

# Photonics

**By**

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**Fourth stage**

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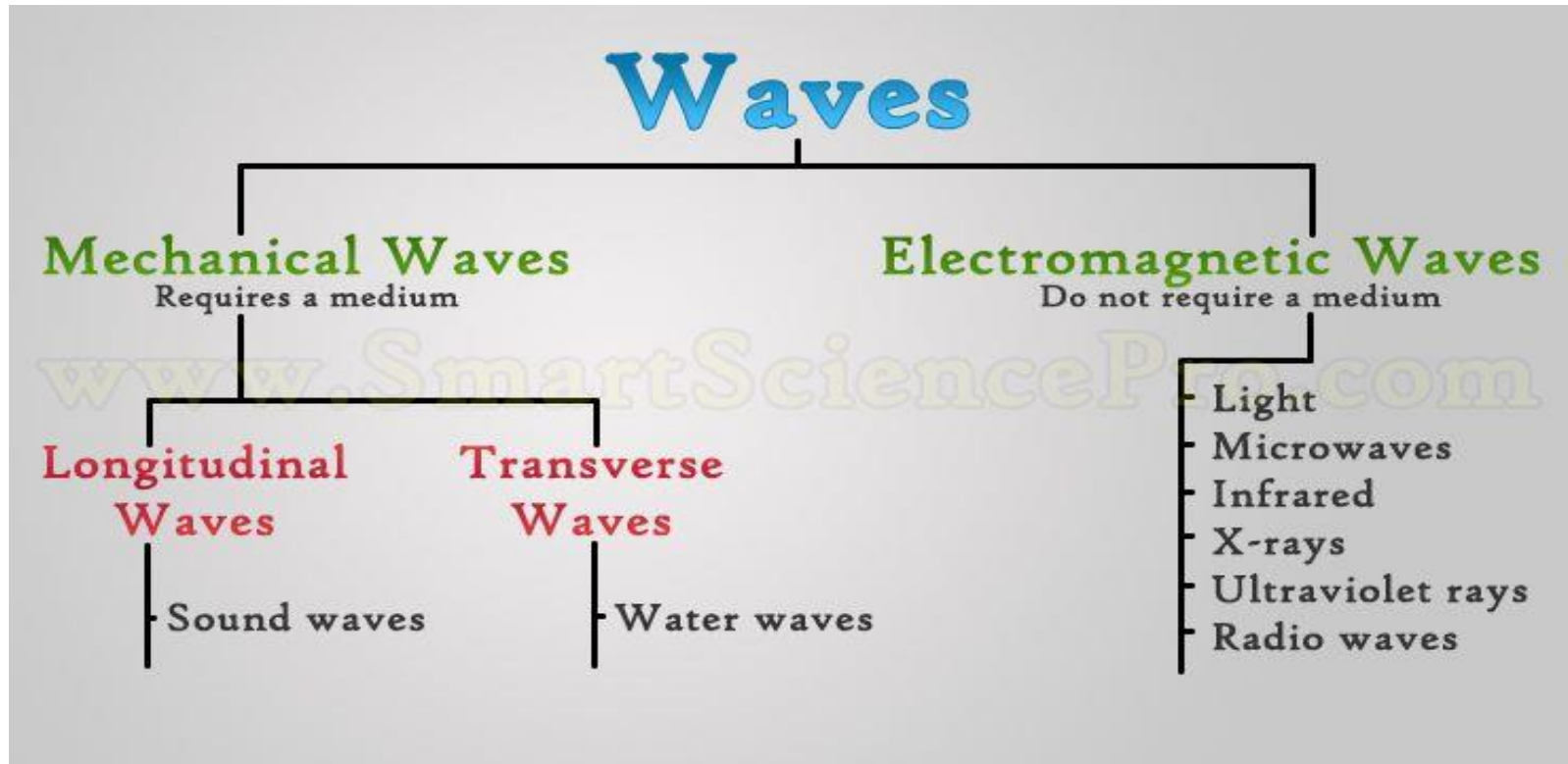
# Introduction

Light is electromagnetic radiation. The word light is used to denote radiation that may be visible to the human eye or invisible. In fact, as we will see later, only a very small portion of the electromagnetic spectrum lies in the visible range.

