

★ SDO is the first mission in the Living With a Star Program within NASA's Heliophysics Division



Solar Dynamic Observatory



SDO's Three Instruments

AIA

The Atmospheric Imaging Assembly (AIA) is a battery of four telescopes designed to photograph the Sun's surface and atmosphere. AIA shows over 10 different wavelengths, or colors, selected to reveal key aspects of solar activity.

EVE

The Extreme Ultraviolet Imager (EUVI) will measure fluctuations in the Sun's ultraviolet output. EVE is designed to detect the Sun's extreme ultraviolet (EUV) output, which is the primary driver of space weather.

HMI

The Helioseismic and Magnetic Imager (HMI) will map solar magnetic fields and provide the Sun's magnetic field structure. HMI will also measure the Sun's internal structure and rotation. A key goal of this experiment is to decipher the physics of the Sun's magnetic dynamo.



Exploring the Sun in High Definition



★ SDO will study how solar activity is created and how space weather results from that activity.

What will SDO do?

The Solar Dynamic Observatory (SDO) is designed to provide solar activity data to help scientists understand the sun's high-speed activity. SDO will study the sun's surface and atmosphere, and will also monitor the sun's internal structure and rotation.

High speed photography had its many sources in the 19th century. SDO doesn't stop at the solar surface. A sensor on the observatory can actually see inside the Sun at the very heart of solar activity—the solar dynamo itself.

SDO will improve our understanding of the physics behind the activity displayed by the Sun's atmosphere, which drives space weather in the heliosphere and in planetary environments. Solar activity and space weather are key concerns of our modern, increasingly technological society. Solar flares and coronal mass ejections can disable satellites, cause power grid failures, and disrupt GPS communications. Furthermore, because the Sun is so powerful, even small changes in its intensity could have effects on climate.

Data Avalanche

Imagine watching a high-resolution movie that never stops. The enormous amount of data from the raging Sun, including high solar flares and billion-ton blasts of hot plasma. By some estimates, SDO will transmit as much as 30 times more science data than any mission in NASA history. Images will be 10 times greater resolution than high-resolution television and will arrive twice as fast as solar activity. SDO's AIA instrument will provide an image every 1.25 seconds. The coronagraph STEREO takes 1 image every 30 seconds and SDO takes 1 image every 12 minutes.

The image above illustrates the resolution capabilities of the SDO, a 1080p, 4:3 HD image. An image from SDO's AIA instrument (left) will have a resolution of pixels that is 1080x1920 pixels, or 20.7 million pixels. An image from SDO's EVE instrument (right) will have a resolution of pixels that is 1080x1080 pixels, or 11.7 million pixels.

★ The amount of data and images SDO will beam back per day is equivalent to downloading half-a-million songs each day.

What is EUV?



EUV or "extreme ultraviolet" is invisible to the human eye. It is high-energy form of electromagnetic radiation with wavelengths between 0.1 and 100 nanometers. EUV photons are much more energetic and dangerous than the ordinary UV rays that cause sunburns. Fortunately for humans, Earth's atmosphere blocks out EUV in space, solar EUV radiation is easy to detect and quantify the most sensitive indicator of solar activity. To monitor solar EUV emissions, SDO will carry the Extreme Ultraviolet Imager (EUVI) on the Solar Dynamic Observatory (SDO).

A Unique Orbit

SDO is a mission that orbits, for the first time, a satellite orbit to provide high-resolution solar magnetic field maps. SDO orbits and observations of the solar UV flux being on the Earth. SDO will orbit the Earth once in 24 hours of one single orbit, or once from the equator. This orbit is geosynchronous, which will allow SDO to maintain constant communication with the dedicated ground station near the Chaco, New Mexico.

