

1. Record Nr.	UNINA9910568271803321
Titolo	Light-matter interactions towards the nanoscale // Maura Cesaria, Antonio Cala Lesina and John Collins, editors
Pubbl/distr/stampa	Dordrecht, The Netherlands : , : Springer Nature B.V., , [2022] ©2022
ISBN	94-024-2138-6
Descrizione fisica	1 online resource (348 pages)
Collana	NATO Science for Peace and Security series. B, Physics and biophysics
Disciplina	621.365
Soggetti	Nanoscience Optics Nanophotonics
Lingua di pubblicazione	Inglese
Formato	Materiale a stampa
Livello bibliografico	Monografia
Nota di bibliografia	Includes bibliographical references.
Nota di contenuto	Intro -- Preface -- Memorial -- Contents -- Part I Lectures -- 1 Plasmonic Effects on Photonic Processes and Devices -- 1.1 Introduction -- 1.2 Spectral Range of Plasmonic Phenomena -- 1.3 Principal Phenomena Affecting Light-Matter Interaction in Presence of Metal Nanobodies -- 1.4 Absorption of Light -- 1.5 Local Density of Photon States and Radiative Lifetime Modification -- 1.6 Scattering -- 1.7 Nonradiative Decay Rate Enhancement -- 1.8 Possible Quantum Yield and Electroluminescence Enhancements -- 1.9 Metal Enhanced Fluorescence -- 1.10 Photovoltaics, Photochemistry, and Photodetectors -- 1.11 Photostability of Pigments and Emitters -- 1.12 Conclusions -- References -- 2 Surface Plasmon-Mediated Decay Processes of Ions in Solids -- 2.1 Introduction -- 2.2 Radiative Decay of an Ion into Surface Plasmon Modes -- 2.2.1 Ion Near a Metallic Surface: General Considerations -- 2.2.2 Einstein Coefficients for Surface Plasmon Modes -- 2.2.3 Purcell Factor for Radiative Decay into Surface Plasmon Modes -- 2.3 Non-radiative Ion-Ion Energy Transfer Mediated by Surface Plasmons -- 2.3.1 Photon-Mediated Energy Transfer -- 2.3.2 Plasmon-Mediated Energy Transfer -- 2.3.3 The Plasmon-Mediated, Ion-Ion Energy Transfer Rate -- 2.3.4 Distance Dependence of the Energy Transfer Rate -- 2.3.5 Estimating the Energy Transfer Rate -- 2.4 Conclusions -- References -- 3 Workshop in

