

BENJAMIN LAWRIE

Research Scientist, Quantum Heterostructures Group, Materials Science and Technology Division,
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EDUCATION

Bachelor of Science, Mathematical Physics
Case Western Reserve University, Cleveland OH May, 2006

Master of Science, Physics
Fisk University, Nashville TN July, 2008

Doctor of Philosophy, Interdisciplinary Materials Science
Vanderbilt University, Nashville TN July, 2011

Intelligence Community Postdoctoral Fellow
Quantum Information Science Group, Oak Ridge National Laboratory, Oak Ridge TN July, 2013

RESEARCH AND PROFESSIONAL EXPERIENCE

2013-2019 Research Scientist, Quantum Information Science Group, CSED, ORNL

2019-present Research Scientist, Quantum Heterostructures Group, MSTD, ORNL

2019-present Affiliate Research Scientist, Functional Hybrid Nanomaterials Group, CNMS, ORNL

RESEARCH INTERESTS

- Quantum sensing with continuous variable quantum optics and spin-based quantum sensors
- Quantum photonics and control of 2D quantum emitters
- Nanophotonics and near-field probes of heterogeneous solid-state systems
- Optical spectroscopies for condensed matter physics

SYNERGISTIC ACTIVITIES

- PI for DOE BES MSE project centered on probing fundamental material limitations of quantum devices with quantum and classical microscopies (2019-present)
- Co-PI for ORNL's Quantum Science Center focused on research exploring spin- and photonic-quantum systems.
- Co-PI at CNMS for nanophotonics and quantum nanophotonics research

AWARDS

- 2013 UT-Battelle Significant Event Award for Demonstration of Plasmonic Mediation of Quantum Information
- 2015 ORNL Awards Night Research Accomplishment Award for disruptive advancement of the fundamental limits of sensing imposed by the Heisenberg Uncertainty Principle
- 2017 UT-Battelle Early Career Researcher Award winner
- 2018 Award for Excellence in Technology Transfer; Federal Laboratory Consortium for Technology Transfer (FLC) *Crypt Licensing of Quantum Random Number Generator from ORNL*

PUBLICATIONS (students* and postdocs**)

1. A Dodson, H Wu, A Rai, S Apte, A O'Hara, B Lawrie, Y Wang, A Ueda, H. Krzyżanowska, M. Titze, J. Davidson, A. Hmelo, A. B. Posadas, A. A. Demkov, S. T. Pantelides, L. C. Feldman, N. H. Tolk "Phonon-mediated temperature dependence of Er³⁺ optical transitions in Er₂O₃", *Communications Physics* **7**, 69 (2024).
2. Yun-Yi Pai**, Claire E Marvinney**, Ganesh Pokharel, Jie Xing, Haoxiang Li, Xun Li, Michael Chilcote**, Matthew Brahlek, Lucas Lindsay, Hu Miao, Athena S Sefat, David Parker, Stephen D Wilson, Jason S Gardner, Liangbo Liang, Benjamin J Lawrie, "Angular-Momentum Transfer

