

AVAILABLE 2017 SUMMER SCHOLAR POSITION

2017 VMEC SUMMER SCHOLAR

BAE Systems, Inc. (Manassas, Virginia)

Company Overview:

BAE Systems plc., a global defense company, is engaged in the development, delivery, and support of advanced defense, security, and aerospace systems. BAE Systems employs 88,200 people with operations in six home countries - Australia, Saudi Arabia, South Africa, Sweden, UK, US, and customers in over 100 countries.

BAE Systems, Inc., with greater than 40,000 employees, is the US subsidiary of BAE Systems plc. The US focus is:

- Support and service solutions for current and future defense, intelligence, and civilian systems.
- Design, develop and manufacture a wide range of electronic systems and subsystems for both military and commercial applications;
- Design, develop, produce, and provide service support of armored combat vehicles, artillery systems and intelligent munitions.

Site Overview:

BAE Systems in Manassas, VA offers advanced systems and components for missions such as space control; intelligence, surveillance, and reconnaissance; environmental and space science; communications; and navigation. This includes notable programs like the computers for the Mars rovers. The Manassas site is a complete design, packaging, and test facility for development and production of CMOS microelectronic technology and other novel devices.

Intern Responsibilities:

BAE Systems Manassas is looking for summer interns to work in integrated circuit modeling, design, simulation and test. Job responsibilities include hands on circuit design and test. Interns develop skills to use design and modeling software, to develop and test a host of digital devices such as advanced microprocessors, memories, ASICs and other high function devices.

Requirements:

We are interested in students completing their sophomore or junior year in electrical engineering with a desire to grow and learn about microelectronics. Students attending Virginia Tech, University of Virginia, Old Dominion University, Virginia Commonwealth University, The College of William and Mary, and George Mason University may apply.

BAE Systems is committed to a high performance culture and provides an environment that challenges our employees to be remarkable and obtain their full potential. We are an EEO/Affirmative Action Employer that understands the value of diversity and its impact on a high performance culture.

Micron Technology, Inc. (Manassas, Virginia)

Company Overview:

For more than 30 years, Micron's teams of dreamers, visionaries, and scientists have redefined innovation—designing and building some of the world's most advanced memory and semiconductor technologies. We develop the technologies that transform what's possible. In fact, you likely use our memory every day—in products from computing, networking, and server applications, to mobile, embedded, consumer, automotive, and industrial designs.

As one of the most prolific patent holders in the world we continually rethink, recast, and advance new ideas to bring innovation to broader markets and find ways our technology can inspire new applications or make fundamental improvements to existing designs.

Our roots are in memory, the core strength of our business. As we look toward the future, we'll continue to build on our past achievements by leveraging the synergies between our core memory business and diversified products and technologies that help drive innovation and growth in new markets.

Site Overview:

Micron Technology Virginia manufactures memory chips used in cell phones, mobile music and video players, notebook computers and more. This site is a premier 300mm wafer fabrication facility deploying the world's most advanced memory technology.

As a leading high-tech manufacturing company in Northern Virginia we realize a strong and healthy community is critical to the success of individuals, companies and society. The Virginia site works closely with government and community organizations to improve the region's quality of life and support initiatives that positively impact the area of greater Manassas, the Prince William region and the Commonwealth of Virginia.

Responsibilities:

Challenge yourself intellectually by working side-by-side, gaining real-world experience from leading industry professionals. You will directly play a pivotal role in continuing the aggressive growth of one of the world's leading providers of advanced semiconductor solutions. During your internship you will work on projects in the areas of product characterization and yield analysis, new tool implementation and process enhancement and new product implementation.

Requirements:

Currently attending one of the following Institutions:

- Virginia Polytechnic Institute, University of Virginia, Old Dominion University, George Mason University, The College of William and Mary, Virginia Commonwealth University, Virginia Military Institute

Current Junior or Senior pursuing a BS in any of the following disciplines:

- Microelectronic Engineering, Electrical Engineering, Chemical Engineering, Materials Science, Computer Engineering

George Mason University

Project: Nanowire FET with Subthreshold Swing < 60 mV/dec

The project is to investigate high performance nanoscale field effect transistors with large on/off ratio and sharp subthreshold swing (< 60 mV/dec), so that a new class of novel logic and memory devices outperforming the conventional bulk/SOI based electronics will be created. The nanowire transistor will be fabricated at a wafer scale in a first-class state-of-the-art cleanroom. The device will be characterized with electronic microscopy (SEM/TEM), current-voltage (I-V), timing delay and power consumption measurements. The device will be simulated with industrial standard CAD tools and electrostatic field simulation softwares. This project will be done in collaboration with the Semiconductor Electronics Division of National Institute of Standards and Technology (NIST), Gaithersburg, Maryland.



