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# **Model LTD-11 3-Element Trap Detector**

## **User Manual**



L-1 Standards and Technology, Inc.  
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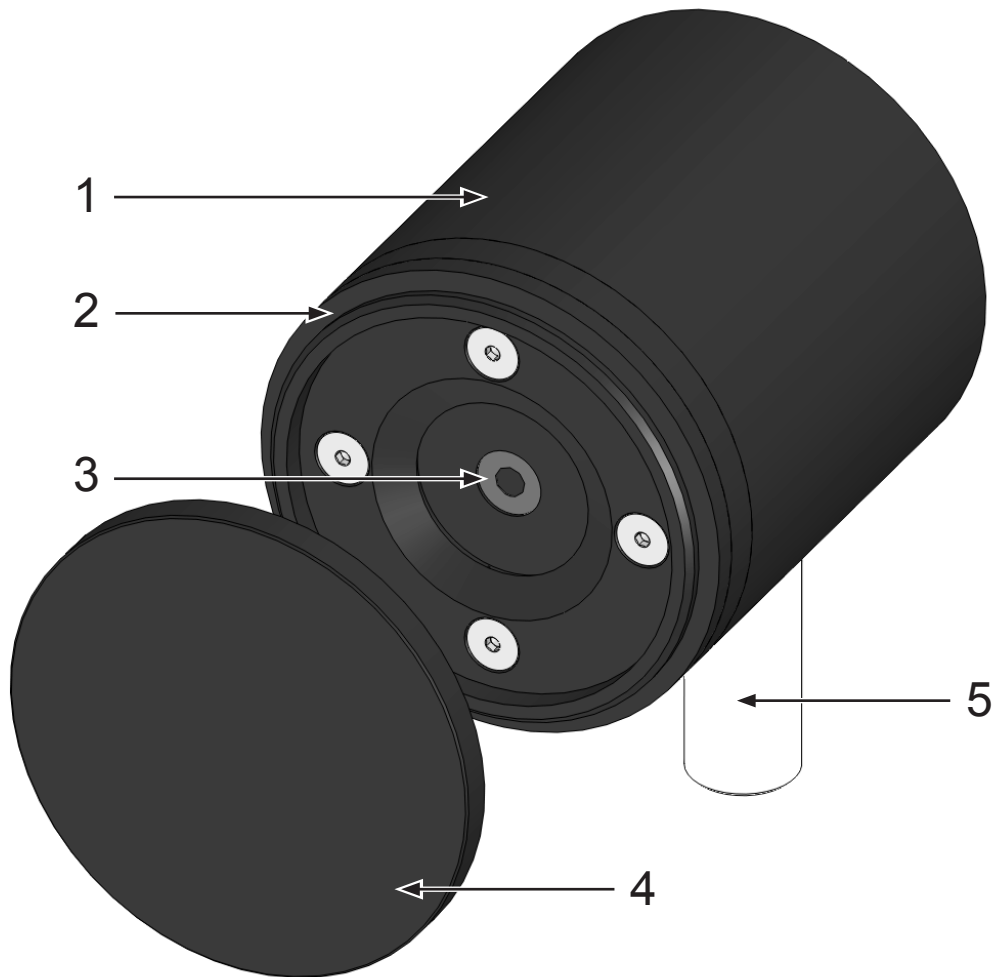
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# 1 Parts List

