Rashid Bashir
Bioengineering, ECE
Email: rbashir@illinois.edu
Website: http://www.ece.illinois.edu directory/profile.asp?rbashir

Professor Bashir's vision in integrating biology and medicine with micro and nanotechnology can be categorized into two broad areas, namely (1) how micro/nano-fabrication can help solve problems in life sciences (such as diagnostics, therapeutics, and tissue engineering), and (2) how we can learn more from life science to solve important problems in micro/nano-science and engineering (such as bio-inspired self-assembly, etc.).

Can Bayram
Electrical & Computer Engineering
Email: cbayram@illinois.edu
Website: https://www.ece.illinois.edu directory/profile/cbayram

Professor Bayram's research is focused on next generation photonic and electronic devices including Solid State Lighting, Next Generation Electronics, Flexible Devices for Therapeutic Applications, and Heterointegrated Devices for Advanced Applications. Our work includes design/simulation, microfabrication, and characterization of semiconductor devices. On-campus collaborations include Materials Science, Physics, Chemical and Mechanical Engineering, and off-campus they range from Northwestern and Stanford Universities to IBM.
Prof. Choquette leads the Photonic device research group, which is involved in the study of semiconductor photonic and optoelectronic device physics, fabrication technologies, and systems with a strong emphasis on vertical cavity surface emitting lasers (VCSELs). Active devices, such as VCSELs, are the foundation for short and soon medium length optical fiber based interconnect applications. Prof. Choquette’s current research efforts include the development of new VCSEL devices, such as composite resonator VCSELs and vertical cavity photonic integrated circuits, as well as to establish new VCSEL applications, such as 2-dimensional source and receiver arrays for high aggregate rate interconnects. Group research into new compound semiconductor processing technologies, such as selective oxidation and heterogeneous integration techniques is also pursued. Finally, the next generation of photonic devices, such as photonic crystal membrane lasers, waveguides and nanocavities, which will enable the next generation of quantum optic communication networks, as well as opto-fluidic microsystems for lab-on-the-chip sensing and health care are under under study.

Professor Cunningham’s research group is focused on the application of sub-wavelength optical phenomena and fabrication methods to the development of novel devices and instrumentation for the life sciences. His group is highly interdisciplinary, with expertise in the areas of microfabrication, nanotechnology, computer simulation, instrumentation, molecular biology, and cell biology. In particular, Professor Cunningham’s group is working on biosensors based upon photonic crystal concepts that can either be built from low-cost flexible
plastic materials, or integrated with semiconductor-based active devices, such as light sources and photodetectors, for high performance integrated detection systems.

John Dallesasse  
Electrical and Computer Engineering  
Email: jdallesa@illinois.edu  
Website: https://www.ece.illinois.edu/directory/profile/jdallesa

Photonic integration is a necessity for next-generation optical networks. As the number of applications that demand significant bandwidth increase, the ability of existing networks to serve those needs is compromised. Solutions that enable the existing fiber infrastructure to carry more data, such as advanced optical modulation formats based upon phase-shift-keying and polarization multiplexing, require complex optical transmitters and coherent optical receivers assembled using discrete components. These solutions are too expensive for broad deployment, and face fundamental challenges in reducing system cost. The most promising approach to overcoming these challenges is photonic integration. Both Silicon Photonics and Monolithic Integration on InP face fundamental challenges. Silicon is an outstanding material for complex electronics and waveguides, but its indirect bandgap and weak nonlinear optical properties create challenges with regard to the generation, efficient detection, and active control of light. Compound semiconductor materials, especially those that are lattice matched to InP or GaAs, are outstanding materials for these functions but are costly and not ideal for the fabrication of complex electronics, especially ICs such as network processors. Past attempts to bring these materials together have not progressed past the R&D stage due to limitations in performance, reliability, or manufacturability. Direct epitaxial growth of GaAs or InP on silicon faces the problem of having a high defect-density metamorphic layer that can impact device reliability. Wafer bonding techniques, which have been successfully employed in the LED area as well as in the fabrication of SOI wafers, show promise but also face challenges. Direct bonding at high temperature creates significant stress, as the thermal expansion coefficients of Si and III-Vs are not well matched. This stress has an unacceptable impact on device reliability. Lower-temperature bonding techniques using plasma activation, chemical treatment, or atomically thin interface layers show promise but require further development. An integration approach that recognizes and addresses material compatibility issues and manufacturability should be able to overcome prior barriers to commercialization and enable broad deployment of photonic integrated circuits. What to integrate is also a key area of interest. Recent progress on the Feng-Holonyak Transistor Laser suggests that it may be able to serve as a fundamental device element in photonic-electronic integrated circuits, but further research on device integration is required.
Professor Eden is Director of the Laboratory for Optical Physics and Engineering, a laboratory devoted to the study and applications of the interaction of visible and ultraviolet radiation with matter. The laboratory has discovered more than a dozen lasers or amplifiers in the ultraviolet, visible, and near-infrared, including the first ultraviolet and violet fiber lasers, atomic lasers pumped by the photoexcitation of atomic collision pairs, and the Cd– and Zn-halide diatomic systems. With his students, Professor Eden has demonstrated several powerful laser spectroscopic techniques that have resulted in the discovery of (for example) Rydberg series in the rare gas dimer molecules, the first observation of excitation spectra for the photoassociation of thermal atom pairs, and three body photoassociation. In the ultrafast domain (n/p/n plasma bipolar junction transistor. Dr. Eden has authored more than 280 journal publications and 66 awarded patents. His is a co-founder of Eden Park Illumination and EP Purification.

