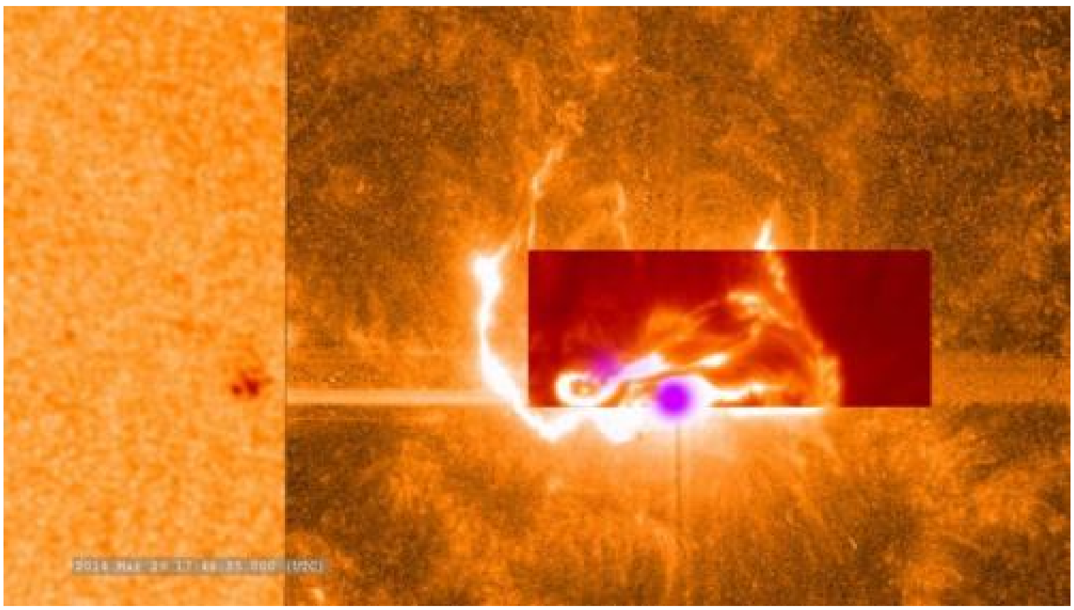
NASA telescopes coordinate best-ever flare observations

May 7 2014, by Karen C. Fox



This combined image shows the March 29, 2014, X-class flare as seen through the eyes of different observatories. SDO is on the bottom/left, which helps show the position of the flare on the sun. The darker orange square is IRIS data. The red rectangular inset is from Sacramento Peak. The violet spots show the flare's footpoints from RHESSI. Credit: NASA

(Phys.org) —On March 29, 2014, an X-class flare erupted from the right side of the sun... and vaulted into history as the best-observed flare of all time. The flare was witnessed by four different NASA spacecraft and one ground-based observatory – three of which had been fortuitously focused in on the correct spot as programmed into their viewing schedule a full day in advance.

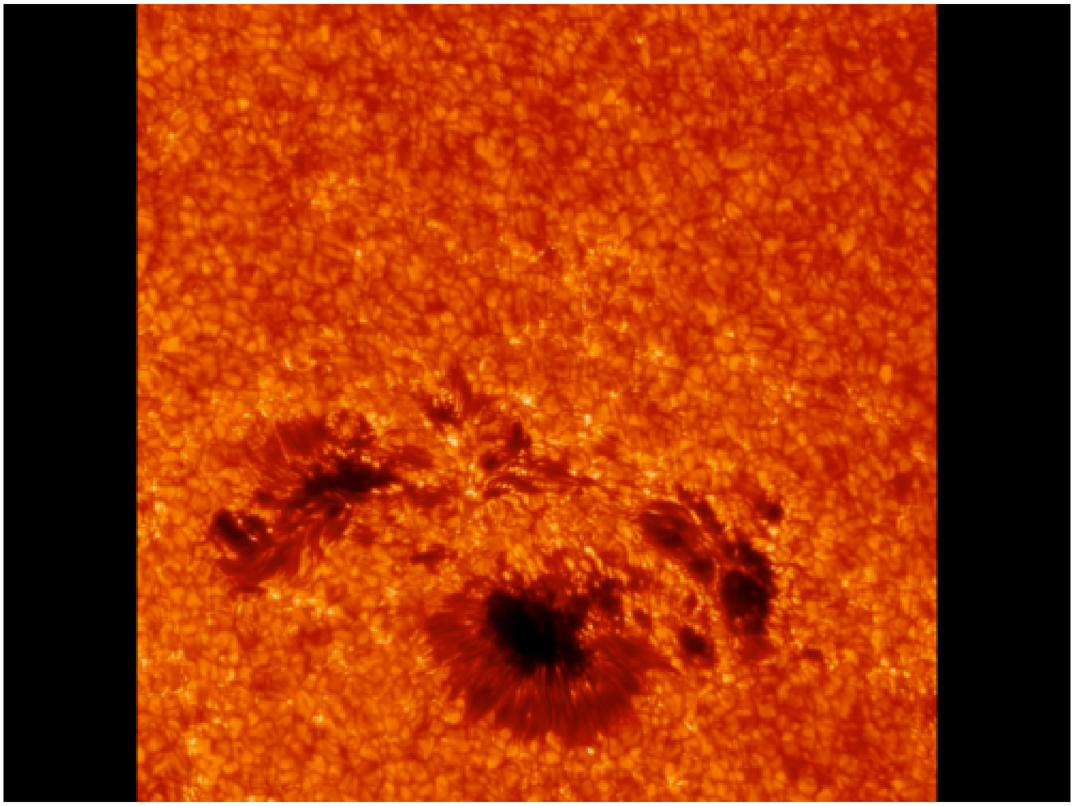
To have a record of such an intense flare from so many observatories is unprecedented. Such research can help scientists better understand what catalyst sets off these large explosions on the sun. Perhaps we may even some day be able to predict their onset and forewarn of the radio blackouts solar flares can cause near Earth – blackouts that can interfere with airplane, ship and military communications.

