Optical fiber

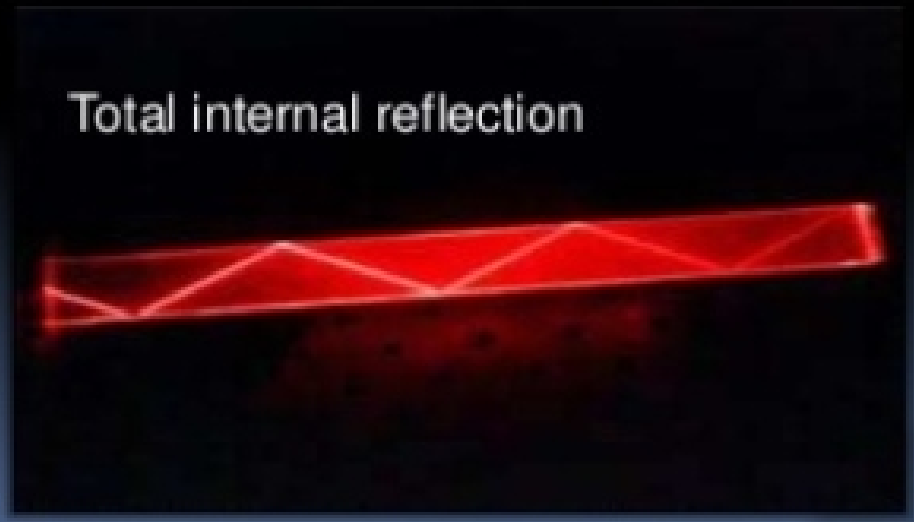
- **INTRODUCTION**

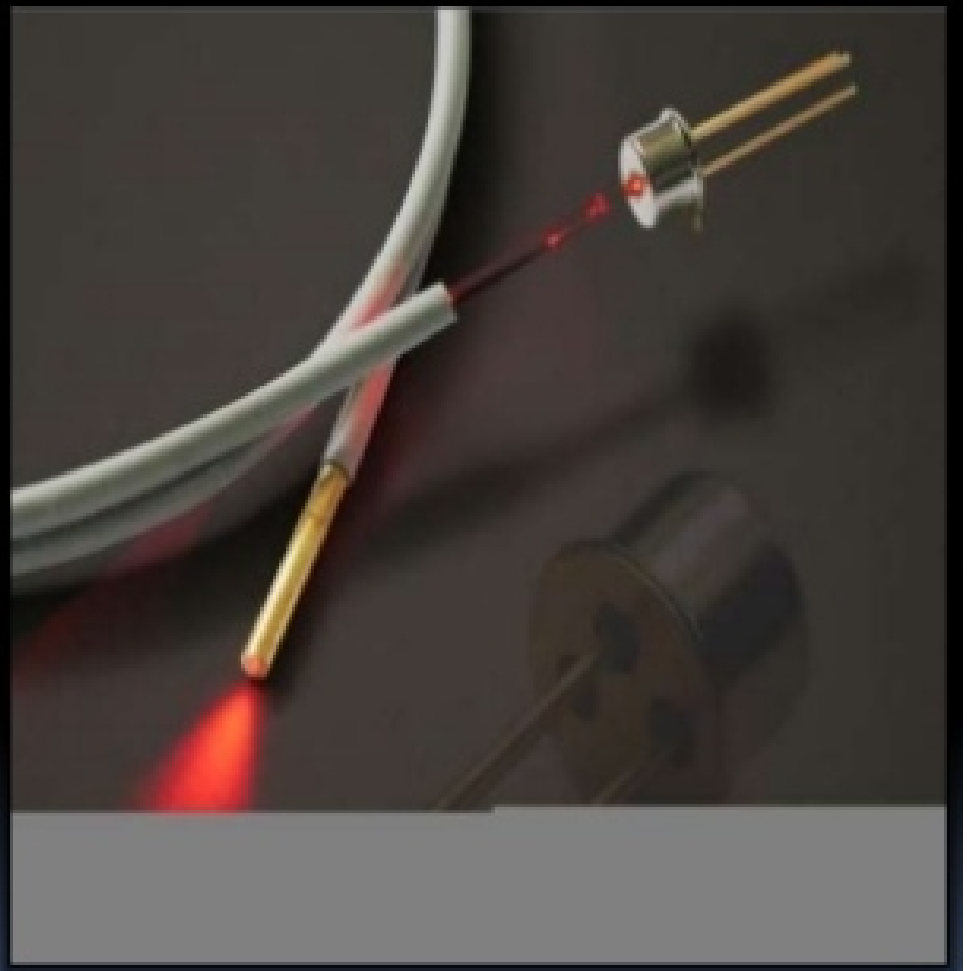
- *Fiber optics (optical fibers) are long, thin strands of very pure glass about the diameter of a human hair. They are arranged in bundles called optical cables and used to transmit light signals over long distances.*
- *CAUSES FOR THE CREATION OF THE OPTICAL FIBER----- Man's HUNGER*
- ***Lastly optical fiber's were invented to satisfy the Man's hunger for communication***

