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(a) Education

University of Alabama at Birmingham	Birmingham, AL	Physics	Ph.D 2021
University of Alabama at Birmingham	Birmingham, AL	Physics	M.S. 2017
University of North Georgia	Dahlonega, GA	Physics	B.S 2015

(b) Skills

Pulsed laser deposition, in situ plasma diagnostics and spectroscopy, machine learning, materials characterization, automation and robotics, autonomous synthesis and experimentation.

(c) Professional Experience

2025 – present	R&D Staff, Center for Nanophase Materials Sciences, ORNL
2023 – 2025	R&D Associate, Center for Nanophase Materials Sciences, ORNL
2021 – 2023	Postdoctoral Research Associate, Oak Ridge National Laboratory
2018	NSF EPSCoR CIPPTA Appointment, Vista Engineering, Birmingham, AL
2016 – 2021	Graduate Fellow, University of Alabama at Birmingham
2015 – 2016	Graduate Teaching Assistant, University of Alabama at Birmingham

(d) Patents

1. US Patent Application 18/417,567, "Remote laser-based sample heater with sample exchange turret," Jan 19, 2024. Inventors: Sumner B. Harris and Christopher M. Rouleau

(e) Publications

1. Ganesh Narasimha, Maryam Bari, Benjamin J. Lawire, Ilia Ivanov, Marti Checa, Sumner B. Harris, Zuo-Guang Ye, Rama Vasudevan, and Yongtao Liu, Ferroelastic Domain Induced Electronic Modulation in Halide Perovskites, arXiv e-prints , arXiv:2504.17882 (2025).
2. Austin C. Houston, Sumner B. Harris*, Hao Wang, Yu-Chuan Lin, David B. Geohegan, Kai Xiao, and Gerd Duscher, Atom identification in bilayer moire materials with Gomb-Net, Nano Letters , in press (2025).
3. Sumner B. Harris*, Patrick T. Gemperline, Christopher M. Rouleau, Rama K. Vasudevan, and Ryan B. Comes*, Deep learning with reflection high-energy electron diffraction images to predict cation ratio in $Sr_{2x}Ti_{2(1-x)}O_3$ thin films, Nano Letters **25**, 5867–5874 (2025).
4. Sumner B. Harris*, Ruth Y. López Fajardo, Alexander A. Puretzky, Kai Xiao, Feng Bao, and Rama K Vasudevan*, Online Bayesian state estimation for real-time monitoring of growth kinetics in thin film synthesis, Nano Letters **25**, 2444 (2025).
5. Sumner B. Harris, Rama K. Vasudevan, and Yongtao Liu, Active oversight and quality control in standard bayesian optimization for autonomous experiments, npj Comput. Mater. **11**, 23 (2025).
6. Elham Foadian, Sheryl L Sanchez, Sumner B. Harris, Benjamin J. Lawrie, Astita Dubey,

Yipeng Tang, Bin Hu, Jonghee Yang, and Mahshid Ahmadi, Impact of halogen groups on the properties of pea-based 2d pb–sn halide perovskites, Advanced Optical Materials , 2403120 (2025), in press.

