

2026

HBCU CHIPS Network Conference

Book of Abstracts

April 1--2, 2026
Atlanta, Georgia

Edited by

Dr. George White, Georgia Institute of Technology
Dr. Mohammadreza Hadizadeh, Central State University
Dr. Daniel Vrinceanu, Texas Southern University



<https://hbcuchips-events.org/e/ChipsConference2026>

Welcome message from the conference chair

Welcome distinguished guests, leaders from academia, government, and industry, and members of the HBCU community.

It is our honor to welcome you to the HBCU CHIPS Network Annual Conference—a gathering that represents not only our collective expertise and vision, but a shared commitment to ensuring America's future in semiconductor innovation, workforce development, and technological leadership.

The passage of the CHIPS and Science Act of 2022 created an unprecedented opportunity for the United States to strengthen its semiconductor capabilities and build a more competitive, secure, and innovative national ecosystem. At the same time, it presents a once-in-a-generation moment for Historically Black Colleges and Universities to assert its role as indispensable partners in cultivating the diverse and skilled workforce this nation needs.

The HBCU CHIPS Network was founded on the belief that when HBCUs collaborate—leveraging its collective strengths, facilities, faculty talent, and student brilliance—it can reshape the semiconductor landscape and expand access to advanced research, training, and economic opportunity. Today, with member institutions across more than a dozen states, growing federal and corporate engagement, and active involvement in national R&D and workforce initiatives, the Network stands stronger than ever.

This conference is more than an annual convening. It is a declaration of what is possible when HBCUs unify with purpose!!

Over the next two days, we will:

- highlight the capabilities and achievements of our institutions,
- advance strategies for workforce development and research excellence,
- strengthen partnerships with government and industry, and
- chart a collaborative path forward for semiconductor and microelectronics-related innovation.

Our mission is clear: to cultivate a diverse and highly skilled semiconductor workforce and to ensure HBCUs have the infrastructure, support, and opportunity needed to lead in America's semiconductor renaissance.

We want to thank each of you for your presence, your partnership, and your belief in what this Network can achieve. Your engagement is essential—not only for the success of our institutions, but for the success of our nation.

Together, we will build capacity.

Together, we will expand opportunity.

Together, we will help shape the future of American innovation.

*Dr. Frances Williams
Dr. George White
March 2026*

Contents

Welcome message from the conference chair	1
Organizing Committee	5
Sponsors and Partners	6
Conference information	7
Welcome to the 2026 HBCU CHIPS Network Conference	7
Conference Theme and Technical Areas	7
Registration and Participation Information	7
Presentation Guidelines	7
Important Dates	7
Conference App: Whova	8
Conference Venue and Visitor Guide	8
2026 Student Achievement in Microelectronics Awards	10
Conference Program	11
Oral Presentation Abstracts	18
Implementation of Finite state logic machines via the dynamics of atomic systems	18
Lite VLA: Efficient Vision-Language-Action Control on CPU-Bound Edge Robots	18
Optics-Electronic Devices: Turn Light into Electricity Turn Electricity Into Light	19
Optimization of Titanium Nitride as a Material for Superconducting Josephson Junctions in Quantum Computing Applications	19
Design, Fabrication, and Characterization of Thermoelectric Devices from Multilayer Thin Films	20
Luminescence from Nanoscale Perovskite Semiconductor Materials	20
Fabrication and Characterization of the Thin Film Solid State Li-Ion Batteries	21
A Method for Calculating PIN Alpha-voltaic Cell Operational Life from Modelling and Simula- tion Data.	21
Urea-based GQDs with PVA Integration	22
Assessment of optoelectronic properties of an ambipolar polymer - photochromic dye blend in the solid state for organic photoresponsive device applications.	23
Building Quantum Information Science Capabilities at HBCUs: Insights and Recommendations	23
IR Photodetector based on the contactless-PdSe ₂ integration with Few-Layered MoSe ₂ Field- effect Transistor	24
Investigation of Surface Acoustic Wave Dynamics at Cryogenic Temperatures for Quantum Device Applications	24
A Lab-to-Go Approach for AI and Semiconductor Education	25
Bridging the Talent Gap: A New Approach to Accelerating Workforce Solutions for Semicon- ductors	25
Collaborative Research: Advancing Semiconductor Education through Expansion and Diver- sification (ASEED)	26
Diamond Quantum Vector Magnetometer Optimization with Machine Learning Models	27
Using Q-Switched Lasers for Multi-Beam Multi-Target Pulsed Laser Deposition of Photonic High-Entropy Alloy Films	27
On the Feasibility of Solving the Time Independent Schrödinger Equation using Neural Net- work and Block Form with Rayleigh Quotient Loss Function	28
Dielectric Properties of Conducting Boron-Doped Diamond	28
Growth of Cubic Boron Nitride by Electron Cyclotron Resonance Chemical Vapor Deposition on Boron Doped Diamond Substrates	29

Maximizing HBCU University Websites to Highlight Contributions to AI-Enabled Semiconductors: Research, Workforce Development, Academic Programs, and Institutional Initiatives	29
Development of a Multiuser Collaborative Virtual Training Environment for Photolithography Cleanroom Processes	30
Van der Waals Integration of Semi-Metallic PdSe ₂ Contacts for High-Performance n-type WS ₂ Field Effect Transistors	31
Adaptive Self-Healing Neuromorphic-Inspired VLSI Architecture for UltraLow Power Edge AI Interface-Engineered van der Waals Heterostructures for Next-Generation Microelectronic Contacts	31
Titanium Oxynitride Thin Film and Nanowires for Ultrahigh Capacitance Supercapacitors	32
Engineering Semiconductor Thin Films with ALD and Integrated Metrology	33
SLA-Printed Architected Polymer Thermal Interface Materials with BN/Microfiber Fillers for High-Power Semiconductor Cooling	33
Multi-layered Porous PVDF 2D Heterostructure Nanofillers as High-Density Capacitive Energy Storage	34
Experimental Evaluation of BNNT-based Thin Films for Mitigating Single Event Effects in SRAM via Proton Beams	34
Materials development and biophotonic sensor fabrication employing lead-free halide perovskites	35
Growth of Scandium Diboride Semimetallic Single Crystals by Laser Floating Zone Method	35
Modeling the Effects of Surface Potential on Gallium Nitride Betavoltaic Cell Collection Efficiency	36
Abstract: Broadband Surface Acoustic Wave Generation via Chirped IDTs for Programmable Spin Control	37
Poster Presentation Abstracts	39
Side-channel Analysis for Hardware Trojan Detection	39
Scalable Growth of 2D VS ₂ : Impact of Process Conditions on Crystallinity and Layer Quality	39
Emergent ferromagnetic correlations and spin textures in the chiral magnet BaFeGaO ₄	40
Microfluidic device for label-free cell deformation analysis	40
Green Synthesis of Pectin-Stabilized ZnO Nanocomposites for Photocatalysis	41
Enhanced electrocatalytic and supercapacitance performances of transition metal oxynitride thin films	41
Jumpshot	42
Intrinsic Ferroelectric Switching in 2D CuInP ₂ S ₆	42
Experimental Investigation of 3D-Printed Polymer Lattice Composite Thermal Interface Materials for Semiconductor Packages	43
Finite Element Analysis of 3D-Printed Polymer Lattice Thermal Interface Materials: Effects of Lattice Configuration and Open/Closed-Cell Topology	44
Computer Organization Teaching Materials Development	44
Deterministic Integration of MoS ₂ -Graphene Heterostructures for Future Chip-Scale 2D Electronics	45
Structural, Optical, and Electrical Analysis of Sputtered Titanium Nitride Thin Films	46
From GaN to Sapphire: How Substrate Influences MoSe ₂ /MoS ₂ Heterostructure Properties	46
Fabrication and Characterization of Surface Acoustic Wave (SAW) Devices	47
A Novel Method for Rapid Fabrication of Boron-Doped Luminescent Porous Silicon	47
Microscopic Origin of Polarization Switching in Zr-Doped HfO ₂ : Real-Space Charge Redistribution and Berry-Phase Branch Analysis	48
Strengthening Education to Workforce Pipelines at HBCUs: Impacts on Career Readiness and Workforce Equity	48
Structural, magnetic, and thermodynamic properties of Nd ₂ MoO ₆	49
Fabrication and Characterization of Lanthanide-Doped Oxide Materials for Sensing Applications	50
Design, Simulation, and Measurement of CMOS-Based Ring Oscillator and Operational Amplifier Integrated Circuits	50
BipBip: A Lightweight Crypto Algorithm for Open Source Processors and AI Accelerators	51
Raman characterization of MBE grown mixed As-Sb alloy nanowires	51
Structural and Optical Characterization of 2D Semiconductors Toward Defect-Based Quantum Sensing with Plasmonic Enhancement	52

Optical Characterization of Defects in 4H-SiC for Room Temperature Quantum Sensing . . .	53
Development of TaC substrates for AlGaN power electronics	53
In-Depth Analysis of How Various Parameters of Immersive VR-Based Training Influence Performance	54
A General and Modular Approach to Solid-State Integration of Zero-Dimensional Quantum Systems	54
Real-Time Lightweight Object Detection Pipelines on PYNQ FPGA for Edge Vision Deployment	55
FPGA Acceleration on PYNQ-Zynq for Efficient Edge AI Workloads	56
About HBCU CHIPS Network	57
Call for Papers: <i>Scientific Reports</i> Special Issue on Organic Semiconductor	59
Acknowledgment	60

Organizing Committee

The success of this conference is made possible through the dedication, leadership, and service of the Organizing Committee, whose members are distinguished representatives of the HBCU CHIPS Network. Their collective expertise, commitment, and vision have been instrumental in shaping a meaningful and engaging conference experience. Through their efforts in planning the program, coordinating activities, and supporting participants, they have helped ensure the success of this event.

We gratefully acknowledge the contributions of the following members:

- **Dr. George White**, SR Director Strategic Partnerships (Georgia Institute of Technology) [*Conference Chair*]
- **Dr. Shyam Aravamudhan**, Professor of Nanoengineering (North Carolina A&T State University)
- **Dr. Mohammadreza Hadizadeh**, Professor of Physics (Central State University)
- **Dr. Taiesha Smith**, Sr. Program Manager (Georgia Institute of Technology)
- **Dr. Dinadayalane Tandabany**, Professor of Chemistry (Clark Atlanta University)
- **Dr. Daniel Vrinceanu**, Professor of Physics (Texas Southern University)
- **Dr. Frances Williams**, VP for Research and Sponsored Programs (Clark Atlanta University)

Sponsors and Partners

Platinum Sponsor

- National Science Foundation (NSF)

Gold Sponsor

- Micron

Silver Sponsor

- ASML
- Synopsys
- Teradyne

Bronze Sponsor

- GlobalFoundries

Network Collaborator

- Sandia National Laboratories

HBCU Network Member Academic Sponsors

- Central State University
- Clark Atlanta University
- Georgia Institute of Technology
- Morgan State University
- North Carolina Agricultural and Technical State University
- Texas Southern University



Conference information

Welcome to the 2026 HBCU CHIPS Network Conference

The 2026 HBCU CHIPS Network Conference will be held on April 1–2, 2026, at the Renaissance Atlanta Midtown Hotel in Atlanta, Georgia. The conference brings together students, faculty, researchers, industry professionals, and federal partners to advance innovation and workforce development across the U.S. semiconductor ecosystem. Launched in 2025, the conference is now entering its second year, following the inaugural meeting hosted at Howard University on April 3–4, 2025. Hosted by the HBCU CHIPS Network—a coalition of more than 30 Historically Black Colleges and Universities committed to cultivating a diverse and highly skilled workforce for the U.S. semiconductor industry—the conference serves as a national platform for collaboration, discovery, and community-building in semiconductors and microelectronics. The conference is designed to showcase cutting-edge research and foster meaningful engagement across academia, industry, and government. Through panel discussions, technical sessions, poster presentations, and networking opportunities, participants will explore emerging advances in microelectronics and semiconductors while strengthening national capacity and expanding diversity within the workforce. This year's conference will also feature the first College Career Fair, offering students an opportunity to connect directly with major leaders in the semiconductor and microelectronics industries and to learn more about internships, careers, and workforce pathways in the field.

Conference Theme and Technical Areas

The theme of the 2026 HBCU CHIPS Network Conference is *Championing New Approaches to Reestablishing U.S. Dominance in Semiconductors & Microelectronics*. The conference will focus on four technical areas:

- Materials & Devices
- Advanced Packaging
- Education & Workforce Development
- AI in Semiconductors

Registration and Participation Information

All conference registrations and payments will be processed through the GT Marketplace portal, also known as the Georgia Tech Shopping Mall. Students are strongly encouraged to participate in the College Career Fair on March 31, 2026. Please note that attendance at the Career Fair requires separate registration using the designated registration link.

Presentation Guidelines

Oral Presentations: Each oral presentation is allotted 15 minutes for the talk, followed by 5 minutes for questions and discussion. Presenters are kindly asked to adhere closely to the allotted time in order to maintain the conference schedule.

Poster Presentations: Poster presenters should prepare posters with dimensions of 48 inches (width) × 36 inches (height).

Important Dates

- **Call for Abstracts Opens:** November 5, 2025
- **Abstract Submission Deadline:** Extended to February 6, 2026 (formerly January 26, 2026)
- **Student Achievement in Microelectronics Award Application Deadline:** February 13, 2026
- **Notification of Acceptance:** February 20, 2026
- **Special Hotel Rate Reservation Cutoff Date:** March 11, 2026

- **Conference Registration Deadline:** March 20, 2026
- **Career Fair Registration Deadline:** March 27, 2026
- **Career Fair:** March 31, 2026
- **Conference Dates:** April 1–2, 2026

Conference App: Whova

To help you make the most of your experience, this conference will use **Whova**, our official event app. Through Whova, you will be able to access the conference program, browse the list of speakers, view sponsors, receive announcements, connect with other attendees, and share photos and updates during the event.

How to Download Whova

Whova is available on most major devices:

- **iPhone/iPad (iOS):** Download the **Whova** app from the **Apple App Store**
- **Android phones/tablets:** Download the **Whova** app from the **Google Play Store**
- **Laptop/Desktop:** You may also access Whova through your web browser

After downloading the app, create your account and log in using the email address you used to register for the conference. Once logged in, search for **HBCU CHIPS Network Conference**. You may also find the event by searching simply for **HBCU**.

Set Up Your Profile

After joining the event, please take a moment to update your profile. Adding your name, institution, photo, title, and a short bio will make it easier for fellow attendees, speakers, and organizers to connect with you throughout the conference.

What You Can Do in Whova

Using Whova, you can:

- Explore the **conference program** and session schedule
- View the **list of speakers**
- Learn more about **sponsors**
- Access conference updates and announcements
- Share and browse **photos**
- Network with other attendees

We strongly encourage all participants to download Whova before arriving so you can stay informed and fully engaged during the conference.

Conference Venue and Visitor Guide

The HBCU CHIPS Network is proud to host the 2026 Annual Conference in the dynamic and diverse city of Atlanta, Georgia—a national center for higher education, technology, entrepreneurship, and culture. All conference sessions, networking events, and poster presentations will be held at the Renaissance Atlanta Midtown Hotel on April 1–2, 2026. Located in Midtown, the Renaissance Atlanta Midtown Hotel offers modern meeting facilities in one of the city's most vibrant and innovative districts. Surrounded by major research institutions, dining, arts venues, and entertainment, the hotel provides an inspiring setting for collaboration, networking, and discovery.

Hotel Information and Amenities

Renaissance Atlanta Midtown Hotel

866 W Peachtree St NW, Atlanta, GA 30308

Phone: (678) 412-2400

Google Maps Link: <https://maps.app.goo.gl/ZRRUEMX5JLkK4nSK7>

A limited block of rooms is available at the Renaissance Atlanta Midtown Hotel at a special conference rate for HBCU CHIPS Network attendees. Please reserve your room by March 11, 2026, through the Hotel Booking with Special Rate link to secure the guaranteed conference rate. Parking at the Renaissance will be available to conference attendees at a discounted rate of \$42 per night, per vehicle. The Renaissance Atlanta Midtown Hotel features:

- Spacious meeting rooms with natural light
- On-site restaurants and lounges
- Rooftop terrace with skyline views
- Complimentary WiFi in meeting areas
- Convenient access to MARTA public transportation

Additional Accommodation Options

Additional nearby accommodations include:

- Hilton Garden Inn Atlanta Midtown — 0.3 miles
- Hyatt Centric Midtown Atlanta — 0.4 miles
- Moxy Atlanta Midtown — 0.5 miles

Early booking is strongly encouraged, as Atlanta's spring season is especially busy with major citywide events.

Travel Information

By Air: Hartsfield–Jackson Atlanta International Airport (ATL) is located approximately 12 miles south of Midtown Atlanta and is about 25 minutes away by car or rideshare, depending on traffic. Direct MARTA service is available from the airport to Midtown Station via the Red or Gold Line. The hotel is approximately a five-minute walk from Midtown Station.

