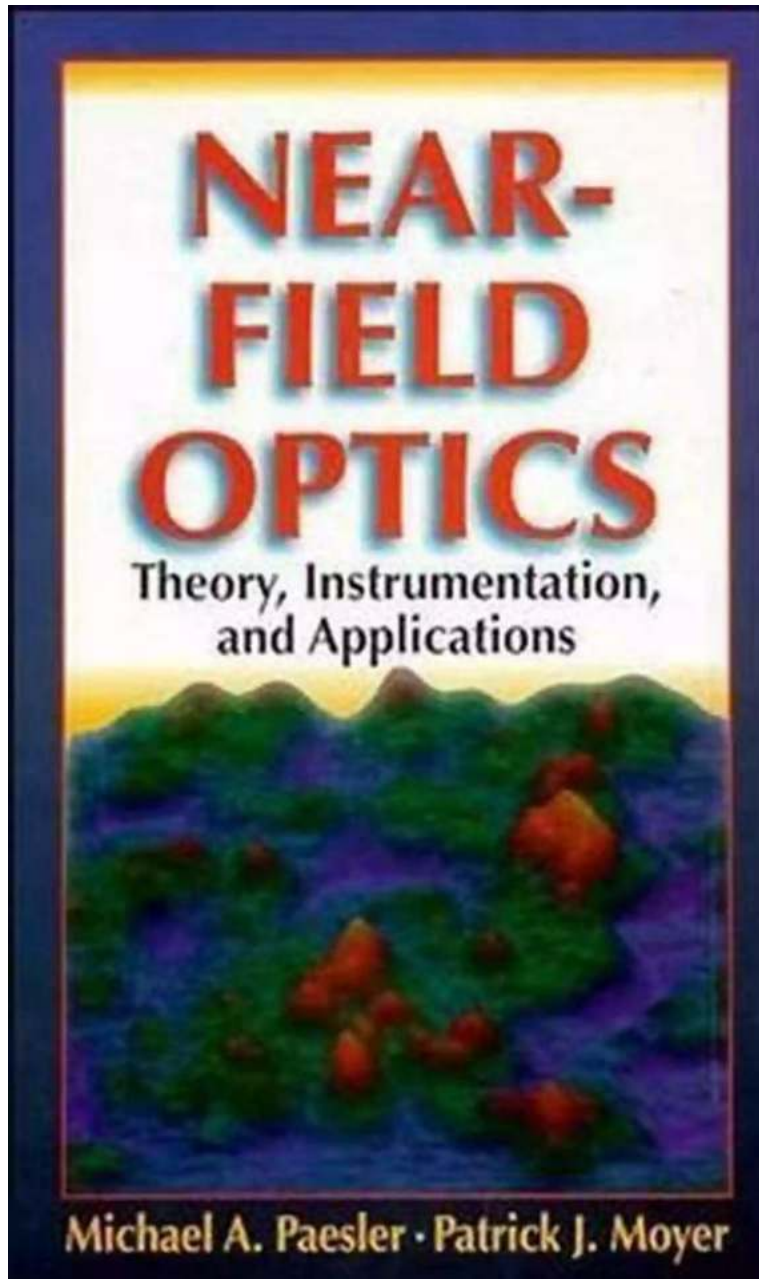


Near Field Optics: Theory, Instrumentation, and Applications

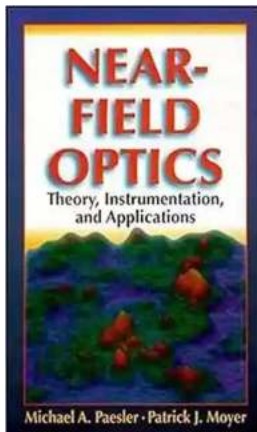


Near Field Optics is a rapidly advancing field that has revolutionized the way we analyze and manipulate light at nanoscale dimensions. By exceeding the diffraction limit of conventional optics, it enables researchers to study and

manipulate objects with extraordinary resolution and precision. In this article, we will delve into the theory, instrumentation, and applications of Near Field Optics.

Theory of Near Field Optics

At the core of Near Field Optics is the concept of evanescent waves. These waves, which exist within a short distance from the surface of an object, carry valuable information that is often lost in traditional far-field measurements. By utilizing high-resolution probes and detectors, Near Field Optics allows us to capture and analyze these evanescent waves, revealing previously hidden details about the sample under investigation.



