

# STRAY LIGHT ERRORS



The stray light rejection of a spectroradiometer is especially critical when measuring the ultraviolet spectral distribution of sunlight or any other broadband source that emits UV radiation. The analysis below shows the errors associated with the measuring of these sources with a high quality single grating monochromator and with the UV-optimized, double grating monochromator-based OL 756 Spectroradiometer.

- 1 Irradiance @ 310 nm for a  $\Delta\lambda = 1$  nm  
 Sunlight:  $E_s = 4.95 \times 10^{-6}$  W/cm<sup>2</sup>  
 Tungsten:  $E_T = 3.48 \times 10^{-7}$  W/cm<sup>2</sup>
- 2 Integrated Irradiance from 295 to 800 nm  
 Sunlight:  $E_{\Delta S} = 2.9 \times 10^{-2}$  W/cm<sup>2</sup>  
 Tungsten:  $E_{\Delta T} = 7.0 \times 10^{-3}$  W/cm<sup>2</sup>
- 3 Broadband Stray Light Rejection of a High Quality Single Monochromator =  $10^{-4}$
- 4 Broadband Stray Light Rejection of the OL 756 Spectroradiometer =  $10^{-8}$

$$\text{Stray Light Error \%} = \frac{(E_{\Delta 1} - E_1) R_1}{E_1} \times 100$$

Where:  $E_{\Delta 1}$  = Integrated Irradiance of Source

$R_1$  = Stray Light Rejection

ERROR DUE TO STRAY LIGHT		
SOURCE	SINGLE MONOCHROMATOR	OL 756 SPECTRORADIOMETER
Sunlight	58%	0.006%
Tungsten	201%	0.02%

In summary, the measurements made at 310 nm with the single monochromator have errors of 58% and 201% for sunlight and tungsten sources respectively because of the stray light, whereas measurements made with the OL 756 are virtually unaffected.

## WAVELENGTH ACCURACY AND REPEATABILITY

The wavelength accuracy and repeatability of a monochromator is also quite critical when measuring the spectroradiometric output of light sources such as sunlight, solar simulators, tungsten lamps, etc. in the ultraviolet spectral region.

The table below gives the effective error in a spectroradiometric measurement of sunlight and a typical tungsten lamp standard when there is an error of  $\pm 1$  nm in the wavelength setting of the monochromator.

EFFECTIVE ERROR		
WAVELENGTH	SUNLIGHT	TUNGSTEN LAMP STANDARD
295 nm	$\pm 253\%$	$\pm 3\%$
300 nm	$\pm 119\%$	$\pm 2.6\%$
325 nm	$\pm 17\%$	$\pm 2\%$
350 nm	$\pm 7\%$	$\pm 1.9\%$
400 nm	$\pm 5\%$	$\pm 1.5\%$
600 nm	$\pm 0.1\%$	$\pm 0.46\%$
800 nm	$\pm 0.4\%$	$\pm 0.2\%$