

Wonhee Ko

University of Tennessee, Knoxville
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Professional Experience

University of Tennessee, Knoxville Assistant Professor, Department of Physics and Astronomy	2022.8 – present
Oak Ridge National Laboratory R&D Associate, Center for Nanophase Materials Sciences	2019.7 – 2022.7
University of Tennessee, Knoxville / Oak Ridge National Laboratory Postdoctoral Research Associate, PI: Dr. An-Ping Li Research Project: <i>Multiprobe STM study on quantum materials</i>	2017.1 – 2019.7
Samsung Advanced Institute of Technology Research Staff Member, Project Leader: Dr. Hwansoo Suh Research Project: <i>Development of mK-UHV-STM</i>	2012.7 – 2016.12

Education

Stanford University , Stanford, CA Ph.D., Applied Physics, Research Advisor: Prof. Hari C. Manoharan Dissertation Title: <i>"Quantum imaging of Dirac materials"</i>	2006.9 – 2012.6
Keio University , Yokohama, Japan Exchange Student, Research Advisor: Prof. Kohei Itoh Research project: <i>Silicon-based solid-state quantum computer</i>	2005.9 – 2006.2
Seoul National University , Seoul, South Korea B.S., Physics and Mathematics (Summa Cum Laude)	2002.3 – 2006.8

Honors and Awards

UT-Battelle Awards Night, Outstanding Scholarly Output Team Award	2021.12
Samsung Best Paper Awards, Silver Prize (Co-author)	2015
Stanford Graduate Fellowship in Science & Engineering	2008.9 – 2011.8
The Korean Foundation for Advanced Studies Scholarship	2006.9 – 2011.8
International Physics Olympiad, Bronze medal	2001.7

Selected Publications ([Scopus, 1144+ citations, 38 papers, h-index: 15](#))

- W. Ko**, J. L. Lado, and P. Maksymovych*, "Non-contact Andreev reflection as a direct probe of superconductivity on the atomic scale," *Nano Lett.* **22** 4042 (2022)
- W. Ko**, Z. Gai, A. Puzetzy, L. Liang, T. Berlijn, J. Hachtel, K. Xiao, P. Ganesh, M. Yoon, and A.-P. Li*, "Understanding Heterogeneities in Quantum Materials (review paper)," *Adv. Mater.* 2106909 (2022) <https://doi.org/10.1002/adma.202106909>
- W. Ko**, E. F. Dumitrescu, and P. Maksymovych*, "Statistical detection of Josephson, Andreev, and single quasiparticle currents in scanning tunneling microscopy," *Phys. Rev. Res.* **3** 033248 (2021)

W. Ko, M. Kolmer, J. Yan, A. D. Pham, M. Fu, F. Lüpke, S. Okamoto, Z. Gai, P. Ganesh, and A.-P. Li*, "Realizing gapped surface states in magnetic topological insulator $\text{MnBi}_{2-x}\text{Sb}_x\text{Te}_4$," *Phys. Rev. B* **102** 115402 (2020)

W. Ko, G. D. Nguyen, H. Kim, J. S. Kim, X.-G. Zhang, and A.-P. Li*, "Accessing the intrinsic spin transport in a topological insulator by controlling the crossover of bulk-to-surface conductance," *Phys. Rev. Lett.* **121** 176801 (2018)

H. W. Kim[†], **W. Ko**[†], J. Ku, I. Jeon, D. Kim, H. Kwon, Y. Oh, S. Ryu, Y. Kuk, S. W. Hwang, and H. Suh*, "Nanoscale control of phonon excitation in graphene nanobubbles," *Nat. Commun.* **6** 7528 (2015)

K. K. Gomes[†], W. Mar[†], **W. Ko**[†], F. Guinea, and H. C. Manoharan*, "Designer Dirac fermions and topological phases in molecular graphene," *Nature* **483** 306 (2012)

[†] Contributed equally, * Corresponding author

Grants

1. DOE Office of Science, BES, QIS and Research Infrastructure at the NSRCs, "Precision Atomic Assembly for Quantum Information Science," Co-PI (Lead PI: Art Baddorf), FY2022 – 2024
2. DOE Office of Science, BES Materials Science and Engineering Division, "Probing Coupled and Competing Polar Orders from the Atomistic to Mesoscopic Scales," Co-PI (Lead PI: Petro Maksymovych), FY2022

Teaching Experience

Teaching Assistant, Stanford University

- [Phys 172] Solid State Physics (2012 spring quarter): led section classes and office hours.
- [Phys 108] Advanced Physics Laboratory: Project (2012 winter quarter): supervised designing and performing experimental projects in cryogenic temperature.
- [Phys 105] Analog Electronics (2011 fall quarter): supervised laboratory classes and final project.

