

**EDITORIAL**

# The next photonic revolution

**Nikolay I Zheludev**  
*Optoelectronics Research  
Centre, University of  
Southampton, UK*

**Guest Editor and  
Editor-in-Chief**

This special section on Nanophotonics and Metamaterials is a follow-up to the second European Topical Meeting of the NANOMETA series of meetings (see [www.nanometa.org](http://www.nanometa.org)) which took place on 5–8 January 2009, in Seefeld, Austria.

The main idea of the first NANOMETA meeting held in 2007 was to bring together the mature community of microwave electrical engineers with the emerging community of photonics researchers interested in the physics of light coupled to nanostructures.

In recent years the research landscape has shifted dramatically. A wider proliferation of nanofabrication techniques such as electron beam lithography, nanoimprint and focused ion beam milling, diagnostics techniques such as near-field scanning imaging, cathodoluminescence with nanoscale resolution and micro-spectrometry, and the availability of affordable broadband and ultrafast optical sources, have moved the research focus of the NANOMETA community to the optical domain. Quite naturally the ideas of the nonlinearity of materials and the coherency of light in the nanoscale realm have been widely discussed. Driven by the dream of untapped device and material functionality, nonlinear and switchable nanophotonic devices and photonic metamaterials, along with the concept of tailoring the electromagnetic space with metamaterials, appear to be the main avenues along which the subject will develop in the coming years.

Indeed, in the last 20 years photonics has played a key role in creating the world as we know it, with enormous beneficial social impact worldwide. It is impossible to imagine modern society without the globe-spanning broadband internet and mobile telephony made possible by the implementation of optical fibre core networks, optical disc data storage (underpinned by the development of compact semiconductor lasers), modern image display technologies and laser-assisted manufacturing.

We now anticipate that the next photonic revolution will continue to grow, explosively fuelled by a new dependence upon active and switchable photonic metamaterials and nanophotonic devices. This revolution will lead to dramatic new science and applications on a global scale in all technologies using light, from data storage to optical processing of information, from sensing to light harvesting and energy conversion.

Five plenary talks at the conference outlined its topical boundaries. They were given by Sir Michael Berry, Bristol University, UK, who spoke on the new topic of optical super-oscillations; Harry A Atwater, California Institute of Technology, USA, who gave an overview of recent developments in plasmonics; Christian Colliex, Université Paris-Sud, France, who presented the concept of electron energy-loss spectroscopy for the study of localized plasmons; Xiang Zhang, University of California at Berkeley, USA, who talked about recent achievements in the optical super-lens, and Antoinette Taylor, National Laboratory, Los Alamos, USA, who discussed recent work on tunable terahertz metamaterials. In the specially assigned 'breakthrough' talks Steven Anlage, University of Maryland, USA, introduced the emerging field of superconducting meta-materials, Tobias Kippenberg, Max-Planck-Institut, Garching, Germany, talked about cavity optomechanics on a chip, while Misha Lukin, Harvard University, USA, explored the field of quantum plasmonics and Victor Prinz, Russian Academy of Science, Russia, introduced a novel class of metamaterials based on three-dimensional semiconductor nanostructures.

The topical scope of this special section, to a great extent, echoes the paradigm shift in the NANOMETA community and includes papers on nanofabrication of plasmonic structure, transformation optics and invisibility, mapping of fields in nanostructures, nonlinear and magnetoplasmonic media, coherent effects in metamaterials, loss compensation in nanostructures, slow light and ultrafast switching of plasmon signals, and many other topics.

The Guest Editor of this special section and the co-chairs of NANOMETA-2009, on behalf of the conference organising committee and the European Physical Society, would like to thank the Nature Publishing Group for sponsoring the meeting and IOP Publishing for supporting and putting together this follow-up special section. We would like to take this opportunity to invite members of the nanophotonics and metamaterials communities to take part in the next NANOMETA conference to be held in Seefeld, Austria, 3–6 January 2011.