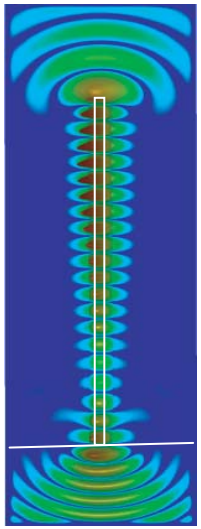
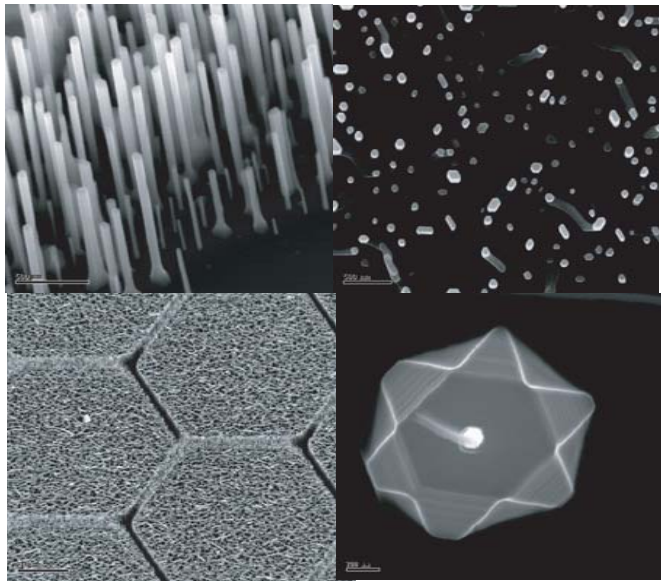
The Institute of OPTICS

Colloquium

University of Rochester

Nanolasers: Approaching the Ultimate Size Limit





Professor Cun-Zheng Ning
Center for Nanophotonics
-Arizona Institute of NanoElectronics,
Center of Solid State Electronics Research (CSSER)
Department of Electrical Engineering

Arizona State University

IEEE-LEOS Distinguished Lecturer

This talk will describe recent progress toward making the smallest possible lasers using nanowires.

10:30 am, Friday, April 11, 2008
Fantone Auditorium
Goergen Building
Refreshments follow
Note special time and location

Nanolasers: Approaching the Ultimate Size Limit

Cun-Zheng Ning
Arizona State University

Abstract:
The rapid development of nanotechnology in general and miniaturization of electronic devices in particular have seriously challenged the optical community to develop ever smaller lasers and other optoelectronic devices compatible with technological trend in size reduction. This has led to the demonstration of lasing capability of a single semiconductor nanowire of ~ 100 nanometers in diameter and a few microns in length, representing one of the smallest lasers. The question of ultimate challenge to the community is: can one make a laser that is smaller than the half-wavelength in all 3 dimensions, or what is the ultimate size limit of a laser?

To answer this and related questions, my talk will start with an overview of impressive recent progress in growth, fabrication, and characterization of semiconductor nanowires and demonstration of lasing activities in various wavelengths. We will show how this new type of miniaturized lasers differs from the conventional semiconductor lasers. To further reduce the dimension of nanowire lasers, a recent proposal of using metal coating of semiconductor wires will be evaluated by numerical simulation. We will show that a proper design of a metal coated semiconductor nanowire can achieve lasing threshold despite significant metal loss. The first experiment demonstrating this idea will also be presented. Finally some recent novel ideas involving surface plasmonic excitations at metal-semiconductor interface will be discussed where much smaller lasers could be potentially made, with size independent of wavelengths of light emitted.

Biography:
Dr. Ning obtained his PhD in Physics from University of Stuttgart, Germany. He was a Senior Scientist, group leader, or task manager at NASA Ames Center for Nanotechnology, NASA Ames Research Center from 1997-2006. He joined Arizona State University in 2006, where he is Professor of Electrical Engineering and Affiliate Professor of Physics and Materials, with the Center for Nanophotonics, Arizona Institute of NanoElectronics and Center of Solid State Electronics Research(CSSER).

Dr. Ning has been conducting research in the general fields of laser physics, geometric phase in lasers, stochastic resonances, semiconductor lasers, optoelectronic device modeling and simulation for the last 20 years. Recently, his group has been involved in growth and optical characterization of semiconductor nanowires and was the first to grow antimonide nanowires and to demonstrate the first single-nanowire infrared laser. He has published over 120 scientific papers and given many conference presentations including over 50 invited talks. He has served in many international conference committees including CLEO, SPIE Photonics West, OSA annual meetings. He was Associate Editor of IEEE J. Quantum Electronics (2001-2003) and a special topic editor for IEEE J. Special. Topics in Quantum Electron., J. Opt. Soc. Am., Optics Express, etc. For his research at NASA, he has won many NASA and NASA contractor awards, including NASA Group Achievment (1999) award and CSS Technical Excellence Award (2003). He was recently awarded the IEEE/LEOS Distinguished Lecturer (2007/2008).