

***A Compact Solar Spectral Irradiance Monitor for Future Small Satellite and CubeSat Science Opportunities***

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Accurate and continuous measurements of solar spectral irradiance (SSI) is recognized as being increasingly important to advancing our understanding of the solar influence on Earth's climate. For example, the magnitude of SSI UV variability has significant implications, both directly and indirectly, for the response of the stratosphere and mesosphere, whereas the visible and near infrared SSI variability influences the radiative balance, thermal structure, and dynamics of the lower atmosphere and ocean layers. Recent SSI measurements are providing critical inputs in evaluating and improving present climate models, however they are not yet of sufficient accuracy to stand alone without overlapping records – gaps in the observational record, caused by future mission delays or early failures of existing missions, effectively destroy our ability to link records from different instruments into a continuous, long-term climate quality record. Recent advancements in calibration facilities and techniques make it now possible to improve significantly the accuracy and traceability of future SSI observations and assure quantification of uncertainty as input to increasingly more sophisticated climate models.

The goal of the proposed compact SSI monitor is to cover 200-2400 nm with the required SI-traceable accuracy and on-orbit stability to meet the solar input measurement requirements defined in the Earth Science Decadal Survey for establishing benchmark climate records. Building upon our experiences and resources from the Total and Spectral Solar Irradiance Sensor (TSIS) program, the instrument will reduce the cost, size, and characterization and calibration schedule of a solar spectral irradiance monitor with SI-traceable absolute calibration at the 0.2% uncertainty level ( $k=1$ ) while maintaining 100 ppm relative stability. System level performance characterizations and final end-to-end absolute irradiance calibration will be accomplished with the LASP Spectral Radiometer Facility (SRF), a comprehensive LASP-NIST jointly developed spectral irradiance calibration facility utilizing the SIRCUS tunable laser system tied to an SI-traceable cryogenic radiometer. The instrument utilizes a straightforward low aberration optical design in a compact, folded geometry that overcomes the extremely high tolerance and costly fabrication requirements associated with previous designs while reducing the overall calibration risks. This will potentially mitigate data continuity risks associated with future mission delays by offering an instrument with implementation flexibility for alternative flight opportunities, including ride share and hosted payloads, small satellites and potentially, multi-sensor CubeSat missions, a rapidly emerging technology for low cost orbital science.