

Related topics

Basic measurement used to characterize an optical fiber. Adjustment and optimization of injection, measurement of optical losses Experimental determination of the numerical aperture Calculation of the refractive index of the cladding. Experimental determination of the index profile of the core, a parabolic profile fiber graded-index Measurement of the diameter of the core by optical method Calculation of the normalized frequency, the number of modes in the fiber, the wavelength cutoff. Observing behavior in polarized light, depolarization by a fiber.

Principle

The optical fiber is a cylindrical waveguide composed of two medium with different refractive index. We distinguish two main types of fiber : multimode fiber and singlemode fibers. The multimode fibers are used for fiber applications "low end" (short), while singlemode fibers are used primarily for telecom applications and thus over long distances.

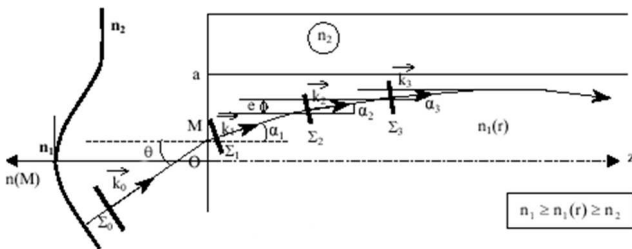
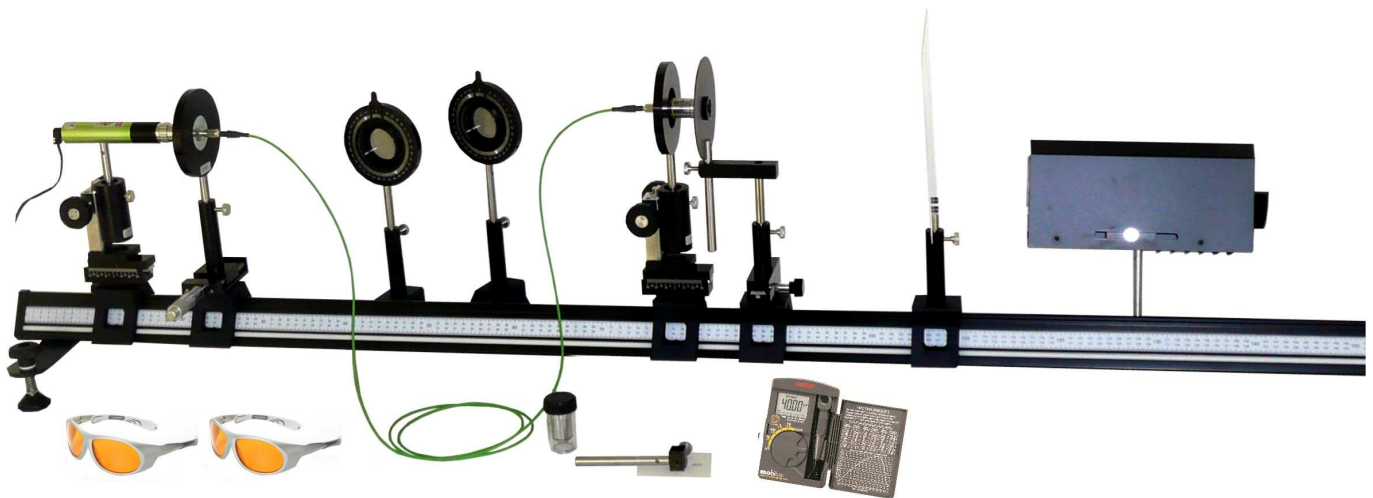


Fig. 1 : beam propagation in a graded index fiber

A light beam will be guided in M if :

$$|\sin \theta(M)| \leq \sqrt{n(M)^2 - n_2^2}$$

Fig. 2: Experimental setup for the setting and study of an optical fiber



Equipment

Optical bench (2 m) with adjustable base	1
Standard slide mount for optical bench	3
Adjustable slide mount (micrometric x 25mm)	1
Adjustable slide mount for optical bench (x = 60mm)	1
Adjustable slide mount for optical bench (y30mm, z40 mm)	2
Compact green laser (532 nm) 3-5 mW unpolarized	1
Precision Achromatic Objective 20x	2
Precision Achromatic Objective 10x	1
Holder for objective	1
Optical fiber 100/140 μm – graded index – length 2m	1
FC-PC connector on diam. 40 mm disk	2
Holder for diam. 40 mm component	2
High brightness lamp 75W with 12V power supply	1
Micrometer : 1mm divided into 100 graduations	1
Holder for plate, grating	1
Offset device	1
Polarizer with precision rotary mount	2
White screen with metal face graduated	1
Handled laser power meter and holder	1
Laser safety goggles	2

Tasks

This lab is particularly well designed to begin training and introduce students to the handling and the precautions to take when measured on an optical fiber. Besides the technical "classic" used on the fibers, this lab also offers two original methods for measuring the index profile and diameter of the fiber core. The various steps involved in this experience are: injection loss, the numerical aperture, the profile index and the inside diameter of the fiber. The phenomenon of depolarization will only be observed.