Ethan C. Ahn, Ph.D.
Associate Professor of Electrical Engineering
VMEC Professor
Associate Director, Quantum Science and Engineering Center (QSEC)
Department of Electrical and Computer Engineering (ECE)
Volgenau School of Engineering
College of Engineering and Computing
George Mason University (GMU)

Founding Director and Principal Investigator
Mason Nanoelectronics Laboratory
Group Webpage: https://masonnano.wixsite.com/ethanahn

Contact Information
- Office Phone: (703) 993 – 8848
- Mail: 4400 University Dr. MSN 1G5, Fairfax, VA 22030
- Office: ENGR 3255/IABR 3019
- Email: eahn7@gmu.edu

Education

Stanford University	Electrical Engineering	Ph.D., 2015
• Thesis advisor: Prof. H.-S. Philip Wong		
• Title: *Emerging nonvolatile memory, enabled by carbon nanomaterials*		
KAIST	Electrical Engineering	M.S., 2007
• Thesis advisor: Prof. Mincheol Shin		
• Title: *Quantum simulation of carbon nanotube field-effect transistors*		
KAIST	Electrical Engineering (minor in IT Business)	B.S., 2005
• *Summa Cum Laude* (GPA: 4.09/4.3)		

Appointments

George Mason University	
• Associate Professor, Electrical and Computer Engineering	09/2023 – present
• Associate Director, Quantum Science & Engineering Center	09/2025 – present
The University of Texas at San Antonio	
• Associate Professor, Electrical and Computer Engineering	09/2022 – 08/2023
• Graduate Advisor of Record, Advanced Materials Engineering	09/2022 – 08/2023
• Graduate Faculty, Advanced Materials Engineering	06/2018 – 08/2023
• Assistant Professor, Electrical and Computer Engineering	09/2016 – 08/2022
Naval Research Laboratory	
• Summer Faculty Fellow	2022 Summer
Air Force Research Laboratory	
• Summer Faculty Fellow	2019 – 2021 Summer
Texas State University	
• Adjunct Graduate Faculty, Physics	06/2017 – 05/2020

Apple Inc. (Cupertino, CA)
• Senior Panel Process Engineer 03/2016 – 08/2016
Stanford University
• Post-Doctoral Researcher, Electrical Engineering 08/2015 – 02/2016
IBM T. J. Watson Research Center
• Summer Research Intern (Manager: Dr. Mark Ritter) 2013 Summer
Samsung Advanced Institute of Technology (SAIT)
• Summer Research Intern (Manager: Dr. Jaekwang Shin) 2012 Summer
IMEC
• Summer Research Intern (Manager: Dr. Kittl Jorge) 2011 Summer
Michigan State University
• Visiting Scholar, Physics and Astronomy (Drs. Pratt and Bass) 03/2007 – 07/2010
KIST (Korea Institute of Science and Technology)
• Research Scientist 03/2007 – 07/2010

Research Topics (Funded Projects)

As Lead PI

- **Computing Hardware**
  - Deep Learning Accelerator (*Funded by* UTSA VPR Office)
  - Emerging Nonvolatile Memory (*Funded by* AFOSR, VMEC)
  - Low-power, High-speed Logic (*Funded by* NSF)
- **Low-dimensional Nanomaterials**
  - Solution-processable Carbon Nanotube (*Funded by* Lam Research)
  - 2D Materials and vdW Heterostructures (*Funded by* UTSA VPR Office)
- **Nanomagnetism and Spintronics**
  - Graphene-inserted Ferromagnetic Tunnel Device (*Funded by* AFOSR)
- **Oxide Electronics**
  - Epitaxial Oxide Heterostructure for Electrostrictive FET (*Funded by* NSF)
- **Energy Harvesting and Storage**
  - Artificial Leaf (*Funded by* Mason VPR Office)
  - High Energy Density Supercapacitor (*Funded by* UTSA VPR Office)
  - Piezoelectric Energy Harvesting (*Funded by* DoT)
  - Thermoelectric Energy Harvesting (*Supported by* Sandia National Lab)
- **Hardware Security**
  - Vulnerability of Memory Against Physical Attack (*Funded by* UTSA Seed Grant)
- **Sensor**
  - Temperature and Vibration Sensor for Power System (*Funded by* Ministry of Trade, Industry and Energy of South Korea)
  - Triboelectric Skin Sensor (*Funded by* Universidad Politécnica de Madrid)

As Co-PI

- **Quantum**
  - Fabrication of Chip-scale, Atom-based RF Sensor (*Funded by* Mason VPR Office)
  - vdW Ferroelectrics (*Funded by* Mason VPR Office)

• **Biomedical**
- Electronic Device for Sarcopenia Assessment (*Funded by* Mason College of Public Health)
- Microneedle Array for Cell Transfection and Transformation (*Funded by* UTSA Seed Grant)
- Digital Extender for Airway Management (*Funded by* US Army Institute of Surgical Research)

Publication Summary

(80+ publications; **2,000**+ citations, **18**+ h-index, and **23**+ i10-index in *Google Scholar***)**

• **30**+ Journal Publications
• **50**+ Conference Publications
• **1** US Patent
• **1** Book chapter