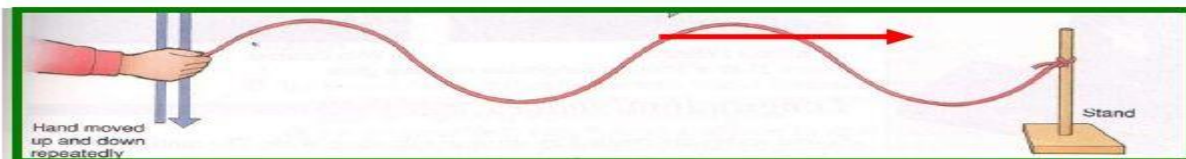
# Waves

The concept of the wave is used to express the transmission of energy. A wave is a loosening of a medium in which energy travels through this medium without moving matter. In a wave, the particles of the medium are temporarily displaced and then return to their original position.

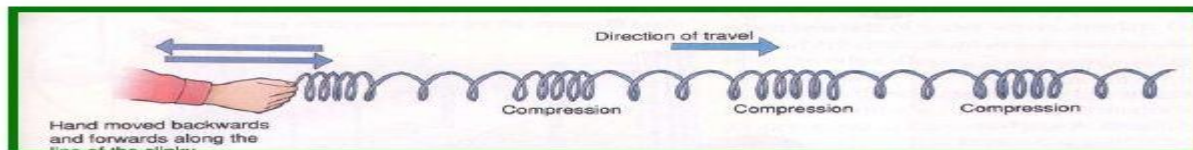
# Types of Waves in Physics



## ■ Transverse Waves

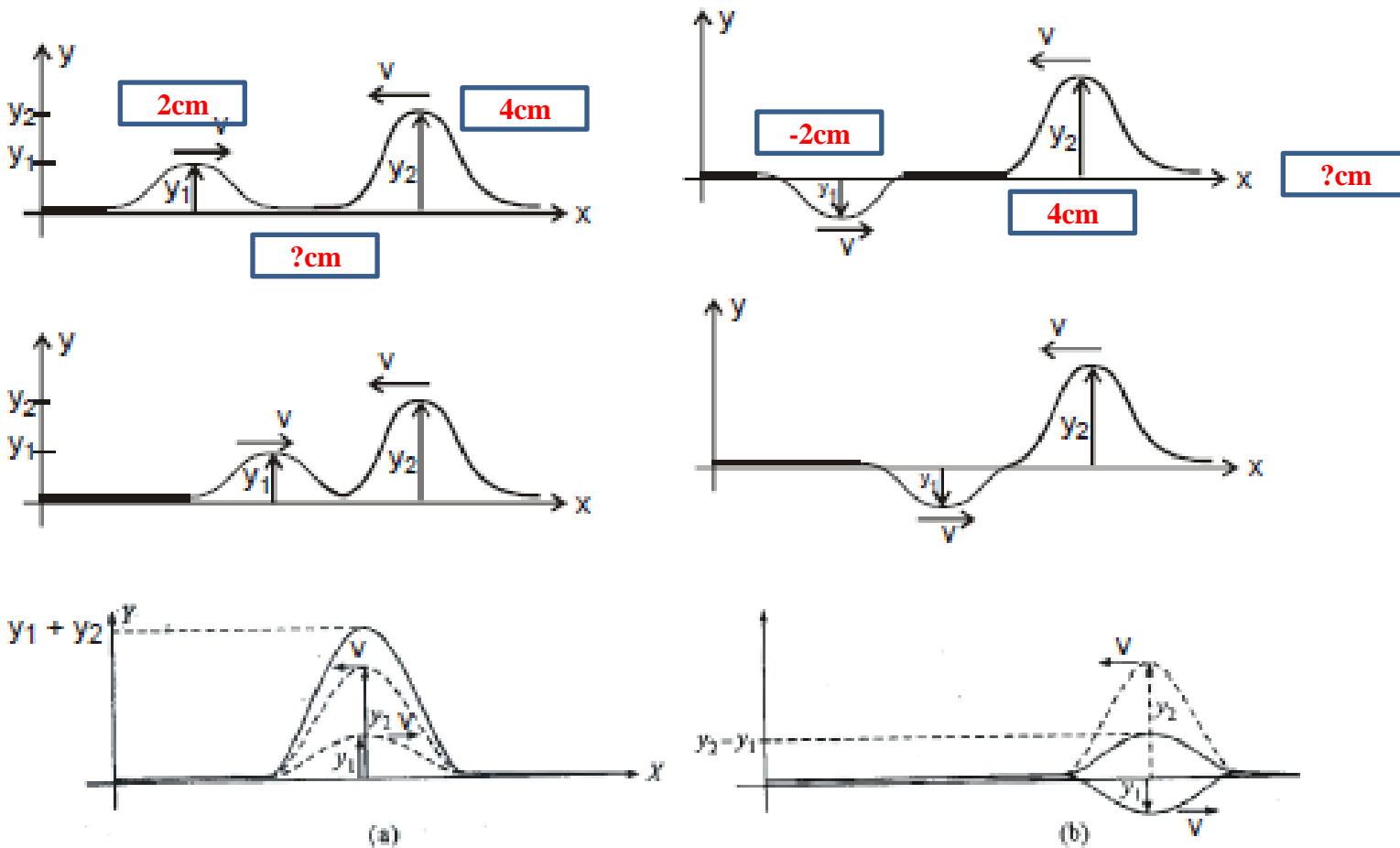


