

Laser And Fiber Optics Communication

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DEFENTION

Coherrant Light

Laser :Light Amplification by Stimulated •
Emission of Radiation

:Also there are •

Maser : Micro wave Amplification by •
Stimulated Emission of Radiation

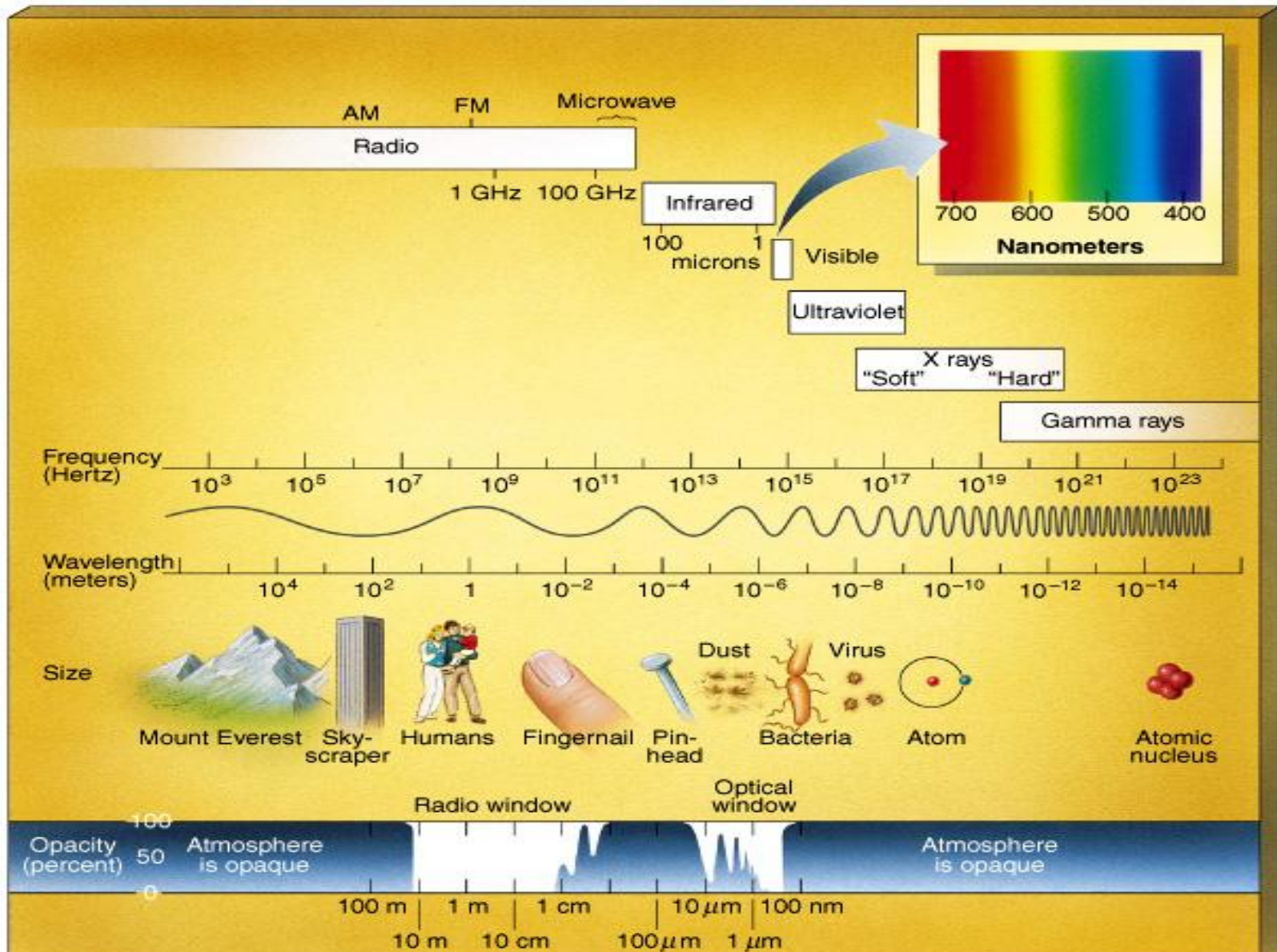
Gaser : Gamma Amplification by Stimulated •
Emission of Radiation

Laser can be used as communication by two ways :-

- 1- **Wireless** : should be LOS with the target
- 2- **By fiber optics**: this will be connected with (sender (transmitter) and receiver) as a cable .

