Measuring the Solar Soft X-Ray Spectrum

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Current solar measurements of soft x-ray (SXR) irradiances are not providing spectra below 6nm, making differences in broader wavelength models difficult to explain. Obtaining a reliable spectrum in this low wavelength range would potentially resolve some of these differences as well as improve upon current models of x-ray radiation. The Amptek X123 x-ray spectrometer, a photon counter designed for these lower wavelengths, was used to obtain a spectrum ranging from approximately 0.1-3 nm. The instrument was launched on board the NASA 36.286 EVE calibration rocket from White Sands Missile Range, New Mexico on June 23, 2012. The X123 records instrument status as well as spectral data, monitoring things like the integration time over which each spectrum was taken and the board and detector temperatures over the course of flight. After extracting the raw data files, several calibrations were done using radioactive sources Am241 and Fe55. Am241 was used to perform a gain calibration on the X123 at different temperatures, and it was found that the gain does not vary significantly with temperature, allowing for the use of a single gain equation in the data analysis. Using this calibration along with the calculated responses of the X123 filter and detector, a spectrum was generated from the X123 raw count data. This spectrum was then compared to solar irradiance models scaled to match the broadband irradiance in the 0.1-7 nm range from the TIMED and SORCE XUV Photometer System (XPS). This XPS-based model, also known as the XPS Level 4 product, overestimates the X123 spectrum by a factor of approximately ten. With the GOES-15 0.1-0.8 nm irradiance in agreement with the X123 result and with SDO EUV Variability Experiment (EVE) spectra being more than a factor of two higher than the XPS Level 4 model in the 7-15 nm range, it appears that the XPS Level 4 model needs major revisions in the 0-15 nm range. The X123 measurement provides a new reference spectrum for the 0.1-3 nm range that can be used to improve solar SXR models.