# (GO1-3) Inverse square law

## Aim of experiment

Verification of inverse square law of visible light.

## Apparatus

Light Source – Lux Meter – Optical Pinch.

## Theory of experiment

This diagram shows how the law works. The lines represent the flux emanating from the source. The total number of flux lines depends on the strength of the source. A greater density of flux lines (lines per unit area) means a stronger field. The density of flux lines is inversely proportional to the square of the distance from the source because the surface area of a sphere increases with the square of the radius. Thus the strength of the field is inversely proportional to the square of the distance from the source.

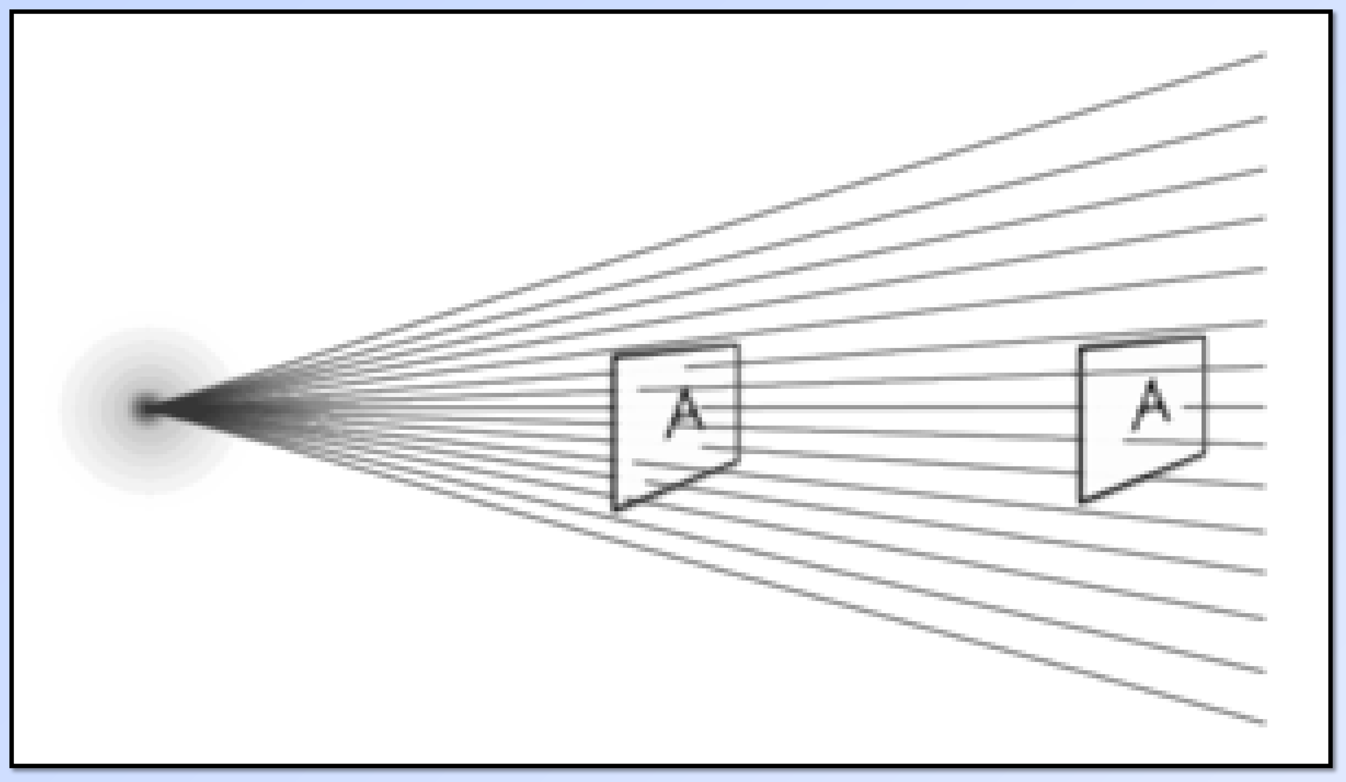


**Figure 1**. Intensity lines, *I*, emerging from a point source crossing same area, A, at different distances.

In physics, an *inverse-square law* is any physical law stating that some physical quantity or strength is inversely proportional to the square of the distance from the source of that physical quantity.

For example, let the total power radiated from a point source, *e.g.,* electrical bulb, be $P$. At large distances from the source (compared to the size of the source), this power is distributed over larger and larger spherical surfaces as the distance from the source increases. Since the surface area of a sphere of radius r is

$$A = 4\pi r^2$$

$$I = \frac{P}{A} = \frac{P}{4\pi r^2}.$$

then the ratio of radiation intensities $I$ at different distances $r$ is given by:

$$\frac{I_1}{I_2} = \frac{{r_2}^2}{{r_1}^2}$$

The intensity decreases by a factor of 1/4 as the distance r is doubled. This is the fundamental reason why intensity of radiation, whether it is electromagnetic or acoustic radiation, follows the inverse-square behavior.

## Procedure

1. Put the Lux Meter in front of light source at distance $r$=5cm and record the corresponding intensity.
2. Vary the distance each 0.5 cm up to 5 cm and record the corresponding intensity in each case.
3. Tabulate the obtained results.
4. Draw a graph between *log r* on x-axis and *log I* on y-axis.
5. Determine the slope of the straight line which must be 2.

## Results

| *r (cm)* | *I (Lux)* | *Log r* | *Log I* |
|---|---|---|---|
| 0.5 | | | |
| 1 | | | |
| 1.5 | | | |
| 2 | | | |
| 2.5 | | | |
| 3 | | | |
| 3.5 | | | |
| 4 | | | |
| 4.5 | | | |
| 5 | | | |

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