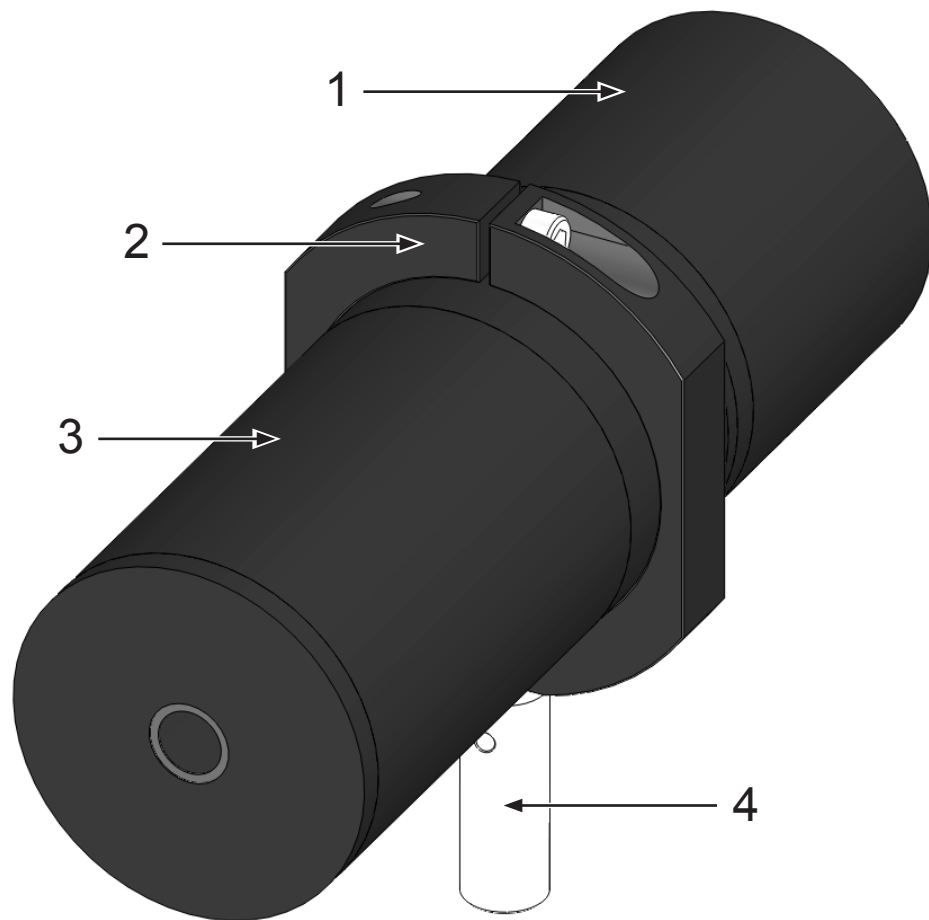
●	Trap Detector (with 5 mm Entrance Aperture Installed)	1 ea
●	Front Cover	1 ea
●	Optical Mounting Post (0.5" diameter) - #8-32 X 3/8" Set Screw (installed)	1 ea 1 ea
●	Gershun Radiance Baffle Tube	1 ea
●	Lens Tube Slip Ring (Thorlabs part # SM2RC)	1 ea
●	3.568 mm Entrance Aperture	1 ea
●	Hex Key 0.062"	1 ea
●	Hex Key 0.050"	1 ea
●	BNC Cable (1.83 Meters Length)	1 ea
●	BNC 90 Degree Adaptor	1 ea
●	Pelican 1170 Storage Case	1 ea
●	Model LTD-11 User Manual	1 ea

