

# Shufeng Bai

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## Highlights:

- Extensive development of nanoimprint lithography, nanofabrication, and advanced lithography
- Research, design and fabrication for nano-photonics, sub-wavelength optics, nanofluidic & nanobio devices
- Strong quantitative, simulation and novel programming skills in multiple platforms
- Exceptional problem solving ability, self-motivated and mission oriented

## Education:

- **Ph.D., Princeton University**, Electrical Engineering (expected: February 2007)  
Thesis topic: **Nanophotonic Devices Fabricated by Nanoimprint Lithography**  
Thesis advisor: Prof. Stephen Y. Chou
- M.A., Princeton University, Electrical Engineering, (2002)
- B.S., Peking University, China, Physics (2000)

## Research Experience:

- Research Assistant, NanoStructures Lab, Princeton University 2000-present
- Developed a novel process to fabricate highly ordered two-dimensional array of nanorings with 83 nm mean diameter and 200 nm pitch over wafer scale with excellent periodicity and uniformity
  - Demonstrated spectrum narrowing ( $<0.06$  nm) and wavelength stabilization (by a factor of 40) of high power semiconductor diode laser array using an innovative external cavity configuration
  - Conducted numerical simulation for a number of subwavelength optical elements, optical and nanophotonic devices and optoelectronic devices; simulation results were proved experimentally
  - Invented a novel process to fabricate high density sub-100 nm nanofluidic channels on at wafer scale for nanobiotechnology applications; the channels were used for stretching DNA molecules
  - Demonstrated a novel single mode diode laser (SMSR  $>37$  dB) with an external cavity using a subwavelength resonant grating (SRG) filter as a frequency selective element
  - Established a process to make high aspect ratio ( $>50$ ) ultra-smooth grating structures through the combination of DRIE and anisotropic wet etching
  - Developed a process using nanoimprint lithography to make high aspect ratio deep structures
  - Invented a miniature atomic clock with better accuracy and reduced power consumption
  - Miscellaneous projects, such as organic light emitting diodes, vapor phase anti-sticking layer coating, photo-curable nanoimprint, novel imprint resists, integrated photonic circuit, and numerical simulations

## Skills:

- 6 years of intensive experience in nanoimprint lithography and other nanofabrication technologies
- Simulation and programming in various environments including Matlab, C, Femlab; parallel programming
- Nanofabrication: nanoimprint lithography, photolithography, thin film deposition (LPCVD, PEVCD, e-bam evaporation, sputtering, oxidation, etc), RIE, deep silicon etcher, wet processing, high temperature process.
- Microscopy: scanning electron microscopy, atomic force microscopy, florescent microscopy
- Optics and optoelectronics: optical spectrum analyzer, monochromator, spectrometer, gas laser, tunable laser, Ar ion laser, excimer laser, free space and fiber optics, diode laser controller, temperature controller, pulse generator, function generator, etc
- Theoretical background: nanophotonics, optics, optoelectronics, advanced mathematics, theoretical physics, solid state physics, device physics, fiber optics, information science.
- Software: Parallel programming with MPI, Matlab, FemLab, Gsolver, DiffractMod, TFCal, FDTD, Labview, Origin, C, Autodesk Inventor, AutoCAD, etc
- Optoelectronic device packaging, organic electronics fabrication and characterization, test and measurement automation, machine shop skills

## US Patent:

- S.Y. Chou, S. Bai, A.S.P. Chang, H. Tan, and J.J. Wang, “*Mode-locked laser using a modelocking wavelength selective reflector*,” Pub. Appl. No. 20040008742, filed March 2003.

### Selected Awards:

- Princeton Material Institute Fellowship, 2000-2005
- Mercedes-Benz fellowship, 1996-2000

### Selected Publications:

- S. Bai and S. Y. Chou, *A novel miniature atomic clock with improved accuracy and reduced power consumption*, (in preparation)
- S. Bai and S. Y. Chou, *A Spectrum-Narrowed, Wavelength and Temperature Stabilized Broad Area Laser Using a Subwavelength Resonant Grating Filter Feedback*, The 19th Annual Meeting of the IEEE Lasers and Electro-Optics Society (LEOS'06), Montreal, Canada, 2006
- S. Bai and S. Y. Cou, *Fabrication of Large Area Metallic Nano-Ring Array Using Nanoimprint Lithograph*, The Fiftieth International Conference on Electron, Ion and Photon Beam Technology and Nanofabrication (EIPBN'06), Baltimore, MD, 2006
- S. Bai, H. Ge, W. Wu, Z. Yu, and S. Y. Chou, *Novel Fabrication of Enclosed Nanofluidic Channels by Direct Imprint and Bonding of Transfer Layer*, The Forty-eighth International Conference on Electron, Ion and Photon Beam Technology and Nanofabrication (EIPBN'04), San Diego, CA, 2004
- S. Bai, H. Ge, Q. Xia, X. Huang, and S. Y. Chou, *Fabrication of High Aspect Ratio, 50  $\mu\text{m}$  Deep Polymer Gratings with Smooth Sidewalls Using Nanoimprint Lithography*, The Second International Conference on Nanoimprint and Nanoprint Technology (NNT'03), Boston, MA, 2003
- X. Lei, S. Bai, H. Gao, and S. Y. Chou, *A Waveguide Beam Splitter based on Optical Tunneling*, The 16th Annual Meeting of the IEEE Lasers and Electro-Optics Society (LEOS'03), Tucson, AZ, 2003
- A. Chang, H. Tan, S. Bai, W. Wu, Z. Yu, and S. Y. Chou, *A novel low-cost tunable laser using a tunable liquid-crystal subwavelength resonant grating filter*, The 23rd annual Conference on Lasers and Electro-Optics (CLEO'03) and the 11th Quantum Electronics and Laser Science Conference (QELS'03), Baltimore, MD, 2003
- A. Chang, H. Tan, S. Bai, W. Wu, Z. Yu, and S. Chou, *Tunable External Cavity Laser Using Subwavelength Resonant Gratings Fabricated by Nanoimprint Lithography*, The First International Conference on Nanoimprint and Nanoprint Technology (NNT'02), San Francisco, CA, 2002
- A. S. P. Chang, S. Bai, H. Tan, W. Wu, Z. Yu and S. Y. Chou, *A Novel, Simple and Low-cost External Cavity Laser using Subwavelength Resonant Grating Filter*, (LEOS'02), Glasgow, Scotland, 2002
- H. Tan, A. S. P. Chang, W. Wu, Z. Yu, S. Bai and S. Y. Chou, *A Tunable Subwavelength Resonant Grating Optical Filter*, (LEOS'02), Glasgow, Scotland, 2002
- Y. Li, S. Bai, and Q. Ouyang, *The Power Law Relation of Spiral Waves in the Belousov-Zhabotinsky Reaction*, J. Chem. Phys 113, 11280 (2000)

### Miscellaneous:

- Reviewer: *Optics Express*, Optical Society of America
- Student Member, *the IEEE Lasers and Electro-Optics Society* (IEEE LEOS)