Electromagnetic radiation is a natural phenomenon found in almost all areas of daily life, from **radio waves** to **sunlight** to **x-rays**. Laser radiation – like all light – is also a form of electromagnetic radiation. EM radiation that has a wavelength **between 380nm and 780nm** is **visible** to the human eye and is commonly referred to as light. At wavelengths **longer than 780nm**, optical radiation is termed infrared (IR) and is invisible to the eye. At wavelengths shorter than 380nm, optical radiation is **termed ultraviolet (UV) and is also invisible to the eye**. The term "laser light" refers to a much broader range of the electromagnetic spectrum than just the visible spectrum, anything between 150nm up to 11000nm (i.e. from the UV up to the far IR).

10^{25} ----- 10^{23}	Gama Ray γ-Ray	10^{-17} 10^{-15} Cancer treatment-----
10^{19} ----- 10^{17}	X-Ray	10^{-11} Material testing & Diagnostic X-Ray 10^{-9}
10^{15} ----- 10^{13}	UV-Ray	Identifying atomic structure----- 10^{-7}
10^{12}	Visible light	Human sight-----
10^{11}	IR –Ray	10^{-5} IR photos & Heat lamps-----
10^9 ----- 10^7	Micro Waves .M. W	10^{-3} Ovens----- 10^{-1}
10^5 ----- 10^3 ----- 10^1	Radio Waves	Radar & TV----10^1 FM radio & AM radio----- 10^3 Long wave& Navigation----- 10^5



Electromagnetic Radiation

Here are some examples of electromagnetic radiation and what are the different ways in which we might experience them or make use of them:

Light	(visibl)
Infrared	(heat)
Ultraviolet	(sunburn)
Microwaves	(cooking, communication)
AM & FM radio	(communication)
TV signals	(communication)
Cell phone signals	(communication)
X-rays	(medical applications)
Y -rays	(radioactive and medical applications)

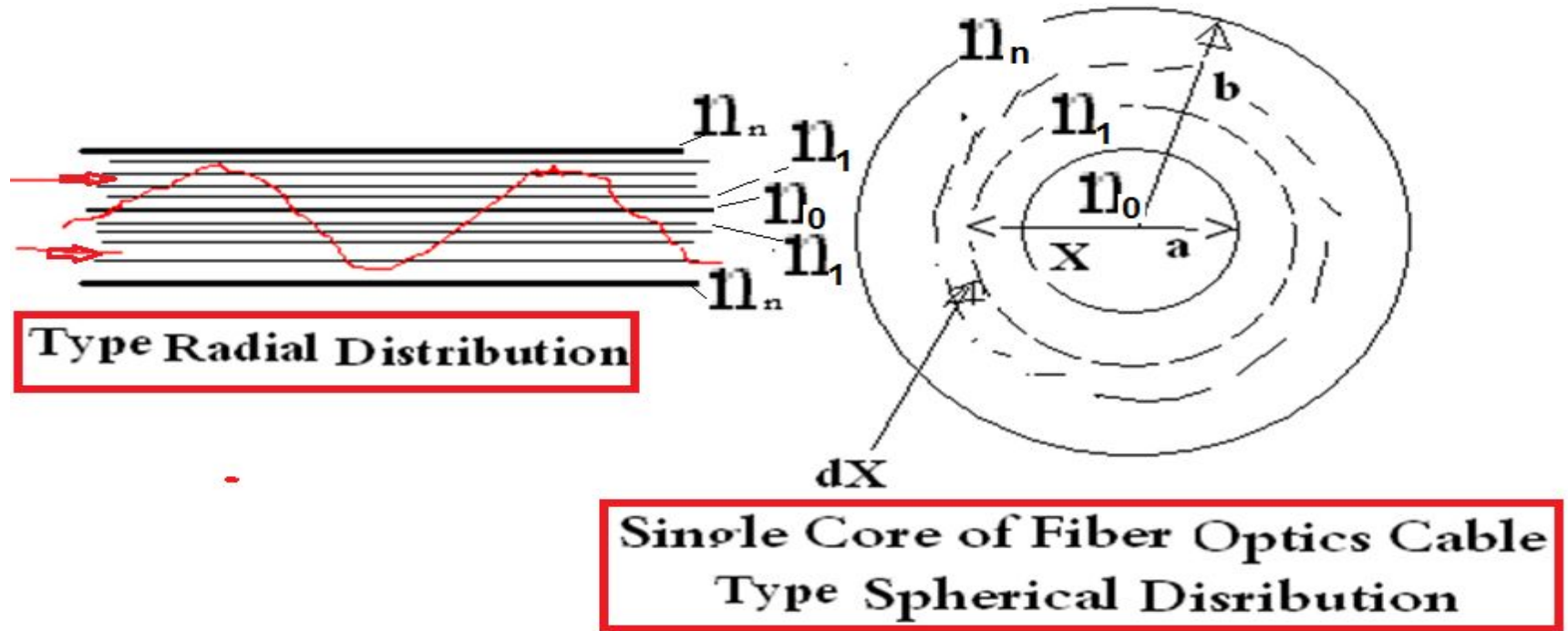
Fiber Optics : It is gradient index lens which ray tracing depend on the refractive index distribution not on the curvature of the surface . There three type of it depending on it's refractive index distribution :

