



### ***Pre-SORCE Meeting Workshops –***

Prior to the 2010 SORCE Science Meeting in Keystone, Colorado, two SORCE-sponsored workshops were held concurrently on Tuesday morning, May 18.

#### **Solar Spectral Irradiance (SSI) and Climate Modeling**

The goals of this workshop led by Jerry Harder (SIM instrument scientist) were to: 1) promote the use of SSI and its variability in a variety of applications including climate, chemistry, and radiative transfer; 2) emphasize climate processes and mechanisms of climate response to SSI variability, with the ultimate goal of improving understanding of SSI-climate interactions; and 3) foster new interactions between the modeling community and the SORCE science team. Approximately 20 scientists were in attendance.



Jerry Harder (right) led the SSI and Climate Modeling Workshop, May 18, 2010, at Keystone, Colorado. Sasha Shapiro and Gérard Thuillier (left to right) were among the 20 participants.

#### **Total Solar Irradiance (TSI) Instrument Calibrations**

*By Greg Kopp, LASP, Univ. of Colorado*

##### Workshop Overview

Greg Kopp (TIM Instrument Scientist) organized this small workshop to discuss improvements in TSI instrument calibrations since the 2005 TSI Accuracy Workshop and plans for future calibration improvements to the TSI record. These discussions particularly involved the newly possible end-to-end validations, diagnostics, and results from the TSI Radiometer Facility (TRF) funded by the Glory program.

Attendees included representatives from all the current or imminent TSI instrument teams, including ACRIM, PREMOS, SOVA, TIM, and VIRGO. Keeping the workshop small let these researchers discuss instrument specific details unique to individual calibration methods.

Each team discussed instrument status, ground calibration approaches, and stability knowledge from on-orbit degradation tracking measurements. New end-to-end validation methods, such as those on the TRF to measure full irradiance under flight-like conditions, are proving a valuable supplement to traditional component-level calibrations, and have led to recent diagnostics helping explain the on-orbit differences between instrument values. NIST presented the results of TSI aperture comparisons they have completed and summarized updates to their facilities to help future TSI instrument calibrations.

##### Questions Addressed

- What causes absolute scale differences between instruments?
- What are aperture area uncertainties?
- How well have diffraction and scatter corrections from view-limiting apertures and baffles been calculated and/or measured?
- Why is there a quasi-annual signal in TIM-VIRGO-ACRIM differences?
- What are uncertainties in composites needed to relate solar minima?

The participants discussed the results and discoveries from the recent Glory/TIM, PICARD/PREMOS, SoHO/VIRGO, and SORCE/TIM comparisons on the TRF. Teams made plans for future validations of the ACRIM III and EURECA instruments on this new facility and for future meetings at which such results would be presented.

##### Summary of Results

- Scatter and diffraction have large needed corrections that are comparable to instrument offsets
- WRC and RMIB aperture calibrations agree well with NIST, but ACRIM aperture calibrations show large deviations that are not understood
- TRF end-to-end irradiance validations and instrument diagnostics completed or planned for all instruments
- On-orbit instrument stability continues to be well tracked
- ACRIM and PMOD composites have current solar minimum values lower than last
- NIST aperture area, cavity reflectance, and optical power calibration facilities improved

### ***Reminder:***

#### ***2010 SORCE Science Meeting Presentations –***

PDF versions of most presentations are available at:

<http://lasp.colorado.edu/sorce/news/2010ScienceMeeting/index.html>

## SSI Session at 2010 Fall AGU –

The AGU Fall 2010 meeting will include session Global Environmental Change 29 (GC29): ***Solar Spectral Irradiance and Long-Term Solar Variability: Observations and Implications.*** Marty Snow (LASP), Rodney Viereck (NOAA SWPC), Bill McClintock (LASP), and Erik Richard (LASP) are the conveners. The Fall AGU Meeting will be Dec. 13-17, in San Francisco, California.



**Session description:** Observations of the spectrally resolved solar irradiance (SSI) now extend over epochs that are long enough to identify the amplitude and phase of solar variability as a function of wavelength. This variability impacts the entire atmosphere, ozone and climate system. Long-term data records are often composites from several instruments or proxies. The methods of combining records and their uncertainties must be well understood to make valid comparisons on solar cycle timescales. We solicit papers on the measurement of SSI, the methods of producing composite time series, and the implications and impacts that SSI variations have on the atmosphere, climate, and near space environment.