7. Sumner B. Harris*, Christopher M. Rouleau, Kai Xiao, and Rama K. Vasudevan, Deep learning with plasma plume image sequences for anomaly detection and prediction of growth kinetics during pulsed laser deposition, npj Comput. Mater. **10**, 105 (2024).
8. Sumner B. Harris*, Arpan Biswas, Seok Joon Yun, Kevin M. Roccapriore, Christopher M. Rouleau, Alexander A. Puretzky, Rama K. Vasudevan, David B. Geohegan, and Kai Xiao*, Autonomous synthesis of thin film materials with pulsed laser deposition enabled by in situ spectroscopy and automation, Small Methods **8**, 2301763 (2024).
9. Yiling Yu, Volodymyr Turkowski, Jordan A. Hachtel, Alexander A. Puretzky, Anton V. Ievlev, Naseem U. Din, Sumner B. Harris, Vasudevan Iyer, Christopher M. Rouleau, Talat S. Rahman, David B. Geohegan, and Kai Xiao, Anomalous isotope effect on the optical bandgap in a monolayer transition metal dichalcogenide semiconductor, Sci. Adv. **10**, eadj0758 (2024).
10. Elham Foadian, Jonghee Yang, Sumner B. Harris, Yipeng Tang, Christopher M. Rouleau, Syed Joy, Kenneth R. Graham, Benjamin J. Lawrie, Bin Hu, and Mahshid Ahmadi, Decoding the broadband emission of two-dimensional pb-sn halide perovskites through high-throughput exploration, Adv. Funct. Mater. **34**, 2411164 (2024).
11. Ivan Vlassiouk, Sergei Smirnov, Alexander Puretzky, Olugbenga Olunloyo, David B. Geohegan, Ondrej Dyck, Andrew R. Lupini, Raymond R. Unocic, Harry M. Meyer III, Kai Xiao, Dayrl Briggs, Nickolay Lavrik, Jong Keum, Ercan Cakmak, Sumner B. Harris, Marti Checa, Liam Collins, John Lasseter, Reece Emery, John Rayle, Philip D. Rack, Yijing Stehle, Pavan Chaturvedi, Piran R. Kidambi, Gong Gu, and Ilia Ivanov, Armor for steel: Facile synthesis of hexagonal boron nitride films on various substrates, Advanced Materials Interfaces **11**, 2300704 (2024).
12. Adam D. Smith, Sumner B. Harris, Renato P. Camata, Da Yan, and Cheng-Chien Chen, Machine learning the relationship between debye temperature and superconducting transition temperature, Phys. Rev. B **108**, 174514 (2023).
13. Sumner B. Harris, Yu-Chuan Lin, Alexander P. Puretzky, Liangbo Liang, Ondrej Dyck, Tom Berlijn, Gyula Eres, Christopher M. Rouleau, Kai Xiao, and David B. Geohegan, Real-time diagnostics of 2D crystal transformations by pulsed laser deposition: Controlled synthesis of Janus WSSe monolayers and alloys, ACS Nano **17**, 2472–2486 (2023).
14. A. Okmi, X. Xiao, Y. Zhang, R. He, O. Olunloyo, S. B. Harris, T. Jabegu, N. Li, D. Maraba, Y. Sherif, O. Dyck, I. Vlassiouk, K. Xiao, P. Dong, B. Xu, and S. Lei, Discovery of graphene-water membrane structure: Toward high-quality graphene process, Advanced Science **9**, 2201336 (2022).
15. Sumner B. Harris, Jacob H. Paiste, Joseph Edoki, Robert R. Arslanbekov, and Renato P. Camata, Experimentally constrained multidimensional simulation of laser-generated plasmas and its application to UV nanosecond ablation of Se and Te, Plasma Sources Sci. Technol. **30**, 105013 (2021).
16. Sumner B. Harris, Jacob H. Paiste, Tharon J. Holdsworth, Robert R. Arslanbekov, and Renato P. Camata, Laser-generated plasmas in length scales relevant for thin film growth and processing: simulation and experiment, J. Phys. D: Appl. Phys. **53**, 015203 (2019).
17. Sumner B. Harris and Renato P. Camata, Double epitaxy of tetragonal and hexagonal phases

in the FeSe system, J. Cryst. Growth **27**, 104778 (2019).

18. Paul A. Baker, Shane A. Catledge, Sumner B. Harris, Katie J. Ham, Wei-Chih Chen, Cheng-Chien Chen, and Yogesh K. Vohra, Computational predictions and microwave plasma synthesis of superhard boron-carbon materials, Materials **11**, 1279 (2018).