## ◆ Longitudinal Waves



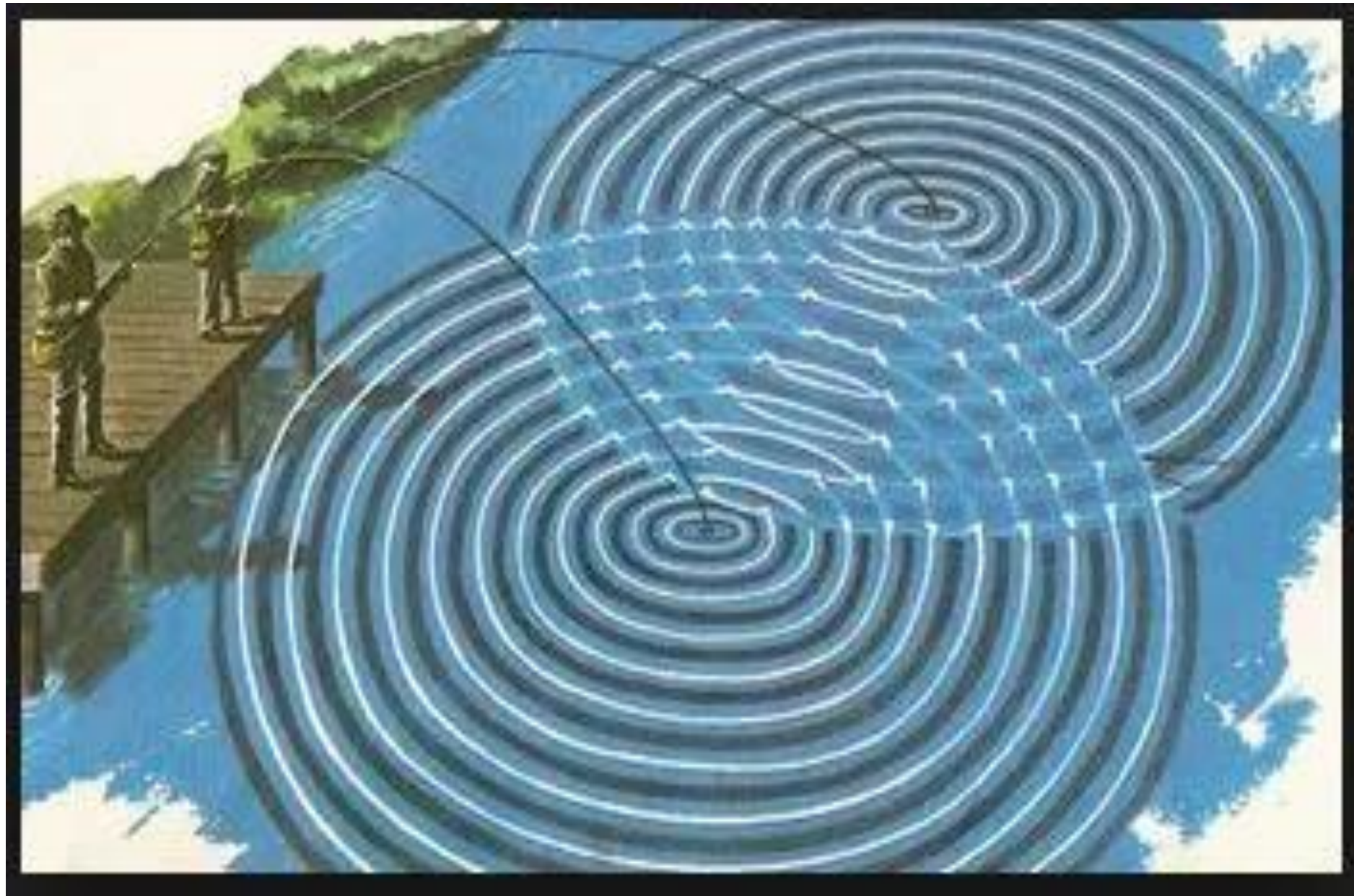
# The principle of superposition

The principle of **superposition** in physics states that in all **linear systems** the **sum of two or more effects** is the sum of the two effects. If effect A produces the output X and effect B produces the output Y, then the two effects (A + B) produce the output (X + Y).



