

New observations of exploding stars reveal pauses, flickers and flares not reliably seen before

December 3 2010

Astronomers have traced the waxing and waning light of exploding stars more closely than ever before and seen patterns that aren't yet accounted for in our current understanding of how these eruptions occur.

Using data from a sensitive instrument aboard a satellite that images the entire sky every 102 minutes, they studied four of these stars, or novae, that exploded so violently their light would have been visible without a [telescope](#) and measured their brightness over the course of the outburst.

Three of the novae stalled before reaching a peak, and all flickered or flared as the explosions ran their course, they report in *The [Astrophysical Journal](#)*.

The instrument they used – the Solar Mass Ejection Imager – was developed by a team led by astrophysicist Bernard Jackson at the Center for Astrophysics and Space Sciences at the University of California, San Diego, to study the sun. Rebekah Hounsell, a graduate student at Liverpool John Moores University in Britain made the measurements while visiting UC San Diego.

Because starlight is a distraction for Jackson's team, noise they must subtract from their data so that they can focus on the sun's outer corona and the heliosphere, they make detailed maps of stellar light, including its brightness.

In those maps Hounsell identified the four novae by finding points of light that rapidly brightened and dimmed over the course of days.

Wavering Light

Other astronomers had observed a pause in the brightening of novae, or "pre-maximum halt" before, but some thought it an anomaly. The precise time-scale and repeated observations of the current study confirms it, they authors say.

"The reality of this halt as found in all three of the fast-declining novae observed is a challenge to detailed models of the nova outburst," said one of the authors, astrophysicist Mike Bode, of Liverpool John Moores University.

Two independent teams of theorists have already begun to refine their models of how novae explode in response.

Astronomers typically characterize novae's changing light with curves smoothly fit to more sporadic observations, but the rapid cadence of the solar imager captured glimmers that hadn't been observed before. All flickered as their light dimmed and one nova, the slowest of the four to dim, flared brightly twice after reaching its peak luminosity.

These novae are white dwarf stars that steal matter, in the form of hydrogen, from a companion star, often an aging, expanding red giant. As hydrogen accumulates the white dwarf's gravity pulls it in and condenses it until it ignites, setting off a runaway nuclear fusion reaction.

The team speculates that the post-peak flares may correspond to changes in the dynamics of that reaction that still need to be explained.

Catching Missing Stars

"Before Hounsell looked through these data, most novae were observed only after their peak luminance. The instrument's very even cadences and uniformly exposed images allow us to trace the entire evolution of these explosions as they brighten and dim," UC San Diego's Jackson said.

Data from the imager, which has been in operation aboard the Coriolis [satellite](#) since January 2003, allows astronomers to measure novae that they initially missed.

"Even today novae are mainly discovered by amateur astronomers around the world who then alert their professional counterparts to conduct observations," Hounsell said.

As many as five novae bright enough to be detected by SMEI explode in our galaxy each year, Allen Shafter, astronomy professor at San Diego State University and one of the co-authors of the report have previously estimated, but more than half have gone undetected.

"The instrument assures that the brightest and most rapidly evolving novae – ones that brighten and then fade within a few days – are not overlooked," Shafter said. "The high time resolution of these observations has opened up a new window into the study of novae in our galaxy."

Provided by University of California - San Diego

Citation: New observations of exploding stars reveal pauses, flickers and flares not reliably seen before (2010, December 3) retrieved 10 April 2024 from <https://phys.org/news/2010-12-stars-reveal-flickers-flares-reliably.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.