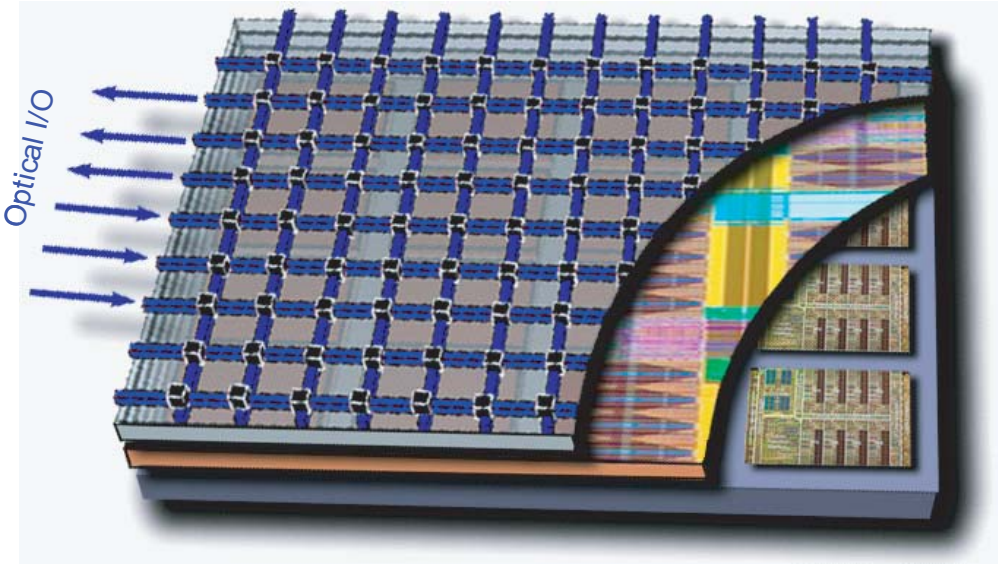
The Institute of OPTICS

Colloquium

University of Rochester

Nano-Photonic Interconnection Networks for Chip-Multiprocessor Computing Systems



Keren Bergman
Professor of Electrical Engineering
Columbia University

BS Bucknel, 1984
PhD MIT, 1994

We explore how recent extraordinary advances in nanoscale silicon photonic technologies can be exploited for developing optical interconnection networks.

3:00 pm, Monday, April 14, 2008
Sloan Auditorium, Goergen Building
Refreshments following lecture

Nano-Photonic Interconnection Networks for Chip-Multiprocessor Computing Systems

Keren Bergman
Department of Electrical Engineering, Columbia University, New York, NY 10027

Abstract:
The emerging class of multicore architectures and chip multiprocessors has fundamentally shifted the impact of communications on computing systems performance. Global communications at all scales is playing a central and dominant role in the ultimate realization of computing systems performance as it falls increasingly on the efficiency of the information exchange among the vastly growing number of compute and memory resources. In this new communication-bound paradigm, the realization of a system-wide scalable communications infrastructure that can meet the enormous bandwidths, capacities, and stringent latency requirements in an energy efficient manner is a key goal for scaling future performance.

We explore how recent extraordinary advances in nanoscale silicon photonic technologies can be exploited for developing optical interconnection networks that address the critical bandwidth and power challenges presented across several levels of the computing system communications infrastructure. Unlike prior generations of photonic technologies, the remarkable capabilities of nanoscale "CMOS photonics" offer the possibility of creating highly-integrated platforms for generating and receiving optical signals with fundamentally superior power efficiencies. Optical interconnection network architectures employing these silicon nanophotonic building blocks are uniquely co-developed and explored in the context of bandwidth-driven computing models. The design of an on-chip optical interconnection network that employs nanoscale CMOS photonic devices and enables seamless off-chip communications to other computing nodes and to external memory is described. Preliminary studies of the performance gains enabled by this network will be presented.

Biography:
Keren Bergman is a Professor of Electrical Engineering at Columbia University where she also directs the Lightwave Research Laboratory. Dr. Bergman received the B.S. from Bucknell University in 1988, and the M.S. in 1991 and Ph.D. in 1994 from M.I.T. all in Electrical Engineering. At Columbia Dr. Bergman leads multiple research projects in optical packet switched networks, distributed grid computing over optical networks, photonic interconnection networks, nanophotonic networks-on-chip, and the applications of optical networking in high-performance computing systems. She served as Senior Technical Advisor to the National Security Agency and recently led the Interconnect Thrust of the NSA's Advanced Computing Systems research initiative. Dr. Bergman is a recipient of the National Science Foundation CAREER award in 1995 and the Office of Naval Research Young Investigator in 1996. In 1997 she received the CalTech President's Award for joint work with JPL on optical packet networks. Dr. Bergman is a senior member of IEEE and a fellow of OSA. She is currently Associate Editor for *IEEE Photonic Technology Letters* and the Editor-in-Chief for the OSA *Journal of Optical Networking*.