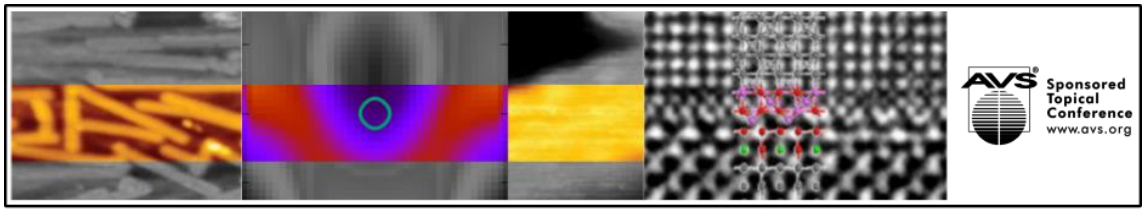
WINDS 2018
Workshop on Innovative Nanoscale Devices and Systems



November 25 – 30, 2018, The Westin Hapuna Beach Resort, Kohala Coast, Hawaii, USA

Sunday, November 25

15:00-18:00 Registration

18:00 Gala Reception

Monday, November 26

09:00 General Welcome, Stephen Goodnick and Josef Weinbub

Session 1 **The Hall Effect at 40**
Chair: David K. Ferry

09:15-10:00 Klaus von Klitzing, MPI für Festkörperphysik, Germany,
"Quantum Hall Effect and the New SI System: The Biggest Revolution in Metrology Since the French Revolution" (invited)

10:00-10:30 A. Seredlinski, A. Draelos, M.-T. Wei, L. Zhao, E. Arnault, C.-T. Ke, and Gleb Finkelstein, Duke University, USA, T. Fleming, Y. Mehta, E. Mancil, H. Li, and F. Amet, Appalachian State University, USA, T. Taniguchi and K. Watanabe, NIMS, Japan, S. Tarucha and M. Yamamoto, University of Tokyo and RIKEN, Japan, and I. Borzenets, City University of Hong Kong, Hong Kong,
"Superconductivity in the Quantum Hall Regime" (invited)

10:30-11:00 Coffee Break

Session 2 **Spintronics**
Chair: Tomoki Machida

11:00-11:30 Eiji Saitoh, JST, University of Tokyo, Tohoku University, JAEA, Japan,
"Various Spin Current Phenomena in Condensed Matter" (invited)

11:30-11:45 Alexander Khitun, University of California - Riverside, USA,
"Spin Wave Devices: Progress Update"

11:45-12:00 Viktor Sverdlov and S. Selberherr, TU Wien, Austria,
"Shot Noise Enhancement at Spin-Dependent Hopping"

12:00-12:30 Patrick M. Lenahan, Pennsylvania State University, USA,
"Electrically Detected Magnetic Resonance in SiC Metal-Oxide-Semiconductor Field Effect Transistors" (invited)

12:30- Lunch and ad hoc sessions

Session 3 Nanoscale and High Frequency Devices
Chair: Robert Wolkow

19:00-19:30 Akira Fujiwara, NTT, Japan,
"Ultimate Electronics with Silicon Nanowire MOSFETs" (invited)

19:30-19:45 Asen Asenov, T. Al-Ameri, and V. Gerorgiev, University of Glasgow, UK,
"Performance Evaluation of Multi-Channel
Silicon Nanowire Transistors"

19:45-20:00 Denis Mamaluy and X. Gao, Sandia National Laboratories, USA,
"Fully-Coupled Electronic-Ionic and Thermal Transport Simulation of Metal Oxide Memristors"

20:00-20:15 Maarten L. Van de Put, M. V. Fischetti, and W. G. Vandenberghe,
University of Texas at Dallas, USA,
"Quantum Transport Modeling Using a Bloch Basis Expansion"

20:15-20:30 M. Mensi, R. Ivanov, and Saulius Marcinkevičius, KTH Royal Institute of Technology, Sweden, K. M. Kelchner, S. P. DenBaars, S. Nakamura, and J. S. Speck, University of California Santa Barbara, USA,
"Nanoscale Mapping of Carrier Diffusion:
Application for InGaN Quantum Wells"