## 2 Identification — Front



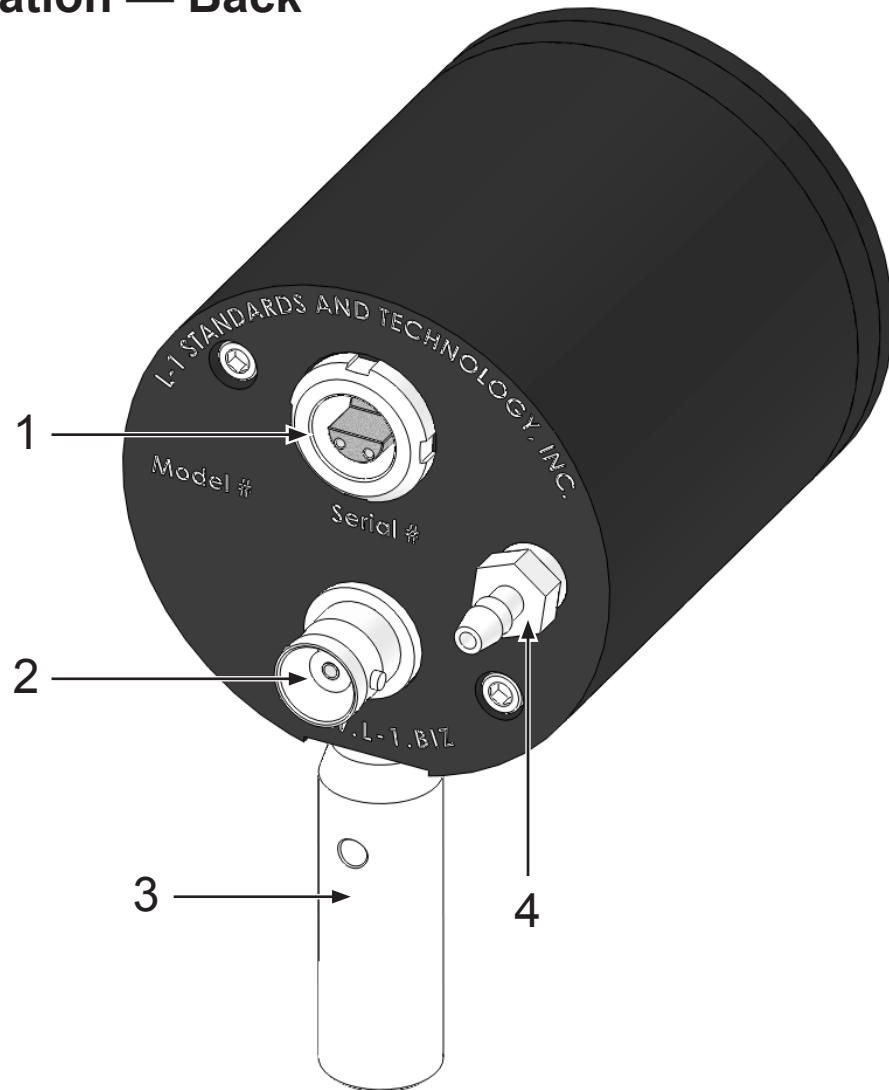
- 1 Trap Detector Housing
- 2 Baffle Mount
- 3 Entrance Aperture
- 4 Front Cover
- 5 Optical Mounting Post (shown attached to bottom of housing)

### 3 Identification — Front (with Gershun Radiance Baffle Tube)



- 1 Trap Detector Housing
- 2 Lens Tube Slip Ring (Thorlabs part # SM2RC)
- 3 Gershun Radiance Baffle Tube
- 4 Optical Mounting Post (shown attached to bottom of slip ring)

## 4 Identification — Back



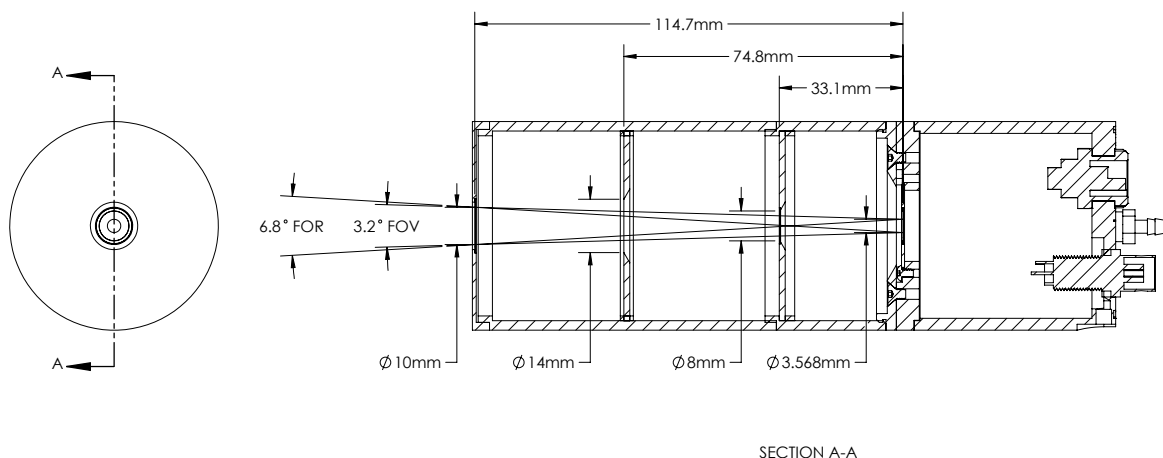
- 1 4-pin Lemo Connector (to Temperature Controller)
- 2 Detector Signal BNC
- 3 Optical Mounting Post
- 4 Purge Fitting

## 5 Gershun Radiance Baffle Tube

The trap detector can be used as a power, irradiance, or radiance meter. Installing an aperture of known area in front of the trap detector allows it to be used as an irradiance meter. The addition of radiance measuring optics then converts the detector to a radiance meter. The provided Gershun (McCluney, 1994; Parr, 2005) radiance baffle tube contains three apertures. One aperture limits the field of view (FOV) to 5° and the other two reject stray light. Assuming that the trap detector has been calibrated for power responsivity, the difference from an ideal radiance is -0.012% for a 5 mm aperture and -0.006% for a 3.568 mm aperture.

