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Control of Light Emission and Propagation in Photonic Nanostructures

GUEST SPEAKER

Prof. Toshihiko Baba
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When: **2nd July 2009, 2.00 p.m. to 3.00 p.m.**
Where: **Institute of Microelectronics, Singapore (Level 2, Auditorium)**
11 Science Park Road Singapore Science Park II Singapore 117685

Abstract

Semiconductor photonic nanostructures, e.g. photonic crystals (PCs) and high index contrast (HIC) structures, have become worldwide topics in the field of photonics in this decade. They strongly control light emission and propagation, and provide unique phenomena and device applications. Particularly in these years, they have been discussed with various new topics such as nanolaser, slow light, negative re-fraction, and Si photonics. This presentation will review recent activities regarding these topics in Japan.

The PC nanolaser has been studied toward ultimately high efficiency light emitter with quantum electrodynamic effects. Room temperature continuous wave lasing with controlled spontaneous emission, single atom lasing with nanowatt threshold, Rabi splitting due to strong electron-photon coupling, dynamic catch and release of optical pulses, high-density channel drop filters, high resolution biosensing, etc. were achieved by a high Q factor up to three million and a small modal volume of less than 0.15 times the cubic wavelength. The PC slow light waveguide enables guided light to slow down by a factor of 30-5000. Carefully controlling its dispersion, ps-wide short optical pulses were buffered for more than 100 ps with a tunable capacity of 22 bits. It is anticipated to achieve optical buffering in future photonic packet routes. Such slow light is also effective for the enhancement of light-matter interaction and optical nonlinearities; strong two photon absorption and self phase modulation were observed with the slow light pulse.

Negative refraction is extensively studied using metal-dielectric composites called metamaterials. But it is also observed in PCs with no optical absorption, which is a big advantage, compared with metamaterials. Unique light behaviours such as prism, lens, and collimation effects were clearly observed, suggesting novel design of optical systems. Silicon photonics based on CMOS compatible technology must be one of the biggest recent topics of optoelectronics. The HIC photonic wire components achieved remarkably dense and flexible photonic integration. Ultracompact MUX/DEMUX, 100G class optical pulse generator, polarization diversity system, clock distribution in LSI, DFB lasers on Si, etc. have been developed. Si photonics foundries accepting shuttle service is expected to accelerate R&D of this field.

Speaker Biography

Prof. Toshihiko Baba received his Ph.D. Degree from Yokohama National University in 1990. He became a full professor at this university in 2005. He has studied ARROW waveguides, VCSELs, micro/nano-lasers, photonic crystals and Si photonics. He is a member of IEICE, JSAP, IEEE/LEOS, OSA, and APS. He received eight academic awards including The 2006-2007 LEOS Distinguished Lecture Award.

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Registration

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