Awards, Fellowships, Scholarships, and Honors

2024 VMEC (Virginia Microelectronics Consortium) Endowed Professorship
2022 NRL Summer Faculty Fellowship, USA
2021 Association of College and University Educators (ACUE) Teaching Fellowship
2021 AFRL Summer Faculty Fellowship, USA
2020 AFRL Summer Faculty Fellowship, USA
2019 AFRL Summer Faculty Fellowship, USA
2018 Certificate of Appreciation, Journal of Nanophotonics, SPIE
2017 User Proposal, Center for Integrated Nanotechnology (CINT), Sandia National Lab
2017 Faculty Travel Award, UTSA College of Engineering, USA
2017 Faculty Research Award, Lam Research, USA
2016 Faculty Travel Award, UTSA College of Engineering, USA
2016 Faculty Research Award, Lam Research, USA
2015 IEEE SFBA Nanotechnology Council Seminar Appreciation, IEEE
2014 Best Paper Award (nominated), VLSI Tech. Symp., USA
2014 John Bardeen Research Award for Excellence in Nanodevices Research, SONIC, USA
2013 Best Summer Intern, T.-C. Chen, IBM T. J. Watson Research Center, USA
2013 KSEA Graduate Scholarship, KSEA, USA-Korea
2010 Excellent Research Team Award, KIST, Korea
2006 Engineering Scholarship for Graduate Studies, KBS Kang Tae-Won Foundation, Korea
2004 GE Scholarship, General Electric, USA
2004 Outstanding Scholastic Performance Award, Purdue University, USA

Services

Professional Society
• **I**EEE (2015 – present)
• **I**EEE EDS (Electron Devices Society) (2017 – present)
- Technical Committee for Optoelectronic Devices (2017 – 2020)
- Vice Chair for Northern Virginia/Washington DC Chapter (2025 – present)
• **I**nternational **M**icro and **N**ano **E**ngineering **S**ociety (iMNEs) (2019 – present)
• **A**merican **V**acuum **S**ociety (AVS) (2009 – present)

• **A**merican **P**hysical **S**ociety (APS) (2009 – present)
• **K**orean **P**hysical **S**ociety (KPS) (2006 – present)
• **K**orean **M**agnetics **S**ociety (KMS) (2006 – present)
• **K**orean-American **S**cientists and **E**ngineers **A**ssociation (KSEA) (2010 – present)

Editorial Board Member
• Scientific Reports (2023 – present)

Guest Editor
• Scientific Reports (2024, Single Molecule Magnets)

Technical Program or Organizing Committee
• MMM-Intermag 2025 (session chair)
https://2025-joint.magnetism.org
• IEEE Nano 2025 (session chair)
https://2025.ieeenano.org
• NSF International Workshop on Large Scale Neuromorphic Computing @ ICONS 2022 (**I**nternational **C**onference **o**n **N**euromorphic **S**ystems)
https://www.nuailab.com/workshop.html
• PDF 2019 (**P**rofessional **D**evelopment **F**orum)
https://pdf.kseas/2019/
• SANTF 2018 (**S**an **A**ntonio **N**ano**T**echnology **F**orum)
http://www.santf.net
• EDSSC 2017 (The 13th IEEE International Conference on **E**lectron **D**evices and **S**olid-**S**tate **C**ircuits)
https://www.aconf.org/conf_101948.html
• SANTF 2017 (**S**an **A**ntonio **N**ano**T**echnology **F**orum)
http://www.santf.net

Advisory Board
• Member, (Go Virginia-funded) Nano-IMAGINE, George Mason University (2024 – 2025)
• Member, Advanced Materials Technology (AMT), Northwest Vista College (2020 – 2023)

Executive and Operations Committee
• Member, VMEC (2024 – present)

GMU Committee (Department Level)
• ECE Faculty Advisory Committee Member (Fall 2025 – present)
• ECE Undergraduate Committee Member (Fall 2023 – present)
• ECE Graduate Committee Member (Fall 2023 – present)
• ECE P&T Committee Member (AY 2024-2025, AY 2025-2026)
• ECE TTR (Tenure Track Renewal) Committee Member (AY 2023-2024, AY 2024-2025)
• ECE Senior Design (Capstone Project) Judge (Fall 2023)
• ECE Senior Design (Capstone Project) Supervisor (Fall 2025 – Spring 2026)
• ME P&T Committee Member (AY 2024-2025)

GMU Committee (College Level)
• Recruitment for Director, Operations and Facilities Projects (2025)

GMU Committee (University Level)
• University Scholars Selection Committee Member (2025)

UTSA Committee (Department Level)
• ECE DFRAC (Departmental Faculty Review Advisory Committee) (Fall 2022 – Spring 2023)
• ECE Scholarships and Awards Committee Member (Fall 2021 – Spring 2023)
• ECE Voting Committee Member (Fall 2019 – Spring 2023)
• ECE Senior Council (Faculty Advisory) Committee Member (Fall 2019 – Spring 2023)
• ECE Graduate Program Committee Member (Fall 2017 – Spring 2023)
• ECE Graduate Student Advisory/Recruitment Committee Member (Fall 2017 – Spring 2023)
• ECE Safety Committee Member (Fall 2017 – Spring 2023)
• ECE Space Committee Member (Fall 2017 – Spring 2023)
• ECE Concentration Chair for Electronic Materials and Devices (Fall 2017 – Fall 2022)
• ECE Annual Review Committee Member (Fall 2019 – Spring 2021)

UTSA Committee (College Level)
• ECE Representative for New PhD Program in Materials Science and Engineering (Fall 2021 – Spring 2023)

UTSA Committee (University Level)
• Physical Safety Committee (Spring 2022 – Spring 2023)

Committee Chair for Graduate Thesis/Dissertation (GMU)
PhD (1)
• Fituneredi ate Gebeyehu (RQE in Fall 2025)
- *Dissertation Title*: $PtSe_2$ Atomristors: Materials, Mechanisms, and Integration

MS (1)
• Khang Diep (defense in Spring 2026)
- *Thesis Title*: Large-area Transfer and Characterization of 2D Materials