Synergistic Activities and Outreach

APS Career Mentoring Fellow (2022 – 2023)

Featured in APS TV 2022 video highlighting the quantum information science research in Center for Nanophase Materials Sciences, ORNL, <https://youtu.be/I5LHWAfgvZ8> (2022)

Executive Committee Member of Nanoscale Science and Technology Division (NSTD), AVS (Jan 2022 – present)

Co-organizer, Topical workshop in *2021 Joint Nanoscience and Neutron Scattering User Meeting: "Quantum Materials Across Multiple Length Scales"*, ORNL (Aug 2021)

Co-organizer, Topical workshop in *2019 CNMS User Meeting: "Understanding Electronic Behaviors in Quantum Materials"*, ORNL (Aug 2019)

Peer-reviewed journal articles for *Science Advances*, *Physical Review Letters*, *Physical Review B*, *Physical Review Applied*, *Scientific Reports*

Skills

Technical

Computer programming in MATLAB, Python, and LabVIEW; CAD with SolidWorks.

Language

Native speaker of Korean; Fluent in English and Japanese.

Full Publication List

1. M. Kolmer*, **W. Ko**, J. Hall, S. Chen, J. Zhang, H. Zhao, L. Ke, C.-Z. Wang, A.-P. Li, and M. C. Tringides, "Breaking of Inversion Symmetry and Interlayer Electronic Coupling in Bilayer Graphene Heterostructure by Structural Implementation of High Electric Displacement Fields," (submitted)
2. F. Lüpke[†], M. Kolmer[†], J. Yan, H. Chang, P. Vilmercati, H. Weitering, **W. Ko***, and A.-P. Li*, "Anti-site defect-induced disorder in compensated topological magnet $\text{MnBi}_{1.36}\text{Sb}_{0.64}\text{Te}_4$," arXiv:2208.13374 (submitted)
3. M. Zohair, N. Moehring, P. Cheng, J. Eaves-Rathert, E. Brody, J. Warner, **W. Ko**, A.-P. Li, P. Kidambi, and C. Pint*, "Nanoporous Graphene Modified Separators Enable Early Dendrite Detection for Safe Lithium and Magnesium Batteries," (submitted)
4. N. K. Moehring, P. Chaturvedi, P. Cheng, **W. Ko**, A.-P. Li, M. S. H. Boutilier, and P. R. Kidambi*, "Kinetic Control of Angstrom-Scale Porosity in 2D Lattices for Direct Scalable Synthesis of Atomically Thin Proton Exchange Membranes," (submitted)
5. P. Cheng, F. Fornasiero, M. L. Jue, **W. Ko**, A.-P. Li, J. C. Idrobo, M. S. H. Boutilier, and P. R. Kidambi*, "Differences in Water and Vapor Transport through Angstrom-scale Pores in Atomically Thin Membranes," (submitted)
6. M. S. Kavrik^{†*}, J. Hachtel^{†*}, **W. Ko**^{†*}, C. Qian, A. Abelson, E. B. Unlu, H. Kashyap, A.-P. Li, J.-C. Idrobo, and M. Law*, "Emergence of Distinct Electronic States in Epitaxially-Fused PbSe Quantum Dot Superlattices," *ResearchSquare DOI:10.21203/rs.3.rs-841852/v1* (accepted to *Nat. Commun.*)
7. Q. Zou, S. Huang, **W. Ko**, M. Fu, Y. Yang, K. Zhao, S. R. Crittenden, E. W. Plummer, R. Jin*, and Z. Gai*, "Exploration of two surfaces observed in Weyl semimetal BaMnSb_2 ," *npj Quantum Mater.* **7** 85 (2022)
8. **W. Ko**, J. L. Lado, and P. Maksymovych*, "Non-contact Andreev reflection as a direct probe of superconductivity on the atomic scale," *Nano Lett.* **22** 4042 (2022)
✓ [Highlighted in Aalto University News: <https://www.aalto.fi/en/news/an-atomic-scale-window-into-superconductivity-paves-the-way-for-new-quantum-materials>]
9. **W. Ko**, S. Hus, H. Kim, J. S. Kim, X.-G. Zhang, and A.-P. Li*, "Resistivity of Surface Steps in Bulk-Insulating Topological Insulators," *Front. Mater.* **9** 887484 (2022)
10. **W. Ko**, Z. Gai, A. Poretzky, L. Liang, T. Berlijn, J. Hachtel, K. Xiao, P. Ganesh, M. Yoon, and A.-P. Li*, "Understanding Heterogeneities in Quantum Materials (review paper)," *Adv. Mater.* 2106909 (2022) <https://doi.org/10.1002/adma.202106909>
11. S.-H. Kang[†], S. Jeon*, H.-J. Kim, **W. Ko**, S. Cho, S. H. Kang, S. W. Kim, H. Yang, H. W. Kim*, and Y.-W. Son*, "Coulomb interaction-driven reshaped Weyl fermionic dispersions in MoTe_2 ," *Phys. Rev. B* **105** 045143 (2022)
12. F. Lüpke, A. D. Pham, Y.-F. Zhao, L.-J. Zhou, W. Lu, E. Briggs, J. Bernholc, M. Kolmer, J. Teeter,

