Something new on the Sun: Spacecraft observes new characteristics of solar flares

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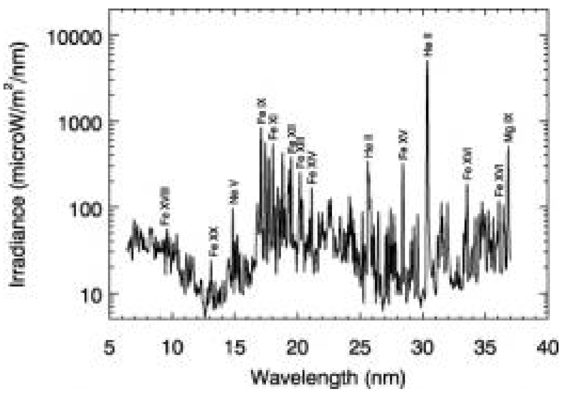

Instead of a conventional picture, the EUV variability Experiment (EVE) on board SDO produces graphs like this, called spectra, that show the total intensity of any given extreme ultraviolet (EUV) wavelength of light coming off of the sun. This image shows a single moment from May 5, 2010. The height of each vertical line represents how much energy is present in that particular wavelength. Spectra like this can measure energy from the sun more comprehensively than instruments that can only “see” a single wavelength. Credit: NASA/SDO/EVE

(PhysOrg.com) -- NASA's Solar Dynamics Observatory, or SDO, has provided scientists new information about solar flares indicating an increase in strength and longevity that is more than previously thought.

Solar flares are intense bursts of radiation from the release of magnetic energy associated with sunspots. They are the solar system's largest explosive events and are seen as bright areas on the sun. Their energy can reach Earth's atmosphere and affect operations of Earth-orbiting communication and navigation satellites.

Using SDO's Extreme ultraviolet Variability Experiment (EVE) instrument, scientists have observed that radiation from solar flares continue for up to five hours beyond the main phase. The new data also show the total energy from this extended phase of the solar flare's peak sometimes has more energy than the initial event.

Video above: A compilation of solar data from various instruments on SDO recording a flare on May 5, 2010. The images on top show the initial magnetic loops of the flare, and a delayed brightening of additional magnetic loops above the originals showing the late phase flare. Along the bottom, graphs from EVE show the extreme ultraviolet light peaking both in time with the main flare and the late phase flare. Credit: NASA/SDO/Tom Woods

"Previous observations considered a few seconds or minutes to be the normal part of the flare process," said Lika Guhathakurta, lead program scientist for NASA's Living with a Star Program at the agency's Headquarters in Washington. "This new data will increase our understanding of flare physics and the consequences in near-Earth space where many scientific and commercial satellites reside."
On Nov. 3, 2010, SDO observed a solar flare. If scientists only had measured the effects of the flare as it initially happened, they would have underestimated the amount of energy shooting into Earth's atmosphere by 70 percent. SDO's new observations provide a much more accurate estimation of the total energy solar flares put into Earth's environment.

"For decades, our standard for flares has been to watch the X-rays as they happen and see when they peak," said Tom Woods, a space scientist at the University of Colorado in Boulder and principal author on a paper in Wednesday's online edition of Astrophysical Journal. "But we were seeing peaks that didn't correspond to the X-rays."

During the course of a year, the team used EVE to map each wavelength of light as it strengthened, peaked, and diminished over time. EVE records data every 10 seconds and has observed many flares. Previous instruments only measured every 90 minutes or didn't look at all wavelengths simultaneously as SDO can.

Video above: On May 5, 2010, shortly after the Solar Dynamics Observatory (SDO) began normal operation, the sun erupted with numerous coronal loops and flares. Many of these showed a previously unseen "late phase flare" appearing minutes to hours after the main flare. Credit: NASA/SDO

To compliment the EVE graphical data, scientists used images from another SDO instrument, the Advanced Imaging Assembly (AIA). Analysis of these images showed the main flare eruption and its extended phase in the form of magnetic field lines called coronal loops that appeared far above the original eruption site. These extra loops were longer and became brighter later than the loops from the main flare and also were physically set apart from those of the main flare.

Because this previously unrealized extra source of energy from flares also is impacting Earth's atmosphere, Woods and his colleagues are studying how the late phase flares can influence space weather. Space weather caused by solar flares can affect communication and navigation systems, satellite drag and the decay of orbital debris.

SDO was launched on Feb. 11, 2010. The spacecraft is the most advanced spacecraft ever designed to study the sun and its dynamic behavior. SDO provides images 10 times clearer than high definition television and more comprehensive science data faster than any solar observing spacecraft in history.

EVE was built by the Laboratory for Atmospheric and Space Physics at the University of Colorado. AIA was built by Lockheed Martin Solar and Astrophysics Laboratory in Palo Alto, Calif.

Provided by JPL/NASA

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