Contents

Preface .................................................................................................................. vii
List of Past Institutes ......................................................................................... xix

Part I Lectures

1 Real-Time Optical Detection of Single Nanoparticles and Viruses Using Heterodyne Interferometry .......................................................... 3
   Anirban Mitra and Lukas Novotny

2 Photonic Metamaterials and Transformation Optics: A Very Brief Introduction and Review ................................................................. 23
   Martin Wegener

3 Plasmonic Enhancement of Light Emission and Scattering in Nanostructures ................................................................. 29
   Sergei V. Gaponenko

4 Sub-Wavelength Optical Fluorescence Microscopy for Biological Applications ................................................................. 47
   P.N. Hedde and Gerd Ulrich Nienhaus

5 Raman Spectroscopy and Optical Coherence Tomography on a Micro-Chip: Arrayed-Waveguide-Grating-Based Optical Spectroscopy ................................................................. 73
   Markus Pollnau, N. Ismail, B.I. Akca, K. Wörhoff, and R.M. De Ridder

6 Introduction to Fluorescence Spectroscopy with Applications to Biological Systems ................................................................. 91
   Baldassare Di Bartolo

7 Nanophotonics: Linear and Nonlinear Optics at the Nanoscale ...... 119
   Christopher C. Evans and Eric Mazur
<table>
<thead>
<tr>
<th>Chapter</th>
<th>Title</th>
<th>Authors</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>Synthesis and Spectroscopy of Nanoparticles</td>
<td>Alexander P. Voitovich, G.E. Malashkevich, and N.V. Tarasenko</td>
<td>177</td>
</tr>
<tr>
<td>9</td>
<td>Photonic-Crystal Fiber Platform for Ultrafast Optical Science</td>
<td>Aleksei M. Zheltikov</td>
<td>195</td>
</tr>
<tr>
<td>10</td>
<td>Structure Property Relationships for Exciton Transfer in Conjugated Polymers</td>
<td>Trisha L. Andrew and T.M. Swager</td>
<td>215</td>
</tr>
<tr>
<td>11</td>
<td>Coherent Control of Biomolecules and Imaging Using Nanodoubler</td>
<td>L. Bonacina and Jean-Pierre Wolf</td>
<td>251</td>
</tr>
<tr>
<td>13</td>
<td>Terahertz Spectroscopy and Imaging at the Nanoscale for Biological and Security Applications</td>
<td>John W. Bowen</td>
<td>287</td>
</tr>
<tr>
<td>14</td>
<td>Application of Plasmonics in Biophotonics: Laser and Nanostructures for Cell Manipulation</td>
<td>Alexander Heisterkamp, M. Schomaker, and D. Heinemann</td>
<td>305</td>
</tr>
<tr>
<td>15</td>
<td>Principles and Applications of Rare Earth Ion-Doped Nanoparticles</td>
<td>John Collins</td>
<td>315</td>
</tr>
<tr>
<td>16</td>
<td>Is There Segregation of Rare Earth Ions in Garnet Optical Ceramics?</td>
<td>Georges Boulon, T. Epicier, W. Zhao, M. Guzik, Y. Pan, and B. Jiang</td>
<td>333</td>
</tr>
</tbody>
</table>
Part II  Short Seminars

19  Metallic Nanoclusters in Layered Crystals: Spectroscopy and Computer Simulations ................................................ 373
    Ivan Karbovnyk, I. Bolesta, S. Velgosh, I. Rovetsky, and I. Kolych

20  Optical Antennas for Single Emitter Fluorescence Enhancement .... 375
    Palash Bharadwaj and Lukas Novotny

21  Ultrafast All-Optical Switching in TiO$_2$ .............................. 377
    Christopher C. Evans, J. Bradley, O. Reshef, E. Marti-Panameño, and Eric Mazur

22  Coherent Manipulation of Motional States of a Single Trapped Ion ................................................................. 379
    Alessandro S. Villar

23  Thermalization of an Open Quantum System Via Full Diagonalization .......................................................... 381
    K. Jacobs and Luciano Silvestri

24  The Role of Localized and Propagating Surface Plasmons in Periodically-Arrayed Nanopillars .............................. 383

25  Optical and Structural Properties of Noble Metal Island Films ...... 385
    M. Lončarić, H. Zorc, and J. Sancho-Parramon

26  Localized Photonic States in Two Dimensional Quasicrystalline Waveguides .................................................. 387
    G. Benedek and Andrea Trabattoni

27  Unified Theoretical Model of Loss Compensation and Energy Transfer for Plasmonic Nanoparticles Coated with a Shell of Active Gain Molecules ........................................ 389
    Vitaliy Pustovit, F. Capolino, and A. Aradian

