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University of California Santa Barbara, Santa Barbara, CA 93106, USA
- IV-A.-2 **Vertical GaN Power FET on Bulk GaN Substrate**
8:40 AM Min Sun¹, Ming Pan², Xiang Gao² and Tomás Palacios¹ ¹ Microsystems Technology Laboratories, Massachusetts Institute of Technology, Cambridge, Massachusetts, USA; ² IQE RF LLC, Somerset, New Jersey, USA
- IV-A.-3 **Demonstration of Thin-Film GaN Schottky Diodes Fabricated with Epitaxial Lift-Off**
9:00 AM J. Wang¹, C. Youtsey², R. McCarthy², R. Reddy², L. Guido³, A. Xie⁴, E. Beam⁴, and P. Fay¹ ¹Univ. of Notre Dame, 275 Fitzpatrick Hall, Notre Dame, IN 46556, USA; ²MicroLink Devices, 6457 W. Howard St, Niles, IL 60714, USA; ³Virginia Tech, 302 Whittemore, Blacksburg, VA 24061, USA; ⁴Qorvo, 500 W. Renner Rd., Richardson, TX 75080, USA
- IV-A.-4 **Drain-offset ZnO Thin Film Transistors for High Voltage Operations**
9:20 AM Yiyang Gong^{1,2} and Thomas N. Jackson¹ Center for Thin Film Devices and Materials Research
Institute, ¹Department of Electrical Engineering, ²Department of Physics, Penn State University. University Park, PA 16802, USA
- IV-A.-5 **Late News**
9:20 AM

Session IV-B. ATOMICALLY THIN DEVICES I

- IV-B.-1
8:20 AM **Two-Dimensional Materials for Electronic, Photonic, Spintronic and Sensing Applications**
Steven J. Koester University of Minnesota, 200 Union St. SE, Minneapolis, MN 55455, USA
- IV-B.-2
9:00 AM **Vertical Ambipolar Barrier Transistor Based on Black Phosphorous-Tin Selenide Van der Waals Heterojunction**
He Tian^{1*}, Cheng Li², Bingchen Deng², Fengnian Xia² and Han Wang¹ ¹Ming Hsieh Department of Electrical Engineering, University of Southern California, Los Angeles, CA 90089; ²Department of Electrical Engineering, Yale University, New Haven, Connecticut 06511
- IV-B.-3
9:20 AM **Fermi Level Tunability of A Novel 2D Crystal: Tin Diselenide (SnSe₂)**
Mingda (Oscar) Li¹, Shudong Xiao¹, Rusen Yan¹, Suresh Vishwanath¹, Susan Fullerton-Shirey², Debdeep Jena¹, Huili Grace Xing¹ ¹Cornell University, NY 14850, USA; ²University of Pittsburgh, PA 15213, USA
- IV-B.-4
9:40 AM **Atomically-Thin HfSe₂ Transistors with Native Metal Oxides**
Michal J. Mleczko¹, Chaofan Zhang², Hye Ryoung Lee^{1,3}, Hsueh-Hui Kuo³, Blanka Magyari-Köpe¹, Zhi-Xun Shen^{2,4,5}, Robert G. Moore⁵, Ian R. Fisher⁴, Yoshio Nishi¹, and Eric Pop^{1,*} ¹Dept. of Electrical Engineering, ²Dept. of Physics, ³Dept. of Materials Science & Engineering, ⁴Dept. of Applied Physics, Stanford University, Stanford, CA 94305, USA

Session V-A. PHOTONIC DEVICES

- V-A.-1
10:30 AM **Aluminum-free Nitride Laser Diodes grown by plasma-assisted MBE**
C. Skierbiszewski^{1,2}, G. Muziol¹, H. Turski¹ and M. Siewak^{1,2} ¹Institute of High Pressure Physics, Sokolowska 29/37, 01-142 Warsaw, Poland; ²TopGaN Ltd, Sokolowska 29/37, 01-142 Warsaw, Poland
- V-A.-2
11:10 AM **The Zener-Emitter: Electron Injection by Direct-Tunneling in Ge LEDs for the on-chip Si Light Source**
R. Koerner¹, M. Oehme¹, K. Kosteki¹, I. A. Fischer¹, E. Rolseth¹, S. Bechler¹, M. Yorgidis¹, A. Blech¹, O. Latzl¹, and J. Schulze¹ ¹Institute for Semiconductor Engineering, University of Stuttgart, Pfaffenwaldring 47, Stuttgart, 70569 Germany
- V-A.-3
11:30 AM **Creating Wide Band Gap LEDs Without P-doping**
Sapan Agarwal, Jeramy R. Dickerson, Jeffrey Y. Tsao Sandia National Laboratories, PO BOX 5800 MS 1084, Albuquerque, NM 87185-1084, USA
- V-A.-4
11:50 AM **Low-Noise High-Gain Tunneling Staircase Photodetector**
Scott J. Maddox¹, Min Ren², Ann Kathryn Rockwell¹, Yaojia Chen², Madison Woodson², Joe C. Campbell², and Seth R. Bank^{1*} ¹Microelectronics Research Center, University of Texas at Austin, Austin, TX, 78758, USA ²Electrical and Computer Engineering Department, University of Virginia, Charlottesville, VA 22904
- V-A.5
12:10 PM **Flexible Graphene-/a-Si:H Multispectral Photodetectors**
Daniel S. Schneider, Andreas Bablich and Max C. Lemme University of Siegen, School of Science and Technology, Hölderlinstr. 3, Siegen, 57076, Germany