What are optical fibers?

- Fiber optics = Fiber + optics
- in essence = Light is guided in optical fiber.
- Fiber = Extremely **pure glass(silica)** or **plastic**
- **Speed= current record**

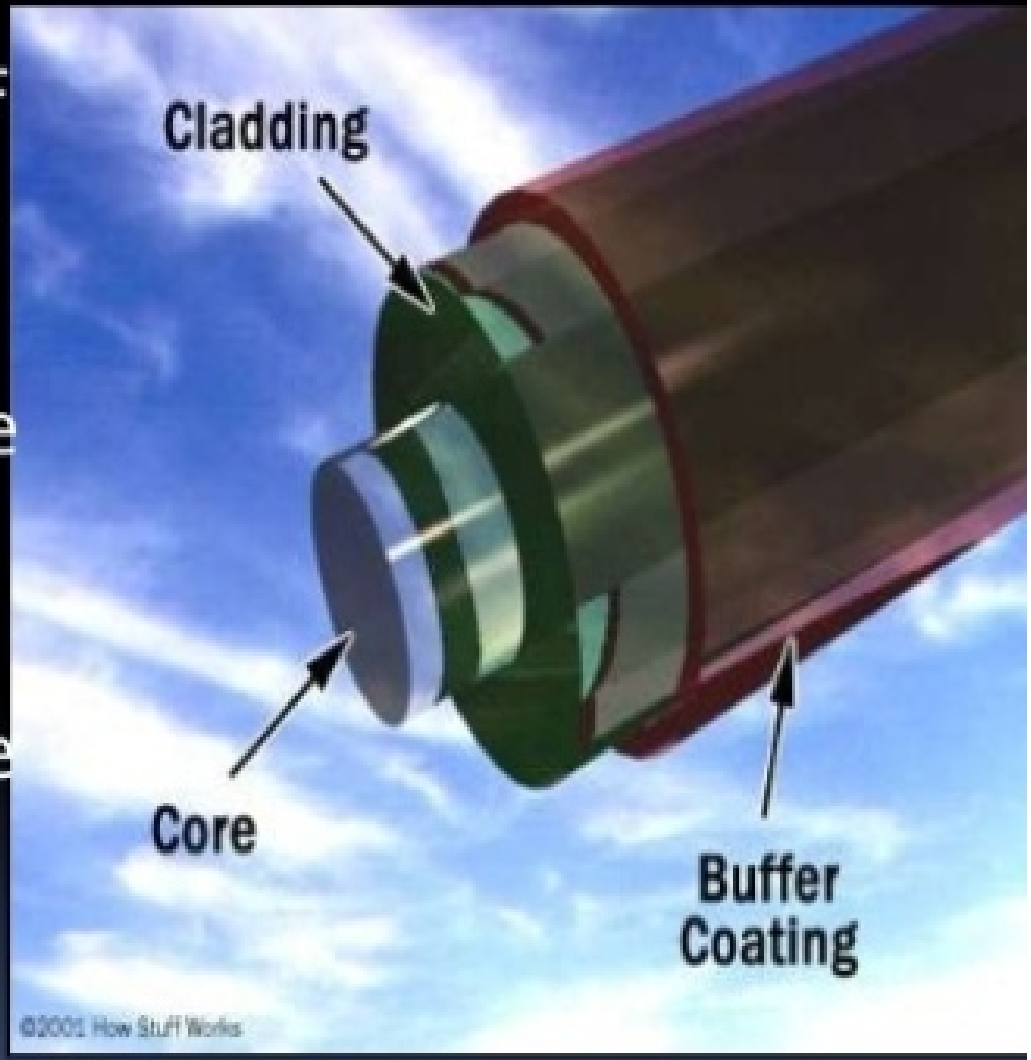
15.5tbps





Construction of optical fiber

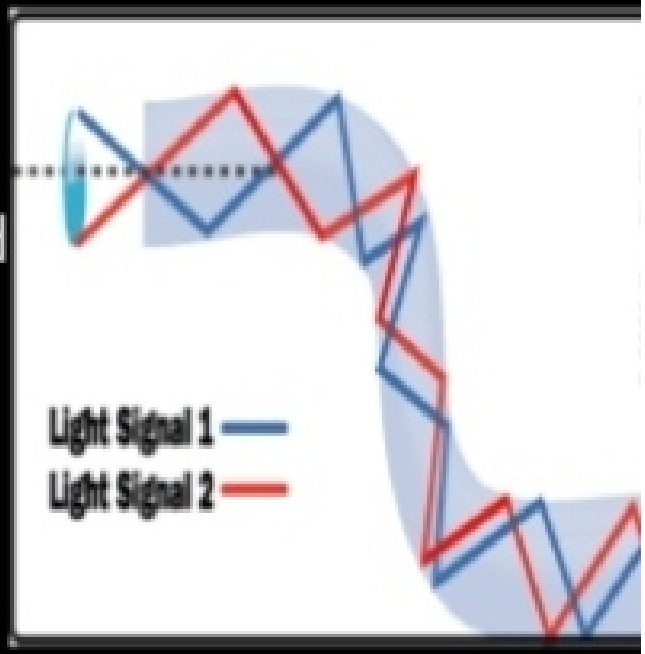
- Core-thin glass center of fiber where light travels.
- Cladding-outer optical material surrounding the core.
- Buffer coating-plastic coating that protects the fiber.



