EPOXI'S MISSION TO COMET 103P/HARTLEY 2.

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Introduction: Two science investigations use the Deep Impact (DI) flyby spacecraft (Fig.1) that remains operational after its July, 2005 encounter with 9P/Tempel 1. Observations of extrasolar planets form the EPOCh phase of the mission (**E**xtrasolar **P**lanet **O**bsrervations and **Ch**aracterization), while the flyby of 103P/Hartley 2 in October, 2010 is the target of DIXI (**D**eep **I**mpact e**X**tended **I**nvestigation) and this presentation. The name EPOXI is a combined acronym from EPOCh and DIXI. By relating the comae of comets to their nuclei and studying the diversity among cometary nuclei and the heterogeneity within them, our objective is to determine how comets form and evolve over multiple orbits around the Sun.

Fig.1. The Deep Impact Flyby spacecraft carries two imagers (MRI and HRI) and an IR spectrometer.

Unexpected Results from Deep Impact: On approach to Tempel 1, DI cameras observed numerous, brief outbursts correlated with rotational phase [1]. In what form do these and other phenomena occur on other comets? Details of coma jet activity were unprecedented in the approach and flyby of Tempel 1 [2], indicating that some jets originate over broad areas of the nucleus while others are highly localized. There is also an indication that some jets may originate from locations beyond the terminator.

The images of Tempel 1's nucleus revealed ubiquitous layers [3] showing signs of flow over the nucleus bordered by backwasting scarps that may play a significant role in the sublimation of volatiles. Some of these features may be young and indicate contemporary geologic activity [3], while others may be primitive and indicate the mode of formation of the nucleus [4]. Similar features are hinted at in earlier, lower resolution images of Wild 2 and Borrelly; what will the high-resolution capability of the MRI and HRI cameras yield on another Jupiter family comet nucleus?

Enhancements of H_2O and CO_2 were observed in different locations in the inner coma with the IR spectrometer [5]. Will this be seen at comet Hartley 2? The unambiguous detection of water ice on the surface of a comet in discrete locations of areal extent too small to produce the OH of the ambient coma indicates that sublimation of water ice is dominated by subsurface ice [6]. To what extent can the results from Tempel 1 be generalized to other comets?

Opportunities for Hartley 2 Flyby: The same cameras (MRI and HRI) and IR spectrometer will observe two comets at similar spatial resolution in order to assess the similarity or diversity of surface morphology and by inference, surface properties. The asymmetry of volatiles suggest either heterogeneous nuclei by composition or a radial gradient of volatile species coupled with differences of insolation and surface erosion with location. Observing two comets with the same instruments will allow comparisons that might distinguish between possible mechanisms for the observed asymmetries and for the production of volatiles in general in the coma. The rotational photometry of Hartley 2 will be acquired with higher time resolution than at Tempel 1 to characterize any possible outbursts and for comparison with those at Tempel 1.

Target and Mission: 103P/Hartley 2, discovered 15 March, 1986 has a 6.41 yr period. Flyby date: 11 October, 2010. Fig. 2 shows the spacecraft's trajectory past the comet.. Maximum spatial resolution is 9 m/px (MRI) and 1.8m/px (HRI), closest approach at 900 km.

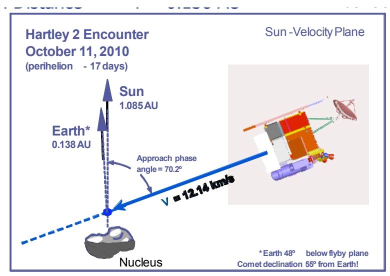

Fig. 2 Spacecraft trajectory: flyby speed 12.14 km/s, phase angle range 70° - 110°.

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