20:30-20:45 G. P. Szakmany, A. O. Orlov, G. H. Bernstein, and Wolfgang Porod,
University of Notre Dame, USA,
"Suspended Antenna-Coupled Nanothermocouples for
Infrared Detection"

20:45-21:00 Kouichi Semba, NICT, Japan,
"Light-Matter Interaction 'Beyond' Strong-Coupling Regime in Superconducting Circuit Quantum Electrodynamics"

21:00-21:15 Goran Rasic, B. Vlahovic, and Y. Tang, North Carolina Central University, USA, "Controlling the Properties of Multiferroic Heterostructures via Nanoscale Topographic Design"

Tuesday, November 27

Session 4 **Oxides**
Chair: Berend T. Jonker

09:00-09:30 J. Wisser, L. Riddiford, M. Veit, P. Li, S. Emori, and Yuri Suzuki, Stanford University, USA, K. Mahalingam, B. Urwin, B. Howe, Air Force Research Laboratory, USA, O.van t'Erve, B.T. Jonker, Naval Research Laboratory, USA, C. Klewe, P. Shafer, A. N'Diaye, E. Arenholz, Lawrence Berkeley National Labroatory, USA, "A New Class of Low Loss Spinel Ferrite Films for Spin Current Based Applications" (invited)

09:30-09:45 Henning Riechert, P. Vogt, and O. Bierwagen, Paul-Drude-Institut für Festkörperelektronik, Germany, "Growth of Semiconducting Oxides – Challenges and Surprises"

09:45-10:00 M. A. Jenkins, J. M. McGlone, J. F. Wager, and John F. Conley, Jr., Oregon State University, USA, "Internal Photoemission Spectroscopy Measurements of Energy Barriers Between Amorphous Metal/Insulator Heterostructures"

10:00-10:30 Satoshi Iwamoto, T. Yamaguchi, Y. Ota, and Y. Arakawa, University of Tokyo, Japan, "Valley-Protected Edge State in Semiconductor Photonic Crystal Slab" (invited)

10:30-11:00 Coffee Break

Session 5 **Topological States I**
Chair: Matthew J. Gilbert

11:00-11:30 Detlev Grützmacher, P. Schüffelgen, D. Rosenbach, M. Gregor, T. Schaepers, J. Koelzer, T. Schmitt, and S. Schmitt, Forschungszentrum Jülich and RWTH Aachen University, Germany, C. Li and A. Brinkmann, University of Twente, Netherlands, "Signatures of Majorana Zero Mode in Scalable, In-Situ Fabricated $(Bi_xSb_{1-x})_2Te_3$/Nb Josephson Junctions" (invited)

11:30-11:45 Andrey E. Antipov, A. Bargerbos, G. W. Winkler, B. Bauer, E. Rossi, and R. M. Lutchyn, Microsoft Research, USA,
"Effects of Gate-Induced Electric Fields on Semiconductor Majorana Nanowires"

11:45-12:00 Y. Wang, G. B. Osterhoudt, and Kenneth S. Burch, Boston College, USA, Y. Tian, SICK Singapore, P. Lampen-Kelley and D. Mandrus, University of Tennessee, USA, A. Banerjee and S. Nagler, Oak Ridge National Laboratory, USA, T. Goldstein and J. Yan, University of Massachusetts Amherst, USA, J. Knolle, Imperial College London, UK, J. Nasu, Tokyo Institute of Technology, Japan, Y. Motome, University of Tokyo, Japan,
"High Temperature Majorana Fermions in $RuCl_3$"

12:00-12:15 Sergey Frolov, University of Pittsburgh, USA,
"Status of the Search for Majorana Fermions in Semiconductor Nanowires"

Session 6 **Biological Sensors**
Chair: Stephen Goodnick

12:15-12:30 Tetyana Ignatova, University of North Carolina at Greensboro, USA, S. V. Rotkin, Pennsylvania State University, USA, S. S. Jedlicka, Lehigh University, USA,
"Developing SWCNT Nano-Sensors for C17.2 Neural Stem Cells"