Committee Member for Graduate Thesis/Dissertation (GMU)
PhD (6)
• Essa Asiri (RQE in Fall 2025)
- *Dissertation Title*: GaN Transistors: Physics, TCAD Simulation and Applications
- *Committee Chair* (dissertation advisor): Dr. Dimitrios Ioannou (ECE)
• Jesus Gil Gil (proposal defense in Fall 2025)
- *Dissertation Title*: Development of Non-Linear Metamaterials for the Suppression of Radio Frequencies in the Microwave Spectrum
- *Committee Chair* (dissertation advisor): Dr. Dimitrios Ioannou (ECE)
• Robert W. Rienstra (proposal defense in Fall 2024)
- *Dissertation Title*: Fabrication and Characterization of Quantum Point Contacts and Quantum Dots in Graphene Heterostructures

- *Committee Chair* (dissertation advisor): Dr. Fereshte Ghahari Kermani (Physics)

• Gordon North Piegan (RQE in Fall 2024)
- *Dissertation Title*: Optimal Battery Sizing at Aggregated Data Centers for Grid Stability
- *Committee Chair* (dissertation advisor): Dr. Liling Huang (ECE)

• Komal Kant (RQE in Fall 2024)
- *Dissertation Title*: Analysis of Power-Delay Product Trade-offs in Nanowire Stacked FinFETs and Tunnel-FETs Under Varying Operating Temperatures
- *Committee Chair* (dissertation advisor): Dr. Rao Mulpuri (ECE)

• Kursten Anne Szabos (RQE in Fall 2024)
- *Dissertation Title*: A Modular Microgrid for the Moon
- *Committee Chair* (dissertation advisor): Dr. Liling Huang (ECE)

MS (1)

• David F. Smith (Fall 2024)
- *Thesis Title*: A Simulation Study of SiC/Diamond & β-Ga_2O_3/Diamond Heterojunction Diodes
- *Committee Chair* (thesis advisor): Dr. Dimitrios Ioannou (ECE)

Committee Chair for Graduate Thesis/Dissertation (UTSA)

PhD (4)

• Hebin Cherian (Spring 2022)
- *Dissertation Title*: Fabrication and Characterization of Spintronic Devices for Energy Efficient Computing

• Md. Khirul Anam (Spring 2022)
- *Dissertation Title*: Simulation, Synthesis and Characterization of Multi-phase Functional Materials for Emerging Computing Device Applications

• Pratheek Gopalakrishnan (Spring 2022)
- *Dissertation Title*: Synthesis and Characterization of Solution-processible Graphitic Nanomaterials for Emerging RRAM Device Applications

• Ann Sebastian (Spring 2022)
- *Dissertation Title*: 2D Materials and Heterostructures for Addressing the Critical Societal Challenges

MS (5)

• Ashkan Aminian (Spring 2023)
- *Thesis Title*: Resistive Random-Access Memory with Enhanced Reliability by 2D Material Engineering

• Chris Carley (Spring 2021)
- *Thesis Title*: Fabrication and Performance Prediction of Graphene Micro-supercapacitor Devices For Future Energy Storage Applications

• Nhu Huynh (Spring 2021)
- *Thesis Title*: Hardware Security of Emerging Non-volatile Memory Devices Under Imaging Attacks

• Susana Ortega-Contreras (Spring 2019)

- *Thesis Title*: Microfluidic Haptic Feedback Sensor for Airway Management
• Hebin Cherian (Fall 2018)
- *Thesis Title*: Emerging Non-volatile Memories for Neuromorphic Computing

Committee Member for Graduate Thesis/Dissertation (UTSA)

PhD (5)

• Nafiseh Ebrahimi (Summer 2021)
- *Dissertation Title*: Biocompatible Electromagnetic Soft Actuator; Design Optimization, Development, Fabrication and Test
- *Committee Chair* (dissertation advisor): Dr. Amir Jafari (Mechanical Engineering)
• Nihar Bendre (Summer 2021)
- *Dissertation Title*: Explainability with Semantic Compositionality and Zero-shot Learning for Anomaly Detection
- *Committee Chair* (dissertation advisor): Dr. Paul Rad (Business)
• Janeth A. Garcia Monge (Summer 2021)
- *Dissertation Title*: Spin Pumping Modulation in YIG-Based Structures Employing Piezoelectric Strain
- *Committee Chair* (dissertation advisor): Dr. Arturo Ayon (Physics)
• Brandon Young (Fall 2020)
- *Dissertation Title*: Development of Ferroic and Multiferroic Nanomaterials for Hybrid 3D Deposition of Multifunctional Devices
- *Committee Chair* (dissertation advisor): Dr. Ruyan Guo (Electrical Engineering)
• Moumita Dutta (Fall 2017)
- *Dissertation Title*: Ferroics and Multiferroics for Dynamically Controlled Terahertz Wave Propagation
- *Committee Chair* (dissertation advisor): Dr. Ruyan Guo (Electrical Engineering)

MS (3)

• Max Estrada (Summer 2019)
- *Thesis Title*: Thermoelectric Performance Optimization of Stand-alone Roadway-embedded Sensing Module
- *Committee Chair* (thesis advisor): Dr. Ruyan Guo (Electrical Engineering)
• Paul Flynn (Summer 2019)
- *Thesis Title*: Dielectric Non-destructive Evaluation of Fiber-reinforced Polymer Composites
- *Committee Chair* (thesis advisor): Dr. Ruyan Guo (Electrical Engineering)
• Barry D. Koehne (Texas State University, Spring 2019)
- *Thesis Title*: Hall bar nano-fabrication on an STO/Si interface system for the detection and comparison of magneto transport measurements with the Van der Pauw method
- *Committee Chair* (thesis advisor): Dr. Nikoleta Theodoropoulou