By Train: MARTA (Metropolitan Atlanta Rapid Transit Authority) provides convenient access to Midtown:

- Take the Red or Gold Line toward North Springs or Doraville
- Exit at Midtown Station
- Use the Peachtree Place exit

Dining and Local Attractions

Local Dining: Guests will find a variety of dining options just steps from the Renaissance Atlanta Midtown Hotel:

- South City Kitchen Midtown — Southern-inspired fine dining
- Ecco Midtown — Mediterranean cuisine and wine bar
- The Consulate — Global menu with a creative twist
- Cafe Intermezzo — Coffee, desserts, and European-style ambiance

Nearby Attractions: Atlanta offers a number of attractions within easy reach of the conference venue:

- High Museum of Art — Renowned collections and architecture (0.6 mi)
- Piedmont Park — Ideal for morning walks or evening relaxation (1.0 mi)
- Fox Theatre — Historic venue for Broadway shows and performances (0.4 mi)
- Atlanta BeltLine Eastside Trail — Urban walking and biking trail (1.5 mi)
- Georgia Institute of Technology — Neighboring campus and innovation hub (approximately a five-minute walk)

2026 Student Achievement in Microelectronics Awards

The 2026 HBCU CHIPS Network Conference is pleased to recognize the recipients of the *2026 Student Achievement in Microelectronics Awards*, which honor outstanding student achievement and promise in the field of microelectronics.



Mustafa Ali
Prairie View A&M University
Undergraduate Award Winner



Roshan Pradhan
Jackson State University
Graduate Award Winner

Mustafa Ali is a junior Electrical Engineering student at Prairie View A&M University with a 3.91 GPA and a recipient of the 2026 Student Achievement in Microelectronics Award at the HBCU CHIPS Network Conference. His work focuses on semiconductor materials and device fabrication, with hands-on experience in nanoscale materials, wafer preparation, and characterization. He serves as a teaching assistant for the senior-level Microelectronic Processing and Characterization Lab. He is interested in semiconductor reliability, process development, and advanced chip technologies, and he plans to pursue a master's degree and a career in the semiconductor industry.

Roshan Padhan is a Ph.D. candidate in Electrical Engineering at Jackson State University, USA, working at the intersection of condensed matter physics and nanoelectronics. His research focuses on two-dimensional (2D) materials and their heterostructures for next-generation electronic and optoelectronic systems. His work investigates charge transport, interfacial phenomena, ferroelectric switching, and photoresponse in 2D heterostructures, with an emphasis on developing high-performance photodetectors, non-volatile memory, and brain-inspired computing devices. He has extensive experience in device fabrication, cryogenic transport measurements, and advanced electrical characterization. His experimental work includes the use of state-of-the-art cleanroom and measurement facilities at Argonne National Laboratory and the cryo-magnetic facility at National High Magnetic Field Laboratory. Roshan has authored multiple peer-reviewed publications in leading journals and actively collaborates with national laboratories in the USA. His long-term research vision is to engineer scalable 2D material platforms that integrate sensing, memory, and computing functionalities, enabling energy-efficient technologies for artificial intelligence, advanced imaging, and quantum electronic systems.

Both awardees will be recognized during the 2026 HBCU CHIPS Network Conference Awards Ceremony.

Conference Program

Wednesday, April 1, 2026

8:00 AM -- 9:00 AM

Registration + Breakfast

Location: Centennial Ball Room

9:00 AM -- 9:15 AM

Plenary Session: Welcome

Location: Centennial Ball Room

Convener: George White

Session Title: Welcome and Provosts Remarks

Speakers:

- Charlene Gilbert (Provost and Senior Vice President for Academic Affairs, Clark Atlanta University)
- Raheem Beyah (Provost, Georgia Institute of Technology)

9:15 AM -- 10:05 AM

Plenary Session: Keynote

Location: Centennial Ball Room

Convener: Frances Williams

Session Title: Keynote Address + Micron Leadership Panel

Speaker:

- Fran Dillard (Vice President Global Culture & Workforce at Micron Technology)

10:05 AM -- 10:30 AM

Coffee Break + Networking

Location: Hallway

10:30 AM -- 11:20 AM

Plenary Session: Panel Discussion

Location: Centennial Ball Room

Convener: Patricia Mead (Department Chair at Norfolk State University)

Session Title: Microelectronics Industry Panel

Speakers:

- Armond Duncan (Sr. Program Manager at Micron Technology)
- Danielle Ferguson-Macklin (Talent Communities Program Manager at Teradyne)
- Robert Hoogland (Department Manager Embedded Software at ASML)
- Tara McCaughey (Strategic University Partnership Manager at GlobalFoundries)

11:20 AM -- 11:30 AM

Transition

Location: Hallways

11:30 AM -- 12:20 PM

Plenary Session: Panel Discussion

Location: Centennial Ball Room

Convener: Shyam Aravamudhan (North Carolina A&T State University)

Session Title: Government Funding Opportunities

Speakers:

- Debbie Black-Conn (Microelectronics Commons WFD Lead, DEVCOM Army Research Laboratory)
- James Moore III (Assistant Director, Directorate for STEM Education at National Science Foundation)

- LaShauna Evans (Program Manager National Science Portal at Air Force Office of Science and Research)
- Michelle Williams-Vaden (Executive Director at SEMI Foundation)
- Wayne Churaman (Technical Execution Area Lead, DEVCOM Army Research Laboratory)

12:20 PM -- 1:10 PM

Lunch + Microelectronics Award

Location: Centennial Ball Room**Technical Session 1**

1:10 PM -- 2:30 PM

Room A: Materials & Devices

Location: Chastain A**Convener:** Eric Mintz

- **1:10 PM** *Optics-Electronic Devices: Turn Light into Electricity Turn Electricity Into Light*
Speaker: Qinglong Jiang (Clark Atlanta University)
- **1:30 PM** *Assessment of optoelectronic properties of an ambipolar polymer – photochromic dye blend in the solid state for organic photoresponsive device applications*
Speaker: Ikem Uba (University of Arkansas at Pine Bluff)
- **1:50 PM** *IR Photodetector based on the contactless-PdSe₂ integration with Few-Layered MoSe₂ Field-effect Transistor*
Speaker: Roshan Padhan (Hampton University)
- **2:10 PM** *A Method for Calculating PIN Alpha-voltaic Cell Operational Life from Modelling and Simulation Data*
Speaker: Kishak Cinfwat (Jackson State University)

1:10 PM -- 2:30 PM

Room B: Quantum Technologies

Location: Chastain B**Convener:** Courtney Quarterman

- **1:10 PM** *Building Quantum Information Science Capabilities at HBCUs: Insights and Recommendations*
Speaker: Thomas Searles (University of Illinois at Chicago)
- **1:30 PM** *Implementation of Finite state logic machines via the dynamics of atomic systems*
Speaker: Dawit Hailu (University of Illinois at Chicago)
- **1:50 PM** *Optimization of Titanium Nitride as a Material for Superconducting Josephson Junctions in Quantum Computing Applications*
Speakers:
 - Ebenezer Vondee (Bowie State University)
 - Kiran Nyaupane (North Carolina A&T State University / North Carolina Agricultural and Technical State University)
- **2:10 PM** *Investigation of Surface Acoustic Wave Dynamics at Cryogenic Temperatures for Quantum Device Applications*
Speaker: Felix Kimeu (Norfolk State University)

1:10 PM -- 2:30 PM

Room C: Materials & Devices (Undergraduate Session)

Location: Rialto A**Convener:** Daniel Vrinceanu (Texas Southern University)

- **1:10 PM** *Urea-based GQDs with PVA Integration*
Speaker: Aldine Willacey (University of Arkansas at Pine Bluff)
- **1:30 PM** *Luminescence from Nanoscale Perovskite Semiconductor Materials*
Speaker: Thomas Murray (Fayetteville State University)

- **1:50 PM** *Fabrication and Characterization of the Thin Film Solid State Li-Ion Batteries*
Speaker: Jamar Dozier (Alabama A&M University)
- **2:10 PM** *Design, Fabrication, and Characterization of Thermoelectric Devices from Multilayer Thin Films*
Speaker: Cole Cooper (Alabama A&M University)

2:30 PM -- 2:45 PM

Break + Transition

Location: Centennial Ball Room

Technical Session 2

2:45 PM -- 4:05 PM

Room A: Materials & Devices

Location: Chastain A

Convener: Durga R. GaJula (Georgia Institute of Technology)

- **2:45 PM** *Using Q-Switched Lasers for Multi-Beam Multi-Target Pulsed Laser Deposition of Photonic High-Entropy Alloy Films*
Speaker: David Rossmanith (Dillard University)
- **3:05 PM** *Van der Waals Integration of Semi-Metallic PdSe₂ Contacts for High-Performance n-type WS₂ Field Effect Transistors*
Speaker: Saurabh Dixit (Jackson State University)
- **3:25 PM** *Dielectric Properties of Conducting Boron-Doped Diamond*
Speaker: Daniel Harrison (Morgan State University)
- **3:45 PM** *Growth of Cubic Boron Nitride by Electron Cyclotron Resonance Chemical Vapor Deposition on Boron Doped Diamond Substrates*
Speaker: Sheikh Mahtab (Graduate research assistant)

2:45 PM -- 4:05 PM

Room B: AI in Semiconductors

Location: Chastain B

Convener: Asif I. Khan (Georgia Institute of Technology)

- **2:45 PM** *A Lab-to-Go Approach for AI and Semiconductor Education*
Speaker: Xuemin Chen (Texas Southern University)
- **3:05 PM** *Diamond Quantum Vector Magnetometer Optimization with Machine Learning Models*
Speaker: Hamdin Ozden (Morgan State University)
- **3:25 PM** *Adaptive Self-Healing Neuromorphic-Inspired VLSI Architecture for UltraLow Power Edge AI*
Speaker: Graham Thomas (Texas Southern University)
- **3:45 PM** *Maximizing HBCU University Websites to Highlight Contributions to AI-Enabled Semiconductors: Research, Workforce Development, Academic Programs, and Institutional Initiatives*
Speaker: Myah Webb (University of Arkansas at Pine Bluff)

2:45 PM -- 4:05 PM

Room C: Education and Workforce Development

Location: Rialto A

Convener: Shyam Aravamudhan (North Carolina A&T State University)

- **2:45 PM** *Bridging the Talent Gap: A New Approach to Accelerating Workforce Solutions for Semiconductors*
Speaker: Michelle Williams-Vaden (SEMI Foundation)
- **3:05 PM** *Collaborative Research: Advancing Semiconductor Education through Expansion and Diversification (ASEED)*
Speaker: Suxia Cui (Prairie View A&M University)
- **3:25 PM** *Development of a Multiuser Collaborative Virtual Training Environment for Photolithography Cleanroom Processes*
Speaker: Emmanuel Osei-Kwame (Norfolk State University)

- **3:45 PM** *On the Feasibility of Solving the Time Independent Schrödinger Equation using Neural Network and Block Form with Rayleigh Quotient Loss Function*
Speaker: T. L. Wallace (Meharry Medical College)

4:05 PM -- 5:00 PM

Poster Session

Location: Hallway

- *A General and Modular Approach to Solid-State Integration of Zero-Dimensional Quantum Systems*
Speaker: Ferdous Ara (Winston-Salem State University)
- *A Novel Method for Rapid Fabrication of Boron-Doped Luminescent Porous Silicon*
Speaker: Elijah Wesley (North Carolina A&T State University)
- *BipBip: A Lightweight Crypto Algorithm for Open Source Processors and AI Accelerators*
Speaker: Alexander Stoyanov-Roberts (Morgan State University CAP Center)
- *Computer Organization Teaching Materials Development*
Speaker: Shavaughn Dunson (Prairie View A&M University)
- *Design, Simulation, and Measurement of CMOS-Based Ring Oscillator and Operational Amplifier Integrated Circuits*
Speaker: Baraka Chimba (Alabama A&M University)
- *Deterministic Integration of MoS₂-Graphene Heterostructures for Future Chip-Scale 2D Electronics*
Speaker: Mustafa Ali (Prairie View A&M University)
- *Development of TaC substrates for AlGaN power electronics*
Speaker: Astrid Dzutcha Kengne (Center for Research and Education in Microelectronics, Department of Electrical and Computer Engineering, Morgan State University, Baltimore, MD 21251, United States)
- *Emergent ferromagnetic correlations and spin textures in the chiral magnet BaFeGaO₄*
Speaker: Orrin Delgado (Norfolk State University)
- *Enhanced electrocatalytic and supercapacitance performances of transition metal oxynitride thin films*
Speaker: Warren Glover II (North Carolina A&T State University)
- *Fabrication and Characterization of Lanthanide-Doped Oxide Materials for Sensing Applications*
Speaker: Tiffany Lukusa (Fayetteville State University)
- *Fabrication and Characterization of Surface Acoustic Wave (SAW) Devices*
Speaker: Quinten Jones (Norfolk State University)
- *Finite Element Analysis of 3D-Printed Polymer Lattice Thermal Interface Materials: Effects of Lattice Configuration and Open/Closed-Cell Topology*
Speaker: Davian Cartwright (Central State University)
- *Experimental Investigation of 3D-Printed Polymer Lattice Composite Thermal Interface Materials for Semiconductor Packages*
Speaker: Camron Nesbitt (Central State University)
- *From GaN to Sapphire: How Substrate Influences MoSe₂/MoS₂ Heterostructure Properties*
Speaker: M. K. Indika Senevirathna (Clark Atlanta University)
- *Green Synthesis of Pectin-Stabilized ZnO Nanocomposites for Photocatalysis*
Speaker: Godwill Tewan (Coppin State University)
- *In-Depth Analysis of How Various Parameters of Immersive VR-Based Training Influence Performance*
Speaker: Sandra Eddie (Norfolk State University)
- *Intrinsic Ferroelectric Switching in 2D CuInP₂S₆*
Speaker: Dion Brumfield (Jackson State University)

- *Jumpshot*
Speaker: Shavaughn Dunson (Prairie View A&M University)
- *Microfluidic device for label-free cell deformation analysis*
Speaker: Ayodeji aderin (Norfolk State University)
- *Microscopic Origin of Polarization Switching in Zr-Doped HfO₂: Real-Space Charge Redistribution and Berry-Phase Branch Analysis*
Speaker: Malachi Moody (Delaware State State University)
- *Optical Characterization of Defects in 4H-SiC for Room Temperature Quantum Sensing*
Speaker: Sheikh Mahtab (Morgan State University)
- *Raman characterization of MBE grown mixed As-Sb alloy nanowires*
Speaker: Joshua White (North Carolina A&T State University)
- *Scalable Growth of 2D VS₂: Impact of Process Conditions on Crystallinity and Layer Quality*
Speaker: Amari Gayle (Clark Atlanta University)
- *Side-channel Analysis for Hardware Trojan Detection*
Speaker: Iain White (Prairie View A&M University)
- *Strengthening Education to Workforce Pipelines at HBCUs: Impacts on Career Readiness and Workforce Equity*
Speaker: Abel Phiri (Student)
- *Structural and Optical Characterization of 2D Semiconductors Toward Defect-Based Quantum Sensing with Plasmonic Enhancement*
Speaker: Tanmay Talukder (Morgan State University)
- *Structural, magnetic, and thermodynamic properties of Nd₂MoO₆*
Speaker: Foster Kwabena Ontumi (Norfolk State University)
- *Structural, Optical, and Electrical Analysis of Sputtered Titanium Nitride Thin Films*
Speaker: Brianna Barbee (North Carolina A&T State University)
- *Real-Time Lightweight Object Detection Pipelines on PYNQ FPGA for Edge Vision Deployment*
Speaker: Enrique Mateo (Prairie View A&M University)
- *FPGA Acceleration on PYNQ-Zynq for Efficient Edge AI Workloads*
Speaker: Donovan Jones (Prairie View A&M University)

5:00 PM -- 7:00 PM

Location: Centennial Ball Room

Reception

Thursday, April 2, 2026

8:30 AM -- 9:00 AM

Registration + Breakfast

Location: Centennial Ball Room

9:00 AM -- 9:30 AM

Plenary Session: State of the HBCU CHIPS Network

Location: Centennial Ball Room**Convener:** George White (Georgia Institute of Technology)

- **9:00 AM** *Conference Technical Committee Co-chairs*
Speakers:
 - Daniel Vranceanu (Texas Southern University)
 - Mohammadreza Hadizadeh (Central State University)
- **9:10 AM** *HBCU CHIPS Network Initiating Committee*

9:30 AM -- 10:20 AM

Plenary Session: Fireside Chat

Location: Centennial Ball Room**Convener:** Erin Lynch (President of Quality Education for Minorities (QEM) Network)**Session Title:** Fireside Chat with CEO**Speaker:**

- Greg Smith (CEO of Teradyne)

10:20 AM -- 10:35 AM

Coffee Break

Location: Centennial Ball Room

10:35 AM -- 11:25 AM

Plenary Session: Panel Discussion

Location: Centennial Ball Room**Convener:** Kevin Kornegay (Morgan State University)**Session Title:** Role of AI in Semiconductors and Microelectronics Panel**Speakers:**

- Dinadayalane Tandabany (Clark Atlanta University)
- Jeremy Muldavin (Director Development A&D, Cadence)
- Konstantin Cvetanov (Global AI Factory Tech Lead at Nvidia)
- Li Song (Memory CAD Engineering & AI/ML at Micron Technology)
- Ron Duncan (Head of Corporate Innovation Programs at Synopsys)
- Tazrien Kamal (Sr. Director Design Enablement at GlobalFoundries)