Session V-B. ATOMICALLY THIN DEVICES II

- V-B.-1
10:30 AM **Towards Wafer Scale Monolayer MoS₂ based Flexible Low-Power RF electronics for IoT systems**
Maruthi Yogeesh, Hsiao-Yu Chang, Wei Li, Somayyeh Rahimi, Amrithesh Rai, Atresh Sanne, Rudresh Ghosh, Sanjay K Banerjee, Deji Akinwande
Microelectronics Research Center, The University of Texas at Austin, Austin, TX, USA
- V-B.-2
10:50 AM **Using Ar ion beam exposure to improve contact resistance in MoS₂ FETs**
Zhihui Cheng¹, Jorge A. Cardenas¹, Felicia McGuire¹, and Aaron D. Franklin^{1,2} ¹Duke University, Department of Electrical & Computer Engineering, Durham, NC 27708, USA; ²Duke University, Department of Chemistry, Durham, NC 27708, USA
- V-B.-3
11:10 AM **Demonstration of electric double layer p-i-n junction in WSe₂**
Sara Fathipour¹, Paolo Paletti¹, Susan Fullerton-Shirey², and Alan Seabaugh¹ ¹Department of Electrical Engineering, University of Notre Dame, Notre Dame, IN 46556, USA; ²Department of Chemical and Petroleum Engineering, University of Pittsburgh, Pittsburgh, PA 15213, USA

- V-B.-4 **Room Temperature Gate-tunable Negative Differential Resistance in MoS₂/hBN/WSe₂ Heterostructures**
 11:30 AM Hema C. P. Movva¹, Sangwoo Kang¹, Amrithesh Rai¹, Kyoungwan Kim¹, Babak Fallahazad¹, Takashi Taniguchi², Kenji Watanabe², Emanuel Tutuc¹, and Sanjay K. Banerjee¹ ¹Microelectronics Research Center, The University of Texas at Austin, Austin, TX 78758, USA; ²National Institute of Materials Science, 1-1 Namiki, Tsukuba, 305-044, Japan
- V-B.-5 **Late News**
 11:50 PM
- V-B.-6 **Late News**
 12:10 PM

Session VI-A. TERAHERTZ PHOTONIC AND ELECTRONIC DEVICES

- VI-A.-1 **Progress of THz Quantum Cascade Lasers using Nitride Semiconductors**
 1:50 PM H. Hirayama^{1,2}, W. Terashima^{1,2}, S. Toyoda^{1,3} and N. Kamata³ ¹RIKEN, 2-1 Hirosawa Wako Saitama 351-0198, Japan; ²RIKEN Center for Advanced Photonics (RAP), 519-1399 Aoba Aramaki, Sendai, Miyagi 980-0845, Japan ³Saitama University, 255 Shimo-Okubo, Sakura-ku, Saitama 338-8570, Japan
- V1-A.-2 **THz Pulse Detection by Photoconductive Plasmonic High Electron Mobility Transistor with Enhanced Sensitivity**
 2:30 PM M. Shur¹, A. Muraviev¹, G. Rupper², and S. Rudin² ¹Rensselaer Polytechnic Institute, Troy, New York, USA; ²U.S. Army Research Laboratory, Adelphi, Maryland, USA
- VI-A.-3 **Plasmonic 1x200 Array Scanner based on 65-nm CMOS Asymmetric FETs for Real-Time Terahertz**
 2:50 PM Min Woo Ryu, Sang Hyo Ahn, Jong-Ryul Yang¹, Woo-Jae Lee¹, Seong-Tae Han¹, and Kyung Rok Kim*
 School of ECE, UNIST, Ulsan 44919, Korea, KERI¹
- VI-A.-4 **Single-Mode Terahertz Emission from Current-Injection Graphene-Channel Transistor under Population Inversion**
 3:10 PM Gen Tamamushi¹, Takayuki Watanabe¹, Alexander A. Dubinov², Junki Mitsushio¹, Hiroyuki Wako¹, Akira Satou¹, Tetsuya Suemitsu¹, Hirokazu Fukidome¹, Maki Suemitsu¹, Maxim Ryzhii³, Victor Ryzhii^{1,4} and Taiichi Otsuji¹
¹ Research Institute of Electrical Communication, Tohoku University, Sendai, Miyagi 980-8577, Japan; ² Institute for Physics of Microstructures, RAS, Lobachevsky State University of Nizhny Novgorod, Nizhny Novgorod 603950, Russia; ³ Department of Computer Science and Engineering, University of Aizu, Aizu-Wakamatsu, Fukushima 965-8580, Japan; ⁴ Institute of Ultra-High-Frequency Semiconductor Electronics, Moscow 117105, Russia

Session VI-B. NEW CHARGE AND SPIN MEMORY DEVICES I

- VI-B.-1 **Vertical band-to-band tunneling based Non-Volatile Memory with high-K gate stack and stable hysteresis characteristics up to 400K**
 1:50 PM Arnab Biswas, Saurabh Tomar, Adrian M. Ionescu Nanolab, École Polytechnique Fédérale de Lausanne (EPFL), CH, -1015, Lausanne, Switzerland
- VI-B.-2 **Electrically Controlled Switching of Antiferromagnets via Proximity Interaction Induced by Topological Insulator**
 2:10 PM Xi-Lai Li, Xiaopeng Duan, Yuriy G. Semenov and Ki Wook Kim Department of Electrical and Computer Engineering, North Carolina State University, Raleigh, NC 27695, USA
- VI-B.-3 **Magnetoelectric Device Feasibility Demonstration - Voltage Control of Exchange Bias in Perpendicular Cr₂O₃ Hall Bar Device**
 2:30 PM Zhengyang Zhao¹, Will Echtenkamp², Mike Street², Christian Binek^{2*} and Jian-Ping Wang^{1*} ¹Department of Electrical and Computer Engineering, University of Minnesota, Minneapolis, MN 55455; ²Department of Physics & Astronomy and the Nebraska Center for Materials and Nanoscience, University of Nebraska, Lincoln, NE 68588
- VI-B.-4 **Topological Spintronics: Measuring & Manipulating Spins using Helical Dirac Fermions**
 2:50 PM Nitin Samarth Dept. of Physics, Penn State University, 104 Davey Lab, University Park PA 16802 USA