12:30-12:45 Kazuhiko Matsumoto, T. Kawata, K. Yamamoto, T. Ono, Y. Kanai, and K. Inoue, Osaka University, Japan,
"Sugar Chain Functionalized Graphene FET for Detection of Virus"

12:45- Lunch and ad hoc sessions

Session 7 **Solar Cells and Novel Devices**
Chair: Wolfgang Porod

19:00-19:30 H. Esmaeilpour, V. R. Whiteside, J. Tang, M. B. Santos, and Ian R. Sellers, University of Oklahoma, USA,
"Inhibited Hot Carrier Thermalization in Type-II Quantum Wells: A Practical Route to Hot Carrier Solar Cells" (invited)

19:30-19:45 David K. Ferry, Arizona State University, USA,
"In Search of a True Hot Carrier Solar Cell"

19:45-20:00 Stephen Goodnick, Y. Zou, and R. Hathwar, Arizona State University, USA,
"Ultrafast Relaxation Processes in Advanced Concept Solar Cell Structures"

20:00-20:15 M. Buchhold, California Institute of Technology, USA, S. Diehl and Alexander Altland, Universität zu Köln, Germany,
"Nodal Points in Weyl Semimetals Survive the Presence of Weak Disorder"

20:15-20:30 Dmitry Pikulin, Microsoft Research, USA,
"Quantum Oscillations in Inhomogeneous Weyl Semimetals"

20:30-20:45 Josef Weinbub, M. Ballicchia, and M. Nedjalkov, TU Wien, Austria,
"Electron Interference in a Double-Dopant Potential Structure"

20:45-21:00 *Mohammad* Al-Mamun, M. Altaf, A. Edrees, and Marius Orlowski, Virginia Tech, USA,
"Neuromorphic Semi-Organic Devices on Flexible Substrates"

Wednesday, November 28

Session 8 **Quantum Information Systems**
Chair: Victor I. Klimov

09:00-09:30 Andrew Sachrajda, National Research Council, Canada,
"Few-Hole Quantum Dots" (invited)

09:30-9:45 Robert Wolkow, University of Alberta and Quantum Silicon, Canada,
"Atomic Computational Elements Composed of Silicon Dangling Bonds"

9:45-10:00 A. Hida and Koji Ishibashi, RIKEN, Japan,
"Formation of Coupled Quantum Dots and Optically Operated Conditional Gates with Single Wall Carbon Nanotubes"

10:00-10:30 Mark A. Eriksson, University of Wisconsin - Madison, USA,
"Quantum Control of Silicon Quantum Dot Spin Qubits" (invited)

10:30-11:00 Coffee Break

11:00-11:15 Shiro Kawabata, AIST, Japan,
"Integration Technology for Scalable Superconducting Quantum Annealer"

11:15-11:30 Aruna N. Ramanayaka, K. Tang, J. A. Hagmann, H.-S. Kim, C. A. Richter, and J. M. Pomeroy, NIST, USA,
"Magnetotransport in Highly Enriched ^{28}Si for Quantum Information Processing Devices"

Session 9 **Van Der Waals 2D Materials I**
Chair: Koji Ishibashi

11:30-12:00 D. Yadav and A. Dubinov, Russian Academy of Sciences, Russia, S. Boubanga-Tombet, G. Tamamushi, T. Watanbe, A. Satou, V. Ryzhii, and Taiichi Otsuji, Tohoku University, Japan, M. Rizhii, University of Aizu, Japan, "Terahertz Current-Driven Plasmonic Lasing and Amplification" (invited)

12:00-12:30 Kosuke Nagashio, University of Tokyo, Japan, "Electrically Inert Interface in 2D Heterostructure FETs" (invited)

12:30-12:45 Slava V. Rotkin, Pennsylvania State University, USA, M. Blades, H. Wang, and X. Xu, Lehigh University, USA, H. Q. Ta and M. H. Rümmeli, Soochow University, China and Polish Academy of Sciences, Poland, "Near-Field Hyperspectral Imaging of Hybrid Plasmonics in Twisted Graphene"

