

# WINDS

## PROGRAM

Hapuna Beach Prince Hotel  
Kohala Coast, Hawaii, USA

December 4-9, 2016

The **Workshop on Innovative Nanoscale Devices and Systems** (WINDS) is a 4½ day meeting with morning and evening sessions, and with afternoons dedicated to *ad hoc* meetings and discussions among participants. WINDS follows the tradition and format of the Advanced Heterostructure Workshop (AHW) as the workshop name morphed in 2008 from AHW to AHNW to WINDS in order to attract more participation from industrial labs. The format of each session involves one or two overview presentations plus lively discussion based on recent data. To ensure enough time for discussion, short presentations of data are encouraged. Each participant is expected to engage in these discussions and is strongly encouraged to display only a few slides showing most recent results. Introductions, summary, and acknowledgements are strictly discouraged. All contributions are by invitation only. The total number of participants is limited to around 80 to keep the discussions lively in the single session. This year the WINDS program includes joint sessions with a special Workshop on Frontiers of Topological Superconductivity, beginning on Thursday morning with a tutorial on Majorana physics. Dedicated sessions on Topological Superconductivity will continue on Thursday afternoon, Friday afternoon and Saturday morning, and are open to all attendees.

### **Conference Committee**

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## **December 4<sup>th</sup> (Sunday)**

15:00-18:00 Registration (Breezeway-Kohala)

18:00-20:00 Welcome Reception (Lower Lawn Area)

## **December 5<sup>th</sup> (Monday)**

8:00-8:50 Registration

8:50-9:00 Opening

### **Nanowires (Henning Riechert, Paul-Drude Inst.)**

9:00-9:30 Alexander Balandin (UC Riverside, USA)  
“Direct Observation of the Acoustic Phonon Spectrum Modification in Individual Free-Standing Semiconductor Nanowires”

9:30-9:45 Josef Weinbub (TU Wien, Austria)  
“Wigner Modelling of Quantum Wires”

9:45-10:00 Guilherme Sipahi (Univ. São Paulo, Brazil)  
“Realistic Determination of Spin-orbit Coupling Effects in Nanowires”

10:00-10:15 Steve Goodnick (Arizona State Univ., USA)  
“Impact Ionization and Ultrafast Relaxation Processes in Semiconductor Nanowires”

10:15-10:30 Alexander Balandin (UC Riverside, USA)  
“High Breakdown Current Density in BN-Capped Quasi-1D TaSe<sub>3</sub> Metallic Nanowires: Prospects of Interconnect Applications”

10:30-11:00 Coffee Break

### **Spintronics I (Siegfried Selberherr, TU Wien)**

11:00-11:30 Yuichi Ohnuma (ASRC / JAEA., Japan)  
“Spin Current and Spin Hall Effect in Half-Metallic Ferromagnets”

11:30-11:45 Viktor Sverdlov (TU Wien, Austria)  
“Universal Dependence of the Spin Lifetime in Silicon Films on the Spin Injection Direction”

## December 5<sup>th</sup> (Monday) continued

- 11:45-12:15 Yuichiro Ando (Kyoto Univ., Japan)  
“Spin-charge Conversion in Graphene and Carbon Nanotube”
- 12:15-12:30 Akira Oiwa (Osaka Univ., Japan)  
“Quantum Photon-spin Interface Consisting of Gate-defined Quantum Dots and Surface Plasmon Structure”
- 12:30-12:45 Hiroshi Yamaguchi (NTT, Japan)  
“Parametric Oscillators as Mechanical Analogue of Spin-1/2 Systems”
- 12:45-13:00 Yasuhiro Tokura (Univ. of Tsukuba, Japan)  
“Coherence of the Photo-generated Spins and Effective Bell Measurement”
- 13:00-19:00 *Ad hoc* Session

## 2D Materials (Berry Jonker, NRL)

- 19:00-19:30 Kazuhito Tsukagoshi (NIMS Tsukuba, JAPAN)  
“Heterojunctions for Atomically Thin 2D Semiconductors Based on Two-dimensional Transition Metal Dichalcogenides”
- 19:30-19:45 Luis Balicas (National High Magnetic Field Lab., USA)  
“Engineering the Structural and Electronic Phases of MoTe<sub>2</sub> through W Substitution”
- 19:45-20:00 Henning Riechert (Paul-Drude-Institut, Germany)  
“Growth of Two-dimensionally Bonded Materials – Fiction, Facts and Some Surprises”
- 20:00-20:15 John Conley (Oregon State Univ., USA)  
“Atomic Layer Deposition of 2D MoS<sub>2</sub> on Si/SiO<sub>2</sub> and Quartz Substrates”
- 20:15-20:45 Xiaodong Xu (Univ. of Washington, USA)  
“Progress in 2D Semiconductor Optoelectronics”
- 20:45-21:00 Dmitry Smirnov (National High Magnetic Field Lab., USA)  
“Magneto-spectroscopy of Excitons in Semiconducting 2D Transition-metal Dichalcogenides”