- Mediated by a Vibronic-Bound-State” **11**, 2304698 (2024).
3. Jonghee Yang, Benjamin J Lawrie, Sergei V Kalinin, Mahshid Ahmadi, “High-Throughput Automated Exploration of Phase Growth Behaviors in Quasi-2D Formamidinium Metal Halide Perovskites” *Adv. Energy Materials*, 2370177 (2023).
 4. Zachariah O Martin, Alexander Senichev, Samuel Peana, Benjamin J Lawrie, Alexei S Lagutchev, Alexandra Boltasseva, Vladimir M Shalaev, “Photophysics of Intrinsic Single-Photon Emitters in Silicon Nitride at Low Temperatures” *Adv. Quantum Tech.*, **6**, 2370113 (2023).
 5. Weijun Luo, Alexander Puretzy, Benjamin Lawrie, Qishuo Tan, Hongze Gao, Anna K Swan, Liangbo Liang, Xi Ling, “Improving Strain-localized GaSe Single Photon Emitters with Electrical Doping”, *Nano Letters*, **23**, 9740 (2023)
 6. Weijun Luo, Alexander A Puretzy, Benjamin J Lawrie, Qishuo Tan, Hongze Gao, Zhuofa Chen, Alexander V Sergienko, Anna K Swan, Liangbo Liang, Xi Ling, “Deterministic Localization of Strain-Induced Single-Photon Emitters in Multilayer GaSe”, *ACS Photonics*, **10**, 2530 (2023)
 7. Weijun Luo, Benjamin J Lawrie, Alexander A Puretzy, Qishuo Tan, Hongze Gao, David B Lingerfelt, Gage Eichman*, Edward Mcgee, Anna K Swan, Liangbo Liang, Xi Ling, “Imaging Strain-Localized Single-Photon Emitters in Layered GaSe below the Diffraction Limit” *ACS Nano*, **17**, 23455 (2023)
 8. Carson Moseley, Summer Bolton, Joseph M Lukens, Yun-Yi Pai**, Michael Chilcote**, Benjamin J Lawrie, Shunqiao Sun, Maddy Woodson, Steven B Estrella, Seongsin M Kim, Patrick Kung, “Investigation of modified uni-traveling carrier photodiode for cryogenic microwave photonic links”, *Optics Continuum*, **2**, 2215 (2023)
 9. Chengyun Hua, Claire E Marvinney, Seongjin Hong, Matthew Feldman, Yun-Yi Pai**, Michael Chilcote**, Joshua Rabinowitz*, Raphael C Pooser, Alberto M Marino, Benjamin J Lawrie, “Quantum Enhanced Probes of Magnetic Circular Dichroism”, *Adv. Quantum Tech.* 2300126 (2023).
 10. Matthew Brahlek, Alessandro R Mazza, Abdulgani Annaberdiyev, Michael Chilcote, Gaurab Rimal, Gábor B Halász, Anh Pham, Yun-Yi Pai, Jaron T Krogel, Jason Lapano, Benjamin J Lawrie, Gyula Eres, Jessica McChesney, Thomas Prokscha, Andreas Suter, Seongshik Oh, John W Freeland, Yue Cao, Jason S Gardner, Zaher Salman, Robert G Moore, Panchapakesan Ganesh, T Zac Ward, “Emergent Magnetism with Continuous Control in the Ultrahigh-Conductivity Layered Oxide PdCoO₂”, *Nano Letters*, **23**, 7279 (2023)
 11. Bogdan Dryzhakov, Benjamin J Lawrie, Jakob Zosa Celio, Miaosheng Wang, Michael Koehler, Bin Hu, “Dual Emission Bands of a 2D Perovskite Single Crystal with Charge Transfer State Characteristics”, *ACS Nano*, **17**, 12200 (2023)
 12. Yongtao Liu, Jonghee Yang, Benjamin J Lawrie, Kyle P Kelley, Maxim Ziatdinov, Sergei V Kalinin, Mahshid Ahmadi, “Disentangling electronic transport and hysteresis at individual grain boundaries in hybrid perovskites via automated scanning probe microscopy”, *ACS Nano*, **17**, 9647 (2023)
 13. Taeyong Kim, Soyeon Park, Vasudevan Iyer**, Basamat Shaheen, Usama Choudhry, Qi Jiang, Gage Eichman*, Ryan Gnabasik, Kyle Kelley, Benjamin Lawrie, Kai Zhu, Bolin Liao, “Mapping the pathways of photo-induced ion migration in organic-inorganic hybrid halide perovskites”, *Nature Communications*, **14**, 1846 (2023)
 14. Sang Yong Song**, Chengyun Hua, Luke Bell, Wonhee Ko, Hans Fangohr, Jiaqiang Yan, Gábor B Halász, Eugene F Dumitrescu, Benjamin J Lawrie, Petro Maksymovych, “Nematically templated vortex lattices in superconducting FeSe”, *Nano Letters*, **23**, 2822 (2023)
 15. V Iyer**, K Roccapriore, J Ng*, B Srijanto, D Lingerfelt, B Lawrie, “Photon bunching in cathodoluminescence induced by indirect electron excitation”, *Nanoscale* **15**, 9738 (2023)
 16. Jonghee Yang, Diana K. LaFollette, Benjamin J. Lawrie, Anton V. Ievlev, Yongtao Liu, Kyle P. Kelley, Sergei V. Kalinin, Juan-Pablo Correa-Baena, Mahshid Ahmadi “Understanding the Role of Cesium on Chemical Complexity in Methylammonium-Free Metal Halide Perovskites” *Advanced Energy Materials*, 2202880 (2022)