12:45-13:00 Tomoki Machida, K. Kinoshita, Y. Wakafuji, M. Onodera, M. Arai, S. Masubuchi, and R. Moriya, University of Tokyo, Japan, K. Watanabe and T. Taniguchi, National Institute for Materials Science, Japan, "Cyclotron Resonance Absorption of Mid-Infrared Light in Graphene/h-BN van der Waals Heterostructures"

13:00-13:15 J. Kwon and David B. Janes, Purdue University, USA, S. Das, Kansas State University, USA, C. J. Delker, C. T. Harris, and B. Swartzentruber, Sandia National Laboratories, USA, "Mobility and 1/f Noise in MoS_2 and $MoSe_2$ Field-Effect Transistors – Understanding the Intrinsic Device"

13:15- Lunch and ad hoc sessions

18:00 Reception and Banquet

Thursday, November 29

Session 10 **Topological States II**
Chair: Henning Riechert

09:00-09:30 Joel E. Moore, University of California and Lawrence Berkeley National Laboratory, USA, "Novel Optical and Electrical Responses in Topological Materials" (invited)

09:30-09:45 M. Kayyalha, A. Kazakov, I. Miotkowski, S. Khlebnikov, Leonid P. Rokhinson, Y. P. Chen, Purdue University, USA, M. Kargarian, V. M. Galitski, and V. M. Yakovenko, University of Maryland, USA,
"Induced Superconductivity in Topological-Insulator $BiSbTeSe_2$ Nanoribbons"

09:45-10:00 Y. Kim, University of Illinois Urbana-Champaign, USA and Matthew J. Gilbert, Stanford University, USA,
"Impact of Thermal Fluctuations on Transport in Antiferromagnetic Topological Dirac Semimetals"

10:00-10:15 M. Hirsbrunner and T. M. Philip, University of Illinois at Urbana-Champaign, USA, and Matthew J. Gilbert, Stanford University, USA,
"Topology of the Non-Hermitian Chern Insulator"

10:15-10:30 Valeria Lauter, Oak Ridge National Laboratory, USA, F. Katmis an J. S. Moodera, Massachusetts Institute of Technology, USA, D. Heiman, Northeastern University, USA,
"High-Temperature Magnetic Order in Topological Insulator – Ferromagnetic Insulator Heterostructures"

10:30-11:00 Coffee Break

11:00-11:15 Tonica Valla, I. K. Drozdov, G. Gu, and I. Bozovic, Brookhaven National Laboratory, USA,
"Superconducting 'Glue' in Cuprates: Disappearance of Superconductivity Due to Diminishing Coupling in Overdoped $Bi_2Sr_2CaCu_2O_{8+\delta}$"

Session 11 Nanowires and Dots
Chair: David Janes

11:15-11:45 Daniel Vanmaekelbergh, M. Slot, T. Gardenier, S. Freeney, I. Swart, S. Kempkes, J. vand Broeke, and C. Morais Smith, University of Utrecht, Netherlands, and C. Delerue, IEMN, France,
"Honeycomb Semiconductors and Their Artificial Analogs" (invited)

11:45-12:00 A. Geremew and Alexander A. Balandin, University of California Riverside, USA, T. T. Salguero, University of Georgia, USA, S. Rumyantsev, Ioffe Physical-Technical Institute, Russia,
"Electron Transport in Quasi-1D $ZrTe_3$ van der Waals Nanoribbons: Extraordinary High Current Density and Unique Noise Characteristics"

12:00-12:15 Cody Hayashi, T. Yamauchi, Carlos Torres Jr., and R. Ordonez,
Space and Naval Warfare Systems Center Pacific, USA,
D. Buzzell and S. Das, Pennsylvania State University, USA,
"Tunneling-Assisted Relaxation in Hybrid Graphene
Quantum-Dot Photodetectors"

12:15-12:30 Heedae Kim, Northeast Normal University China and University of Oxford, UK,
J. Kim, Yeungnam University, Republic of Korea, and J. Song,
KIST, Republic of Korea,
"Optical Studies of Exciton/Biexciton States on a
Single Coupled Quantum Dot"

