X−rays reveal 250,000 tonnes of water released by Deep Impact (Forwarded)

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X−RAYS REVEAL 250,000 TONNES OF WATER RELEASED BY DEEP IMPACT

Over the weekend of 9−10 July 2005 a team of UK and US scientists, led by Dr. Dick Willingale of the University of Leicester, used NASA's Swift satellite to observe the collision of NASA's Deep Impact spacecraft with comet Tempel 1.

Reporting today (Tuesday) at the UK 2006 National Astronomy Meeting in Leicester, Dr. Willingale revealed that the Swift observations show that the comet grew brighter and brighter in X−ray light after the impact, with the X−ray outburst lasting a total of 12 days.

"The Swift observations reveal that far more water was liberated and over a longer period than previously claimed," said Dick Willingale.

Swift spends most of its time studying objects in the distant Universe, but its agility allows it to observe many objects per orbit. Dr. Willingale used Swift to monitor the X−ray emission from comet Tempel 1 before and after the collision with the Deep Impact probe.

The X−rays provide a direct measurement of how much material was kicked up after the impact. This is because the X−rays were created by the newly liberated water as it was lifted into the comet's thin atmosphere and illuminated by the high−energy solar wind from the Sun.

"The more material liberated, the more X−rays are produced," explained Dr. Paul O'Brien, also from the University of Leicester.

The X−ray power output depends on both the water production rate from the comet and the flux of subatomic particles streaming out of the Sun as the solar wind. Using data from the ACE satellite, which constantly monitors the solar wind, the Swift team managed to calculate the solar wind flux at the comet during the X−ray outburst. This enabled them to disentangle the two components responsible for the X−ray emission.

Tempel 1 is usually a rather dim, weak comet with a water production rate of 16,000 tonnes per day. However, after the Deep Impact probe hit the comet this rate increased to 40,000 tonnes per day over the period 5−10 days after impact. Over the duration of the outburst, the total mass of water released by the impact was 250,000 tonnes.

One objective of the Deep Impact mission was to determine what causes cometary outbursts. A simple theory suggests that such outbursts are caused by the impact of meteorites on the comet nucleus. If this is the case, Deep Impact should have initiated an outburst.

Although the impact was observed across the electromagnetic spectrum, most of what was seen was directly attributable to the impact explosion. After 5 days, optical observations showed that the comet was indistinguishable from its state prior to the collision. This was in stark contrast to the X−ray observations.

The analysis of the X−ray behaviour by the Swift team indicates that the collision produced an extended X−ray outburst largely because the amount of water produced by the comet had increased.

"A collision such as Deep Impact can cause an outburst, but apparently something rather different from the norm can also happen," said Dr. Willingale. "Most of the water seen in X−rays

came out slowly, possibly in the form of ice−covered dust grains."

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From 4 to 7 April, Dr. Willingale and Dr. O'Brien can be contacted via the NAM press office (see above)

IMAGES

Images and graphs are available on the web at:
http://www.star.le.ac.uk/~rw/deepimpact/

NASA Deep Impact web site:
http://deepimpact.jpl.nasa.gov/home/index.html

NOTES FOR EDITORS

UK Involvement

The UK role in Swift has been to provide core elements of the narrow field instruments (the X−ray telescope and the UV/Optical telescope), utilising mature technology already developed for the ESA XMM−Newton mission, and the JeT−X instrument.

University of Leicester

Lead role in the X−ray telescope design, focal plane camera assembly and X−ray design (using past experience from JET−X and XMM−Newton). The UK SWIFT Science Data Centre at Leicester will provide an archive of all SWIFT data, with open access for the wider UK astronomical community.

Mullard Space Science Laboratory−UCL

The major part of the UV/Optical telescope was constructed at MSSL using designs and expertise from the XMM−Newton Optical Monitor.

The Deep Impact mission was managed by NASA's Jet Propulsion Laboratory, Pasadena, California. Swift is a medium−class NASA explorer mission in partnership with the Particle Physics and Astronomy Research Council in the United Kingdom and the Italian Space Agency. The Swift mission is managed by NASA Goddard. Penn State controls science and flight operations from the Mission

Operations Center in University Park, Pennsylvania.

The spacecraft was built in collaboration with national laboratories, universities and international partners, including Penn State University; Los Alamos National Laboratory, New Mexico; Sonoma State University, Rohnert Park, Calif.; Mullard Space Science Laboratory, Dorking, Surrey, UK; the University of Leicester, UK; Brera Observatory in Milan; and the ASI Science Data Centre in Frascati, Italy.
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