Session VII-A. EMERGING DEVICES

- VII-A.-1
3:50 PM **Building quantum logic circuits using arrays of superconducting qubits**
Jared B. Hertzberg¹, Antonio D. Córcoles¹, Maika Takita¹, Nicholas T. Bronn¹, Easwar Magesan¹, Markus Brink¹, Sarah Sheldon¹, Jay M. Gambetta¹, and Jerry M. Chow¹ ¹IBM T.J. Watson Research Center, 1101 Kitchawan Rd, Yorktown Heights NY 10598
- VII-A.-2
4:30 PM **Device modeling challenges in the realm of overlapping physical scales: from atomistic to continuum, from coherent to diffusive transport**
R. Kotlyar¹, V. Degtyarov², A. Slepko¹, A. P. Kaushik¹, J. R. Weber¹, and S. M. Cea¹ ¹Intel Corporation, TCAD, 2501 NW 229th Ave, Hillsboro, OR 97124, USA; ²Intel Corporation, CDG, Turgeneva Str. 30, Nizhny Novgorod, NIZ 603024, Russian Federation
- VII-A.-3
5:10 PM **Phase Transition Oxide Neuron for Spiking Neural Networks**
Matthew Jerry¹, Wei-yu Tsai², Baihua Xie², Xueqing Li², Vijay Narayanan², Arijit Raychowdhury³, and Suman Datta¹ ¹University of Notre Dame, 275 Fitzpatrick Hall, Notre Dame, IN 46556, USA; ²Pennsylvania State University, 342 Information Sciences and Tech. Building, University Park, PA 16802, USA; ³Georgia Institute of Technology, North Avenue, Atlanta, GA 30332, USA
- VII-A.-4
5:30 PM **GaSb-based Photon Counting Gamma-ray Detectors**
Bor-Chau Juang¹, David L. Prout³, Baolai Liang², Arion F. Chatziioannou³ and Diana L. Huffaker^{1,2} ¹Department of Electrical Engineering, University of California, 420 Westwood Plaza, Los Angeles, California 90095, USA; ²California NanoSystems Institute, 570 Westwood Plaza, Los Angeles, California 90095, USA; ³Department of Molecular and Medical Pharmacology, Crump Institute for Molecular Imaging, University of California, 570 Westwood Plaza, Los Angeles, California 90095, USA
- VII-A.-5
5:50 PM **Late News**

Session VII-B. NEW CHARGE AND SPIN MEMORY DEVICES II

- VII-B.-1
3:50 PM **Nanoelectronic Neurocomputing: Status and Prospects**
L. Ceze,¹ J. Hasler,² K. K. Likharev,³ J.-s. Seo,⁴ T. Sherwood,⁵ D. Strukov^{5*}, Y. Xie,⁵ and S. Yu⁴ ¹University of Washington, Seattle WA 98195-2350, U.S.A.; ²Georgia Institute of Technology, Atlanta GA 30332-0250, U.S.A.; ³Stony Brook University, Stony Brook, NY 11794-3800, U.S.A.; ⁴Arizona State University, Tempe, AZ 85281-9309, U.S.A.; ⁵UC Santa Barbara, Santa Barbara, CA 93106-9560, U.S.A.
- VII-B.-2
4:30 PM **A Novel One Transistor Resistance-Gate Nonvolatile Memory**
Steve S. Chung, E. R. Hsieh, S. P. Yang, and C. H. Chuang Department of Electronics Engineering & Institute of Electronics, National Chiao Tung University, Taiwan
- VII-B.-3
4:50 PM **Electrical Pump-Probe Characterization Technique for Phase Change Materials**
Faruk Dirisaglik^{1,2}, Gokhan Bakan¹, Sadid Muneer¹, Nicholas Williams¹, Mustafa Akbulut¹, Helena Silva¹, Ali Gokirmak¹ ¹University of Connecticut, Storrs, CT, 06269, USA; ²Eskisehir Osmangazi University, Eskisehir, 26480, Eskisehir, Turkey
- VII-B.-4
5:10 PM **Physics-based Switching Model for Cu/SiO₂/W Quantum Memristor**
S. R. Nandakumar¹ and Bipin Rajendran¹ ¹Department of Electrical and Computer Engineering, New Jersey Institute of Technology, Newark, NJ 07102, USA
- VII-B.-5
5:30 PM **Late News**
- VII-B.-6
5:50 PM **Late News**

RUMP SESSIONS

R.1 **TFETs, NcFETs, HyperFETs, SpinFETs, or MOSFETs Forever?**
8:15 PM Session Moderators: Sayeef Salahuddin (UC-Berkeley), Avik Ghosh (UVA)

R.2 **Plasmonics / Metamaterials: Where are the Devices?**
8:15 PM Session Moderators: Berardi Sensale-Rodriguez (Utah)

JOINT DRC/EMC PLENARY SESSION

8:20 AM **STUDENT AWARDS**

8:30 AM **Mixed Dimensional Nanoelectronic Heterostructures**
Mark C. Hersam Department of Materials Science and Engineering, Northwestern University, Evanston, Illinois, United States

Session VIII. FRONTIERS IN PHOTONIC DEVICES

VIII.-1 **Recent Developments in Mid-Infrared Quantum Cascade Lasers and Applications**
10:00 AM Claire Gmachl Dept. of Electrical Engineering & MIRTHE, Princeton University, Princeton, NJ08544, USA

VIII.-2 **Challenges and breakthroughs in the development of AlGaIn-based UVC lasers**
10:40 AM R. Kirste², B. Sarkar¹, F. Kaess¹, I. Bryan¹, Z. Bryan¹, J. Tweedie², R. Collazo¹, Z. Sitar^{1,2} ¹North Carolina State University, Material Science and Engineering Department, Raleigh 27695, NC, USA; ²Adroit Materials, Inc., 991 Aviation Pkwy, Suite 800, Morrisville, NC 27560, USA

VIII.-3 **Finding the Proper Place for Photons in the World full of Electrons and their Spins**
11:20 AM Jacob B Khurgin Johns Hopkins University Baltimore MD 21218 USA

58th Electronic Materials Conference Afternoon Sessions

Session F.- NITRIDE NANOWIRE MATERIALS AND DEVICES

F1 **Selective Area Growth of GaN Nanocolumns on Graphene/SiO₂ with Thin GaN/AlN Buffer Layer**
1:30 PM Yuta Konno¹ and Katsumi Kishino^{1, 2}; ¹Sophia University, Tokyo, Japan; ²Sophia Nanotechnology Research Center, Tokyo, Japan.