17. Bibek S. Dhimi, Vasudevan Iyer**, Aniket Pant, Ravi P. N. Tripathi, Ethan J. Taylor, Benjamin J. Lawrie, Kannatassen Appavoo “Angle-resolved polarimetry of hybrid perovskite emission for photonic technologies” *Nanoscale* **14**, 17519 (2022)
18. David Curie*, Jaron T Krogel, Lukas Cavar, Abhishek Solanki*, Pramey Upadhyaya, Tongcang Li, Yun-Yi Pai**, Michael Chilcote**, Vasudevan Iyer**, Alexander Poretzky, Iliia Ivanov, Mao-Hua Du, Fernando Reboredo, Benjamin Lawrie “Correlative nanoscale imaging of strained hBN spin defects” *ACS Applied Materials and Interfaces* **14**, 41361 (2022)
19. Muneer Alshowkan, Philip G Evans, Brian P Williams, Nageswara SV Rao, Claire E Marvinney**, Yun-Yi Pai**, Benjamin J Lawrie, Nicholas A Peters, Joseph M Lukens “Advanced architectures for high-performance quantum networking” *Journal of Optical Communications and Networking* **14**, 493-499 (2022)
20. Alessandro R Mazza, Jason Lapano, Harry M MeyerIII, Christopher T Nelson, Tyler Smith, Yun-Yi Pai**, Kyle Noordhoek, Benjamin J Lawrie, Timothy R Charlton, Robert G Moore, T Zac Ward, Mao-Hua Du, Gyula Eres, Matthew Brahlek, “Surface-Driven Evolution of the Anomalous Hall Effect in Magnetic Topological Insulator MnBi₂Te₄ Thin Films” *Advanced Functional Materials*, 2202234 (2022)
21. Alaina Attanasio, Sunil A Bhave, Carlos Blanco, Daniel Carney, Marcel Demarteau, Bahaa Elshimy, Michael Febbraro, Matthew A Feldman, Sohritri Ghosh, Abby Hickin, Seongjin Hong, Rafael F Lang, Benjamin Lawrie, Shengchao Li, Zhen Liu, Juan Maldonado, Claire Marvinney, Hein Zay Yar Oo, Yun-Yi Pai, Raphael Pooser, Juehang Qin, Tobias J Sparmann, Jacob M Taylor, Hao Tian, Christopher Tunnell, Windchime Collaboration “Snowmass 2021 White Paper: The Windchime Project” arXiv preprint arXiv:2203.07242 (2022)
22. David A Garfinkel, Vasudevan Iyer**, Robyn Seils, Grace Pakeltis, Marc R Bourgeois, Andrew W Rossi, Clay Klein*, Benjamin J Lawrie, David J Masiello, Philip D Rack, “Visualizing Electric and Magnetic Field Coupling in Au-Nanorod Trimer Structures via Stimulated Electron Energy Gain and Cathodoluminescence Spectroscopy: Implications for Meta-Atom Imaging” *ACS Applied Nano Materials* **5**, 1798-1807 (2022)
23. Jie Zhang, Yun-Yi Pai**, Jason Lapano, Alessandro R Mazza, Ho Nyung Lee, Rob G Moore, Benjamin J Lawrie, T Zac Ward, Gyula Eres, Valentino R Cooper, Matthew Brahlek “Design and realization of Ohmic and Schottky interfaces for oxide electronics” *Small Science* **2**, 2100087 (2022)
24. Yun-Yi Pai**, Claire E Marvinney**, Liangbo Liang, Jie Xing, Allen Scheie, Alexander A Poretzky, Gábor B Halász, Xun Li, Rinkle Juneja, Athena S Sefat, David Parker, Lucas Lindsay, Benjamin J Lawrie, “Mesoscale interplay between phonons and crystal electric field excitations in quantum spin liquid candidate CsYbSe₂” *Journal of Materials Chemistry C* **10**, 4148-4156 (2022)
25. Yun-Yi Pai**, Claire E Marvinney**, Chengyun Hua, Raphael C Pooser, Benjamin J Lawrie “Magneto-Optical Sensing Beyond the Shot Noise Limit” *Advanced Quantum Technologies* **5**, 2100107 (2022)
26. Benjamin J Lawrie, Claire E Marvinney**, Yun-Yi Pai**, Matthew A Feldman*, Jie Zhang**, Aaron J Miller, Chengyun Hua, Eugene Dumitrescu, Gábor B Halász “Multifunctional superconducting nanowire quantum sensors” *Physical Review Applied* **16**, 064059 (2021)
27. Yun-Yi Pai**, Claire E Marvinney**, Matthew A Feldman*, Brian Lerner*, Yoong Sheng Phang*, Kai Xiao, Jiaqiang Yan, Liangbo Liang, Jason Lapano, Matthew Brahlek, Benjamin J Lawrie, “Magnetostriction of α -RuCl₃ Flakes in the Zigzag Phase” *The Journal of Physical Chemistry C* **125**, 25687-25694 (2021)
28. BE Lerner*, A Flores-Garibay*, BJ Lawrie, P Maksymovych “Compressed sensing for scanning tunnel microscopy imaging of defects and disorder”, *Physical Review Research* **3**, 043040 (2021)
29. Jie Zhang, Jong Mok Ok, Yun-Yi Pai**, Jason Lapano, Elizabeth Skoropata, Alessandro R Mazza, Haoxiang Li, Amanda Huon, Sangmoon Yoon, Benjamin Lawrie, Matthew Brahlek, T

