2021 Device Research Conference
Final Program

June 20-23, 2021
All times U.S. Eastern Daylight Time

All events will take place using the Underline.io Virtual Conference Platform
https://www.underline.io/events/126/reception

For the latest information, please see
https://www.mrs.org/drc-2021

Sunday Afternoon

Sunday Afternoon DRC Short Course	
13:00PM	Introduction
13:05PM—16:20PM	***Quantum Computing Devices and Materials*** Organizers **Sumeet Gupta (Purdue University, USA)** **Asif Khan (Georgia Institute of Technology, USA)** Presenters **Louis Hutin (The French Alternative Energies and Atomic Energy Commission, CEA-Leti, France)** **Ravi Pillarisetty (Intel Corporation, USA)** **Heike Riel (IBM Research-Zurich, Switzerland)** **Pramey Upadhyaya (Purdue University, USA)**
16:20PM—16:40PM	Discussions and Conclusion

Monday Morning

Monday DRC Plenary Session Chairs: Becky (R.L.) Peterson (University of Michigan, USA) and Zhihong Chen (Purdue University, USA)	
08:30AM—08:50AM	Opening Remarks and Awards
08:50AM—09:50AM	**Philip Kim (Harvard University, USA)** **Plenary P1:** Stacking van der Waals atomic layers: quest for new quantum materials
10-min Coffee Break	
10:00AM—11:00AM	**Shuji Nakamura (University of California Santa Barbara, USA)** **Plenary P2:** III-Nitride Based LEDs and laser Diodes
10-min Coffee Break	

DRC Session 1 – 2D Devices Chair: Tania Roy (University of Central Florida, USA)	
11:10AM—11:50AM	**Dennis H.C. Lin (imec Leuven, Belgium)** **Invited 1A:** On MX_2-based metal-oxide-semiconductor device capacitance-voltage characteristics and dual-gate operation
11:50AM—12:10PM	**Emanuel Ber (Technion - Israel Institute of Technology, Israel)** **1B:** Pinpointing the Dominant Component of Contact Resistance to Atomically Thin Semiconductors
12:10PM—12:30PM	**Zhihui Cheng (National Institute of Standards and Technology, USA)** **1C:** Asymmetrical Contact Measurements of Contact Scaling in 2D FETs
12:30PM—12:50PM	**Myungsoo Kim (The University of Texas at Austin, USA)** **1D:** Single-Pole-Double-Throw RF switches based on monolayer MoS_2
40-min Lunch Break	

Monday Afternoon

DRC Session 2 – Memory Devices Chair: Jean Anne C. Incorvia (The University of Texas at Austin, USA)	
13:30PM—14:10PM	**John Paul Strachan (Hewlett Packard Laboratories, USA)** **Invited 2A:** In-memory computing with non-volatile analog memories for machine learning applications
14:10PM—14:30PM	**Haibo Gong (SUNY Polytechnic Institute, USA)** **2B:** Bilayer Ga-Sb Phase Change Memory with Intermediate Resistance State
14:30PM—14:50PM	**Corentin Delacour (LIRMM CNRS, France)** **2C:** Frequency Injection Locking-Controlled Oscillations for Synchronized Operations in VO_2 Crossbar Devices
14:50PM—15:30PM	**Deji Akinwande (University of Texas at Austin, USA)** **Invited 2D:** A Library of Atomristors: Non-Volatile Resistive Switching Phenomenon in 2D Atomic Sheets
15:30PM—15:50PM	**Adithi Krishnaprasad (University of Central Florida, USA)** **2E:** Ultra-low cycle-to-cycle variability in Au/MoS_2/Ti/Au memristive synapses for neuromorphic computing
10-min Coffee Break	