Computational Nanophotonics -- 3.1 Introduction -- 3.2 Lab I: Scattering from a Gold Nanosphere -- 3.3 Lab II: Transmittance from a Plasmonic Metasurface -- 3.4 Lab III: Nonlinear Efficiency of Hybrid Metasurfaces -- 3.5 Nonlinear Simulations Methods -- 3.6 Conclusions -- References -- 4 Interaction Between a Plasmonic Nano-Resonator and a Whispering Gallery Mode Photonic Resonator Described Through Coupled Mode Theory and Experiment -- 4.1 Introduction.  
4.2 Theoretical Approach: Coupled Mode Theory (CMT) -- 4.3 Experimental Assembly of WGM-nph Resonator -- 4.4 Application of CMT to the Experimental Results -- 4.5 Heuristic Approach for Understanding the Linewidth Broadening Arising from Forming the WGM-nph -- 4.6 Conclusions -- References -- 5 Time Reversal Symmetry and Topology in Electromagnetics -- 5.1 Introduction -- 5.2 Time Reversal -- 5.3 Scattering Matrix Symmetry -- 5.3.1 Electromagnetic Reciprocity -- 5.3.2 Condensed-Matter Systems -- 5.4 P-T-D Invariant Systems -- 5.5 Time Reversal Symmetry Breaking -- 5.5.1 Static Magnetic Field Bias -- 5.5.2 Unidirectional Plasmons in Gyrotropic Media -- 5.5.3 Drift-Current Bias -- 5.6 Topological Photonics -- 5.6.1 Topological Classification of Electromagnetic Continua -- 5.6.2 Bulk-Edge Correspondence -- 5.6.3 Ill-Defined Topologies and Energy Sinks -- References -- 6 All-Dielectric Nonlinear Meta-Optics -- 6.1 Introduction -- 6.2 Theory and Numerical Modeling -- 6.2.1 Principles of Nonlinear Nano-Optics -- 6.2.2 Multi-polar Modelling of Nanoscale Optics -- 6.2.3 Multi-polar Numerical Modelling of the Nonlinear Response -- 6.2.4 Quasi-Normal-Mode Description of Nonlinear Nano-Optics -- 6.2.5 Practical Application of QNM to Nonlinear Nano-Optics -- 6.3 Experimental Demonstrations -- 6.3.1 SHG in Semiconductor Nanoantennas -- 6.3.2 Spontaneous Parametric Down-Conversion in a Sub- Nanoantenna -- 6.3.3 From Single Nanoantennas to Quadratically Nonlinear Metasurfaces -- 6.4 Conclusion and Perspectives -- References -- 7 Nanophotonic Circuits for Unconventional Computing Applications -- 7.1 Introduction -- 7.2 Arithmetic Processing with PCM Photonic Devices -- 7.3 Artificial All-Optical Neural Networks -- 7.4 Conclusions -- References -- 8 Terahertz Light-Matter Interactions at the Nanoscale -- 8.1 Introduction -- 8.2 Terahertz Technology.  
8.3 Terahertz Nanoscopy -- 8.4 Terahertz Scanning Tunnelling Microscopy (THz-STM) -- 8.5 Terahertz Sensing with Nanoslot Antennas -- 8.6 Nanoscale Phenomena in Biological Systems -- 8.7 Terahertz Control over Matter -- 8.8 Terahertz Bioelectromagnetics -- 8.9 Conclusion -- References -- 9 An Alternative Starting Point for Electromagnetism -- 9.1 About These Lectures -- 9.2 An Alternative Form of Maxwell Equations -- 9.3 The Operator and G as the Polarization Description -- 9.3.1 From the  $(r,t)$  to the  $(r,)$  Domain -- 9.3.2 The Operator -- 9.3.3 The Meaning of G -- 9.3.4 The Importance of Complex Fields -- 9.3.5 The G Split as the Polarization Description: Generality and Invariance -- 9.4 An Even Simpler Form of Maxwell Equations and the i Operator -- 9.5 Summary -- 9.6 Concluding Remarks -- References -- 10 Absorption, Emission, and Vacuum Fluctuations -- 10.1 Introduction -- 10.2 Interference and Energy Conservation -- 10.3 Stimulated Emission in a Fabry-Pérot Resonator -- 10.4 Lorentz Oscillator Model -- 10.5 Quantized Electric Fields -- 10.6 Summary -- References -- 11 Nd<sup>3+</sup> Ion as a Structural Probe in Studies of Selected Oxide Host Lattices: Coupling the Low-Temperature High-Resolution Spectroscopic Techniques with Microscopy -- 11.1 Introduction -- 11.2 Experimental Section -- 11.2.1 Sample Preparation -- 11.2.2 Techniques for Analysis -- 11.3 Energy Level Diagram of Nd<sup>3+</sup> Ion in Solids -- 11.4 Various Energy-

Transfer Processes with Nd<sup>3+</sup> Ions -- 11.5 Nd<sup>3+</sup> Ion in the Host as a Structural Probe -- 11.6 Examples of Nd<sup>3+</sup> Ions in Different Host Lattices -- 11.6.1 Cubic Nd<sup>3+</sup>-Doped Lu<sub>2</sub>O<sub>3</sub> and Its Two C<sub>3</sub>i and C<sub>2</sub> Symmetry Sites -- 11.6.2 Vacancied Scheelite-Type Structure Cd1-3xNd<sub>2</sub>xxMoO<sub>4</sub> Molybdates: Double Distribution of Nd<sup>3+</sup> Sites with D<sub>2</sub>d Point Symmetry Slightly Deformed.