11:25 AM -- 12:20 PM

Lunch Day 2

Location: Centennial Ball Room**Technical Session 3**

12:25 PM -- 1:45 PM

Room A: Materials & Devices

Location: Chastain A**Convener:** Mohammadreza Hadizadeh (Central State University)

- **12:25 PM** *Interface-Engineered van der Waals Heterostructures for Next-Generation Microelectronic Contacts*
Speaker: Mohamed Noufal (Hampton University)
- **12:45 PM** *Growth of Scandium Diboride Semimetallic Single Crystals by Laser Floating Zone Method*
Speaker: Ahamed Raihan (Morgan State University)

- **1:05 PM Abstract: Broadband Surface Acoustic Wave Generation via Chirped IDTs for Programmable Spin Control**
Speaker: Andre Saffore II (Norfolk State University)
- **1:25 PM Engineering Semiconductor Thin Films with ALD and Integrated Metrology**
Speaker: Swapnil Nalawade (North Carolina A & T State University)

12:25 PM -- 1:45 PM

Room B: Power Electronics

Location: Chastain B**Convener:** Daniel Vrinceanu (Texas Southern University)

- **12:25 PM Titanium Oxynitride Thin Film and Nanowires for Ultrahigh Capacitance Supercapacitors**
Speaker: Sheilah Cherono (North Carolina Agricultural and Technical State University)
- **12:45 PM Modeling the Effects of Surface Potential on Gallium Nitride Betavoltaic Cell Collection Efficiency**
Speaker: Monté Hendrix (Morgan State University)
- **1:05 PM Multi-layered Porous PVDF 2D Heterostructure Nanofillers as High-Density Capacitive Energy Storage**
Speaker: William Gladney (Jackson State University)
- **1:25 PM SLA-Printed Architected Polymer Thermal Interface Materials with BN/Microfiber Fillers for High-Power Semiconductor Cooling**
Speaker: Tahseen Al-wattar (Central State University)

12:25 PM -- 2:00 PM

Room C: Advanced Packaging

Location: Rialto A**Convener:** Dinadayalane Tandabany

- **12:25 PM Materials development and biophotonic sensor fabrication employing lead-free halide perovskites**
Speaker: Demetris Geddis (Hampton University)
- **12:45 PM Lite VLA: Efficient Vision-Language-Action Control on CPU-Bound Edge Robots**
Speaker: Justin Williams (Hampton University)
- **1:05 PM Experimental Evaluation of BNNT-based Thin Films for Mitigating Single Event Effects in SRAM via Proton Beams**
Speaker: Alexander Roque (Clark Atlanta University)

2:00 PM -- 2:10 PM

Break + Transition

2:10 PM -- 3:00 PM

Plenary Session: Technical Session Sprints

Location: Centennial Ball Room**Session Title:** Recap and Highlights from Technical Sessions

3:00 PM -- 3:20 PM

Plenary Session: Special Announcement

Location: Centennial Ball Room**Session Title:** HBCU CHIPS Network Initiation Committee

3:20 PM -- 3:30 PM

Closing Remarks

Location: Centennial Ball Room

Oral Presentation Abstracts

Technical Session 1 / Abstract #11

Implementation of Finite state logic machines via the dynamics of atomic systems

Author: Dawit Hailu¹

¹*Bowie State University*

Following the success of Moore's predictions, we are approaching a limit in the miniaturization of semiconductors for computing materials. This has led to the exploration of various research paths in search of alternative computing paradigms, such as quantum computing, 3D transistors, molecular logic, and continuous logic. In this context, we propose a novel approach in which the dynamics of a two-level atom is used to execute classical Boolean logic operations. Unlike traditional combinational logic circuits, where the output depends solely on the input, we suggest a finite-state machine-like computing model, where the output is influenced by both the input and the system's initial state. The proposed mechanism leverages the dynamics of a two-level quantum state, with information encoded in observable quantities. These observables, the density matrix's population (diagonal) and coherence (off-diagonal) elements, were analyzed using the Liouville equation. The selection of observables within the Liouville space allows us to encode more variables. Although environmental noise may cause some loss of encoded information, fast computations can still be performed before it dissipates. In addition, logic operations can be read in parallel, enabling complex computations. This system can also be scaled to an N-level configuration.

Academic or Professional Status:

Faculty

Technical Session 1 / Abstract #23

Lite VLA: Efficient Vision-Language-Action Control on CPU-Bound Edge Robots

Author: Justin Williams¹

Co-author: Kishor datta Gupta¹

¹*Clark Atlanta University*

The deployment of artificial intelligence models at the edge is increasingly critical for autonomous robots operating in GPS-denied environments where local, resource-efficient reasoning is essential. This work demonstrates the feasibility of deploying small Vision-Language Models (VLMs) on mobile robots to achieve real-time scene understanding and reasoning under strict computational constraints. Unlike prior approaches that separate perception from mobility, the proposed framework enables simultaneous movement and reasoning in dynamic environments using only on-board hardware. The system integrates a compact VLM with multimodal perception to perform contextual interpretation directly on embedded hardware, eliminating reliance on cloud connectivity. Experimental validation highlights the balance between computational efficiency, task accuracy, and system responsiveness. Implementation on a mobile robot confirms one of the first successful deployments of small VLMs for concurrent reasoning and mobility at the edge. This work establishes

a foundation for scalable, assured autonomy in applications such as service robotics, disaster response, and defense operations.

Academic or Professional Status:

Graduate Student

Technical Session 1 / Abstract #41

Optics-Electronic Devices: Turn Light into Electricity Turn Electricity Into Light

Author: Qinglong Jiang¹

Co-author: Maoding Cheng

¹*University of Arkansas at Pine Bluff*

The first paper about hybrid organic-inorganic solid state solar cells with perovskite-structured $\text{CH}_3\text{NH}_3\text{PbI}_3$ as the active layer was published in 2009. Over 26% efficiency in few years, perovskite solar cells are the most promising next generation solar cell. It has been found application in light emitting, photoluminescence, sensors and so on. This presentation involves the synthesis and doping of halide perovskite materials for the application in solar cells, light emitting, electrochromism and other related topics.

Academic or Professional Status:

Faculty

Technical Session 1 / Abstract #24

Optimization of Titanium Nitride as a Material for Superconducting Josephson Junctions in Quantum Computing Applications

Authors: Ebenezer Vondee¹; Kiran Nyaupane¹

Co-authors: Richard Taylor¹; Shyam Aravamudhan¹

¹*North Carolina A&T State University*

The scalability of superconducting quantum computers remains fundamentally constrained by decoherence mechanisms in Josephson junction-based qubits, with two-level system (TLS) defects at material interfaces representing a primary source of energy dissipation. While aluminum has served as the conventional electrode material for superconducting qubits, its limitations in coherence times and susceptibility to surface oxidation have motivated the exploration of alternative superconductors. Titanium nitride (TiN) has emerged as a compelling candidate material, demonstrating superior resistance to oxidation, tunable kinetic inductance, and reduced TLS densities at critical interfaces. However, despite extensive application in superconducting resonators and capacitive elements, the systematic optimization of TiN-based Josephson junctions remains largely unexplored, representing a critical gap in quantum hardware development. This research investigates the comprehensive optimization of titanium nitride as an electrode material for superconducting Josephson junctions, addressing fundamental material science challenges that have impeded its widespread adoption.

The study focuses on three interconnected objectives; establishing reproducible fabrication protocols for TiN thin films with controlled stoichiometry, crystallinity, and superconducting properties through systematic variation of deposition parameters; engineering and characterizing barrier materials compatible with TiN electrodes to achieve tunnel junctions with high critical current uniformity and low loss tangents; and correlating material properties with quantum coherence metrics.

Academic or Professional Status:Graduate Student

Technical Session 1 / Abstract #59**Design, Fabrication, and Characterization of Thermoelectric Devices from Multilayer Thin Films****Author:** Cole Cooper¹**Co-authors:** Essence Carter¹; Kristen Harris¹; Satilmis Budak¹; Zaria Weeks¹; Zhigang Xiao¹¹*Alabama A&M University*

The objective of this project is to use nano-engineering and nanofabrication to develop nanostructured thermoelectric materials for application in high-efficiency thermoelectric power generators and solid-state micro cooling devices. Multi-nano-layered super-lattice thin films of Bi₂Te₃/Sb₂Te₃ were grown using ultra-high vacuum-based deposition methods for achieving a high thermoelectric figure of merit, ZT. To significantly increase the ZT value, the values of the Seebeck coefficient and electrical conductivity should increase while the thermal conductivity should decrease for the efficient thermoelectric generators and thermoelectric coolers. Bi₂Te₃/Sb₂Te₃ multilayer thermoelectric devices were fabricated and these samples addition to the previous single layers of Bi₂Te₃ and Sb₂Te₃ samples were characterized. The planned characterization techniques listed as: Seebeck Coefficient, Thermal Conductivity, four probe Hall effect measurements, SEM/EDS, XPS/Raman, I-V Characterizations, Impedance Measurements. After the characterizations are performed, the nanofabrication of the thermoelectric devices will be performed using the best recipe for the high efficient thermoelectric devices. The findings will be shared during the conference.

Academic or Professional Status:Undergraduate Student

Technical Session 1 / Abstract #48**Luminescence from Nanoscale Perovskite Semiconductor Materials****Author:** Thomas Murray¹**Co-authors:** Cameron Lewis¹; Zhiping Luo¹¹*Fayetteville State University*

Semiconductors exhibit distinctive electronic behavior governed by transitions across narrow bandgaps, typically 0 to a few electron volts. Upon optical or electrical excitation, electrons are promoted to the conduction band, leaving holes in the valence band. Luminescence is produced when these

electron-hole pairs recombine radiatively, emitting photons. Because emission efficiency depends strongly on radiative pathways, defect states, and electron-phonon interactions, semiconductors remain central to luminescence technologies, including light-emitting diodes (LEDs), which are valued for their high energy efficiency, long operating lifetimes, and strong brightness. In this work, we investigate Mn-doped vacancy-ordered hexagonal perovskites as promising phosphor candidates for solid-state lighting. The materials were synthesized using a facile solution-based method and characterized by X-ray diffraction and electron microscopy to confirm phase formation and assess crystal structure and morphology. Mn incorporation was systematically optimized using photoluminescence measurements to tune emission features and improve quantum efficiency. Additional spectroscopic studies were carried out to probe energy-transfer pathways, defect-related relaxation processes, and thermal stability, properties that ultimately determine performance under practical device conditions. Finally, the synthesized phosphors were incorporated into phosphor-converted LED prototypes, demonstrating their potential as efficient and stable emitters for next-generation solid-state lighting.

Academic or Professional Status:Undergraduate Student

Technical Session 1 / Abstract #55**Fabrication and Characterization of the Thin Film Solid State Li-Ion Batteries****Author:** Jamar Dozier¹**Co-authors:** Kelvin Perkins¹; Kendall G. Montgomery¹; Mauyon Wusu¹; Ruvarashe Nyabanda¹; Satilmis Budak¹; Zhigang Xiao¹¹*Alabama A&M University*

Solid-state lithium-ion batteries are recognized as the emerging battery technology of choice for electronics that store electrical energy, providing greater safety and compactness compared to standard lithium-ion batteries. The latter contains a liquid electrolyte, which leads to more leakages and other dangers. The advantages provide benefits to the emerging battery technology. The chances of leakage are reduced and there is less risk of burning. We focused on a strong fabrication and measurement process for the materials for a thin-film solid-state lithium-ion battery. The battery materials used were LiCoO₂ as the cathode, LiPON as the solid electrolyte, Sn as the anode, and a stack of these materials as a single entity in a film format placed on silicon substrates utilizing electron-beam evaporation. The films were also annealed at 50°C, 100°C, and 150°C for one hour each with an unannealed set used as reference to analyze the effects of annealing. To evaluate how annealing affected battery behavior, we used a Van der Pauw measurement system analyzing electrical parameters: resistivity, sheet resistance, mobility, carrier density, and Hall coefficient. These measurements were complemented by current-voltage (I-V) characterization for each material and the multilayer stack. Findings will be presented during the meeting.

Academic or Professional Status:Undergraduate Student

Technical Session 1 / Abstract #68

A Method for Calculating PIN Alpha-voltaic Cell Operational Life from Modelling and Simulation Data.

Author: Kishak Cinfwat¹

Co-authors: Monte Hendricks¹; Peker Peker Milas¹; Christopher Thomas²; MVS Chandrashekar¹; Michael Spencer¹

¹*Morgan State University*

²*Widetronix Corp, Ithaca New York 14850*

Nuclear batteries find applications in medical implants, sensor nodes, and are suited to deployment in extreme environments. Nuclear batteries made from alpha radiation sources offer the potential of higher energy density compared to beta-voltaic batteries. The mitigation of alpha particle damage to semiconductor charge collection structures remains a challenge, to extend the very short operational life of the alpha-voltaic battery. Degradation of carrier mobility in semiconductors occurs due to alpha irradiation induced deep defects, which reduce the carrier lifetime (τ). The degraded τ leads to the transducer failure, which reduces the operational life of the battery. In this study I_{sc} , V_{oc} and P_{max} of the PIN type GaN alpha-voltaic cells were simulated using Silvaco Atlas, a TCAD software, for different lengths of the PIN transducers I-region from $0.2\mu\text{m}$ to $2\mu\text{m}$, for τ from 10^{-8} to 10^{-15}s . τ was employed as a surrogate for radiation defect density within the device. From plots of normalized P_{max} of each device, the alpha particle fluence, semiconductor damage constant, and typical crystalline GaN τ , the operational life of the optimum device was computed.

Academic or Professional Status:

Graduate Student

Technical Session 1 / Abstract #66

Urea-based GQDs with PVA Integration

Author: Aldine Willacey¹

¹*University of Arkansas at Pine Bluff*

Graphene Quantum Dots (GQDs) have emerged as a highly promising class of nanomaterials due to their strong photoluminescence, chemical tunability, and favorable electrochemical properties. In this study, urea-derived GQDs and poly(vinyl alcohol) (PVA)-GQD composites were synthesized through a two step process aimed at enhancing both their optical performance and structural characteristics. First, GQDs were produced using a bottom up synthesis approach to generate uniform nanoscale particles exhibiting stable blue green emission. Subsequently, these GQDs were incorporated into a PVA matrix to form PVA-GQD composites with improved photoluminescent behavior. The optical properties of the synthesized materials were characterized through UV-Vis absorption and photoluminescence spectroscopy. Additional characterization was conducted using Dynamic Light Scattering (DLS) and zeta potential analysis to evaluate particle size distribution and colloidal stability. Building on these findings, the next phase of the study will involve electrochemical assessment via cyclic voltammetry and electrical impedance spectroscopy. These measurements are expected to provide deeper insight into material quality and guide the identification of optimal applications. Based on preliminary results, we anticipate strong potential for electrochemical applications, with additional utility in optical systems owing to the material's robust photoluminescence.

Academic or Professional Status:

Undergraduate Student

Technical Session 1 / Abstract #45**Assessment of optoelectronic properties of an ambipolar polymer - photochromic dye blend in the solid state for organic photoresponsive device applications.****Author:** Ikem Uba¹**Co-authors:** Abdul-Majeed Hamidu ; Wisdom Jagoi ; Mohamed Noufal ; Demetris Geddis¹*Hampton University*

Research in polymer semiconductors drives the race to efficient flexible electronics, synaptic transistors and polymer solar cells. The current study investigated the fundamental optoelectronic properties of a donor - acceptor polymer blend, incorporated with a photochromic dye in the solid state, with the view to optimize the material's parameters for organic photoresponsive device applications. It is a work in progress that is built on the premise that (i) a donor - acceptor blend might present a better charge transfer than a single polymer and (ii) a photochromic dye could potentially control charge transport via isomerization. A blend of Poly- 3-Hexylthiophene (P₃HT), Poly naphthalene bithiophene (N₂200) and Spiropyran dye was used as a case study, where a 1:1 weight ratio was maintained for all samples studied. Optoelectronic properties were extracted through UV - Vis spectral analysis and in the frames of Spitzer- Fan and Wemple-DiDomenico models. Results showed significant changes in properties such as bandgap and charge density of the blend compared to pristine P₃HT and N₂200 samples.

Academic or Professional Status:

Faculty

Technical Session 1 / Abstract #49**Building Quantum Information Science Capabilities at HBCUs: Insights and Recommendations****Author:** Thomas Searles¹**Co-authors:** Kayla Lee²; Michelai Lowe³¹*University of Illinois at Chicago*²*IBM*³*IBM HBCU Quantum Center*

The IBM HBCU Quantum Center is at the forefront of revolutionizing education and research through a one-of-a-kind industry academic partnership. Here, we delve into strategies for building Quantum Information Science and Engineering (QISE) capabilities at HBCUs, drawing insights from initiatives such as the HBCU Quantum Center while considering the broader context of the CHIPS and National Quantum Initiative Renewal Acts. Our discussion encompasses the current status of QISE initiatives at HBCUs, including curriculum development, research capabilities, and faculty research output across physics, computer science, and engineering. We also explore the interdisciplinary nature of quantum education and research, emphasizing collaborative efforts aimed at equipping students with the skills necessary for success in advanced computing technologies of the future. Additionally, we offer actionable recommendations for enhancing capacity-building efforts including curriculum enhancement, faculty recruitment and retention strategies, and fostering cross-institutional research collaboration. In conclusion, this presentation provides a comprehensive overview of the ongoing

efforts to build QISE capabilities at HBCUs, informed by specific initiatives in the HBCU Quantum Center and broader HBCU community. Through collaboration and strategic investment, we aim to further advance quantum education and research, ensuring that HBCUs play a pivotal role in shaping the future of quantum information science.

