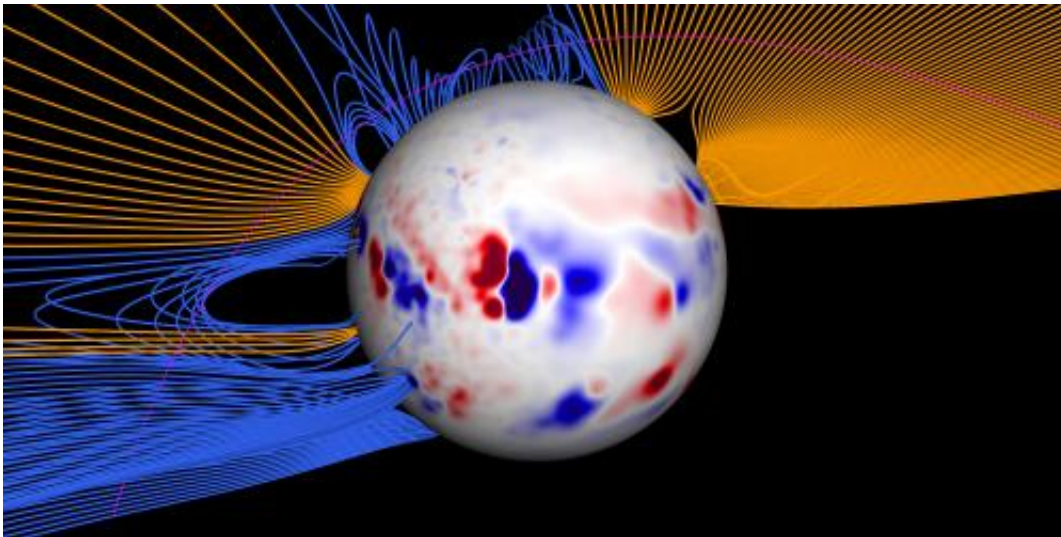


Comet Lovejoy's wiggle offers glimpse of Sun's variable coronal magnetism (w/ video)

June 7 2013, by Bob Yirka



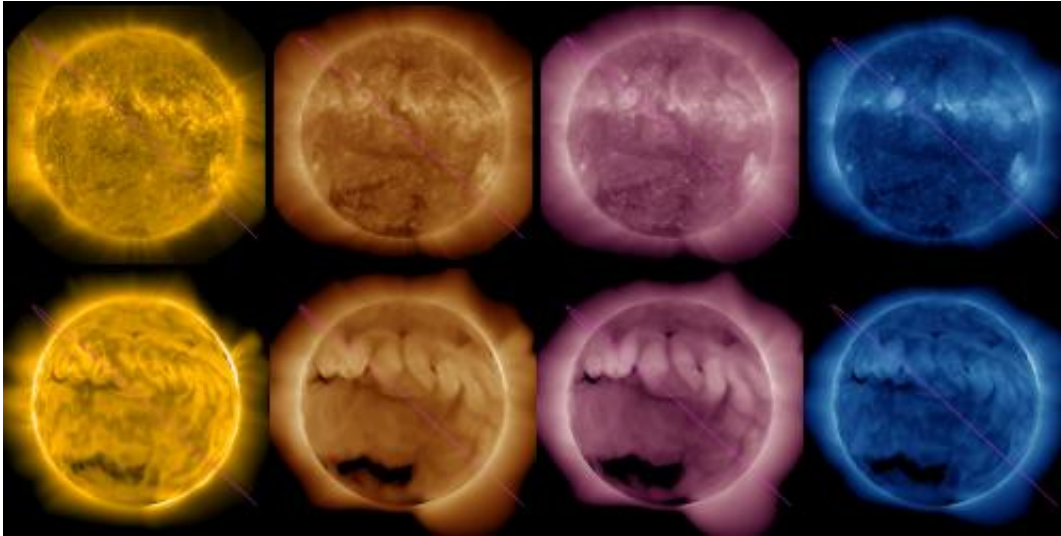
Visualization of the coronal magnetic field through which comet Lovejoy passed. The magenta arc indicates Lovejoy's path, which traversed both open (orange) and closed (blue) magnetic field lines. The unexpected directions and changes in tail motion were found to be consistent with the orientation and variation of the magnetic field along this path, which was determined from a sophisticated computer model of the solar corona. Credit: Cooper Downs

