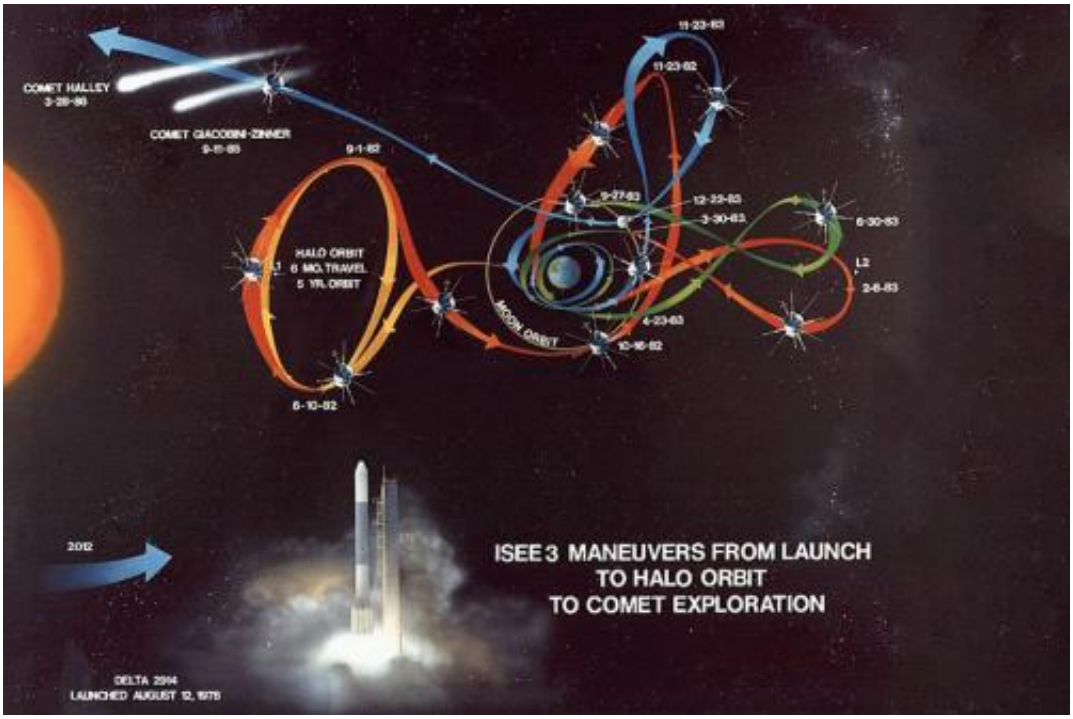
A timeline of deep-space comet encounters

November 10 2014



Projected orbit showing a planned 1985 encounter with Comet Giacobini-Zinner for the International Cometary Explorer

12th November 2014. That is the date in which Rosetta, led by the European Space Agency, will release its lander Philae to touchdown on Comet 67P/Churyumov-Gerasimenko in outer space.

The Open University is one of several partners involved in this extraordinary space mission, and Professor Ian Wright leads a team of researchers that have designed Ptolemy, an instrument capable of

performing isotopic measurements on the comet's surface.

The mission has been over 10 years in the making after Rosetta set off on its journey in March 2004. After being awoken from hibernation in January 2014, the spacecraft arrived at the comet in August, in preparation for this month's rendezvous.

Ahead of next week's landing, a stunning selection of images have been retrieved from the online archives that shows just how close space missions have come to comets in the past.

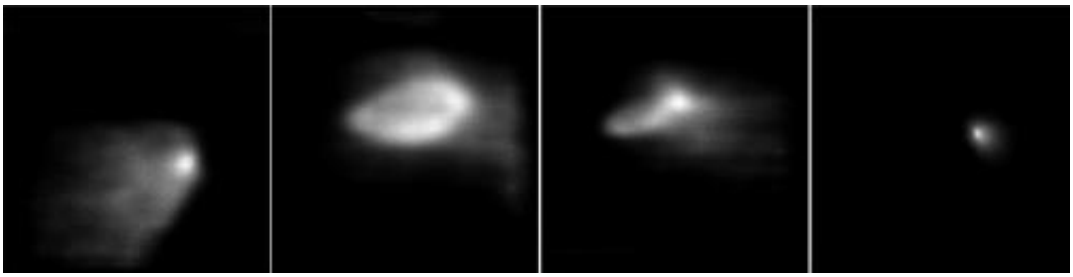
1985: International Cometary Explorer ('ICE')

The 'ICE' spacecraft was the first to fly past a comet in 1985, and later went on to join the international exploration of Halley's Comet.

