Experience directionality

The word LASER
These are the first letters of the phrase Amplification by Stimulated Light Emission of Radiation, which means **"amplifying light by excitation of its radiation waves."**

Laser: It is a form of light rays, in the form of pulses or continuous waves. It has many ideal properties that distinguish it from other types of light from natural sources such as the sun, traditional lamps or electric lamps.
The laser device is a source of light that collects, concentrates, and strengthens the light rays that are generated inside the device in the form of a very thin beam of light in one focused direction. These are homogeneous and coherent electromagnetic rays that can travel infinite distances in a straight line. It is characterized by its increasing intensity.

*The wavelength of the resulting laser rays varies depending on the material that produces it.

Laser properties:

1-Directivity: It is one of the most important characteristics of the laser.
The angle of spread of the laser beams is very small, and therefore it can travel long distances without dispersing its energy or changing its direction. This property is used in many applications, which depend on measuring near and far distances, and identifying targets with extreme accuracy.

2- Beam intensity: The laser beam is characterized by the fact that its cross-sectional size is very small.
Since all the light energy released by the laser is concentrated in this small cross-section, it will appear in the form of illumination or an intense beam, such that the intensity of the beam emanating from the laser is considered greater than the intensity of light emanating from the sun, or lamps, and these rays can also travel long distances without interruption. Its illumination intensity decreases, and this property is used in delicate surgical operations, treating skin and eye diseases, and in drilling and cutting materials.

3- Monochrome: Laser light differs from other types of light, as laser light appears in one color and with a high degree of purity, while other types of light consist of the colors of the visible spectrum, so this property is exploited and laser light is used in fiber optic communications systems. , as a carrier of information.

4- Interconnection and cohesion of photons: The light frequencies resulting from laser rays are characterized by the fact that the photons of these rays are interconnected and coherent, which are properties that do not exist in any other type of light. This property is used in optical interference, three-dimensional imaging, studying the structure of materials, and measuring speed. And distance.

* Laser rays are described as parallel

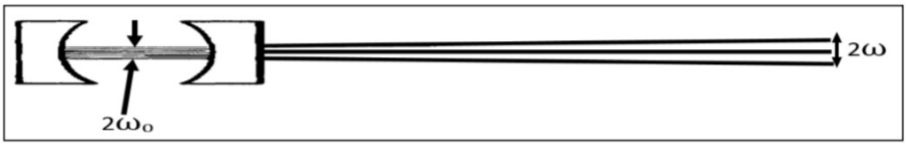
Laser uses: laser treatment

1-Laser to treat cancer (some skin cancer).
2- Laser removal of kidney stones.

3 - For eye problems (myopia and others).
4-Cosmetic uses of laser.
5- To remove birthmarks.
6 - In dentistry.
7-The laser is used to cut, drill, perforate and engrave.

Theory: The directionality of laser beams depends on the waist of the beam (Wo) arising inside the resonator of the laser device, which works to oscillate and direct the beam. Therefore, the diameter of the waist can be measured by measuring the diameter of the laser beam falling on a screen outside the device and at specific distances, in order to depend on the diameter of the laser beam (W). On the distance (Z) and the wavelength.

The directionality is a direct result of the fact that the active material is placed inside a resonator cavity and the laser moves inside it many times before it emerges from the front mirror, and after it only oscillates the beam parallel to the axis of the resonator. Thus, the emerging rays are parallel to the axis of the resonator, and parallel, and only a very little diffraction occurs in them.



The beam narrows to its minimum diameter (beam waist) where the wave front is flat and the radius of curvature is equal to ∞ in the waist area, and it decreases successively as we move away from the waist and begins to increase for very long distances.

The radius of the beam Wo (at a distance of Z from the waist) is given by the following equation

$$\omega_o = \left[\frac{\omega^2}{2} - \left\{\frac{\omega^4}{4} - \left(\frac{\lambda Z}{\pi}\right)^2\right\}^{\frac{1}{2}}\right]^{\frac{1}{2}}$$

First, how to calculate the waist of the laser beam used

1 - After installing it, we operate the laser device completely parallel to the surface of the workbench and at a suitable height with the reflective mirrors.

2- We adjust the directions by directing the laser beam to the first woman on the opposite side so that it is completely reflected to the second woman, and so on several times until you get the largest diameter of the laser beam on the screen.

-3- We measure the distance Z from the laser hole to the screen and the diameter (2w) on the screen.

4- Reduce the distance Z by an appropriate amount and accurately measure the diameter of the spot on the screen and record the readings in a table as follows:

5 - Calculate wo

$Z\ m$	$2\omega\ cm$	$\omega\ cm$	ω_o