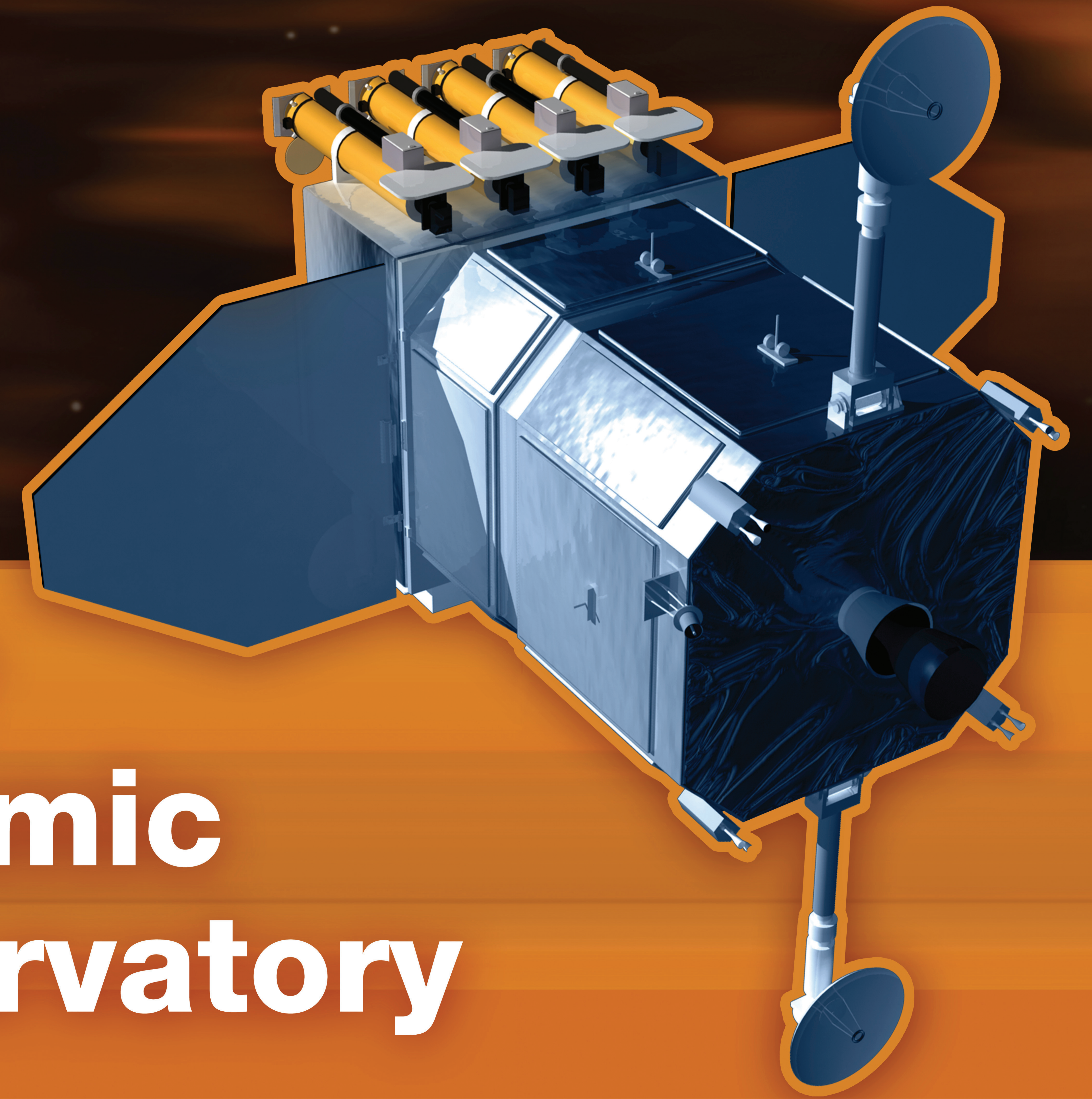


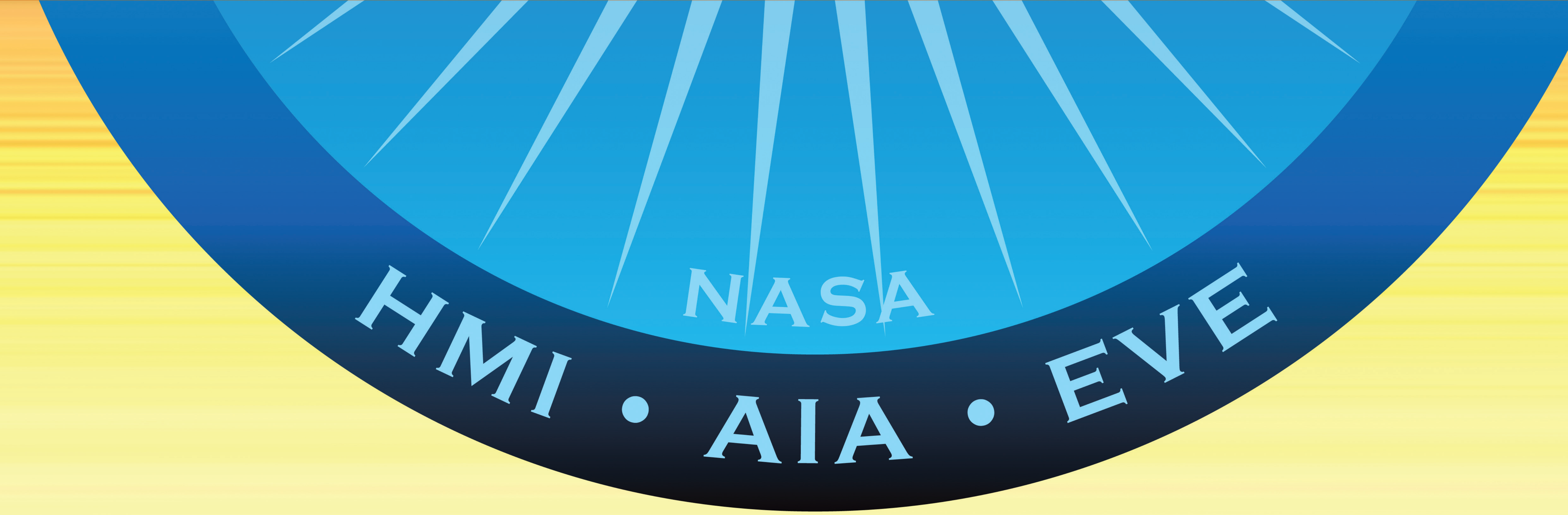
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OUR EYE ON THE SUN