ICE passed through comet Giacobini-Zinner within 7,800km of the nucleus on Sept 11, 1985.

1986: The 'Halley Armada'

In 1986 - dubbed the "Year of the Comet" - several international space probes were sent to examine Halley's Comet as part of the 'Halley Armada'. These included two Russian spacecraft (Vega 1 and 2), two Japanese (Sagigake and Suisei), and one from the European Space Agency (Giotto).



Collection of images showing Vega 1's encounter with Comet Halley. All images taken during a flyby on 6th March 1986

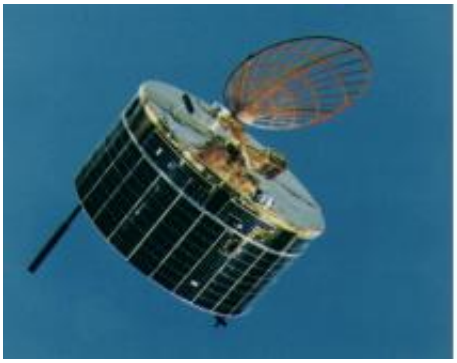
Vega 1 was the vanguard of the international fleet, and began formal studies on 4th March 1986, approaching within a distance of 8,889 km to Halley's Comet.

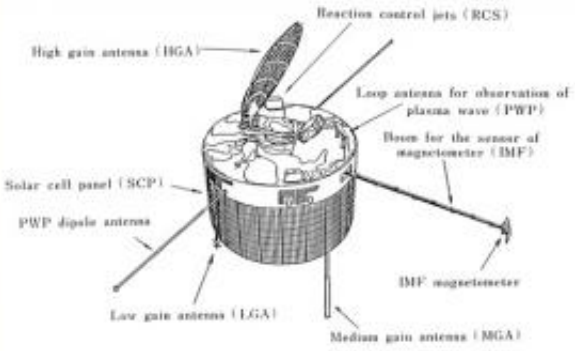
Collection of images from Vega 2, encountering Comet Halley three days after twin spacecraft Vega 1 had made a flyby. Images taken on 9th March 1986

Vega 2, the twin of Vega 1, first encountered Halley's Comet on 7th March 1986 from a distance of 14million km, taking photos from a safer distance.

A series of images taken by Suisei's Ultraviolet Imager (UVI) of Comet Halley from a distance of over 150,000km during the flyby on 8th March 1986

Suisei, developed by the Japanese Aerospace Exploration Agency, encountered Halley's Comet on 8th March 1986, within a distance of 151,000km.





The image shows a diagram of the Sakigake configuration, as it travelled within 7milliion km of Comet Halley during 1986