1-**Radial distribution**' (most popular)

2- **Axial distribution** .

3- **Spherical distribution** .

Refractive Index Distribution in Fiber Optics



For Radial Distribution Type

Concept of Laser Construction

-: The main concept of laser construction

(Active Medium (solid , liquid or gas -1

Optical Resonators -2

Q-Switching (to create population inversion) -3

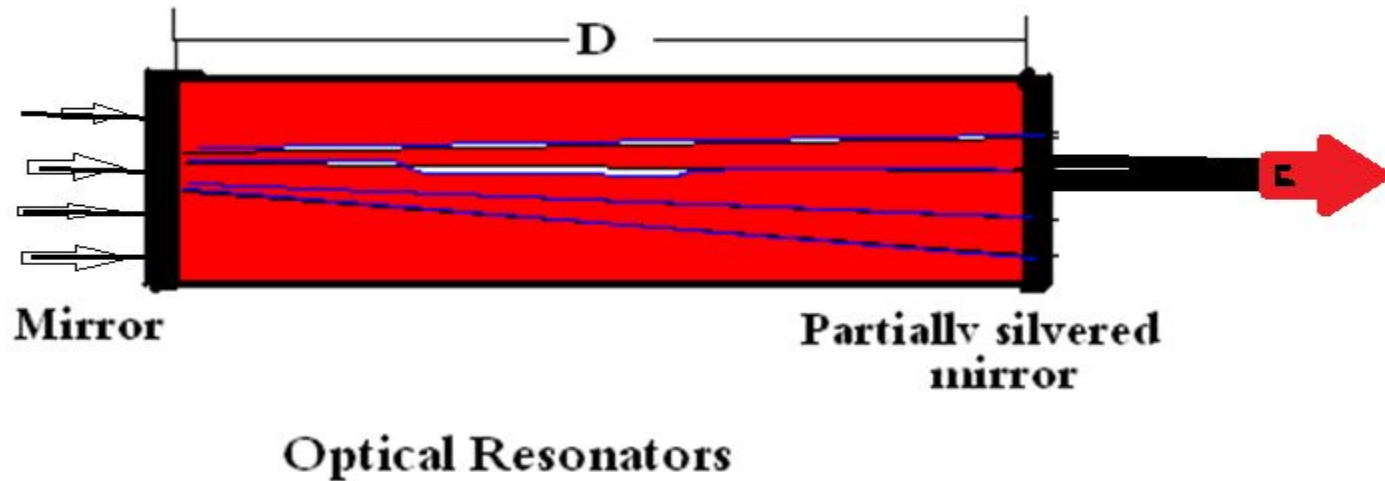
$$2D = m\lambda \quad \& \quad c = f \lambda$$