Part III  Poster Presentations

28  Deep UV Strategy for Discriminating Biomolecules ................. 393
<table>
<thead>
<tr>
<th>Chapter</th>
<th>Title</th>
<th>Authors</th>
</tr>
</thead>
<tbody>
<tr>
<td>30</td>
<td>Optical and Structural Properties of Europium Oxide Thin Films on Silicon Substrates</td>
<td>Gabriele Bellocci, G. Franzò, F. Iacona, S. Boninelli, M. Miritello, A. Terrasi, C. Spinella, and F. Priolo</td>
</tr>
<tr>
<td>33</td>
<td>Investigation of the Metal – Semiconductor Hybrid Nanostructure as an Active Medium for Laser</td>
<td>Alaa EL-din Eid Abd EL-Aziz Ragab, A. Gadallah, M.B. Mohamed, and I.M. Azzouz</td>
</tr>
<tr>
<td>35</td>
<td>Atomic Layer Deposition of Lanthanide Oxides: Exemplified by Europium Oxide</td>
<td>Per-Anders Hansen, T. Finstad, H. Fjellvåg, and O. Nilsen</td>
</tr>
<tr>
<td>37</td>
<td>Femtosecond Laser Nanofabrication of Metal Structures Through Multiphoton Photoreduction</td>
<td>Seung Yeon Kang, K. Vora, S. Shukla, and Eric Mazur</td>
</tr>
<tr>
<td>38</td>
<td>Nanostructured Thick-Film Spinel Ceramic Materials for Sensor Device Applications</td>
<td>H. Klym and Ivan Karbovnyk</td>
</tr>
</tbody>
</table>
Contents

40 Nanoscale Semiconductor Optical Devices .................................................. 417
Nadezda Kuznetsova, E. Semenova, S. Kadkhodazadeh, and K. Yvind

41 Optical Properties of Thermochromic VO$_2$ Nanoparticles .................. 419

42 Lithium Niobate: The Silicon of Photonics! ............................................. 421
Michele Manzo, F. Laurell, V. Pasiskevicius, and K. Gallo

43 Infrared Induced White Anti-stokes Emission of LiYbP$_4$O$_{12}$ Nanocrystals ........................................................ 423
Łukasz Marciniak, W. Strek, A. Lukowiak, A. Bednarkiewicz, R. Wiglusz, and D. Hreniak

44 Enhanced Light Emission from Si Nanocrystals Coupled to Plasmonics Structures .................................................. 425
Enrico Massa, T. Roshuk, S. Maier, D. Kovalev, I. Crowe, M. Halsal, and R. Gwillian

45 A Spintronic Single Photon Source and Spin Manipulation in Spininjection-LEDs .................................................. 427
Andreas Merz

46 Polarizing Beam Splitter: A New Approach Based on Transformation Optics .................................................. 429
Jonhatan Mueller and Martin Wegener

47 Point Defects Aggregation in Lithium Fluoride Crystals After Irradiation .................................................. 431
Alexander P. Voitovich, V.S. Kalinov, A.N. Novikov, and A.P. Stupak

48 Diamond Photonic Crystal Slab with Enhanced Photoluminescence Extraction Efficiency ........................................ 433
Lukas Ondič and I. Pelant

49 Spectral Markers of Erythrocytes on Solid Substrate .................. 435
Adkhhamjon A. Paiziev and V.A. Krakhmalev

50 Lanthanide Doped Nanocrystalline Alkaline Earth Fluorides: Synthesis, Structural, Morphological and Spectroscopic Investigation .................................................. 437
Marco Pedroni, F. Piccinelli, M. Bettinelli, and A. Speghini

51 Observation of Surface Plasmons in Metal-Coated Tapered Fiber Terminated by a Subwavelength Aperture ............. 439
V. Palm, Mihkel Rähn, and V. Hizhnyakov
52 Fabrication of Single-Photon Sources by Use of Pyramidal Quantum-Dot Microcavities ............................................. 441
Daniel Rülke, C. Reinheimer, D.M. Schaad, H. Kalt, and M. Hetterich

53 Investigation of GaN- and CuInGaSe₂-Based Heterostructures for Optoelectronic Applications .................. 443
Mikalai V. Rzheutski, E.V. Lutsenko, G.P. Yablonskii, C. Mauder, H. Behmenburg, H. Kalisch, M. Heuken, V. Jmeric, S.V. Ivanov, and V.Y. Shiripov

54 Ebic Investigation of the Recombination at the Edges of GaAs Solar Cells ......................................................... 445
Andrea Scaccabarozzi and M. Acciarri

55 Dynamical Properties of Cardiomyocytes in Three-Dimensional Polymer Scaffolds .......................... 447
Andrea Scheiwe, B. Richter, M. Bastmeyer, and Martin Wegener

56 Femtosecond Laser Doped Silicon for Photovoltaic Applications ..... 449
Meng-Ju Sher, Yu-Ting Lin, M.T. Winkler, B. Franta, and Eric Mazur

57 Laser and Optical Properties of Green-Emitting ZnCdSe Quantum Dot Based Heterostructures ................. 451
Aliaksei G. Vainilovich, E.V. Lutsenko, G.P. Yablonskii, I.V. Sedova, S.V. Sorokin, S.V. Gronin, S.V. Ivanov, and P.S. Kop’ev

58 Stokes Parameters Measurements for Whispering Gallery Modes Microcavities Characterization ............. 453
Francis Vanier, C. La Mela, A. Hayat, and Y.-A. Peter

59 Photonic-Crystal Fiber Synthesizers of Ultrafast Lightwaves ......... 455
Alexander A. Voronin, I.V. Fedotov, A.B. Fedotov, and Aleksei M. Zheltikov

60 Single Nanoparticle Surface Enhanced Fluorescence ............ 457
Linden R. Webster, K. Suhling, and D. Richards

Index .................................................................................. 475
Nano-Optics for Enhancing Light-Matter Interactions on a Molecular Scale
Plasmonics, Photonic Materials and Sub-Wavelength Resolution
Di Bartolo, B.; Collins, J. (Eds.)
2013, XIX, 477 p. 185 illus., Hardcover
ISBN: 978-94-007-5312-9