

# NASA satellite sees solar hurricane detach comet tail

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This is a still taken from a visualization showing Comet Encke and the coronal mass ejection erupting from the surface of the Sun. Credit: NASA

A NASA satellite has captured the first images of a collision between a comet and a solar hurricane. It is the first time scientists have witnessed such an event on another cosmic body. One of NASA's pair of Solar Terrestrial Relations Observatory satellites, known as STEREO, recorded the event April 20.

The phenomenon was caused by a coronal mass ejection, a large cloud of magnetized gas cast into space by the sun. The collision resulted in the complete detachment of the plasma tail of Encke's comet. Observations of the comet reveal the brightening of its tail as the coronal mass ejection swept by and the tail's subsequent separation as it was carried away by the front of the ejection. The researchers combined the images into a movie.

"We were awestruck when we saw these images," says Angelos Vourlidas, lead author and researcher at the Naval Research Laboratory, Washington. "This is the first time we've witnessed a collision between a coronal mass ejection and a comet and the surprise of seeing the disconnection of the tail was the icing on the cake."

Encke's comet was traveling within the orbit of Mercury when a coronal mass ejection first crunched the tail then ripped it completely away. The comet is only the second repeating, or periodic, comet ever identified. Halley's comet was the first.

Scientists at the Naval Research Laboratory made the observations using the Heliospheric Imager in its Sun Earth Connection Coronal and Heliospheric Investigation telescope suite aboard the STEREO-A spacecraft. The results will be published in the Oct. 10 issue of the *Astrophysical Journal Letters*.

Coronal mass ejections are violent eruptions with masses greater than a few billion tons. They travel from 60 to more than 2,000 miles per second. They have been compared to hurricanes because of the widespread disruption they can cause when directed at Earth. These solar hurricanes cause geomagnetic storms that can present hazards for satellites, radio communications and power systems. However, coronal mass ejections are spread over a large volume of space, mitigating their mass and power to create an impact softer than a baby's breath.

Scientists have been aware of the disconnection of the entire plasma tail of a comet for some time, but the conditions that lead to these events remained a mystery. It was suspected that coronal mass ejections could be responsible for some of the disconnected events, but the interaction between a coronal mass ejection and a comet never had been observed.

Preliminary analysis suggests the disconnection likely is triggered by

what is known as magnetic reconnection, in which the oppositely directed magnetic fields around the comet are crunched together by the magnetic fields in the coronal mass ejection. The comet fields suddenly link together, reconnecting, to release a burst of energy that detaches the comet's tail. A similar process takes place in Earth's magnetosphere during geomagnetic storms, powering the aurora borealis and other phenomena.

Comets are icy leftovers from the solar system's formation billions of years ago. They usually reside in the cold, distant regions of the solar system. Occasionally, the gravitational tug from a planet, another comet or a nearby star sends a comet into the inner solar system, where the sun's heat and radiation vaporizes gas and dust from the comet to form its tail. Comets typically have two tails: one of dust and a fainter one of electrically conducting gas called plasma.

"Even though STEREO is primarily designed to study coronal mass ejections, particularly their impact on Earth, we hope this impact will provide many insights to scientists studying comets," said Michael Kaiser, STEREO project scientist at NASA's Goddard Space Flight Center, Greenbelt, Md.

Source: Goddard Space Flight Center

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