

# Variations in the Solar Spectral Irradiance

## Introduction

The TIMED (Thermosphere Ionosphere Mesosphere Energetics and Dynamics, <http://www.timed.jhuapl.edu/WWW/index.php>) mission is studying the influences of the Sun the Mesosphere and Lower Thermosphere/Ionosphere (MLTI). The SEE (Solar EUV Experiment, <http://lasp.colorado.edu/home/see/overview/>) has been providing solar spectral irradiance measurements since Feb 8, 2002. The SEE Level 3 data products contain measured solar irradiance spectra spanning approximately 27-115, 121.5, and 129-190 nm.

The primary science objectives for SEE are to accurately and precisely determine the solar Vacuum Ultraviolet (VUV, from 0 to 200 nm) absolute irradiance and variability during (see <http://lasp.colorado.edu/home/see/overview/> for more details). The SEE data can be viewed online either as:

- an average spectrum for a given day. ([http://lasp.colorado.edu/lisird/see/level3/3\\_ssi.html](http://lasp.colorado.edu/lisird/see/level3/3_ssi.html))
- a time series for a specific wavelength plotted daily. ([http://lasp.colorado.edu/lisird/see/level3/3\\_ssi\\_ts.html](http://lasp.colorado.edu/lisird/see/level3/3_ssi_ts.html))

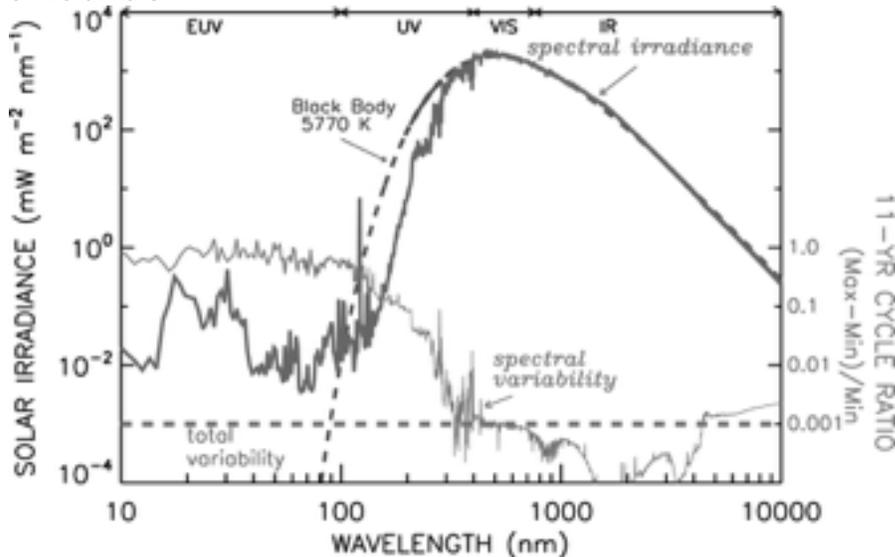
In addition, a proxy for the overall variation of the VUV irradiance can be seen using a simple measurement from a series of diodes. An example can be seen here ([http://lasp.colorado.edu/lisird/see/level3/3\\_xps\\_diodes.html](http://lasp.colorado.edu/lisird/see/level3/3_xps_diodes.html))

- *Open all three of these plots in separate windows, and perhaps on separate screens so that you can compare one to the other.*

## Structure and Features VUV Spectrum

Try to identify structure and features of the VUV spectrum.

- *Choose the spectrum for a particular date. Compare it to the spectrum shown in figure 10.1 of Volume 3?*



- **Are these two plots consistent with each other?**
- **Choose a different date. Do the features change?**
- **Compare to a different phase in the solar cycle. Do the features change?**
  
- **Identify a few features of seen in the spectrum.**
  - *Can you find the Lyman-alpha line? Why is that so strong?*
  - *What other elements do you expect to be present in the spectrum? Can you identify them?*

## Variations in the spectrum

Choose one of the three possible variations in the VUV spectrum and explore it.

1. Variations through out the solar cycle
2. Variations over the course of a year
3. Transient variations

You may find this link useful (<http://tinyurl.com/HSS-solar-irradiance>) showing the GOES 3-day X-Ray flux along with two SOHO EUV images and a white-light image

Here are some guiding questions for each of the investigations.

### 1. Variations through out the solar cycle

- *Is the solar cycle variation evident in the VUV spectrum?*
- *Is the variation due to the solar cycle the same over the spectrum? Is the variation the same for the features*
- *Is the magnitude the same? Is the period or phase the same?*

### 2. Variations over the course of a year

- *Zoom in the time scale to view a single year for a particular wavelength.*
- *What variations do you see over the course of a year?*
- *Compare the variations to the EUV images seen in the SOHO.*

### 3. Transient variations

- *Can you identify the transients in the solar irradiance?*
- *How do the spectrum of the transients compare to the spectrum without transients?*