**December 6<sup>th</sup> (Tuesday)**

8:00-9:00 Registration

**Graphene Devices (David Janes, Purdue)**

9:00-9:30 Taiichi Otsuji (Tohoku Univ., Japan)

“Current-Injection Terahertz Lasing in Graphene-Channel Field Effect Transistors”

9:30-9:45 Yasuhide Ohno (Tokushima Univ., Japan)

“Intrinsic Ion Sensitivity of Graphene Field-effect Transistors”

9:45-10:00 Akinobu Kanda (Univ. of Tsukuba, Japan)

“Graphene Strain Engineering for Band Gap Opening”

10:00-10:15 Alexander Balandin (UC Riverside, USA)

“An Integrated 1T-TaS<sub>2</sub> – h-BN – Graphene Oscillator:  
A Charge-Density-Wave Device Operating at Room Temperature”

10:15-10:30 Dave Ferry (Arizona State Univ., USA)

“Density Dependence of the High Field Transport and Velocity Saturation in Graphene”

10:30-11:00 Coffee Break

**Quantum Hall and Information (Josef Weinbub, TU Wien)**

11:00-11:30 Tomoki Machida (Univ. of Tokyo, Japan)

“Quantum Transport in van der Waals Junctions of Graphene and 2D Materials”

11:30-11:45 Vito Scarola (Virginia Tech, USA)

“Stability of Fractional Quantum Hall States with Non-Zero Width, Landau Level Mixing, and Temperature”

11:45-12:00 Kenji Shibata (Tohoku Inst. of Technology, Japan)

“Transport through InSb Self-assembled Quantum Dots  
Coupled to Nanogap Metal Electrodes”

**December 6<sup>th</sup> (Tuesday) continued**

- 12:00-12:30 Shigeki Takeuchi (Kyoto Univ., Japan)  
“Photonic Quantum Information and Quantum Metrology”
- 12:30-12:45 Robert Wolkow (Univ. of Alberta, Canada)  
“Atomic Silicon Quantum Dots Enable an All-silicon Quantum Annealing Machine”
- 12:45-19:00 *Ad hoc* Session

**Nano and Bio Devices (Kazuhiko Matsumoto, Osaka Univ.)**

- 19:00-19:15 Hirokazu Tada (Osaka Univ., JAPAN)  
“Rectifying Current-Voltage Characteristics of Single Molecular Junctions”
- 19:15-19:30 Mark Reed (Yale Univ., USA)  
“Nanofluidic Ionic Devices“
- 19:30-19:45 Kazuhiko Matsumoto (Osaka Univ., Japan)  
“Electrical Detection of Dissociation Process of Virus  
Using Sugar Chain Modified Graphene FET”
- 19:45-20:00 David Janes (Purdue Univ., USA)  
“Electrochemical Micro-Electrode Arrays for Measurement of Transient  
Concentration Gradients of Hydrogen Peroxide”
- 20:00-20:30 Shusuke Yoshimoto (Osaka Univ., Japan)  
“Wearable and Implantable Bio-signal Monitoring Systems”
- 20:30-20:45 Hirokazu Tada (Osaka Univ., Japan)  
“Magnetoresistance in Organic Materials”

**December 7<sup>th</sup> (Wednesday)**

**Novel Devices (Dave Ferry, ASU)**

- 9:00-9:30 Seth Bank (UT Austin, USA)  
“Staircase and Homojunction Avalanche Detectors in InAlAsSb”
- 9:30-9:45 Shintaro Nomura (Univ. of Tsukuba, Japan)  
“Scanning Nano-SQUID Microscope for Investigations of Properties of Two-dimensional Layer of Semiconductors and Superconductors”
- 9:45-10:00 Kaz Hirakawa (Univ. of Tokyo, Japan)  
“Uncooled, Very Sensitive Bolometer using a Doubly Clamped Microelectromechanical Beam Resonator for Terahertz Detection”
- 10:00-10:15 Wolfgang Porod (Univ. of Notre Dame, USA)  
“Antenna-Coupled Single-Metal Nanothermocouples for THz Wave Detection”
- 10:15-10:30 Victor Ryzhii (Russian Acad. of Sciences, Russia)  
“Infrared and Terahertz Detectors based on Graphene- van der Waals Heterostructures”
- 10:30-10:45 Alexei Suslov (National High Magnetic Field Lab., USA) ·  
“Interaction of Surface Acoustic Waves with a 2D Wigner Crystal in High-Mobility n-GaAs/AlGaAs”
- 10:45-11:15 Coffee Break