Near-Field Optics: Theory, Instrumentation, and Applications by Michael A. Paesler(1st Edition, Kindle Edition)

★★★★★ 5 out of 5

Language : English

File size : 7850 KB

Text-to-Speech: Enabled

Screen Reader: Supported

Print length : 368 pages

Lending : Enabled



The interaction between the probe and the sample can be explained using the scattering and absorption of light. By carefully controlling the polarization and wavelength of incident light, we can probe specific features of interest in a sample. Various techniques such as aperture-based scanning near-field optical microscopy (SNOM), photon scanning tunneling microscopy (PSTM), and scattering scanning near-field optical microscopy (s-SNOM) have been developed to image and map the nanoscale features of a sample.

Instrumentation in Near Field Optics

Instrumentation plays a crucial role in Near Field Optics experiments. The key component is the probe, which is responsible for detecting the near-field signals and converting them into measurable optical signals. Probes are typically fabricated using tapered optical fibers, metallic tips, or plasmonic nano-antennas, and they can provide resolutions beyond the diffraction limit.

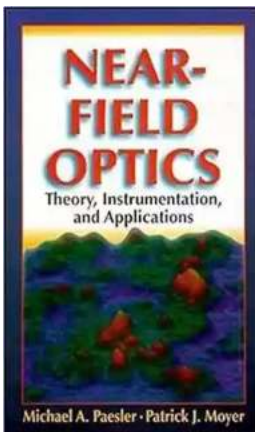
In addition to the probe, a variety of other instruments are used in Near Field Optics experiments, including lasers, optical filters, detectors, and scanning systems. These instruments work in tandem to provide precise control over the illumination, collection, and manipulation of near-field signals. Advanced imaging techniques such as fluorescence lifetime imaging microscopy (FLIM) and stimulated emission depletion microscopy (STED) are often employed to enhance the imaging capabilities of near-field optical systems.

Applications of Near Field Optics

The applications of Near Field Optics span a wide range of disciplines, including physics, biology, chemistry, and materials science. In the field of physics, it has significantly contributed to the understanding of quantum phenomena and the study of plasmonic resonances. In biology, Near Field Optics has facilitated imaging and analysis of biological structures at the nanoscale, enabling breakthroughs in cell biology and neurobiology.

Furthermore, Near Field Optics has found applications in the characterization and fabrication of nanoscale structures and devices. By utilizing near-field probes, scientists can investigate the properties of nanomaterials, such as their optical, electrical, and mechanical properties. This knowledge is crucial for the development of next-generation electronic devices, sensors, and solar cells.

Near Field Optics has revolutionized our ability to analyze and manipulate light at the nanoscale. By enabling resolutions beyond the diffraction limit, it has opened up new possibilities for scientific research and technological advancements. Through the use of advanced theoretical concepts, sophisticated instrumentation, and diverse applications, this field continues to push the boundaries of what is possible in the world of optics. As researchers continue to explore and innovate, the potential for Near Field Optics to shape the future of various industries remains immense.



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A complete guide to one of the most revolutionary technologies in the history of imaging

Near-field microscopes combine the richness of optical analysis, the noninvasive character of light, and the wide variety of sample environments of conventional microscopes with the finer spatial resolution of alternative technologies. Near-Field Optics combines an to near-field optical theory with a handbook and reference for the practice and application of near-field microscopy. Michael A. Paesler and Patrick J. Moyer provide the most comprehensive presentation available on the instrumentation and operation of near-field microscopes. Writing

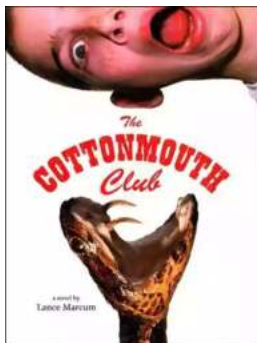
from the viewpoint of the scientist who wants to apply these revolutionary instruments in a laboratory setting, the authors:

- * Explain the pertinent optical theory and provide a developmental history of near-field instruments
- * Discuss imaging theory and its application in the near-field scanning optical microscope (NSOM)
- * Explore the optical behavior of elements that provide the near-field/far-field connection in an NSOM
- * Provide operational how-to's for NSOMs
- * Examine the theory and operation of optical tunneling microscopes with special emphasis on the photon tunneling microscope (PTM)
- * Enumerate contrast mechanisms available to the near-field microscopist
- * Describe the application of near-field techniques in biology, materials science, surface chemistry, and information storage



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