PROCEEDINGS OF SPIE

# *Silicon Photonics IV*

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*Editors*

**26–28 January 2009**
**San Jose, California, United States**

*Sponsored and Published by*
SPIE

**Volume 7220**

Proceedings of SPIE, 0277-786X, v. 7220

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Please use the following format to cite material from this book:
Author(s), "Title of Paper," in *Silicon Photonics IV*, edited by Joel A. Kubby, Graham T. Reed, Proceedings of SPIE Vol. 7220 (SPIE, Bellingham, WA, 2009) Article CID Number.

ISSN 0277-786X
ISBN 9780819474667

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.

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# Introduction

Silicon has a legendary history as the material of choice for microelectronic integration, but has not been the material of choice for optoelectronic integration. That is now beginning to change with the introduction of monolithic and hybrid silicon photonics. Silicon photonic devices have been demonstrated with the capability to emit, modulate, guide and detect light and can be combined with microelectronics to form electronic and photonic integrated circuits. Silicon photonic devices such as high-speed (40 GSa/s) analog to digital converts are now being fabricated in commercial CMOS foundries, enabling these devices to leverage the $500 billion fabrication infrastructure for integrated circuits. The previous barrier of silicon's indirect bandgap has been overcome through the integration of germanium and III-V materials to form novel in-plane silicon lasers and high-speed (16 GHz) modulators. The cascaded Raman effect and nano-engineering of crystalline silicon and silicon-rich nitride films have also been used to obtain light from silicon and an electrically pumped silicon laser is on the horizon.

The decrease in waveguide bend radius made possible in silicon due to its high-index contrast, together with increased levels of optical and microelectronic integration, may lead to a new formulation of Moore's Law for silicon photonics. We are now seeing the convergence of communications and computing directly on-chip with the advent of optical interconnects, driven by the need for smaller and less expensive components that can leverage the infrastructure for CMOS manufacturing. In addition to on-chip communications and signal processing, silicon photonics is also being used to form laboratories on a chip with integrated micro-fluidics for low-cost, label-free biosensing. The past year has been an exciting time for silicon photonics! We hope you will enjoy the papers detailing these advancements that are included in this conference proceeding.

**Joel A. Kubby**
**Graham T. Reed**