Proposal Reviewers and Panelists

• NSF (2017, 2018, 2021, 2022 (2), 2023 (2), 2024)
• DOE (2020, 2021, 2023)

• ERC (European Research Council) (2022, 2023)
• Fondecyt (2024)

Journal Reviewers
Solid State Electronics; Nano Letters; Applied Physics Letters (APL); APL Materials; APL Electronic Devices; Journal of Applied Physics (JAP); Journal of Physics D: Applied Physics; Journal of Nanophotonics (JNP); npj 2D Materials and Applications; ACS Nano; Optical Materials (OM); Nanoscale; Applied Sciences; Journal of the Electron Devices Society; IEEE Journal on Emerging and Selected Topics in Circuits and Systems (JETCAS); AIP Advances; Computers and Electrical Engineering; Energy Systems; IEEE Transactions on Nanotechnology (TNT); IEEE Transactions on Electron Devices (TED); IEEE Transactions on Very Large Scale Integration Systems (TVLSI); IEEE Transactions on Computer-Aided Design of Integrated Circuits and Systems (TCAD); IEEE Transactions on Neural Networks and Learning Systems (TNNLS); IEEE Electron Device Letters (EDL)

Media
• George & CEC (College of Engineering and Computing) News
"NSF Grant Supports Nanofabrication Workforce Training" (Sep. 2025)
(https://ece.gmu.edu/news/2025-09/nsf-grant-supports-nanofabrication-workforce-training)
"Small Prints with Big Impacts" (Feb. 2025)
(https://www.gmu.edu/news/2025-02/small-prints-big-impact?utm_source=george&utm_medium=email)
• Mason ECE Annual Report (Cover-Featured)
"Nanofabrication Facility Offers New Learning Opportunities" (Sep. 2024)
(https://issuu.com/volgenauschoolofengineeringannualre2/docs/gmu_ece_annual_report_email-web?fr=sMzJjMDY2MTEzMDA)
• Mason Story
"Nanoelectronics expert Ethan Ahn joins department of electrical and computer engineering" (Dec. 2023)
(https://ece.gmu.edu/news/2023-12/nanoelectronics-expert-ethan-ahn-joins-department-electrical-and-computer-engineering)
• UTSA Today
"UTSA professor awarded $150K from Air Force for semiconductor research" (May 2022)
(https://www.utsa.edu/today/2022/05/story/professor-award-funding-from-air-force-for-semiconductor-research.html)
"Faculty commit to intensive teaching certification course amidst pandemic" (May 2021)
(https://www.utsa.edu/today/2021/05/story/ACUE-effective-teaching-practices.html)
• Phys.Org
"Team harnesses spin of electrons to power tech devices" (Apr. 2019)
(https://phys.org/news/2019-04-team-harnesses-electrons-power-tech.html)
• News 4, San Antonio
"UTSA engineers developing security measures for implantable technology" (Jul. 2017)
(http://news4sanantonio.com/news/local/utsa-engineers-developing-security-measures-for-implantable-technology)

• **Stanford News**
"Graphene key to high-density, energy-efficient memory chips, Stanford engineers say" (Oct. 2015)
(http://news.stanford.edu/2015/10/23/graphene-memory-chips-102315/)

Courses Taught

(GMU)

• **ECE 101 Introduction to Electrical and Computer Engineering (Undergrad)**
Fall 2023, Spring 2025, Spring 2026
• **ECE 488/588 Nanoelectronics Fundamentals (Undergrad/Grad)**
Spring 2024, Spring 2025, Spring 2026
• **ECE 685 Nanoelectronics (Grad)**
Fall 2025
• **ECE 430/584 Principles of Semiconductor Devices (Undergrad/Grad)**
Fall 2024, Fall 2025

(UTSA)

• **EE 4523/5503 Introduction to Nanoelectronics (Undergrad/Grad)**
Spring 2023, Spring 2022, Spring 2021, Spring 2020, Spring 2019, Spring 2018, Fall 2017, Fall 2016
• **EE 4533/5413 Principles of Microfabrication (Undergrad/Grad)**
Fall 2022, Fall 2021, Fall 2020, Fall 2019, Fall 2018, Spring 2017
• **EE 6493/MATE 5253 Introduction to Spintronics (Grad)**
Spring 2021, Fall 2020, Spring 2019
• **EE 2213 Electric Circuits and Electronics (Undergrad)**
Spring 2023, Summer 2022, Spring 2022

Research Mentoring

• **Mason Nanoelectronics Laboratory**
- **PhD Candidates (1)**
1. Fitunerediate Gebeyehu
- **MS Candidates (8)**
1. Tayga Alaca
2. Khang Diep
3. Isa Saleheen
4. John Baban
5. Nigama Vajjula
6. Hwijung Kang
7. Sean Peregonov
8. Philip Acatrinei

• **Summer Interns (GMU)**
- **VMEC Scholar (College)**
Cohort 2025: Julia Rodrigues (William & Mary), Noreen Hossain (University of Virginia)
Cohort 2024: Julia Rodrigues (William & Mary), Michael Liang (Virginia Tech)

- **ASSIP (K-12)**
Cohort 2025: Aarna Gupta (Oakton High), Aditi Karnik (Chantilly High), Emma Graf (Walt Whitman High), Sean Kim (Centreville High), Suan Cho (Sunset High)
Cohort 2024: Risha Krishnan (Chantilly High), Anusha Agarwal (Oakton High)

