The Case for a Radiometric Imager, and How to Build One

Mark Rast *[mark.rast@lasp.colorado.edu], Dept. of Astrophysical and Planetary Sciences, Laboratory for Atmospheric and Space Physics (LASP), University of Colorado, Boulder; and Jerald Harder, LASP, University of Colorado, Boulder.*

Global solar spectral irradiance variations depend on changes in the distribution of magnetic flux elements in the solar photosphere. The spectral contributions of these show strong center-to-limb dependencies that have never been determined. While high-accuracy spacecraft measurements of the disk integrated total and spectral irradiance of the Sun have been ongoing for over 30 years, all precision irradiance imaging of the Sun has been ground-based and thus photometric, measuring the intensity of pixels on the disk relative to some arbitrarily defined reference 'quiet-sun' background. Since this reference center-to-limb profile is highly wavelength dependent, the origin of solar spectral irradiance variations cannot be unambiguously determined without distinguishing it from changes in the magnetic structure contributions. This argues for a full disk solar imager with radiometric capabilities. The effort would combine in one package a Photometric Imager to acquire photometrically accurate images through select bandpass filters, an Integrating Radiometer to determine the radiometric intensity of the integrated disk over the same passbands with absolute accuracy, and a Passband Monitor to determine the actual passband being observed. Rather than calibrate and monitor the radiometric accuracy of the full optical train of the telescope, the photometric images would be corrected using the measured bandpass and spectral irradiance data to determine the integrated radiation that should have contributed at the image plane, to yield for the first time radiometrically calibrated full disk solar images.