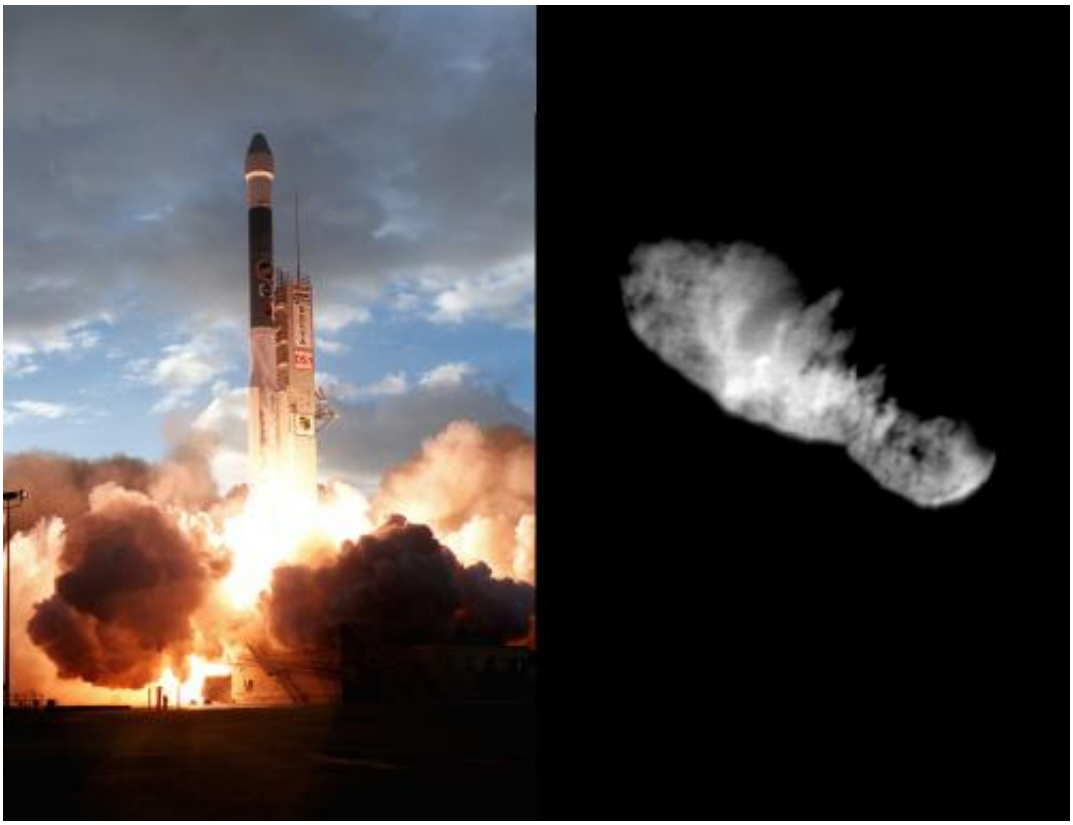
Sakigake, nearly identical to Suisei, was sent on a long-range encounter with Halley, and made its closest approach on 11th March 1986 at 6.9million km.

Comet Halley's nucleus as seen by Giotto during a flyby on 13th March 1986. The image was captured by the Halley Multicolour Camera (HMC)

Giotto, the ESA's first deep-space mission, made the closest approach to the comet, flying within just 600km of Halley and provided groundbreaking data and images.

2001: Deep Space 1

In 2001, NASA's Deep Space 1 spacecraft made a close encounter with Comet Borrelly, after an extended mission that had an original goal of testing innovative technologies for future use.