Monday Afternoon, *Continued*

DRC Session 3 – Wide Bandgap Devices I Chair: Sukwon Choi (The Pennsylvania State University, USA)	
16:00PM—16:20PM	**Nidhin Kurian Kalarickal (Ohio State University, USA)** **3A:** Demonstration of MOCVD-grown β-Ga_2O_3 MESFETs with Insulating Mg-Doped Buffer Layers
16:20PM—16:40PM	**Ahmad E Islam (Air Force Research Laboratory, USA)** **3B:** Hysteresis-free MOSCAP made with Al_2O_3/(010)β-Ga_2O_3 interface using a combination of surface cleaning, etching and post-deposition annealing
16:40PM—17:00PM	**Wenshen Li (Cornell University, USA)** **3C:** A Unified Thermionic and Thermionic-Field Emission Model for Ideal Reverse Leakage Current in Wide-Bandgap Schottky Barrier Diodes
17:00PM—17:20PM	**Saurav Roy (University of Utah, USA)** **3D: (LATE NEWS)** Record High BFOM (1.47 GW/cm^2) Field-Plated Vertical (001) β-Ga_2O_3 Schottky Barrier Diode with Surface Breakdown Field of 5.45 MV/cm
17:20PM—17:40PM	**Arkka Bhattacharyya (University of Utah, USA)** **3E: (LATE NEWS)** Multi-kV class MOCVD-grown β-Ga_2O_3 lateral MESFETs with Power Figure of Merit exceeding 300MW/cm^2
17:40PM—18:00PM	**Joong-Won Shin (Tokyo Institute of Technology, Japan)** **3F: (LATE NEWS)** MFSFET with 5 nm Thick Ferroelectric Undoped HfO_2 Gate Insulator
Dinner Break	

Monday Evening

19:00PM—21:00PM	**DRC Poster Session 1**

PS1.A: Jun Tao (University of Southern California , USA)
Artificial Optic-neural Synapse Based on Floating-gate Phototransistor for Machine Vision

PS1.B: Molla Manjurul Islam (University of Central Florida, USA)
Broadband optoelectronic synapse using p-Si/$PtTe_2$/Al_2O_3/MoS_2

PS1.C: Ricardo Martinez-Martinez (University of Central Florida, USA)
Graphene/Ta_2O_5/Graphene Optoelectronic synapses

PS1.D: Xi Zhou (Shanghai Advanced Research Institute, Chinese Academy of Sciences, China)
CuAg/Al_2O_3/CuAg Threshold Switching Selector for RRAM Applications

PS1.E: Wenbin Zhang (Institute of Microelectronics, BNRist, Tsinghua University, China)
Impact of Bottom Electrode Roughness on the Analog Switching Characteristics in Nanoscale RRAM Array

PS1.F: Xinkang Chen (Purdue University, USA)
Modeling and Circuit Analysis of Interconnects with TaS_2 Barrier/Liner

PS1.G: Koichi Tamura (Research Institute of Electrical Communication, Tohoku University, Japan)
Fast terahertz detection by asymmetric dual-grating-gate graphene FET

PS1.H: Jiaxuan Wen (University of Minnesota, USA)
Optimized Graphene Varactors with Q > 18 at 18 GHz

PS1.I: Jaeyoung Jung (Massachusetts Institute of Technology, USA)
Performance Estimation of GaN CMOS Technology

PS1.J: David Brown (BAE Systems Inc, USA)
140 nm GaN HEMT Technology for High Efficiency, Broadband mm-wave Power Amplification

PS1.K: Cui Peng (University of Delaware, USA)
HZO/InAlN/GaN MIS-HEMT on Silicon with SS of 60 mV/dec and f_T/f_{max} of 115/200 GHz

PS1.L: Yao-Luen Shen (Institute of Electronics Engineering, National Tsing Hua University, Taiwan, ROC)
Investigation on Forward Biased Gate Robustness of p-GaN HEMTs with an Indium-Tin-Oxide Gate Electrode

PS1.M: Nicholas C. Miller (Air Force Research Laboratory Sensors Directorate, USA)
Pulsed Gate Simulations of Trapping Effects in GaN HEMTs using Fermi Kinetics Transport

PS1.N: Subhajit Mohanty (University of Michigan, USA)
A systematic study of interfacial property of HfO_2 gate dielectric on N-polar GaN

PS1.O: Ashwin Tunga (University of Illinois at Urbana-Champaign, USA)
Modeling-based design and benchmarking of Al-rich AlGaN 3D nanosheet MOSFET and MOSHEMTs for RF Applications

PS1.P: Yao-Luen Shen (Institute of Electronics Engineering, National Tsing Hua University, Taiwan, ROC)
Fabrication of Light-Emitting AlGaN/GaN High Electron Mobility Transistors with a Single Quantum Well Inserted

