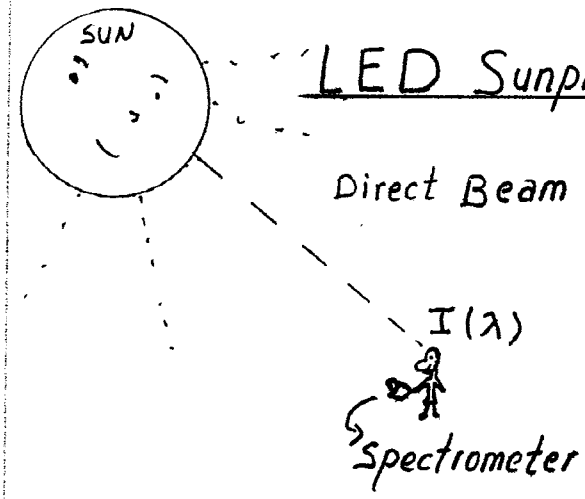
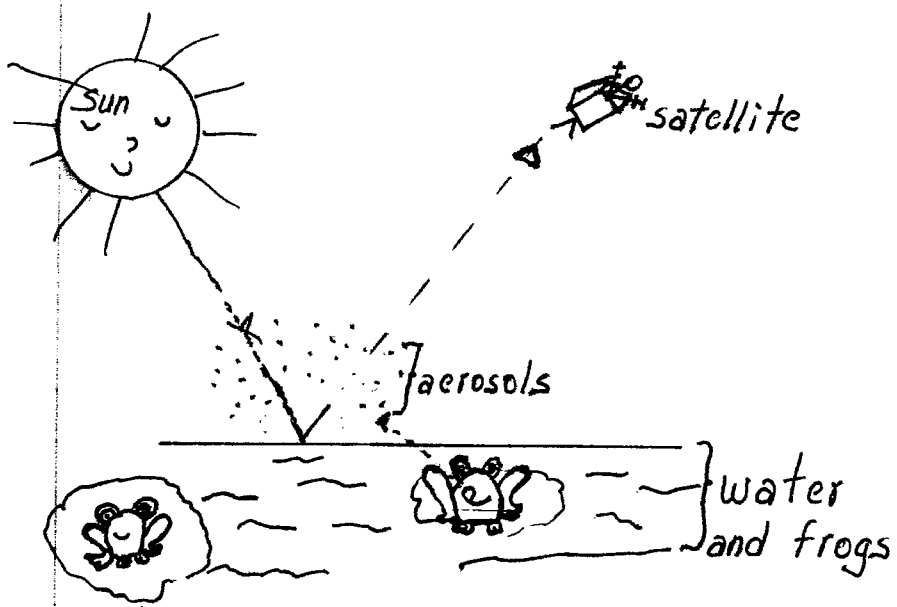
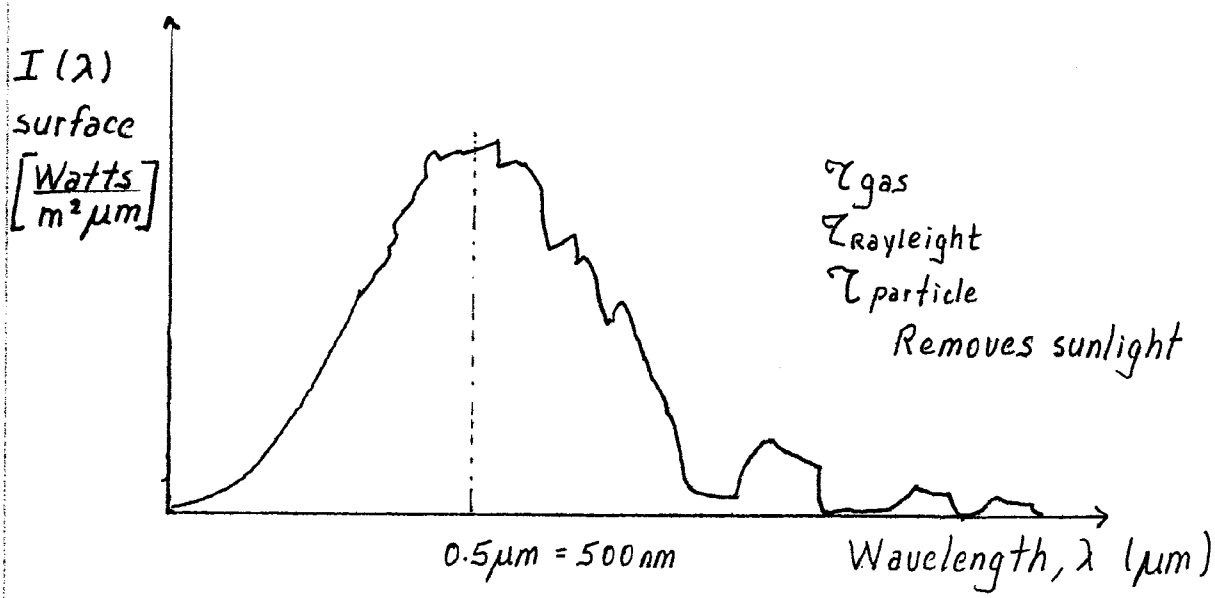
LED Sunphotometer Measurements



Consider an observer with a spectrometer to measure the spectrum of sunlight. The person may also be packin' an LED-based sunphotometer.
Why? Because she/he can measure the optical properties of the atmosphere using an instrument that costs as little as $30. The optical properties can be related to the aerosol concentration.

