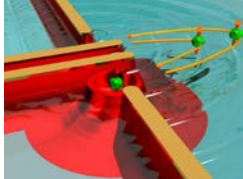


# Department of Electrical Engineering

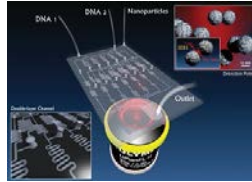
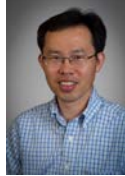
## Solid State Electronics

**Jonathan Bird**



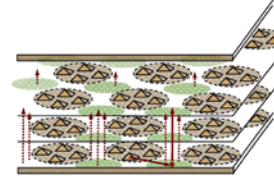
Nanoelectronics and Mesoscopic physics: Fundamental Investigations of Quantum Phenomena; Exploration: New Device and Sensing Paradigms; Electrical Properties of Novel Nanomaterials

**Kwang Oh**



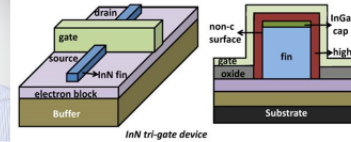
Lab-on-chip (LOC), point-of-care (POC), BioMEMS (Bio Micro Electro Mechanical Systems), microfluidics, microPCR (Micro Polymerase Chain Reaction), on-chip blood separation, biomedical microfluidic devices, sensors, microactuators, droplet-based microfluidics, microfluidic circuits, wearable and implantable sensors

**Vladimir Mitin**



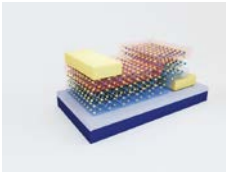
Nanoelectronic, Microelectric and Optoelectronic Devices and Materials; Transport and Noise in Heterostructures, Thin Films, Quantum Wells and Quantum Wires; Simulation, Design and Testing of Photodetectors, Terahertz Sensors and Solar Cells

**Uttam Singiseti**



Advanced GaN and Novel III-N Devices for THz electronics; Transport in III-N Hetero-Structures; Widebandgap power devices; beyond CMOS ferroelectric tunnel devices; Energy-Efficient, Nano-Electronics in Emerging Materials

**Huamin Li**



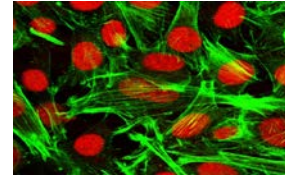
Field-effect transistors, tunnel diodes and transistor-photodetectors and photovoltaics based on low-dimensional materials and their van der Waals heterostructures.

**Arindam Sanyal**



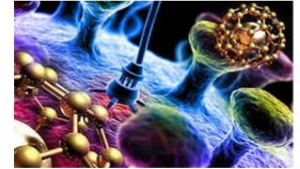
Analog, mixed-signal integrated design; time-domain ADC design; mismatch and ISI shaping in DACs; analog circuit design for biomedical applications

**PC Cheng**



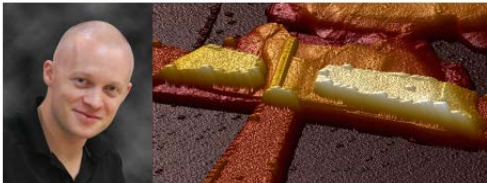
Confocal Microscopy; Biomedical Imaging; X-ray Microscopy; Microtomography; Lithography

**Liesl Folks**



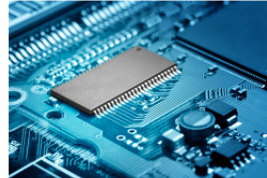
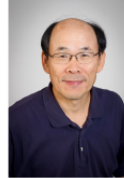
Nanotechnology and Magnetism

**Erik Einarsson**

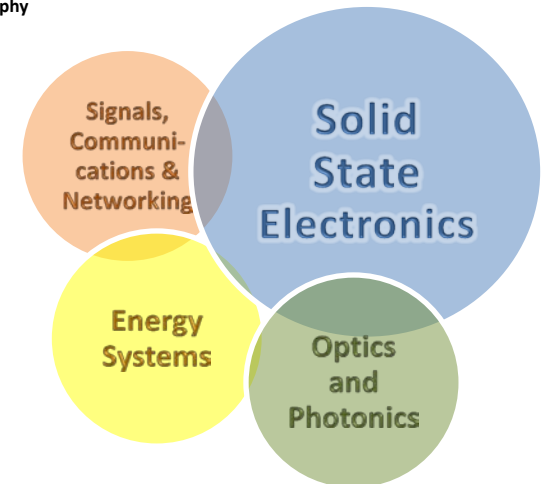


Synthesis of low-dimensional materials such as graphene and single-walled carbon nanotubes, materials characterization, and THz applications of nanoscale materials.