Academic or Professional Status:Faculty

Technical Session 1 / Abstract #28**IR Photodetector based on the contactless-PdSe₂ integration with Few-Layered MoSe₂ Field-effect Transistor****Author:** Roshan Padhan¹**Co-authors:** Akshay Wali²; Anirudha V. Sumant²; Daniel Rosenman²; Nivetha Murugesan¹; Ralu Divan²; Rohit R Srivastava¹; Shan Yang¹; Nihar R. Pradhan¹¹*Jackson State University*²*Argonne National Laboratory*

Narrow-bandgap two-dimensional (2D) semiconductors are promising for near- and far-infrared photodetection, particularly at telecommunication wavelengths, but their performance is often limited by high dark current, carrier recombination, and thermal noise. Here, we report a hybrid van der Waals phototransistor that overcomes these challenges by integrating contact-free palladium diselenide (PdSe₂) as an infrared-absorbing layer with a molybdenum diselenide (MoSe₂) field-effect transistor (FET). Exfoliated PdSe₂ back-gated FETs exhibit ambipolar transport with hole and electron mobilities of 24.8 and 58.4 cm² V⁻¹ s⁻¹, respectively. Under 1650 nm illumination, PdSe₂ devices show clear photocurrent generation and a responsivity of ~300 mA W⁻¹ at a gate voltage of 15 V, confirming its suitability as a narrow-bandgap IR photodetector. To achieve tunable and enhanced photoresponse, few-layer PdSe₂ is transferred onto the channel of a MoSe₂ FET while remaining electrically isolated from the metal contacts. In this architecture, PdSe₂ acts as the primary IR absorber, whereas MoSe₂ provides efficient charge transport and gate control. The resulting spatial separation significantly improves device performance, yielding responsivities up to 972 mA W⁻¹ at a low power density of 1.5 mW mm⁻².

Academic or Professional Status:Graduate Student

Technical Session 1 / Abstract #33**Investigation of Surface Acoustic Wave Dynamics at Cryogenic Temperatures for Quantum Device Applications****Author:** Felix Kimeu¹**Co-authors:** Derricka Jones¹; Doyle Temple¹; Quinten Jones¹¹*Norfolk State University*

Surface acoustic waves (SAWs) offer potential for next-generation quantum technologies, including spin current generation, control of magnetization dynamics, and hybrid SAW-skyrmion platforms for qubit manipulation. Although SAW devices have long been used as RF filters, signal processors, and sensors, their operation in extreme environments remains underexplored. This work studies the frequency response of SAW devices at ultralow temperatures and under high magnetic fields, while also investigating hybrid coupling between SAWs and surface plasmon polaritons (SAW-SPP). SAW devices are designed on 128° YX-cut lithium niobate, selected for its strong piezoelectric response and high electromechanical coupling. Devices use 50 finger pairs with 2 μm width and a 8 μm wavelength in the HF range, and a 300 μm aperture for improved acoustic confinement. Equivalent circuit models including IDT capacitance, motional branches, acoustic delay, and matching networks are implemented in Mathcad and LTSpice, with COMSOL Multiphysics simulations used for validation. Cryogenic analysis shows reduced phonon scattering modifies velocity, attenuation, and coupling, shifting resonance and increasing Q. High magnetic fields and integrated metal-dielectric interfaces enable study of magneto-acoustic effects and SAW-SPP interactions, establishing a multiphysics framework linking RF, acoustic, cryogenic, and plasmonic behavior for compact, high-Q, field-tunable quantum and sensing platforms.

Academic or Professional Status:Graduate Student

Technical Session 2 / Abstract #29**A Lab-to-Go Approach for AI and Semiconductor Education****Author:** Xuemin Chen¹**Co-author:** Daniel Vrinceanu¹¹*Texas Southern University*

The rapid adoption of artificial intelligence in semiconductor systems has exposed a persistent gap in engineering education: students often learn AI using high-level software platforms without understanding how underlying silicon realities shape performance, efficiency, and reliability. This disconnect, referred to as the Cleanroom Barrier, separates algorithmic learning from hardware constraints such as power consumption, thermal behavior, and physical variability, limiting students' ability to reason across the full AI-hardware stack. This work proposes a portable Lab-to-Go educational approach that enables experiential learning at the intersection of machine learning and semiconductors, without reliance on traditional cleanroom facilities or large-scale infrastructure. By emphasizing hands-on interaction with real hardware and observable system behavior, the approach reinforces the connection between AI models and the physical platforms on which they execute. The proposed direction supports workforce development needs in the CHIPS era by promoting systems-level thinking and preparing students to design, evaluate, and deploy AI solutions with an awareness of semiconductor constraints.

Academic or Professional Status:Faculty

Technical Session 2 / Abstract #14

Bridging the Talent Gap: A New Approach to Accelerating Workforce Solutions for Semiconductors

Author: Michelle Williams-Vaden¹

¹*SEMI Foundation*

The semiconductor industry cannot scale without people. In this keynote, Michelle Williams, Executive Director of the SEMI Foundation, shares how the SEMI Foundation is transforming lives and strengthening communities through bold new initiatives coupled with tried-and-true programs. From sparking industry curiosity in K-12 classrooms, to helping veterans launch new careers, to launching and leading the National Network for Microelectronics Education, the SEMI Foundation is expanding career pathways for people around the globe. Learn how you can join these efforts to build a innovative, skilled, industry-ready workforce that will power the future of semiconductors.

Academic or Professional Status:

Nonprofit / NGO Representative

Technical Session 2 / Abstract #18

Collaborative Research: Advancing Semiconductor Education through Expansion and Diversification (ASEED)

Author: Suxia Cui¹

Co-authors: Mohammadreza Hadizadeh²; Zhigang Xiao³; Lujun Zhai¹; Mubbashar Khan²; Xiang Zhao³; Satilmis Budak³; Qunying Yuan³; Shujun Yang³

¹*Prairie View A&M University*

²*Central State University*

³*Alabama A&M University*

The Chips & Science Act, while focused on strengthening U.S. semiconductor manufacturing, also creates critical opportunities for workforce development. However, chip design and manufacturing demand advanced facilities and interdisciplinary STEM expertise, posing significant challenges for small institutions. These challenges include limited access to training resources, difficulty sustaining expensive infrastructure, and constraints in assessing community impact. In response, Prairie View A&M University, Central State University, and Alabama A&M University launched the NSF-funded ASEED project under the INCLUDES program to develop shared solutions and raise national awareness of these systemic challenges. The ASEED leadership also serves as lead investigators on major industry-supported initiatives, including Apple NSI and Intel-SERP, establishing a strong, multi-state foundation for semiconductor education and research. Building on this foundation, ASEED seeks to expand collaboration among small institutions and strengthen infrastructure across the full chip design pipeline. The project emphasizes broad access and industry-relevant skill development through integrated research and educational thrusts in materials science, IC design, and fabrication and characterization. ASEED also delivers diverse training pathways: seminars, workshops, certificates, and graduate credentials while engaging community colleges and high schools. The project aims to share its outcomes broadly to foster feedback, partnership, and scalable impact nationwide.

Academic or Professional Status:

Faculty

Technical Session 2 / Abstract #50**Diamond Quantum Vector Magnetometer Optimization with Machine Learning Models****Author:** Hamdin Ozden¹**Co-authors:** Peker Milas¹; Isar Uslu²; Fatih Karatay³; Tomas Sujeta¹; Rapsan A. Anonto¹; Birol Ozturk¹¹*Morgan State University*²*University of Maryland*³*Johns Hopkins University*

Defects in semiconductors and diamond are emerging as highly efficient platforms for quantum sensing applications. Machine learning offers a powerful alternative to conventional model-based data analysis in quantum sensing, particularly for computationally intensive techniques such as continuous-wave optically detected magnetic resonance (CW-ODMR) using nitrogen-vacancy (NV) centers in diamond. Traditional extraction of magnetic field information relies on nonlinear spectral fitting, which becomes a major bottleneck for high-throughput and real-time applications. In this study, we present a machine learning-based framework for full-vector magnetic field reconstruction directly from raw CW-ODMR spectra acquired from NV-diamond ensembles. By combining fast photodiode-based ODMR detection with data-driven regression models, the proposed approach preserves the intrinsic spectral resolution of NV spin resonances while eliminating the need for iterative fitting procedures. The models are trained on datasets incorporating realistic noise, strain effects, temperature variations, and contrast fluctuations, enabling direct prediction of three-dimensional magnetic field components from single-shot spectra. This framework significantly reduces computational latency while maintaining high magnetic field sensitivity, making it well suited for real-time vector magnetometry and scalable quantum sensing platforms. Overall, our results highlight the potential of machine learning to enhance the speed, robustness, and accessibility of NV-based magnetic field sensing technologies.

Academic or Professional Status:

Graduate Student

Technical Session 2 / Abstract #52**Using Q-Switched Lasers for Multi-Beam Multi-Target Pulsed Laser Deposition of Photonic High-Entropy Alloy Films****Authors:** Abdalla Darwish¹; Darayas Patel; David Rossmann¹; Paolo Melle; Sergey Sarkisov¹*Dillard University*

Presentation describes the application of Q-switched lasers to the concurrent multi-beam multi-target pulsed laser deposition (CMBMT-PLD) of the high-entropy alloy (HEA) films. A six-beam system included permanent magnets under the PLD targets and the substrate and a substrate heater. Magnets narrowed down the plasma plumes from the targets and increased the material deposition rate. Three- (Au-Ag-Cu), four- (Au-Ag-Cu-Al), five- (Au-Ag-Cu-Al-Ti), and six-metal (Au-Ag-Cu-Al-Ti-W) films were deposited on Cu, Al, Fe, and Ni substrates. Scanning electron microscopy and X-ray analysis indicated the films were the aggregates of crystalline nanoparticles (NPs) of mostly individual metals and double-metal alloys. Heating the substrates up to 300°C resulted in the formation of a wider variety of double-alloy nanoparticles due to higher mobility and reactivity of the deposited atomic species. The HEA films amplified the photoluminescence (PL) of the perovskite

CsPbBr₃ quantum dots (QDs) deposited on the top by 6 to 16 times. This was because of two simultaneous effects: the enhancement of the incident ultraviolet radiation (372-nm wavelength laser) by the localized surface plasmon polariton resonance in the metal NPs surrounding the perovskite QD, and the fast decay of the excited state of the QD due to resonant coupling between the QD and near vicinity NPs.

Academic or Professional Status:

Faculty

Technical Session 2 / Abstract #57

On the Feasibility of Solving the Time Independent Schrödinger Equation using Neural Network and Block Form with Rayleigh Quotient Loss Function

Author: B. Patton¹

Co-author: T.L. Wallace¹

¹*Meharry Medical College*

In the HBCU Chips 2025 conference, M.R. Hadizadeh, B. Sarker, and M.A. Khan presented an approach for solving 1D quantum systems using machine learning. Here, we present a discussion and feasibility consideration of numerical methods for computing multiple eigenpairs of Hamiltonian matrix $A \in \mathbb{R}^{n \times n}$ using a block formulation of the Rayleigh quotient in either Python or Julia in a closely related problem. This approach reformulates the classical eigenvalue problem $A\mathbf{v} = \lambda\mathbf{v}$ into a block structured optimization framework. This block formulation may enable simultaneous computation of multiple eigenpairs and provide enhanced numerical stability through the use of structured matrix operations. The method will attempt to leverage the geometric properties of the Rayleigh quotient in block space, where the gradient and Hessian structure are exploited for efficient optimization. The proposed technique discussed may combine elements of the Rayleigh quotient iteration with possible block Krylov subspace methods, towards achieving convergence rates compared to traditional power iteration approaches for small blocks. The algorithm's computational complexity is considered and may scale favorably with problem dimensions, particularly for computing the k smallest eigenpairs. Numerical experiments will be discussed.

Academic or Professional Status:

Faculty

Technical Session 2 / Abstract #58

Dielectric Properties of Conducting Boron-Doped Diamond

Author: Daniel Harrison¹

Co-authors: Ahamed Raihan¹; Astrid Dzutcha Kengne¹; Christopher Thomas²; Grigory Simin³; Joshua Burrow¹; MVS Chandrashekar¹; Md. Jahangir Alam¹; Michael Spencer¹

¹*Morgan State University*

²*Widetronix*

³*University of South Carolina*

We extract the infrared dielectric function from Fourier transform infrared reflectance spectra 650-4000 cm^{-1} for conducting single crystal and polycrystalline boron-doped ($3\text{-}6 \times 10^{20} \text{ cm}^{-3}$) diamond (BDD) by Kramers-Kronig (K-K) analysis, validating our method on commercial SiC substrates. This method highlights the importance of using integrable functions in K-K, solving issues with convergence near the endpoints of the measurement spectral range. Polycrystalline BDD shows an elevated optical index $\sim 3\text{-}3.5$ below 2000 cm^{-1} compared to the $\sim 2.5\text{-}2.7$ in single-crystal BDD, and the ~ 2.4 for ideal diamond, accompanied by increased dielectric loss at $\sim 1250 \text{ cm}^{-1}$, termed the L2-mode. Raman mapping of this IR-active ω_{L2} revealed elevated levels of graphitic sp^2 inclusions, particularly at grain boundaries. These optical measurements are consistent with polycrystalline BDD showing lower electrical resistivity $0.05 \Omega\text{-cm}$, one order lower than that of the single crystal $0.6 \Omega\text{-cm}$, highlighting the strong role of sp^2 inclusions in grain boundary conductivity as a source of dielectric loss. These results show that extrinsic factors beyond B-doping alone should be considered in the interpretation of the optoelectronic properties of BDD and inform its use for thermal management in codesigned microelectronics for power and RF systems, plasma-assisted epitaxy of cubic boron nitride and electrochemistry.

Academic or Professional Status:Graduate Student

Technical Session 2 / Abstract #64**Growth of Cubic Boron Nitride by Electron Cyclotron Resonance Chemical Vapor Deposition on Boron Doped Diamond Substrates**

Authors: Birol Ozturk¹; Christopher Thomas¹; Kishak Cinfwat¹; MVS Chandrashekar¹; Md. Jahangir Alam¹; Michael Spencer¹; Peker Milas¹; R. Shipra,¹; Sheikh Mahtab¹

¹*Morgan State University*

Cubic boron nitride (c-BN) is an ultrawide-bandgap semiconductor with a 6.4 eV bandgap, a high breakdown field above 15 MV/cm, and great thermal conductivity of 940 W/m-K. This makes it excellent for the next generation high-power and high-temperature electronic devices. In this work, we report the growth of c-BN using a custom-built Electron Cyclotron Resonance Chemical Vapor Deposition (ECR-CVD) reactor. Energy-dispersive spectroscopy (EDS) revealed a B/N ratio of approximately 1:1, consistent with that of reference bulk c-BN crystals, confirming the presence of boron nitride. Fourier Transform Infrared (FTIR) measurements represent clear features corresponding to the reststrahlen band of cBN, with initial evidence of the responsible phonons at 1050 cm^{-1} and 1305 cm^{-1} through Raman spectroscopy. Some samples show a mixture of c-BN and h-BN, while most are single-phase c-BN. Capacitance measurements indicated a film thickness of $0.1\text{-}0.3 \mu\text{m}$, consistent with the results obtained from atomic force microscopy (AFM). Boron Doped Diamond Substrate is ideal for c-BN growth, but its strong Raman signals hinder BN phase analysis, underscoring the need for Cathodoluminescence (CL) mapping. CL imaging distinctly resolved h-BN and c-BN grains of around $20 \mu\text{m}$, identified by their characteristic sub-bandgap emissions near 330 nm and 470 nm, respectively.

Academic or Professional Status:Graduate Student

Technical Session 2 / Abstract #72**Maximizing HBCU University Websites to Highlight Contributions to AI-Enabled Semiconductors: Research, Workforce Development, Academic Programs, and Institutional Initiatives****Authors:** Ahlam Alharbi^{None}; Myah Webb¹; Trina Fletcher¹¹*University of Arkansas at Pine Bluff*

As the U.S. advances efforts to strengthen its semiconductor and microelectronics workforce, institutional websites have become a primary source of information for students, researchers, industry partners, and federal funders seeking to identify research capacity, workforce initiatives, and collaboration opportunities. These stakeholders, particularly students exploring workforce pathways and funders assessing institutional readiness, public-facing web content serves as the first point of engagement and a critical signal of institutional priorities. Historically Black Colleges and Universities (HBCUs) play a vital role in diversifying and sustaining the national semiconductor workforce, yet their contributions to AI-enabled semiconductor research and workforce development remain under-documented in broader research literature. Rather than cataloging academic offerings, this study addresses this need by examining the following research question: How are Historically Black Colleges and Universities contributing to AI-enabled semiconductor workforce development through research and institutional initiatives? Our findings will be the first data-driven mapping of visible HBCU engagement in AI-enabled semiconductor workforce development, which highlights areas of strength and structural gaps in institutional signalling, while underscoring the strategic importance of web visibility. Collectively, this work positions HBCUs as essential contributors to the AI-enabled semiconductor workforce while offering actionable insights for institutions and policymakers seeking to strengthen inclusive workforce ecosystems.