F2 **Polarity in AlN Nucleation Layers and GaN Nanowires**
1:50 PM Alexana Roshko, Matthew D. Brubaker, Paul Blanchard, Todd Harvey and Kristine Bertness; National Institute of Standards and Technology, Boulder, Colorado, United States.

F3 **Mechanical Resonance and Damping Properties of Gallium Nitride Nanowires in Selected-Area Growth Arrays Measured via Optical Bragg Scattering**
2:10 PM John P. Houlton¹, Matthew D. Brubaker², Kristine Bertness² and Charles Rogers¹; ¹Physics, University of Colorado Boulder, Boulder, Colorado, United States; ²NIST, Boulder, Colorado, United States.

F4 **Controlled Top-Down Fabrication of GaN Nanostructures**
2:30 PM Benjamin Leung¹, Miao-Chan Tsai², Ganesh Balakrishnan², Changyi Li², Steven R. Brueck², Jeffrey J. Figiel¹, Ping Lu¹, Andrew Allerman¹, Mary H. Crawford¹ and George T. Wang¹; ¹Sandia National Laboratories, Albuquerque, New Mexico, United States; ²Center for High Technology Materials, University of New Mexico, Albuquerque, New Mexico, United States.

- F5**
2:50 PM **(Student) Effect of Growth Temperature and Mask Geometry on Morphology and Photoluminescence of GaN/InGaN Core-Shell Nanowires**
Mohsen Nami³, Rhett F. Eller³, Serdal Okur¹, Ashwin K. Rishinaramangalam¹, Sheng Liu², Igal Brener² and Daniel F. Feezell¹; ¹Electrical and Computer Engineering, University of New Mexico, Albuquerque, New Mexico, United States; ²Center for Integrated Nanotechnologies, Sandia National Laboratories, Albuquerque, New Mexico, United States; ³Physics, University of New Mexico, Albuquerque, New Mexico, United States
- F6**
3:30 PM **III-Nitride Nanowire Lasers: Fabrication and Control of Optical Properties**
George T. Wang¹, Changyi Li², Sheng Liu¹, Jeremy B. Wright¹, Benjamin Leung¹, Huiwen Xu², Qiming Li¹, Daniel D. Koleske¹, Jeffrey J. Figiel¹, Ganapathi Subramania¹, Ting S. Luk¹, Igal Brener¹, Ganesh Balakrishnan² and Steven R. Brueck²; ¹Sandia National Laboratories, Albuquerque, New Mexico, United States; ²Center for High Technology Materials, University of New Mexico, Albuquerque, New Mexico, United States.
- F7**
3:50 PM **Semipolar (10-11) GaN-Based Core-Shell Nanostructure LEDs on c-Plane Sapphire Using Selective-Area MOCVD**
Ashwin K. Rishinaramangalam¹, Michael N. Fairchild¹, Mohsen Nami², Olivia R. Johnson¹, Darryl M. Shima¹, Ganesh Balakrishnan¹, Steven R. Brueck¹ and Daniel F. Feezell¹; ¹Electrical and Computer Engineering, Center for High Technology Materials, University of New Mexico, Albuquerque, New Mexico, United States; ²Physics and Astronomy, Center for High Technology Materials, University of New Mexico, Albuquerque, New Mexico, United States.
- F8**
4:10 PM **(Student) Monolithically Integrated GaN/Al/GaN Tunnel Junction Nanowire Visible and Deep UV Light Emitting Diodes**
Sharif M. Sadaf, Yong-Ho Ra, Songrui Zhao and Zetian Mi; Electrical and Computer Engineering, McGill University, Montreal, Quebec, Canada.
- F9**
4:30 PM **(Student) Integration of Ultraviolet Nanowire LEDs Directly on Flexible Metal Foil—A Route toward Scalable Photonics**
Brelon J. May¹, ATM Golam Sarwar² and Roberto C. Myers^{1,2}; ¹Materials Science and Engineering, Ohio State University, Columbus, Ohio, United States; ²Electrical and Computer Engineering, The Ohio State University, Columbus, Ohio, United States.
- F10**
4:50 PM **(Student) AlN/BN Nanowire Heterostructures for High Efficiency Deep Ultraviolet Photonics**
David A. Laleyan, Songrui Zhao, Huy B. Le, Hong N. Tran and Zetian Mi; Electrical and Computer Engineering, McGill University, Pierrefonds, Quebec, Canada.

Session G: GALLIUM OXIDE—EPITAXY, MATERIALS AND DEVICES

- G1**
1:30 PM **Characterization of the (010), (-201), and (100) Surfaces of Edge-Defined Film Fed (EFF) Grown β -Ga₂O₃**
Marko Tadjer, Nadeem Mahadik, Jaime Freitas, Rachael Myers-Ward, Karl Hobart, Charles R. Eddy and Fritz Kub; Naval Research Laboratories, Washington, District of Columbia, United States.
- G2**
1:50 PM **Homoepitaxial Growth of Semiconducting β -Ga₂O₃ Films by Metal Organic Vapor Phase Epitaxy**
Guenter Wagner, Michele Baldini, Andreas Fiedler, Klaus Irmischer, Robert Schewski, Martin Albrecht and Zbigniew Galazka; Leibniz-Institute for Crystal Growth, Berlin, Germany.
- G3**
2:10 PM **Distilled Ozone Based Molecular Beam Epitaxy of β -Ga₂O₃ Thin Films on c-Plane Sapphire Substrate**
Amit Verma¹, Darrell G. Schlom² and Debdeep Jena^{1,2}; ¹School of Electrical and Computer Engineering, Cornell University, Ithaca, New York, United States; ²Department of Materials Science and Engineering, Cornell University, Ithaca, New York, United States.
- G4**
2:30 PM **(Student) Characterization of Deep Level Defects in β -Ga₂O₃**
Esmat Farzana¹, Zeng Zhang¹, Stephen Kaun², James S. Speck², Aaron R. Arehart¹ and Steven A. Ringel¹; ¹Electrical and Computer Engineering, Ohio State University, Columbus, Ohio, United States; ²Materials Department, University of California, Santa Barbara, Santa Barbara, California, United States.
- G5**
2:50 PM **Doping to Corundum-Structured α -Ga₂O₃ on Sapphire for Conductivity and Structure Control**
Shizuo Fujita, Kazuaki Akaiwa, Sam-Dong Lee and Kentaro Kaneko; PESEC, Graduate School of Engineering, Kyoto University, Kyoto, Japan.

