PROCEEDINGS OF SPIE

Advances in Slow and Fast Light II

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Editors

25–27 January 2009
San Jose, California, United States

Sponsored and Published by
SPIE

Volume 7226

Proceedings of SPIE, 0277-786X, v. 7226

The papers included in this volume were part of the technical conference cited on the cover and title page. Papers were selected and subject to review by the editors and conference program committee. Some conference presentations may not be available for publication. The papers published in these proceedings reflect the work and thoughts of the authors and are published herein as submitted. The publisher is not responsible for the validity of the information or for any outcomes resulting from reliance thereon.

Please use the following format to cite material from this book:
Author(s), "Title of Paper," in *Advances in Slow and Fast Light II*, edited by Selim M. Shahriar, Philip R. Hemmer, John R. Lowell, Proceedings of SPIE Vol. 7226 (SPIE, Bellingham, WA, 2009) Article CID Number.

ISSN 0277-786X
ISBN 9780819474728

Published by
SPIE
P.O. Box 10, Bellingham, Washington 98227-0010 USA
Telephone +1 360 676 3290 (Pacific Time) · Fax +1 360 647 1445
SPIE.org

Printed in the United States of America.

Publication of record for individual papers is online in the SPIE Digital Library.

SPIEDigitalLibrary.org

Paper Numbering: Proceedings of SPIE follow an e-First publication model, with papers published first online and then in print and on CD-ROM. Papers are published as they are submitted and meet publication criteria. A unique, consistent, permanent citation identifier (CID) number is assigned to each article at the time of the first publication. Utilization of CIDs allows articles to be fully citable as soon they are published online, and connects the same identifier to all online, print, and electronic versions of the publication. SPIE uses a six-digit CID article numbering system in which:

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Introduction

Since the first demonstration of ultraslow and superluminal group velocities of light, the field of slow and fast light has expanded significantly, with demonstrations of slow and fast light in a wide range of systems. In parallel, a wide range of applications of both slow and fast light have begun to emerge. The goal of this conference was to present the latest developments around the world in the studies and applications of slow and fast light. The presentations were categorized in several groups: 1) Slow Light in Polaritons, Gratings, and Related Systems; 2) Slow and Fast Light in Optical Fiber; 3) Slow Light in Atomic Vapor; 4) Slow and Fast Light in Plasmonics and Metamaterials; 5) Slow and Fast Light in Microresonators; 6) Slow and Fast Light in PBG Structures, Waveguides and Cavities; 7) Interferometric Application of Slow and Fast Light. This volume contains some representative papers from these groups. As always, due to time constraints and other reasons, authors of some very interesting talks presented at the conference were unable to submit their manuscripts in time to be included in this volume. A reader interested in finding our more about such a talk is encourage to contact the authors directly.

The first four papers are from group 1. The first paper in this group (7726-3) deals with a dispersion-free slow light pulse and its functionalities. The second paper (7226-4) deals with SBS-based slow light in optical fibers, and addressed issues such as optimum design considerations for undistorted slow-light signal propagation in small and large signal regimes. The next paper (7226-6) describes enhanced second harmonic generation in coupled semiconductor whispering gallery mode microresonators. The last paper in this group (7226-7) addresses theoretical issues surrounding non-linear interactions in electromagnetically induced transparency and related pump-probe optical phenomena.

The next four papers are taken from group 2. We start with a paper (7226-9) that describes important experimental developments in the exploration of few photon switching with slow light in hollow fiber. The next paper (7226-10) describes the use of a Faraday rotator mirror for delay stabilization of SBS slow light in fibers. The third paper in this group (7226-12) addresses new directions in the exploration of producing slow and fast light in optical fibers, including a wide range of interesting experimental results. The final paper (7226-15) in this group deals with a new idea of slow and fast light in optical fibers using acousto-optic coupling between two co-propagating modes.

This is followed by three papers representing group 3. Here, the first paper (7226-17) describes some exciting experimental developments in the study of practical constraints imposed on the study of slow light and electromagnetically induced transparency in an atomic vapor, with implications for further development of vapor-bases atomic clocks, among others. The next paper (7226-19) describes a

realistic model for electromagnetically-induced transparency and slow light in a hot atomic vapor, taking into account various sources of imperfections. The last paper in this group (7226-20) presents an important study of the impact of non-adiabatic fields and dissipation on the emerging field of quantum information storage and retrieval.

The next four papers are from group 4, dealing with slow and fast light in plasmonics and metamaterials. The first paper in this group (7226-21) addresses some exciting ideas for tailoring dispersion of slow or stopped and subwavelength surface-plasmonodielectric-polaritonic light. The second paper (7226-22) addresses the cyclic power flow mechanism of slow, fast and stopped light in plasmonics. The third paper (7226-23) describes new results regarding slow and stored light in metamaterials, opening up exciting prospects for applications. The final paper in this group (7226-24) presents a novel study of Rabi splitting induced by photon tunneling modes in effective zero-index metamaterials.

Representing group 5 are three important papers dealing with slow and fast light in microresonators. The first paper here (7226-25) describes recent developments in the investigation of active delay lines based on coupled ring optical waveguides (CROWs). The next paper (7226-26) describes light trapping and related dynamic effects with one or two microcavities, with important practical applications. The final paper in this group (7226-28) describes in great detail the dispersion properties of high-Q passive and active single or coupled micro-resonators.

Finally, five papers are presented from group 6, dealing with various aspects of slow and fast light in PBG structures, waveguides and cavities. The first paper (7226-29) deals with coupling and propagation losses in slow light photonic crystal waveguides. The second paper (7226-30) investigates mechanisms for controlling the group velocity of light via resonant nonlinearity and disorder in a photonic crystal. The third paper (7226-31) presents a detailed study of slow-light vortices and resonances in periodic waveguides. The next paper (7226-32) presents an extensive study of slow and fast light effects in semiconductor waveguides for applications in microwave photonics. The volume concludes with the fifth paper (7226-33) in this group, detailing experimental and theoretical studies pertaining to the optical spectra of coherent atoms inside an optical cavity.

This conference presents a broad overview of the state of the field of slow and fast light. We hope the readers will find this volume highly informative.

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