EUV Variability Experiment

SDO EUV Variability Experiment (EVE)

The NASA Solar Dynamic Observatory (SDO), with its launch planned for October 2008, is the first mission for the NASA Living With a Star (LWS) program. The SDO mission will provide measurements and models of solar magnetic fields, active region dynamics, and the solar extreme ultraviolet (EUV) radiation that can dramatically disturb Earth's space weather environment.

The EUV Variability Experiment (EVE) is one of three instruments on SDO. EVE will measure the solar EUV irradiance with unprecedented spectral resolution, temporal cadence, accuracy, and precision. Furthermore, the EVE program will incorporate physics-based models of the solar EUV irradiance to advance the understanding of the solar EUV irradiance variations based on the activity of the solar magnetic features. NASA Goddard Space Flight Center is managing the SDO project and is providing the spacecraft and ground operations for the SDO mission.

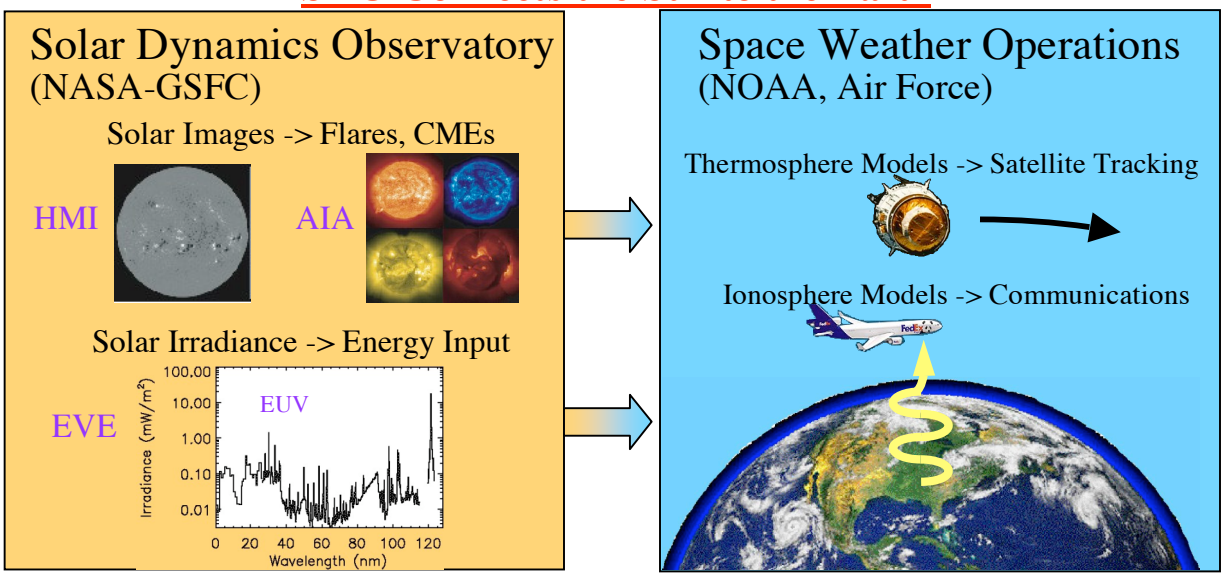
In addition to EVE, there are 2 other instruments on-board the SDO satellite. The Helioseismic and Magnetic Imager (HMI) and the Atmospheric Imaging Assembly (AIA) will obtain solar images that provide information about magnetic fields and action region dynamics.

EVE Science Objectives

EVE's purpose is to measure and model the solar EUV irradiance variations due to flares (seconds), solar rotation (days), and solar cycle (years). The EVE program has 4 primary science objectives:

1. Specify the solar EUV spectral irradiance and its variability on multiple time scales.
2. Advance current understanding of how and why the solar EUV spectral irradiance varies.
3. Improve the capability to predict the EUV spectral irradiance variability.
4. Understand the response of the geospace environment to variations in the solar EUV spectral irradiance and the impact on human endeavors.

SDO Connects the Sun to the Earth



EVE Team

Science:

University of Colorado, LASP:
- Tom Woods, Principal Investigator
- Frank Eparvier, Project Scientist
- Phil Chamberlin, Andrew Jones

University of Southern California:
- Darrell Judge, Co-I
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Naval Research Laboratory:
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Virginia Tech: Scott Bailey, Co-I

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- Rodney Viereck, Collaborator
- Tim Fuller-Rowell, Collaborator

Space Environment Technology:
- W. Kent Tobiska, Collaborator

Utah State Univ.: Jan Sojka, Collaborator

Management:

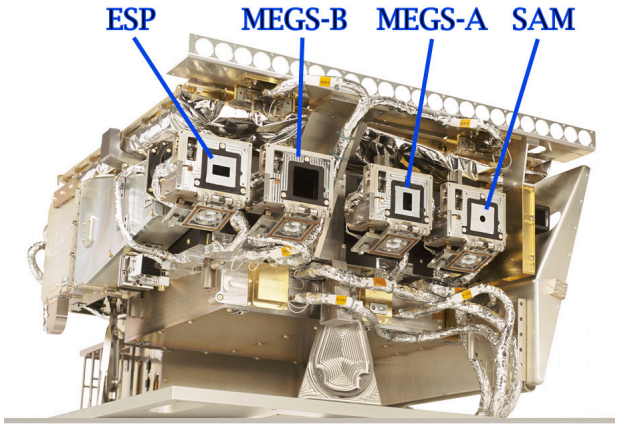
University of Colorado, LASP:
- Mike Anfinson, Program Manager
- Greg Ucker, System Engineer
- Rick Kohnert, System Engineer
- Gail Tate, Software Manager

SDO EVE Instrument Overview

The EVE instrument consists of three main subsystems:

- Multiple EUV Grating Spectrometer (MEGS)
- EUV SpectroPhotometer (ESP)
- EVE Electronics Box (EEB)

The MEGS and ESP channels mount on the EVE optical platform (EOP), and the EEB mounts to the spacecraft deck.



Multiple EUV Grating Spectrograph (MEGS) –

Set of 2 Rowland-circle grating spectrographs, MEGS A and MEGS B, that measure the 5-105 nm spectral irradiance with 0.1 nm spectral resolution and with 10-second cadence. Part of the MEGS-A CCD is directly illuminated to measure the individual X-ray photons in the 0-7 nm range with 1 nm or better spectral resolution, and this channel is called SAM (Solar Aspect Monitor) as it also provides solar position information. The MEGS-P channel is a Si photodiode that provides calibrations for the MEGS B sensitivity changes.

EUV Spectrophotometer (ESP) –

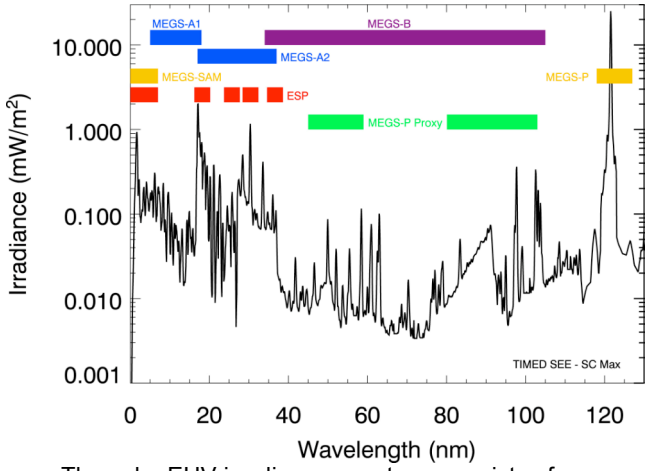
Transmission grating spectrograph that measures 0.1-7 nm to provide solar X-ray measurement shortward of 7 nm and measures 17-34 nm to provide calibrations for MEGS sensitivity changes and higher time cadence (0.25-second). The ESP is very similar to the SOHO SEM instrument.

EVE Electronics Box (EEB) –

Electronics that control the MEGS and ESP instruments and provide an interface to/from the SDO spacecraft. This includes processor, memory, power converters, power control, and interfaces to EVE channels and spacecraft.

How does EVE measure EUV?

Channel	λ Range	Δλ (nm)	Time Cadence
MEGS-SAM	0.1 – 7 nm	1 nm	10 sec
MEGS-A	5 – 37 nm	0.1 nm	10 sec
MEGS-B	35 – 105 nm	0.1 nm	10 sec
ESP 0th Order	0.1 – 7 nm	7 nm	0.25 sec
ESP 1st Order	17 – 38 nm	2 nm	0.25 sec
MEGS-P	121.6 nm	1 nm	0.25 sec



The solar EUV irradiance spectrum consists of many emissions from the chromosphere, transition region, and corona. There are several EVE channels to measure over the EUV range.

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Websites:

SDO EVE home page: http://lasp.colorado.edu/eve/
SDO Project home page: http://sdo.gsfc.nasa.gov/

EVE Resources

Mass:	54.4 kg
Power (average):	47.2 Watts
Data Rate - Engineering:	2 Kbps
Science:	6.8 Mbps
Dimensions (EVE Envelope):	~ 99 cm L x 61 cm W x 36 cm H
Observations:	solar, 10-sec cadence
Wavelength Coverage:	0.1 – 105 nm, 121.5 nm
Wavelength Resolution:	0.1 nm > 5 nm and 1 nm < 5 nm
Accuracy:	10% (1-σ)
Preflight Calibration:	NIST Synchrotron UV Radiation Facility (SURF-III)
In-flight Calibration:	On-board photometers, and underflight measurements
Field of View:	2°

EVE Data Products

Level	Description	Time Cadence	Wavelength Resolution	Latency of Availability
L0C	Space weather (minimum latency)	10 sec	1 nm	<15 minutes
L1	Highest time resolution, best spectral resolution	10 sec	0.1 nm	1 day
L2	Highest time resolution, common wavelength grid	10 sec	0.1 nm	1 day
L3	Daily averaged, common wavelength grid	1 day	0.1 and 1 nm	1 day