

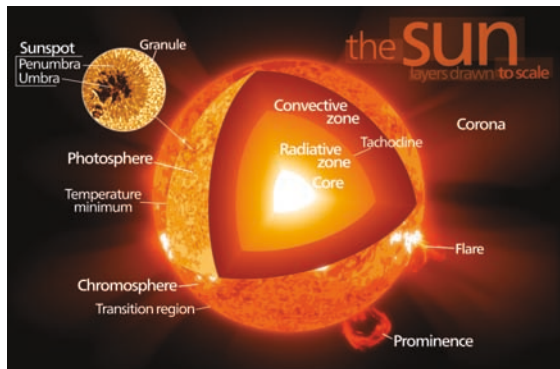
Mission Overview

NASA's Interface Region Imaging Spectrograph (IRIS) advances our understanding of what role the interface region that lies between the sun's photosphere and corona plays in powering its dynamic million-degree atmosphere and driving the solar wind. The interface region is where most of the sun's ultraviolet emission is generated that impacts the near-Earth space environment and Earth's climate.

Beginning in 2013, the IRIS spacecraft will orbit Earth and use its ultraviolet telescope to obtain high resolution solar images and spectra. IRIS observations along with advanced computer models will deepen our understanding of how heat and energy move through the lower atmosphere of the sun and other sun-like stars.

IRIS is a NASA Small Explorer that will complement the Solar Dynamics Observatory (SDO) and Hinode missions to explore how the solar atmosphere works and impacts Earth—SDO and Hinode monitoring the solar surface and outer atmosphere, with IRIS watching the region in between.

The mission of the Explorers Program is to provide frequent flight opportunities for world-class scientific investigations from space within the heliophysics and astrophysics science areas.



Key Themes

- IRIS advances our understanding of what role the enigmatic interface region on the sun plays in powering its dynamic million-degree atmosphere called the corona.
- IRIS contributes to our understanding of the energy flow that is deposited in the interface region, with only a fraction leaking through to drive the solar wind that fills the heliosphere.
- IRIS improves our understanding of the interface region where most of the sun's ultraviolet emission is generated that impacts the near-Earth space environment and Earth's climate.

What Will IRIS Study?

- The sun's dynamically changing chromosphere and transition region make up the key "interface region" that IRIS will study that lies between the photosphere and corona.
- Beginning in 2013, the IRIS spacecraft will orbit Earth and use its ultraviolet telescope to obtain high resolution images and spectra of the interface region. IRIS observations will be taken every second and reveal details as small as 150 miles across on the sun.
- IRIS will use solar images and spectra and advanced computer models to deepen our understanding of how heat and energy move through the lower atmosphere of the sun and other sun-like stars.
- Earth continuously plows through the solar wind, a stream of charged particles emitted by the sun, and is affected by dramatic changes caused by extreme space weather events. IRIS increases our ability to forecast space weather, which can disable satellites, cause power grid failures, and disrupt GPS services.

National Aeronautics and Space Administration



For more information on IRIS, see:
www.nasa.gov/IRIS



IRIS is part of the Explorers Program within NASA's Heliophysics Division.

IRIS

**INTERFACE REGION
IMAGING SPECTROGRAPH**

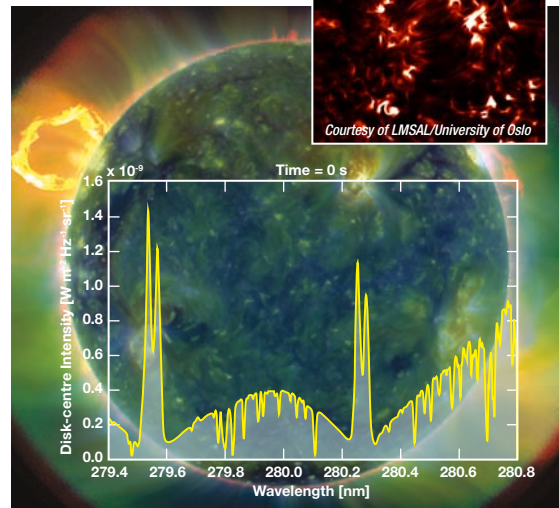
Striving to understand how the solar atmosphere is energized

What Can IRIS Do?

Tracking the complex processes within the interface region of the solar atmosphere requires instrument and modeling capabilities that are only now within our technological reach. IRIS is the first mission designed to simultaneously observe the range of temperatures specific to the chromosphere and transition region not only at very high resolution, but at the quick rate of once every few seconds.

IRIS is an imaging spectrograph, an instrument that splits the sun's light into its various colors allowing scientists to remotely measure temperatures, densities and velocities of the solar gases. IRIS will take both images and spectra of the interface region, observing about one percent of the sun at a time. It will be able to resolve very fine features, as small as 150 miles (240 km) across on the sun.

IRIS' high resolution, fast imaging rate and wide temperature coverage together with computer modeling will enable scientists to determine how solar material moves through the interface region. This will help pinpoint where and how the plasma gains energy and heats.



This extreme ultraviolet image of the sun was taken by the Solar Dynamics Observatory (SDO). This tri-color composite image traces different gas temperatures. Reds being cooler and blues hotter. IRIS will use ultraviolet images of the chromosphere and transition region (shown in the simulated IRIS image insert) to similarly diagnose conditions in the interface region. IRIS uses spectroscopy (overlaid graph) to learn about the detailed flow of energy and gases.