(D=length of cavity $(dN_p / dT$

. where N_p is number of photons in cavity

T is transmitted photons

The resonators of Laser System

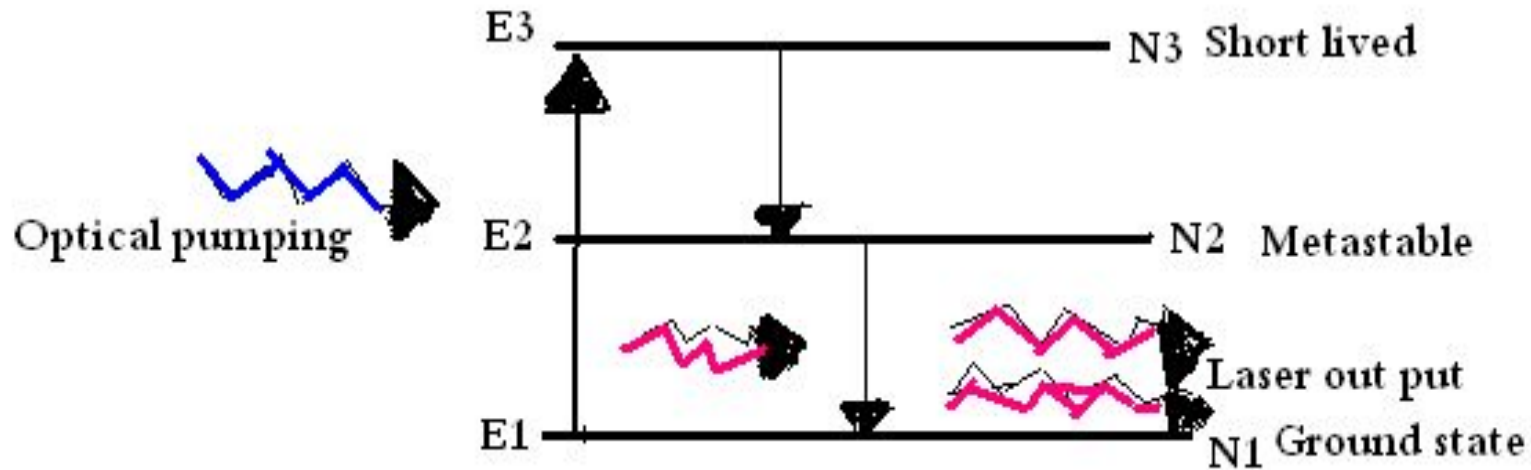


LASER GENERATION

Laser generate by moving electrons between •
. different energy levels

There are two type of laser generation **Three** •
levels & **Four levels**, and each one has it's
characteristics according to the **power**, **type**
, **time duration** and **cost**. And it may be
continuous or pulse