Professor Feng is director of the High Speed Device and IC group, which is aimed at "breakthrough" device and integrated IC and antenna technology toward THz operation. Prof. Feng (With Prof. Holonyak) invented new transistor, Transistor Laser (3 port operation-an electrical input with an electrical output and optical
output) in 2004, opened up new frontier in optoelectronics integration as well as fast laser modulation, switching and signal processing.

Prof. Goddard's research group, the Photonic Systems Laboratory, studies the ways that light, and lasers in particular, can be used for sensing and measurement, communications, and data processing. His research focuses on fabricating, characterizing, and modeling individual lasers and photodetectors, photonics-based sensors, instrumentation, and integrated circuits, as well as developing new processing, inspection, and characterization techniques, and testing novel semiconductor materials and devices. Applications include hydrogen detection for fuel cells, carbon dioxide detection for reducing post harvest food loss, optical spectrum analysis and quantitative phase microscopy for metrology, integrated microring Bragg reflectors for narrow linewidth lasers and next generation chip-scale communication systems, and optical logic, memory and switches for high speed data processing.

Songbin Gong
Electrical and Computer Engineering

Email: songbin@illinois.edu
Website: http://ilirm.ece.illinois.edu/
Professor Gong's research interests primarily include design and implementation of RF-MEMS devices, components, and subsystems for reconfigurable RF front ends, and engineering hybrid microsystems based on the integration of MEMS devices with photonics or circuits for imaging, sensing, and signal processing.

Xiuling Li
Electrical & Computer Engineering
Email: xiuling@illinois.edu
Website: http://mocvd.ece.illinois.edu/

Professor Li's research interests are in the area of nanostructured semiconductor materials and devices. Areas of interest include include planar nanowires and self-rolled-up membranes, metal-assisted chemical etching (MacEtch) for high aspect ratio nanostructures, Planar III-V Nanowire electronics, Vertical III-V Nanowire Heterogeneous Integration, and metalorganic chemical vapor deposition (MOCVD).

Logan Liu
Electrical and Computer Engineering, Bioengineering
Email: loganliu@illinois.edu
Website: http://nanobionics.mntl.illinois.edu/LNBL2/home.html

Prof. Liu's research area lies at the intersection of engineering, physics, chemistry, biology and information technology including both theoretical and experimental aspects. In particular, Prof. Liu's research includes the micro and nano scale interface between solid-state electronic/photonic system and biological system. His research efforts have been dedicated to understand and control molecular and cellular systems using nanoengineering methods for the benefit of curing diseases, and improving life quality and preserving environmental sustainability. Prof. Liu's research fosters innovative research projects to directly respond to these challenges with the immediate and long-term scientific, technology and societal impacts. The three
closely related thrusts are 1) Nano-Bio hybrid photonic devices, 2) Green microfluidic environmental sensors, and 3) Mobile digital health biochips. This research includes strong collaborations with different disciplines including chemistry, physics, environmental science, agricultural and food engineering, molecular and cell biology.

Arend Van der Zande
Mechanical Science and Engineering
Email: arendv@illinois.edu
Website: http://mechanical.illinois.edu/directory/faculty/arendv

Professor van der Zande's research re-engineers classic 3D systems at atomic length scale like mechanical structures such as atomically-thin membranes or flexible films and electronic structures such as transistors or photodiodes. He utilizes molecular scale building blocks made from new 2D materials like graphene and molybdenum disulfide. The materials are naturally stable at only one to a few atoms thick and can be grown or manually manipulated to build heterostructures with tailored properties by stacking 2D materials layer-by-layer, like lego building blocks. These new structures are then used in applications that lie at the forefront of nanotechnology such as highly-tunable nano-electro-mechanical systems, flexible electronics, pushing Moore’s Law, sensors, biological interfaces and new energy systems.

Wenjuan Zhu
Electrical and Computer Engineering
Email: wjzhu@illinois.edu
Website: https://www.ece.illinois.edu/directory/profile/wjzhu

Prof. Zhu's research focuses on two-dimensional (2D) materials and nano-scale devices including advanced electronic, photonic, and bio-sensing devices for computation, energy, and communication and biomedical applications. The 2D materials of interest to Dr. Zhu include graphene, transition metal dichalcogenides, black phosphorous, and many other layered materials. Two-dimensional (2D) crystals have many unique properties as compared to their bulk counterparts due to their reduced dimensionality and symmetry. The key difference
is the band structures, which lead to distinct electronic and photonic properties. Additionally, 2D crystals also have many other unique properties of 2D crystals open up a broad territory of applications in computing, communication, energy, and medicine.