SDO

**Solar
Dynamic
Observatory**



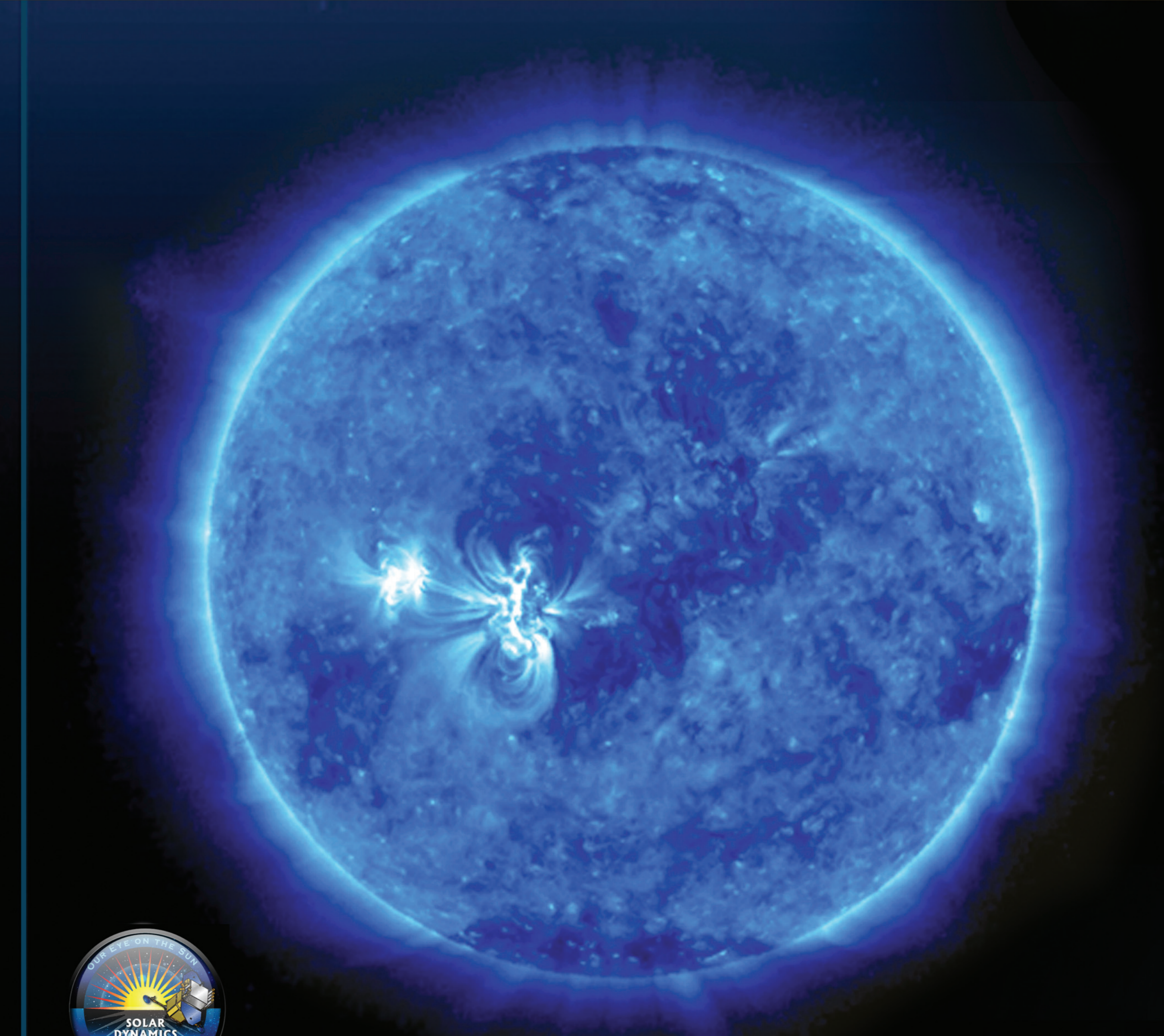
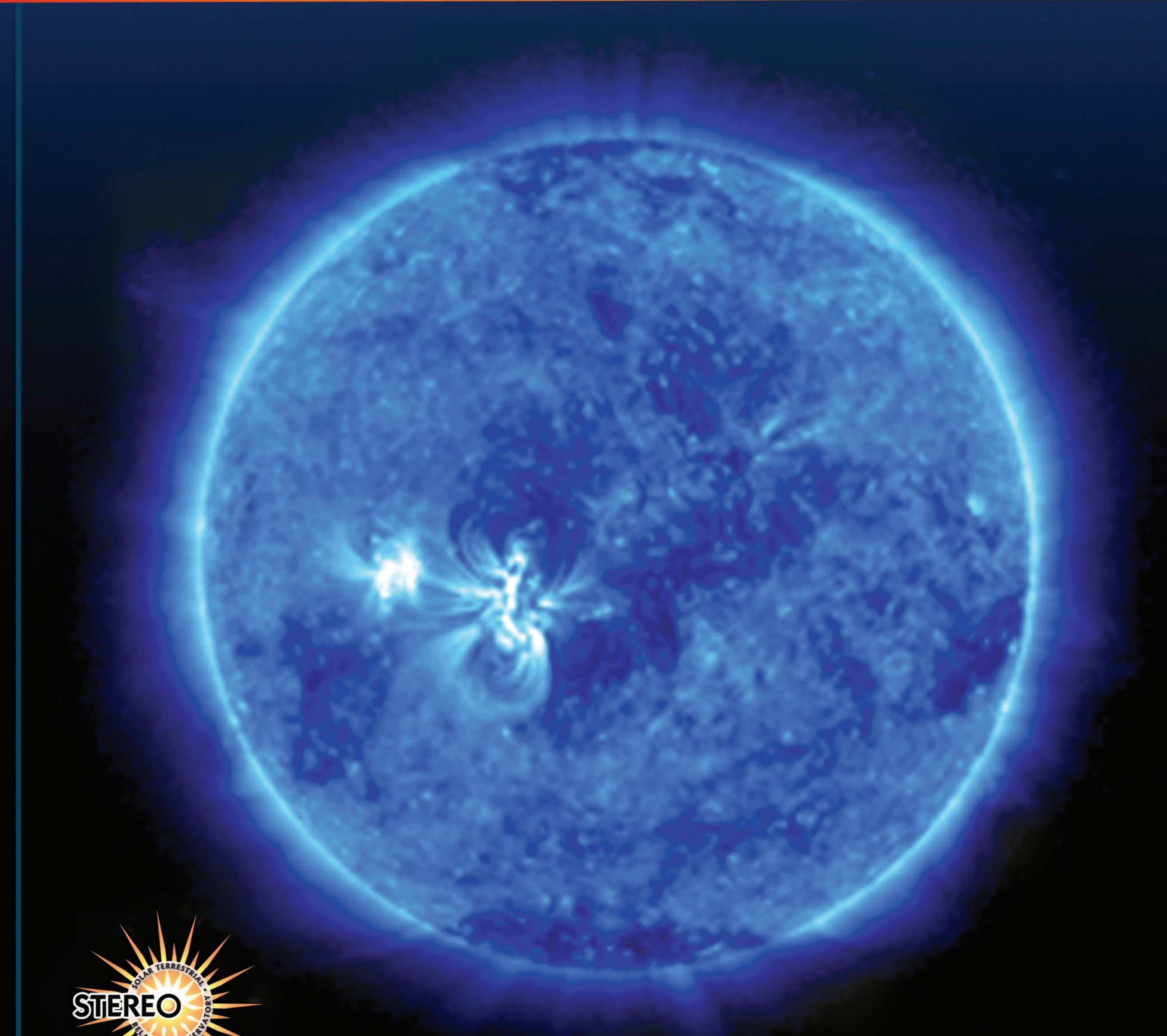
