Edited by R. B. Wehrspohn,
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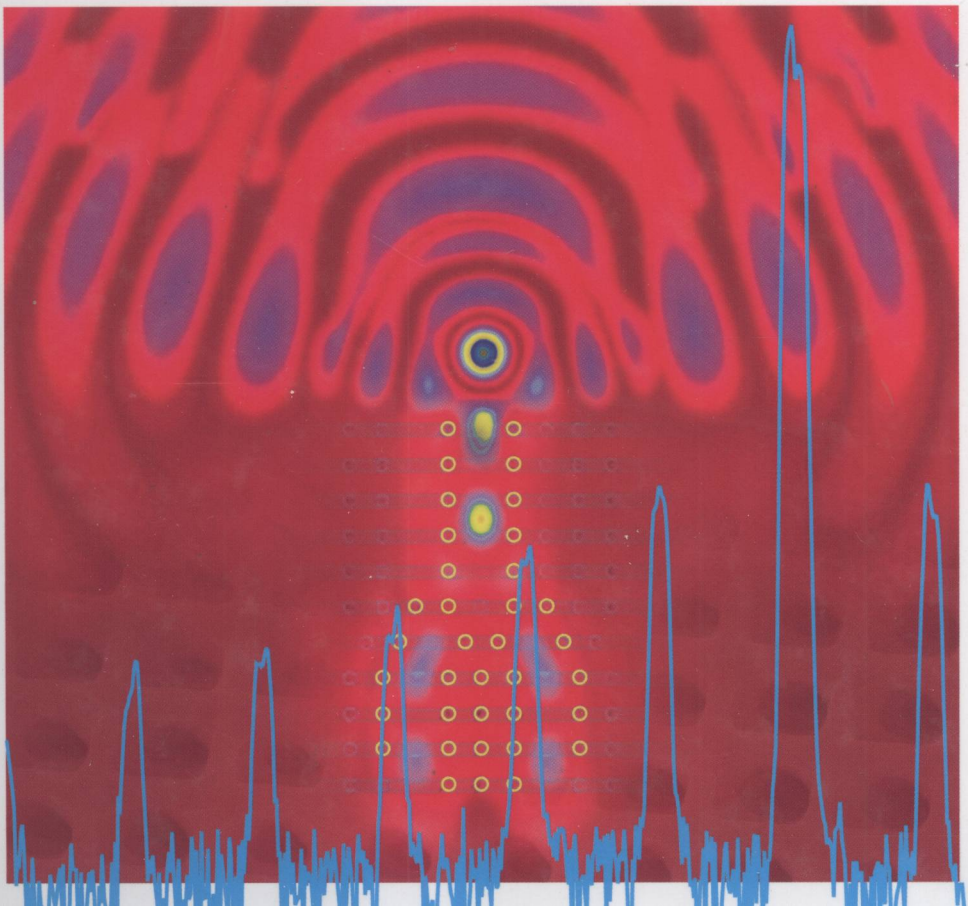
Photonic Crystals, Plasmonics, and Metamaterials



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Cover
Overlay of a 3D photonic crystal made from macroporous silicon, a simulation of a waveguide splitter and the lasing modes of a planar photonic crystals laser made from III-V-compound semiconductors (printed with kind permission of conImago, www.conimago.de).

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Preface

Stimulated by the pioneering work of Sajeev John and Eli Yablonovitsch in 1987, German research groups started in the early 1990s with theoretical and experimental work on 2D and 3D photonics crystals. This initial work was the basis of an application for a focused project on photonic crystals at the German Science Foundation (DFG) in 1999. In the last seven years, a consortium consisting of more than 20 German research groups worked together in the area of photonic crystals.

We started with linear, non-dispersive properties of purely dielectric 2D and 3D photonic crystals in the late 90s and developed the field of research step-by-step to non-linear and dispersive properties of dielectric photonic crystals including gain and/or losses. These properties where studied on different materials systems such as silicon, III-V-compound semiconductors, oxides and polymers as well as hybrid systems consisting of dielectric photonic crystals and liquid crystals. Applications of these systems were developed in the area of active photonic crystals fibres, functional optical components as well as sensors. Some of them have now even entered into industrial applications. During the funding period, some groups extended the initial focus to non-dielectric, dispersive materials such as metals and discussed the properties of periodic metallic structures (plasmonic crystals). After the groundbreaking work of John Pendry at the beginning of this century, resonances in dispersive structures with periodic permeability and permittivity (metamaterials) were studied as well. This was important in order to understand the difference of negative refraction in metamaterials and dielectric photonic crystals.

This special issue summarizes the work of those groups which were part of the focused German program. Other groups not funded by this project but by other grants joined the German initiative on photonic crystals. Workshops of all groups working in the field have been carried out at the German Physical Society meeting each year. Our work was also stimulated by the numerous Humboldt Awardees who visited Germany in the last seven years such as Sajeev John, Costas Soukoulis, Thomas Krauss and many others. We are also pleased that some of our close

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collaborators over the last six years have contributed to this issue: Dan Davidov's group from the Hebrew University, Israel, and Masanori Ozaki's group from Osaka University, Japan.

November 2007

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