12:30-12:45 Y.-S. Park, J. Lim, and Victor I. Klimov, Los Alamos National Laboratory, USA,
"Asymmetrically Strained Quantum Dots with Ultrastable Single-Dot Emission
Spectra and Subthermal Room-Temperature Linewidths"

12:45- Lunch and ad hoc sessions

Session 12 **Posters**
19:00-21:00

P1 F. Kargar, E. Aytan, J. S. Lewis, and Alexander A. Balandin,
University of California Riverside, USA, E. H. Penilla and J. E. Garay,
University of California San Diego, USA,
"Acoustic Phonon Spectrum Engineering in Bulk Crystals via Incorporation of the
Size-Dissimilar Dopant Atoms"

P2 Gautam Gaddemane, M. L. Van de Put, and M. V. Fischetti,
University of Texas at Dallas, USA,
"Performance Analysis of a 10 nm Phosphorene
Double-Gate MOSFET"

P3 Jubin Nathawat, M. Zhao, C.-P. Kwan, H. Ramamoorthy, J. E. Han, and
J. P. Bird, State University of New York at Buffalo, USA,
G.-H. Kim, Chinese Academy of Sciences, China,
N. Matsumoto, M. Matsunaga, and N. Aoki, Chiba University, Japan,
K. Watanabe and T. Taniguchi, National Institute for Materials Science, Japan,
"Transient Investigation of Hot-Carrier Transport in BN-Encapsulated
Graphene FETs"

P4 Bilal Barut, E. Einarsson, J. M. Jornet, and J. P. Bird,
State University of New York at Buffalo, USA,
G. R. Aizin, Kingsborough Community College, USA, and T. Sugaya, AIST, Japan,
"Realizing Asymmetric Boundary Conditions for Plasmonic THz Wave Generation
in HEMTs"

P5 Seong Hyeok Jeon, Y. H. Chang, J. Seo, and M. Shin,
Korea Advanced Institute of Science and Technology, Republic of Korea,
"DFT Hamiltonian Based Simulation of GaSb UTB-FET with
Spin Orbit Coupling Effect"

P6 Yasuyuki Miyamoto, N. Kise, and R. Aonuma,
Tokyo Institute of Technology, Japan,
"GaAsSb/InGaAs Double Gate Tunnel FET Operating Below 60 mV/Decade and
Temperature Dependence of Band-Edge Decay Parameters"

P7 Michael D. Randle, A. Kumar, K. He, C.-P. Kwan, J. Nathawat, R. Dikxit, S. Yin,
N. Arabchigavkani, U. Singisetti, and J. P. Bird,
State University of New York at Buffalo, USA, A. Lipatov, P. A. Dowben, and
A. Sinitskii, University of Nebraska-Lincoln, USA,
"Electrical Characterization of Thin, Quasi-1D Titanium Trisulfide (TiS_3) Field
Effect Transistors"

P8 Z.-T. Ao, F. Shan, H.-S. Kim, H.-B. Guo, J.-Y. Lee, and Sung-Jin Kim,
Chungbuk National University, Republic of Korea,
"Solution Processed Indium Zinc Oxide Thin-Film Transistors with Nanoscale
Multi Stacking Channel Layer"

P9 F. Shan, Z.-T. Ao, H.-S. Kim, H.-B. Guo, J.-Y. Lee and Sung-Jin Kim,
Chungbuk National University, Republic of Korea,
"Enhanced Electrical Properties of TiO_2-Based Oxide Thin Film Transistor by a
Femtosecond Laser Irradiation"

P10 Futo Hashimoto and N. Mori, Osaka University, Japan,
"Impact of Lattice Matching Condition on the Simulation of Band-to-Band
Tunneling in MoS_2/Ge van der Waals Heterojunctions"

P11 Takaya Mishima, F. Hashimoto, and N. Mori, Osaka University, Japan,
"Modeling of Inter-Layer Tunneling Between Semiconductor
Nanoribbons"

P12 N. Nishizawa, T. Takahashi, and Hiro Munekata, Tokyo Institute of Technology,
Japan, T. Kuchimaru, Jichi Medical University, Japan,
"Preparation of a Phantom: A Step Toward Application of a Spin-LED for
Unstained and Non-Invasive Cancer Detection"