- W. Ko**, C.-Z. Chang, P. Ganesh*, and A.-P. Li*, "Local manifestations of thickness dependent topology and axion edge state in topological magnet MnBi_2Te_4 ," *Phys. Rev. B* **105** 035423 (2022)
13. K. Wang, L. Zhang, G. D. Nguyen, X. Sang, C. Liu, Y. Yu, **W. Ko**, R. R. Unocic, A. A. Puretzy, C. M. Rouleau, D. B. Geohegan, G. Duscher, A.-P. Li, M. Yoon, and K. Xiao*, "Selective Antisite Defect Formation in WS_2 Monolayers via Reactive Growth on Dilute W-Au Alloy Substrates," *Adv. Mater.* **34** 2106674 (2022)
- ✓ [Selected as Frontispiece of *Advanced Materials* 3/2022: <https://onlinelibrary.wiley.com/doi/10.1002/adma.202270024>]
14. **W. Ko**, E. F. Dumitrescu, and P. Maksymovych*, "Statistical detection of Josephson, Andreev, and single quasiparticle currents in scanning tunneling microscopy," *Phys. Rev. Res.* **3** 033248 (2021)
15. J. Lapano, O. Dyck, A. Lupini, **W. Ko**, H. Li, H. Miao, H. N. Lee, A.-P. Li, M. Brahlek, S. Jesse, R. G. Moore*, "Van der Waals Epitaxy Growth of Bi_2Se_3 on a Freestanding Monolayer Graphene Membrane: Implications for Layered Materials and Heterostructures," *ACS Appl. Nano Mater.* **4** 7607 (2021)
16. H. W. Kim, I. Jeon, **W. Ko***, and S. H. Kim*, "Unidirectional Growth of Graphene Nano-Islands from Carbon Cluster Seeds on Ge(110)," *App. Surf. Sci.* **536** 147722 (2021)
17. S. M. Hus, R. Ge, P.-A. Chen, M.-H. Chiang, G. Donnelly, **W. Ko**, F. Huang, L. Liang, A.-P. Li, and D. Akinwande*, "Observation of single-defect memristor in an MoS_2 atomic sheet," *Nat. Nanotechnol.* **16** 58 (2021)
- ✓ [Highlighted in ORNL News: <https://www.ornl.gov/research-highlight/observation-single-defect-memristor-mos2-atomic-sheet>]
18. **W. Ko**, M. Kolmer, J. Yan, A. D. Pham, M. Fu, F. Lüpke, S. Okamoto, Z. Gai, P. Ganesh, and A.-P. Li*, "Realizing gapped surface states in magnetic topological insulator $\text{MnBi}_{2-x}\text{Sb}_x\text{Te}_4$," *Phys. Rev. B* **102** 115402 (2020)
19. **W. Ko***, H. W. Kim†, Y. Cho, J. Ku, H. Kwon, Y. Oh, J.-W. Jung, I. Jeon, H. Suh, Y. Kuk, and S. W. Hwang, "Magnetic states of atomic vacancies in graphite probed by scanning tunneling microscopy," *AIP Adv.* **10** 085325 (2020)
20. P. Cheng, M. M. Kelly, N. K. Moehring, **W. Ko**, A.-P. Li, J. C. Idrobo, M. S. H. Boutilier, and P. R. Kidambi*, "Tailoring Sub-nanometer Pore Size Distributions in Atomically Thin Graphene Membranes for Desalination and Molecular Separations," *Nano Lett.* **20** 5951 (2020)
21. H. W. Kim†, S.-H. Kang†, H.-J. Kim†, K. Chae, S. Cho, **W. Ko**, S. Jeon, S. H. Kang, H. Yang, S. W. Kim, S. Park, S. Hwang, Y.-K. Kwon, and Y.-W. Son*, "Symmetry dictated grain boundary state in a two-dimensional topological insulator," *Nano Lett.* **20** 5837 (2020)
22. M. Kolmer, A. K. Steiner, I. Izydorczyk, **W. Ko**, M. Engelund, M. Szymonski, A.-P. Li*, and K. Amsharov*, "Rational synthesis of atomically precise graphene nanoribbons directly on metal oxide surfaces," *Science* **369** 571 (2020)
- ✓ [Highlighted in ORNL News: <https://www.ornl.gov/news/surface-synthesis-graphene-nanoribbons-could-advance-quantum-devices>, and Phys.org: <https://phys.org/news/2020-10-on-surface-synthesis-graphene-nanoribbons-advance.html>]
23. G. D. Nguyen, A. D. Oyedele, A. Haglund, **W. Ko**, L. Liang*, A. A. Puretzy, D. Mandrus, K. Xiao,