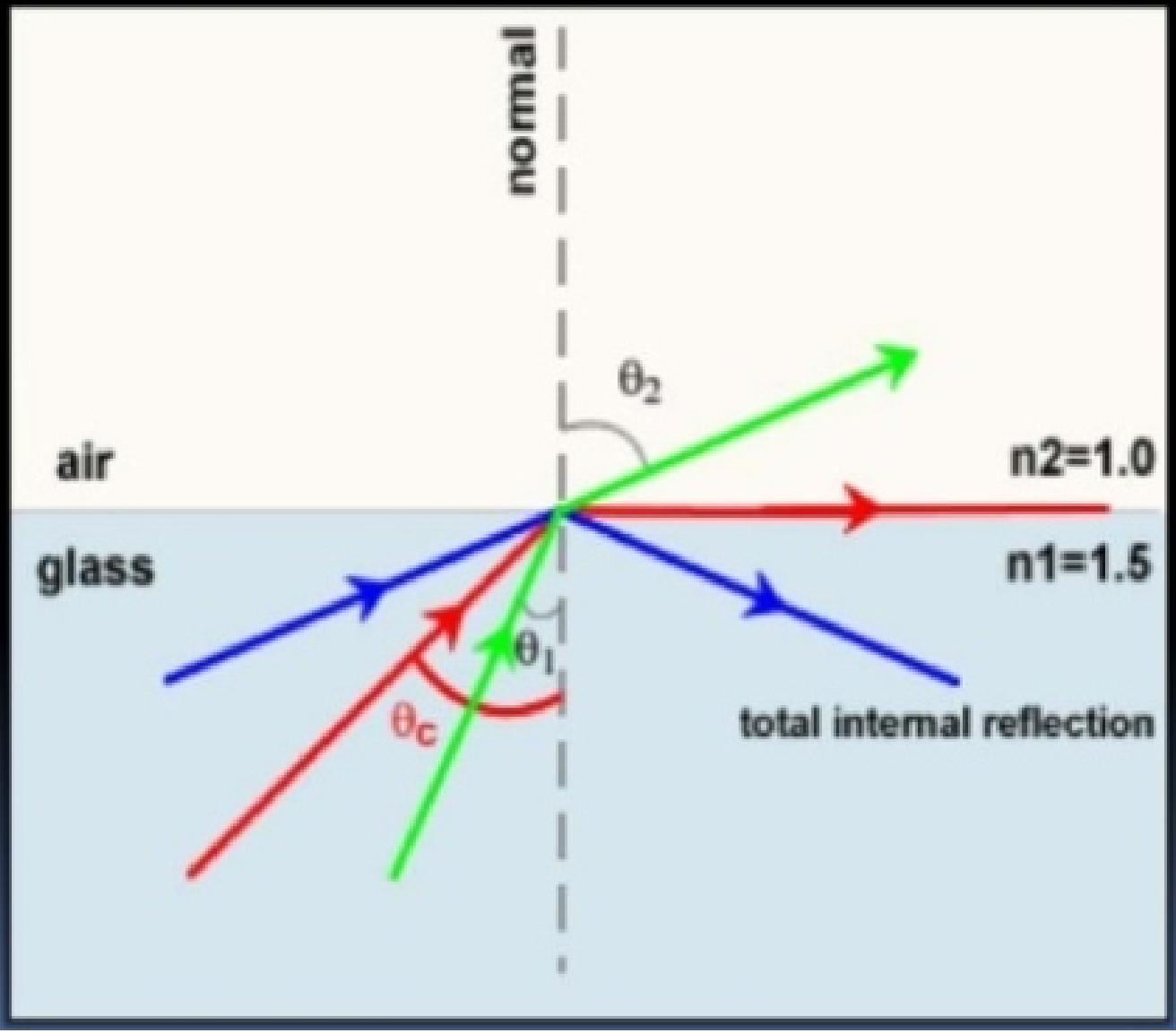
TOTAL INTERNAL REFLECTION

- When light travelling in an optically dense medium hits a boundary at an angle larger than the "critical angle" for the media, the light will be completely reflected. This is called total internal reflection.

- Fiber optic cables use total internal reflection inside the optical fiber.

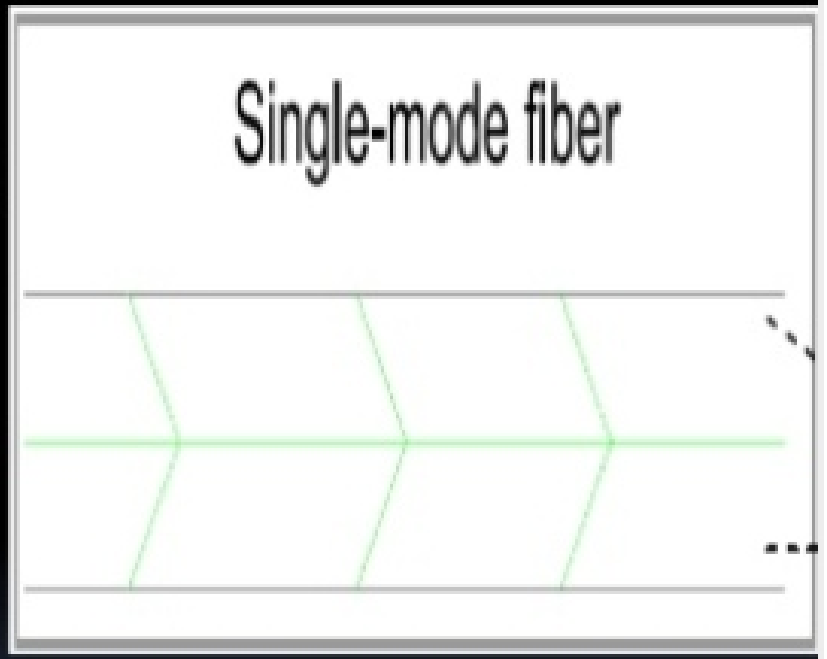


TOTAL INTERNAL REFLECTION



FIBRE OPTIC CONFIGURATION
SINGLE MODE OPTICAL FIBER

- transmit one signal per fiber (used in telephone and cable TV).
- They have small cores(9 microns in diameter) and transmit infra-red light from laser.
- Single-mode fiber's smaller core (<10 micrometers) necessitates more expensive components and interconnection methods
- Allows much longer, higher-performance links.