- G6**
3:30 PM **Investigation of Mg-Ion-Implanted Ga₂O₃ as Current Blocking Layer in Vertical Ga₂O₃ Transistors**
Man Hoi Wong¹, Kohei Sasaki^{2,1}, Akito Kuramata², Shigenobu Yamakoshi² and Masataka Higashiwaki¹; ¹National Institute of Information and Communications Technology, Koganei, Tokyo, Japan; ²Tamura Corporation, Sayama, Japan.
- G7**
3:50 PM **Modeling of the Two-Dimensional Electron Gas at the β-Ga₂O₃ / Sn-Doped β-(Al_xGa_{1-x})₂O₃ Interface**
Stefan C. Badescu¹, Darren B. Thomson¹, Stephen Kaun², Yuichi Oshima², Elaheh Ahmadi² and James S. Speck²; ¹Air Force Research Laboratory, Wright Patterson Air Force Base, Ohio, United States; ²University of California, Santa Barbara, California, United States.
- G8**
4:10 PM **(Student) Electrical Properties of (-201) β-Ga₂O₃ MOS Devices with LPCVD and ALD Gate Dielectrics**
Asanka U. Jayawardena¹, Ayayi C. Ahyi¹, Rahul Ramamurthy², Dallas Morisette² and Sarit Dhar¹; ¹Physics, Auburn University, Auburn, Alabama, United States; ²Electrical and Computer Engineering, Purdue University, West Lafayette, Indiana, United States.
- G9**
4:30 PM **Effects of Post-Deposition Anneal on SiO₂ Films on Ga₂O₃ (010)**
Keita Konishi¹, Takafumi Kamimura¹, Man Hoi Wong¹, Kohei Sasaki^{2,1}, Akito Kuramata², Shigenobu Yamakoshi² and Masataka Higashiwaki¹; ¹National Institute of Information and Communications Technology, Koganei, Japan; ²Tamura Corporation, Sayama, Japan.
- G10**
4:50 PM **(Student) Comparison of Surface Cleaning Techniques and Different Metals as Schottky Contacts to β-Ga₂O₃**
Yao Yao¹, Raveena Gangireddy¹, Jaewoo Kim¹, Tom Salagaj², Nick Sbrockey², Gary Tompa², Kalyan K. Das³, Robert Davis¹ and Lisa Porter¹; ¹Materials Science and Engineering, Carnegie Mellon University, Pittsburgh, Pennsylvania, United States; ²Structured Materials Industries, Inc., Piscataway, New Jersey, United States; ³JBP Materials, Morrisville, North Carolina, United States.
- G11**
5:10 PM **(Student) Comparison of Different Metals as Ohmic Contacts to β-Ga₂O₃**
Yao Yao, Johanne A. Rokholt, Raveena Gangireddy, Jaewoo Kim, Robert F. Davis and Lisa M. Porter; Materials Science and Engineering, Carnegie Mellon University, Pittsburgh, Pennsylvania, United States.

Session H: NOVEL NITRIDES

- H1**
1:30 PM **Single-Phase Wurtzite BAIN with 7.2%-B Contents Grown by MOCVD**
Xiaohang Li^{2,1}, Shou Wang³, Hanxiao Liu³, Fernando Ponce³, Theeradetch Detchprohm² and Russell Dupuis²; ¹King Abdullah University of Science and Technology, Thuwal, Saudi Arabia; ²Georgia Institute of Technology, Atlanta, Georgia, United States; ³Arizona State University, Tempe, Arizona, United States.
- H2**
1:50 PM **(Student) Study of Impact Excitation Processes in Boron Nitride for Deep Ultra-Violet Electroluminescence Photonic Devices**
Thushan Wickramasinghe and Wojciech Jadwisieniczak; Electrical Engineering and Computer Science, Ohio University, Athens, Ohio, United States.
- H3**
2:10 PM **Growth and Characterization of Epitaxial ScAlN on N-polar GaN by Plasma-Assisted Molecular Beam Epitaxy**
Matthew T. Hardy¹, Neeraj Nepal², Brian P. Downey¹, David F. Storm¹, Douglas S. Katzer¹ and David J. Meyer¹; ¹Electronic Science and Technology Division, Naval Research Laboratory, Washington, District of Columbia, United States; ²Sotera Defense Solutions, Herndon, Virginia, United States.
- H4**
2:30 PM **Molecular Beam Epitaxial Growth of III-N Materials on Epitaxial Metallic β-Nb₂N Thin Films**
Douglas S. Katzer¹, Neeraj Nepal², David J. Meyer¹, Brian P. Downey¹, Virginia Wheeler³, David F. Storm¹ and Matthew T. Hardy⁴; ¹US Naval Research Laboratories, Washington, District of Columbia, United States; ²Sotera Defense Solutions, Herndon, Virginia, United States; ³US Naval Research Laboratory, Washington, District of Columbia, United States; ⁴Post-Doctoral Fellow Residing, National Research Council, Washington, District of Columbia, United States.
- H5**
2:50 PM **(LATE NEWS) Stimulated Emission of Al_{0.72}Ga_{0.28}N-Based GRINSCH Structures Grown by MBE Emitting at 257 nm**
Haiding Sun^{1,2}, Emanuele F. Pecora¹, Luca D. Negro¹ and Theodore D. Moustakas¹; ¹Electrical and Computer Engineering Department, Boston University, Boston, Massachusetts, United States; ²Computer, Electrical, and Mathematical Sciences and Engineering Division, King Abdullah University of Science and Technology, Thuwal, Saudi Arabia.

