Construct, Conduct & Comprehend Physics Experiments

LEOK-3-11 Verifying Inverse Square Law of Light

- *Complete set*
- *Cost effective solution*
- *Detailed instructional manual*
- *Easy alignment*

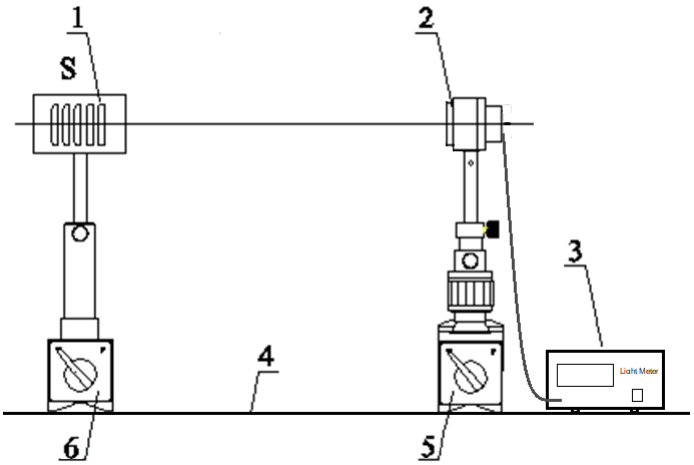


Figure 11-1 Schematic of experiment setup

1: Bromine Tungsten Lamp *S* (LLC-3)
2: Light Sensor
3: Light Meter
4: Meter Scale
5: Magnetic Base (SZ-04)
6: Magnetic Base (SZ-04)

Theory

The luminous intensity in a specific direction of a point light source is defined as the light flux emitted from the source within a solid angle element in this direction. As shown in Figure 11-2, taking a solid angle element $d\Omega$ on the axis *r*, if the light flux in $d\Omega$ is *dF*, the luminous intensity in direction *r* is:

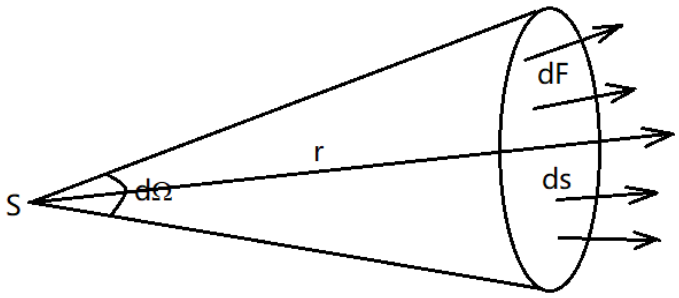


Figure 11-2 Schematic of photometric definitions

$$I = dF/d\Omega \quad (11\text{-}1)$$

When a surface is illuminated by a luminous flux, illuminance is defined as:

$$E = dF/ds \quad (11\text{-}2)$$

where *dF* is the light flux on an area element *ds*.

If the area element *ds* is perpendicular to the line of incident light, we have

$$ds = r^2 * d\Omega. \quad (11\text{-}3)$$

From (11-1), (11-2) and (11-3), we finally get:

$$E = I/r^2 \quad (11\text{-}4)$$

According to Equation (11-4), the illuminance of a surface decreases proportionally to the square of distance for a constant luminous intensity. It describes the photometric law of distance or the reverse square law of light.

Experiment Procedures

1. Refer to Figure 11-1, place a meter ruler or a tape measure on the optical table; place the white light source LLC-3 on the front end of the ruler. The filament in the bulb of the light source has a small size, which can be considered as a spot light source approximately.

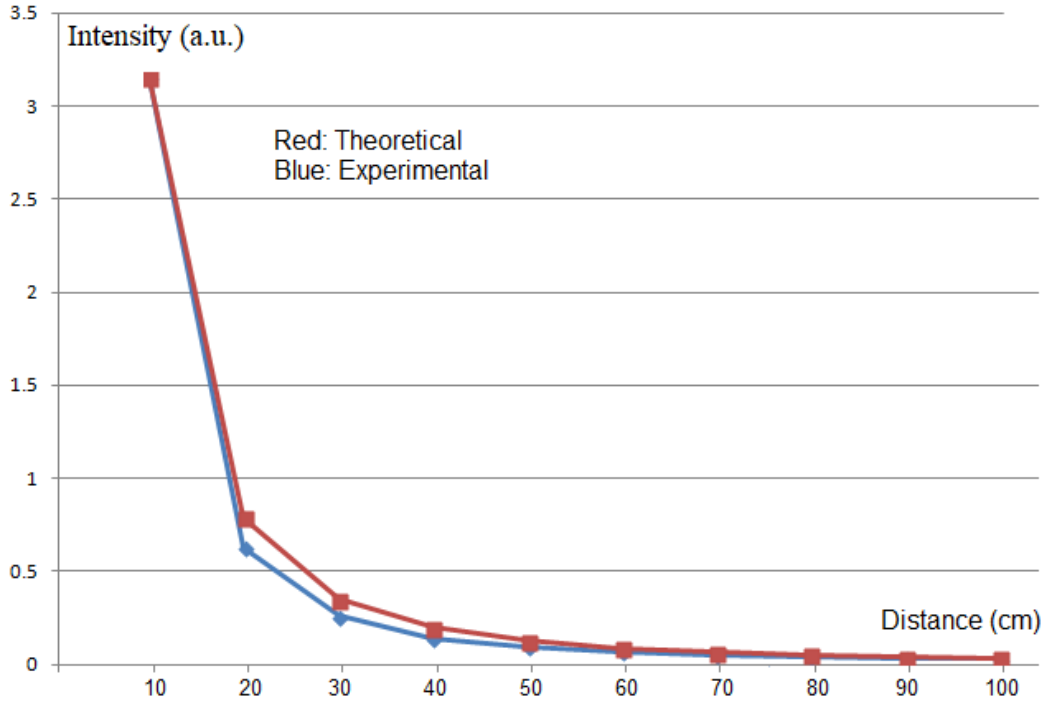
2. Adjust the direction of the photo sensor to point it to the light source till the maximum meter reading is achieved at a certain position. Note, to reduce the influence of stray light, make the room as dark as possible.

3. Measure the illuminance at various distances from the light source along the ruler.

4. Do measurement starting at 10 cm with step 10 cm, record experiment data in the Table below.

r (cm)	10	20	30	40	50	60	70	80	90	100
E (a.u.)										

5. Plot the curve of illuminance changes with distance. An example is shown below.



Example of measured and theoretical results

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