PS1.Q: Xinyi Xia (University of Florida, USA)
Operation Up to 600K of Vertical β-Ga_2O_3 Schottky Rectifier With 754V Reverse Breakdown Voltage

PS1.R: Mohamad Ghulam Moinuddin (Indian Institute of Technology Mandi, India)
(LATE NEWS) Reduced Switching Current Density and Improved Interface Quality using Oxynitride Tunnel Barrier in Magnetic Tunnel Junctions for MRAM Application

PS1.S: Shun-ichiro Ohmi (Tokyo Institute of Technology, Japan)
(LATE NEWS) Ferroelectric Nondoped HfO_2 Blocking Layer Formation for Hf-based FeNOS Analog Memory Applications

Tuesday Morning

Tuesday DRC Plenary Session Chair: Gregg Jessen (BAE Systems, USA)	
08:00AM—09:00AM	**Nicky Lu (Etron Technology, Inc. and Invention & Collaboration Lab., Taiwan, ROC)** **Plenary P3:** Optimizing Monolithic and Heterogeneous Integration to Create Intelligent-Grand-Scale-Integration for Smart MicroSystems
10-min Coffee Break	

DRC Session 4 – Sensors, Optoelectronics, and Integration Chair: Cezar Zota (IBM Research – Zurich, Switzerland)	
09:10AM—09:50AM	**Veena Misra (North Carolina State University, USA)** **Invited 4A:** Self-Powered Wearable Sensors for Pervasive Health and Environmental Monitoring
09:50AM—10:10AM	**Zane A. Jamal-Eddine (The Ohio State University, USA)** **4B:** Tunnel Junction-Enabled High-Efficiency Multi-Active Region III-Nitride Light Emitting Diodes
10:10AM—10:30AM	**Ayush Pandey (University of Michigan, Ann Arbor, USA)** **4C:** Short-wavelength AlGaN Tunnel Junction Light Emitting Diodes
10:30AM—10:50AM	**Rasha H. El-Jaroudi (University of Texas at Austin, USA)** **4D:** Reducing III-V avalanche photodiode noise through the introduction of boron
10:50AM—11:30AM	**Subramanian S Iyer (University of California, Los Angeles, USA)** **Invited 4E:** Heterogeneous Integration, Advanced Packaging, Dielets and Chiplets - why the hype?
40-min Lunch Break	

Tuesday Afternoon

DRC Session 5 – Quantum and Spintronic Devices Chair: Tony Low (University of Minnesota, USA)	
12:10PM—12:50PM	**Louis Hutin (CEA-LETI, France)** **Invited 5A:** MOS technology for quantum computing: recent progress and perspectives for scaling up
12:50PM—13:10PM	**Yi Han (Peter Grünberg Institute (PGI 9) and JARA-FIT, Forschungszentrum Jülich GmbH, Germany)** **5B:** Characterization of UTBB MOSFETs for Cryogenic Quantum Computing Application
13:10PM—13:30PM	**Denis R. Candido (University of Iowa, USA)** **5C:** Opportunities for long-range magnon-mediated entanglement of spin qubits
13:30PM—13:50PM	**Mahshid Alamdar (University of Texas at Austin, USA)** **5D:** Optimized Spin Orbit Torque Magnetic Tunnel Junction Devices and Circuits for In-Memory and Neuromorphic Computing
10-min Coffee Break	

Tuesday Afternoon, *Continued*

DRC Session 6 – Power Devices Chair: Hans-Joachim Würfl (Ferdinand Braun Institut, Germany)	
14:00PM—14:20PM	**Oliver Hilt (Ferdinand Braun Institut, Germany)** **6A:** GaN-channel HEMTs with AlN buffer for high-voltage switching
14:20PM—14:40PM	**Mohammad Wahidur Rahman (The Ohio State University, USA)** **6B:** Demonstration of kV-class $BaTiO_3$/AlGaN/GaN Transistors with > 3 MV/cm Average Breakdown Field
14:40PM—15:00PM	**Dolar Khachariya (North Carolina State University, USA)** **6C:** $Al_{0.85}Ga_{0.15}N/Al_{0.6}Ga_{0.4}N$ High Electron Mobility Transistors on Native AlN Substrates with >9 MV/cm Mesa Breakdown Fields
15:00PM—15:40PM	**Srabanti Chowdhury (Stanford University, USA)** **Invited 6D:** Integration of Polycrystalline diamond on top of GaN and Ga_2O_3 devices for thermal management
15:40PM—16:00PM	**Atsushi Shimbori (University of Texas at Austin, USA)** **6E:** Design and fabrication of low pinch-off voltage 700V lateral 4H-SiC MESFET with thin RESURF layer
10-min Coffee Break	