• International Visiting Scholars (UTSA)
- **Faculty on Sabbatical Leave**
Prof. Heonchang Yoo (Korea University, South Korea); January 2020 – August 2020

- **Doctoral Students**
Laura Verdugo (Mexico); 2018-2019
Project topic: PVD synthesis and characterization of II-IV nanomaterials and heterostructures for photovoltaic applications

- **Undergraduate Students**
Arushi Shrivastava (International Institute of Information Technology, India); Spring/Summer 2020
(placeholder) (Vellore Institute of Technology); Spring 2026

- **High School Students**
Huyk-June Seong (Kyung-gi Science High School, Korea); January 2018
Chaewon Kim (Kyung-gi Science High School, Korea); January 2018

• UTSA REU (Research Experiences for Undergraduates) Program
- **Research Immersion Camp Program** (from Universidad de Sonora, Mexico)
Guillermo Olivarria Arnold (Industrial Engineering); Summer 2019

- **Alamo Colleges Advanced Materials Technology (AMT) Internship**
Kyle Slattery; Fall 2019

- **NSF-funded LSAMP CIMA Program** (from Alamo Colleges)
Robert Mendoza (Northwest Vista College); Summer 2018

- **Research Volunteer**
Reva Kulkarni; Fall 2020
Amber Slater; Fall 2020
Justin Bisignano; Summer/Fall 2020

- **Research Rotation**
Michael Gomez; Spring 2022

Invited Talks and Seminars

1. (placeholder)
2. Speaker & Panelist, **Spark & Share**, Innovation District (Manassas), VA, Nov. 2024
3. "Small for Big," **Mason Nanotechnology Day**, Manassas, VA, Oct. 2024
4. "Electrostriction Meets with Nanotechnology," **Mason Mechanical Engineering Graduate Seminar**, Fairfax, VA, Aug. 2024

5. "AI Meets Nanotechnology," **Mason Nano Summer Camp**, Manassas, VA, Jun. 2024
6. "From Quantum Materials to Devices and Applications," **Mason Quantum Week (Quantum Science and Engineering Center, GMU)**, Fairfax, VA, Apr. 2024
7. "AI Meets Nanotechnology," **Galileo Science Cafe (College of Science, GMU)**, Manassas, VA, Feb. 2024
8. "Nano MTJ for Emerging Computing Paradigm," **Georgetown University Graduate Colloquium (Dept. of Physics)**, Washington, DC, Nov. 2022
9. "Multi-functional Oxide Thin Films for Future Computing Paradigm," **The US-Korea Conference on Science, Technology, and Entrepreneurship (UKC) 2022**, Washington, DC, Aug. 2022
10. "Metal-oxide RRAM with rGO as oxygen exchange layer," **International Workshop on Thin Films for Electronics, Electro-Optics, Energy and Sensors (TFE3S) 2022**, Boston, MA, Aug. 2022
11. "Nanoscale PCM for Neuromorphic Computing," **IEEE NAECON (National Aerospace & Electronics Conference) 2022**, OH, Jul. 2022 (online)
12. "Hardware Implementation of Machine Learning by Emerging Nanodevices," **UTSA Matrix AI Distinguished Lecture Series**, TX, Jan. 2022 (online)
13. "2D Nanomaterials for Memristor-based Neuromorphic Computing," **AFRL Branch Seminar (RX/AN)**, OH, Nov. 2021 (online)
14. "Emerging Nanomaterials for Energy Harvesting and Storage Applications," **SKKU (Sungkyunkwan University) Department of Energy Science, Distinguished Lecture Series**, Seoul, South Korea, Oct. 2021 (online)
15. "Emerging Non-volatile Memory for Neuromorphic Computing," **AFRL**, OH, Jul. 2021 (online)
16. "Emerging Nanomaterials and Nanodevices for Power Systems of the Future," **KERI**, Changwon, South Korea, Jun. 2021 (online)
17. "Emerging Nanomaterials and Nanodevices for Ultra-low Energy Systems," **KU Leuven**, Leuven, Belgium, Sep. 2020 (online)
18. "Nano MTJs for Emerging Computing Paradigm," **Seoul National University**, Seoul, South Korea, Sep. 2019
19. "Leading the way to better writing: from papers to proposals," **UTSA ECE Summer Academy**, San Antonio, TX, USA, Aug. 2019
20. "Nano MTJs for Emerging Computing Paradigm," **Purdue University**, West Lafayette, IN, USA, Jul. 2019
(Available at nanoHUB: https://nanohub.org/resources/30911/watch?resid=30913**)**
21. "Nano MTJs for Emerging Computing Paradigm," **Ohio State University**, Columbus, OH, USA, Jun. 2019
22. "Nanotechnology for AI and Beyond," **KSEA-Professional Development Forum**, Austin, TX, USA, Jun. 2019
23. "Emerging Non-volatile Memory for Neuromorphic Computing," **IEEE Central Texas – San Antonio Computer Group**, St. Mary's University, San Antonio, TX, USA, Feb. 2019
24. "Emerging Nonvolatile Memory for Machine Learning," **AMD Inc.,** Santa Clara, CA, USA, May 2018