Mentor: Dr. Qiliang Li
VMEC Professor
VLSI and Nanoelectronics Lab
ECE Department, George Mason University
<http://mason.gmu.edu/~qli6>

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The College of William and Mary

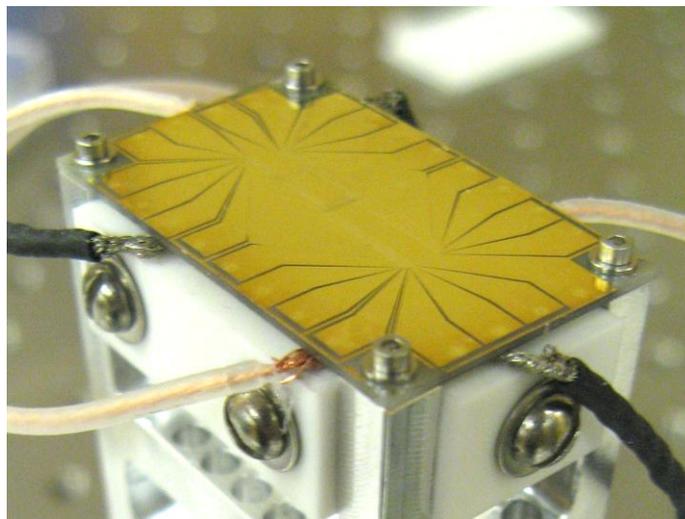
Project Title: Microwave near-field microscopy of atom chips for ultra-cold atoms.

The objective of this project is to develop a probe to measure electric and magnetic near-fields at RF and microwave frequencies. The optical fiber-based probe will be used to map the near-fields produced by an atom chip for ultra-cold atoms (10 nK – 100 μ K).

Atom chips, have been used extensively for trapping atoms with static magnetic fields generated from DC currents, but the use of microwave near-fields for trapping has only begun to be explored. Importantly, microwave fields offer the possibility of producing spin-dependent potentials for coherent manipulation of quantum gases such as Bose-Einstein condensates. This capability is important for quantum information processing and matter-wave interferometry.

The VMEC candidate should have some knowledge of RF and microwave engineering, EM simulation, fiber optics, and lasers, and an interest in quantum physics.

Seth A. M. Aubin, Assoc. Prof.
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Virginia Commonwealth University

Wright-Virginia Microelectronics Center at VCU

Virginia Commonwealth University (Richmond, VA) hosts 8000 ft² of state-of-the-art, class-100 cleanroom laboratories in its Wright-Virginia Microelectronics Center. The VCU VMEC Internship offers the unique opportunity to work independently in this high-tech facility and really “do it yourself”. You will have the opportunity to work hands-on, from initial concept to final testing and obtain a complete microfabrication experience, including:

- (1) CAD layout and design of a microelectronic device,
- (2) Photomask fabrication using our own custom maskmaking facilities,
- (3) Device fabrication in the W-VMC clean room and
- (4) Device testing in our characterization lab.

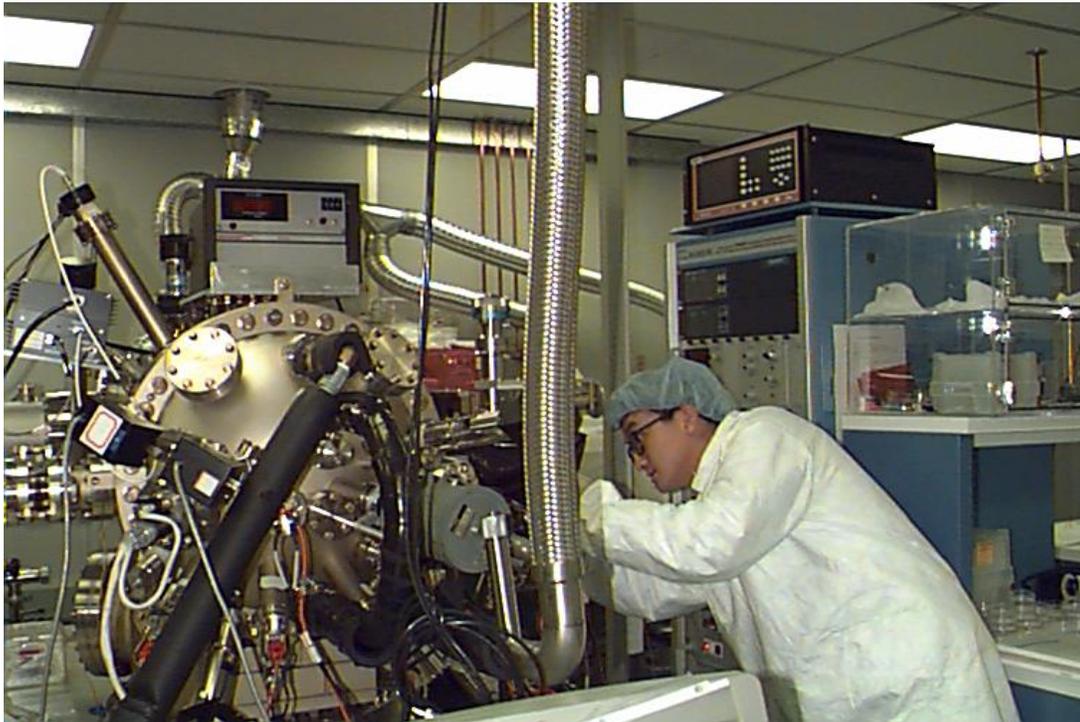
Training will also include standard clean room protocol and safety training. The technology for this fabrication project will vary, and in the past has included MOSFETS, Polymer Based Micromachines, surface acoustic wave (SAW) devices and solar cells.