Session I: SILICON PHOTOVOLTAICS

- I1**
3:30 PM **(Student) Silicon Nanopyramid Solar Cells Using Aluminum as a Growth Catalyst and a Dopant**
Mel F. Hainey¹, Chen Chen¹, Alyssa Brigeman², Marcie Black³ and Joan M. Redwing¹; ¹Materials Science and Engineering, The Pennsylvania State University, University Park, Pennsylvania, United States; ²Electrical Engineering, The Pennsylvania State University, University Park, Pennsylvania, United States; ³Advanced Silicon Group, Lincoln, Massachusetts, United States.
- I2**
3:50 PM **(Student) Comparing Interface Defect Density vs Material Interface Charge for Gap Passivation of Inter-Digitated Back Contact Silicon Heterojunction Solar Cells**
Lei Zhang^{1,2}, Ujjwal Das², Robert Birkmire^{3,2} and Steven Hegedus^{1,2}; ¹Electrical and Computer Engineering, University of Delaware, Newark, Delaware, United States; ²Institute of Energy Conversion, University of Delaware, Newark, Delaware, United States; ³Physics and Astronomy, University of Delaware, Newark, Delaware, United States.
- I3**
4:10 PM **(Student) Si Surface Passivation by H₂S Reaction for c-Si Solar Cell**
Hsiang-Yu Liu^{1,2}, Ujjwal Das¹, Steven Hegedus¹, Zachary Voras³, Thomas P. Beebe³ and Robert Birkmire^{1,2,4}; ¹Institute of Energy Conversion, University of Delaware, Newark, Delaware, United States; ²Department of Materials Science and Engineering, University of Delaware, Newark, Delaware, United States; ³Department of Chemistry and Biochemistry, University of Delaware, Newark, Delaware, United States; ⁴Department of Physics and Astronomy, University of Delaware, Newark, Delaware, United States.
- I4**
4:30 PM **(LATE NEWS) Thermal Stability of Annealed Germanium-Tin Alloys Grown by Molecular Beam Epitaxy**
Nupur Bhargava¹, Jay Gupta¹, Nikolai Faleev², Leszek Wielunski³ and James Kolodzey¹; ¹Department of Electrical and Computer Engineering, University of Delaware, Newark, Delaware, United States; ²School of Electrical, Computer, and Energy Engineering, Ira A. Fulton Schools of Engineering, Solar Power Laboratory, Arizona State University, Tempe, Arizona, United States; ³Department of Physics and Astronomy, Rutgers University, Piscataway, New Jersey, United States.

Session J: NARROW BANDGAP MATERIALS AND DEVICES

- J1**
1:30 PM **Low Loss Reconfigurable RF Circuits Enabled by Low Resistivity Phase Change Materials**
Matthew King^{1,2}, Nabil El-Hinnawy^{1,3}, Brian Wagner¹, Evan Jones¹, Andy Ezis¹, Pavel Borodulin^{1,4}, Colin Furrow¹, Carlos Padilla¹, Michael Lee¹, Doyle Nichols¹, Elizabeth Dickey², Jon-Paul Maria² and Robert M. Young¹; ¹Northrop Grumman, Linthicum, Maryland, United States; ²Materials Science and Engineering, North Carolina State University, Raleigh, North Carolina, United States; ³Electrical and Computer Engineering, Carnegie Mellon University, Pittsburgh, Pennsylvania, United States; ⁴Electrical and Computer Engineering, Johns Hopkins University, Baltimore, Maryland, United States.
- J2**
1:50 PM **Pre-Metallization Surface Treatment of Germanium Telluride**
Hamed Simchi, Haila M. Aldosari and Suzanne E. Mohney; Materials Science & Engineering, Penn State University, State college, Pennsylvania, United States.
- J3**
2:10 PM **(Student) Thermal Stability of Low-Resistance Ohmic Contacts to Germanium Telluride**
Haila M. Aldosari, Hamed Simchi, Kayla Cooley, Zelong Ding, Shih-ying Yu and Suzanne E. Mohney; Pennsylvania State University, University Park, Pennsylvania, United States
- J4**
2:30 PM **(Student) Transmission Electron Microscopy Based Characterization of InAlSb Metamorphic Buffer Grown on GaSb Substrates**
Sadhvikas J. Addamane, Darryl M. Shima and Ganesh Balakrishnan; Center for High Technology Materials, University of New Mexico, Albuquerque, New Mexico, United States.
- J5**
2:50 PM **(Student) Two-Step Etching for Release and Transfer of Type II Superlattice Membranes**
Marziyeh Zamiri, Brianna Klein, Shima Nezhadbadeh, Francesca Cavallo and Sanjay Krishna; Electrical and Computer Engineering, University of New Mexico, Albuquerque, New Mexico, United States.
- J6**
3:30 PM **Investigation of Crystalline Quality of Lattice-Matched Low-Temperature-Grown InGaAs to InP Substrate**
Yoriko Tominaga, Shingo Hirose, Kentaro Hirayama and Yutaka Kadoya; Graduate School of Advanced Sciences of Matter, Hiroshima University, Higashihiroshima, Japan.

- J7**
3:50 PM **Power- and Temperature-Dependent Optical Characterization of MOVPE-Grown GaAs_xBi_{1-x} Using Time-Resolved Photoluminescence Techniques**
Mark Peterson¹, Z. R. Lingley¹, Y L. Sin¹, S C. Moss¹, H Kim², Yingxin Guan², K Forghani², Luke Mawst² and T F. Keuch²; ¹Microelectronics Technology Department, The Aerospace Corporation, El Segundo, California, United States; ²University of Wisconsin, Madison, Madison, Wisconsin, United States.
- J8**
4:10 PM **Capacitance Analysis of Band Offsets and Interface Trap Densities in GaAsBi/GaAs and AlInAsSb/GaSb Heterostructures**
Laura Treider and Michael Scarpulla; Electrical Engineering, University of Utah, Ogden, Utah, United States.
- J9**
4:30 PM **The Influence of Excess Carrier Chemical Potential on Defect Formation in Semiconductors**
Michael Scarpulla¹ and Kirstin Alberi²; ¹Materials Science and Engineering, University of Utah, Salt Lake City, Utah, United States; ²National Renewable Energy Laboratory, Golden, Colorado, United States.