- Zac Ward, Gyula Eres, Hu Miao, Ho Nyung Lee “Extremely large magnetoresistance in high-mobility SrNbO₃/SrTiO₃ heterostructures” *Physical Review B* **104**, L161404 (2021)
30. Muneer Alshowkan, Brian P Williams, Philip G Evans, Nageswara SV Rao, Emma M Simmerman, Hsuan-Hao Lu, Navin B Lingaraju, Andrew M Weiner, Claire E Marvinney**, Yun-Yi Pai**, Benjamin J Lawrie, Nicholas A Peters, Joseph M Lukens “Reconfigurable quantum local area network over deployed fiber” *PRX Quantum* **2**, 040304 (2021)
 31. Vasudevan Iyer**, Yoong Sheng Phang*, Andrew Butler, Jiyang Chen, Brian Lerner*, Christos Argyropoulos, Thang Hoang, Benjamin Lawrie, “Near-field imaging of plasmonic nanopatch antennas with integrated semiconductor quantum dots” *APL Photonics* **6**, 106103 (2021)
 32. Jason Lapano, Yun-Yi Pai**, Alessandro R Mazza, Jie Zhang, Tamara Isaacs-Smith, Patrick Gemperline, Lizhi Zhang, Haoxiang Li, Ho Nyung Lee, Gyula Eres, Mina Yoon, Ryan Comes, T Zac Ward, Benjamin J Lawrie, Michael A McGuire, Robert G Moore, Christopher T Nelson, Andrew F May, Matthew Brahlek “Self-regulated growth of candidate topological superconducting parkerite by molecular beam epitaxy” *APL Materials* **9**, 101110 (2021)
 33. Jong Mok Ok, Narayan Mohanta, Jie Zhang, Sangmoon Yoon, Satoshi Okamoto, Eun Sang Choi, Hua Zhou, Megan Briggeman, Patrick Irvin, Andrew R Lupini, Yun-Yi Pai*, Elizabeth Skoropata, Changhee Sohn, Haoxiang Li, Hu Miao, Benjamin Lawrie, Woo Seok Choi, Gyula Eres, Jeremy Levy, Ho Nyung Lee “Correlated oxide Dirac semimetal in the extreme quantum limit” *Science Advances* **7**, eabf9631 (2021)
 34. H Li, TT Zhang, T Yilmaz, YY Pai**, CE Marvinney**, A Said, QW Yin, CS Gong, ZJ Tu, E Vescovo, CS Nelson, RG Moore, S Murakami, HC Lei, HN Lee, BJ Lawrie, H Miao, “Observation of Unconventional Charge Density Wave without Acoustic Phonon Anomaly in Kagome Superconductors AV₃Sb₅ (A=Rb, Cs)” *PRX* **11**, 031050 (2021)
 35. C Hua, GB Halász, E Dumitrescu, M Brahlek, B Lawrie, “Optical vortex manipulation for topological quantum computation” *Physical Review B* **104**, 104501 (2021)
 36. C Lee, B Lawrie, R Pooser, KG Lee, C Rockstuhl, M Tame, “Quantum Plasmonic Sensors” *Chemical Reviews* **121**, 4743 (2021)
 37. CE Marvinney**, BE Lerner*, AA Puretzy, AJ Miller, BJ Lawrie “Waveform analysis of a large-area superconducting nanowire single photon detector” *Superconductor Science and Technology*, **34** 035020 (2021)
 38. MA Feldman*, CE Marvinney**, AA Puretzy, BJ Lawrie “Evidence of photochromism in a hexagonal boron nitride single-photon emitter” *Optica*, **8**, 1 (2021)
 39. R Pamu*, BJ Lawrie, B Khomami, D Mukherjee “Broadband Plasmonic Photocurrent Enhancement from Photosystem I Assembled with Tailored Arrays of Au and Ag Nanodisks” *ACS Applied Nano Materials* **4**, 1209 (2021)
 40. Jason Lapano**, Lauren Nuckols, Alessandro R Mazza, Yun-Yi Pai**, Jie Zhang, Ben Lawrie, Rob G Moore, Gyula Eres, Ho Nyung Lee, Mao-Hua Du, T Zac Ward, Joon Sue Lee, William J Weber, Yanwen Zhang, Matthew Brahlek, “Adsorption-controlled growth of MNTe(Bi₂Te₃)_n by molecular beam epitaxy exhibiting stoichiometry-controlled magnetism” *Physical Review Materials* **4**, 111201 (2020)
 41. RC Pooser, N Savino*, E Batson*, JL Beckey*, J Garcia*, BJ Lawrie, “Truncated nonlinear interferometry for quantum enhanced atomic force microscopy”, *Physical Review Letters*, **23**, 230504 (2020) *highlighted at* <https://www.energy.gov/science/bes/articles/squeezing-noise-out-microscopes-quantum-light>
 42. B Lawrie, R Pooser, P Maksymovych, “Squeezing Noise in Microscopy with Quantum Light” *Trends in Chemistry*, **2** 683 (2020)
 43. Chuanxu Ma, Zhongcan Xiao, Alexander A Puretzy, Hao Wang, Ali Mohsin, Jingsong Huang, Liangbo Liang, Yingdong Luo, Benjamin J Lawrie, Gong Gu, Wenchang Lu, Kunlun Hong, Jerzy Bernholc, An-Ping Li, “Engineering Edge States of Graphene Nanoribbons for Narrow-Band Photoluminescence”, *ACS Nano*, **14**, 5090 (2020)

