HERSCHEL SPACE OBSERVATORY

Comet 103P/Hartley 2 in a new light: *Herschel* studies the EPOXI encounter comet

In the period 24 October to 17 November 2010 the ESA *Herschel Space Observatory* is using its complement of state-of-the-art instruments to observe the far-infrared and submillimetre spectrum and to image the thermal dust radiation of comet 103P/Hartley 2, covering the 55-671 μm spectral range. *Herschel* is taking part in an extraordinary worldwide astronomical campaign to study comet Hartley 2 before, during, and after the flyby by the NASA EPOXI (Extrasolar Planet Observation and Deep Impact Extended Investigation) mission on 4 November 2010 (closest approach at 15:00 CET).

This year's return of comet Hartley 2 is exceptional. The comet has made its perihelion passage on 28 October 2010, having passed at 0.13 AU (18 million km) from the Earth on 20 October. This has been the comet's closest approach to the Earth since its discovery in 1986 and by far its closest approach in the next century. Comet Hartley 2 passed just 0.11 AU (16.4 millions km) from *Herschel* on October 20, providing an opportunity to acquire sensitive measurements, complementary to the observations from EPOXI and other facilities. The early *Herschel* observations of comet Hartley 2 already demonstrate the observatory's unique capabilities: sensitive far-infrared continuum images constrain the size of the large dust particles and spectra reveal the distribution of water molecules released from the nucleus as the ices evaporate when the comet approaches the Sun, about 230 kg every second. The water excitation is constrained using observations of high-excitation rotational water transitions using the three *Herschel* instruments: the Heterodyne Instrument for the Far Infrared (HIFI), the Spectral and Photometric Imaging REceiver (SPIRE), and the Photodetector Array Camera and Spectrometer (PACS). PACS and SPIRE allow quasi-simultaneous measurements of strong water lines. HIFI spectrally resolves the narrow line profiles, which yields key information on the kinematics of the comet's outgassing. PACS also provides images of the dust and water emission at the time of the EPOXI flyby.

"Observations of the dust coma with PACS and SPIRE allow us to constrain properties of the large dust particles and to measure the dust production rate", said Dr. Dominique Bockelée-Morvan, team member and scientist from LESIA in France. "The SPIRE observations represent the first imaging of a comet at these wavelengths of the electromagnetic spectrum", said Prof. Dr. Bruce Swinyard, team member and scientist from the University College London in the UK. "This close approach of comet Hartley 2 allows observations of weak spectral lines, not previously observed in short-period comets and high spatial resolution imaging of the water emission in the coma", said Dr. Dariusz Lis, team member from the California Institute of Technology in the USA. "We are looking forward to seeing these scientifically exciting data arrive", said Dr. Miriam Rengel, from the Max-Planck-Institut für Sonnensystemforschung in Germany, team member and HIFI calibration scientist.

The fast movement of comet Hartley 2, the constraints caused by the direct sunlight heating of the telescope's star trackers, and the need to schedule observations with multiple instruments during the same operational day required detailed planning for this campaign by the *Herschel* Mission Planning Team. Thanks to all these efforts, *Herschel* is observing comet Hartley 2 in fantastic detail in support of the EPOXI flyby event.

The observations reported here are part of the *Herschel* Guaranteed Time Key program "Water and related chemistry in the Solar System" (HssO), which includes an international team of scientists led by Principal Investigator Dr. Paul Hartogh (Max-Planck-Institut für Sonnensystemforschung, Germany)*.