To attach the Gershun baffle tube:

- 1 Unscrew the front cover from the baffle mount if connected.
- 2 Screw the baffle tube onto the baffle mount.
- 3 Open the lens tube slip ring and place it over the area where the baffle tube is connected to the baffle mount.
- 4 Tighten the lens tube slip ring until it is secure.
- 5 Unscrew the optical mounting post from the trap detector housing and attach it to the lens tube slip ring.
- 6 Mount the trap detector assembly on the laser table using an optical post holder.
- 7 Make any adjustments to the location of the trap detector within the lens tube slip ring as needed to obtain proper alignment.

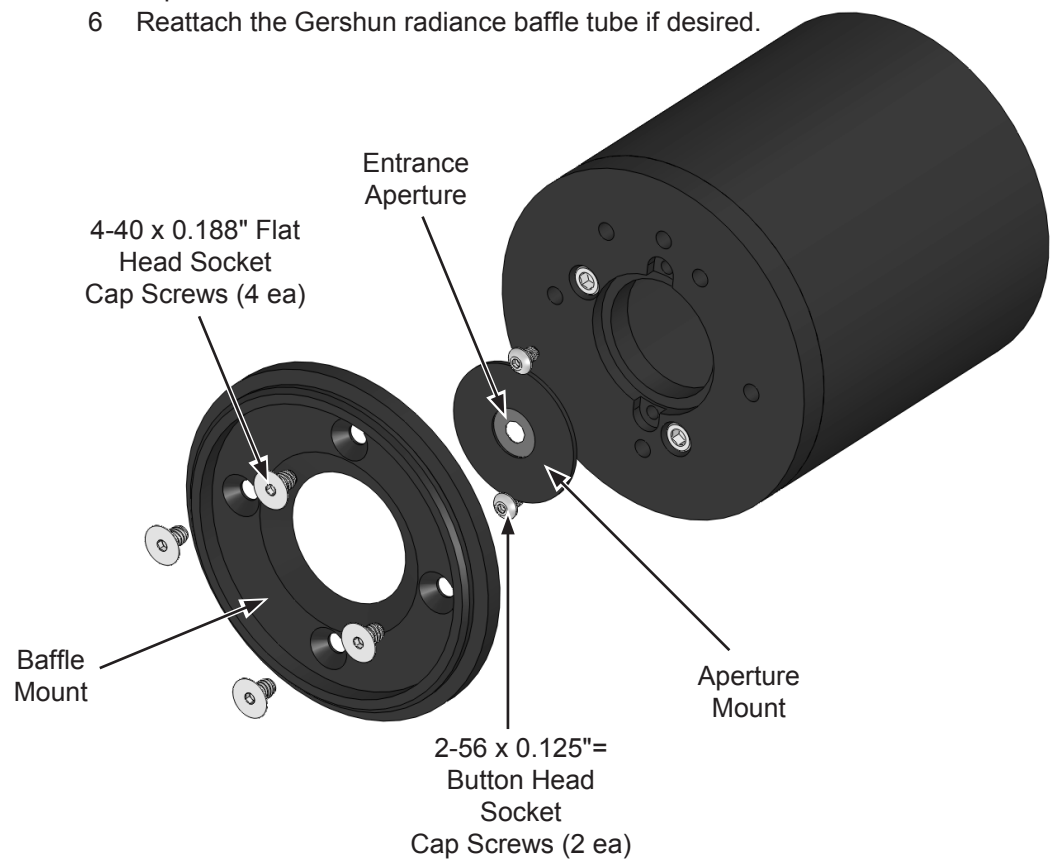




## 6 Front Entrance Aperture

The trap detector is shipped with a 5 mm aperture mounted in front of the entrance. A 3.568 mm entrance aperture is also provided. Each aperture is permanently secured in an aperture mount which can be removed from the trap detector. To switch between the 5 mm and 3.568 mm apertures:

- 1 Unscrew the Gershun radiance baffle tube from the baffle mount if connected.
- 2 Remove the baffle mount by unscrewing the four, 4-40 x 0.188" flat head socket cap screws using the 0.062" hex key provided.
- 3 Remove the two, 2-56 x 0.125" button head socket cap screws holding the aperture mount (with 5 mm aperture installed) in place using the .050" hex key provided.
- 4 Replace with 3.568 mm aperture mounted in its aperture mount and secure with the two, 2-56 x 0.125" button head socket cap screws.
- 5 Resecure the baffle mount with the four, 4-40 x 0.188" flat head socket cap screws.
- 6 Reattach the Gershun radiance baffle tube if desired.



## 7 Setup

### NOTE

*Turn off power to the transimpedance amplifier and the temperature controller before starting the below steps.*

- 1 Connect the supplied BNC cable between the Model LTD-11 trap detector and a standards grade current to voltage transimpedance amplifier. Use the provided BNC 90° adaptor if necessary. A standards grade transimpedance amplifier minimizes drift and maintains the highest accuracy.
- 2 Connect the transimpedance amplifier output to a 6.5 digit voltmeter to monitor the trap detector output.
- 3 Make sure the Model 3100 Temperature Controller is turned off.
- 4 Connect the trap detector to the Model 3100 Temperature Controller using the cable supplied with the controller. The four pin LEMO connector of the cable connects to the back of the trap detector and the Db-15 connector to the back of the temperature controller.
- 5 Power on the temperature controller. The temperature controller is preprogrammed to automatically control the detector to 29° Celsius. If a change in the set point is needed or if automated recording of the temperature is desired, please refer to the Model 3100 Temperature Controller User Manual.

## 8 Alignment

### NOTE

*Do not exceed 10 mW total optical power or 500 mW/cm<sup>2</sup> incident upon the trap detector or damage to the detectors may result.*

- 1 The maximum acceptance angle for each of the following cases is:
  - 1) Beam focused at the entrance aperture with the Gershun radiance baffle tube removed: 7.3° (127 mrad) Full Angle
  - 2) Overfilled 3.568 mm aperture: 3.7° (64 mrad) Full Angle
  - 3) Overfilled 5 mm aperture: 2.1° (37 mrad) Full Angle
- 2 Align the front face of trap detector so that it is normal to the incident beam. Verify proper alignment by placing a flat mirror (not provided) against the front of the trap detector and adjust the trap detector until the beam is retroreflected upon itself.
- 3 The detectors inside the trap have been aligned so that the weak retroreflected beam returning from the trap detector is aligned 0.5 degrees upwards along the vertical axis. This can be verified by viewing the beam spot reflected by the trap detector from a laser.

## 9 Cleaning and Maintenance

### NOTE

*Do not clean the detectors located inside the housing. The detectors are windowless with exposed silicon surfaces and delicate gold wire bonds that are easily damaged.*

- Every attempt should be made to limit exposure to dust and contaminants. Use the provided front cover at all times when not in use.
- A purge fitting is provided on the rear of the detector housing. Dry, filtered nitrogen gas can be attached to the purge fitting and allowed to flow at a rate no more than 0.5 liters/minute (1 SCFH) to prevent dust from entering the detector housing.
- The outside of the detector housing can be cleaned with a low particle producing cleanroom wipe (such as Texwipe® BlueWipe®) dampened with a small amount of ethanol. Do not apply any liquid directly onto the housing as it may seep inside and damage the detectors.

## 10 General Specifications

### NOTE

*Do not exceed 10 mW total optical power or 500 mW/cm<sup>2</sup> incident upon the trap detector or damage to the detectors may result.*