DRC Session 7 – RF/Terahertz Devices Chair: Andrew Carter (Teledyne Scientific & Imaging, USA)	
16:10PM—16:30PM	**Austin L Hickman (Cornell University, USA)** **7A:** Large Signal Response of AlN/GaN/AlN HEMTs at 30 GHz
16:30PM—16:50PM	**Wenjian Liu (University of California, Santa Barbara, USA)** **7B:** Ru/N-polar GaN Schottky-HEMT with 27% PAE and 4.87 W/mm at 94 GHz
16:50PM—17:10PM	**Reet Chaudhuri (Cornell University, USA)** **7C:** E-Mode AlN/GaN/AlN MOS-HFETs with 3 nm GaN Quantum Well Channels
17:10PM—17:30PM	**Joshua A Perozek (Massachusetts Institute of Technology, USA)** **7D:** Small-Signal, High Frequency Performance of Vertial GaN FinFETs with f_{max}=5.9 GHz
17:30PM—17:50PM	**Brian D. Markman (University of California Santa Barbara, USA)** **7E:** L_g = 40nm Composite Channel MOS-HEMT Exhibiting f_τ = 420 GHz, f_{max} = 562 GHz
40-min Dinner Break	

Tuesday Evening

DRC Rump Session	
18:300PM—20:00PM	***The Future of Ferroelectric Device Technologies*** Organizers **Sukwon Choi (The Pennsylvania State University, USA)** **Shaloo Rakheja (University of Illinois at Urbana-Champaign, USA)** **Huili (Grace) Xing (Cornell University, USA)** Panelists **Carlos H. Diaz (Taiwan Semiconductor Manufacturing Company, Limited (TSMC))** **Susan Trolier-McKinstry (The Pennsylvania State University, USA)** **Sayeef Salahuddin (University of California, Berkeley, USA)** **Peide Ye (Purdue University, USA)**

Wednesday Morning

Electronic Materials Conference (EMC) Plenary Session**	
09:00AM	**Electronic Materials Conference Opening Session**
09:15AM—10:15AM	**David D. Awschalom (The University of Chicago, USA)** **EMC Plenary:** Abandoning Perfection for Quantum Technologies
15-min Coffee Break	

****Throughout the day on Wednesday, DRC registrants may attend EMC sessions free of charge. The EMC program can be found at www.mrs.org/63rd-emc**

DRC Session 8 – Thin Film Devices Chair: Tuo-Hung (Alex) Hou (National Yang Ming Chiao Tung University, Taiwan, ROC)	
10:30AM—10:50AM	**Mengwei Si (Purdue University, USA)** **8A:** High-Performance Atomic-Layer-Deposited In_2O_3 Transistors with EOT Scaling down to 0.86 nm: Achieving I_{ON} of 1.2 A/mm at V_{GS}-V_T=1V and V_{DS}=1 V and g_m of 1.5 S/mm at V_{DS}=1 V
10:50AM—11:10AM	**Tonglin Lu (University of Michigan, USA)** **8B:** Steep Subthreshold Swing ALD ZTO TFTs with in situ Gate Insulator
11:10AM—11:50AM	**Thomas Anthopolous (King Abdullah University of Science and Technology (KAUST), Saudi Arabia)** **Invited 8C:** Large-area nanoelectronics manufactured at a flash
11:50AM—12:10PM	**Kelly Liang (University of Texas at Austin, USA)** **8D:** Field-Emission Enhanced Contacts for Disordered Semiconductor based Thin-Film Transistors
40-min Lunch Break	