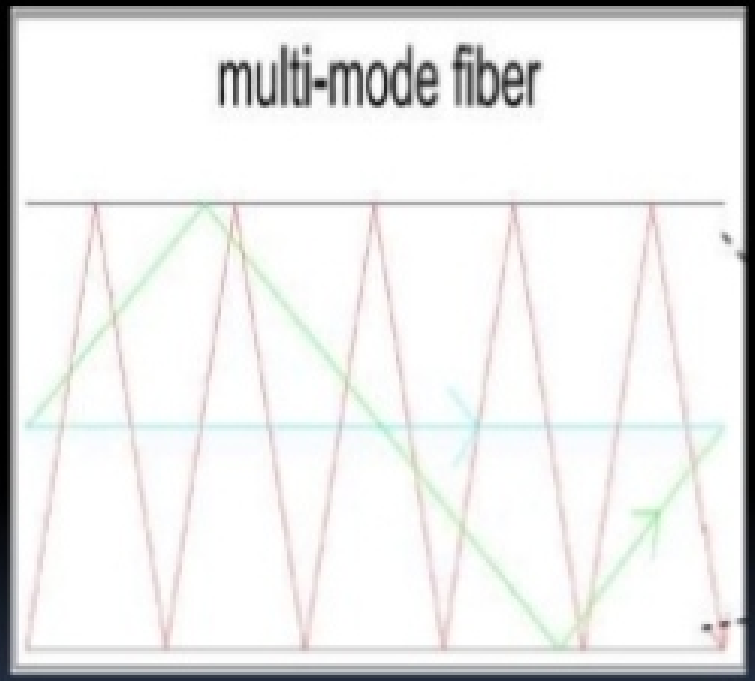
MULTI MODE OPTICAL FIBRE

- This type of optical fiber are used to transmit many signals per fiber (used in computer networks).

- They have larger cores(62.5 microns in diameter) and transmit infra-red light from LED.

- Multi-mode fiber introduces multi-mode distortion which often limits the bandwidths and length of the link.

- Furthermore, because of its higher dopant content, multimode fiber is some what more expensive.

