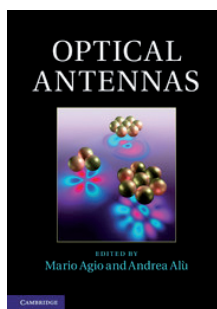


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M. AGIO AND A. ALÙ (EDITORS)

OPTICAL ANTENNAS

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Nano-optics sounds like an oxymoron, since visible light wavelengths are in the submicron range, one or two orders of magnitude above the scale of nanotechnology. Actually near-field optics reveals important properties of the electromagnetic field generated by an electronic transition at nanometric distance from the source, before the photon is formed. Scanning near-field optical microscopy, currently known as SNOM, field-enhanced spectroscopy, nanoscale harmonic generation and optical antennas are just a few examples of application of those properties. The continuous progress in nanoscale fabrication on the one hand allows for developing nano-optical devices; on the other hand it profits of the progress in the invention of devices for optical characterization and control on the nanoscale. Optical antennas, though sharing many basic properties with ordinary radio-wave antennas, are not just a matter of scaling-down known properties to the nano-metric dimensions. Quantum phenomena like surface-plasmon polaritons and electronic band-structure effects, emerging on the nanoscale, far from being unwanted complications, represent a source of innumerable novel properties and applications. There is much expectation as regards the development of new optoelectronic devices, photonic computers and metamaterials, optical processors and communications, all with broad cross-disciplinary aspects covering physics,

chemistry, electrical engineering, etc., up to nanomedicine.

The editors of the volume, Mario Agio (LENS, Florence, Italy) and Andrea Alù (UTx, Austin, USA) have made a wonderful job in bringing together and organizing with excellent coherence the most significant and durable contributions made in such a broad and rapidly developing field. The fathers and the best specialists of the field have contributed, on both the experimental and theoretical sides, to the 21 chapters of the book, all of great clarity and tutorial character. The chapters are grouped in three sections: nine chapters of fundamentals, eight on modelling, design and characterization of nano-optical systems, and four chapters on applications. The part on fundamentals, with the opening chapter by Dieter Pohl, covers the features and functioning of optical antennas: their origin from near-field optics and spectroscopy, the way concepts in radio-antennas and optics meet on the nanoscale, the use of nanoparticles with gain as conventional antennas, the development of antennas for field-enhanced spectroscopy, the quantum and non-linear effects to amplify emission, and the coherent control of nano-optical fields.

The chapters devoted to theory and modelling in the second part of the book illustrate methods and results in computational electrodynamics and *ab initio* simulations of near-field effects, as well as what we learn

from the electrostatic approach. On the nanoscale, theory and large-scale simulations have become essential tools in the analysis of experimental observations, *e.g.* for structural analysis, photoemission electron microscopy, etc. Moreover they can be a useful complement in the characterization of complex systems like arrays of well-oriented optical antennas, and for the design and novel fabrication methods based on soft nanolithography and self-assembling, beautifully described in Chaps. 15-17.

The four chapters on applications show how far fundamental experimental and theoretical investigations can determine, very often through unpredictable routes, a revolution in certain technological areas of great economical relevance. These areas encompass optical communications, optoelectronic devices, energy harvesting, scanning-probe nanoscopy and nanolensing and, finally, the use of aperture optical antennas in nano- and biophotonics.

The book, enriched by an illuminating preface by the Editors, 958 references grouped at the end of the volume, and a detailed subject index, is an excellent and indispensable tool for researchers as well as for graduate students who undertake their career in this fascinating and promising field.

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