44. BJ Lawrie, PD Lett, AM Marino, and RC Pooser, "Quantum Sensing with Squeezed Light" *ACS Photonics* **6**, 1307 (2019)
45. J. Hachtel*, S. Cho, R. Davidson*, M. Chisholm, R. Haglund, J. Idrobo, S. Pantelides, B. Lawrie, "Spatially and spectrally resolved orbital angular momentum interactions in plasmonic vortex generators" *Nature, Light: Science and Applications*, **8**, 33, (2019)
46. Matthew Feldman*, Alex Poretzky, Lucas Lindsay, Ethan Tucker*, Dayrl Briggs, Philip Evans, Richard Haglund, Benjamin Lawrie, "Phonon-induced multi-color correlations in hBN single-photon emitters" *Physical Review B Rapid Communications* **99**, 020101 (2019)
47. Mohammadjavad Dowran, Ashok Kumar, Benjamin J Lawrie, Raphael C Pooser, Alberto M Marino, "Quantum-enhanced plasmonic sensing" *Optica* **5**, 628, (2018) *highlighted at* <http://science.sciencemag.org/content/360/6394/1199.6>, *OPN Year in Review 2018*
48. Matthew A Feldman*, Eugene F Dumitrescu**, Denzel Bridges*, Matthew F Chisholm, Roderick B Davidson*, Philip G Evans, Jordan A Hachtel, Anming Hu, Raphael C Pooser, Richard F Haglund, Benjamin J Lawrie, "Colossal photon bunching in quasiparticle-mediated nanodiamond cathodoluminescence", *Phys. Rev. B Rapid Communications*, **97**, 081404 (2018)
49. Jordan A Hachtel, Roderick B Davidson*, Elena R Kovalik*, Scott T Retterer, Andrew R Lupini, Richard F Haglund, Benjamin J Lawrie, Sokrates T Pantelides, "Polarization-and wavelength-resolved near-field imaging of complex plasmonic modes in Archimedean nanospirals" *Optics Letters*, **43**, 927 (2018)
50. Z. Ahmed et al., "Quantum Sensing for High Energy Physics", <https://arxiv.org/abs/1803.11306>
51. E. Dumitrescu** and B. Lawrie, "Zero delay anti-bunching as an entanglement signature for plasmonically coupled driven qubits" *Physical Review A* **96** (5), 053826 (2017).
52. MW Holtfrerich, M Dowran, R Davidson*, BJ Lawrie, RC Pooser, AM Marino, "Toward quantum plasmonic networks." *Optica*, **3**, 985, (2016).
53. Ying Ma, Hong Li, Denzel Bridges, Peng Peng, Benjamin J Lawrie, Zhili Feng, Anming Hu, "Zero-dimensional to three-dimensional nanojoining: current status and potential application." *RSC Advances*, **6**, 75916, (2016)
54. Cheng Cheng, Shutong Wang, Jayne Wu, Yongchao Yu, Ruozhou Li, Shigetoshi Eda, Jiangang Chen, Guoying Feng, Benjamin Lawrie, Anming Hu, "Bisphenol A Sensors on Polyimide Fabricated by Laser Direct Writing for Onsite River Water Monitoring at Attomolar Concentration." *ACS Applied Materials & Interfaces*, **8**, 17784, (2016)
55. BJ Lawrie, Y Yang*, M Eaton*, AN Black*, RC Pooser, "Robust and compact entanglement generation from diode-laser-pumped four-wave mixing." *Applied Physics Letters*, **108**, 151107, (2016)
56. R.B. Davidson II*, A. Yanchenko, J. I. Ziegler, S.M. Avanesyan, B.J. Lawrie, R.F. Haglund, Jr, "All-Optical Field-Induced Second-Harmonic Generation", *ACS Photonics*, **3**, 1477, (2016)
57. R.C. Pooser and B.J. Lawrie, "Plasmonic trace sensing below the photon shot noise limit", *ACS Photonics* **3**, 8-13, (2016).
58. A.Farah*, R. Davidson, A. Malasi, R.C. Pooser, B.J. Lawrie, and R. Kalyanaraman, "Cobalt stabilization of silver extraordinary optical transmission sensing platforms" *Applied Physics Letters* **108**, 043101 (2016).
59. A Malasi, H Taz, A Farah*, M Patel, B.J. Lawrie, R Pooser, A Baddorf, G Duscher, R Kalyanaraman, "Novel Iron-based ternary amorphous oxide semiconductor with very high transparency, electronic conductivity, and mobility" *Scientific Reports* **5**, 18157 (2015).
60. W. Fan*, B.J. Lawrie, R. Pooser, "Quantum plasmonic sensing" *Phys. Rev. A* **92**, 053812 (2015).
61. R.C. Pooser and B.J. Lawrie "Ultrasensitive measurement of MEMS cantilever displacement sensitivity below the shot noise limit" *Optica* **2**, 393 (2015). Highlighted at <http://science.energy.gov/>
62. W.P. Grice, P.G. Evans, B. Lawrie, M. Legre, P. Lougovski, W. Ray, B.P. Williams, B. Qi and A.M. Smith, "Two-Party Secret Key Distribution via a Modified Quantum Secret Sharing Protocol" *Optics Express* **23**, 7300 (2015).