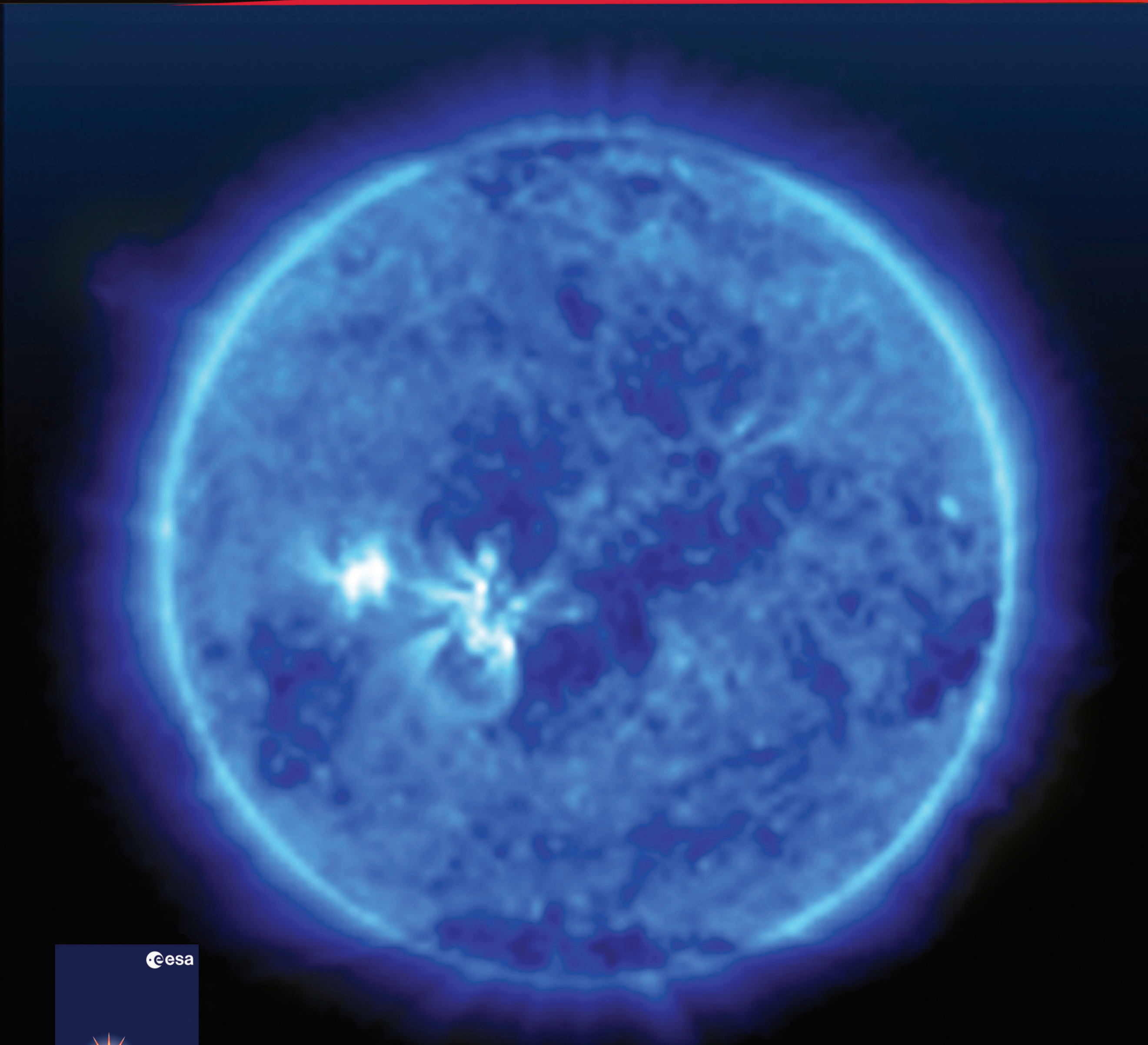


