# NASA's IRIS mission to launch in June

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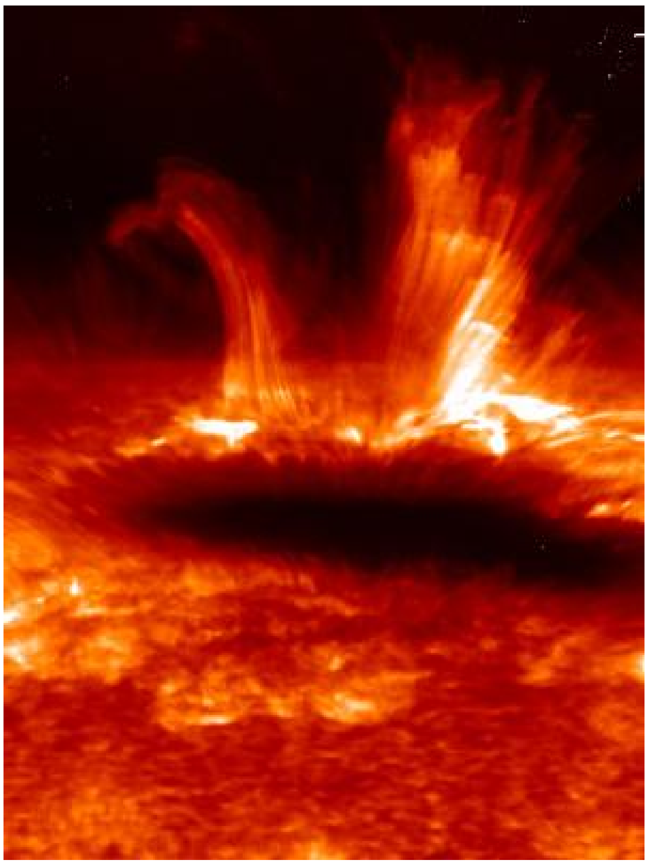

This image from the joint NASA-Japan Aerospace Exploration Agency's Hinode mission shows the lower regions of the sun's atmosphere, the interface region, which a new mission called the Interface Region Imaging Spectrograph, or IRIS, will study in exquisite detail. Credit: NASA & JAXA/Hinode

Lying just above the sun's surface is an enigmatic region of the solar atmosphere called the interface region. A relatively thin region, just

3,000 to 6,000 miles thick, it pulses with movement: Zones of different temperature and density are scattered throughout, while energy and heat course through the solar material.

Understanding how the energy travels through this region – energy that helps heat the upper layer of the atmosphere, the corona, to temperatures of 1 million kelvins (about 1.8 million F), some thousand times hotter than the sun's surface itself – is the goal of NASA's Interface Region Imaging Spectrograph, or IRIS, scheduled to launch on June 26, 2013, from California's Vandenberg Air Force Base.

"IRIS will extend our observations of the sun to a region that has historically been difficult to study," said Joe Davila, IRIS project scientist at NASA's Goddard Space Flight Center in Greenbelt, Md. "Understanding the interface region better improves our understanding of the whole corona and, in turn, how it affects the solar system."

Scientists wish to understand the interface region in exquisite detail, because energy flowing through this region has an effect on so many aspects of near-Earth space. For one thing, despite the intense amount of energy deposited into the interface region, only a fraction leaks through, but this fraction drives the solar wind, the constant stream of particles that flows out to fill the entire solar system. The interface region is also the source of most of the sun's ultraviolet emission, which impacts both the near-Earth space environment and Earth's climate.

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 1 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.

"Previous observations suggest there are structures in the solar atmosphere just 100 or 150 miles across, but 100,000 miles long," said Alan Title, the principal investigator for IRIS at Lockheed Martin in Palo Alto, Calif. "Imagine giant jets, like the huge fountains you see in Las Vegas. Except these jets have a footprint the size of Los Angeles, and are long enough and fast enough that they would zoom around Earth in 20 seconds. We have seen hints of these structures, but never with the high resolution or the information about velocity, temperature and density that IRIS will provide."

The velocity, temperature and density information will be provided by IRIS' spectrograph. While ultraviolet images look at only one wavelength of light at a time, spectrographs 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 light. Analysis of the spectral lines can also provide velocity, temperature and density information, key information when trying to track how energy and heat moves through the region.

Not only does IRIS provide state-of-the-art observations to look at the interface region, it makes uses of advanced computing to help interpret what it sees. Indeed, interpreting the light flowing out of the interface region could not be done well prior to the advent of today's supercomputers because, in this area of the sun, photons of light bounce around so much that it is difficult to understand the path the photon traveled.

"When you observe the interface region, there is no intuitive approach to understanding the light's path from the sun's surface and that's been a major stumbling block," said Bart De Pontieu, the IRIS science lead at Lockheed Martin. "We're trying to understand something that's hidden in a fog – but now, thanks to the enormous advance of computers and sophisticated numerical models, the fog is lifting."

This modeling of the IRIS data takes place on cutting-edge supercomputers at NASA's Ames Research Center in Moffett Field, Calif. Moreover, science teams at Lockheed Martin and the University of Oslo in Norway have worked over the last year to create and refine the models to interpret the dominant processes expected to be at work in the interface region.

For its launch at the end of June, IRIS will take flight using a Pegasus XL rocket, carried aloft by an Orbital Sciences L-1011 aircraft from Vandenberg. IRIS weighs 400 pounds, and upon deployment, will extend its solar panels to reach 12 feet across. IRIS will travel in a polar, sun-synchronous orbit, traveling around Earth at the globe's sunrise line, ranging from approximately 390 miles to 420 miles above Earth's surface. Each orbit will take IRIS around 97 minutes to complete. This orbit was selected because it provides nearly eight months of eclipse-free sun viewing and also maximizes IRIS' ability to downlink data, by traveling over several ground receivers.

After launch, the IRIS team will perform post-flight checkouts for about 60 days before the official science campaign begins. Once the campaign starts, IRIS will join a host of other spacecraft currently observing the sun and its effects on Earth. NASA's Solar Dynamics Observatory and the joint NASA-Japan Aerospace Exploration Agency's Hinode, for example, both capture high-resolution images of the sun, but focusing on different layers of the sun. Together, the observatories will explore how the corona and solar wind are powered – Hinode and SDO monitoring the solar surface and outer atmosphere, with IRIS watching the region in between.

"Relating observations from IRIS to other solar observatories will open the door for crucial research into basic, unanswered questions about the corona," said Davila.

Answering such fundamental physics questions about the sun's atmosphere has applications outside of simply understanding the sun, as well. Explosions in the corona can send radiation and solar particles toward Earth, interfering with satellites, causing power grid failures and disrupting GPS services. By knowing more about what causes such solar eruptions, scientists can improve their ability to forecast such space weather. Moreover, the better we understand this closest star, the better we can understand how other stars are energized as well.

Goddard manages IRIS, a NASA Small Explorer Program mission. IRIS' launch is managed by NASA's Launch Services Program at NASA's Kennedy Space Center, Fla. Lockheed Martin's Advanced Technology Center designed and built the IRIS spacecraft and instrument. Ames provides mission operations and ground data systems. The Norwegian Space Centre is providing regular downlinks of science data. Other contributors include the Smithsonian Astrophysical Observatory in Cambridge, Mass., Montana State University in Bozeman, Mont., Stanford University in Stanford, Calif., and the University of Oslo in Norway.

**More information:** www.nasa.gov/iris

Provided by NASA's Goddard Space Flight Center

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