The Sun as a Star: Flare Response of the FUV Continuum

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Outline

- Flares and FUV
- Purpose
- Analysis
- Final Results
Flares

- Flares are built up magnetic energy that is released into the solar atmosphere.
FUV Continuum

- Far Ultraviolet is considered from 115 nm to 180 nm
- We looked at 150 to 153 nm of this continuum
**SOLSTICE II**

- **SOLar-STellar Irradiance Comparison Experiment**
- **Launched January 2003.**
- **Scanning grating monochromator**
- **Measures 115-320 nm**
  - **FUV 115-180 nm ($\Delta \lambda = 0.1$ nm)**
  - **MUV 180-320 nm ($\Delta \lambda = 0.1$ nm)**

![Graph of Solar-Stellar Irradiance Comparison](image)

**Graph Details:**
- **Solar Irradiance**
- **Eta UMa Irradiance ($\times 10^8$)**
- **Wavelength (nm)**

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**Image:**
- SORCE Satellite Image
SOLSTICE Planning

正常的 vs 快速扫描

这些扫描的积分时间不同
Purpose

- The spectral distribution of solar flares in the ultraviolet is not well known.
- Ultimately this analysis will help us find out more about where the energy of a flare goes, and more about flares themselves.
SORCE Time Series

**SORCE Solar Spectral Irradiance - Time Series**

![Graph showing SORCE Solar Spectral Irradiance](image)

**SORCE Solar Spectral Irradiance, Wavelength=121.5nm**

- **Y-axis:** Spectral Irradiance (W/m²/nm)
- **X-axis:** Dates from Jan '04 to Jan '13

The graph illustrates the spectral irradiance over time, with a notable increase in irradiance from Jan '11 to Jan '13.
Day in the Life of SORCE

FUV Spectrum 2

Wavelength

12:00 31-Dec 2007
12:00 01-Jan 2008
12:00 02-Jan 2008
12:00 03-Jan 2008
12:00 04-Jan 2008
Spectrum of Portion of Interest
Average Irradiance of SORCE scans

![Graph showing the average irradiance of SORCE scans over time, with two distinct wavelength ranges: 151.3–151.9 nm and 150.3–150.9 nm. The graph includes data points for each wavelength range, showing fluctuations in irradiance over time from January 2008 to early February 2008.](image-url)
Histogram of Averaged Irradiance
Data Mining

- Looked at data from GOES to find dates of X-class flares
- Decided on 2003
Xray Irradiance of November 4\textsuperscript{th} 2003

![Graph showing Xray Irradiance of November 4\textsuperscript{th} 2003]
Time Before the Flare-Xray Irradiance

X-ray Irradiance Pre Flare

Irradiance

- 151.3–151.9 nm
- 150.3–150.9 nm

14:24 04–Nov 2003
15:35 04–Nov 2003
16:48 04–Nov 2003
18:00 04–Nov 2003
19:12 04–Nov 2003
20:24 04–Nov 2003
Time Before the Flare-SOLSTICE Scans

SOLSTICE Pre-Flare Scans

- Irradiance vs. Wavelength (nm)
- Data points for different wavelength ranges:
  - 151.3–151.9 nm
  - 150.3–150.9 nm
  - Average of Scans

Graph showing data points and trend lines for irradiance across different wavelength ranges.
Time After the Flare-Xray Irradiance
Time After the Flare-SOLSTICE Scans

SOLSTICE Post-Flare Scans

- Irradiance vs. Wavelength (nm)
- Data markers for different wavelength ranges:
  - 151.3–151.9 nm
  - 150.3–150.9 nm
  - Average of Scans

Graph showing irradiance levels across different wavelength ranges after a flare.
Final Results

Flare Response for All Flares Analyzed

17 March 2003 19:07:00 *
28 October 2003 10:30:00 ◊
29 October 2003 20:45:00 △
3 November 2003 09:50:00 □
4 November 2003 19:40:00 ×

151.3–151.9 nm
150.3–150.9 nm
Acknowledgments

- Martin Snow
- LASP and CU Boulder
- Solar and Space Physics REU Program, Erin Wood
- LASP Lunar Albedo Measurement and Analysis from SOLSTICE (LLAMAS)
- NASA Grant NNX09AQ60G
Questions?