Academic or Professional Status:

Undergraduate Student

Technical Session 2 / Abstract #74**Development of a Multiuser Collaborative Virtual Training Environment for Photolithography Cleanroom Processes****Author:** Emmanuel Osei-Kwame¹**Co-authors:** Michael Kozhevnikov¹; Yaw Amankrah Sam-Okyere¹¹*Norfolk State University*

The semiconductor industry relies heavily on photolithography processes conducted in controlled cleanroom environments, where training and collaboration are constrained by stringent contamination protocols, high operational costs, and physical limitations. To address these challenges, we present a novel immersive Collaborative Virtual Training Environment (CVTE) designed for multiuser interaction and collaboration. This system enables participants to engage in shared simulations of cleanroom workflows, fostering real-time teamwork without the risks associated with physical cleanrooms. Key features include synchronized multiuser avatars for interpersonal communication, controller-based interactions for manipulating virtual photolithography equipment (e.g., wafer handling, mask alignment, and exposure simulation), and environmental fidelity. Python scripting facilitates dynamic scenario customization, real-time physics simulations, and the integration of collaborative tools such as shared annotations and voice chat. Preliminary evaluations demonstrate low-latency synchronization across networked head-mounted displays (HMDs), achieving response

times under 50ms for interactions, and high user immersion scores via standardized VR questionnaires. Our VTE represents a scalable solution for industrial training on semiconductor device fabrication, with potential extensions to other high-stakes manufacturing domains. Future work will incorporate haptic feedback and AI-driven adaptive scenarios to further elevate collaborative efficacy.

Academic or Professional Status:

Graduate Student

Technical Session 2 / Abstract #12**Van der Waals Integration of Semi-Metallic PdSe₂ Contacts for High-Performance n-type WS₂ Field Effect Transistors**

Authors: Saurabh Dixit¹; Roshan Padhan¹; Nihar Pradhan¹

¹*Jackson State University*

Two-dimensional transition metal dichalcogenides (TMDs) show immense potential for next generation nanoelectronics and optoelectronics, owing to their atomic-scale thickness and compatibility with van der Waals (vdW) integration. Consequently, TMDs have become central to emerging technologies such as neuromorphic computing, high-speed photodetectors, and superconducting quantum circuits. However, a critical bottleneck remains the high contact resistance at the metal-semiconductor interface, often caused by Fermi level pinning and substantial Schottky barrier heights. This interface degradation leads to severe resistive power loss and limits device scalability. To address this, we investigate the efficacy of few-layer, semi-metallic palladium di-selenide (PdSe₂) as a van der Waals contact interlayer. We fabricated field effect transistors (FETs) utilizing n-type tungsten disulfide (WS₂) as the semiconducting channel and PdSe₂ as the source/drain terminals. We evaluated performance metrics, including carrier mobility and contact resistance, using the transfer length method across varying channel lengths. Temperature-dependent transport measurements were performed to determine the Schottky barrier height. Preliminary results indicate that PdSe₂ contacts significantly improve carrier injection compared to traditional metals. The improved performance is attributed to the favorable band alignment between the semi-metallic PdSe₂ and n-type WS₂. This work highlights the promise of PdSe₂ as a scalable, low-resistance contact material for high-performance 2D electronics.

Academic or Professional Status:

Postdoctoral Researcher / Research Scientist

Technical Session 2 / Abstract #67**Adaptive Self-Healing Neuromorphic-Inspired VLSI Architecture for UltraLow Power Edge AI**

Authors: Graham Thomas¹

Co-authors: Adebola Adamson¹; Mustafa Wari¹

¹*Texas Southern University*

The project is conducted as a collaborative effort involving The rapid expansion of edge computing and AI-enabled IoT devices demands VLSI architectures that are not only energy-efficient but also resilient to process variations, aging effects, and momentary faults. The proposed novel Adaptive Self-Healing Neuromorphic-Inspired Very Large-Scale Integration (ASHN-VLSI) architecture integrates on-site health monitoring, machine-learning-driven fault prediction, and dynamic reconfigurable logic to enhance reliability while minimizing power consumption. The proposed architecture introduces three key innovations: (1) distributed on-chip nanoscale health sensors embedded within standard cell libraries to monitor parameters such as threshold voltage drift, electromigration stress, and temperature hotspots; (2) a lightweight hardware neural predictor that anticipates aging-induced failures using realtime telemetry; and (3) a fine-grained reconfigurable fabric capable of dynamically rerouting critical logic paths and reallocating computational loads without interrupting system operation. Unlike conventional redundancy-based fault-tolerance techniques incurring high area and power overheads, the ASHN-VLSI framework leverages predictive analytics and localized reconfiguration to significantly reduce standby power and extend chip lifetime. Fabricated using advanced FinFET technology nodes, the architecture demonstrates improved resilience against soft errors and process variability while maintaining subthreshold operational capability for ultra-low-power edge AI. Improvements in mean time to failure (MTTF), reduced leakage power, and enhanced energy-delay product could be achieved compared to traditional fault-tolerant designs.

Academic or Professional Status:

Faculty

Technical Session 3 / Abstract #62**Interface-Engineered van der Waals Heterostructures for Next-Generation Microelectronic Contacts****Authors:** Demetris Geddis¹; Mohamed Noufal¹¹*Hampton University*

The continued scaling of microelectronic devices is fundamentally constrained by non-ideal metal-semiconductor interfaces, where Fermi-level pinning and metal-induced gap states limit Schottky barrier tunability and increase contact resistance. This work proposes an integrated research and workforce framework to advance next-generation contact engineering through atomically controlled van der Waals heterostructures and critical materials innovation. Central to this effort is the development of tunable interfaces that restore near-ideal transport behavior by suppressing interfacial disorder and enabling predictable band alignment. Leveraging expertise in carbon-based semiconducting materials, nanoscale spectroscopy, and multifunctional nanomaterials, the project explores molecular-2D hybrid architectures capable of improving charge injection efficiency, reducing barrier variability, and supporting thermionic-field emission mechanisms critical for high-performance nanoelectronic and optoelectronic devices. Density-functional-theory-guided design and advanced structural characterization will be used to correlate interfacial chemistry with carrier transport, providing pathways toward low-resistance, thermally stable contacts compatible with future microelectronic manufacturing. Beyond device innovation, this initiative integrates workforce development to prepare a technically skilled pipeline aligned with the growing semiconductor and microelectronics sectors. By combining interface engineering, predictive materials design, and scalable training models, the program positions Hampton University as a strategic contributor to domestic microelectronics capability, supporting technological competitiveness and national supply-chain resilience.

Academic or Professional Status:

Undergraduate Student

Technical Session 3 / Abstract #32**Titanium Oxynitride Thin Film and Nanowires for Ultrahigh Capacitance Supercapacitors****Author:** Sheilah Cheron¹**Co-authors:** Dhananjay Kumar¹; Ghanashyam Gyawali¹; Panupong Jaipan¹; Ram K. Gupta²; Simon Gelin³; Zixiao Shi⁴¹*North Carolina A&T State University*²*Pittsburgh State University*³*Carnegie Mellon University*⁴*Cornell University*

High-quality, multifunctional two-dimensional (2D) titanium oxynitride (TiNO) thin films and one-dimensional (1D) TiNO nanowires have been synthesized using a pulsed laser deposition, a simple, fast, and congruent evaporation method. First-principles calculations as a function of surface orientation and termination indicate that surface oxidation of TiNO nanowires can stabilize the (110) orientation observed experimentally. The specific capacitance value for the TiNO nanowire samples (2725 mF/cm²) has been found to be nearly six times more than that of the TiNO thin film samples (400 mF/cm²), which is attributed to the high packing density of TiNO nanowires over a given area. The nanowire samples have also been found to exhibit a significantly higher energy density (1.35 μWh/cm²) than the TiNO thin-film samples (0.33 μWh/cm²). Thus, the TiNO material system in thin-film and nanowire forms has been demonstrated to be a promising candidate for use as an electrode material in supercapacitors and other charge-storage applications.

Academic or Professional Status:

Graduate Student

Technical Session 3 / Abstract #19**Engineering Semiconductor Thin Films with ALD and Integrated Metrology****Authors:** Shyam Aravamudhan¹; Swapnil Nalawade¹¹*North Carolina A&T State University*

The CHIPS and Science Act has accelerated the need for domestic semiconductor manufacturing capabilities built on precise thin-film deposition, scalable process control, and integrated metrology. Atomic Layer Deposition (ALD), with its angstrom-level thickness control and excellent conformality, is a critical enabler for next-generation logic, memory, and interconnect technologies. This work presents a process-engineering and metrology-driven approach to metal and metal-oxide thin films developed through extensive hands-on experience with ALD and complementary vacuum deposition techniques. Rather than focusing on materials discovery, the emphasis is on establishing repeatable, manufacturing-relevant thin-film processes. Films are characterized using X-ray photoelectron spectroscopy (XPS), X-ray diffraction (XRD), X-ray reflectivity (XRR), atomic force microscopy (AFM), Raman spectroscopy, and spectroscopic ellipsometry to correlate deposition conditions with thickness, crystallinity, surface chemistry, and morphology. By integrating multi-modal metrology with deposition process development, this work enables rapid feedback for recipe optimization, improved film uniformity, and enhanced integration readiness. Select electrochemical

evaluations are used as secondary performance validation of film quality and stability. Overall, this approach demonstrates how ALD process engineering combined with comprehensive metrology directly supports CHIPS Act priorities by advancing scalable manufacturing workflows and strengthening the semiconductor workforce pipeline.

Academic or Professional Status:

Postdoctoral Researcher / Research Scientist

Technical Session 3 / Abstract #22**SLA-Printed Architected Polymer Thermal Interface Materials with BN/Microfiber Fillers for High-Power Semiconductor Cooling**

Author: Tahseen Al-wattar¹

Co-author: Mohammadreza Hadizadeh¹

¹*Central State University*

Power semiconductor devices generate substantial heat during operation, making thermal interface materials (TIMs) critical for maintaining performance and reliability. Conventional greases and pads, however, often suffer from poor mechanical stability, limited reusability, and inconsistent application. Here we present a scalable approach to fabricate architected polymer (P-TIMs) using high-resolution stereolithography (SLA) printing of a high-temperature resin loaded with boron nitride (BN) and glass microfibers. 3D polymer scaffolds with controlled microarchitectures including vertically oriented pillar arrays and lattice networks were printed and subsequently infiltrated with engineered thermal compounds to enhance through-plane heat conduction while maintaining electrical insulation and coefficient of thermal expansion (CTE) compatibility with semiconductor packages. The P-TIMs were characterized for thermal, electrical, and mechanical performance. Thermal conductivity was measured using laser flash analysis and the transient plane source (TPS) method; dielectric strength and permittivity were evaluated with an LCR meter; mechanical response was assessed via tensile and compression testing; and CTE was determined by dilatometry. Device-level performance was evaluated using a chip-based test setup to quantify junction-to-case temperature reduction relative to commercial TIMs. Results demonstrate that scaffold geometry and filler composition enable repeatable control of interface thickness, compressibility, and through-plane thermal pathways, improving robustness and mitigating pump-out under thermal cycling.

Academic or Professional Status:

Postdoctoral Researcher / Research Scientist

Technical Session 3 / Abstract #13**Multi-layered Porous PVDF 2D Heterostructure Nanofillers as High-Density Capacitive Energy Storage**

Author: William Gladney¹

Co-author: Nihar Pradhan¹

¹*Jackson State University*

The increasing demand for high-performance energy storage devices has intensified interest in dielectric polymers for electrostatic capacitive applications due to their high-power density and compatibility with thin-film architectures. Among these materials, poly(vinylidene fluoride) (PVDF) is particularly attractive because of its high dielectric constant, low cost, mechanical flexibility, and biocompatibility. The piezoelectric response of PVDF originates from its electroactive β -phase; however, its output performance remains inherently limited. Recent studies have demonstrated that introducing controlled porosity into polymer thin films can substantially enhance their dielectric and piezoelectric properties. In this work, we systematically investigate the dielectric behavior, electric polarization, and energy density of PVDF, Porous PVDF, PVDF/MoO₃ nanocomposite capacitors. Exfoliated two-dimensional MoO₃ nanofillers are incorporated as interfacial layers within multilayer PVDF thin films, forming capacitor heterostructures with configurations of PVDF/MoO₃/PVDF (PMP) and Po-PVDF/MoO₃/Po-PVDF (Po-PMP). Porous PVDF films are fabricated via nonsolvent induced phase separation (NIPS), producing polymer-rich and polymer-poor domains that yield a well-defined porous morphology. The synergistic effects of porosity and interfacial MoO₃ nanolayers lead to enhanced dielectric polarization and improved energy storage performance, highlighting the potential of porous PVDF-based heterostructures for advanced capacitive energy storage applications.

Academic or Professional Status:Postdoctoral Researcher / Research Scientist

Technical Session 3 / Abstract #16**Experimental Evaluation of BNNT-based Thin Films for Mitigating Single Event Effects in SRAM via Proton Beams****Author:** Youngjun Lee¹**Co-authors:** Alexander Roque¹; Hargsoon Yoon¹; Keun-Woo Lee²; Woong-Ki Kim²¹Norfolk State University²QRT Inc.

Semiconductor chips in space are highly vulnerable to Single Event Effects (SEE) caused by high-energy radiation. While conventional bulk shielding is limited by mass and volume, lightweight solutions are essential for space system efficiency. This study investigates thin-film shielding materials utilizing Boron Nitride Nanotubes (BNNTs) and polymer composites. Due to their low atomic mass and high hydrogen-like atomic density, BNNTs are excellent candidates for slowing down incident protons. We evaluated the radiation shielding performance of BNNT-Parylene C composite films using a Static Random-Access Memory (SRAM) array exposed to 100 MeV proton beam. The results demonstrated that the shielding effectiveness varied based on film thickness and proton energy. Although the reduction in radiation effects was moderate, the findings validate the potential of BNNT-based thin films as lightweight shields against high-energy protons. Future work will focus on optimizing multilayer structures combining hydrogen-rich polymers and higher-density BNNT configurations to enhance shielding performance.

Academic or Professional Status:Postdoctoral Researcher / Research Scientist

Technical Session 3 / Abstract #51**Materials development and biophotonic sensor fabrication employing lead-free halide perovskites****Author:** Demetris Geddis¹**Co-authors:** Breon McCray III¹; Uwe Hommerich¹; Kesete Ghebreyessus¹; Folashade Teriba¹; Madison Emehel¹; Simone Nelson¹¹*Hampton University*

This study explored the development of a light source for a biophotonic sensor by integrating a lead-free halide perovskite-polymer composite thin film or dome on an inorganic UV LED source. This 3D organic/inorganic integrated device was designed to convert photons in the ultraviolet (UV, 350nm) wavelength range to 600nm light using a fluorescence process. The selected halide perovskites fluorescence material $\text{Cs}_4\text{MnBi}_2\text{Cl}_{12}$ (CMBC) was synthesized via a precipitation method or by hydrothermal synthesis, employing commercial precursors of CsCl, $\text{MnCl}_2 \cdot 4\text{H}_2\text{O}$, and Bi_2O_3 (or BiCl_3). Er doped CMBC was also prepared for enhanced visible light emission. CMBC can be considered as a possible non-toxic alternative to the well-known halide perovskites containing lead (e.g. CsPbCl_3). Following optical excitation at 360nm the undoped CMBC and Er: CMPC samples exhibited a broad band, orange-red emission centered at $\sim 605\text{nm}$. In addition, the Er: CMBC sample also revealed a distinct visible emission centered at $\sim 650\text{nm}$ from an Er^{3+} intra- $4f$ transition. For biophotonic sensor applications, prototype filters were prepared with varying concentrations of CMBC and either UV resin or cyanoacrylate adhesive in the composite film. This allowed for a comparison between filtered and unfiltered emission spectra, specifically targeting changes in transmittance at selected wavelengths.