## December 7<sup>th</sup> (Wednesday) continued

### Spintronics II (Viktor Sverdlov, TU Wien)

- 11:15-11:30 Alexander Khitun (UC Riverside, USA)  
“Spin Wave Reversible Logic Gates”
- 11:30-11:45 Alexander Khitun (UC Riverside, USA)  
“Quantum Algorithms without Quantum Entanglement:  
Data Processing with Magnonic Holographic Memory”
- 11:45-12:15 Peter Dowben (Univ. of Nebraska, USA)  
“Electrically Controlled Surface Magnetism”
- 12:15-12:30 Siegfried Selberherr (TU Wien, Austria)  
“Influence of the Free Layer Alignment on the Reliability of a Non-Volatile  
Magnetic Shift Register”
- 12:30-13:00 Roger Lake (UC Riverside, USA)  
“Spin Josephson Effects in Exchange Coupled Ferromagnets and  
Antiferromagnets”
- 13:00-13:15 Wolfgang Porod (Univ. of Notre Dame, USA)  
“Signal Processing by Spin-Wave Interference”
- 13:15-18:30 *Ad hoc* Session
- 18:30-21:00 Banquet (Courtyard) with reception at 18:30, dinner at 19:00. Live music.



## December 8<sup>th</sup> (Thursday)

### 2D Materials and Devices (Alexander Balandin, UC Riverside)

- 9:00-9:30 Montserrat Fernández-Bolaños (EPFL, Switzerland)  
“Steep Slope Devices Combining Two Subthermionic Switching Principles”
- 9:30-9:45 Rajib Rahman (Purdue Univ., USA)  
“Novel Energy-efficient Transistors with 2D Materials”
- 9:45-10:00 Yang-Fang Chen (National Taiwan Univ., Taiwan)  
“Quantum Tunneling in Vertically Stacked Quasi-2D Heterojunctions Enabled Multifunctional Optoelectronic Devices”
- 10:00-10:15 Jaroslav Fabian (Univ. of Regensburg, Germany)  
“Graphene/TMDC Heterostructures for Spintronic Applications”
- 10:15-10:30 Dave Ferry (Arizona State Univ., USA)  
“Intervalley Scattering and Velocity Saturation in MoS<sub>2</sub>”
- 10:30-11:00 Coffee Break

### JOINT Session Quantum Information and Majorana Physics (Leonid Rokhinson, Purdue)

- 11:00-12:00 Roman Lutchyn (Microsoft-Q, USA)  
Tutorial  
“Topological Quantum Computation with Majorana Zero Modes”
- 12:00-12:15 Igor Zutic (Univ. at Buffalo, USA)  
“Wireless Majorana Bound States:  
From Magnetic Tunability to Braiding”
- 12:15-12:30 Xiao Hu (NIMS Tsukuba, Japan)  
“Novel Phenomena in Quantum Tunnelling  
of Majorana Quasiparticles”
- 12:30-12:45 Ewelina Hankiewicz (Univ. of Würzburg, Germany)  
“From the Parity Anomaly to a Majorana Fermion - Realization of the Ultra-relativistic Physics in Topological Insulators”
- 12:45-13:00 Jed Pixley (Univ. of Maryland, USA)  
“The Density of States of Dirac and Weyl Semi-metals in the Presence of Weak Disorder”
- 13:00-19:00 *Ad hoc* Session

## December 8<sup>th</sup> (Thursday) continued

### Energy Harvesting & Innovative Devices (John Conley, Oregon State Univ.)

- 19:00-19:30 Victor Klimov (LANL, USA)  
“New Approaches to Solar Energy Conversion using Engineered Quantum Dots”
- 19:30-19:45 Dragica Vasileska (Arizona State Univ., USA)  
“Predictive Modeling of CdTe Solar Cells for Higher Efficiency and Larger Reliability”
- 19:45-20:00 Adrian Podpirka (Drexel Univ., USA)  
“Strain and Barrier Effects on Photovoltaic Response in Epitaxial BaTiO<sub>3</sub>”
- 20:00-20:15 Koji Ishibashi (RIKEN, Japan)  
“InSb Double Quantum Dots Interacting with Electromagnetic Fields in a Superconducting Microwave Cavity”
- 20:15-20:30 Paolo Lugli (TU München, Germany)  
“Printing Technologies for Sensors and Other Electronic Components”
- 20:30-20:45 Saulius Marcinkevičius (KTH, Sweden)  
“Intervalley Energy of GaN Conduction Band Estimated by Ultrafast Pump-probe Spectroscopy”