63. B.J. Lawrie, N. Otterstrom*, and R.C. Pooser, “Coherence area profiling in multi-spatial-mode squeezed states” *Journal of Modern Optics* **63**, 989 (2016).
64. N. Otterstrom*, R. C. Pooser, and B. J. Lawrie, “Nonlinear optical magnetometry with accessible in situ optical squeezing” *Optics Letters* **39**, 6533-6536 (2014).
65. B. J. Lawrie, P. Evans, R. C. Pooser, “Extraordinary optical transmission of multimode quantum correlations via localized surface plasmons” *Phys. Rev. Lett.* **110**, 156802 (2013).
66. B.J. Lawrie, R. Mu, and R.F. Haglund, “Plasmonic control of near-interface exciton dynamics in defect-rich ZnO thin films” *Plasmonics*, **8**, 693, (2013).
67. B. J. Lawrie and R. C. Pooser, “Toward Real Time Quantum imaging with a single pixel camera” *Optics Express* **21**, 7549 (2013).
68. B.J. Lawrie, K.W. Kim, D.P. Norton, and R.F. Haglund, “Plasmon-exciton hybridization in ZnO quantum well-Al nanodisc heterostructures” *Nano Letters* **12**, 6152-6157, (2012).
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PATENTS

- R. Kalyanaraman, A. P. Baddorf, G. Duscher, A. Farah*, A. Malasi, B. J. Lawrie and R. C. Pooser, *Semiconductor Composition Containing Fe, Dy, and Tb*. **US Patent 9,773,876**
- B.J. Lawrie, R.C. Pooser, B. Qi, and B. Williams, *Integrated Autocorrecting Continuous Variable True Random Number Generator*. **US Patent 10635403, Licensed to Qrypt, Inc. 2018, Memcus Inc, 2020.**
- B.J. Lawrie, P. Maksymovych, R.C. Pooser, *Truncated Nonlinear Interferometer-Based Atomic Force Microscopes*. **US Patent 11,119,386**
- RC Pooser, BJ Lawrie, P Maksymovych, *Truncated non-linear interferometer-based sensor system* **US Patent 11,561,453**

INTERNATIONAL INVITED CONFERENCE PRESENTATIONS

1. *Near-field imaging and manipulation of excitons and color centers in nanoscale and 2D materials*, IMC20, 2023, Busan South Korea
2. *Ultrascale plasmonic sensing with quantum states of light*, NanoMeta 2017, Seefeld Austria

DOMESTIC INVITED CONFERENCE PRESENTATIONS

1. *Nanoscale measurement and manipulation of single-photon emitter photophysics*, SPIE Optics and Photonics 2023
2. *Nanoscale strain control of spin defects in hBN*, SPIE Optics and Photonics 2022
3. *Near-Field Imaging and In Situ Plasmonic Control of Color Centers and Excitons in Nanoscale Materials*, Metamaterials 2021
4. *Free-space confocal magneto-optical spectroscopies at milliKelvin temperatures*, SPIE Optics and Photonics 2021
5. *Toward practical quantum-enhanced microscopies*, APS March Meeting 2021
6. *Toward a microscopic understanding of superconducting nanowire single photon detectors*, IEEE Quantum Week 2020
7. *Cathodoluminescence Microscopies of Color Centers in Bulk and 2D Materials*, M&M 2020
8. *Practical Quantum Sensing at Ultra Trace Levels with Squeezed States of Light*, Advanced Photonics 2017

9. *Plasmonics for Integrated Quantum Information*, BBN Integrated Quantum Information Workshop 2014
10. *Quantum Plasmonic Information Science*, OSA Quantum Plasmonics Incubator 2013
11. *Transduction and Control of Squeezed Light Sources by Localized and Propagating Surface Plasmons*, CLEO 2013