Wednesday Afternoon

DRC Session 9 – Wide Bandgap Devices II Chair: Michael Goldflam (Sandia National Laboratories, USA)	
12:50PM—13:30PM	**Martin Kuball (University of Bristol, United Kingdom)** **Invited 9A:** Thermal modeling for wide bandgap devices
13:30PM—13:50PM	**Aditya Raj (University of California Santa Barbara, USA)** **9B:** GaN/AlGaN superlattice based E-mode p-channel MES-FinFET
13:50PM—14:10PM	**Reet Chaudhuri (Cornell University, USA)** **9C:** GHz-speed GaN/AlN p-channel MIS-HFETs with I_{max} of 0.5 A/mm
14:10PM—14:50PM	**Mina Rais-Zadeh (NASA Jet Propulsion Laboratory, USA)** **Invited 9D:** III-Nitride acousto-electric microsystems for extreme space environments
10-min Coffee Break	

DRC Poster Session 2	
15:00PM—17:00PM	**DRC Poster Session 2**

PS2.A: Zehao Lin (Purdue University, USA)
Ferroelectric Field-effect Transistors by Atomic-Layer-Deposited Hafnium Zirconium Oxide and Indium Oxide as Gate Insulator and Channel Semiconductor

PS2.B: Boce Lin (Georgia Institute of Technology, USA)
Experimental RF Characterization of Ferroelectric Hafnium Zirconium Oxide Material at GHz for Microwave Applications

PS2.C: Keerthana Shajil Nair (Helmholtz Zentrum Berlin, Germany)
Process dependent ferroelectric switching in Metal-Ferroelectric-Dielectric-Metal FTJ stack

PS2.D: Saketh Ram Mamidala (Lund University, Sweden)
Controlling Filament Stability in Scaled Oxides (3 nm) for High Endurance (>106) Low Voltage ITO/HfO_2 RRAMs for Future 3D Integration

PS2.E: Keren Stern (Technion, Israel)
Sub-Nanosecond Partial Reset for Analog Phase Change Neuromorphic Devices

PS2.F: Daniel S Schneider (AMO GmbH, Germany)
MoS_2/graphene Lateral Heterostructure Field Effect Transistors

PS2.G: Shayan Parhizkar (AMO GmbH, RWTH Aachen University, Germany)
Waveguide-Integrated Photodetectors based on 2D Platinum Diselenide

PS2.H: Agata Piacentini (AMO GmbH, Germany)
Low Hysteresis MoS_2-FET Enabled by CVD-Grown h-BN Encapsulation

PS2.I: Sourish Banerjee (Helmholtz-Zentrum Berlin (HZB), Germany)
Amorphous ALD-grown GaO_x TFT for BEOL integration

PS2.J: Jie Zhang (University of Delaware, USA)
Crystallinity engineering of stoichiometric TiO_2: transition from insulator to semiconductor

PS2.K: Neel Chatterjee (University of Minnesota, Twin Cities, USA)
Mobility Boost in Transparent Oxide Semiconductors with High-κ Gated TFTs

PS2.L: Dong Yang (Forschungszentrum Jülich GmbH, Germany)
Enhanced Performance of Ultra-Scaled Vertical SiC Gate-All-Around Nanowire 1.2 kV Power MOSFET

PS2.M: Ankit Shukla (University of Illinois at Urbana-Champaign, USA)
Terahertz auto oscillations in non-collinear coplanar metallic antiferromagnets

PS2.N: Suyogya Karki (Univeristy of Texas Austin, USA)
Spin-Dependent Electron Transport in Scandium Nitride Magnetic Tunnel Junction Devices Using First Principles

PS2.O: Karam Cho (Purdue University, USA)
Exchange-Coupling-Enabled Electrical-Isolation of Compute and Programming Paths in Valley-Spin Hall Effect based Spintronic Device for Neuromorphic Applications

PS2.P: Kaikai Liu (University of California, Santa Barbara, USA)
(LATE NEWS) 720 Million Quality Factor Integrated All-Waveguide Photonic Resonator

PS2.Q: Ying-Chen Daphne Chen (Northern Arizona University, USA)
(LATE NEWS) Self-Rectified Memristor with Bimodal Functionality and Forming Polarity Responses in Crossbar Array Applications