The Spacecraft

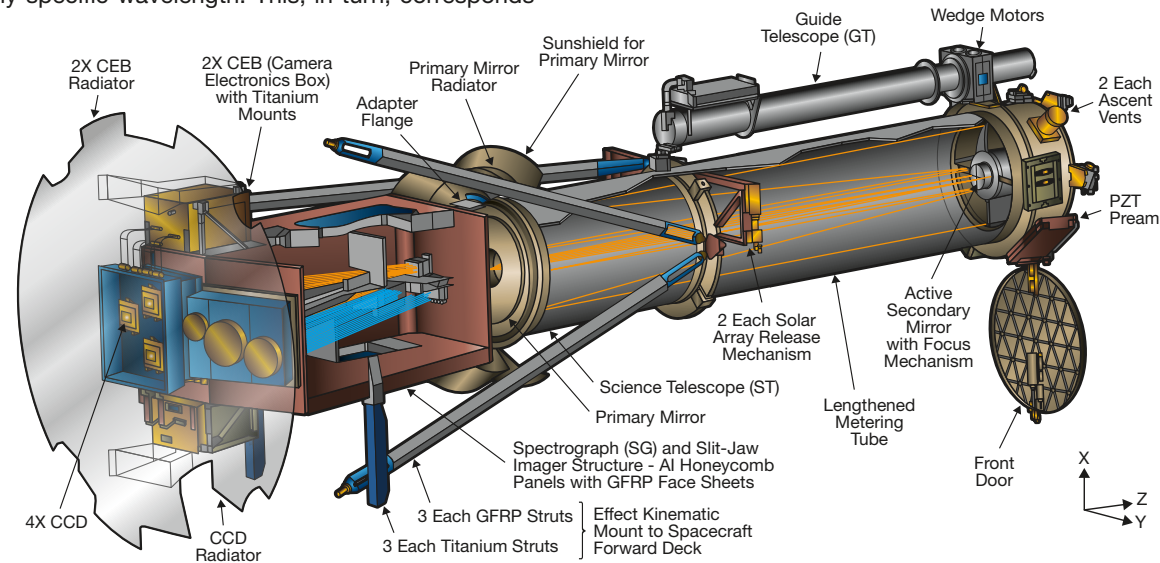
IRIS carries an ultraviolet telescope that feeds an imaging spectrograph. The telescope's primary mirror has a diameter of about eight inches. The images from IRIS's telescope will record observations of material at specific temperatures, ranging from 5000 K to 65,000 K (and up to 10 million K during solar flares), a range tailored to observe material on the sun's surface and in the chromosphere and transition region.

The spectrograph will observe material at temperatures from 5,000 K to 10 million K. Spectra provide information on exactly how much light is visible from any specific wavelength. This, in turn, corresponds

to how much material is present at specific velocities, temperatures and densities.

The instrument will capture a new image every 5 to 10 seconds, and spectra about every one to two seconds. These unique capabilities will be coupled with state-of-the-art 3-D numerical modeling using supercomputers at NASA's Ames Research Center and other facilities in the USA and Norway.

IRIS weighs 403 pounds. It is approximately 7 feet (2.1 meters) long and, with its solar panels extended, is a little over 12 feet (3.7 meters) across.



The Mission

IRIS was designed and built at Lockheed Martin's Space Systems Company Advanced Technology Center (ATC) in Palo Alto, Calif. IRIS is a Principal Investigator led mission by Dr. Alan Title. The Lockheed Martin Solar and Astrophysics Laboratory will manage the science investigation. The program was developed with support from Lockheed Martin's Civil Space line of business as well as partners Smithsonian Astrophysical Observatory, Montana State University, Stanford University, and the University of Oslo. NASA's Goddard Space Flight Center in Greenbelt, Md., manages the IRIS

project for the Agency's Science Mission Directorate at NASA Headquarters in Washington.

NASA's Ames Research Center, Moffett Field, Calif., is responsible for mission operations and the ground data system. The Norwegian Space Centre will capture the IRIS data with their antennas in Svalbard, inside the Arctic Circle in northern Norway. The science data will be managed by the Joint Science Operations Center of the Solar Dynamics Observatory, run by Stanford and Lockheed Martin.

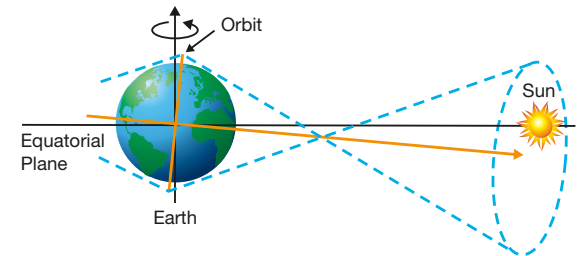
Launch

The spacecraft will launch in 2013 aboard a Pegasus XL rocket from Vandenberg Air Force Base, Calif. Orbital Sciences Corporation of Dulles, Va. is providing the launch vehicle.



Orbit

IRIS will travel in a polar, sun-synchronous orbit. This means it will travel around Earth along the Earth's sunrise line and remain pointed at the sun throughout the year. The spacecraft's orbit is approximately 390 miles (620 km) above Earth's surface at its closest point, and at 420 miles (670 km) at the farthest. The orbit allows for eight months of continuous observations per year and maximizes eclipse-free viewing of the sun.



Science Objectives

IRIS science objectives are to answer the following questions:

1. Which processes heat the solar chromosphere and the regions beyond?
2. How does the chromosphere regulate mass and energy supply to the sun's atmosphere, the corona?
3. How do matter and magnetic energy rise through the lower atmosphere of the sun and what role does this play in flares and coronal mass ejections?