Session K: 2D DEVICES AND CHARACTERIZATION

- K1**
1:30 PM **High Current Density p-MoS₂/n-GaN Inter-Band 2D/3D Tunnel Junctions**
Sriram Krishnamoorthy¹, Edwin Lee¹, Choong Hee Lee¹, William McCulloch², Yuewei Zhang¹, Jared Johnson³, Lu Ma², Jinwoo Hwang³, Yiyong Wu² and Siddharth Rajan^{1,3}; ¹Electrical and Computer Engineering, Ohio State University, Columbus, Ohio, United States; ²Department of Chemistry and Biochemistry, Ohio State University, Columbus, Ohio, United States; ³Department of Material Science and Engineering, Ohio State University, Columbus, Ohio, United States.
- K2**
1:50 PM **(Student) Layered 2H-MoS₂/GaN Hot Electron Transistor**
Edwin W. Lee¹, William D. McCulloch², Choong Hee Lee¹, Sriram Krishnamoorthy¹, Yiyong Wu² and Siddharth Rajan^{1,3}; ¹Electrical and Computer Engineering, Ohio State University, Columbus, Ohio, United States; ²Chemistry and Biochemistry, Ohio State University, Columbus, Ohio, United States; ³Materials Science and Engineering, The Ohio State University, Columbus, Ohio, United States.
- K3**
2:10 PM **(Student) Thin Film Transistors Using Continuous WSe₂ Films**
Yiyang Gong, Xiaotian Zhang, Joan Redwing and Thomas N. Jackson; Pennsylvania State University, University Park, Pennsylvania, United States.
- K4**
2:30 PM **(Student) Contact Induced Spin Relaxation in Graphene Spin Valves with Al₂O₃ and MgO Tunnel Barriers**
Walid Amamou¹, Zhisheng Lin¹, Jeremiah van Baren¹, Serol Turkyilmaz¹, Jing Shi¹ and Roland Kawakami²; ¹Physics, University of California, Riverside, Columbus, Ohio, United States; ²Ohio State University, Columbus, Ohio, United States.
- K5**
2:50 PM **(Student) Large Area, Single-Crystal, Multilayer MoS₂ Photodetectors with Effective Photoresponsivity of 505 AW⁻¹**
Edwin W. Lee¹, ATM Golam Sarwar², William D. McCulloch³, Yiyong Wu³, Roberto C. Myers² and Siddharth Rajan¹; ¹Electrical and Computer Engineering, Ohio State University, Columbus, Ohio, United States; ²Materials Science and Engineering, Ohio State University, Columbus, Ohio, United States; ³Chemistry and Biochemistry, Ohio State University, Columbus, Ohio, United States.
- K6**
3:30 PM **Self-Heating and Failure of Chip-Scale Graphene Devices**
Thomas Beechem, Ryan Shaffer, John Nogan, Taisuke Ohta, Allister Hamilton, Anthony McDonald and Stephen Howell; Sandia National Laboratory, Albuquerque, New Mexico, United States
- K7**
3:50 PM **(Student) Two-Dimensional Wide-Bandgap β -G₂O₃ Field-Effect Transistors**
Janghyuk Kim and Jihyun Kim; Korea University, Seoul, Korea (the Republic of).
- K8**
4:10 PM **(Student) Investigation of the Variation in Transport Characterization of Identically Prepared Graphene Hall Devices**
Kenneth S. Stephenson¹, Ifat Jahangir², Shawn Draper¹ and MVS Chandrashekar²; ¹Physics and Astronomy, University of South Carolina, Evans, Georgia, United States; ²Electrical Engineering, University of South Carolina, Columbia, South Carolina, United States.
- K9**
4:30 PM **(Student) Ultrafast Charge Carrier Dynamics in Correlated Electron Phases of Cu_xTiSe₂**
David B. Lioi¹, Richard D. Schaller², Gary P. Wiederrecht² and Goran Karapetrov¹; ¹Physics Department, Drexel University, Philadelphia, Pennsylvania, United States; ²Center for Nanoscale Materials, Argonne National Laboratory, Argonne, Illinois, United States.

Session L: 2D DEVICES AND CHARACTERIZATION

- *L1**
1:30 PM **Engineered Materials for Memristor Mate**
Zhongrui Wang, Saamil Joshi and Jianhua J. Yang; The Department of Electrical and Computer Engineering, University of Massachusetts, Amherst, Massachusetts, United States.
- L2**
2:10 PM **Application of Focused Ion Beam Irradiations to Create Electroforming-Free TaOx Memristors**
Jose L. Pacheco¹, David R. Hughart², Edward S. Bielejec¹, Paul G. Kotula³ and Matthew Marinella^{2,1}; ¹Radiation-Solid Interactions, Sandia National Laboratories, Albuquerque, New Mexico, United States; ²Rad Hard CMOS Technology, Sandia National Laboratories, Albuquerque, New Mexico, United States; ³Materials Characterization and Performance, SNL, Albuquerque, New Mexico, United States.
- L3**
2:30 PM **(LATE NEWS) Single Crystalline SrZr0.7Ti0.3O3 on Ge—Evidence for Ferroelectric Behavior**
J. Moghadam¹, Z.Y. Xiao², Kamyar Ahmadi-Majlan¹, E. Grimley³, J.M. Lebeau³ and Joseph Ngai¹; ¹Department of Physics, University of Texas at Arlington, Arlington, Texas, United States; ²Department of Physics, University of Nebraska, Lincoln, Lincoln, Nebraska, United States; ³Department of Materials Science and Engineering, North Carolina State University, Raleigh, North Carolina, United States.
- L4**
2:50 PM **Tunable Stark-Shifted Photoluminescence in Nd³⁺-Doped GaN Heterostructures**
Blair C. Connelly, Ryan W. Enck, Vladimir S. Malinovsky, Grace D. Metcalfe, Sergey Rudin, Michael Wraback and Meredith L. Reed; Sensors and Electron Devices Directorate, US Army Research Laboratories, Adelphi, Maryland, United States.
- *L5**
3:30 PM **Negative Capacitance Transistors**
Sayeef Salahuddin; Electrical Engineering and Computer Sciences, University of California, Berkeley, Berkeley, California, United States.
- L6**
4:10 PM **(Student) Insights into Structural Changes that Underlie Wake-Up and Fatigue Phenomena in Ferroelectric Doped HfO₂ Thin Films**
Everett D. Grimley¹, Tony Schenk², Xiahan Sang¹, Milan Pesic², Uwe Schroeder² and James M. LeBeau¹; ¹Materials Science and Engineering, North Carolina State University, Raleigh, North Carolina, United States; ²NaMLab g GmbH/TU Dresden, Dresden, Germany.
- L7**
4:30 PM **(Student) Electrical Characterization of Novel Canted Antiferromagnetic BaFe₄O₇ Crystal Synthesized by Hydroflux**
Mohammad Mirwazul Islam¹, Timothy E. Ferreira², Harry J. Ploehn³, Hans-Conrad z. Loye² and MVS Chandrashekhar¹; ¹Department of Electrical Engineering, University of South Carolina, West Columbia, South Carolina, United States; ²Department of Chemistry and Biochemistry, University of South Carolina, Columbia, South Carolina, United States; ³Department of Chemical Engineering, University of South Carolina, Columbia, South Carolina, United States.
- L8**
4:50 PM **(Student) Synthesis of Multi-Functional Lithium Niobite (LiNbO₂)**
Joshua Shank, Marshall B. Tellekamp and W. A. Doolittle; Electrical and Computer Engineering, Georgia Institute of Technology, Atlanta, Georgia, United States.