25. "Nanotechnology for Intelligent Heterogeneous Systems," **KSEA-Professional Development Forum**, San Jose, CA, USA, May 2018
26. "Current status and future challenge in emerging non-volatile memory technologies," **Naval Research Laboratory (NRL) – Physics of Electronic Materials Branch**, Washington, D.C., USA, Feb. 2018
27. "Advancing Emerging Nonvolatile Memory with Carbon Nanomaterials," **San Antonio Nanotechnology Forum** Networking Lunch Seminar, San Antonio (UTSA), TX, USA, Feb. 2018
28. "Future computing architecture and enabling materials and devices technology: message for computer scientists," **Sogang University**, Korea, June 2017
29. "Emerging non-volatile memory: from nanomaterials to nanosystems," **KAIST (Department of Electrical Engineering)**, Korea, May 2017
30. "Emerging non-volatile memory for next-generation computing paradigm," **KIST**, Korea, May 2017
31. "Nanoscale memories beyond SRAM, DRAM, and Flash," **Kyung-Hee University**, Korea, May 2017
32. "Future of memory and storage device technologies," **Samsung Electronics**, Korea, May 2017
33. "Emerging materials and devices technology and career opportunity for future physicists," **Texas State University (Dept. of Physics)**, San Marcos, TX, USA, Apr. 2017
34. "Emerging non-volatile memory: from devices to architectures," **AMD Inc.**, Austin, TX, USA, Apr. 2017
35. "Carbon nanomaterials to advance emerging non-volatile memory," **UT Dallas (Dept. of Materials Science and Engineering)**, Richardson, TX, USA, Mar. 2017
36. "Emerging non-volatile memory: from devices to architectures," **Sandia National Lab. (Center for Integrated Nanotechnologies)**, Albuquerque, NM, USA, Mar. 2017
37. "Emerging non-volatile memory: from devices to architectures," **IEEE Central Texas – San Antonio Computer Group**, St. Mary's University, San Antonio, TX, USA, Feb. 2017
38. "STT-MRAM: Challenges and research direction," **Qualcomm**, San Diego, CA, Nov. 2016
39. "STT-MRAM: Challenges and research direction," **UCSD**, San Diego, CA, Nov. 2016
40. "Energy-efficient computing: from devices to architectures," **U. of Pittsburgh**, Pittsburgh, PA, Jan. 2016
41. "Energy-efficient computing: from devices to architectures," **UT San Antonio**, San Antonio, TX, Jan. 2016
42. "Energy-efficient computing: from devices to architectures," **U. of Rochester**, Rochester, NY, USA, Mar. 2016
43. "Memory devices beyond SRAM, DRAM, and FLASH," **Intel**, Hillsboro, OR, USA, Oct. 2015
44. "Energy-efficient non-volatile memory, enabled by carbon nano-materials," **HGST, Inc., a Western Digital Company**, San Jose, CA, USA, Oct. 2015
45. "One-dimensional selection device for X-point RRAM array," **IMEC**, Leuven, Belgium, Sep. 2015
46. "Emerging non-volatile memory, enabled by carbon nanomaterials," **IEEE SFBA (San**

Francisco Bay Area) Nanotechnology Council, Santa Clara, CA, USA, Sep. 2015
47. "Energy-efficient design for emerging NVM technology," **NCCAVS (Northern California Chapter, AVS)**, San Jose, CA, USA, Sep. 2015
48. "Emerging nanoscale memory/logic devices and architectures," **EPFL**, Lausanne, Switzerland, Mar. 2015
49. "Emerging nanoscale memory/logic devices and architectures," **CMU**, Pittsburgh, PA, USA, Mar. 2015
50. "Emerging non-volatile memory devices and architectures," **Micron**, Boise, ID, Mar. 2015
51. "Emerging non-volatile memory devices and architectures," **Micron**, Milpitas, CA, Mar. 2015
52. "Emerging nanoscale memory/logic devices and architectures," **Georgia Tech.**, Atlanta, GA, USA, Jan. 2015
53. "Physics of electrical conduction in the sub-threshold regime and crystallization due to thermal disturbances in phase-change memory," **E\PCOS**, Tampere, Finland, Jul. 2012
54. "Introduction to Spintronics," **KAIST**, Daejeon, Korea, Oct. 2009
55. "Nanoscale device modeling: Green's function method," **Samsung Electronics** (SAIT), Giheung, Korea, Feb. 2006

Outreach Activities

GMU

- Nanotechnology Day (2025, GMU)
- K-12 Annual STEM night (2024, HB Woodlawn)
- Faculty Mentor for VMEC Summer Scholar (2024 – present, GMU)
  : Virginia Microelectronics Consortium (https://vmecteam.org/vmec-summer-scholar-program/)
- Faculty Mentor for ASSIP (2024 – present, GMU)
  : Aspiring Scientists Summer Internship Program (https://science.gmu.edu/assip)
- Gen Next Education Masterclass (2024, GMU)
  : Graduate Recruitment Program, gradED Virtual Session (https://cec.gmu.edu/admissions/graduate-admissions/upcoming-events)

UTSA

- GAR (Graduate Advisor of Record) for the MS Degree Program in Advanced Materials Engineering (2022 – 2023, UTSA)
  : Masters Pathway in Engineering (Virtual Recruitment Fair in the College of Engineering, UTSA)
- Faculty Research Mentor (2017 – 2023, UTSA)
  : NSF-funded Alamo College LSAMP (Louis Stokes Alliance for Minority Participation) program
- Faculty Advisor for UTSA Student Organization (2020 – 2023, UTSA)
  : Roadrunner Men's & Women's Bowling
- Faculty Advisor for IEEE-Honor Society (2021 – 2023, UTSA)
  : HKN, Eta Kappa Nu

Stanford University

- K-12 Outreach
  : Stanford Splash (2010 – 2015)
  : President of Korean Student Association at Stanford (KSAS) (2012 – 2013)

Grant Records and History

Current (4)

US Federal

• NSF ExLENT ($934,614): October 2025 – September 2028, PI
"Reshaping Education in Nanofabrication for the Northern Virginia Ecosystem and Workforce (RENEW)"

