NASA IRIS: Improving our view of the sun

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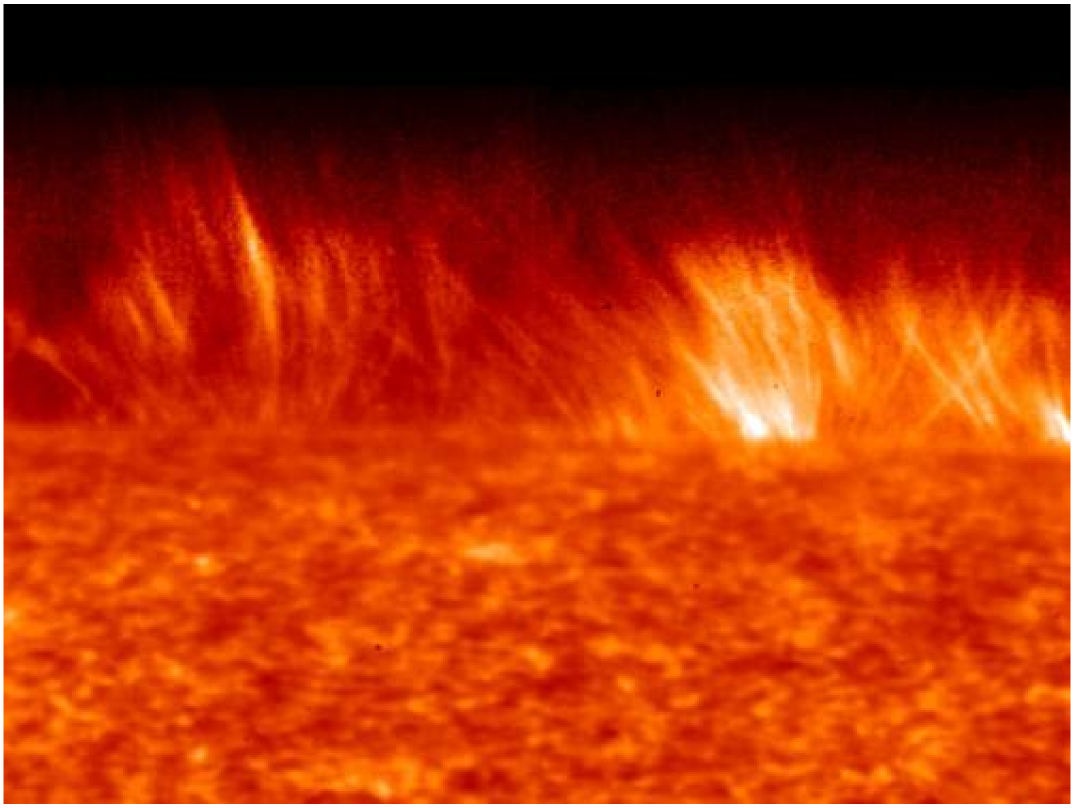

This image from the Japan Aerospace Exploration Agency's Hinode mission shows the lower regions of the sun's atmosphere, the interface region, which a new mission called the Interface Region Imaging Spectrograph, or IRIS, will study in exquisite detail. Where previous missions have been able to image material at only a few predetermined temperatures in this region, IRIS will observe a wide range of temperatures from 5,000 kelvins to 65,000 kelvins (8,540 F to 116,540 F), and up to 10 million kelvins (about 18 million F) during solar flares. Its images will resolve structures down to 150 miles across. Credit: JAXA/Hinode

In late June 2013, NASA will launch a new set of eyes to offer the most detailed look ever of the sun's lower atmosphere, called the interface region. This region is believed to play a crucial role in powering the sun's dynamic million-degree atmosphere, the corona. The Interface Region Imaging Spectrograph or IRIS mission will provide the best resolution so far of the widest range of temperatures for of the interface region, an area that has historically been difficult to study.

"This region is crucial for understanding how the corona gets so hot," said Joe Davila, IRIS project scientist at NASA's Goddard Space Flight Center in Greenbelt, Md. "For the first time, we will have the capability to observe it at fundamental physical scale sizes and see details that have previously been hidden."

IRIS's capabilities are uniquely tailored to unravel the interface region by providing both high-resolution images and a kind of data known as spectra.

For its high-resolution images, IRIS will capture data on about one percent of the sun at a time. While these are relatively small snapshots, IRIS will be able to see very fine features, as small as 150 miles across.

"We have some great space observatories currently looking at the sun," said Bart DePontieu, the IRIS science lead at Lockheed Martin in Palo Alto, Calif. "But when it comes to the interface region, we've never been able to resolve individual structures. We have been able only to see conglomerates of various structures. Now we will finally be able to observe the details."

IRIS's images will be three to four times as detailed as the images from NASA's Solar Dynamics Observatory – though SDO can observe the whole sun at once. SDO's wavelengths are not tailored, however, to see the interface region. Scientists can use IRIS observations to hone in on smaller details while working with the larger instruments, such as SDO or the Japan Aerospace Exploration Agency's Hinode, to capture images of the entire sun. Together, the observatories will explore how the corona works and impacts Earth – SDO and Hinode monitoring the solar surface and outer atmosphere, with IRIS watching the region in between.

Ultraviolet images look at only one wavelength of light at a time, but IRIS will also provide spectra, a kind of data that can show information about many wavelengths of light at once. Spectrographs split the sun's light into its various wavelengths and measure how much of any given wavelength is present. This is then portrayed on a graph showing spectral "lines" – taller lines correspond to wavelengths in which the sun emits relatively more radiation.

Each spectral line also corresponds to a given temperature, so this provides information about how much material of a particular temperature is present. The images from IRIS' telescope will record observations of material at specific temperatures, ranging from 5,000 kelvins to 65,000 kelvins (8,540 F to 116,540 F)—and up to 10 million kelvins (about 18 million F) during solar flares—a range best suited to observe material on the sun's surface and in the interface region.

"By looking at spectra of material in these temperature ranges, we can also diagnose velocity and perhaps density of the material, too," said De Pontieu.

The IRIS instrument will capture a new image every five to 10 seconds, and spectra about once every two seconds. These unique capabilities will be coupled with state-of-the-art 3-D numerical modeling sophisticated enough to deal with the complexity of this region. The modeling makes use of supercomputers at NASA's Ames Research Center, Moffet Field, Calif.

In combination, IRIS' resolution, fast imaging rate, wide temperature coverage and computer modeling will enable scientists for the first time to track solar material as it is accelerated and heated in the interface region and thus help pinpoint where and how the plasma gains energy and heat along its travels through the lower levels of the solar atmosphere.

IRIS was developed by Lockheed Martin as a NASA Small Explorer mission. The NASA Explorer Program is designed to provide frequent, low-cost access to space for heliophysics and astrophysics missions using small- to mid-sized spacecraft. Goddard manages the Explorer Program for the agency's Science Mission Directorate in Washington. Major contributions for IRIS were provided by Lockheed Martin Sensing and Exploration Systems, NASA's Ames Research Center, Smithsonian Astrophysical Observatory, Montana State University, Stanford University, the Norwegian Space Centre and the University of Oslo.

Provided by NASA's Goddard Space Flight Center

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