The Fundamentals of Laser Operation



Three Levels Laser Action

Type of Laser

-:There are many types of laser as follow •

: As it's generation-1

a-Three levels laser

b-Four levels laser

: As it's active media-2

a- Gas laser

b- Chemical laser

c- Dye laser

: As it's application -3

(a- Medical laser (Treatment

(b- Industrial laser (Cutting

(c- Military (Weapons

:As it's power -4

a- High power laser for example 30W

b- Medium power laser 10 joul

c- Low power laser few mW

: As it's form -5

a- Rod laser

b- Diode laser

: As it's wavelength -6

,a- I R laser (such as CO₂ & Nd-Yag laser 10.6
(μm 1.06

(b- Red laser (such as He-Ne laser 633nm

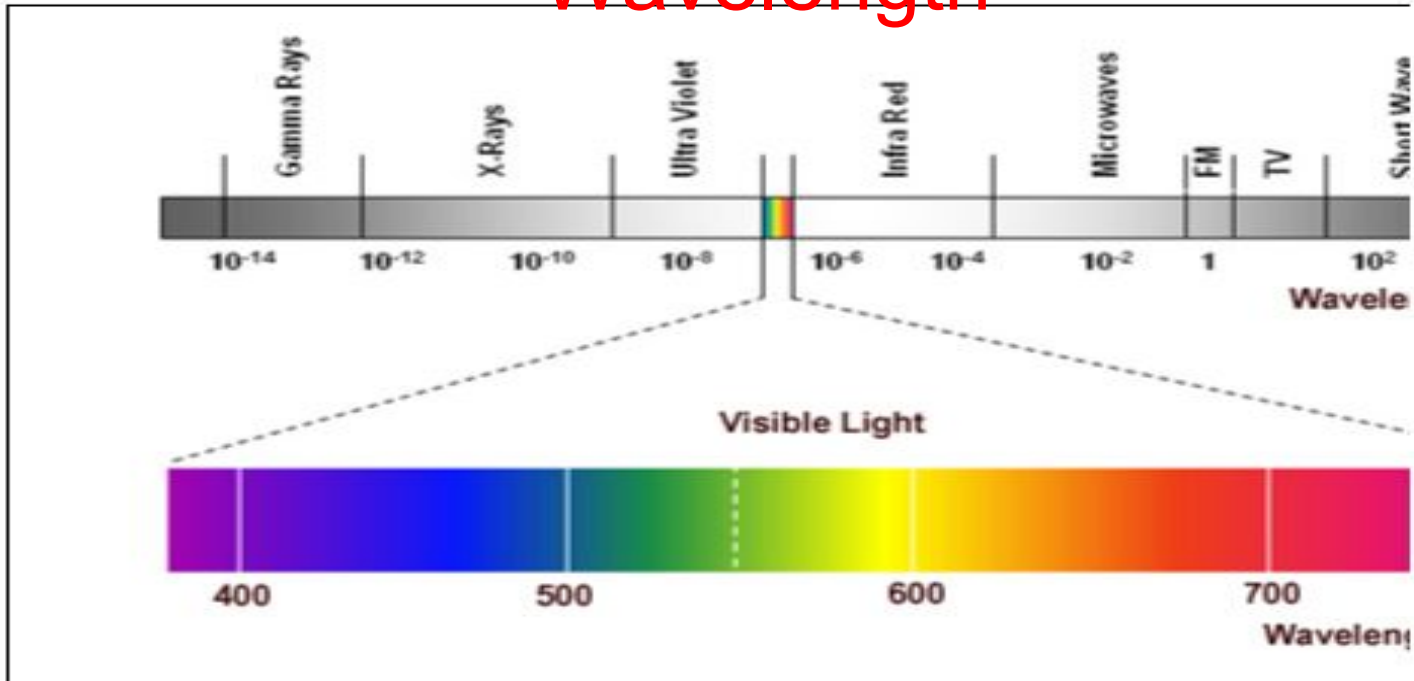
(c- Green laser (such as Argon [514nm]laser

(d- Orange laser (such as 680nm Ruby laser

(e- Yellow laser (such as GaAs/GaP

(f- Blue laser (such as Argon [488nm] laser

Spectrum of Visible Light As it's Wavelength



Laser Safety

Any body

When he works with laser (any type) should be
.careful and protect his body from it