Session M: ORGANIC TRANSISTORS

- M1**
1:30 PM **(Student) Performance Evaluation of Blending Polymer Semiconductors for Stretchable Organic Field-Effect Transistors**
Tianlei Sun, Joshua Scott and Brendan O'Connor; Mechanical and Aerospace Engineering, North Carolina State University, Raleigh, North Carolina, United States.
- M2**
1:50 PM **Non-Linear Organic Field-Effect Transistor Characteristics Resulting from the Interplay between Material Mobility and Contact Resistance**
Emily G. Bittle¹, Hyun Wook Ro², Chad R. Snyder², Oana D. Jurchescu³, Dean M. DeLongchamp² and David J. Gundlach¹; ¹Engineering Physics Division, National Institute of Standards and Technology, Gaithersburg, Maryland, United States; ²Materials Science and Engineering Division, National Institute of Standards and Technology, Gaithersburg, Maryland, United States; ³Department of Physics, Wake Forest University, Winston-Salem, North Carolina, United States.

- M3**
2:10 PM **Fabrication and Properties of Field Effect Transistors from Poly(3-hexylthiophene) Colloidal Dispersions**
Bin Tan; Plastics Engineering Department, University of Massachusetts Lowell, LOWELL, Massachusetts, United States.
- M4**
2:30 PM **(Student) Highly Stable Organic Field-Effect Transistors with Bilayer Gate Dielectrics Comprised of a Perfluorinated Polymer and a Metal-Oxide Nanolaminate**
Cheng-Yin Wang¹, Canek Fuentes-Hernandez¹, Minseong Yun¹, Ankit Singh², Amir Dindar¹, Sangmoo Choi¹, Samuel Graham² and Bernard Kippelen¹; ¹Electrical and Computer Engineering, Georgia Institute of Technology, Atlanta, Georgia, United States; ²Woodruff School of Mechanical Engineering, Georgia Institute of Technology, Atlanta, Georgia, United States.
- M5**
2:50 PM **(Student) Charge Transport above and below Threshold in High-Mobility Polymer Field-Effect Transistors**
Seohee Kim¹, Tae-Jun Ha², Prashant Sonar³ and Ananth Dodabalapur¹; ¹Electrical & Computer Engineering, The University of Texas at Austin, Austin, Texas, United States; ²Department of Electronic Materials Engineering, Kwangwoon University, Seoul, Korea (the Republic of); ³School of Chemistry, Physics and Mechanical Engineering, Queensland University of Technology, Brisbane, Queensland, Australia.

Session N: ORGANIC OPTOELECTRONIC MATERIALS AND DEVICES

- N1**
PM **Infrared-to-Visible Up-Conversion Light-Emitting Photo-Transistor with an External Photon-to-Photon Conversion Efficiency over 1,000 %** 3:30
Hyeonggeun Yu and Franky So; Materials Science and Engineering, North Carolina State University, Raleigh, North Carolina, United States.
- N2**
3:50 PM **(Student) Origin of Sub-Bandgap Electroluminescence in Organic Light Emitting Diodes**
Cheng Peng^{1,2}, Chaoyu Xiang², Ying Chen¹ and Franky So¹; ¹Materials Science of Engineering, North Carolina State University, Raleigh, North Carolina, United States; ²Materials Science and Engineering, University of Florida, Gainesville, Florida, United States.
- N3**
4:10 PM **Organic Exciton Interactions with Plasmonic Metasurface Electrodes for Energy Efficiency and Energy Harvesting Applications**
Deirdre O'Carroll^{1,2}; ¹Materials Science and Engineering, Rutgers University, Piscataway, New Jersey, United States; ²Chemistry and Chemical Biology, Rutgers University, Piscataway, New Jersey, United States.
- N4**
4:30 PM **(Student) Mechanisms for Engineering Highly Anisotropic Conductivity in a Layered Covalent Organic Framework**
Dequan Er¹, Liang Dong¹ and Vivek B. Shenoy^{1,2,3}; ¹Department of Materials Science and Engineering, University of Pennsylvania, Philadelphia, Pennsylvania, United States; ²Department of Bioengineering, University of Pennsylvania, Philadelphia, Pennsylvania, United States; ³Department of Mechanical Engineering and Applied Mechanics, University of Pennsylvania, Philadelphia, Pennsylvania, United States.
- N5**
4:50 PM **(LATE NEWS) Low Voltage Flexible and Transparent Organic Transistor and Inverter Based on High-k Perovskite Dielectric**
Subhasis Ghosh and Sarita Yadav; School of Physical Sciences, Jawaharlal Nehru University, New Delhi, India