What will SDO do?

The Solar Dynamics Observatory (SDO) is designed to probe solar variability in a way that no other mission can match. High-speed cameras on SDO will take rapid-fire snapshots of solar flares and other magnetic activity. This will have the same transformative effect on solar physics that the invention of high-speed photography

had on many sciences in the 19th century. SDO doesn't stop at the stellar surface. A sensor on the observatory can actually look inside the Sun at the very source of solar activity—the solar dynamo itself.

SDO will improve our understanding of the physics behind the activity displayed by the Sun's atmosphere, which drives space weather in the heliosphere and in planetary environments. Solar activity and space weather are key concerns of our modern, increasingly technological society. Solar flares and coronal mass ejections can disable satellites, cause power grid failure, and disrupt GPS communications. Furthermore, because the Sun is so powerful, even small changes in its irradiance could have effects on climate.

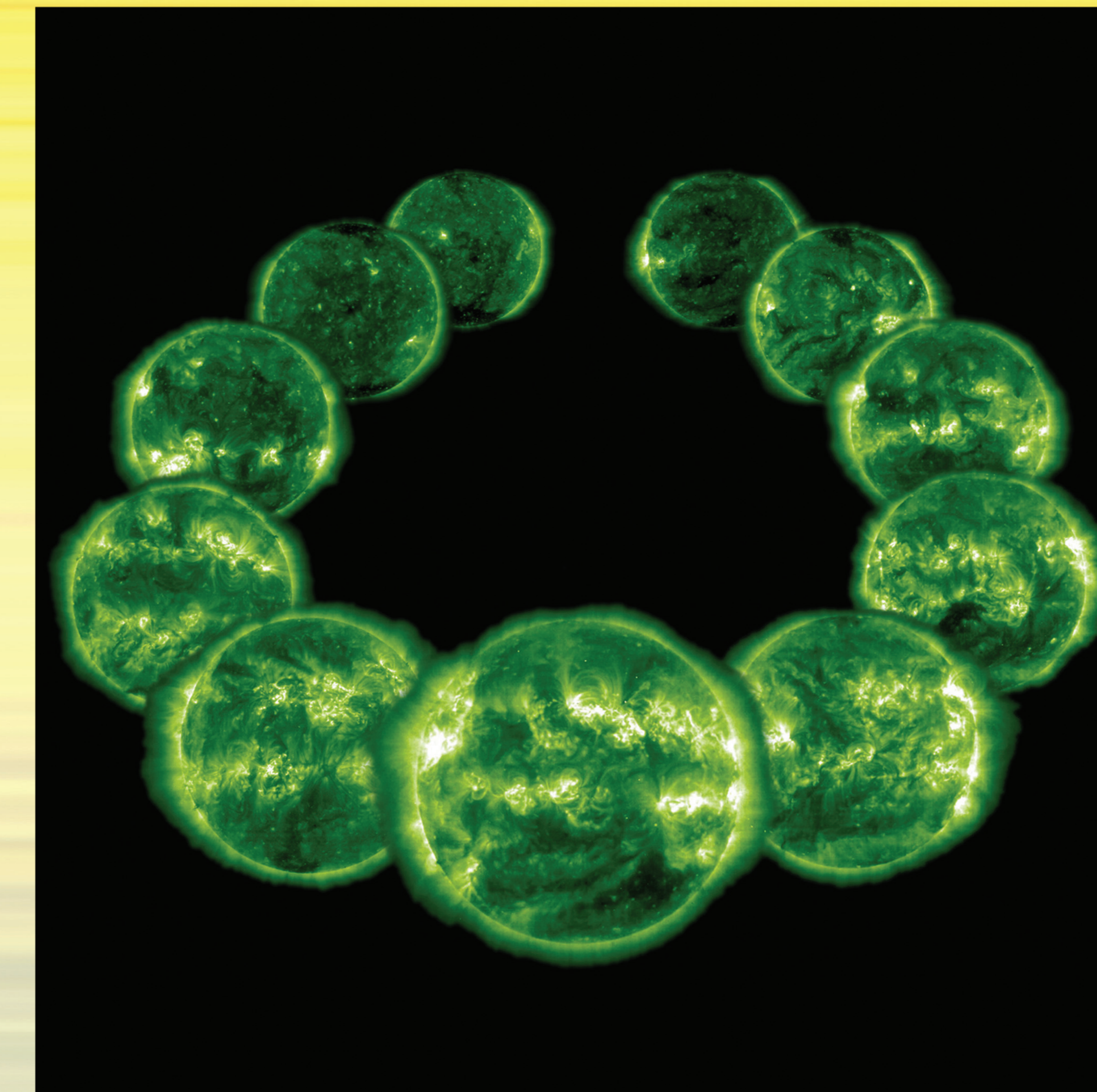


Exploring the Sun in High Definition

Data Avalanche

Imagine watching a high-definition movie that never stops. The enormous screen is filled with the raging Sun, unleashing huge solar flares and billion-ton clouds of hot plasma. By some estimates, SDO will transmit as much as 50 times more science data than any mission in NASA history. Images with 10 times greater resolution than high-definition television will reveal every nuance of solar activity. SDO's AIA instrument will provide an image every 1.25 seconds. For context, STEREO takes 1 image every 90 seconds and SOHO takes 1 image every 12 minutes.

The image above illustrates the resolution capabilities of the SDO, STEREO, and SOHO spacecraft. An image from SDO's AIA instrument (right) will have 4 times the number of pixels than a STEREO image (middle) and 16 times that of a SOHO image (left).