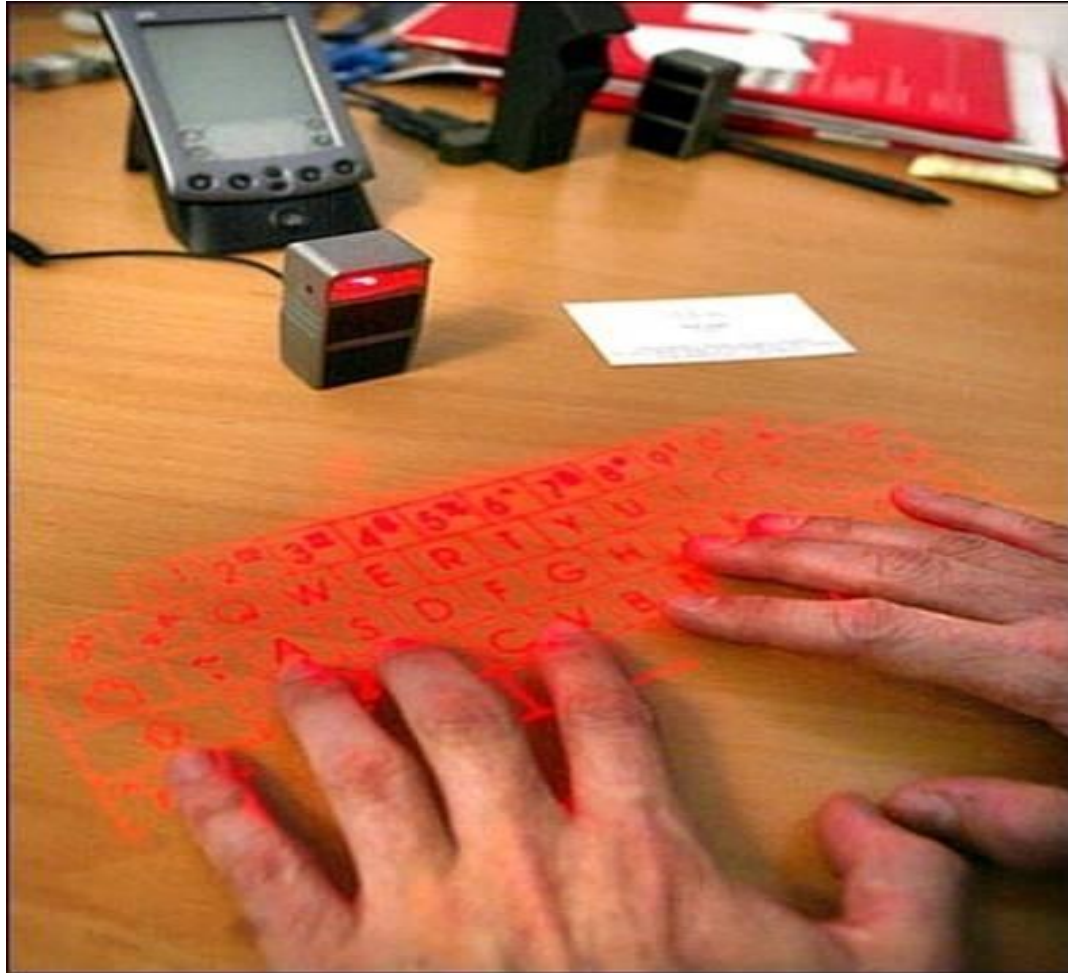
Thank you

Laser Applications



Keyboard

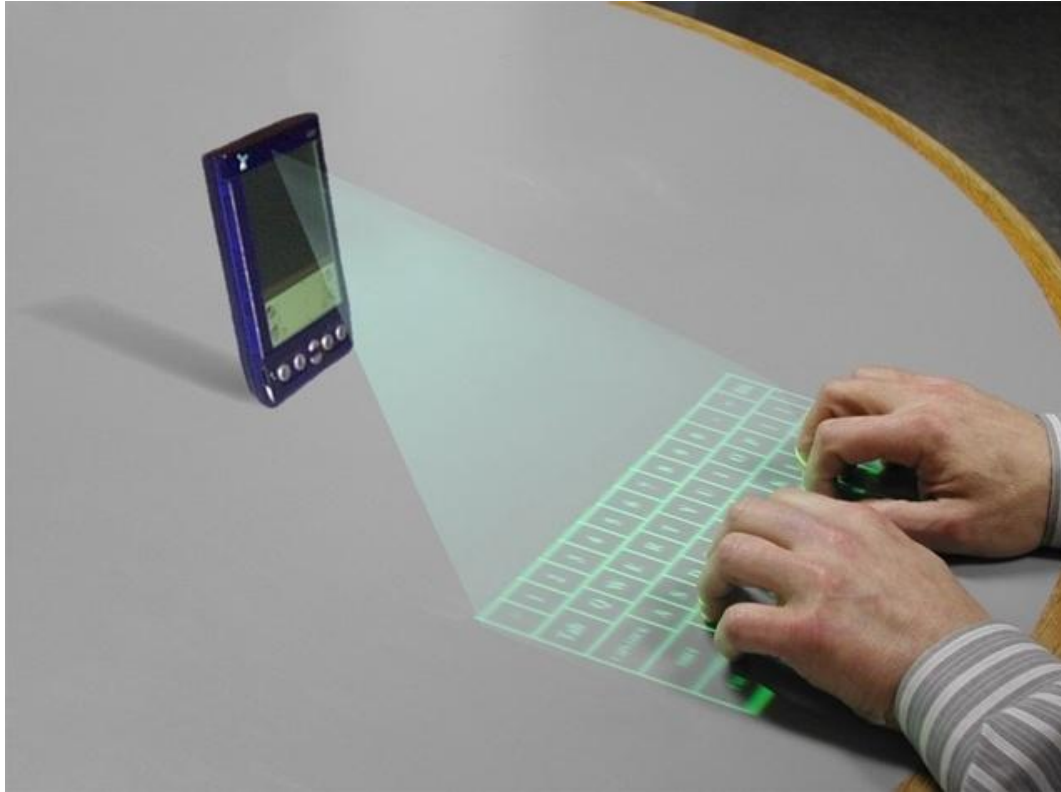
Leaser Applications



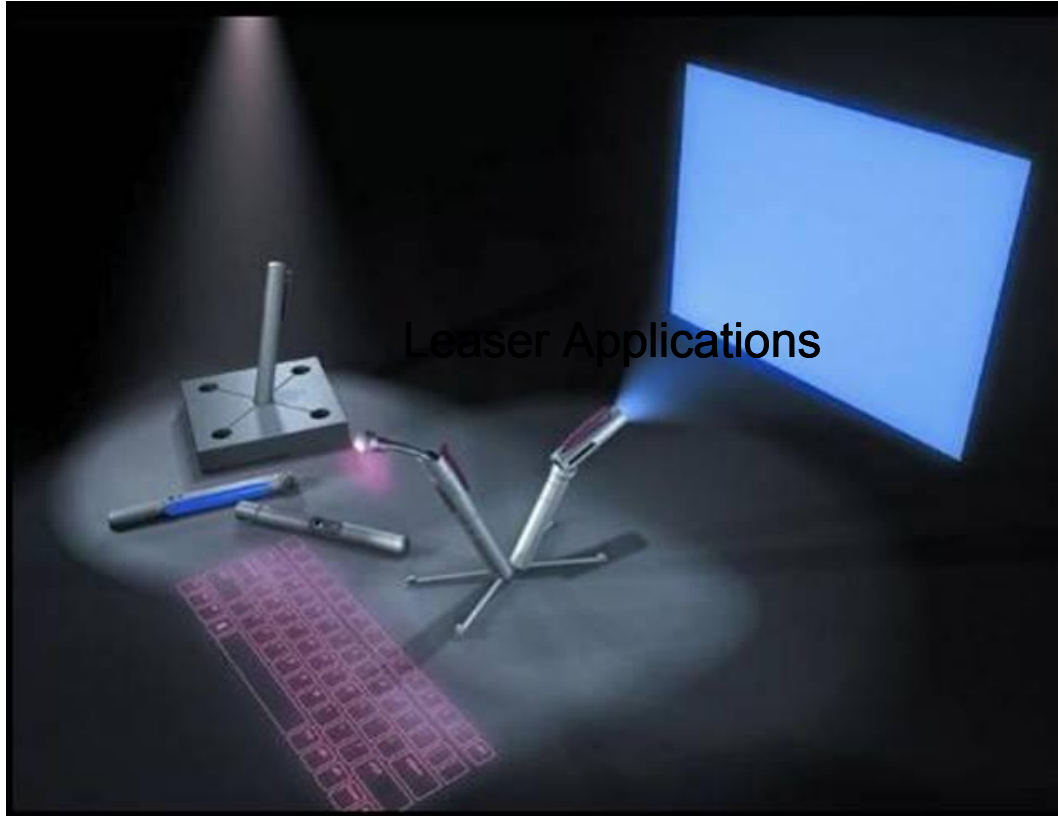
Leaser Applications



Leaser Applications



Laser Applications



Laser Applications