P13 Junbeom Seo, S. H. Jeon, and M. Shin,
Korea Advanced Institute of Science and Technology, Republic of Korea,
"A Variability Study of Ferroelectric Tunnel Junction"

P14 V. Sverdlov, A. Makarov, and Siegfried Selberherr, TU Wien, Austria,
"Fast, Reliable and Field-Free Perpendicular Magnetization Reversal in Advanced Spin-Orbit Torque MRAM by Two-Pulse Switching"

P15 Zhu Diao, K. Yang, and D. G. Cahill,
University of Illinois at Urbana-Champaign, USA,
"Magnetic Anisotropy of $KNiF_3$ Single Crystals Investigated by Torque Magnetometry"

P16 Shintaro Makihira and N. Mori, Osaka University, Japan,
"Zero-Eigenvalue Method for Solving the Barker-Ferry Equation in One-Dimensional Systems"

Friday, November 30

Session 13 **Van Der Waals 2D Materials II**
Chair: John F. Conley, Jr.

08:30-09:00 Christopher L. Hinkle, University of Notre Dame, USA,
"Low-Temperature Growth for 3D Integration of 2D Materials"
(invited)

09:00-09:15 Curt A. Richter, S. T. Le, and A. Balijepalli,
National Institute of Standards and Technology, USA, and N. D. Amin and H. C. Pant, National Institutes of Health, USA,
"Quantum-Limited Monolayer MoS_2 pH and Biosensors"

09:15-09:30 A. T. Hanbicki, H.-J. Chuang, M. R. Rosenberger, C. S. Hellberg, S. V. Sivaram, K. M. McCreary, I. I. Mazin, and Berend T. Jonker,
Naval Research Laboratory, USA,
"Double Indirect Interlayer Exciton in a $MoSe_2/WSe_2$ van der Waals Heterostructure"

09:30-09:45 Masashi Kawasaki, K. S. Takahashi, K. Maruhashi, M. S. Baharamy, H. Ishizuka, R. Kurihara, A. Miyake, S. Shimizu, T. Murata, Q. Y. Wang, M. Tokunaga, Y. Tokura, and N. Nagaosa, RIKEN and University of Tokyo, Japan,
"Quantum Transport in a Magnetic Semiconductor Oxide"

09:45-10:15 M. Bonilla, P. Coelho Neto, S. Kolekar, V. Kalappattil, M.-H. Phan and Matthias Batzill, University of South Florida, USA,
"Magnetism in Monolayer Transition Metal Dichalcogenides"
(invited)

10:15-10:45 Coffee Break

Session 15 **Spin Photonics**
Chair: Viktor Sverdlov

10:45-11:15 Hayk Harutyunyan, Emory University, USA, A. Govorov, Ohio University, USA, S. K. Gray and G. Wiederrecht, Argonne National Laboratory, USA, "Enabling Optically Forbidden Transitions by Extreme Localization of Light" (invited)

11:15-11:45 Igor Zutic, State University of New York at Buffalo, USA, "Spintronics Beyond Magnetoresistance: From Spin-LEDs to Spin-Lasers" (invited)

11:45-12:00 Hiro Munekata and N. Nishizawa, Tokyo Institute of Technology, Japan, "Realization of Pure Circular Polarization Electroluminescence at Room Temperature with Spin-LEDs"

12:00-12:15 Mehdi Alouini, J. Frougier, and J. M. George, CNRS, France, A. Joly, G. Baili and D. Dolfi, Thales Research & Technology, France, "Modelling Framework for Predicting Polarization Behavior of Spin-Controlled VCSELs and its Experimental Validation"

12:15-12:30 M. Lindemann, M. R. Hofmann, and Nils Gerhardt, Ruhr-University Bochum, Germany, T. Pusch, and R. Michalzik, Ulm University, Germany, G. Xu and I. Zutic, State University of New York at Buffalo, USA, "Ultrafast Birefringent Spin-Lasers"

12:30 **Closing Session**
Stephen Goodnick
Josef Weinbub