- and A.-P. Li*, "Atomically Precise PdSe₂ Pentagonal Nanoribbons," *ACS Nano* **14** 2 1951-1957 (2020)
24. N. Briggs, B. Bersch, Y. Wang, J. Jiang, R. Koch, N. Nayir, K. Wang, M. Kolmer, **W. Ko**, A. de la Fuente Duran, S. Subramanian, C. Dong, J. Shallenberger, M. Fu, Q. Zou, Y.-W. Chuang, Z. Gai, A.-P. Li, A. Bostwick, C. Jozwiak, C.-Z. Chang, E. Rotenberg, J. Zhu, A. van Duin, V. Crespi, and J. Robinson*, "Atomically thin half-van der Waals metals enabled by confinement heteroepitaxy," *Nat. Mater.* **19** 637 (2020)
- ✓ [Highlighted in ORNL News: <https://www.ornl.gov/research-highlight/atomically-thin-half-van-der-waals-metals-enabled-confinement-heteroepitaxy>]
25. J. W. Kim, T.-S. Ju, S. Song, D. Lee, S. Y. Cho, S. D. Bu, **W. Ko**, A.-P. Li, J. Park*, and S. Park*, "Enhancing the Local Conductivity of Cu Films Using Temperature-Assisted Agglomerated Cu Nanostructures," *J. Phys. D: Appl. Phys.* **53** 09LT02 (2020)
26. **W. Ko**, C. Ma, G. D. Nguyen, M. Kolmer, and A.-P. Li*, "Atomic-Scale Manipulation and In Situ Characterization with Scanning Tunneling Microscopy (review paper)," *Adv. Funct. Mater.* **29** 1903770 (2019)
27. A. L. Miettinen, M. S. Nevius, **W. Ko**, M. Kolmer, A.-P. Li, M. N. Nair, B. Kierren, L. Moreau, E. H. Conrad*, and A. Tejada, "Edge States and Ballistic Transport in Zig-zag Graphene Ribbons: The Role of SiC Polytypes," *Phys. Rev. B* **100** 045425 (2019)
28. M. H. Lee, J. H. Yun, G. Kim, J. E. Lee, S.-D. Park, H. Reith, G. Schierning, K. Nielsch, **W. Ko**, A.-P. Li, and J.-S. Rhyee*, "Synergetic Enhancement of Thermoelectric Performance by Selective Charge Anderson Localization-Delocalization Transition in n-Type Bi-Doped PbTe/Ag₂Te Nanocomposite," *ACS Nano* **13** 3806 (2019)
29. H. W. Kim*, **W. Ko**, W.-J. Joo, Y. Cho, Y. Oh, J. Ku, I. Jeon, S. Park, and S. W. Hwang*, "Unraveling the Structural and Electronic Properties of Graphene/Ge(110)," *J. Phys. Chem. Lett.* **9** 7059 (2018)
30. **W. Ko**, G. D. Nguyen, H. Kim, J. S. Kim, X.-G. Zhang, and A.-P. Li*, "Accessing the intrinsic spin transport in a topological insulator by controlling the crossover of bulk-to-surface conductance," *Phys. Rev. Lett.* **121** 176801 (2018)
- ✓ [Highlighted in DOE Office of Science: <https://www.energy.gov/science/bes/articles/channeling-electrons-ultrafast-spin-conductivity>, <https://www.eurekalert.org/features/doe/2020-02/drnl-cef020520.php>]
31. C.-S. Lee, K. W. Shin, H.-J. Song, H. Park, Y. Cho, D.-H. Im, H. Lee, J.-H. Lee, J. Y. Won, J. G. Chung, C. Kim, K.-E. Byun, E.-K. Lee, Y. Kim, **W. Ko**, H. J. Lim, S. Park*, and H.-J. Shin*, "Fabrication of metal/graphene hybrid interconnects by direct graphene growth and their integration properties," *Adv. Electron. Mater.* **4** 1700624 (2018)
32. **W. Ko**, S. M. Hus, X. Li, T. Berlijn, G. D. Nguyen, K. Xiao, and A.-P. Li*, "Tip-induced local strain on MoS₂/graphite detected by inelastic electron tunneling spectroscopy," *Phys. Rev. B* **97** 125401 (2018)
33. H. W. Kim^{†*}, **W. Ko**[†], J. Ku, Y. Kim, S. Park, and S. W. Hwang, "Evolution of graphene growth on Pt(111): From carbon clusters to nanoislands," *J. Phys. Chem. C* **121** 25074 (2017)
34. H. Kwon[†], K. Lee[†], J. Heo, Y. Oh, H. Lee, S. Appalakondaiah, **W. Ko**, H. W. Kim, J.-W. Jung, H. Suh, H. Min, I. Jeon*, E. Hwang*, and S. W. Hwang, "Characterization of edge contact: Atomically resolved semiconductor-metal lateral boundary in MoS₂," *Adv. Mater.* **29**