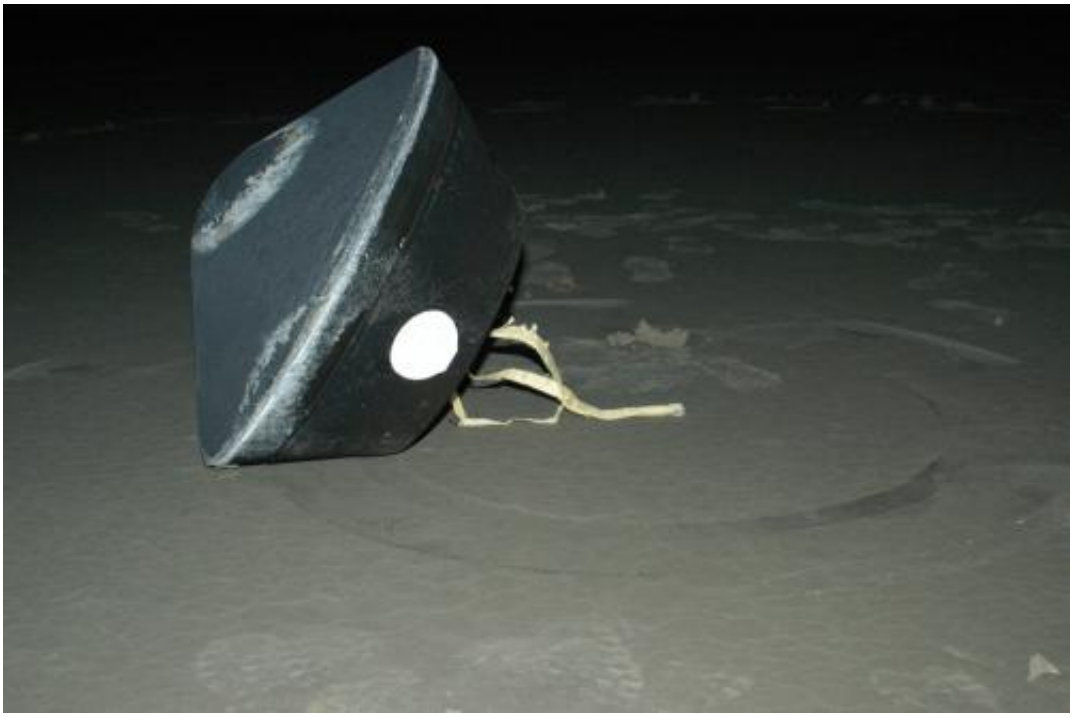


(Left) a Boeing Delta II rocket launches Deep Space 1 towards outer space in 1998 (Image source), and (right) the then-highest resolution view of the rocky nucleus from Comet Borrelly in 2001

On 22nd September 2001, Deep Space 1 passed within 2,200km of Comet Borrelly to obtain high quality pictures and infrared spectra of the nucleus.

2004: Stardust

In 2004, NASA's Stardust spacecraft completed a first of its kind, by successfully collecting dust samples from comet Wild 2, along with samples of cosmic dust, and successfully delivering them back to Earth in a return capsule in 2006.

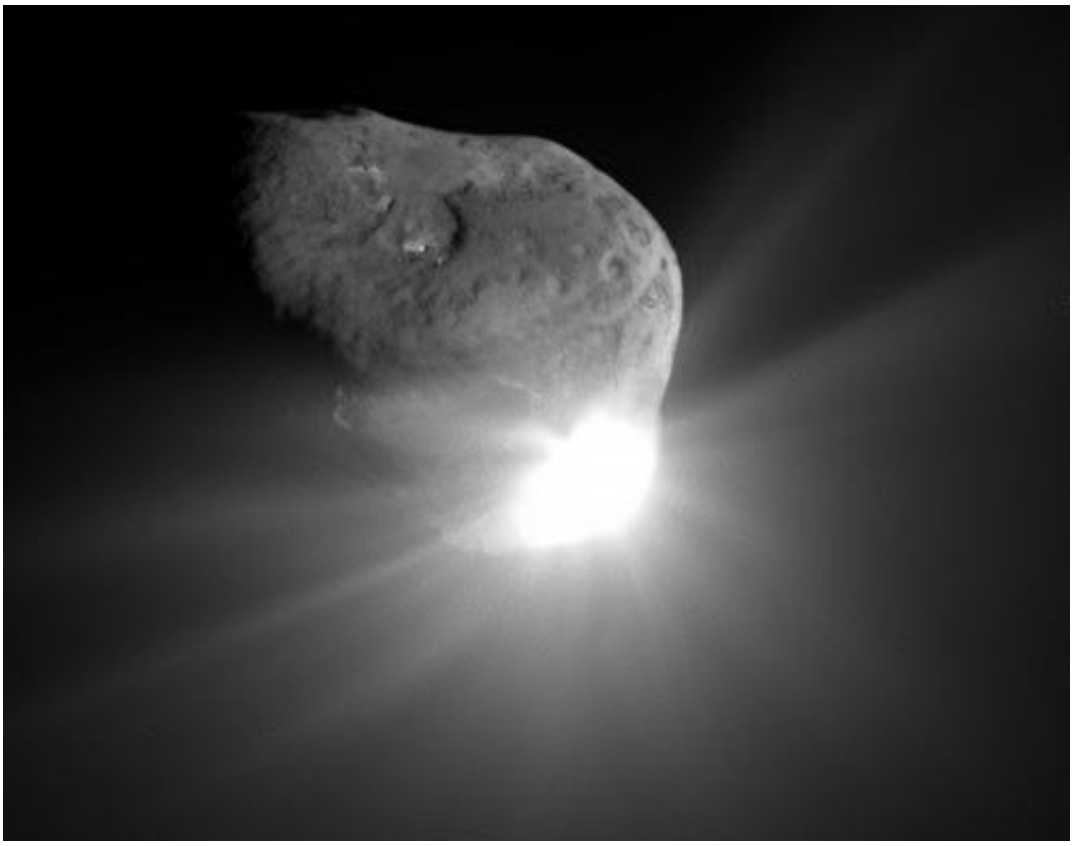


NASA's Stardust sample return capsule lands in Utah on 15th January 2006, after successfully returning from Comet Wild 2 with interstellar samples