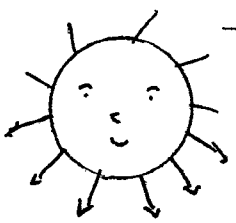


These simple instruments are also useful to calibrate satellites with active (Lidar) or passive (spectrometers) sensors on them.



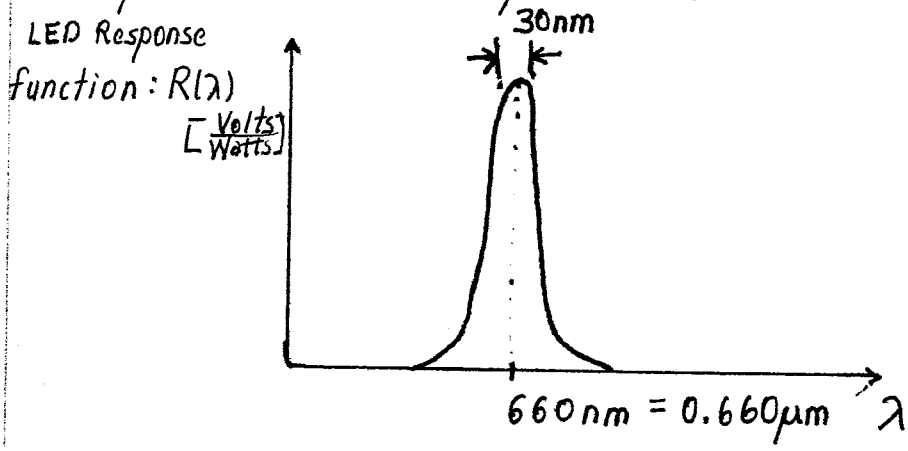
This is the spectrum of sunlight at the surface after it has passed through the atmosphere. Gas and aerosol particles absorb and scatter sunlight. Cloudy days have much more variable sunlight.

LED Sunphotometer

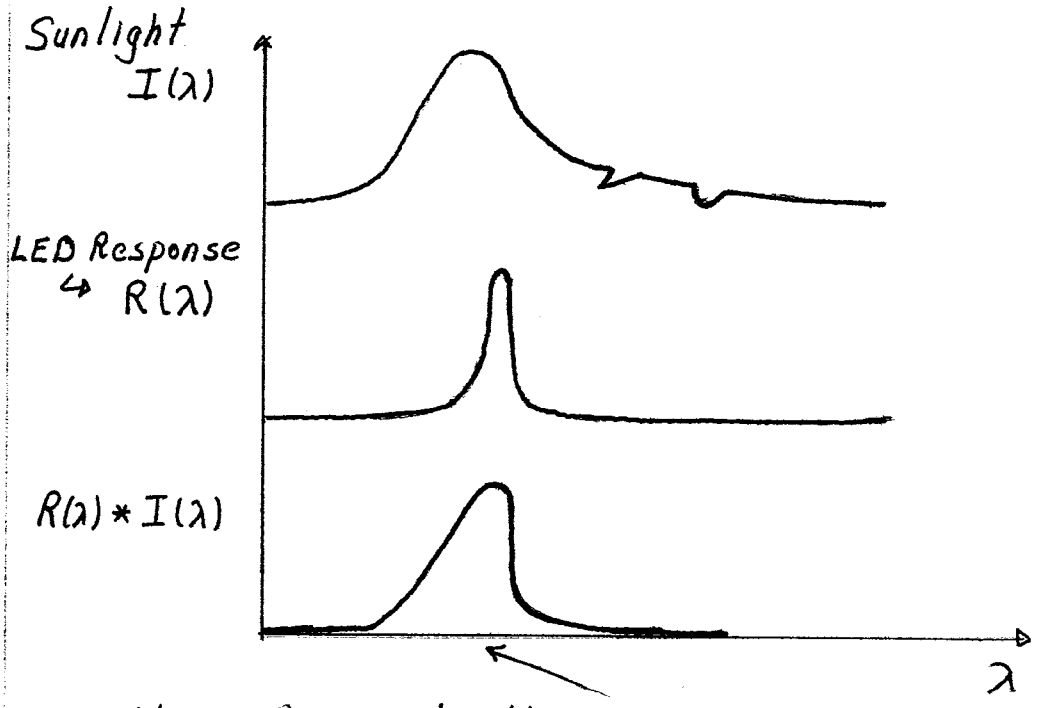


Response area of a LED = A

Example of a detector response function



The light Emitting Diode (LED) responds to light in a narrow wavelength band.



V_{LED} = Area under this curve

$$V_{LED} = A \int_0^\infty I(\lambda)\, R(\lambda)\, d\lambda$$

V_{LED}: Sunphotometer Voltage

A: m^2

$I(\lambda)$: $\frac{\text{Watts}}{m^2\,\mu m}$ — Source Response (Sunlight)

$R(\lambda)$: $\frac{\text{Volts}}{\text{Watt}}$ — Detector Response (LED)

$d\lambda$: μm

This is a specific example of how a detector works.