(f) Invited Talks

1. "AI and in situ Diagnostics Enabled Autonomous PLD System for Fast Thin Film Material Fabrication." 68th Annual Society of Vacuum Coaters Technical Conference, Nashville, TN, 5/19/25-5/22/25.
2. "New methods for intelligent PLD growth of thin film materials." 2025 Laser Segment Engineering Seminar, hosted by Coherent, INC. Online, 4/18/25.
3. "AI-driven materials synthesis with pulsed laser deposition." Scientific Discovery in the AI Age, Lemont, Il, 4/15/25-4/17/25. Workshop hosted by Argonne National Laboratory.
4. "Approaches for AI-driven pulsed laser deposition using in situ diagnostics." ACerS Electronic Materials and Applications 2025, Denver, Co, 2/25/25-2/28/25.
5. "Machine learning approaches for thin film synthesis with pulsed laser deposition." Accelerating Research on Novel Approaches for Energy-Efficient Computing. Online, Workshop hosted by Stanford Synchrotron Radiation Lightsource/SLAC National Accelerator Laboratory. 2/3/25-2/7/25.
6. "AI-driven pulsed laser deposition of nanomaterials." SPIE Photonics West LASE, San Francisco, CA, 1/25/25-1/30/25.
7. "Autonomous Synthesis of Thin Films with Pulsed Laser Deposition." Tennessee Advanced Materials Summit, University of Tennessee, Knoxville, TN, 7/9/24-7/10/24
8. "Combining gas-phase, structural, and optical diagnostics for in situ feedback and control during pulsed laser deposition." SPIE Phononics West LASE, San Francisco, CA, Jan. 2023.
9. "Real-time optical diagnostics for in situ feedback during growth and transformation of transition metal dichalcogenides with pulsed laser deposition." ACerS Electronic Materials and Applications 2023, Orlando, FL, Jan. 2023.
10. "AI-driven synthesis of thin film materials with pulsed laser deposition." 2023 CNMS User Meeting Workshop on Machine Learning in Autonomous Science: Synthesis, Characterization, and Theory. CNMS, 8/7/23-8/11/23, Knoxville, TN.

(g) Mentorship Activities

1. Mentor for Next Generation STEM Internship (NGSI) program Spring and Summer 2025.
   (a) NGSI affords high school juniors and seniors the oppurtunity to aprticipate in STEM projects with research staff at ORNL.
2. Primary mentor for CNMS postoc Asraful Haque

(h) Synergistic Activities

1. Reviewer for Argonne National Laboratory's Autonomous Discovery Initiative, April 14-17 2025.
2. CNMS Representative for the DOE Office of Science (SC) Integrated Research Infrastructure (IRI) / High Performance Data Facility (HPDF) coordination kickoff meeting, July 16-18 2024.
3. Organizing Committee Member for the Community for Autonomous Experimentation (CASE)

2023-2025

4. Reviewer for Nature Communications, Journal of Vacuum Science & Technology A, Physics of Plasmas, Applied Physics Letters, Scientific Reports, ACS Nanoscience Au
5. Machine Learning Certificates:
   - IBM AI Engineering Professional Certificate
   - Google Advanced Machine Learning with TensorFlow Specialization Certificate
6. Dedicated academic, evidenced by numerous awards and fellowships:
   - UAB Samuel B. Barker Award for Excellence in Graduate Studies at the Doctoral Level, May 2020 - First ever graduate student from physics to be honored. Selected from pool of graduate students from every department.
   - UAB College of Arts and Sciences' Dean's Award, May 2020 - Selected from pool of graduate students in the Department of Arts and Sciences
   - Outstanding Physics Graduate Student Award, May 2020
   - Alabama Space Grant Consortium (ASGC) Fellowship, Aug 2018-Aug 2021. Maximum renewal
   - NSF EPSCoR Corporate Internship Program on Plasma Technology Applications (CIPPTA) 2018 - Worked with private engineering consulting firm Vista Engineering, Birmingham, AL
   - Graduate Assistance in Areas of National Need (GAANN) Fellowship, Jan 2016-Dec 2017. Maximum renewal.
7. Service and Outreach Activities
   - UAB Science Olympiad, Birmingham, AL. February 2019 Demonstration of the Meissner effect to 60+ middle and high school aged students
   - Spring Valley School, Birmingham, AL. March 2019 Demonstration of the Meissner effect and zero resistance properties of superconductors to 25 high school juniors and seniors
   - Central Alabama Regional Science and Engineering Fair, Birmingham, AL. March 2017-2019 Senior physical science category judge
   - 2018-2021 Member of a Plasma Diagnostics Working Group, a group composed of plasma physics experimentalists from 7 Alabama universities participating in NSF EPSCoR CPU2AL projects to share problems and solutions in plasma diagnostic and measurement techniques.