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BOOK REVIEW

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Near-field microscopy and near-field optics: Daniel Courjon Imperial College Press, distributed by World Scientific Publishing Co. Pte. Ltd., ISBN 1-86094-258-X, 317 pages, price US $72

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Near-field scanning optical microscopy allows researchers to simultaneously observe optical properties and the topography of their sample with the precision of tens of nanometres. Recently, researchers have theorized that an apertureless near-field microscope could be used to capture and manipulate particles as small as a few nanometers in diameter. Near-field optics is therefore the converging point of several apparently unrelated research domains. This book consists of 12 chapters, which can be read more or less independently from each other. An appendix surveys the fundamental relations in optics including the basic elements of Fourier optics and Maxwell equations.

Near-field optics is based on the existence of evanescent waves, and near-field microscopes of super resolution were developed in the eighties. The three classes of components, that is the optical, mechanical and electronic components, are constituted in any near-field optical microscope. Because of historical reasons the main near-field microscopes are divided into four principal categories, they are, the transmission, the reflection, the internal reflection, and the hybrid microscopes. With various configurations of near-field microscopes, the book provides users practical guidance. Evanescent fields generated by total internal reflection or by diffraction have been studied both theoretically and experimentally by well-known scientists such as A. Fresnel (1788–1827). The book presents a few methods developed recently to accurately describe the interaction of light with sub-wavelength structures. Furthermore, the author analyses the general problem of quality criteria including notions of degree of freedom, noise, artefacts and resolution in the near-field microscopy. Readers can also find different solutions proposed for emitting or collecting the light field in the near-field zone and the methods for improving image quality especially in scanning microscopes. The book provides an overview for undergraduates and anyone who has an interest in this peculiar phenomenon, and serves as a manual for engineers and researchers.