Stardust flew within 240km of comet Wild 2 in order to collect samples and capture detailed imagery, on 2nd January 2004.

2005: Deep Impact

The 2005 Deep Impact mission was the first to directly impact a comet's surface. Previous missions to comets had been flybys to study from a distance, however Deep Impact was developed to study the interior composition of Comet Tempel 1.



On 3rd July 2005, Deep Impact released an 'impactor' spacecraft into the path of the comet. The impactor collided with the nucleus of Comet Tempel 1, producing a bright light, along with debris and dust, providing new information about how a comet is formed.

2010: EPOXI

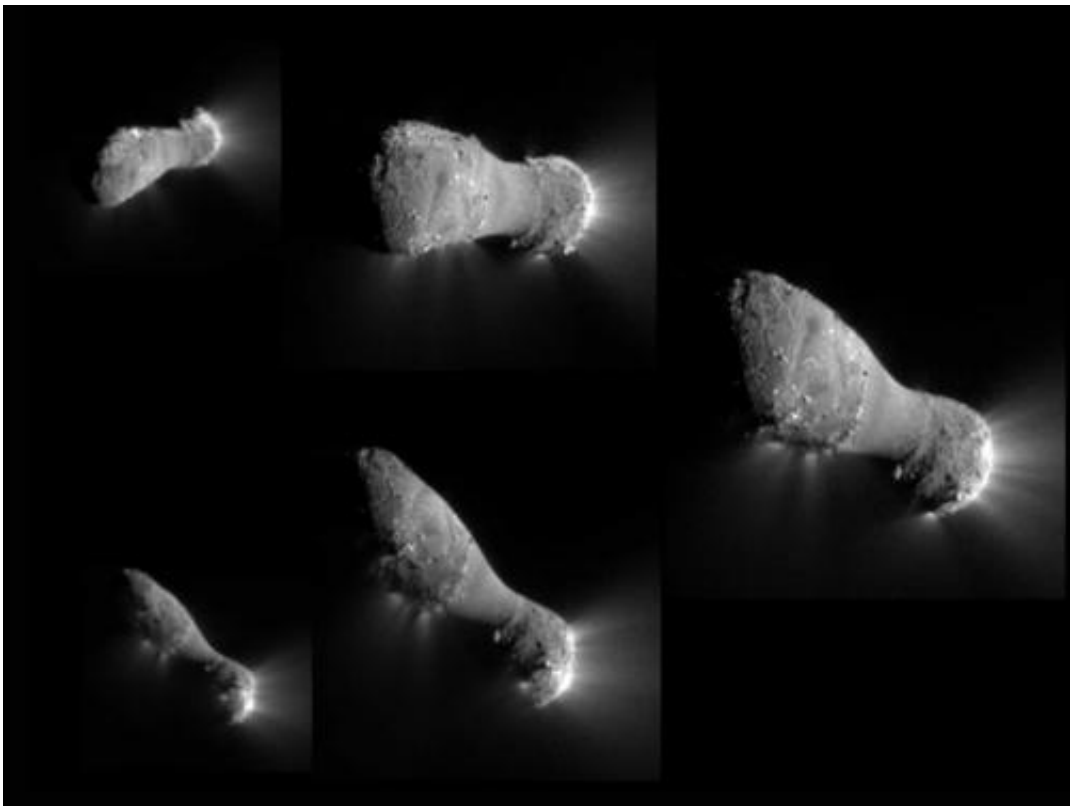


Image montage from the EPOXI mission, as different photos were taken from underneath Comet Hartley 2 during a flyby on 4th November 2010

Following the successful Deep Impact mission, the spacecraft was still fit to fly, and a new mission - EPOXI - was formed to flyby Comet Hartley 2.

