HARTLEY-2'S PUZZLING GAS ANOMALY.

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Introduction: Although the EPOXI mission is best known for its fly-by on November 4th, 2010, the spacecraft started observing comet 103P/Hartley 2 60 days before. Here we discuss observations acquired with the Medium Resolution Imager (MRI) that were used to characterize the comet's dust and gas production.

Observations: The MRI camera is based on a 2.1 m focal length Cassegrain telescope, with 12 cm aperture and a 9 position filter wheel [1]. It has a field of view of approximately 35 x 35 arcminutes, and a per pixel resolution of 2 arcsec. Five of the filters are based on the Hale-Bopp narrowband filter set [2], with three filters designed to measure different gas species (CN, OH, and C_2) and two to measure the continuum at 345 and 526 nm; two others are medium-width filters for measuring colors at 750 and 950 nm, and two are nearly identical broadband "clear" filters that are sensitive to the 200 – 1100 nm band.

The comet was observed with the MRI in the period 2010 Sept. 5 – Nov. 26. During most of this period, only the Clear1 and CN filters were used in order to get an optimal sampling of the comet's lightcurve (the narrowband filters require a relatively long exposure time to get good S/N). The other narrow band filters were used between Oct 28 and Nov 16.

Production Rates: We used the narrowband images to derive absolute gas and dust production rates of comet 103P. To do this, we first used aperture photometry to measure the comet's flux in the different filters, where images were carefully checked for cosmic rays and background stars. The measured flux in the narrowband filters is the sum of a reflected continuum and the gaseous emission bands of interest. To remove the continuum contribution, we assumed an unreddened solar continuum and convolved this with the filter transmission and quantum efficiency of the detector [3]. The resulting 'clean' CN, OH, and C_2 fluxes were used to derive column densities using fluorescent efficiencies scaled to the comet's heliocentric distance and velocity.

To derive gas production rates, we first produced a model image based on the estimated number density and emissivity of gas molecules and dust, and compared the resulting model image with the observed MRI image.

CN Anomaly: Between 9 and 17 Sept. 2010, the outgassing of CN, increased by a factor of 7 and then slowly decreased, returning to its prior trend line by Sept. 24 (Fig. 1; [4]). There was no apparent change in the reflected continuum, acquired with the clear filter, other than a small, gradual increase consistent with the

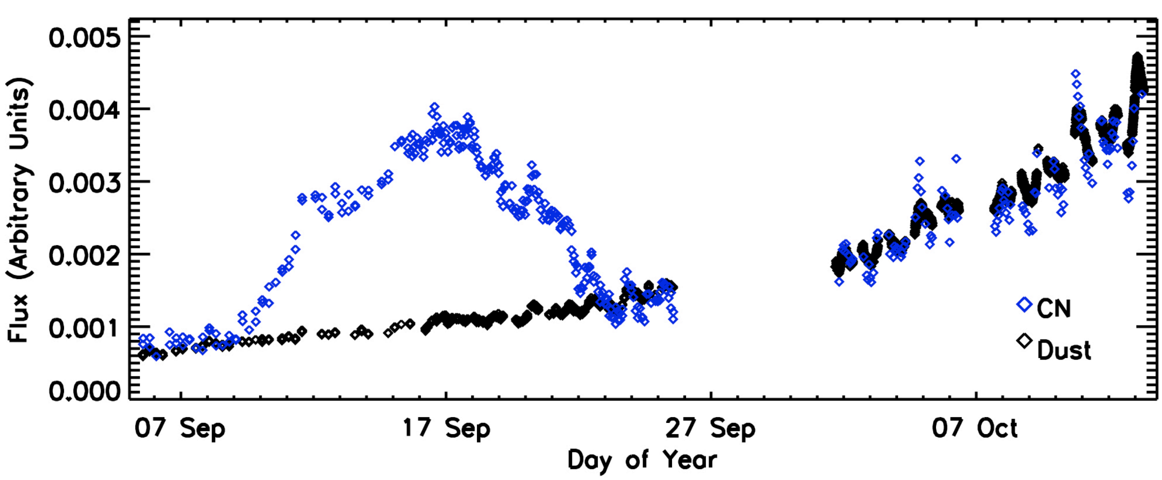

Fig. 1: Light curve of 103P acquired with the MRI CN (blue) and Clear1 (black) filters. Data are plotted in arbitrary flux units and scaled to align the curves. No continuum was removed from the CN fluxes. Between Sept. 5 – 17, the CN gas production rate increased with as much as a factor 7 and then slowly decreased to its prior trend by Sept. 24, with no change in the dust production rate.

increases before and after this period in both CN and dust due to the decreasing range from the spacecraft to the comet and the increasing activity of the nucleus as it approaches the Sun. The gap in data from Sept. 25 through Oct 1st, was due to a scheduled break in the observations for calibration observations, a trajectory correction maneuver, and preparations for beginning infrared spectroscopy observations in addition to the continuation of visual observations of the comet.

This long-duration, gradual increase and decrease of gaseous emission without any corresponding increase in the dust is very unlike typical cometary outbursts, which have sudden onsets and are usually accompanied by considerable dust. This Hartley 2 CN anomaly is dissimilar to the activity observed at 9P/Tempel 1 and not like anything we are aware of in any other comet.

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