11.6.3 Monoclinic/Cubic La<sub>2</sub>-xNd<sub>x</sub>Mo<sub>2</sub>O<sub>9</sub> Micro-powders: Disordered Structure and Multisite Character -- 11.6.4 Cubic Nd<sup>3+</sup>-Doped Y<sub>6</sub>Mo<sub>12</sub> - Two Aspects: Multisite Character and Detection of Nd<sup>3+</sup>-Y<sub>2</sub>O<sub>3</sub> Phase Contamination -- 11.7 Summary -- References -- 12 Research of Efficient and Fast Scintillator Garnet Crystals: The Role of Ce<sup>4+</sup> in Ce<sup>3+</sup>, Mg<sup>2+</sup>-Co-Doped Gd<sub>3</sub>Al<sub>2</sub>Ga<sub>3</sub>O<sub>12</sub> from Spectroscopic and XANES Characterizations -- 12.1 Introduction -- 12.2 Strategy for Optimization of Garnet Scintillator Composition in the Defect Engineering and Band Gap Engineering -- 12.3 Crystal Growth and Spectroscopic Properties of Ce<sup>3+</sup>-Doped GAGG and Ce, Mg<sup>2+</sup>-Co-Doped GAGG Single Crystals -- 12.3.1 Crystal Growth -- 12.3.2 Absorption Spectra -- 12.3.3 Radioluminescence -- 12.3.4 Scintillation Decays -- 12.3.5 Gamma-Ray Response -- 12.3.6 Time Resolution -- 12.4 Role of Ce<sup>4+</sup> Cations in the Scintillation Mechanism -- 12.5 Evidence and Evaluation of Stable Ce<sup>4+</sup> Ions by XANES Technique in Ce<sup>3+</sup>, Mg<sup>2+</sup>-Co-Doped GAGG -- 12.6 Conclusions -- References -- Part II Short Seminars -- 13 Refractive Index Sensing by Phase Shift Cavity Ringdown Spectroscopy -- 13.1 Introduction and Experimental Method -- 13.2 Results and Discussions -- 13.3 Conclusion -- References -- 14 Hyperpolarizability of Plasmonic Nanostructures: A Method to Quantify the SHG Emission from a Metasurface -- 14.1 Calculating SHG from a Plasmonic Metasurface -- References -- 15 Nonlinear Up- and Down-Conversion in AlGaAs Microdisks Integrated in a Photonic Circuit -- 15.1 Introduction -- 15.2 Results -- 15.3 Discussion -- References -- 16 Tuning of Phonons and Surface Phonon Polaritons -- References -- 17 Defect-Related Optical Properties of ZnO Nanoparticles in ZnO/SiO<sub>2</sub> Systems -- 17.1 Introduction -- 17.2 Results -- 17.3 Conclusions -- References -- 18 Integrated Slot Waveguide-Based Phase Shifter -- 18.1 Introduction.

18.2 Approach -- 18.3 Characterization of the Static Phase Shift -- 18.4 Dynamic Response of the Phase Shifter -- References -- 19 Radiation by a Finite-Length Electric Dipole in a Uniaxial Medium -- References -- 20 How Integrated Photonics Can Help to Understand Our Brain -- References -- 21 Polarized and Diffracted Second Harmonic Generation from Semiconductor Metasurfaces -- 21.1 Introduction -- 21.2 Results -- 21.3 Conclusion -- References -- 22 Simple Multidimensional Two-Fluid Plasma Model Solver Based on PseudoSpectral Time-Domain Method -- 22.1 The Two-Fluid Plasma Model -- 22.2 Numerical Algorithm -- 22.3 Validation of the Code -- References -- 23 Volumetric, Glass-Based Luminescent Nanocomposites Produced Using the NPDD Method -- References -- 24 Hybrid Optical Nanocavities for Reflective Displays -- 24.1 Introduction -- 24.2 Results -- 24.3 Conclusions -- References -- 25 Laser-Irradiated Nanostructures for Intracellular Delivery -- References -- 26 Integrated Photonics for Infrared Spectroscopy -- 26.1 Introduction -- 26.2 Material Platform -- 26.3 Fabrication and Results -- Reference -- 27 Self-Organized Nanostructures Obtained by Bottom-Up Methods as Plasmonic Materials and Metamaterials for VIS and IR Applications -- References -- Part III Poster Presentations -- 28 Few-Femtosecond Plasmon Transients Probed with nm-Scale Sensitivity -- 28.1 Introduction -- 28.2 Results -- References -- 29 Simulating Small Metallic Nanoparticles in FDTD: Nonlocal Correction to the Drude

Model -- 29.1 Nonlocal Optical Response -- References -- 30 Eu<sup>3+</sup> Exchange in High-Charge Synthetic Mica-2 for Radioactive Waste Storage Applications -- 30.1 Introduction -- 30.2 Experimental -- 30.3 Results -- References -- 31 Equivalent Circuit of the Defected Ground Structure in the Coplanar Waveguide -- 31.1 Introduction -- 31.2 Equivalent Model of the DGS Unit. 31.3 Conclusion.

---

**Sommario/riassunto**

---

The investigation of light-matter interactions in materials, especially those on the nanoscale, represents perhaps the most promising avenue for scientific progress in the fields of photonics and plasmonics. This book examines a variety of topics, starting from fundamental principles, leading to the current state of the art research.

---