GMU/Virginia Seed Grant

• IDIA P3 Fellowship ($50,000): September 2024 – August 2026, Co-PI
"Atom-Based Quantum RF Electric Field Sensors"
• CPH Pilot ($30,000): April 2025 – March 2026, Co-PI
"Pathway Development of an e-Screening Sarcopenia Algorithm and an Integrated Medical Device for Older Adults (SARCMED)"
• 4-VA ($36,000): July 2025 – June 2026, Co-PI
"Collaboration on CMOS+X Arrays for Compute-in-Memory (CiM)"

Past (17)

VMEC

• Seed Grant ($45,000): January 2024 – December 2024, Co-PI
"Ion Implantation Strategy modulating Charge and Thermal Transport Properties for High Performance Narrow-gap Semiconducting Thermoelectric Materials for Innovative Use in Nonvolatile (ReRAM) Memory Arrays"

US Federal

• AFRL ML-RCP ($149,999): July 2022 – August 2023 ($73,150 at UTSA), September 2024 – August 2025 ($76,848 at GMU), PI
"Emerging Phase Change Alloys and Devices for High Temperature Applications"
• AFOSR, Quantum Electronic Solids/Condensed Matter Physics Program ($444,951): March 2019 – February 2022, PI
"All-spin Logic enabled by 2D Materials"
• NSF, Division of ECCS ($99,853): June 2019 – December 2020, PI
"EAGER: Feasibility Study of Epitaxial Oxide Resistive Field Effect Transistor (EOR-FET)"
• DoT, Tran-SET ($80,000): March 2018 – August 2019, Co-PI
"Smart Charging of Future Electric Vehicles Using Roadway Infrastructure"
• Army Advanced Medical Technology Initiative ($50,000): January 2018 – December 2018, Sub-contractor (from the US Army Institute of Surgical Research)
"Combat Airway Intubation Assistance Device with Haptic and Physiological Feedback"

The University of Texas System

• Strategic Investment Fund ($500K): September 2022 – August 2023, PI
"UTSA to Become a National Hub for Materials Research and Education"

US Industry

• Lam Research ($50,000): April 2017 – March 2019, PI
"Investigation of novel nanomaterials for future computing paradigm"

US National Laboratory

• Sandia National Laboratory CINT (User Proposal): January 2017 – June 2018, PI
"Nanoscale Thermoelectric Device Based on 2D-layered Materials"

International

• VitzroEM ($240K): June 2024 – December 2024, PI
"Development of integrated platform for temperature and vibration sensing for power system applications"
• Korea Electrotechnology Research Institute ($10,000): September 2020 – August 2021, PI
"Study on Smart, Self-powered Sensors Applicable to Power System Diagnosis"
• UPM Seed Grant (€5,000): May 2025 – December 2025, Co-PI
"A Novel High Sensitivity Triboelectric Skin Sensor"

UTSA Seed Funding

• T^2 (Transdisciplinary Teams) ($20,000): September 2019 – December 2020, PI
"Transdisciplinary Investigation of Electromechanical Coupling-driven Properties of New 2D Materials"
• Strategic Research Award ($15,000): January 2020 – December 2020, Co-PI
"Fabrication of an Innovative Nanopore Microneedle for Controlled Gene Transfection within 3D Cell Volumes"
• GREAT (Grant for Research Advancement and Transformation) ($20,000): September 2018 – August 2019, PI
"A Full-Stack Solution for NVM-Based Deep Learning Acceleration"
• Strategic Research Award ($15,000): April 2021 – August 2021, PI
"Proof-of-Concept Study for Perovskite Oxide-based New Logic Devices"
• Strategic Research Award ($15,000): April 2021 – August 2021, Co-PI
"Fabrication of an Innovative Nanopore Microneedle for Controlled Electroporation and Gene Transfection"

(see next page for publication)

Journal Publications (h-index: 18+; i10-index: 23+; 2,000+ citations; sorted by date)

Google Scholar: http://scholar.google.com/citations?hl=en&user=moiA1e8AAAAJ

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P. Gopalakrishnan, N. Ibaroudene, S. Ganguli, A. Roy, and **E. C. Ahn**, "Metal-oxide RRAM with rGO as Oxygen Exchange Layer", *Proc. SPIE* **12477**, 124770I (2023)

D. Fernandez, A. Sebastian, P. Raby, M. Genedy, **E. C. Ahn**, M. R. Taha, S. Dessouky, and S. Ahmed, "Roadway Embedded Smart Illumination Charging System for Electric Vehicles", *Energies* **16**, 835 (2023)

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I. V. Martinez, J. Iturbe Ek, **E. C. Ahn**, and A. O. Sustaita, "Moleculary Imprinted Polymer via Reversible Addition-Fragmentation Chain-Transfer Synthesis in Sensing and Environmental Applications", *RSC Advances* **12**, 9186 (2022)

Z. Jiang, Z. Wang, X. Zheng, S. Fong, S. Qin, H.-Y. Chen, **E. C. Ahn**, J. Cao, Y. Nishi, S. Wong, and H.-S. P. Wong, "Bidirectional Analog Conductance Modulation for RRAM-based Neural Networks", *IEEE Transactions on Electron Devices* **67**, 4904 (2020)

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P. Gopalakrishnan, A. Sebastian, and **E. C. Ahn**, "Perovskite Oxides Tunable by Electromechanical and Electrothermal Couplings," *ECS Transactions* **98**, 87 (2020)

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Md. K. Anam, and **E. C. Ahn**, "Understanding the Effect of Dry Etching on Nanoscale Phase-Change Memory", *Nanotechnology* **30**, 495202 (2019)