University of Virginia

University of Virginia Microelectronics Laboratory

The UVML has recently obtained a number of new state of the art tools. Summer research projects cover wide-ranging microelectronics fields. We have research in superconducting devices, micro-electro-mechanical (MEMS) systems, RF electronics, nanoelectronic devices, photonic devices, laser processing, molecular electronics, photovoltaics, and many others. Students will work with faculty and graduate students on significant research programs.



Old Dominion University

Applied Research Center at Thomas Jefferson National Accelerator Facility Newport News, VA

**Project Title: "Physical Characterization and Electrical Measurements of high-k
Dielectric Films deposited by Atomic Layer Deposition (ALD) "**

This research project involves the growth of high-k dielectric films by Atomic Layer Deposition (ALD) for advanced gate stack engineering. Examples of the ALD films which will be studied are HfO₂, Al₃O₂, ZrO₂, TiO₂ and includes semiconducting ZnO films. These novel electronic materials will replace the conventional SiO₂ gate dielectric of MOS Field Effect Transistors in the future beyond the 45 nm technology node. These high-k dielectric films will be grown with suitable chemical precursors and need to be post deposition annealed by Rapid Thermal Annealing (RTA). The physical characterization will be performed with spectroscopic ellipsometry, Atomic Force Microscopy (AFM), optical microscopy and scanning and transmission electron microscopy (SEM & TEM). X-ray Diffraction (XRD), SIMS etc. The electrical measurements will include I-V and C-V measurements of MOS Capacitors. The overall project also includes photo lithography of suitable capacitor structures, ALD film deposition technique, and various post-deposition RTA annealing cycles. For the film deposition by ALD, surface treatment such as nitridation can also be introduced. Our ALD projects include work with porous alumina membranes, which are coated or filled with ALD ZnO to fabricate novel ZnO nano-tubes or nano-rods for sensor and detector applications. This VMEC summer project will provide a unique opportunity for undergraduate students to receive hands-on laboratory training in state-of-the-art thin film Atomic Layer Deposition (ALD) technology, which will play a crucial role for the deep nano-technology node of future CMOS device generations.

**Advisor: Dr. Helmut Baumgart, VMEC Professor, Department of Electrical and
Computer Engineering ,Old Dominion University**

2017 VMEC SUMMER SCHOLAR

Virginia Tech

1. Fabrication and evaluation of Si and Ge Nanomembranes, Nanoribbons and Nanowires.

A process flow has been developed at Virginia Tech to manufacture nanomembrane, nanoribbon and nanowire structures using SOI-type wafers and standard CMOS manufacturing techniques. The goal of the project is to investigate the properties of lower dimensional systems in terms of resistivity, carrier mobility, diffusion and interface effects. The project requires participation in CMOS process technology such as lithography, layer deposition by Chemical Vapor Deposition (CVD), Reactive Ion Etching (RIE), wet etching, metallization. The student will also participate in characterization of the structures in terms of mobility chemical composition (SIMS), resistance, carrier density, and temperature effects.

2. Metal Ion Transport in Solid Electrolytes and the Formation of Nanowire Bridge Switches

We are investigating the formation of nano-metal bridge formation in electrolytes between two metallic electrodes. The formation of the metal nanofilament is being used as a basic mechanism for a new type of non-volatile memory, called resistive RAM or RRAM. The student will be involved in manufacturing of such structures using Physical Vapor Deposition (PVD) and Atomic Layer Deposition (ALD). He or she will be using lithography to define the basic cross-bar structure. The student will participate in the evaluation of the memory function of such a device. Some prior experience with clean room technology is desired but not necessary.

