Thomas R. Metcalf Lecturer Award: Report for Amir Caspi

2013 LWS/SDO Science Workshop, Cambridge, MD; 4–8 March 2013

Biography:

Amir Caspi is a Research Scientist at the Laboratory for Atmospheric and Space Physics, at the University of Colorado, Boulder. He earned his Ph.D. in Physics from the University of California, Berkeley in 2010, under the advisorship of Robert P. Lin; his dissertation work focused on the origins and evolution of super-hot (T > 30 MK) thermal plasma in solar flares using X-ray data from RHESSI. He currently continues this work with additional data from SDO/EVE, and is the instrument scientist for the next-generation X-ray Sensor (XRS) being built for the upcoming GOES-R-series operational spacecraft.

Contributed Presentations:

Talk: Exploring Thermal & Non-Thermal Flare Emission with EVE & RHESSI

The EUV Variability Experiment (EVE) on-board the Solar Dynamics Observatory (SDO) observes EUV emission lines with peak formation temperatures of 2–20 MK, while the Reuven Ramaty High Energy Spectroscopic Imager (RHESSI) observes the X-ray bremsstrahlung of hot, 10–50 MK plasma. Combined, the two instruments cover the full range of flare plasma temperatures and offer the most comprehensive view of the flare differential emission measure (DEM), i.e., the plasma temperature distribution – the amount of emitting material at any given temperature. We presented the current progress in developing a technique for determining flare DEMs using both EVE and RHESSI simultaneously, with each instrument constraining the other. The technique uses forward-fitting of physical solar spectral inputs, folded through the respective instrument response functions, to generate predicted spectra for both instruments, which are then fit simultaneously to minimize the joint χ^2. We applied this technique to a number of synthetic test cases to show that it robustly recovers the input test DEMs. We then showed preliminary results of analyzing real data from an intense, X-class flare. Through this technique, for the first time, we can determine self-consistent DEMs over the complete flare temperature range of ~3–50 MK, and this precise determination of the thermal emission will later enable detailed studies of the non-thermal electron populations, as well.

Poster: A New Observation of the Quiet Sun Soft X-ray (0.5–5 keV) Spectrum

The solar spectrum from ~0.25 to ~3 keV has not been systematically measured with spectrally-resolved observations in many decades, with limited exceptions (e.g. SphinX, MESSENGER/SAX), which has significant implications for studies of both solar physics and of the Earth ionospheric response to solar X-rays. We presented a new observation from the Amptek-X123 silicon drift detector, flown on the 2012 SDO/EVE sounding rocket calibration underflight. The X123, using an 8-μm-thick Be entrance window, observed the quiescent solar X-ray emission from ~0.5 to ~5 keV with a resolution of ~0.15 keV FWHM and cadence of ~2 s. Despite the very weak activity on the Sun at the time, the solar photon spectrum inferred from the X123 observations is orders of magnitude brighter than the SphinX observations of the truly-quiet Sun during the deep minimum of 2009. The flux predicted by the XPS Level 4 model overestimates the observations by ~10×, indicating a need for revision of the XPSL4 model.