## TSI Session at 2010 Fall AGU –

The AGU Fall 2010 meeting will also include session Global Environmental Change 17 (GC17): ***Total Solar Irradiance Observations and Calibrations.*** Greg Kopp (LASP) and Richard Willson (ACRIM) are the session conveners.



**Session description:** The ‘native’ scale of ACRIM3 and VIRGO satellite TSI results agree within 0.1 %. SORCE/TIM results are lower by 0.35 %, exceeding the theoretical uncertainty bounds for these three operational experiments. New TSI sensor calibration and characterization techniques using lasers calibrated by cryogenic radiometers have been implemented at LASP and NRL. Characterizations have recently been conducted on ACRIM3, VIRGO, TIM and PREMOS sensors to understand current scale differences and relate their results more accurately to the follow-on experiments to be launched during 2010: PREMOS and SOVAP on PICARD and GLORY/TIM. Papers on calibration of flight TSI instrumentation and their impact on TSI monitoring are solicited.



The Fall AGU Meeting is Dec. 13-17, in San Francisco, California. **You are encouraged to submit abstracts to AGU sessions (GC29 and GC17).**

**Abstract deadline: Thursday, September 2<sup>nd</sup>**

<http://www.agu.org/meetings/fm10/>.



## **38th COSPAR Scientific Assembly –**

Members of the SORCE science team went to Bremen, Germany, July 18-25, to participate in the 38<sup>th</sup> Committee on Space Research (COSPAR) Meeting. SORCE-sponsored talks included “*Irradiance observations of solar active longitudes over three solar cycles*”, by Marty Snow in Session C12, the 8<sup>th</sup> Annual Thermospheric-Ionospheric-Geospheric (TIGER) Symposium. SORCE SIM instrument scientist Jerry Harder presented “*Measured and modeled trends in solar spectral irradiance variability in the visible and infrared*” in Session A11, Atmosphere Chemistry and Physics. And representing TSI, Greg Kopp gave a talk on “*Total Solar Irradiance record accuracy and recent improvements*” in session A11, Solar Variability, Cosmic Rays and Climate. Additional SORCE scientists presenting at COSPAR this year include Tom Woods (SORCE PI), Erik Richard, Bill McClintock, and Peter Pilewskie.



## **Meeting of the Americas –**

SORCE SIM scientist Juan Fontenla will be attending AGU’s Meeting of the Americas in Foz do Iguacu, Brazil, August 8–12, 2010. The science program covers topics in all areas of geophysical sciences.

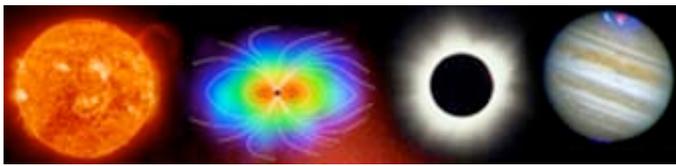


Juan will present two talks during the week. “*First Results of Modeling the UV Solar Spectral Irradiance*” shows the first-cut comprehensive physical models of the solar layers responsible for the UV radiation, the results derived from them, and the issues still remaining. This modeling allows us to study the effects of electromagnetic radiation on the Earth’s atmosphere in detail.

Juan’s second talk (invited), “*The Solar Radiation Physical Modeling Approach, Current Status, and Issues*” explains how SRPM assimilates the physical

properties of the solar atmosphere to understand and synthesize the entire solar spectral irradiance (SSI). There has been great success modeling the SSI for the near-UV, VIS, and IR ranges so far, and first-cut results over shorter UV ranges look promising. Recent observations by *SORCE* SIM shed new light on the SSI variations over the SC, and these are being incorporated in SRPM. These observations and their modeling provides novel tools for reconstructions of the past, complementing the current observational data with higher spectral resolution and coverage, and even for producing accurate forecasts. These advances pave the way for a new quantitative understanding of the radiative effects of the Sun's magnetic activity and the Earth's atmosphere.