1702931 (2017)

35. H. W. Kim*, J. Ku, **W. Ko**, Y. Cho, I. Jeon, and S. W. Hwang, "Quenching of the resonant states of single carbon vacancies in graphene/Pt(111)," *J. Phys. Chem. C* **121** 24641 (2017)
36. S. M. Hus, X.-G. Zhang, G. D. Nguyen, **W. Ko**, A. P. Baddorf, Y. P. Chen, and A.-P. Li*, "Detection of the spin-chemical potential in topological insulators using spin-polarized four-probe STM," *Phys. Rev. Lett.* **119** 137202 (2017)
37. Y. Oh*, Y. Cho, H. Kwon, J. Lee, I. Jeon, **W. Ko**, H. W. Kim, J. Ku, G. Kim, H. Suh*, and S. W. Hwang, "Electronic structure and switching behavior of the metastable silicene domain boundary," *Appl. Phys. Lett.* **110** 263112 (2017)
38. S. Cho†, S. H. Kang†, H. S. Yu, H. W. Kim, **W. Ko**, S. W. Hwang, W. H. Han, D. H. Choe, Y. H. Jung, K. J. Chang, Y. H. Lee*, H. Yang*, and S. W. Kim*, "Te vacancy-driven superconducting transition in orthorhombic molybdenum ditellurides," *2D Mater.* **4** 021030 (2017)
39. **W. Ko***, J. Park, I. Jeon, H. W. Kim, H. Kwon, Y. Oh, J. S. Kim, H. Suh*, S. W. Hwang, and C. Chung, "Local potential fluctuation of topological surface states in $\text{Bi}_{1.5}\text{Sb}_{0.5}\text{Te}_{1.7}\text{Se}_{1.3}$ observed by Landau level spectroscopy," *Appl. Phys. Lett.* **108** 083109 (2016)
40. H. W. Kim†, **W. Ko**†, J. Ku, I. Jeon, D. Kim, H. Kwon, Y. Oh, S. Ryu, Y. Kuk, S. W. Hwang, and H. Suh*, "Nanoscale control of phonon excitation in graphene nanobubbles," *Nat. Commun.* **6** 7528 (2015)
41. H. W. Kim, J. Ku, **W. Ko**, I. Jeon, H. Kwon, S. Ryu, S.-J. Kahng, S.-H. Lee, S. W. Hwang, and H. Suh*, "Strong interaction between graphene edge and metal revealed by scanning tunneling microscopy," *Carbon* **78** 190 (2014)
42. **W. Ko**, I. Jeon, H. W. Kim, H. Kwon, S.-J. Kahng, J. Park, J. S. Kim*, S. W. Hwang, and H. Suh*, "Atomic and electronic structure of an alloyed topological insulator, $\text{Bi}_{1.5}\text{Sb}_{0.5}\text{Te}_{1.7}\text{Se}_{1.3}$," *Sci. Rep.* **3** 2656 (2013)
43. K. K. Gomes†, W. Mar†, **W. Ko**†, F. Guinea and H. C. Manoharan*, "Designer Dirac fermions and topological phases in molecular graphene," *Nature* **483** 306 (2012)
44. S. Lee, M. F. Toney, **W. Ko**, J. C. Randel, H. J. Jung, K. Munakata, J. Lu, T. H. Geballe, M. R. Beasley, R. Sinclair, H. C. Manoharan and A. Salleo*, "Laser-synthesized epitaxial graphene," *ACS Nano* **4** 7524 (2010)
45. K. K. Gomes†, **W. Ko**†, W. Mar†, Y. Chen, Z. X. Shen and H. C. Manoharan*, "Quantum imaging of topologically unpaired spin-polarized Dirac fermions," *arXiv:0909.0921*
46. C. R. Moon, B. K. Foster, L. S. Mattos, G. Zeltzer, **W. Ko** and H. C. Manoharan*, "Quantum geometry and phase extraction in isospectral electronic nanostructures," *Science* **319** 782 (2008)
47. H. Hayashi, **W. Ko**, T. Itahashi, A. Sagara, K. M. Itoh*, L. S. Vlasenko* and M. P. Vlasenko, "Dynamic nuclear polarization of ^{29}Si nuclei in the isotope enriched n-type silicon," *Phys. Stat. Sol. (c)* **3** 4388 (2006)

