greenstein effect. The IFU has 246 fibers arranged in an approximate square covering 1.7 × 1.7 arcmin on a side with a 1/3 fill factor. The fibers are 4.1 arcsec in diameter. Table 1 is a log of the observations

Table 1

Date	R_h (AU)	Δ (AU)
15 Jul 2010	1.72	0.92
13 Sep 2010	1.23	0.30
14 Sep 2010	1.22	0.29
15 Sep 2010	1.21	0.29
16 Sep 2010	1.21	0.28
14 Oct 2010	1.08	0.13
15 Oct 2010	1.07	0.13
09 Nov 2010	1.07	0.18
10 Nov 2010	1.07	0.18

Once the data were flat fielded, wavelength and flux calibrated and converted into spatially separated spectra, the known fiber positions allowed us to assign positions accurately relative to the optocenter. Figure 1 shows the gas distribution around the optocenter for 4 different molecules.

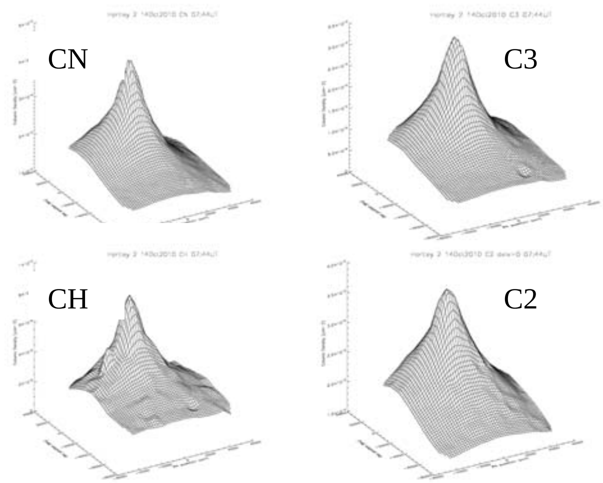

Fig. 1: CN, C_3, CH and C_2 (Δv=0) gas distribution from 07:44 UT 14 October 2010.

Analysis: Once we have maps of the distribution of each molecule within the coma, we can model the morphology observed to understand the underlying physical processes creating the coma. We used the modified vectorial model described by Ihalawela et al. (2011) [2], which is capable of modeling the spatial distribution of asymmetric comae. With the changing viewing angles over the range of dates of the observations, we can examine the placements of jets to determine if seasonal effects are visible. The first specie to be modeled was the CN because of the very high signal/noise. The CN results are verified with other species. We will present these results at the meeting.

References: [1] Hill, G. J., et al., Proc. SPIE 7014, 257, 2008; [2] Ihalawela, C. A., Pierce, D. M., Dorman G. R. and Cochran, A. L., ApJ 741, 89, 2011.

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