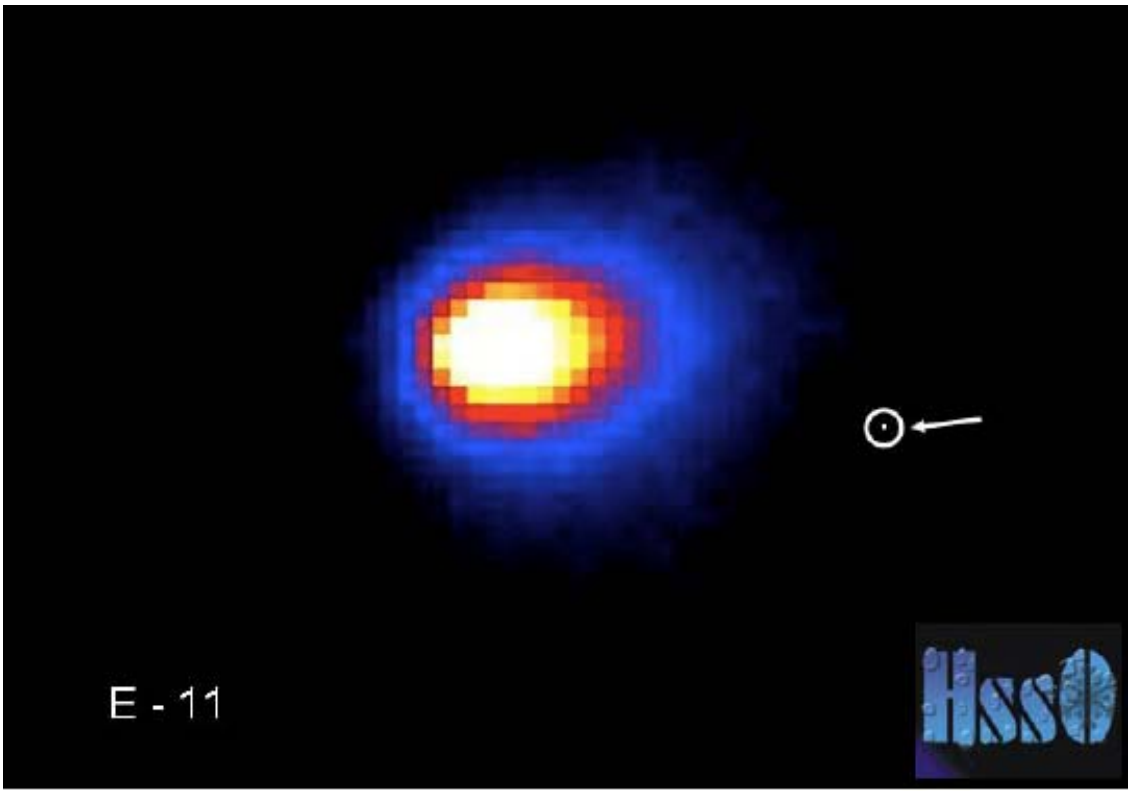

Figure 1*: Comet 103P/Hartley 2 as seen by Herschel/SPIRE. This processed 8' x 5' image was taken with SPIRE on 24 October 2010 at 250 μm, 11 days before the EPOXI´s Encounter phase, with a distance between Herschel and comet Hartley 2 of 17.2 million km. The Sun symbol and arrow indicate the projected direction towards the Sun.*

(Image Credit: ESA/Herschel/HSSO Consortium)