D. Fernandez, A. Sebastian, **E. C. Ahn**, M. R. Taha, S. Dessouky, and S. Ahmed, "Smart illuminative Charging (SiC) of Future Electric Vehicles Using Roadway Infrastructure", *MATEC Web of Conferences* **271**, 06006 (2019)

A. H. Aboutalebi, **E. C. Ahn**, B. Mao, S. Wu, and L. Duan, "Mitigating and Tolerating Read Disturbance in STT-MRAM-Based Main Memory via Device and Architecture Innovations", *IEEE Trans. Computer-Aided Design of Integrated Circuits and Systems (IEEE-TCAD)* **38**, 2229 (2019)

A. Asghari, N. A. Ulloa Castillo, E. Segura-Cardenas, A. O. Sustaita, W. Park, A. Yoon, and **E. C. Ahn**, "Enrichment of Solution-processable Single-walled Carbon Nanotubes for Flexible Nanoelectronics," *Materials Research Express* **6**, 0850b4 (2019)

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L. Li, X. Chen, C.-H. Wang, J. Cao, S. Lee, A. Tang, **C. Ahn**, S. Roy, M. Arnold, and H.-S. P. Wong, "Vertical and Lateral Cu Transport through Graphene Layers", *ACS Nano* **9**, 8361 (2015)

C. Ahn, Z. Jiang, C.-S. Lee, H.-Y. Chen, J. Liang, L. Liyanage, and H.-S. P. Wong, "1D Selection Device using Carbon Nanotube FETs for High-density Cross-point Memory Arrays", *IEEE Trans. Electron Devices* **62**, 2197 (2015)

K. Kim, H.-B.-R. Lee, R. Johnson, J. Tanskanen, N. Liu, M.-G. Kim, C. Pang, **C. Ahn**, S. Bent, and Z. Bao, "Selective Metal Deposition at Graphene Line Defects by Atomic Layer Deposition", *Nature Communications* **5**, 4781 (2014)

T. Y. Lee, **C. Ahn**, B.-C. Min, J. M. Lee, K.-J. Lee, S. H. Lim, S.-Y. Park, Y. Jo, J. Langer, B. Ocker, W. Maass, and K.-H. Shin, "Critical switching current and thermal stability of magnetic tunnel junctions with uncompensated CoFeB/Ru/CoFeB synthetic free layers", *Journal of Applied Physics* **113**, 093906 (2013)

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C. Ahn, B. Lee, R. Jeyasingh, M. Asheghi, G.A.M. Hurkx, K. Goodson, and H.-S. P. Wong, "Effect of Resistance Drift on the Activation Energy for Crystallization in Phase Change Memory", *Japanese Journal of Applied Physics* **51**, 02BD06 (2012)

C. Ahn, B. Lee, R. Jeyasingh, M. Asheghi, G.A.M. Hurkx, K. Goodson, and H.-S. P. Wong, "Crystallization Properties and Their Drift Dependence in Phase-Change Memory Studied with a Micro-Thermal Stage", *Journal of Applied Physics* **110**, 114520 (2011)

C. Ahn, K.-H. Shin, J. Bass, R. Loloee, and W. Pratt, Jr., "Current-Perpendicular-to-Plane Spin Transport Properties of CoFe Alloys: Spin Diffusion Length and Scattering Asymmetry", *Journal of Applied Physics* **108**, 023908 (2010)

C. Ahn, K.-H. Shin, and W. Pratt, Jr., "Magnetotransport properties of CoFeB and Co/Ru interfaces in the current-perpendicular-to-plane geometry", *Applied Physics Letters* **92**, 102509 (2008)

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C. Ahn and M. Shin, "Quantum Simulation of Coaxially Gated CNTFETs by Using an Effective Mass Approach", *Journal of the Korean Physical Society* **50**, 1887 (2007)

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US Patents

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- Synopsis: Provided is a phase change memory device including a graphene layer inserted between a lower electrode into which heat flows and a phase change material layer, to prevent the heat from being diffused to an outside so as to efficiently transfer the heat to the phase change material layer

(provisional) E. C. Ahn, "Zero-Power Carbon Interconnect for Next-Generation Computing Devices and Methods of Use", 62/853, 992 *(filed in May 2019)*
- Synopsis: Provided is an all-spin logic device including a tunable graphitic sheet inserted between a spin injection nanomagnet and a spin transport channel, to implement a highly energy-efficient interconnect for next-generation computing hardware

Book Chapters

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J. Rodrigues, M. Liang, P. Choori, and **E. C. Ahn**, "Re-Looking at Silicon Oxide for Neuromorphic Computing," *247th ECS Meeting,* Montreal, Canada, May 2025

M. Liang, J. Rodrigues, P. Choori, S. Wagoner, and **E. C. Ahn**, "Ultra-low Energy SiO_2 CBRAM: Driving Intelligence at the Edge," *MRS Spring Meeting*, Seattle, WA, Apr. 2025

S. Dey, K. Song, H. Ju, S. Hwangbo, and **E. C. Ahn**, "Mechanically Driven Electromagnetic Energy Harvesting for Power System Sensing Applications," *245th ECS Meeting*, May 2024

N. Ibaroudene, Md. K. Anam, and **E. C. Ahn**, "High Temperature Phase Change Materials," *MRS Spring Meeting* (*Virtual)*, Apr. 2023

P. Gopalakrishnan, N. Ibaroudene, S. Ganguli, A. Roy, and **E. C. Ahn**, "Reducing the Variability of RRAM by Graphitic Nanosheets," *48th International Conference on Micro and Nano Engineering (MNE)*, Leuven, Belgium, Sep. 2022

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