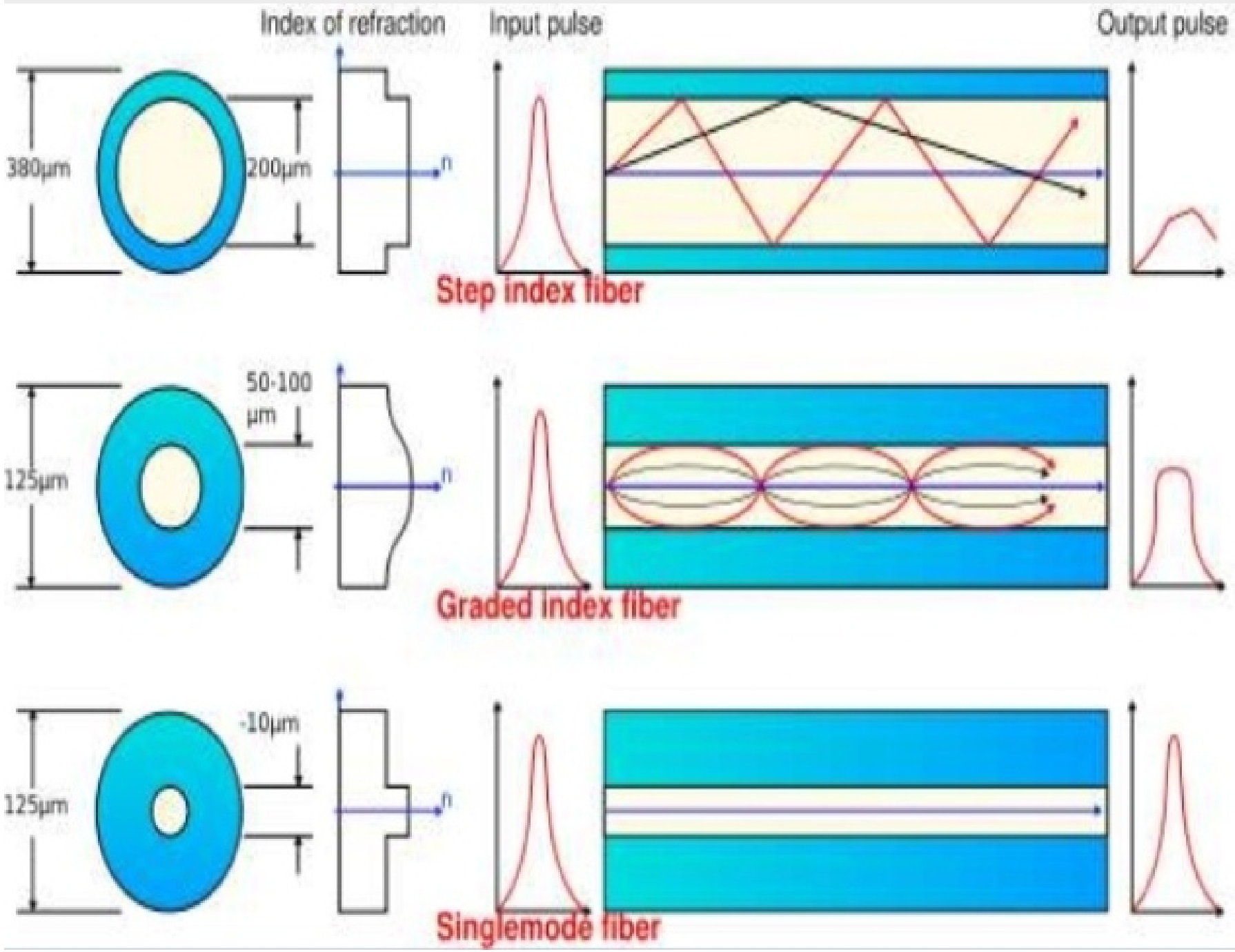


Step Index fibre

- The refractive index of core is constant
- The refractive index of cladding is constant
- The refractive index of cladding is slightly lower than that of core

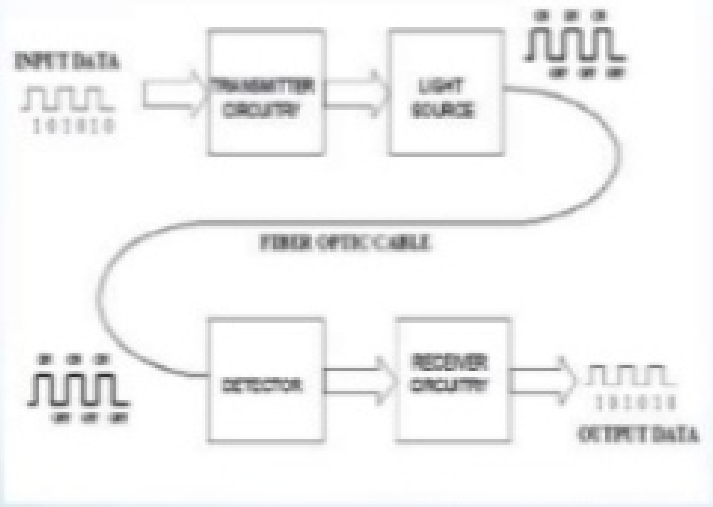
Graded index fibre

- Refractive index of core decreases smoothly from the centre to the outer edge
- Refractive index of cladding is constant


Index of refraction
Input pulse
Output pulse
380μm
200μm
n
Step index fiber
50-100
μm
125μm
n
Graded index fiber
10μm
125μm
n
Singlemode fiber