Academic or Professional Status:

Faculty

Technical Session 3 / Abstract #60**Growth of Scandium Diboride Semimetallic Single Crystals by Laser Floating Zone Method****Author:** Ahamed Raihan¹**Co-authors:** Astrid Dzotcha Kengne¹; Daniel Joel Harrison¹; Evan N. Crites²; Fnu Shipra¹; MVS Chandrashekhar¹; Michael G. Spencer¹; Satya Kushwaha²; Tyrel M. McQueen²¹*Morgan State University*²*The Johns Hopkins University*

Scandium diboride (ScB_2) is a refractory semi-metallic ultrahard ceramic crystal that is lattice matched to ultra-wide bandgap (UWBG) AlGaIn. The lattice match of $\text{ScB}_2/\text{Al}_{0.55}\text{Ga}_{0.45}\text{N}$ would reduce the strain and crystal defects of epitaxial layers enabling thicker pseudomorphic drift layers $>5\mu\text{m}$ for high voltage vertical power devices $>5\text{kV}$ on these semi-metallic substrates, while eliminating the substrate series resistance parasitic. We demonstrate the growth of ScB_2 crystals by the laser-diode floating zone (LDFZ) method. Poly-crystalline ScB_2 rods were used as our feed and seed rods, and Sc as flux, with a starting resistivity of $\sim 400\mu\Omega\text{cm}$. Our growth rate is $\sim 2\text{mm/hr}$ giving a typical total growth of $>20\text{mm}$ long. X-Ray Diffraction (XRD) data shows clear signatures of (001) ScB_2 . Laue measurements on cut/polished samples show six-fold symmetry over mm length scales, with room temperature bulk resistivity $\sim 20\mu\Omega\text{-cm}$, $\sim 20\times$ lower than the starting feed material. Heat-capacity measurements were performed at temperatures $2\text{K} < T < 300\text{K}$ and were analyzed to quantify the

contributions of phonons and electrons. The Debye temperature ($\theta_D \sim 710\text{K}$) and the electronic coefficient ($\gamma \sim 3.8 \text{ mJ}\cdot\text{mol}^{-1}\cdot\text{K}^{-2}$) of heat capacity Determined. These samples had thermal conductivity $\sim 100 \text{ W/m}\cdot\text{K}$ at the level of Si and GaN, showing the potential for substrates from an electrothermal co-design perspective.

Academic or Professional Status:Graduate Student

Technical Session 3 / Abstract #69**Modeling the Effects of Surface Potential on Gallium Nitride Betavoltaic Cell Collection Efficiency****Author:** Monté Hendrix¹**Co-authors:** Kishak Cinfwat¹; Michael G. Spencer¹¹*Morgan State University*

The performance of Gallium Nitride (GaN) betavoltaic devices is strongly influenced by surface potential due to the shallow penetration depth of beta particles from Tritium (³H). In this work, the effects of surface potential on charge collection efficiency in a PN, GaN betavoltaic cell are modeled using a Metal-Oxide-Semiconductor (MOS)-based field-plate approach implemented in Silvaco TCAD. The model incorporates incomplete dopant ionization and surface recombination to realistically capture carrier transport near the surface. By varying the surface potential and P-type doping concentration, the impact of surface-induced depletion on carrier collection is quantified. Simulation results indicate that at a surface potential of 1.5 eV, a P-type doping concentration of $1.10^{19}/\text{cm}^3$ enables approximately 87% of the ideal (flat-band) collection efficiency, whereas a lower doping concentration of $1.10^{18}/\text{cm}^3$ results in only 57% of the maximum achievable efficiency due to complete depletion of the P-layer. These findings demonstrate that surface potential is an unavoidable effect in GaN betavoltaic devices and that high P-type doping combined with ultra-thin junction design is essential for mitigating surface-induced carrier loss. The results provide design guidelines for optimizing shallow-junction GaN betavoltaic cells for long-lifetime, ultra-low-power nuclear energy harvesting applications.

Academic or Professional Status:Graduate Student

Technical Session 3 / Abstract #75 Abstract: Broadband Surface Acoustic Wave Generation via Chirped IDTs for Programmable Spin Control**Author:** Felix Kimeu¹**Co-author:** Andre Saffore II¹¹*Norfolk State University*

Controlling spin states in quantum and magnetic materials using dynamic strain fields offers a promising route toward hybrid quantum and spintronic technologies. Surface acoustic waves (SAWs)

provide a versatile mechanism for generating such strain via magnetoelastic or piezomagnetic coupling. However, conventional interdigital transducers (IDTs) are limited by narrow frequency bands. This narrow bandwidth limits the ability to address spin transitions across a range of energy scales to compensate for inhomogeneous broadening. This work focuses on designing and implementing chirped IDTs to generate broadband SAWs for tunable multi-frequency spin control. We first developed a predictive frequency-domain model of the chirped geometry on Mathcad, a computational software. To bridge the gap between theory and application, devices are fabricated on a 1280 YX cut lithium niobate substrate using the Nanyte Beam maskless lithography tool. We use the liftoff technique to create the device patterns. This approach bypasses the need for physical photomasks, enabling rapid prototyping of complex, customizable chirp profiles and varying electrode densities. Experimental RF characterization, performed via S-parameter measurements using the Tektronix RSA518A spectrum analyzer, confirms successful broadband operation. The results show strong agreement with our modeled spectra, validating the design's efficiency.

Academic or Professional Status:

Graduate Student

Poster Presentation Abstracts

Poster Session / Abstract #30

Side-channel Analysis for Hardware Trojan Detection

Author: Iain White¹

Co-authors: Mani Gurram¹; Akshay Kulkarni¹; Suxia Cui¹; Lujun Zhai¹; Xiang Zhao²; Qunying Yuan²; Satilmis Budak²; Mubbashar Khan³

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Hardware Trojans pose a critical security risk by embedding malicious functionality that can evade design-time verification and remain dormant until activated. This ongoing project investigates side-channel analysis as a non-invasive approach for detecting hardware Trojans in FPGA-based systems, with a particular focus on electromagnetic (EM) emissions. An AES-128 encryption core is implemented on a Zynq XC7Z020 FPGA platform and serves as the baseline for experimental evaluation. The EM emission characteristics of the Trojan-free design are first measured and statistically characterized under controlled operating conditions. Representative hardware Trojans, including leakage-based and trigger-activated designs, are then integrated into the AES core to emulate realistic attack scenarios. EM measurements are collected both before and after Trojan insertion, and deviations in spatial and temporal emission patterns are systematically analyzed. Multiple side-channel analysis techniques, such as statistical feature extraction, and anomaly detection, are employed to distinguish Trojan-infected designs from trusted implementations. This work aims to contribute an experimental framework and effective detection methodology for identifying hardware Trojans on FPGA platforms.

Academic or Professional Status:

Undergraduate Student

Poster Session / Abstract #34

Scalable Growth of 2D VS₂: Impact of Process Conditions on Crystallinity and Layer Quality

Author: Amari Gayle¹

Co-authors: M.K. Indika¹; Pitigala

¹*Clark Atlanta University*

Vanadium disulfide (VS₂) is a 2D transition metal dichalcogenide with highly tunable electronic, magnetic, and optoelectronic properties. While bulk VS₂ exhibits metallic behavior, monolayer and H-phase forms are p-type semiconductors with a direct bandgap of 0.3-1.3 eV, high structural stability, and room-temperature ferromagnetism. The metallic phase is ideal for ultrathin, low-resistance contacts in field-effect transistors, whereas semiconducting monolayers serve as active channels. Monolayer VS₂ also exhibits strong light-matter interactions, enabling photodetector and phototransistor applications. Various techniques have been employed to synthesize VS₂ layers, among which

chemical vapor deposition (CVD) is particularly effective. CVD enables a controllable and reproducible process for producing high-quality crystalline monolayers. Furthermore, its strong compatibility with established industrial fabrication standards makes it well-suited for both fundamental research and scalable production of two-dimensional materials. This study investigates the optoelectronic properties of VS_2 synthesized via CVD on various substrates, extending beyond conventional growth approaches. Optimal growth conditions, including temperature and carrier gas flow rate, are systematically identified to achieve a high-quality, continuous VS_2 monolayer. Using photoluminescence, Raman spectroscopy, and confocal laser optical microscopy, we examine surface morphology, crystalline quality, phonon modes, and band gap characteristics of the VS_2 layers.

Academic or Professional Status:Undergraduate Student

Poster Session / Abstract #39**Emergent ferromagnetic correlations and spin textures in the chiral magnet BaFeGaO₄****Author:** Orrin Delgado¹**Co-authors:** Doyle Temple¹; Sunil Karna¹; Chin-Wei Wang²¹*Norfolk State University*²*Australian Nuclear Science and Technology Organisation*

Topological spin textures in solids are of great interest for future spin-electronic technologies. Recent studies of chiral cubic materials hosting skyrmions—such as the itinerant magnets MnSi and FeGe and the Mott insulator Cu₂OSeO₃—have shown that they exhibit a common set of magnetic phases characterized by long-period spin modulations and undergo similar field-induced transitions. Here, we investigate the structural and magnetic properties of BaFeGaO₄ using x-ray diffraction, neutron diffraction, and magnetic measurements. BaFeGaO₄ crystallizes in the hexagonal crystal system with space group P6₃. Magnetic susceptibility measurements performed at fields of 0.01 and 1 T reveal an inflection point near T≈50K, indicating a magnetic phase transition. Magnetic hysteresis observed at T=2K suggests the development of ferromagnetic behavior. Neutron diffraction measurements on powder samples show no additional magnetic Bragg peaks down to 2 K; however, a slight enhancement in intensity superimposed on the nuclear reflections indicates the presence of weak ferromagnetic correlations and potentially novel spin textures in this system.

Academic or Professional Status:Graduate Student

Poster Session / Abstract #15**Microfluidic device for label-free cell deformation analysis****Author:** Ayodeji aderin¹**Co-authors:** Aylin Marz¹; Messaoud Bahoura¹; Patricia Mead¹; Yaw Sefa-Boateng¹¹*Norfolk State University*

Breast cancer outcomes are closely linked to the stage at which the disease is first detected. To make early detection more accessible, a device capable of distinguishing between low- and high-HER2 breast cancer using optical tweezing has been proposed. Initial efforts using the optical trapping of SKBR3 cells have been fully manual, limiting precision, reproducibility, and throughput. This effort has produced a fully automated capability, allowing users to adjust experimental parameters, including laser power, image capture, and cell delivery parameters. Automated control of the operation parameters for a microfluidic controller, microscope camera, and laser diode driver has been fabricated at the Norfolk State University Micron-NSU Nanofabrication cleanroom facility. The system synchronizes device operation, enabling consistent cell manipulation and deformation. The functional prototype can regulate microchannel flow velocity via microfluidic pressure control, trapping and deforming cells by modulating the current output for laser diode drivers and capturing and storing micrographs at user-prescribed intervals. The prototype was developed in compliance with biomedical device safety standards (IEC/IEEE 82079-1:2019, IEC 62304, IEC 60601-1) ensuring operational safety. This automated optical tweezing system enhances the process of cell trapping and deformation assays, representing a step toward developing a clinically relevant diagnostic tool for breast cancer detection.

Academic or Professional Status:Undergraduate Student

Poster Session / Abstract #17**Green Synthesis of Pectin-Stabilized ZnO Nanocomposites for Photocatalysis****Authors:** Godwill Tewan¹; Jude Namaga¹; Emmanuel Atta-Obeng¹¹*Coppin State University*

The development of environmentally benign nanocomposite materials has gained significant attention in photocatalytic applications, particularly for wastewater treatment. In this study, a pectin-zinc oxide (ZnO) nanocomposite was synthesized using a green, solution-based route that leverages the natural polysaccharide pectin as a biopolymeric stabilizer and matrix. The structural, morphological, and optical characteristics of the resulting composite were analyzed using X-ray diffraction (XRD), Fourier-transform infrared spectroscopy (FTIR), scanning electron microscopy (SEM), and UV-Vis spectrophotometry. The results confirmed the successful incorporation of ZnO nanoparticles within the pectin matrix, exhibiting a uniform dispersion and reduced particle agglomeration. Photocatalytic activity was assessed by the degradation of a model organic dye under UV and visible light irradiation.

Academic or Professional Status:Undergraduate Student

Poster Session / Abstract #27**Enhanced electrocatalytic and supercapacitance performances of transition metal oxynitride thin films**

Author: Dhananjay Kumar¹

Co-authors: Brianna Barbee; Warren GloverII¹; Wisdom Akande¹

¹*North Carolina A&T State University*

The importance of research in the field of non-conventional energy generation and storage cannot be overemphasized in order to be less dependent on limited resources in nature. Our research has established the effectiveness of the pulsed laser deposition (PLD) method for the synthesis of an emerging class of transition metal oxynitride (TMON) material systems in epitaxial thin film form. The material systems cover a wide range of compositions that exhibit the physicochemical properties needed in electrocatalysis and extended-life electrochemical energy storage. The attraction of TMONs over more widely studied transition metal oxides (TMOs) is rooted in the polarizability, electronegativity, and anion charge of nitrogen versus that of oxygen, which induces an enormous change in the physical and chemical properties of the resulting compounds. TMON films were deposited in the presence of oxygen in the PLD chamber. The films were characterized using high resolution x-ray diffraction, x-ray reflectometry techniques, and x-ray photoelectron spectroscopy. The electrochemical supercapacitor measurements on the TiNO films using cyclic voltammetry have shown that the specific capacitance values are amongst the highest values reported for the recently top-tier nanoscale electrode materials.

Academic or Professional Status:

Undergraduate Student

Poster Session / Abstract #35

Jumpshot

Author: Shavaughn Dunson¹

Co-authors: Yonghui wang¹; Suxia Cui¹

¹*Prairie View A&M University*

Feedback on athletic technique often requires a human input. However, there are many problems associated with this. Human input includes biases, humans often lack expertise, and humans are not always available. A lot of efforts have gone into the physics of basketball. Determining how factors like lift, angle, and velocity can impact the accuracy of a shot. But what if there was an automatic, easily accessible way to get feedback on the form of the shot itself, and for that feedback to be better than that of many people? I created a new system that extracts key phases of the shot from the video using key point estimation, and utilizes a Multilayer Perceptron trained on 100+ videos and 300+ images, which takes shot phase and key points as input to detect issues with shot form at over 63% accuracy, whilst finding issues in the follow through at 84% and issues in the base of the shot at 80%. These results show the potential of using Computer Vision to critique the performance of athletes in ways only humans have historically been able to, which could potentially revolutionize sports training and expand the realm of what computer vision can be applied to.

Academic or Professional Status:

Undergraduate Student

Poster Session / Abstract #40**Intrinsic Ferroelectric Switching in 2D CuInP_2S_6** **Author:** Dion Brumfield¹¹*Jackson State University*

Two-dimensional (2D) ferroelectric materials are promising candidates for next-generation nano-electronic and non-volatile memory devices. Reliable electrical characterization at the nanoscale remains challenging. In this work, we investigate the ferroelectric properties of layered CuInP_2S_6 (CIPS) using a modified conductive atomic force microscopy (C-AFM) approach. CIPS flakes were mechanically exfoliated onto a conducting gold (Au) substrate, followed by the transfer of few-layer graphene (FLG) on top, forming an Au/CIPS/FLG van der Waals heterostructure. Au serves as the bottom electrode, FLG acts as the top contact, and CIPS functions as the ferroelectric layer. Due to the small lateral dimensions of the FLG electrode, a conducting AFM tip was employed to establish a precise electrical connection to the FLG, enabling localized ferroelectric measurements. The conducting tip was interfaced with a ferroelectric tester to probe the electrical response of the heterostructure. Frequency-dependent polarization-electric field (P-E) hysteresis loops were measured under various electric field sweeps, along with current-voltage characteristics. Additionally, positive-up-negative-down (PUND) measurements were performed to distinguish intrinsic ferroelectric switching from non-ferroelectric contributions. The observed hysteresis behavior and PUND response confirm the intrinsic ferroelectric nature of 2D CIPS and demonstrate the effectiveness of the modified C-AFM technique for probing nanoscale ferroelectricity.

Academic or Professional Status:

Undergraduate Student

Poster Session / Abstract #20**Experimental Investigation of 3D-Printed Polymer Lattice Composite Thermal Interface Materials for Semiconductor Packages****Author:** Tahseen AL-wattar¹**Co-authors:** Camron Nesbitt¹; Davian Cartwright¹; Rashad Appoleon¹; Mohammadreza Hadizadeh¹¹*Central State University*

Polymerization enables precise control of polymer lattice architectures for thermal interface materials (P-TIMs), creating new opportunities to tailor heat transfer and mechanical compliance. This study experimentally investigates SLA-printed lattice P-TIMs as a function of unit-cell topology and composite formulation. A baseline lattice was modified by introducing vertical struts in uniform, alternating, and graded arrangements, and both open- and closed-cell configurations were designed within the Gibson-Ashby cellular solids framework. A high-temperature photocurable resin was loaded with boron nitride (BN) microparticles and glass microfibers at varying weight fractions and printed using high-resolution stereolithography (SLA). Printed lattices were post-cured and subsequently infiltrated with thermally conductive polymer composites to enhance through-plane conduction. Through-plane thermal conductivity and thermal contact resistance were measured under controlled compressive loading, and mechanical compliance was evaluated to assess stability under representative interface pressures. Results show that lattice configuration and filler composition jointly govern through-plane heat transfer and overall thermal resistance. Architectures that promote continuous vertical conduction pathways, combined with appropriate open/closed-cell topology, achieve improved thermal performance while maintaining compliance and mechanical stability.

These findings establish additively manufactured, geometry- and composition-engineered P-TIMs as a clean, reusable, high-performance option for chip-to-heat-sink thermal management in advanced electronics cooling applications.

