

The realization of total spectral radiant flux scale and calibration service at NIST

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Spectroradiometers are increasingly used in integrating sphere measurement systems for obtaining photometric, radiometric, and colorimetric quantities of a light source with a single measurement. These spectral measurement systems need to be calibrated against total spectral radiant flux standards. In response to the need, we have realized the total spectral radiant flux scale and developed a calibration service.

Two approaches are used to derive the total spectral radiant flux scale for cross check. The first approach is based on goniometric method. A lamp under test is first measured for relative spectral radiant intensity at many directions to determine the relative total spectral radiant flux, using a goniospectroradiometer calibrated against a spectral irradiance standard lamp for relative spectral irradiance responsivity. The test lamp is then calibrated for total luminance flux to determine the scale factor to obtain the absolute total spectral radiant flux.

The second approach is to directly derive the total spectral radiant flux scale from the spectral irradiance scale by using the absolute integrating sphere equipped with a spectroradiometer. A spectral irradiance standard lamp and a precision aperture outside the absolute integrating sphere are used to obtain the reference spectral radiant flux introduced into the integrating sphere. The total spectral radiant flux of the test lamp is then determined by directly comparison against the reference spectral radiant flux, with corrections of spatial nonuniformity of sphere responsivity and other factors applied spectrally.

The details of the scale realizations based on the two different approaches and uncertainty analyses will be presented. The current transfer standard lamps and the calibration service will be discussed.

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