CONTRIBUTED CONFERENCE PRESENTATIONS

1. *Nearly-Resonant Crystalline-Phononic Coupling in Quantum Spin Liquid Candidate CsYbSe₂*, CLEO 2022
2. *Correlative Cathodoluminescence Microscopy of Strain-Enhanced hBN Spin Defects*, CLEO 2022
3. *Spatially Resolved Superconducting Nanowire Single Photon Detector Rise-Time Analysis*, OSA Quantum 2.0 2020
4. *Superconducting Nanowire Single Photon Detector Fall-Time Analysis*, CLEO 2020
5. *Truncated nonlinear interferometric cantilever beam-displacement: accessible quantum sensing*, CLEO 2019
6. *Phonon-induced multi-color correlations in hBN single-photon emitters*, CLEO 2019
7. *Single photon spectroscopy of excited state structure in hBN quantum emitters*, CLEO 2019
8. *Colossal Photon Bunching Driven by Phonon Recombination Dynamics*, CLEO 2018
9. *Quantum-Enhanced Ultrasound Detection with Plasmonic Sensors*, CLEO 2018
10. *Atomic Force Microscopy Beyond the Standard Quantum Limit*, CLEO 2018
11. *Plasmon-Mediated Entanglement Dynamics*, CLEO 2018
12. *Colossal Photon Bunching Driven by Phonon Recombination Dynamics*, CLEO 2018
13. *Spectrally Resolved Second-Order Coherence of Nanoscale Plasmonic-NV Center Hybrids*, APS March Meeting 2018
14. *Colossal Bunching in Nanodiamond Cathodoluminescence*, Frontiers in Optics 2017
15. *Quantum Sensing Beyond the Shot-Noise Limit with Plasmonic Sensors*, APS March Meeting 2017
16. *Nano-chirality detection with vortex plasmon modes*, CLEO 2017
17. *Quantum computing over the optical spatial mode comb with cluster states*, CLEO 2017
18. *Transduction of Entangled Images by Localized Surface Plasmons*, Quantum Information and Measurement 2017
19. *Photon bunching and antibunching in cathodoluminescence at high currents*, NanoMeta 2017
20. *Nano-chirality detection with vortex plasmon modes*, NanoMeta 2017
21. *Nonlinear Interferometric Plasmonic Sensing*, Frontiers in Optics 2016
22. *Plasmonic Cavity Quantum Electrodynamics*, META 2016
23. *Unveiling Complex Plasmonic Resonances in Archimedean Nanospirals through Cathodoluminescence in a Scanning Transmission Electron Microscope*, Microscopy and Microanalysis 2016
24. *Plasmonic Sensing with Quantum Noise*, CLEO 2016
25. *Locked SU (1, 1) Nonlinear Interferometer for Phase Shift Measurements in Triangular Nanohole Arrays*, DAMOP 2016
26. *Complex Near-Field Plasmonic Response of Au Nanospirals*, APS March Meeting 2016
27. *Continuous-Variable Quantum Cluster-State Generation Using a Tapered Amplifier*, SESAPS2015
28. *Ultratrace Quantum Plasmonic Sensing*, Advanced Photonics 2015
29. *Plasmon-Induced Nonlinearities in Polarized Materials*, Advanced Photonics 2015
30. *Quantum Model of Plasmon-Quantum Emitter Interaction in the Strong-Coupling Regime*, CLEO 2015
31. *Nonlinear Optical Magnetometry with Accessible in situ Optical Squeezing*, CLEO 2015
32. *Secret key generation via a modified quantum secret sharing protocol*, SPIE Sensing Technology

and Applications 2015

33. *Quantum secret sharing with phase-encoded photons*, CLEO 2015
34. *Coherence Area Profiling in Multi-spatial-mode Squeezed States*, Frontiers in Optics 2014
35. *Ultrasensitive Measurement of MEMS Cantilever Displacement Below the Photon Shot Noise Limit*, Quantum Information and Measurement 2014
36. *Ultrafast Surface-Plasmon Enhancement of Exciton and Defect Luminescence in ZnO Thin Films*, XVIIIth International Conference on Ultrafast Phenomena 2013
37. *Multi-mode Squeezed Light Transduction via Localized Surface Plasmons*, Frontiers in Optics 2012
38. *Real-Time Quantum Imaging Via Compressed Sensing*, CLEO 2012
39. *Exploring exciton-plasmon coupling in laser-and electron-beam-fabricated nanostructures*, SPIE Synthesis and Photonics of Nanoscale Materials IX 2012
40. *Resonant Plasmon-Exciton Coupling in Zinc Oxide Quantum Well-Aluminum Nanodisc Heterostructure Arrays*, CLEO 2011
41. *Ultrafast Observation of Weak Coupling Effects in ZnO-Ag Heterostructures*, CLEO 2011
42. *Substrate Dependence of Purcell Enhancement in ZnO-Ag Multilayers*, EXCON 2010
43. *Coupling of photoluminescent centers in ZnO to localized and propagating surface plasmons*, EMRS Spring 2009 Meeting
44. *Coupling dynamics between photoluminescent centers in ZnO and surface plasmons*, SPIE Optics and Photonics 2009

