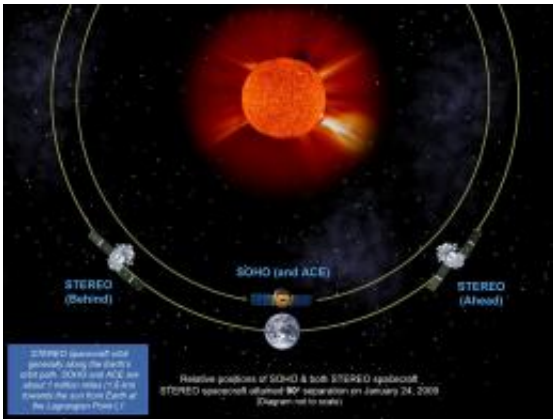


# Mystery of the Solar Tsunami -- Solved (w/ Video)

November 19 2009



The unique orbit of STEREO's twin spacecraft allowed scientists to confirm the existence of solar tsunamis. Credit: NASA

(PhysOrg.com) -- Sometimes you really can believe your eyes. That's what NASA's Solar Terrestrial Relations Observatory (STEREO) is telling researchers about a controversial phenomenon on the sun known as the "solar tsunami."

Years ago, when solar physicists first witnessed a towering wave of hot plasma racing across the sun's surface, they doubted their senses. The scale of the wave was staggering: It rose up higher than Earth itself and rippled out from a central point in a circular pattern millions of kilometers in circumference. Skeptical observers suggested it might be a shadow of some kind—a trick of the satellite's eye—but surely not a real

wave.

"Now we know," says Joe Gurman of the [Solar Physics](#) Laboratory at NASA's Goddard Space Flight Center. "Solar tsunamis are real."

The twin [STEREO spacecraft](#) confirmed their reality in February 2009 when sunspot 11012 unexpectedly erupted. The blast hurled a billion-ton cloud of gas (a coronal mass ejection, or CME) into space and sent a tsunami racing along the sun's surface. STEREO recorded the wave from two positions separated by 90 degrees, giving researchers an unprecedented view of the event.

"It was definitely a wave," says Spiros Patsourakos of George Mason University, lead author of a paper reporting the finding in *Astrophysical Journal Letters*. "Not a wave of water, but a giant wave of hot plasma and magnetism."

The technical name is "fast-mode magnetohydrodynamical wave," or "MHD wave" for short. The one STEREO saw reared up about 100,000 kilometers high, raced outward at 250 km/second (560,000 mph), and packed as much energy as 2400 megatons of TNT (1029 ergs).

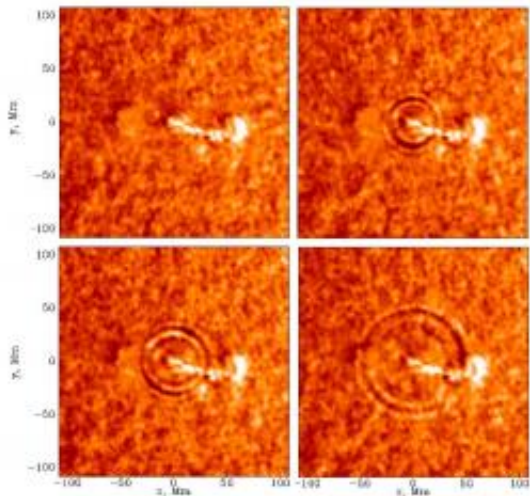
Solar tsunamis were discovered in 1997 by the Solar and Heliospheric Observatory (SOHO). In May of that year, a CME came blasting up from an active region on the sun's surface, and SOHO recorded a tsunami rippling away from the blast site.

"We wondered," recalls Gurman, "is that a wave, or just a shadow of the CME overhead?"

SOHO's single point of view was not enough to answer the question—neither for that first wave nor for many similar events recorded by SOHO in years that followed.

The question remained open until after the launch of STEREO. At the time of the February 2009 eruption, STEREO-B was directly over the blast site, while STEREO-A was stationed at a right angle — "perfect geometry for cracking the mystery," says co-author Angelos Vourlidas of the Naval Research Laboratory in Washington, D.C.

The physical reality of the waves has been further confirmed by movies of the waves crashing into things. "We've seen the waves reflected by sunspots," says Vourlidas. "And there is a wonderful movie of a solar prominence oscillating after it gets hit by a wave. We call it the 'dancing prominence.'"



Scientists first spied tsunami-like waves on the surface of the sun in July 1996 with SOHO. Credit: SOHO (ESA & NASA)

Solar tsunamis pose no direct threat to Earth, but they are important to study. "We can use them to diagnose conditions on the [sun](#)," notes Gurman. "By watching how the waves propagate and bounce off things, we can gather information about the sun's lower atmosphere available in

no other way."

"Tsunami waves can also improve our forecasting of space weather," adds Vourlidas, "Like a bull-eye, they 'mark the spot' where an eruption takes place. Pinpointing the blast site can help us anticipate when a CME or radiation storm will reach Earth."

And they're pretty entertaining, too. "The movies," he says, "are out of this world."

More information: [Astrophysical Journal Letters](http://www.iop.org/EJ/abstract/1538-4357/700/2/L182/): "'Extreme Ultraviolet Waves' are Waves: First Quadrature Observations of an Extreme Ultraviolet Wave from STEREO"  
[www.iop.org/EJ/abstract/1538-4357/700/2/L182/](http://www.iop.org/EJ/abstract/1538-4357/700/2/L182/)

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