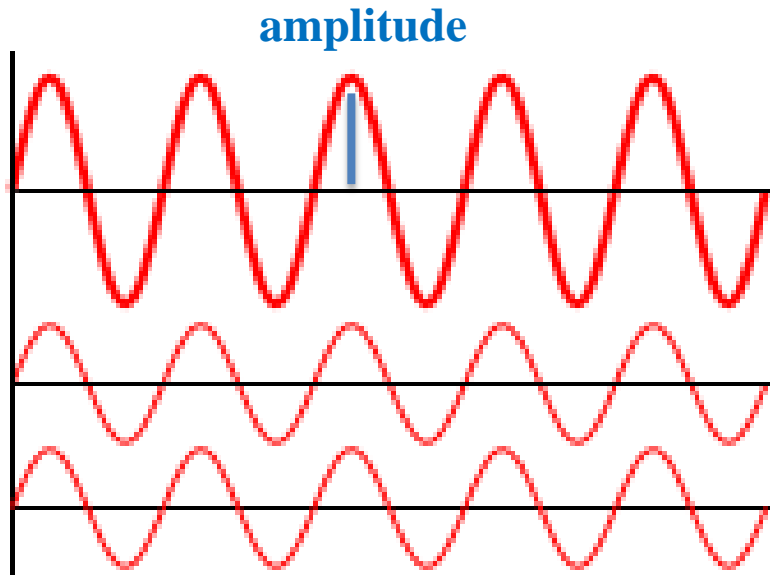


# interference

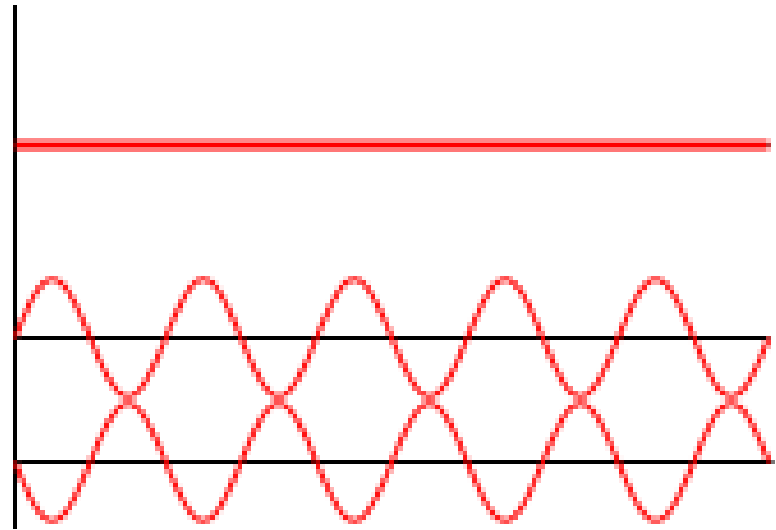


## Wave interference

When **two or more waves** traverse the same space, the net amplitude at each point is the sum of the amplitudes of the individual waves



**Two waves in the same phase**



**Two waves with a phase difference of  $180^\circ$**

**Q: Name the experiment performed to prove interference of light?**

-Young's double slit Experiment

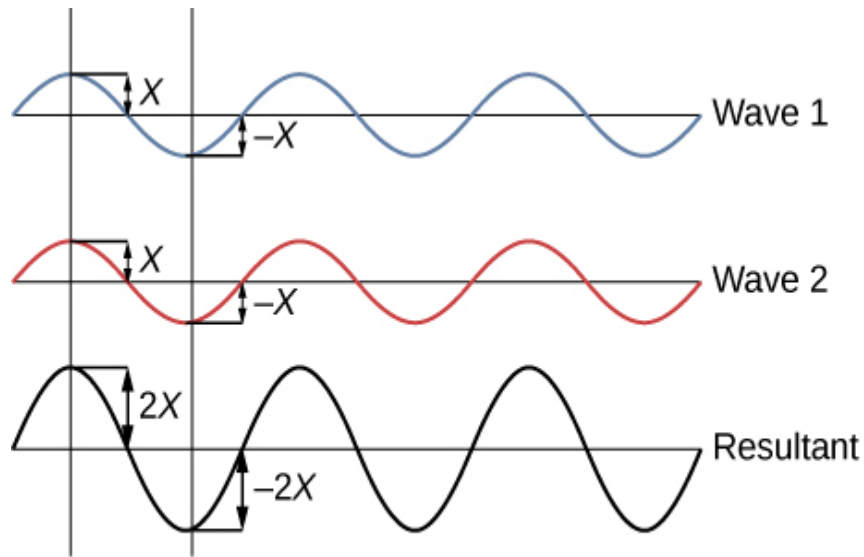
# What types of interference and they are