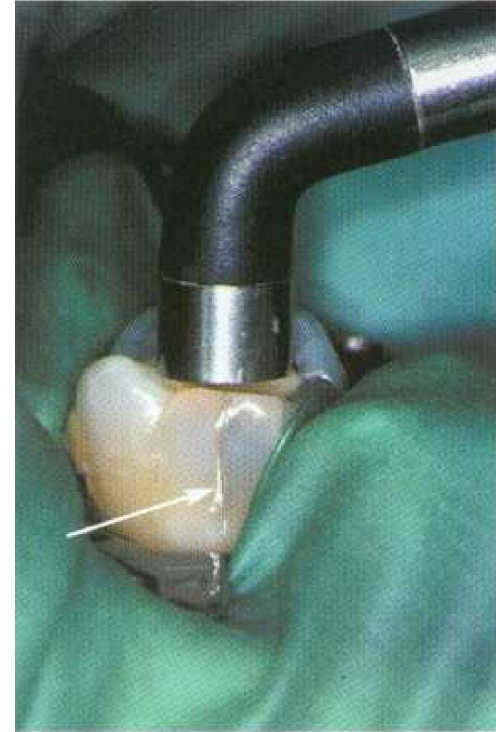
Leaser With Dentist Doctor1 System

Endoscope •



Endoscope





Laser With Dentist Doctor2 System

Fiber Optics Samples





**Thanks for
Attendance and Attention**



Optical Fiber Communications

Principles and Practice

Third Edition



JOHN M. SENIOR

