

# 2024 Radiation Damage of Electronics Review

Dr. Kenneth Goretta | October 23-25, 2024 | Albuquerque, NM -hybrid

University of New Mexico, The Rotunda, 801 University Blvd, SE, Park North 1st Floor-East,  
Albuquerque, NM 87106

## Agenda Day 1 | Wednesday, October 23, 2024

Time	Topic	Speaker
8:15-9:00	Check in and test Zoom link	
9:00-9:10	Opening remarks	Art Edwards and Michael Yakes, AFRL
9:10-9:30	Space Vehicles Directorate and radiation-damage research	Jesse Mee, AFRL/RV
9:30-10:00	Overview of Center of Excellence	Ron Schrimpf, Vanderbilt U
10:00-10:30	Overview of MURI project	Rongming Chu, Penn State U
10:30-11:00	BREAK	
Theory session: Renee van Ginhoven, AFRL/RD, chair		
11:00-11:35	Radiation-induced crystalline defects and threshold defect formation and properties in GaN/AlN/AlGaIn by molecular dynamics	Mia Jin and Blair Tuttle, Penn State U
11:35-12:00	Local defect properties and their signatures in electrical probes of GaN defect spin dynamics	Michael Flatte, U Iowa
12:00-1:00	LUNCH	
1:00-1:25	Defect processes enabled by radiation-induced excess electron-hole pairs – A comparative study of Ga <sub>2</sub> O <sub>3</sub> , GaN, and SiC	Sok Pantelides, Vanderbilt U
1:25-1:50	Fundamental studies of radiation damage mechanisms in wide-band-gap semiconductors	Chris Van de Walle, UCSB
1:50-2:25	Thermalization of radiation-induced carriers in insulators and wide bandgap semiconductors	Max Fischetti/Dallin Nielsen, U Texas at Dallas
2:25-3:50	Poster session	
3:50-5:10	Panel 1: Modeling and Simulation	Art Edwards, AFRL/RV, moderator
5:10	MEETING ADJOURN	

Agenda Day 2   Thursday, October 24, 2024		
Time	Topic	Speaker
8:15-8:30	Check in and test Zoom link	
8:30-8:35	Opening remarks	Ken Goretta, AFRL/AFOSR
Defects session: Tadj Asel, AFRL/RX, chair		
8:35-9:00	Mechanisms of cavity formation in GaN devices induced by swift heavy ion irradiation	Xing Wang, Penn State U
9:00-9:25	Near-zero-field magnetization spectroscopy and electrically detected magnetic resonance studies of GaN devices	Pat Lenahan, Penn State U
9:25-9:50	Impact of proton and x-ray irradiation on trap behavior in Ga <sub>2</sub> O <sub>3</sub> materials and devices and the influence of electric fields using defect spectroscopies	Steve Ringel, Ohio State U
9:50-10:20	BREAK	
10:20-10:45	Impact of radiation-induced defects on WBG/UWBG transistors	Aaron Arehart, Ohio State U
10:45-11:45	Panel 2: Single-Event Burnout	Art Edwards, AFRL/RV, moderator
11:45-12:45	LUNCH	
Irradiation studies session: Shin Mou, AFRL/RX, chair		
12:45-1:10	Threshold voltage hysteresis and gate leakage in AlGa <sub>N</sub> /GaN HEMTs	Dan Fleetwood, Vanderbilt U
1:10-1:45	Responses of wide bandgap semiconductors to swift heavy ion irradiation: single-ion and broad-beam experiments	Maik Lang, U Tennessee Knoxville; Adam Neal, AFRL/RX
1:45-2:05	Impact of heavy ion irradiation on GaN devices	Jianan Song, PSU
2:05-2:30	Probing defect evolution in GaN under heavy ion irradiation: insights from advanced diffraction techniques	Reeja Jayan, CMU
2:30-4:00	Poster session	
4:00-5:10	Panel 3: What next?	Michael Yakes, AFOSR, moderator
5:10	MEETING ADJOURN	

