# ليزر عملي

## الكورس الاول /التجربة الرابعه

## المرحلة الثالثة

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# تجربة الاتجاهية

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# Purpose

Calculate the radius of the laser beam waist

**Devices used**

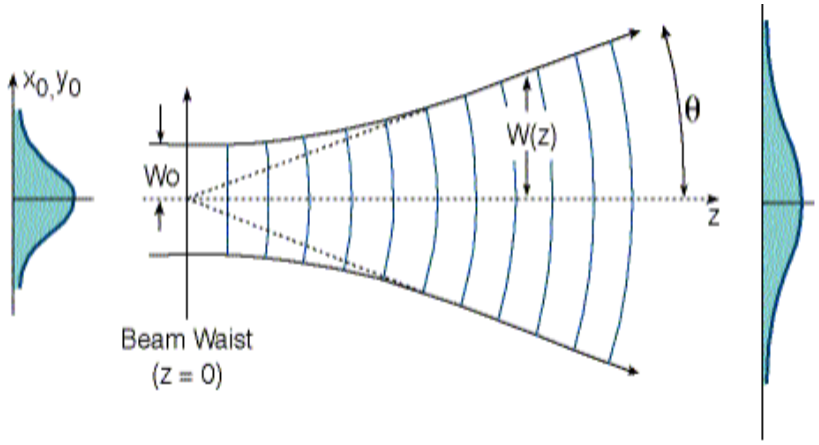
Laser

Mirror

Screen

# Theory

Based directional laser beam on the waist of the beam ($w_0$) The arising inside the resonator of the laser device that works to oscillate and direct the beam from the midway between the mirrors, so the waist diameter can be measured by measuring the diameter of the laser beam spot falling on the screen outside the device and at specific distances So as to adopt the diameter of the laser beam (w) On the distance (z) Addition to the wavelength . Directivity is a direct result of the fact that the active substance is placed inside the cavity of the resonator and the motion of the laser is in several times before it exits the front mirror. After oscillation only the ray parallel to the resonator axis and thus the outgoing rays are parallel to the axis of the resonator and parallel, and there is very little diffraction in them.




The laser beam is a single-phase Gaussian beam ($TEM_{00}$) that depends on the size of the spot at the waist($W_0$) , the spot size at the distance from the waist (W) can be written as follows

$$W_{(z)} = W_0 \sqrt{1 + (\frac{\lambda . Z}{W_0^2 . \pi})^2}$$

The caussan beam narrows to the smallest diameter where the wave front is plane, and the radius of the beam or the size of the spot is given at a distance (z) from the centralization as follows:

$$W_0 = \left[\frac{w^2}{2} - \left\{\frac{w^4}{4} - \left(\frac{\lambda z}{\pi}\right)^2\right\}^{1/2}\right]^{1/2}$$

## Method of Work

Turn on the laser after installing it with images completely parallel to the working surface of Bing, at an appropriate height with 100% reflective mirrors, and adjust the directions by directing the laser beam to the first mirror on the opposite side to fully reflect to the second mirror. Thus, several times to find the largest diameter of the laser beam on the screen, measure the distance (z) From the laser hole to the screen, then measure the diameter (2w)