### *SORCE Benefits from REU Program –*



The Boulder Solar and Space Physics Research Experience for Undergraduates (REU) Program comes to a close on Friday, August 6. Three lucky student interns – Brendan Lamarre, Lois Smith, and Erica Dolinar have been working at LASP this summer on *SORCE*-related projects. Each student is given a unique project and a *SORCE* science team mentor to help them with their 8-week research project.

The purpose of the program is to provide students with a summer opportunity to work with scientists on projects spanning the field of solar and space physics, from instrument hardware to data analysis to modeling of the Sun-Earth system. This NSF program is administered by LASP at the University of Colorado, in collaboration with the NCAR, NOAA's Space Weather Prediction Center (SWPC), NWRA's Colorado Research Associates (CoRA), CIRES at the University of Colorado, and the Southwest Research Institute (SwRI). The *SORCE* mission sponsors 3 students per year in this program.



The 2010 REU students – still smiling at the end of their first week! The first week was jam-packed with introductory lectures on the Sun-Earth system. Talks were given by various NCAR and LASP scientists.



The REU students enjoyed a BBQ at Marty Snow's home early in program so they could get to know each other. Marty is the 2010 REU Coordinator for the entire Boulder REU Program, which includes a record number of students (16) this year.

**Erica Dolinar** from Millersville University, a small school of 8,000 students in Lancaster, Pennsylvania, is working with mentor Marty Snow. Erica will be a senior this fall and is majoring in Meteorology with a minor in Physics. Graduate School (maybe even CU) is a strong possibility as she considers opportunities to do research. Erica's first visit to Colorado was in April when her Millersville University class brought 12 students to NOAA's Space Weather Workshop in Boulder. The focus of her REU project is to use the *SOLSTICE* Lyman alpha airglow measurements to study how the geocorona responds to changes in solar irradiance and geomagnetic activity.

Erica Dolinar is working with mentor Marty Snow using *SOLSTICE* data to explore how airglow varies due to geomagnetic activity.



**Lois Smith** will begin her junior year when she returns to Furman University in Greenville, South Carolina, this fall to complete her Physics and Latin double-major. For the summer REU program she has been working with *SORCE* scientist Erik Richard on the *Short Term Correlations between Solar Spectral Irradiance and Total Solar Irradiance Variability*. Using data from *SORCE*'s SIM and TIM instruments and SOHO images corresponding to peak solar activity, Lois is comparing SSI and TSI over specific 3-week periods starting from January 2004 to present. Two facular brightening days, one sunspot day, and a reference day of a quiet sun were used in these comparisons. She is also using Judith Lean's SSI models in her comparisons to explore the subtle short-term variability differences between the two data sets. For fun Lois, or Lo as her

friends call her, has been enjoying the Rocky Mountains whenever she can. Her highlights include summiting



Lois Smith and Erik Richard are working with SIM and TIM data as they compare SSI and TSI measurements.

Longs Peak (14,255 feet) and trying rock climbing for the first time. (Both are major accomplishments for someone who is afraid of heights!) She hopes to return to Colorado for graduate school.

Jerry Harder is mentoring **Brendan Lamarre**, who will be returning to Colorado College in Colorado Springs for his second year this fall. Brendan's project title is *Analysis of Solar Variability using SORCE SIM data*. He is using solar irradiance measurements in the 300-400 nm range from SIM to compare with PSPT image data and other observations in this wavelength regime. In the fall, Brendan will continue his studies in physics and math, while making time for his personal passion – a good game of competitive lacrosse.



Brendan Lamarre is working with mentor Jerry Harder, SORCE SIM scientist.

All of the REU students are taking full advantage of their summer in Boulder by enjoy the local activities, such as hiking the beautiful foothills and peaks, tubing down the Boulder Creek, rock climbing, and visiting Rocky Mountain National Park.

**1,566,756**  
**Hits to the SORCE Website**  
*(Since 4/21/03, As of 7/23/10)*

***Upcoming Meetings / Talks –***  
*SORCE scientists plan to present papers or attend the following 2010 meetings:*

- AGU Meeting of the Americas, August 8-12,  
Foz do Iguacu, Brazil
- AGU Fall Meeting, Dec. 13-17, San Francisco, California