## December 9<sup>th</sup> (Friday)

### Emerging Nonvolatile Memory (Wolfgang Porod, Notre Dame)

- 9:00-9:30 An Chen (IBM/SRC, USA)  
“Emerging Nonvolatile Memory and Logic Devices  
for Beyond-CMOS Applications”
- 9:30-10:00 Xia Hong (Univ. of Nebraska, USA)  
“Enhanced Ferroelectric-Control of All-Oxide Mott Transistors via Interfacial  
Charge Engineering”
- 10:00-10:30 Xavi Marti (Acad. of Science, Czech Republic)  
“Electrical Switching of an Antiferromagnet”

10:30-11:00 Coffee break

### JOINT Session Topological Insulators and Systems (Yuli Lyanda-Geller, Purdue)

- 11:00-11:15 Tony Valla (BNL, USA)  
“Chiral Magnetic Effect in Condensed Matter”
- 11:15-11:30 Berry Jonker (NRL, USA)  
“Direct Comparison of Current-induced Spin Polarization  
in Topological Insulator  $\text{Bi}_2\text{Se}_3$  and InAs Rashba States”
- 11:30-11:45 Xiao Hu (NIMS Tsukuba, Japan)  
“All-Dielectric Topological Photonics”
- 11:45-12:00 Matt Gilbert (Univ. of Illinois - Urbana-Champaign, USA)  
“Understanding Topological Superconductivity in an Ultra-thin Magnetically-  
Doped Proximity-Coupled Topological Insulator”
- 12:00-12:15 Slava Rotkin (Lehigh Univ., USA)  
“Heterostructure Topological Polariton: On Existence of Exact Solution of  
Bosonic Coupled Dyson Equations All-Dielectric Topological Photonics”
- 12:15-12:30 *Closing Remarks*



# Workshop on Frontiers of Topological Superconductivity

## PROGRAM

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December 8-10, 2016

## December 8<sup>th</sup> (Thursday)

### Topological superconductors / theory (Felix vo Oppen)

- 14:30-15:00 Maissam Barkeshli (Microsoft-Q, USA)  
“Charge  $2e/3$  superconductivity and topological degeneracies without localized zero modes in bilayer fractional quantum Hall states”
- 15:00-15:30 Kirill Shtengel (UC Irvine, USA)  
“Crossed Andreev reflection with chiral quantum Hall edges”
- 15:30-16:00 Leonid Glazman (Yale Univ., USA)  
“Coulomb blockade of electron transport through a proximitized nanowire”
- 16:00-16:30 Coffee break
- 16:30-17:00 Dima Pikulin (Univ. of British Columbia, Canada)  
TBD
- 17:00-17:30 Elena Klinovaya (Univ. of Basel, Switzerland)  
“Majorana and parafermions due to cross-Andreev reflection”

## December 9<sup>th</sup> (Friday)

13:00-14:30 Lunch

### Topological superconductors / experiment (Kirill Stengel)

- 14:30-15:00 Lawrence Moulenkamp (Univ. of Wuerzburg, Germany)  
“Topological physics in HgTe-based quantum devices”
- 15:00-15:30 Leonide Rokhinson (Purdue Univ., USA)  
“Electrostatic control of quantum Hall ferromagnetic transition:  
A step toward reconfigurable network of helical channels”
- 15:30-16:00 Coffee break
- 16:00-16:30 Yew San Hor (Missouri S&T Univ., USA)  
“Zero-field Hall effect in  $\text{Nb}_{0.25}\text{Bi}_2\text{Se}_3$  topological material”
- 16:30-17:00 Sangjun Jeon (Princeton Univ., USA)  
“Spin polarization measurement of ferromagnetic atomic chains  
on a superconductor”

## December 10<sup>th</sup> (Saturday)

### Topological superconductors / mixed (Yew San Hor)

- 9:00-9:30 Felix von Oppen (FU Berlin, Germany)  
“Parity anomaly and spin transmutation  
in quantum spin Hall Josephson junctions”
- 9:30-10:00 Yuli Lyanda-Geller (Purdue Univ., USA)  
“Topological matter in charge carrier hole systems”
- 10:00-10:30 Javad Shabani (CUNY, USA)  
“Epitaxial superconductor-semiconductor two-dimensional systems:  
Platforms for quantum circuits”
- 10:30-11:00 Coffee Break
- 11:00-11:30 Barry Bradlyn (Princeton Univ., USA)  
TBD
- 11:30-12:00 Attila Geresdi (Delft Univ., Netherlands)  
“On-chip microwave spectroscopy of topological Josephson junctions”
- 12:00-12:15 *Closing Remarks*