Detectors:	Hamamatsu 1337 Windowless Silicon Photodiodes 10 mm square
Temperature Control:	Internal thermoelectric Peltier cooler used to stabilize the detector elements to a given temperature. Default temperature is 29° C.
Arrangement:	Three detectors arranged in a retroreflecting design providing a total of five reflections from the silicon diode detectors. Detectors are oriented so as to minimize polarization sensitivity.
Max Acceptance Angle (Full):	Beam focused at entrance aperture: 7.3° (127mrad) Overfilled 3.568 mm aperture: 3.7° (64 mrad) Overfilled 5 mm aperture: 2.1° (37 mrad)
Linearity:	Detector responsivity guaranteed to be linear up to 500 µW over the spectral range of 450 nm to 950 nm.
Vacuum Compatibility:	Can be used in clean, high vacuum environments when vacuum compatible cables are used.
Weight (trap detector only):	214.4 grams (without optical mounting post, Gershun baffle tube, or lens tube slip ring)
Storage Environment:	0° C to 50° C Up to 80 % relative humidity, non-condensing
Operating Environment:	15° C to 40° C Up to 80 % relative humidity, non-condensing
Wavelength Range:	450 nm – 950 nm
Warranty:	All goods manufactured by L-1 shall be free from defects in material and workmanship for a period of one (1) year from the date of delivery. The purchaser is responsible for all transportation costs to and from the factory for repair. Resale products shall carry only the warranty offered by the original manufacturer.

## 11 Characterization Equation

In general, the spectral responsivity **R** for a photon detector can be given by:

$$R = \frac{\eta q \lambda}{hc}$$

In energy units, where:

$\eta$  = quantum efficiency

$q$  = electron charge

$\lambda$  = vacuum wavelength

$h$  = Planck's constant

$c$  = velocity of light

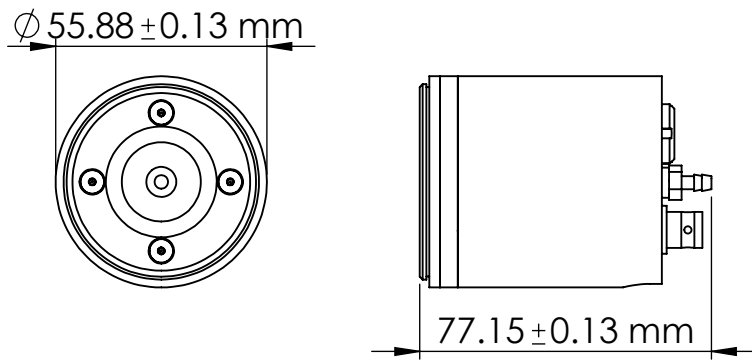
The spectral responsivity **R** for the LTD-11 trap detectors is:

$$R = \frac{0.9965 \lambda}{1239.84} \text{ A W}^{-1}$$

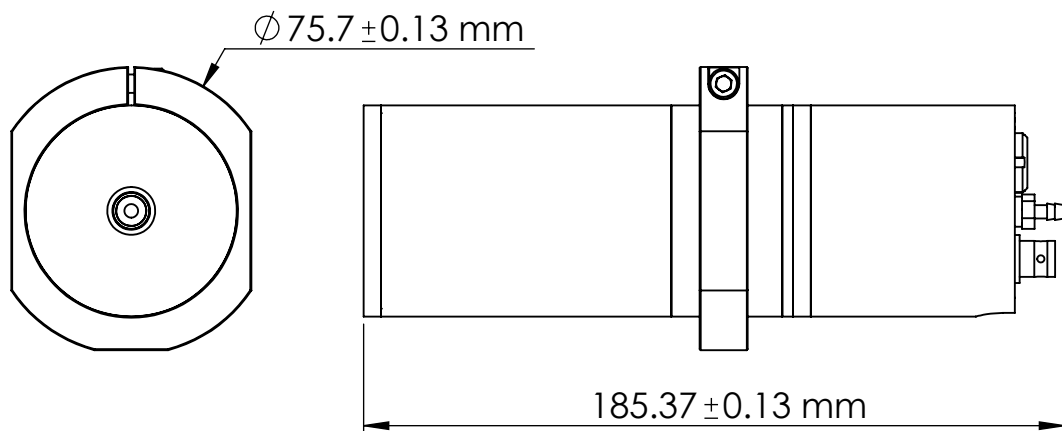
where  $\lambda$  is the vacuum wavelength in nm.

## 12 Dimensions

### Trap Detector Only:



### Trap Detector with Gershun Radiance Baffle Tube:



## 13 References

McCluney, R. (1994). *Introduction to Radiometry and Photometry*. Norwood, MA: Artech House.

Parr, A.C., Datla, R.U., & Gardner, J.L. (Eds). (2005). Optical Radiometry. *Experimental Methods in Physical Sciences (Vol. 41, pp. 188-189)*. San Diego, CA: Elsevier, Inc.