<https://www.youtube.com/watch?v=CAe3IkYNKt8>

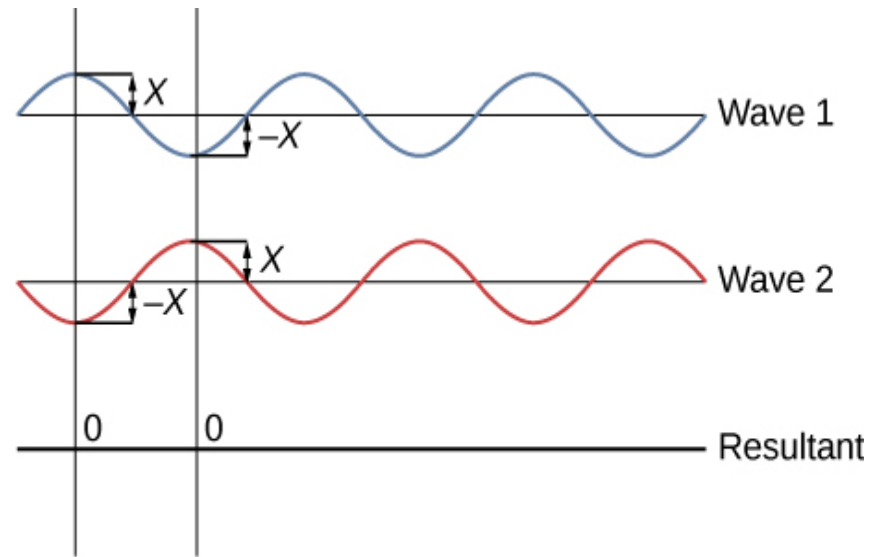
## There are two types of interference and they are:

**Constructive interference:** When the amplitude of the waves increases because of the wave amplitudes reinforcing each other is known as constructive interference

**Destructive interference:** When the amplitude of the waves reduces because of the wave amplitudes opposing each other is known as destructive interference.