† Contributed equally, * Corresponding author

Patents

1. J. Ku, **W. Ko** and H. W. Kim, "Method of fabricating graphene structure having nanobubbles,"

US Patent 11,078,082 (2021)

2. **W. Ko**, H. W. Kim, J. Ku, D. Kim, S. Ryu, and S.-J. Jeon, "Conductor including nano-patterned substrate and method of manufacturing the conductor," US Patent 10,312,100 (2019)
3. **W. Ko** and I. Jeon, "Transporting apparatus and method for transporting using the same," US Patent 10,249,473 (2019)

Invited Talks

1. "Topological States Revealed by Scanning Tunneling Microscope", *2021 Joint Nanoscience and Neutron Scattering User Meeting: Topical Workshop on Quantum Materials across Multiple Length Scales*, ORNL, Oak Ridge, TN (Aug 2021)
2. "Probing Quasiparticles in Topological Quantum Materials by Advanced Scanning Tunneling Microscopy," *CMP Seminar Series, University of Tennessee, Knoxville*, TN (Feb 2021)
3. "Probing the Quantum States of Topological Materials by Advanced Scanning Tunneling Microscopy," *CNMS Seminar Series, Oak Ridge National Laboratory*, Oak Ridge, TN (May 2020)
4. "Detecting the Topologically Protected Spin Current with Four-Probe Scanning Tunneling Microscope," *POSTECH*, Pohang, South Korea (Oct 2019)
5. "Accessing the Intrinsic Surface Transport in a Topological Insulator with Multiprobe Scanning Tunneling Microscope", *2019 CNMS User Meeting: Topical Workshop on Understanding Electronic Behaviors in Quantum Materials*, ORNL, Oak Ridge, TN (Aug 2019)
6. "STM studies of topological materials: From building the materials atom-up to detecting the topologically protected spin current," *Oak Ridge National Laboratory*, Oak Ridge, TN (Feb 2019)
7. "Manipulating Atoms to Realize Artificial Materials and Topological States," *Princeton University*, Princeton, NJ (May 2016)
8. "Construction and characterization of topological materials with scanning tunneling microscopy," *Max Plank Institute for the Structure and Dynamics of the Matter*, Hamburg, Germany (May 2015)
9. "Molecular graphene: Designing Dirac fermions by atom manipulation," *KPS Spring Meeting*, Daejeon, South Korea (Apr 2014)
10. "Molecular graphene: Designing Dirac fermions by atom manipulation," *10th Workshop on Surface Nano-Science*, *POSTECH*, Pohang, South Korea (Feb 2014)