Academic or Professional Status:

Postdoctoral Researcher / Research Scientist

Poster Session / Abstract #21

Finite Element Analysis of 3D-Printed Polymer Lattice Thermal Interface Materials: Effects of Lattice Configuration and Open/Closed-Cell Topology

Author: Tahseen AL-wattar¹

Co-authors: Davian Cartwright¹; Rashad Appoleon¹; Camron Nesbitt¹; Mohammadreza Hadizadeh¹

¹*Central State University*

Finite element analysis (FEA) was used to investigate the thermal behavior of additively manufactured polymer lattice thermal interface materials (P-TIMs) across a range of architectural configurations. Starting from a baseline lattice, we generated multiple designs by selectively adding vertical struts in uniform, alternating, and graded arrangements to enhance through-plane heat conduction. Both open- and closed-cell configurations were considered within the Gibson-Ashby cellular solids framework to assess the influence of unit-cell topology on effective thermal performance. Three-dimensional lattice models were analyzed in Abaqus using steady-state and transient thermal simulations to quantify effective thermal resistance, heat-flux distributions, and temperature gradients under representative operating conditions. Thermal contact at the chip-TIM and TIM-heat-sink interfaces was modeled to capture the impact of interface pressure on heat transfer. The simulations show that architectures promoting continuous vertical conduction pathways, combined with optimized open/closed-cell topologies, reduce effective thermal resistance and improve heat-transfer efficiency relative to the baseline lattice. Overall, the results highlight the critical role of unit-cell topology and strut arrangement in controlling through-plane conduction and demonstrate that FEA-guided geometry optimization is an effective design strategy for high-performance 3D-printed polymer lattice TIMs for advanced electronics cooling.

Academic or Professional Status:

Postdoctoral Researcher / Research Scientist

Poster Session / Abstract #36

Computer Organization Teaching Materials Development

Authors: Shavaughn Dunson¹; Enrique Mateo¹

Co-authors: Yonghui Wang¹; Suxia Cui¹; Xiang Zhao²; Zhigang Xiao²; Shujun Yang²; Mohammadreza Hadizadeh³

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³*Central State University*

It is often challenging to provide students with hands-on experience in low-level computer science concepts. Developing engaging, experiential course materials for Computer Organization can be particularly demanding, yet such approaches are highly effective in increasing student interest and understanding. Student engagement is frequently hindered by difficulties in setting up experiments across diverse hardware platforms, limited access to specialized resources, and the lack of immediately visible results. To address these challenges, we developed six instructional, hands-on laboratory modules based on two widely used textbooks in computer organization and digital design. To create a more user-friendly learning environment for RISC-V architecture, two browser-based platforms were adopted: the Venus Instruction Set Simulator and the Surfer Waveform Viewer. The use of web-based tools eliminated compatibility issues and significantly improved accessibility, while the inclusion of waveform visualization enhanced the visibility of execution results. Students completed programming tasks in Venus and analyzed execution behavior using Surfer, an approach they found both challenging and engaging. These outcomes demonstrate the effectiveness of integrating web-based, hands-on materials to enhance learning in computer organization education.

Academic or Professional Status:

Undergraduate Student

Poster Session / Abstract #26**Deterministic Integration of MoS₂-Graphene Heterostructures for Future Chip-Scale 2D Electronics****Author:** Mustafa Ali¹**Co-authors:** Anthony Hill¹; Avra Bandyopadhyay¹; Joseph Hong²; Yuxuan Lin²¹*Prairie View A&M University*²*Texas A&M University*

Two-dimensional (2D) van der Waals heterostructures offer a powerful materials-by-design approach for beyond-CMOS electronics, enabling atomically sharp junctions, clean interfaces, and heterogeneous integration on silicon platforms. Among these, MoS₂-graphene heterostructures combine graphene's high conductivity and tunable work function with the semiconducting bandgap of MoS₂, providing a versatile platform for low-resistance contacts, ultrathin channels, and 2D-2D junction devices relevant to future chip technologies. Here, we report the fabrication and spectroscopic verification of a MoS₂-graphene vdW heterostructure assembled on SiO₂/Si using a viscoelastic stamping technique. This approach enables deterministic placement and alignment of exfoliated 2D layers while minimizing solvent exposure and interfacial contamination, which are critical for reproducible device integration. Optical microscopy confirms successful overlap of graphene and MoS₂ flakes. Raman spectroscopy reveals the simultaneous presence of characteristic graphene G (~1576 cm⁻¹) and 2D (~2708 cm⁻¹) bands, along with MoS₂ E12g (~377 cm⁻¹) and A1g (~402 cm⁻¹) modes, confirming few-layer MoS₂ and high-quality graphene in the heterostructure. Building on these results, we will advance MoS₂-graphene 2D-2D junctions through spectroscopic mapping, interface engineering, and correlation of Raman signatures with electrical and optoelectronic performance. This platform enables scalable integration of 2D materials for chip-scale technologies, including low-power electronics, RF contacts, photodetectors, and heterogeneous integration on Silicon.

Academic or Professional Status:

Undergraduate Student

Poster Session / Abstract #31**Structural, Optical, and Electrical Analysis of Sputtered Titanium Nitride Thin Films****Author:** Brianna Barbee¹**Co-authors:** Dhanajay Kumar¹; Wisdom Akande¹¹*North Carolina A&T State University*

Titanium nitride (TiN) thin films have attracted significant interest for supercapacitor applications due to their high electrical conductivity, chemical stability, and electrochemical durability. In this study, TiN thin films were systematically synthesized using magnetron sputtering under controlled Ar:N₂ flow conditions of 18:2 sccm. Films were deposited at temperatures of 500 °C, 600 °C, and 700 °C to investigate the influence of deposition temperature on structural and electrochemical properties. Structural characterization revealed that variations in surface morphology, grain size, and grain distribution significantly affected the electrochemical behavior of the films. Electrochemical measurements, including cyclic voltammetry and electrochemical impedance spectroscopy, demonstrated that the TiN thin films exhibited stable capacitive behavior, low internal resistance, and good rate capability. These results indicate that sputtered TiN thin films possess favorable charge storage characteristics and long-term electrochemical stability, highlighting their potential as electrode materials for supercapacitor energy storage applications.

Academic or Professional Status:

Graduate Student

Poster Session / Abstract #37**From GaN to Sapphire: How Substrate Influences MoSe₂/MoS₂ Heterostructure Properties****Author:** M. K. Indika Senevirathna¹**Co-authors:** Jamaris McElhaney¹; Trinity Berry¹; Yamil Riveranape¹; Kedar Johnson¹; Elycia Wright¹; Amari Gayle¹; P. K. D. D. P. Pitigala¹¹*Clark Atlanta University*

2D transition metal dichalcogenides (TMDs) have attracted significant attention due to their unique properties, including layer-dependent band structures, valley-selective optical coupling, catalytic activity, large exciton binding energies, and strong nonlinear optical responses. These features make TMDs promising for next-generation optoelectronic and photonic devices. Stacking different monolayer TMDs to form van der Waals heterostructures enables precise tuning of band gaps from the visible to infrared range, enhancing optoelectronic performance. Integrating these 2D heterostructures with conventional three-dimensional semiconductors, such as GaN with a 3.4 eV band gap, further extends band gap tunability and device functionality. This study explores MoSe₂/MoS₂ heterostructures grown on GaN substrates using chemical vapor deposition (CVD), a scalable and reliable technique for large-area synthesis. We investigate how substrate and temperature influence the optoelectronic properties of the heterostructures, including the band gap and phonon modes. In addition, we examine optical properties, such as photoluminescence and absorption, as well as

structural characteristics, including interlayer coupling, layer alignment, and crystal quality. By examining the differences between MoSe₂/MoS₂ grown on GaN and sapphire substrates, this study reveals the crucial role of substrate interactions in tuning TMD heterostructures for optoelectronic applications.

Academic or Professional Status:Faculty

Poster Session / Abstract #38**Fabrication and Characterization of Surface Acoustic Wave (SAW) Devices****Author:** Quinten Jones¹**Co-authors:** Derricka Jones ; Doyle Temple¹; Felix Kimeu ¹¹*Norfolk State University*

For decades, surface acoustic wave devices have widely been used in radio frequency (RF) filters, sensors, and signal processing systems. This project focuses on the microfabrication of SAW delay lines and resonators, emphasizing the lithography steps used to define interdigital transducers (IDTs) on piezoelectric substrates. Devices are fabricated on 128° YX-cut lithium niobate and quartz. For many general applications, 128° YX-cut lithium niobate is chosen for its strong piezoelectric properties and efficient conversion between electrical and acoustic signals. The process begins with substrate cleaning, followed by spin-coating a positive photoresist to achieve a uniform thin film. UV photolithography using maskless lithography is used to pattern fine electrode fingers with 2 μm width and 2 μm spacing, forming 50 finger-pair IDTs. After development, a thin gold layer is deposited to create the electrodes, and a lift-off process defines the final metal pattern. Careful control of exposure, alignment, and resist thickness is critical for achieving high-resolution features and minimizing defects. The fabricated structures form two-port SAW devices that generate and detect acoustic waves traveling along the substrate surface. This work highlights how microfabrication techniques directly influence device performance and demonstrates the importance of lithography precision in RF microsystems and emerging acoustic-electronic technologies.

Academic or Professional Status:Undergraduate Student

Poster Session / Abstract #43**A Novel Method for Rapid Fabrication of Boron-Doped Luminescent Porous Silicon****Authors:** Edward Nguyen¹; Michael Sailor¹; Siran Rao²**Co-authors:** Elijah Wesley³; Gael Alvarado¹; Nata Velarde-Alvarez⁴¹*University of California, San Diego*²*Scripps College*³*North Carolina A&T State University*⁴*Harvey Mudd College*

Quantum dots exhibit narrow linewidths stemming from their size, semiconductor composition, and confinement regions, making them ideal candidates for solid state lighting applications. Currently, silicon quantum dots are utilized in a wide variety of applications, from biomedicine to catalysts. Research continues to elucidate their fundamental nature; seeking to solve inefficiencies and pervasive problems such as quantum blinking, which causes quantum dots to lose photoluminescence. In many applications, this loss of photoluminescence means a loss of function for the quantum dots, so it is important to understand the phenomenon on a fundamental level and develop blink-off proof samples. Testing blinking hypotheses requires chemically passivated quantum dots, these already exist, however require days to years to manufacture and result in low yields. In this study we present a method for the fabrication of stable p-type porous silicon quantum dots. Using a photoelectrochemical etching procedure, followed by low temperature furnace oxidation, then a chemical etch, and finally a steam oxidation method, passivated porous silicon with tunable photoluminescence can be created. The entire process is also significantly faster than traditional methods, only taking around an hour from start to finish.

Academic or Professional Status:Undergraduate Student

Poster Session / Abstract #42**Microscopic Origin of Polarization Switching in Zr-Doped HfO₂: Real-Space Charge Redistribution and Berry-Phase Branch Analysis****Authors:** Jinjie Liu¹; Kevin Díaz-Aponte¹; Malachi Moody¹; Mukti Rana¹; Nurunnesa Sultana¹; Yanan Xu¹¹*Delaware State State University*

Ferroelectric Hafnium Oxide (HfO₂) is a leading candidate for scalable nonvolatile devices, yet the microscopic origin of polarization switching in isovalently doped HfO₂ remains incompletely understood. Here, we investigate Zr-doped HfO₂ using first-principles density-functional theory by constructing $\pm P$ polarization endpoints and analyzing the real-space charge density $\rho(+P)$, $\rho(-P)$, and their difference $\Delta\rho = \rho(+P) - \rho(-P)$ in the xz -plane (averaged along y) for 3.125%, 6.25%, and 9.375% Zr concentrations. The charge density maps show oxygen-centered electron localization in both polarization states, confirming that the material remains insulating and predominantly ionic across all dopings. The $\Delta\rho$ distributions exhibit clear dipolar charge rearrangements around the anion sublattice, indicating that polarization reversal is governed by collective Hf/Zr-O displacement patterns rather than metallic charge transfer. Despite the persistence of a coherent switching-induced charge redistribution, the magnitude and spatial uniformity of $\Delta\rho$ evolve with Zr content, revealing a doping-dependent modulation of the local polar distortion network. In parallel, Berry-phase polarization analysis demonstrates that experimentally relevant switching polarization corresponds to a physically connected branch of the polarization lattice; a consistent branch correction ($n=+1$) is required to obtain meaningful switched polarization values for the calculated Zr-doped structures.

Academic or Professional Status:Graduate Student

Poster Session / Abstract #44

Strengthening Education to Workforce Pipelines at HBCUs: Impacts on Career Readiness and Workforce Equity

Author: Abel Phiri¹

¹*Student*

Historically Black Colleges and Universities play a critical role in preparing a diverse and resilient workforce for the United States economy. As technology and innovation driven industries evolve, alignment between higher education and workforce needs has become important. Research shows that HBCUs disproportionately contribute to the development of Black professionals while fostering strong career readiness through supportive learning environments and targeted career pathways (UNCF, 2024). Industry partnerships and experiential learning further strengthen these outcomes by connecting academic preparation with real world workforce demands (Google, 2023). This study examines how education to workforce development initiatives at HBCUs support student career readiness and long term workforce participation. It explores the role of structured career pathways, industry partnerships, and sustained investment in addressing workforce gaps in high demand sectors. Using a qualitative review of national reports and existing literature, including sources from UNCF, McKinsey and Company, and industry case studies, the study analyzes employment trends, career readiness outcomes, and collaboration models. Findings indicate that intentional workforce development strategies at HBCUs improve employment outcomes, career mobility, and representation in growth industries (HBCU Connect, 2026). These initiatives benefit both individual students and the broader economy, highlighting the essential role of HBCUs in advancing workforce equity, economic mobility, and national competitiveness.

Academic or Professional Status:

Undergraduate Student

Poster Session / Abstract #46

Structural, magnetic, and thermodynamic properties of Nd₂MoO₆

Author: Foster Kwabena Ontumi¹

Co-authors: Doyle Temple¹; Orion Delgado¹; Pashupati Dhakal²; Sunil Karna¹; Ulrich Welp³

¹*Norfolk State University*

²*Thomas Jefferson National Lab*

³*Materials Science Division, Argonne National Lab*

Rare-earth molybdates offer an ideal platform for exploring frustrated magnetism arising from the interplay of crystal electric field effects, exchange interactions, and lattice geometry. We report a comprehensive structural, magnetic, and thermodynamic study of the insulating rare-earth molybdate Nd₂MoO₆. Powder x-ray diffraction confirms a tetragonal crystal structure featuring a bilayered Nd sublattice separated by MoO₆ octahedral networks. Magnetic susceptibility and isothermal magnetization measurements reveal dominant paramagnetic behavior with strong low-temperature enhancement and no evidence of long-range magnetic ordering. Low-temperature heat-capacity measurements show no sharp anomaly down to the lowest measured temperatures. Instead, C_p/T exhibits a pronounced low-temperature upturn that is strongly suppressed by an applied magnetic field, indicating a magnetic origin. Analysis of C_p/T versus T^2 reveals a finite $T \rightarrow 0$ intercept, consistent with persistent low-energy magnetic excitations. The extracted magnetic entropy is strongly suppressed relative to the free-ion value for Nd³⁺, pointing to a highly frustrated or dynamically fluctuating magnetic ground state.

Academic or Professional Status:Graduate Student

Poster Session / Abstract #47**Fabrication and Characterization of Lanthanide-Doped Oxide Materials for Sensing Applications****Authors:** Ge Yang¹; Sangeetha Balabhadra²; Tiffany Lukusa²; Zhiping Luo²¹*North Carolina State University*²*Fayetteville State University*

Oxides doped with rare-earth elements (REEs) have garnered significant attention for their strong photoluminescent properties in sensing applications. REEs are used in many high-performance technologies due to their unique 4f electronic transitions. Although the oxides are not inherently luminescent, they serve as excellent host for lanthanide-ion doping because of their open structure, thermal stability, oxygen mobility, and tunability enabled by partial or complete substitution at the A- or B-site cations. These nanoscale scintillators can be used in a variety of sensing applications, including light-emitting diodes, nuclear radiation detection, and medical imaging. The main objectives of this study are to synthesize, characterize, and enhance the luminescence of lanthanide-ion-doped materials. A simple calcination method was used to synthesize a series of oxide materials. Powder X-ray diffraction (PXRD) confirmed that all synthesized pure-phase materials. Scanning electron microscopy (SEM) was used to obtain high-magnification images of the materials, which revealed a mixture of plate-like and spherical particles. Spectrophotometry and electron probe microanalysis (EPMA) were used to observe and quantify the photo- and cathodoluminescence of the lanthanide-doped materials, respectively. Energy-dispersive spectroscopy (EDS) was used to verify the nominal elemental compositions. Overall, this research supports the design of lanthanide-ion-doped oxide materials for sensing applications.

