

A tale of two comets: MESSENGER captures images of Encke and ISON

November 26 2013



MESSENGER image of comet 2P/Encke during its closest approach to Mercury. At that time, Encke was approximately 2.3 million miles (3.7 million kilometers) from MESSENGER and 32.7 million miles (52.6 million kilometers) from the Sun. The image is 7° by 4.7° in size and has been slightly smoothed to enhance the faint tail of the comet. The tail was oriented nearly side on to MESSENGER in this image and is seen to stretch several degrees from the comet's bright coma in the direction away from the Sun. MESSENGER's cameras have been acquiring targeted observations ([watch an animation here](#)) of Encke since October 28 and ISON since October 26, although the first faint detections didn't come until early November. During the closest approach of each comet to Mercury, the Mercury Atmospheric and Surface Composition Spectrometer

(MASCS) and X-Ray Spectrometer (XRS) instruments also targeted the comets. Observations of ISON conclude on November 26, when the comet passes too close to the Sun, but MESSENGER will continue to monitor Encke with both the imagers and spectrometers through early December. Read this mission news story for more details. The MESSENGER spacecraft is the first ever to orbit the planet Mercury, and the spacecraft's seven scientific instruments and radio science investigation are unraveling the history and evolution of the Solar System's innermost planet. During the first two years of orbital operations, MESSENGER acquired over 150,000 images and extensive other data sets. MESSENGER is capable of continuing orbital operations until early 2015. Credit: NASA/Johns Hopkins University Applied Physics Laboratory/Carnegie Institution of Washington/Southwest Research Institute

On November 18, NASA's Mercury-orbiting MESSENGER spacecraft pointed its Mercury Dual Imaging System (MDIS) at 2P/Encke and captured this image of the comet as it sped within 2.3 million miles (3.7 million kilometers) of Mercury's surface. The next day, the probe captured another companion image of C/2012 S1 (ISON), as it cruised by Mercury at a distance of 22.5 million miles (36.2 million kilometers) on its way to its late-November closest approach to the Sun.

MESSENGER's cameras have been acquiring targeted observations of Encke since October 28 and ISON since October 26, although the first faint detections didn't come until early November. During the closest approach of each comet to Mercury, the Mercury Atmospheric and Surface Composition Spectrometer (MASCS) and X-Ray Spectrometer (XRS) instruments also targeted the comets. Observations of ISON conclude on November 26, when the comet passes too close to the Sun, but MESSENGER will continue to monitor Encke with both the imagers and spectrometers through early December.

The spacecraft has a view of the comets very different from that of

Earth-based observers. "MESSENGER imaged Encke only a few days before its perihelion when it was at its brightest," explains Ron Vervack, of the Johns Hopkins University Applied Physics Laboratory, who is leading MESSENGER's comet-observation campaign. "That we are so close to the comet at this time offers a chance to make important observations that could shed light on its asymmetric behavior about perihelion."

In contrast, ISON did not pass as close to Mercury, but the comet was between the Earth and Mercury when it passed closest to MESSENGER. "We saw the side opposite to that visible from Earth," says Vervack, "so our images and spectra are complementary to observations from Earth made at the same time and could aid in understanding the variable activity of the comet as it approached the Sun."



MESSENGER image of comet C/2012 S1 (ISON) during its closest approach to Mercury. At that time, ISON was approximately 22.5 million miles (36.2 million

kilometers) from MESSENGER and 42.1 million miles (67.8 million kilometers) from the Sun. The image is 7° by 4.7° in size and has been slightly magnified and smoothed to enhance the faint tail of the comet. The tail was oriented at an angle to MESSENGER at the time and is foreshortened in this image; however, some faint structure can still be seen. MESSENGER's cameras have been acquiring targeted observations (watch an animation [here](#)) of Encke since October 28 and ISON since October 26, although the first faint detections didn't come until early November. During the closest approach of each comet to Mercury, the Mercury Atmospheric and Surface Composition Spectrometer (MASCS) and X-Ray Spectrometer (XRS) instruments also targeted the comets. Observations of ISON conclude on November 26, when the comet passes too close to the Sun, but MESSENGER will continue to monitor Encke with both the imagers and spectrometers through early December. Read this mission news story for more details. The MESSENGER spacecraft is the first ever to orbit the planet Mercury, and the spacecraft's seven scientific instruments and radio science investigation are unraveling the history and evolution of the Solar System's innermost planet. During the first two years of orbital operations, MESSENGER acquired over 150,000 images and extensive other data sets. MESSENGER is capable of continuing orbital operations until early 2015. Credit: NASA/Johns Hopkins University Applied Physics Laboratory/Carnegie Institution of Washington/Southwest Research Institute

On the day that Encke was closest to Mercury, the MDIS wide-angle camera scanned the comet with all of its 12 filters while the instrument's narrow-angle camera (NAC) snapped images of the rotating comet every 10 minutes to capture a full 360° view. The imaging campaign for ISON was similar, with the NAC capturing a series of stills every 30 minutes.

Several ground- and space-based NASA observatories, as well as many other observatories around the world, are collecting data on the comets. However, none will be able to collect simultaneous images and spectra from X-ray through near-infrared wavelengths when the comets are so close to the Sun, as will MESSENGER. Vervack expects MESSENGER

to gather 15 hours worth of data on Encke and another 25 hours on ISON. "These observations of Encke and ISON fill a gap in heliocentric coverage to which most other observatories don't have access," Vervack says.

Scientists are still combing through the data collected by MASCS, but there are already confirmed detections of several molecules and atoms, including OH, NH, CS, oxygen, carbon, sulfur, and hydrogen. "Far-ultraviolet observations can't be made from ground-based observatories, and only a few instruments in space have been able to look at the comets in the ultraviolet," says Vervack. "The MASCS observations are therefore of great interest."

Scientists were also hoping to obtain the first definitive detections of cometary X-ray emission from silicon, magnesium, and aluminum. "NASA's Chandra X-ray space telescope has observed ISON and Encke and seen X-ray emission from them both," Vervack says. "We are able to make these observations when both comets are closer to the Sun, so the X-ray emissions have the potential to be much more intense." However, a series of large solar flares during the observations increased the contaminating background in the X-ray spectra and have complicated the analysis. "We can't help what the Sun does," says Vervack, "but we're going to analyze the data carefully to see if there are any detections to be had."

Taken together, the MESSENGER observations offer a varied science investigation of the comets. "Whereas the MDIS images will provide a global picture of the [comet](#) coma morphology, MASCS [observations](#) will inform us about the composition of the cometary ices and XRS may be able to tell us what the dust is made of," Vervack says.

"Comet encounters were not considered when the MESSENGER mission was designed," adds MESSENGER Principal Investigator Sean

Solomon of Columbia University. "If Encke and ISON share a few of their secrets on the formation and evolution of the solar system, the MESSENGER team will be delighted with the scientific bonus."

Provided by NASA

Citation: A tale of two comets: MESSENGER captures images of Encke and ISON (2013, November 26) retrieved 9 April 2024 from <https://phys.org/news/2013-11-tale-comets-messenger-captures-images.html>

<p>This document is subject to copyright. Apart from any fair dealing for the purpose of private study or research, no part may be reproduced without the written permission. The content is provided for information purposes only.</p>
--