"This is the most comprehensive data set ever collected by NASA's Heliophysics Systems Observatory," said Jonathan Cirtain, project scientist for Hinode at NASA's Marshall Space Flight Center in Huntsville, Ala. "Some of the spacecraft observe the whole sun all the time, but three of the observatories had coordinated in advance to focus on a specific active region of the sun. We need at least a day to program in observation time and the target – so it was extremely fortunate that we caught this X-class flare."

Images and data from the various observations can be seen in the accompanying slide show. The telescopes involved were: NASA's Interface Region Imaging Spectrograph, or IRIS; NASA's Solar Dynamics Observatory, or SDO; NASA's Reuven Ramaty High Energy Solar Spectroscopic Imager, or RHESSI; the Japanese Aerospace Exploration Agency's Hinode; and the National Solar Observatory's Dunn Solar Telescope located at Sacramento Peak in New Mexico. Numerous other spacecraft provided additional data about what was happening on the sun during the event and what the effects were at Earth. NASA's Solar Terrestrial Relations Observatory and the joint European Space Agency and NASA's Solar and Heliospheric Observatory both watched the great cloud of solar material that erupted off the sun with the flare, an event called a coronal mass ejection. The U.S. National Oceanic and Atmospheric Administrations GOES satellite tracked X-rays from the flare, and other spacecraft measured the effects of the flare as it came toward Earth.

This event was particularly exciting for the IRIS team, as this was the first X-class flare ever observed by IRIS. IRIS launched in June 2013 to zoom in on layers of the sun, called the chromosphere and transition region, through which all the energy and heat of a flare must travel as it forms. This region, overall is called the interface region, has typically been very hard to untangle – but on March 29, IRIS provided scientists with the first detailed view of what happens in this region during a flare.

Coordinated observations are crucial to understanding such eruptions on the sun and their effects on space weather near Earth. Where terrestrial weather watching involves thousands of sensors and innumerable thermometers, solar observations still rely on a mere handful of telescopes. The instruments on the observatories are planned so that each shows a different aspect of the flare at a different heights off the sun's surface and at different temperatures. Together the observatories can paint a three-dimensional picture of what happens during any given event on the sun.



This close-up of the sunspot underneath the March 29, 2014, flare shows incredible detail. The image was captured by the G-band camera at Sacramento Peak in New Mexico. This instrument can focus on only a small area at once, but provide very high resolution. Ground-based telescope data can be hindered by Earth's atmosphere, which blocks much of the sun's ultraviolet and X-ray light, and causes twinkling even in the light it does allow through. As it happens, the March 29 flare occurred at a time of day in New Mexico that often results in the best viewing times from the ground. Credit: Kevin Reardon (National Solar Observatory), Lucia Kleint (BAER Institute)

In this case, the Dunn Solar Telescope helped coordinate the space-based observatories. Lucia Kleint is the principal investigator of a NASA-funded grant at the Bay Area Environmental Research Institute grant to coordinate ground-based and space-based flare observations. While she and her team were hunting for flares during ten observing days scheduled at Sacramento Peak, they worked with the Hinode and IRIS teams a day in advance to coordinate viewing of the same active region at the same time. Active regions are often the source of solar eruptions, and this one was showing intense magnetic fields that moved in opposite directions in close proximity – a possible harbinger of a flare. However, researchers do not yet know exactly what conditions will lead to a flare so this was a best guess, not a guarantee.

But the guess paid off. In the space of just a few minutes, the most comprehensive flare data set of all time had been collected. Now scientists are hard at work teasing out a more detailed picture of how a flare starts and peaks – an effort that will help unravel the origins of these little-understood explosions on the sun.

Provided by NASA's Goddard Space Flight Center

Citation: NASA telescopes coordinate best-ever flare observations (2014, May 7) retrieved 24 April 2024 from https://phys.org/news/2014-05-nasa-telescopes-best-ever-flare.html