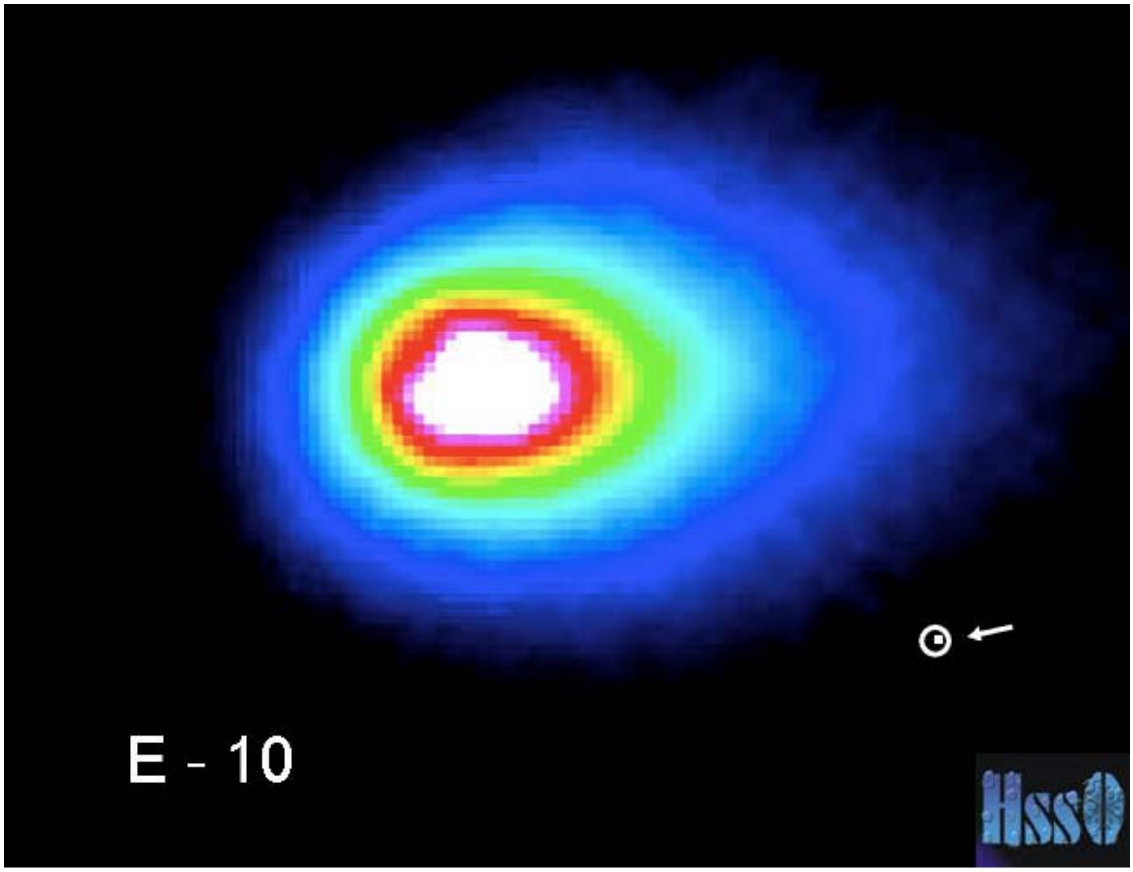

Figure 2*: Comet 103P/Hartley 2 as seen by Herschel/PACS. This processed 1.7' x 1.3' image was taken with PACS on 25 October 2010, in its "blue" channel (70 μm), 10 days before the EPOXI´s Encounter phase, with a distance between Herschel and comet Hartley 2 of 17.5 million km. The Sun symbol and arrow indicate the projected direction towards the Sun.*

(Image Credit: ESA/Herschel/HssO Consortium)

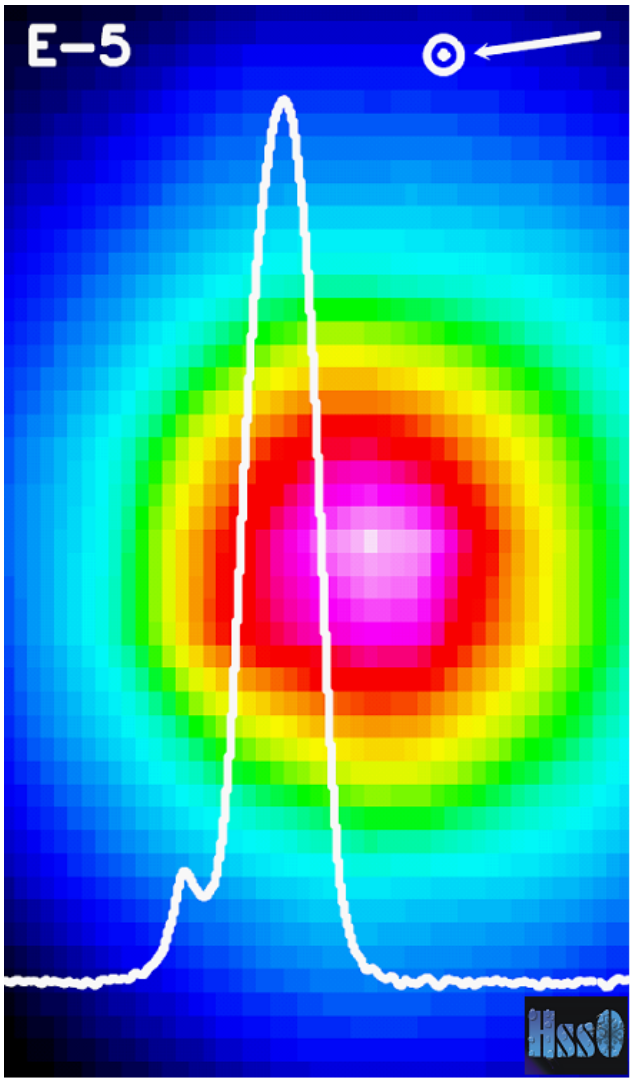

Figure 3*: A 1.5' x 3' image of the 557 GHz water emission in comet 103P/Hartley 2, obtained by Herschel/HIFI, with superposed high-resolution spectrum toward the peak. The data were taken on 30 October 2010 at 15 UT, five days before the EPOXI encounter, with a distance between Herschel and comet Hartley 2 of 19.5 million km. The derived water production rate is 230 kg per second. The Sun symbol and arrow indicate the projected direction towards the Sun.*

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*(Image Credit: ESA/Herschel/***HssO** *Consortium)*

*HssO partner institutes involved in the comet Hartley 2 observations:

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Herschel is an ESA space observatory with science instruments provided by European-led Principal Investigator consortia and with important participation from NASA.

For more information on *Herschel* consult:

ESA SciTech website: http://sci.esa.int/herschel/
ESA Herschel Science Centre website: http://herschel.esac.esa.int/

For more information on HssO consult:

HssO website: http://www.mps.mpg.de/projects/herschel/HssO/index.htm

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