Working of optical fiber

A Simple Fiber Optic Communication Link

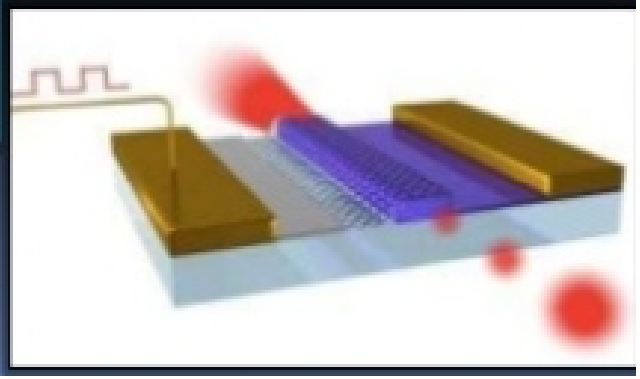


1. Laser
2. Optical Fiber
3. Photodetector

Laser Coupled Into Fiber

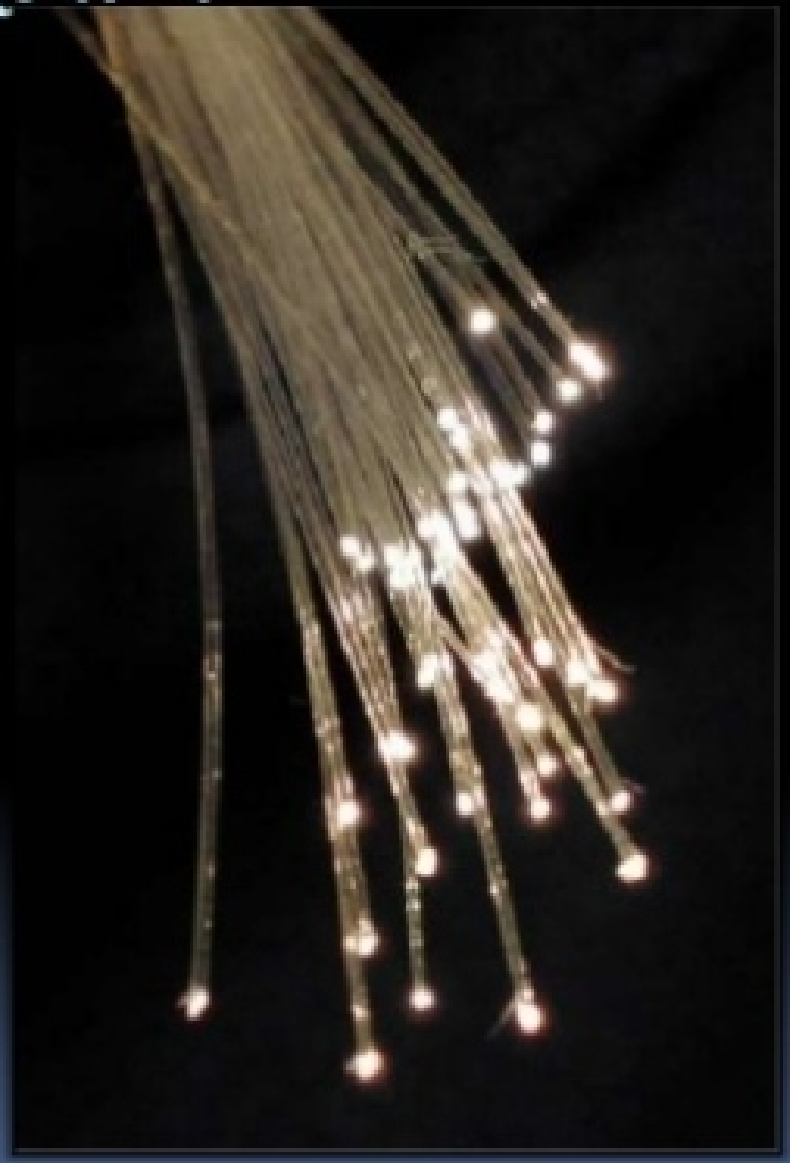
Photodetector

Light Transmission



Fiber Optics in uses

- Communication Systems
- Cable Television
- Imaging
- Additional Uses



Communication Systems

- *Networking and telecommunication are two areas where fiber-optic cables are ideal signal conductors.*
- *well-matched for both long-distance and short-distance communication*
- *Individual glass fibers can transmit independent light pulses on multiple wavelengths, which allows each strand to carry simultaneous streams of data on various channels.*

Cable Television

- *Usage of fiber-optic cables in the cable-television industry began..*
- *Advantages of using fiber optic in cable television*
- *Fiber-optic cable allows cable providers to offer more customized service*

Imaging

- *In a medical setting it is used in endoscope*
- *In other environments, where the device is also called a bore scope or fiberscope*

Additional Uses

- *Computer and Internet technology has improved due to optical fibers' enhanced transmission of digital signals.*

- *fiber-optic signals stay strong longer, requiring less power over time to transmit signals than copper-wire systems.*

ADVANTAGES

- *Much higher bandwidth*
- *Thousands of channels can be multiplexed together over one strand of fiber*
- *Immunity to noise*
- *Safety*
- *Security*
- *Attenuation*
- *Reliability*
- *Size*

Advantages of optical fiber

The optical fiber has following advantages over twisted -pair and coaxial cable.

- *Resistance to noise*
- *Huge bandwidth*
- *Higher signal carrying capacity*

The Future of Fiber Optic

- *As with all technology current fiber optics does have a theoretical limit. The idea that transferring data through light was at one time thought to be limitless, however laboratory tests are showing that we are quickly reaching the ceiling that fiber optics offer us.*

- *Small improvements are on the horizon modifying the way signals are encoded, which would carry us a few extra years.*

- *The next big breakthrough is still deep in development though, and little is known what the future holds.*