RESEARCH GRANTS

- DOE BES: “Nanoscale quantum and classical sensing for superconducting and topological quantum information”, PI
- DOE BES: “Thin film platform for rapid prototyping novel materials with entangled states for quantum information science”, co-investigator
- LDRD: Quantum Materials Initiative: Excitations and Transport in Novel Quantum Matter, co-investigator
- LDRD: Probing quantum entanglement using neutron scattering and magnetic Wollaston prisms, co-investigator
- SEED: Atomic Force Microscopy Beyond the Standard Quantum Limit, PI
- William and Mary Keck Foundation: Ultra-trace Sensors, co-investigator
- LDRD: Dissipation Driven Quantum State Engineering On-Chip, co-investigator
- LDRD: Nonlinear Nanophotonics with Ultrastrong Plasmonic Coupling, PI
- SEED: Large-Scale Cluster State Generation for Fault Tolerant Quantum Computation, PI
- Director’s R&D Fund General Hire: Quantum Plasmonic Memory, PI
- LDRD: Phase Change Material Detectors for Single Photon Detection in the UV-Vis Region, co-investigator
- LDRD: Quantum-enhanced plasmonic ultra-trace sensors, co-investigator

MENTOR TO HIGH SCHOOL INTERNS

- | | | |
|----------------|-------------------------|--------------------------|
| 1. Evan Davies | Summer 2017-Summer 2018 | Webb School of Knoxville |
| 2. Jimin Lee | Summer 2018 | Oak Ridge High School |

MENTOR TO UNDERGRADUATE INTERNS

- | | | |
|--------------------|-------------------|-----------------------------------|
| 1. Nils Otterstrom | Summer 2014 | Brigham Young University |
| 2. Allison Sachs | Summer 2014 | University of Tennessee |
| 3. Aaron Wirthwein | Summer 2015 | Wabash College |
| 4. Nick Black | Summer 2015, 2016 | Middle Tennessee State University |
| 5. Miller Eaton | Summer 2015, 2016 | Southern Illinois University |
| 6. Yang Yang | Fall 2015 | Wabash College |

7. Noah Detal	Fall 2015	Beloit College
8. Marisol Beck	Summer 2016	Harvey Mudd College
9. Anthony Giljum	Summer 2016	New Mexico Institute of Mining and Technology
10. Elena Kovalik	Summer 2017	UNC Chapel Hill
11. Justin Deterding	Summer 2017	Southern Illinois University Edwardsville
12. Michael Tripepi	Summer 2017	Hillsdale College
13. Ethan Tucker	2017-2018	Case Western Reserve University
14. Nick Savino	Summer 2018	Lynchburg College
15. Ryan Kaufman	Summer 2018	University of Pittsburgh
16. Jacob Beckey	Summer 2018	Clarion College
17. Zachary Croft	Spring 2019	University of Michigan
18. Emma Batson	Summer 2019	MIT
19. Tristan Carlson	Summer 2019/2020	Sewanee College
20. Nathan Rosenmann	Summer 2019	University of Illinois, Chicago
21. Casey Christian	Fall 2019	Morehead State
22. Brian Lerner	Fall 2019-Spring 2021	Rutgers
23. Alec Dinerstein	Spring 2020	Montana State University
24. Edward Gheorghita	Summer 2020	Belmont University
25. Xavier Szigethy	Summer 2020	Penn State University
26. Eric Liu	Summer 2020	Purdue University
27. Yoong Sheng Phang	Spring 2021	UGA
28. Clay Klein	Summer 2021	Clarion College
29. Lukas Cavar	Fall 2021	Indiana University
30. Nathan Mayer	Spring 2022	Bellarmino College
31. Josh Rabinowitz	Summer 2022	Duke University
32. Gage Eichman	Summer 2022	Texas Tech University
33. Ian Gallagher	Spring 2023-Fall 2023	UNC Greensboro
34. Gabriel Cowley	Spring 2024	Wabash College

GRADUATE STUDENT RESEARCH ADVISOR/CO-ADVISOR

1. David Curie	Vanderbilt University/Oak Ridge National Laboratory
2. Matthew Feldman	Vanderbilt University/Oak Ridge National Laboratory
3. Roderick Davidson	Vanderbilt University/Oak Ridge National Laboratory
4. Emily Layden	University of Tennessee/Oak Ridge National Laboratory

POSTDOCTORAL ADVISOR/CO-ADVISOR

1. Yueh-Chun Wu	October 2023-present
2. Yun-Yi Pai	October 2019-October 2022
3. Michael Chilcote	September 2021-October 2022
4. Vasudevan Iyer	March 2020-August 2022
5. Claire Marvinney	October 2018-September 2021
6. Eugene Dumitrescu	January 2017-January 2018

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- NPJ Journals
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- ACS Journals
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