**Chu-Ryang Wie**



Semiconductor devices - device reliability under voltage/current stress, radiation (gamma-ray, proton, x-ray) effect, X-ray analysis of semiconductor materials such as metamorphic buffer materials using reciprocal space mapping and other x-ray methods, Quantum computing



## Current Research Projects in Solid State Electronics:

Many-body interactions in one-dimensional systems • Mesoscopic phenomena in graphene • Nanoscale semiconductor rectifiers for terahertz detection • All-semiconductor memristor devices • Domain-Wall Defined Logic • Epitaxially-formed silicide nanowires for nanoelectronics • Carbon-based organic electronics • Lifetime Reliability of Systems-on-Chip: Unified Modeling and Dynamic Reliability Management • Cross-Layer Design Methodology for Energy and Reliability of Multicore Systems-on-Chip • Nanoscale engineering for high efficiency quantum dot solar cells: enhanced light harvesting and optimized electron hole kinetic • Adaptive IR Sensing Based on Advanced Nanostructures with Tunable Kinetics • Geometric visualization of qubit entanglement • Development of novel devices in emerging III-N semiconductor, and new electronic materials systems • Transport, and device physics in semiconductor-heterostructures, and novel electronic materials • III-N based nano-structured electronic devices with potential applications in energy conversion, energy generation, mixed signal systems • Research Coordination Network for a Sino/U.S. collaborative research at the nexus of energy/water/climate/air pollution • InN and In-rich InGaN surface passivation by novel Atomic Layer Deposition (ALD) technology • Droplet-based Microfluidics •

## Sample of Research Contributions:

G. Bohra, R. Somphonsane, N. Aoki, Y. Ochiai, R. Akis, D. K. Ferry, and J. P. Bird, "Nonergodicity and microscopic symmetry breaking of the conductance fluctuations in disordered mesoscopic graphene", *Phys. Rev. B* **86**, 161405, 2012.

Z. Chen, T.-Y. Lin, X. Wei, M. Matsunaga, T. Doi, Y. Ochiai, N. Aoki, and J. P. Bird, "The magnetic Y-branch nanojunction: Domain-wall structure and magneto-resistance", *Appl. Phys. Lett.* **101**, 102403, 2012.

R. Somphonsane, H. Ramamoorthy, G. Bohra, G. He, D. K. Ferry, Y. Ochiai, N. Aoki, and J. P. Bird. "Fast energy relaxation of hot carriers near the Dirac point of graphene", *Nano Lett.* **13**, 4305, 2013.

T. Kim, R. V. Chamberlin, and J. P. Bird, "Large magnetoresistance of nickel silicide nanowires: Non-equilibrium heating of magnetically-coupled dangling bonds", *Nano Lett.* **13**, 1106, 2013.

J. K. Choi, V. Mitin, et al., "THz Hot-Electron Micro-Bolometer Based on Low-Mobility 2-DEG in GaN Heterostructure," *IEEE Sensors*, Vol. 13(1), pp. 80-88, Jan 2013.

"Strong Enhancement of Solar Cell Efficiency Due to Quantum Dots with Built-In Charge", K. A. Sablon, J. W. Little, V. Mitin, A. Sergeev, N. Vagidov, and K. Reinhard, *Nano Letters*, Vol. 11, pp. 2311–2317, 2011.

M. H. Wong, U. Singiseti, J. Lu, J. S. Speck, U. K. Mishra, "Anomalous output conductance in N-polar GaN based High Electron Mobility Transistors", *IEEE Transactions on Electron Devices*, vol. 59, no. 11, pp. 2988-2995, 2012.

U. Singiseti, M. H. Wong, and U. K. Mishra, "Interface roughness scattering in ultra-thin N-polar GaN quantum well channels", *Applied Physics Letters*, vol 101, no.1, pp. 012101-4, 2012.

Linfeng Xu, Hun Lee, Rajagopal Panchapakesan, and Kwang W. Oh, "Fusion and sorting of two parallel trains of droplets by using a railroad-like channel network and guiding tracks," Special Issue on Emerging Investigator, *Lab Chip*, 2012, 3936-3942