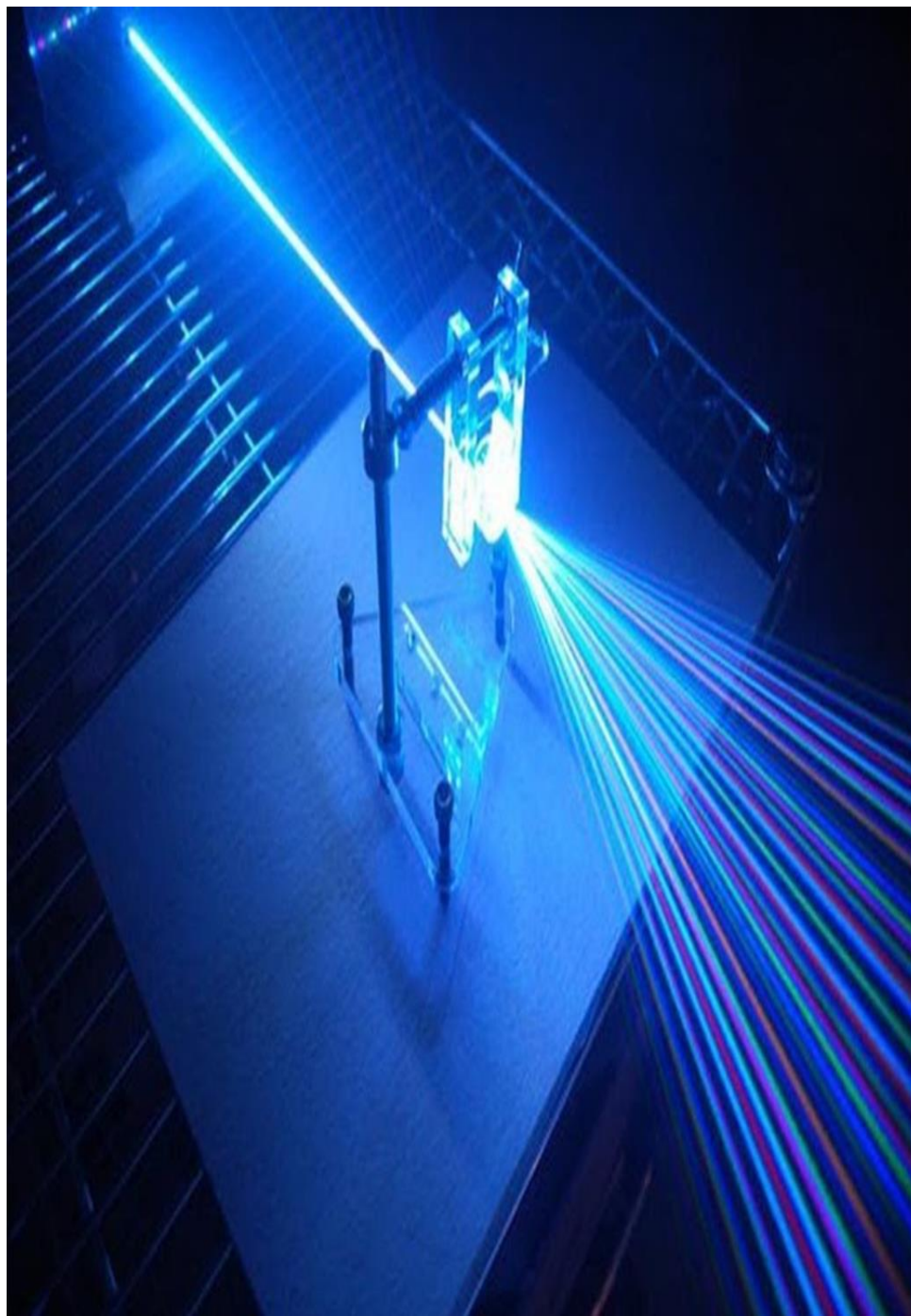


(a) Constructive interference



(b) Destructive interference





# ***What is Diffraction***

## ***Diffraction of Light***

# Diffraction

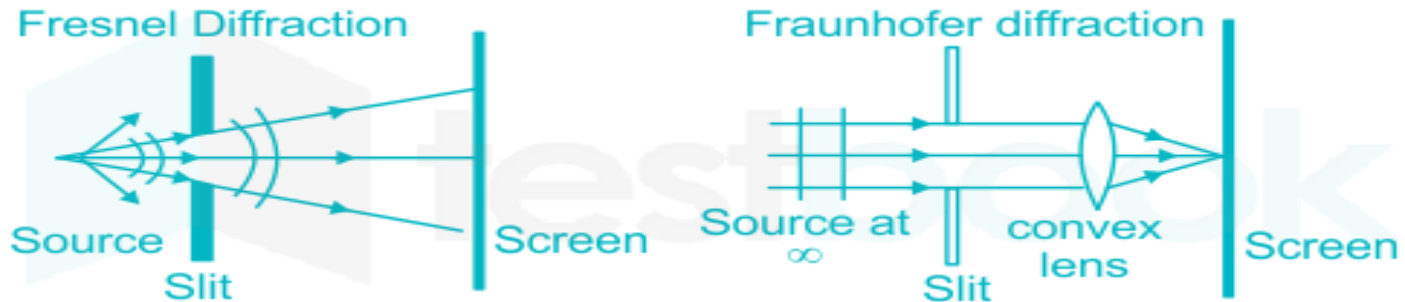


# Diffraction

diffraction of light usually refers to several natural phenomena that occur when a wave hits an obstacle, and is described as a very pronounced bending of the waves around small obstacles and the propagation of waves through **small** holes

**The two types of diffraction are Fresnel diffraction and Fraunhofer diffraction.**

- **Fresnel diffraction:** When the light from the point source reaches the obstacle, the waves produced are **spherical** and the pattern of the image of the object is a **fringed image**.
- **Fraunhofer diffraction:** When the waves from the light source are in the form of wave-fronts, and they are infinite.



## Fresnel Diffraction

1. This type of wave diffraction is observed at the near distance from the obstacle or slit. This diffraction is also known as the Near Field Diffraction.

2. The diffraction patterns formed in this type of diffraction change if we move downstream of the diffraction. The shape, as well as the intensity of the diffraction, also changes.

## Fraunhofer Diffraction

1. This type of wave diffraction is observed at the far distance from the obstacle or slit. This diffraction is also known as the Far Field Diffraction.

2. The diffraction patterns formed in this type of diffraction do not change, they are constant throughout the pattern and the shape, as well as the intensity of the diffraction, remains constant.