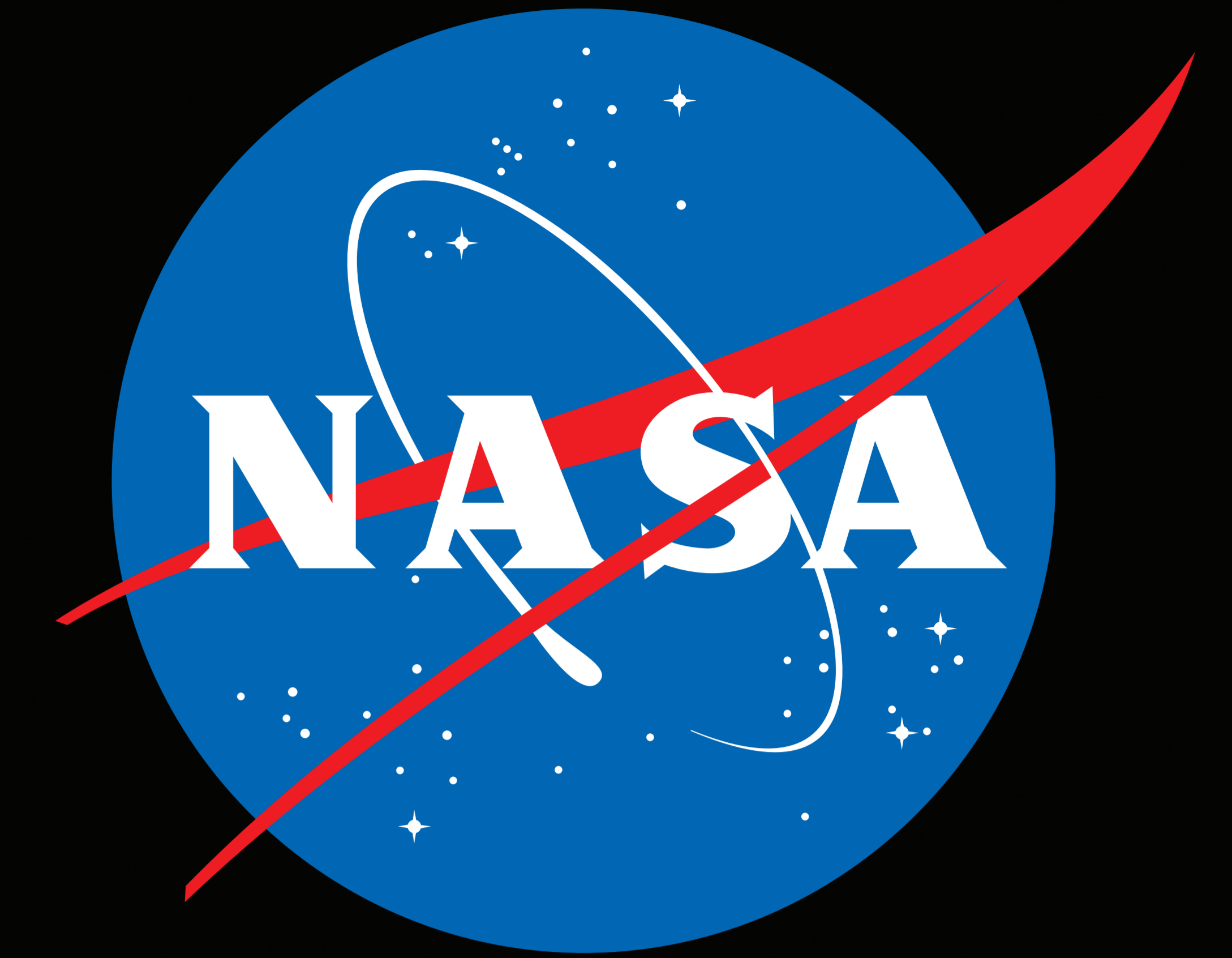


What is EUV?

EUV or “extreme ultraviolet,” is invisible energy form of ultraviolet radiation with a wavelength of 10-105 nanometers, EUV photons are much more energetic than the ordinary UV rays that cause sunburn. Earth's atmosphere blocks solar EUV. EUV is easy to detect and arguably the most important form of solar activity. To monitor solar EUV emissions, SDO has an instrument named “EVE,” short for Extreme Ultraviolet Experiment, onboard SDO.

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SDO's Three Instruments



AIA

The Atmospheric Imaging Assembly (AIA) is a battery of four telescopes designed to photograph the Sun's surface and atmosphere. AIA filters cover 10 different wavelength bands, or colors, selected to reveal key aspects of solar activity.