Academic or Professional Status:Undergraduate Student

Poster Session / Abstract #53**Design, Simulation, and Measurement of CMOS-Based Ring Oscillator and Operational Amplifier Integrated Circuits****Authors:** Baraka Chimba¹; Fabian Sanchez^{None}; Goodwill Kwenda^{None}; Jaylan Hayesfain^{None}; Meek Simbule^{None}; Nehemiah Edison^{None}; Satilmis Budak¹; Shujun Yang¹; Suxia Cui²; Xiang Zhao¹; Zhigang Xiao¹¹*Alabama A&M University*²*Prairie View A&M University*

This work presents the design, fabrication, and silicon bring-up of a CMOS integrated circuit developed through a full-custom VLSI tape-out project in TSMC 180 nm technology. The fabricated chip integrates inverter-based and NAND-based multi-stage ring oscillators along with a two-stage operational amplifier. A complete custom design flow was followed, including schematic design,

pre- and post-layout simulation, physical layout, DRC, LVS, parasitic extraction, and verification using industry-standard EDA tools. Ring oscillators with varying stage counts were implemented to analyze the effects of logic topology, parasitics, and supply voltage on oscillation frequency, with post-layout simulations predicting frequencies from the megahertz to gigahertz range. Silicon bring-up was performed using probe-station testing, PCB mounting, and packaged devices. Measured results showed stable oscillation and expected frequency scaling with minor deviations attributed to parasitics and loading effects. The operational amplifier was validated in multiple configurations, achieving a closed-loop gain matching design targets and an open-loop gain of approximately 180 V/V.

Acknowledgements: The authors acknowledge the support of the Apple New Silicon Initiative (NSI) and National Science Foundation under Grant No. EES-2436204. Special thanks to Eric Smith from Apple for his technical guidance throughout the project.

Academic or Professional Status:

Undergraduate Student

Poster Session / Abstract #54

BipBip: A Lightweight Crypto Algorithm for Open Source Processors and AI Accelerators

Author: Alexander Stoyanov-Roberts¹

Co-authors: Dranel Jiles¹; Favour Okonkwo¹; Jeremiah Conway¹; Jose Dominguez¹; Kevin Kornegay¹; Shameer Rao¹

¹*Morgan State CAP Center*

Abstract—Lightweight cryptography is essential in systems constrained by power, performance, and area (PPA), particularly in IoT and embedded applications. To address these challenges, we present a RISC-V implementation of the BipBip algorithm, a symmetric tweakable block cipher tailored for fine-grained protection of pointer and contextual data in the CPU path of an SoC. Unlike larger-block ciphers like Deoxys-BC, PRESENT, Joltik, and Kisau, which are motivated by the need for pointer encryption, BipBip uses 24-bit blocks, a 40-bit tweak, and a 256-bit key to achieve ultra-low latency. This unique configuration supports contextual encryption without the overhead of nonce management, enabling predictable security in resource-limited systems. Our contributions emphasize RTL/FPGA implementation and SoC integration. We demonstrate a 2×2 mm block implementation of BipBip in Intel's 16 nm technology, operating at 300 MHz and with a full encryption-to-decryption path in two cycles. The lightweight primitive can be used in trusted microelectronics, requiring a small footprint, consistent latency, and integration with open-source CPUs and AI acceleration

Academic or Professional Status:

Graduate Student

Poster Session / Abstract #56

Raman characterization of MBE grown mixed As-Sb alloy nanowires

Authors: Joshua White¹; Shanthi Iyer¹

¹*North Carolina A&T State University*

In the short-wave infrared (SWIR) photonic device market, there's a need for small, low weight and low power devices (SWaP). As and Sb based nanowire photonic devices addresses this while demonstrating higher performance than conventional thin film devices. As-Sb nanowires promises more complex device design and SWIR extended wavelength operability when combined with group III materials such as Ga and Al. However, growth of Sb alloys is challenging due to its surfactant nature increasing phase segregation and disrupting crystal growth. Thus, the proper material characterization of Sb based alloy is critical. In this research material characterization of GaAsSb nanowire and core-shell heterostructure variants are explored. The nanowires are grown using an MBE 930 system and characterized using a Horiba Jobin Yvon ARAMIS Raman microscope with a He-Ne laser (633nm). Analysis of GaAs and GaSb LO and TO peak types are analyzed by observing changes in the Raman shifts, and the FWHM. Using this characterization technique, we determine ternary alloy group V mole fraction estimates, lattice mismatch, and growth quality. Raman characterization is a powerful technique for the material analysis of As-Sb based nanowire devices.

Acknowledgement: Research was sponsored by the Office of Naval Research and was accomplished under Grant Number N00014-22-1-2779.

Academic or Professional Status:

Graduate Student

Poster Session / Abstract #61

Structural and Optical Characterization of 2D Semiconductors Toward Defect-Based Quantum Sensing with Plasmonic Enhancement

Author: Tanmay Talukder¹

Co-authors: Birol Ozturk¹; Md. Jahangir Alam¹; Michael G. Spencer¹; Musa Salami¹; Peker Milas¹; Rapsan A. Anonto¹; Sheikh Mahtab¹; Yusuf Selim Ocak¹

¹*Morgan State University*

Two-dimensional (2D) semiconductors such as WS₂, MoSe₂, InSe, and GaSe are promising materials for next generation optoelectronic and quantum technologies due to their layer dependent band structures, strong light matter interactions, and tunable defect states. Our research focuses on the structural and optical characterization of mechanically exfoliated 2D materials to understand their intrinsic and defect induced properties. Techniques such as Raman spectroscopy, photoluminescence (PL) mapping, and atomic force microscopy (AFM) are employed to correlate layer thickness and material quality with optical responses. A major objective is to explore and engineer defect centers in these layered semiconductors for quantum sensing applications. Defects can host localized electronic states enabling optically detected magnetic resonance (ODMR), similar to nitrogen vacancy (NV) centers in diamond. By controlling defect creation for coherent spin manipulation in the monolayer regime, we aim to develop atomically thin quantum sensors capable of detecting local magnetic fields with high spatial resolution. Additionally, plasmonic enhancement using gold and silver nanoparticles is being investigated to amplify optical signals. The localized surface plasmon resonances (LSPRs) significantly enhance excitation and emission intensities, improving sensitivity in optical and ODMR based measurements. This integrated approach advances nanoscale, high performance quantum sensing platforms.

Academic or Professional Status:

Graduate Student

Poster Session / Abstract #63

Optical Characterization of Defects in 4H-SiC for Room Temperature Quantum Sensing

Authors: Birol Ozturk¹; Michael Spencer¹; Peker Milas¹; Sheikh Mahtab¹

¹*Morgan State University*

4H-SiC is a host to a wide-range of optically active point defects with outstanding properties such as extremely high brightness and long spin coherence time. These remarkable characteristics make 4H-SiC defects ideal for various quantum applications, including magnetometry, thermometry, and quantum metrology. To investigate its potential for quantum sensing, we conducted a comprehensive study of optically active defects in 4H-SiC. We employed various excitation sources at both cryogenic temperatures and ambient conditions and observed zero phonon line (ZPL) emission peaks in the visible to near IR range. We discuss techniques for creating defects and enhancing their photoluminescence (PL) intensity. Additionally, the influence of crystal orientation on PL at different temperatures is explored. We have also conducted a temperature-dependent study of the previously neglected secondary peaks adjacent to V1 and V1' ZPL peaks. Finally, we report on statistical success of room temperature optically detected magnetic resonance (ODMR) scans with silicon vacancy defects in 4H-SiC.

Academic or Professional Status:

Graduate Student

Poster Session / Abstract #65

Development of TaC substrates for AlGaN power electronics

Author: Astrid Dzutcha Kengne¹

Co-authors: Ahamed Raihan¹; Brooks Tellekamp²; Daniel Joel Harrison¹; Fnu Shipra¹; MVS Chandrashekar¹; Michael G. Spencer¹; Olayemi Olaniyi¹; Satya Kushwaha³; Tyrel M. McQueen³

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Performance of UWBG materials for vertical high-power, high-frequency electronics is characterized by the Baliga FOM which is a measure of power handling, a cubic function of critical electric field. Further scaling of power handling to 106x compared to the industry workhorse Si is limited by the availability of conducting lattice matched substrates. Conventional substrate materials that can be grown in bulk are either lattice mismatched to the best-known active layers (e.g., Al₂O₃ is lattice mismatched for AlGaN), lack a good combination of electrical and thermal properties (e.g., Ga₂O₃), or are cost prohibitive (e.g., diamond). High electrical and thermal conductivity of the substrate leads to improved device functionality and reliability with lower electrical losses, higher switching frequencies, and more robust performance under extreme conditions. We will discuss how the power handling of Al_{0.7}Ga_{0.3}N (001) devices on lattice matched TaC (111) with measured resistivity ~200Ω «10Ω for SiC substrates could lead to 100X power handling compared to similar GaN/SiC

devices. We show rectification in lattice matched AlGaIn/TaC Schottky diodes with measured critical fields $>4\text{MV/cm}$ higher than GaN/SiC. Use of TaC substrates could enable thick unstrained AlGaIn drift layers to be realized for high voltage devices $>3\text{kV}$ and high current handling $>10\text{kA/cm}^2$.

Academic or Professional Status:

Postdoctoral Researcher / Research Scientist

Poster Session / Abstract #71**In-Depth Analysis of How Various Parameters of Immersive VR-Based Training Influence Performance**

Author: Sandra Eddie¹

Co-authors: Dickson Afful¹; Michael Kozhevnikov¹

¹*Norfolk State University*

Virtual Reality (VR) has emerged as a powerful tool for training in high-risk and resource-intensive fields such as semiconductor manufacturing, where traditional hands-on learning is often limited by safety, cost, and facility access constraints. This study presents the development and in-depth evaluation of a Photolithography-focused Virtual Training Environment (PL-VTE) designed to support skill acquisition in one of the most precision-critical semiconductor fabrication processes. The research investigated how variations in some major VR design parameters influence trainee performance, procedural accuracy, knowledge retention, and perceived presence. Guided by literature-based VR design principles, an enhanced PL-VTE module has been developed in Unity 3D and deployed on Meta Quest headsets. A mixed experimental design compared outcomes between VR-based and traditional training groups using pre- and post-tests, performance tracking, interviews, concluding, and presence questionnaires. Findings provide evidence-based guidelines for optimizing immersive VR training in engineering education and address existing gaps in VR-based instructional design. The study contributes to the advancement of pedagogically sound, accessible, and effective immersive learning environments for technical skill development.

Academic or Professional Status:

Graduate Student

Poster Session / Abstract #73**A General and Modular Approach to Solid-State Integration of Zero-Dimensional Quantum Systems**

Author: Marzieh Kavand¹

Co-authors: Ezekiel Johnston-Halperin²; Ferdous Ara³; Jay Gupta²

¹*University of Alabama*

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Zero-dimensional quantum systems, such as molecules, defects, and quantum dots, are promising building blocks for scalable quantum technologies; however, their practical deployment is often limited by challenges associated with device integration and reliable readout. We present an all-electrical readout mechanism for quasi-0D quantum states (0D-QS), such as point defects, adatoms, and molecules, that is modular and general, providing an approach that is amenable to scaling and integration with other solid-state quantum technologies. Our approach relies on the creation of high-quality tunnel junctions via the mechanical exfoliation and stacking of multilayer graphene (MLG) and hexagonal boron nitride (hBN) to encapsulate the target system in an MLG/hBN/0D-QS/hBN/MLG heterostructure. This structure allows for all-electronic spectroscopy and readout of candidate systems through a combination of coulomb and spin-blockade. To validate this, we demonstrated Scanning tunneling microscopy (STM) measurements of the molecular spin qubit vanadyl phthalocyanine (VOPc) deposited on hBN that reveal well-ordered bilayer films and the difference between direct tunneling and tunneling through the quantum states with differential conductance spectra. Our approach demonstrates a new pathway for the incorporation of molecules and atomic defects into solid-state quantum devices and circuits.

Academic or Professional Status:

Faculty

Poster Session / Abstract #85**Real-Time Lightweight Object Detection Pipelines on PYNQ FPGA for Edge Vision Deployment**

Authors: Enrique Mateo¹; Lujun Zhai¹; Suxia Cui¹; Zhigang Xiao²; Satilmis Budak²; Mohammadreza Hadizadeh³

¹*Prairie View A&M University*

²*Alabama A&M University*

³*Central State University*

Object detection is a fundamental capability in modern computer vision systems, supporting applications such as autonomous vehicles, robotics, smart surveillance, and edge AI. However, deploying deep learning-based detection models on resource-constrained platforms remains challenging due to high computational demands and energy consumption. Field-programmable gate arrays (FPGAs) provide a promising solution by enabling low-power, real-time acceleration of vision workloads at the edge. This project explores the feasibility of implementing and optimizing object detection pipelines using the PYNQ FPGA platform, with an emphasis on hands-on semiconductor workforce training and practical edge AI deployment. Inspired by recent demonstrations of real-time edge detection on PYNQ, we extend FPGA-based image processing toward more advanced detection tasks, including lightweight convolutional neural network (CNN) inference and hardware-accelerated preprocessing. The study investigates how FPGA programmable logic can support key components of object detection, such as feature extraction, edge-enhanced filtering, and model acceleration. The project also evaluates trade-offs between software-based Python execution on embedded ARM processors and hardware-based acceleration using FPGA overlays. The long-term goal is to develop an accessible framework for integrating computer vision with FPGA-based acceleration while contributing toward efficient, real-time object detection at the edge. This work supports the mission of semiconductor and AI workforce development.

Academic or Professional Status:

Undergraduate Student

Poster Session / Abstract #86**FPGA Acceleration on PYNQ-Zynq for Efficient Edge AI Workloads****Authors:** Donovan Jones¹; Lujun Zhai¹; Suxia Cui¹; Xiang Zhao²; Shujun Yang²; Mubbashar Khan³¹*Prairie View A&M University*²*Alabama A&M University*³*Central State University*

This project investigates the use of FPGA-based acceleration for artificial intelligence workloads using a PYNQ-enabled Zynq system-on-chip platform. The work focuses on designing and deploying a custom hardware accelerator for low-precision matrix multiplication, a core computational kernel underlying many modern AI algorithms including convolutional neural networks and transformer models. Using a hardware–software co-design approach, the accelerator is implemented in programmable logic and integrated with the processing system via AXI interfaces and direct memory access (DMA). High-level synthesis is employed to explore architectural optimizations such as loop unrolling, pipelining, and on-chip buffering, enabling efficient data reuse and increased throughput. Performance is evaluated by comparing FPGA-accelerated execution against CPU-based baselines, with particular emphasis on the impact of data movement, memory bandwidth, and quantization on overall system efficiency. The project demonstrates how FPGA architectures can be leveraged to tailor computation and dataflow to AI workloads, providing insight into the tradeoffs between performance, resource utilization, and precision in edge-oriented AI acceleration.

Academic or Professional Status:

Undergraduate Student

About HBCU CHIPS Network

The **HBCU CHIPS Network** brings together faculty, staff, researchers, and partners committed to advancing research, education, workforce development, and collaboration in semiconductors and microelectronics across Historically Black Colleges and Universities and partner institutions. Through coordinated programs and shared leadership, the Network supports innovation in research, expands access to facilities and infrastructure, and strengthens pathways for student training, internships, and professional development. The following committees play an important role in planning conference activities, guiding technical engagement, supporting facilities access, and advancing workforce development initiatives. We gratefully acknowledge their service and contributions.

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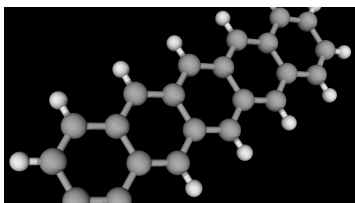
We are pleased to feature this special issue in *Scientific Reports* on **Organic Semiconductor**, led by guest editors from the **HBCU CHIPS Network**. This collection offers a valuable opportunity for network members and conference participants to publish their work in a widely visible journal while supporting a scholarly effort shaped by researchers from our own community. We invite attendees to review the flyer for submission details, submit their manuscripts for consideration, and share this opportunity with collaborators, colleagues, and students who may benefit from it.

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Organic semiconductors are carbon-based materials that combine the electronic functionality of conventional semiconductors with the mechanical flexibility and tunability of organic compounds. Their significance lies in offering lightweight, solution-processable, and structurally versatile alternatives to inorganic counterparts, enabling new device paradigms in flexible electronics, low-cost photovoltaics, light-emitting diodes, and bioelectronics. By harnessing molecular design, researchers can tune optoelectronic properties through precise control of conjugation, packing, and interfacial interactions, making organic semiconductors central to advancing next-generation electronic and energy technologies. Recent progress has been driven by the synthesis of novel π -conjugated molecules and

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Acknowledgment

We sincerely thank all speakers, participants, guests, and supporters for contributing to the success of this conference. This event reflects the excellence, leadership, and collaborative spirit of the **HBCU CHIPS Network** and its distinguished members.

We extend our special appreciation to the Organizing Committee for their dedication, service, and thoughtful planning in delivering a meaningful and enriching conference experience. We also gratefully acknowledge the contributions of our invited speakers, panelists, moderators, and technical session chair, whose expertise and engagement greatly enhanced the quality of the program. In addition, we recognize our sponsors and academic partners, whose generous support helped make this event possible.

We are especially grateful for the support of National Science Foundation (NSF), Micron, ASML, Synopsys, Teradyne, GlobalFoundries, and Sandia National Laboratories. We also acknowledge the valued partnership of our academic sponsors: Central State University, Clark Atlanta University, Georgia Institute of Technology, Morgan State University, North Carolina Agricultural and Technical State University, and Texas Southern University.

It is our hope that the discussions, connections, and insights shared throughout this conference will continue to inspire innovation, strengthen collaboration, and advance future achievements across our community and beyond.

We look forward to welcoming you again at our next conference in 2027.



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