(Phys.org) —A team of researchers studying comet Lovejoy has discovered that as the ball of ice passed through the sun's corona in December 2011, its tail wiggled in a way that allowed them to better understand coronal magnetism. In their paper published in the journal *Science*, the team says observations of Lovejoy's close call with the sun

have helped them improve models used to describe the irregular nature of coronal magnetism.

[Comet Lovejoy](#) is part of a class of comet's known as Kreutz sungrazers—they are believed to be remnants of a much larger comet that broke apart hundreds of years ago. They're called sungrazers because they have a tendency to strike the sun's corona at an angle. Most break apart and disappear—Lovejoy did not. Instead it spun around the sun at very [high velocity](#) and shot back out into space, only to break apart several days later. Sungrazers offer researchers a unique way to study the sun's corona—it's too hot to send a probe—temperatures typically hover in the millions of degrees. Instead they can watch what happens to comets as they are impacted by intense temperatures and magnetism.

What the researchers found most interesting about Lovejoy's close call was the movement of its tail as it passed through parts of the corona—it wiggled, displaying major changes in intensity, direction, persistence and magnitude. Suspecting the wiggling was due to interactions between the ions that make up the comet's tail and magnetism from the corona, the researchers sought to reproduce the effect using models—one of which gave a close approximation of the real thing, suggesting a high degree of accuracy.



Multi-wavelength emission from the portion of the solar corona traversed by comet Lovejoy (magenta arc). Each color represents a different wavelength of extreme ultraviolet (EUV) light. The unique temperature sensitivity of each spectral window provides complementary information into the distribution of hot plasma in the solar corona, which is typically around one to three million degrees. The top row shows NASA Solar Dynamics Observatory (SDO) images. These are compared to emission generated from a computer model of the corona in the bottom row. This comparison was used to understand how well the model describes the large-scale plasma structure of the corona during this time period. Credit: Cooper Downs

Gaining a better understanding of coronal magnetism has become more critical as Earth-bound technology has become more sophisticated. [Solar flares](#) and storms can disrupt [satellite communications](#) and other [electronic equipment](#) and in some cases the grid itself.

Comet Lovejoy came within 140,000 kilometers of the surface of the sun—its path was traced using ultraviolet light based equipment at facilities such as the Solar Terrestrial Relations Observatory and the Solar Dynamics Observatory. The researchers are hoping that their models will one day be able to help with space weather forecasting,

giving operators of sensitive equipment time to shut down before it's too late.

More information: Probing the Solar Magnetic Field with a Sun-Grazing Comet, *Science* 7 June 2013: Vol. 340 no. 6137 pp. 1196-1199
[DOI: 10.1126/science.1236550](https://doi.org/10.1126/science.1236550)

ABSTRACT

On 15 and 16 December 2011, Sun-grazing comet C/2011 W3 (Lovejoy) passed deep within the solar corona, effectively probing a region that has never been visited by spacecraft. Imaged from multiple perspectives, extreme ultraviolet observations of Lovejoy's tail showed substantial changes in direction, intensity, magnitude, and persistence. To understand this unique signature, we combined a state-of-the-art magnetohydrodynamic model of the solar corona and a model for the motion of emitting cometary tail ions in an embedded plasma. The observed tail motions reveal the inhomogeneous magnetic field of the solar corona. We show how these motions constrain field and plasma properties along the trajectory, and how they can be used to meaningfully distinguish between two classes of magnetic field models.

© 2013 Phys.org

Citation: Comet Lovejoy's wiggle offers glimpse of Sun's variable coronal magnetism (w/ video) (2013, June 7) retrieved 24 April 2024 from <https://phys.org/news/2013-06-comet-lovejoy-wiggle-glimpse-sun.html>

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.