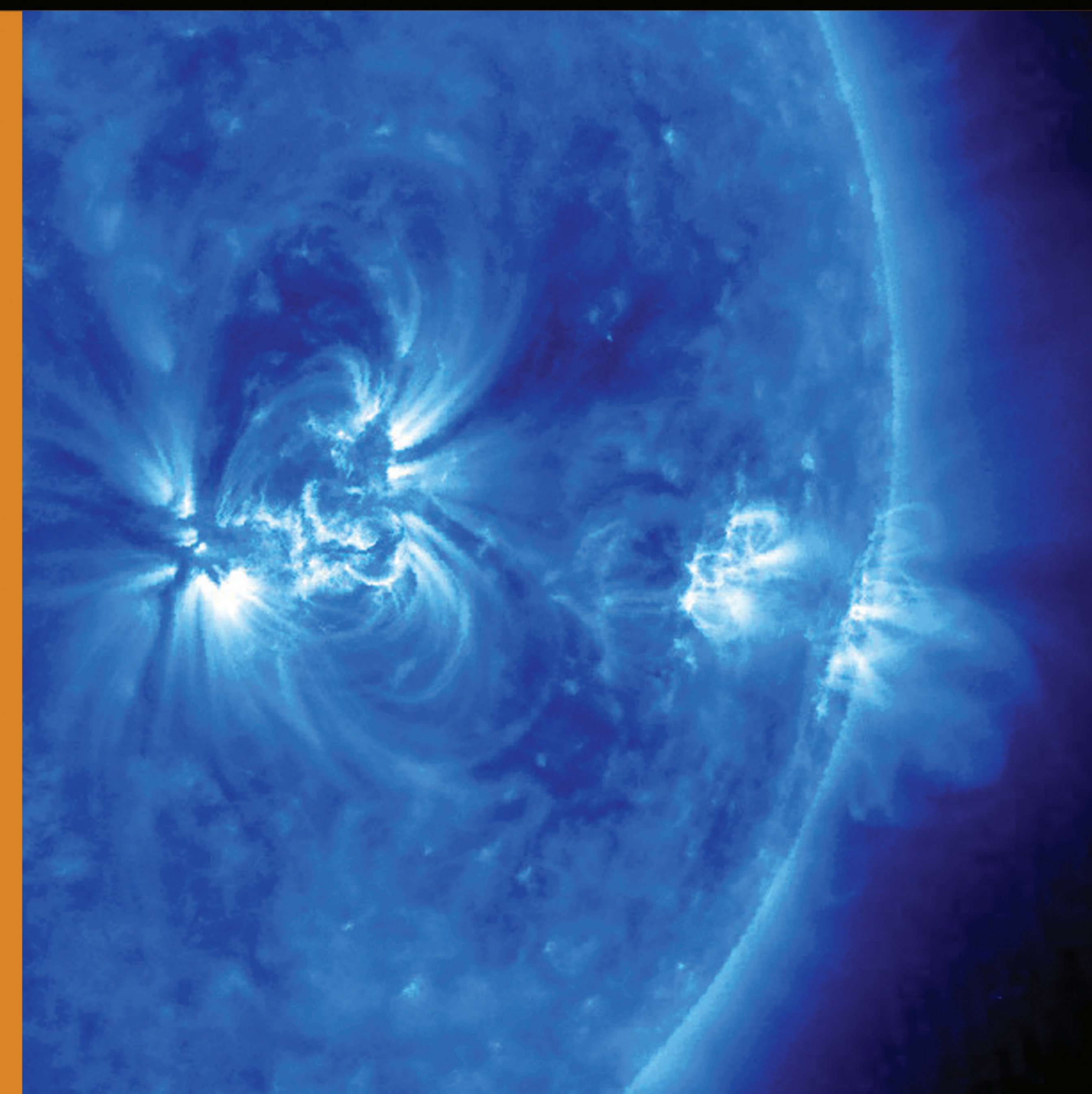
EVE

The Extreme Ultraviolet Variability Experiment (EVE) will measure fluctuations in the Sun's ultraviolet output. EUV radiation from the Sun has a direct and powerful effect on Earth's upper atmosphere, heating it, puffing it up, and breaking apart atoms and molecules.

HMI

The Helioseismic and Magnetic Imager (HMI) will map solar magnetic fields and peer beneath the Sun's opaque surface using a technique called helioseismology. A key goal of this experiment is to decipher the physics of the Sun's magnetic dynamo.

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A Unique Orbit

SDO is a mission that utilizes, for the first time, a unique orbit to provide high-resolution solar magnetic field images, EUV images, and measurements of the solar UV flux falling on the Earth. SDO will orbit the Earth once in 24 hours at an angle offset, or inclined from the equator. This inclined geosynchronous orbit will allow SDO to maintain constant communications with its dedicated ground station near Las Cruces, New Mexico.



Image Credit: NASA/Barbara Lambert

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