The closest approach was made on 4th November 2010, passing within 694km of Hartley 2, and is the only such hyperactive comet visited by a spacecraft.

2011: Stardust (NExT)

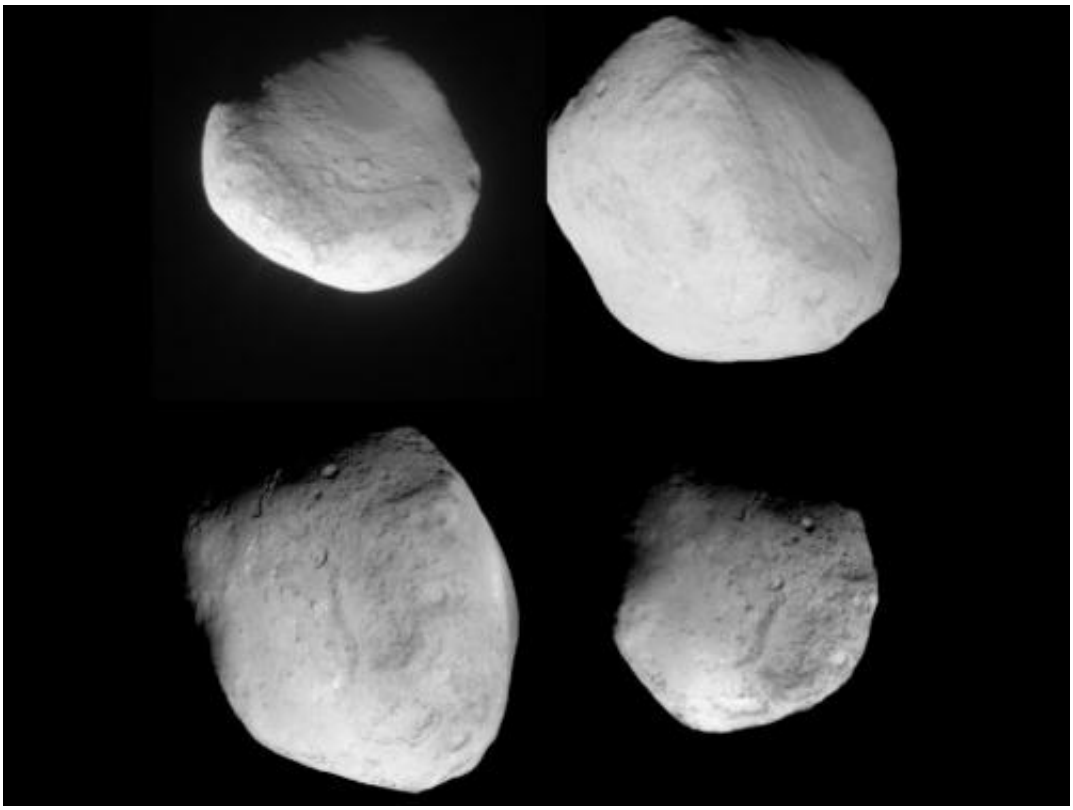
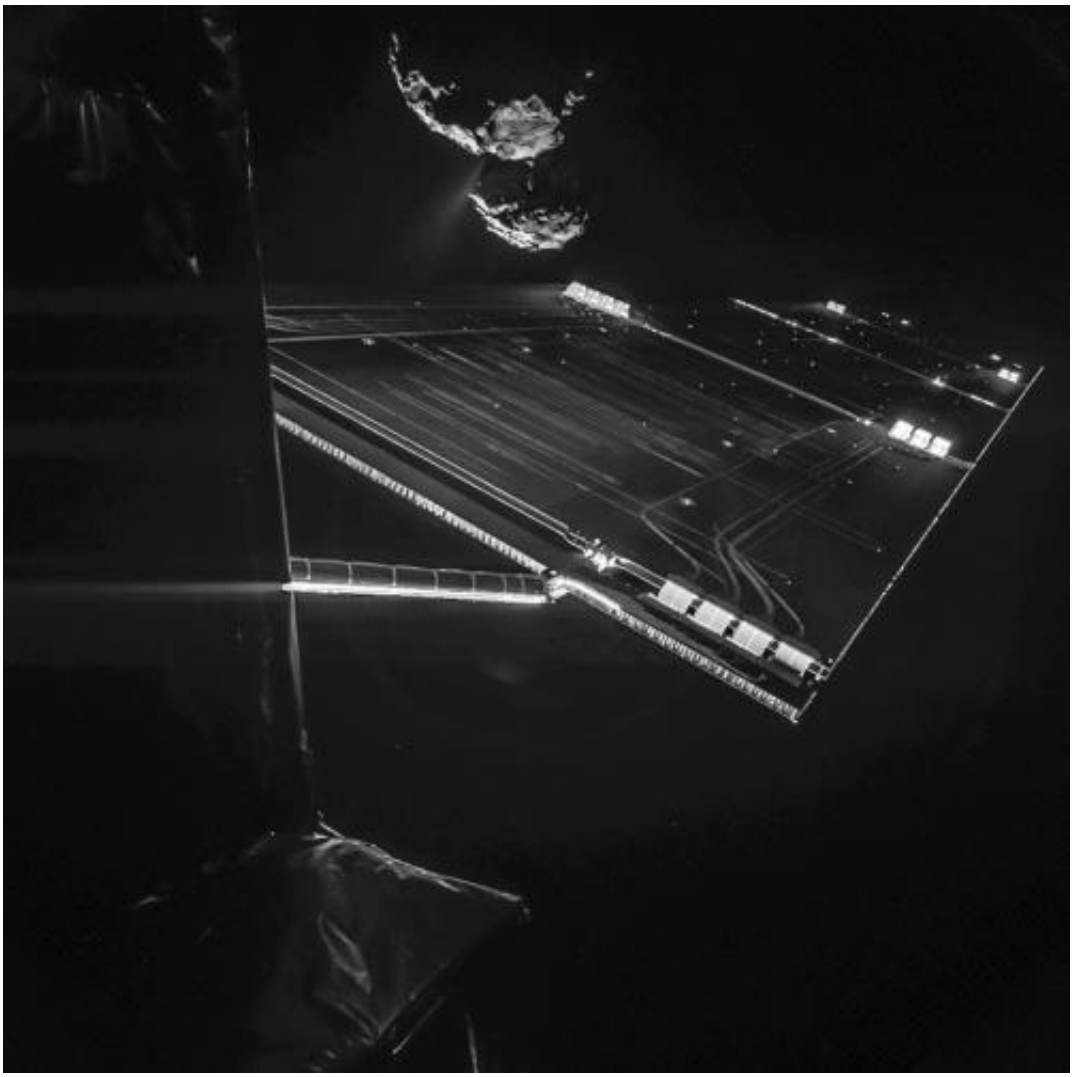


Image mosaic showing four different views of Comet Tempel 1, taken by the Stardust spacecraft during a flyby on 14th February 2011

Following Stardust's 2004 mission to Wild 2, the spacecraft went on an extended mission - NExT - and in February 2011 incepted comet Tempel 1, previously visited by Deep Impact in 2005.

Stardust completed a successful flyby of Tempel 1 on 14th February 2011, after the spacecraft's approach of just 181km from the comet.

2014: Rosetta



The CIVA camera on Rosetta's Philae lander captures a stunning selfie from within 16km of Comet 67P/Churyumov–Gerasimenko, on 14th October 2014

Having already performed flyby missions, the world now eagerly awaits the 12th November, as Rosetta prepares to send its lander to Comet 67P/Churyumov–Gerasimenko. Natalie Starkey, a Research Associate at The Open University, this week described it as the "greatest space mission of our lifetime" as the date edges closer.

There will undoubtedly be stunning high quality images retrieved from

the continued Rosetta mission, and as Philae makes a touchdown on the comet's surface, however in the meantime we have some wonderful photographs already returned to Earth.

More information: *The story is courtesy of The Open University. The original article can be found at* www.openuniversity.edu/news/ne … ace-comet-encounters .

Provided by The Open University