Agenda Day 3   Friday, October 25, 2024		
Time	Topic	Speaker
8:15-8:30	Check in and test Zoom link	
8:30-8:35	Opening remarks	Michael Yakes, AFRL/AFOSR
8:35-9:00	Analyzing radiation induced defects in GaN MESFETs and JFETs with AC transconductance method	Tania Roy, Duke U
<b>Devices session:</b> Michael Yakes, AFRL/AFOSR chair		
9:00-9:25	Device design and testing	Rongming Chu, Penn State U
9:25-9:50	Development of High Al-content AlGaN vertical diodes for radiation studies	Jim Speck, UCSB
9:50-10:15	Heavy-Ion Induced Leakage Current in Power Devices	Enxia Zhang, U Central Florida
10:15-11:30	Parallel meetings: Advisory Board; CoE team and colleagues; MURI team and colleagues	
11:30	Feedback and closing remarks	Art Edwards, Michael Yakes, and Ken Goretta
ca 12:00	<b>MEETING ADJOURN</b>	

#### POSTER SESSION LIST

	Title	Presenter
1	Multiscale approach for charged point defects in Bulk and Slab SiC, SiO <sub>2</sub> , and GaN	Renee van Ginhoven, AFRL/RD
2	Intrinsic and extrinsic defects in AlN and AlGaN	Art Edwards, AFRL/RV
3	Alloying and doping effects on radiation hardening properties of wide gap semiconductors and scintillator crystals	Arnold Burger of Fisk University
4	Heterogeneous integration of GaN-HEMTs for RF applications	Mona Ebrish of Vanderbilt University
5	Extreme permittivity for electric field management: overcoming SEEs in wide bandgap space power electronics	Shin Mou of AFRL/Materials and Manufacturing
6	Beyond shielding: toward intrinsic and extrinsic radiation resistance in polymer-based hybrid materials for space environments	Larry Drummy of AFRL/Materials and Manufacturing
7	2D material-polymer multilayers for simultaneous IR-RF detection	Jarrett Vella of AFRL/Sensors
8	Model for ultrafast carrier scattering in semiconductors	Danhong Huang of AFRL/RV
9	Exploring AlGaN defects with molecular dynamics	Farshid Reza, Penn State

10	First-principles calculations of nonradiative carrier capture rates for defect complexes in AlGa <sub>N</sub> systems	Alex Hauck, Penn State
11	Mechanisms of cavity formation in GaN devices induced by swift heavy ion irradiation	Mahjabin Mahfuz, Penn State
12	Investigating the Impact of Radiation on AlGa <sub>N</sub> with Varying Aluminum Composition Using High-Resolution X-Ray Diffraction	TBD, CMU
13	High Resolution X-Ray Diffraction Analysis of Proton Irradiated GaN	TBD, CMU
14	GaN device test structures	Yuxin Du, Penn State
15	Heavy Ion Irradiation Experiments	TBD, Penn State
16	AC-Gm method to identify defects in GaN	TBD, Duke U
17	1/f noise in GaN MESFETs and JFETs	TBD, Duke U
18	Design and Operation of an In Situ NZFMR Spectrometer for Utilization at the Sandia Ion Beam Lab	Ashton Higgins, Penn State
19	Studies of Multiple Types of GaN and SiC Devices with NZFMR and EDMR	Dustin Hassenmayer, Penn State
20	Hyperfine coupling of native defects in wurzite GaN from hybrid ab initio/real-space propagator simulations	Joe Sink, U Iowa
21	The effect of multiple cell upsets on the probability of error correcting codes failures	Stefania Esquer, Vanderbilt U
22	Role of epitaxial layer thickness in single-event burnout of Ga <sub>2</sub> O <sub>3</sub> Schottky diodes	Sajal Islam, Vanderbilt U
23	Molecular dynamics for silicon single-event displacement damage	Grant Mayberry, Vanderbilt U
24	Development of high Al-content AlGa <sub>N</sub> vertical diodes for radiation studies	Ashley Wissel and Griffin Tong, UCSB
25	Research and Education for Enhancing Reliability and Performance of GaN Devices	Enxia Zhang, U Central Florida
26	Enabling High-Speed Characterization of Radiation Effects in Electronic-Photonic Integrated Circuits	James Trippe and Robert Reed, Vanderbilt U
27	Dielectric Engineering for Radiation-Tolerant WBG and UWBG Electronics Siddharth Rajan	Ohio State U
28	The SCALE Workforce Development Program in Radiation Hardened Microelectronics Brian Sierawski	Vanderbilt U
29	Radiation Effects on Gallium Oxide MOSFETs	Ricky Cadena, Vanderbilt