The project - a collaboration between Virginia Tech (VTech), National Institute of Standards (NIST), and Old Dominion University - aims to elucidate the atomistic mechanisms of the metal ion migration and filament formation and its disconnection. It is the objective of the present study to ascertain the responsible mechanisms for: i) injection of Cu ions from electrode into the electrolytes, ii) drift-diffusion-reaction mechanisms for Cu ions transport, trapping, clustering, and agglomeration, iii) the dependence of the transport mechanisms on temperature, stress, and the strength of the atomic bonds, iv) statistical distributions for filament formation and its dismantlement. v) The factors that control the quality of the filament.

Contact:

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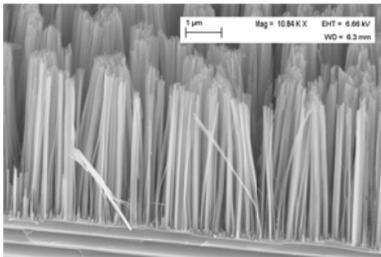
2017 VMEC SUMMER SCHOLAR

Norfolk State University

1. Fabrication of Silicon Nanowire Arrays for Reducing Surface Reflection

Silicon nanowire (SiNW) arrays are useful to reduce surface reflection of silicon substrates significantly below its 35% reflectivity. The reduction in reflectivity should lead to enhanced performance of silicon detectors, solar cells and other optoelectronic devices. This project will investigate the antireflection properties of SiNW and any resultant enhancement in quantum efficiency of such devices.

The student will fabricate SiNW using Ag assisted catalytic etching method that is simple and does not require expensive equipment to fabricate large area samples. A high degree of control on the diameter, length, and density of SiNW can be achieved using the AgNO₃/HF solution that provides the Ag nanoparticles for catalytic etching. The VMEC summer project will focus on the following topics:

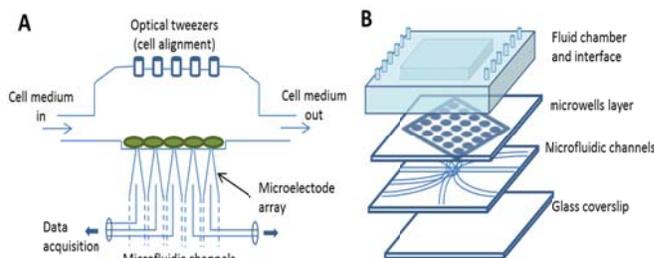


1. Metal assisted etching of Si surface to produce SiNW.
2. Surface reflectivity of the nanostructured silicon surface.
3. Effect of low reflectivity of nanostructured silicon surface of a Si p-n junction.

NSU has excellent cleanroom facilities to conduct the chemical fabrication. The surface structures will be studied using high resolution scanning electron microscopes and atomic force microscopes. Reflectivity will be measured using integrating sphere and spectrometer. Si p-n junctions will be fabricated using diffusion and/or ion implantation and annealing. Quantum efficiency will be measured using our solar cell research facility.

2. Design and Fabrication of optofluidic chip for biological electrophysiology measurements

Excitable biological cells exhibit mechano-electric sensitivity by which their electrical behavior is modulated by mechanical stimuli or stretch. Specialized stretch-activated ion channels in cells are thought to be responsible for this mechano-electric modulation. The goal of this project is to design a microfluidic-based platform to record electrophysiological currents from biological cells in their stretched conditions. A microfluidic chamber consisting of an array of micro-wells will be designed as depicted in the schematic below. Each microwell will be equipped with a microelectrode recording assembly underneath the substrate. The cells will be trapped and guided to the microwells using computer-controlled optical tweezers. A novel optical non-contact cell stretching method using counter-propagating laser beams, carried to the microwells via optical waveguides, will be designed to produce a controlled stretch in the trapped cells. The proposed optofluidic chip will be used to systematically characterize the stretch-activated ion channels in biological cells. The proposed research has potential to provide mechanistic breakthroughs in our understanding of several chronic diseases such as heart failure and hypertension.



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student will work in a team with other graduate students and faculty involved in the project. The student will get an opportunity to use the modern cleanroom facility in the Department of Engineering, and learn experimental techniques and algorithm development in Matlab and C++.



Contact: Dr. Sacharia Albin, Professor & Chair, Department of Engineering, Norfolk State University, Email: salbin@nsu.edu , Web: <http://www.nsu.edu/cset/engineering/>