

JEAN ANNE (CURRIVAN) INCORVIA

Assistant Professor in Electrical & Computer Engineering, University of Texas at Austin

EDUCATION

HARVARD UNIVERSITY	Physics	Ph.D. 2015
HARVARD UNIVERSITY	Physics	M.A. 2012
UNIVERSITY OF CALIFORNIA, BERKELEY	Physics, Philosophy	B.A. 2008

PROFESSIONAL EXPERIENCE

UNIVERSITY OF TEXAS AT AUSTIN, Austin, TX Electrical & Computer Engineering Department <i>Assistant Professor</i> Research on design, growth, fabrication, and testing of emerging spintronic devices and circuits using magnetic thin films and 2D materials Leading group of 8+ student and postdoctoral researchers	Aug. 2017 – Present
STANFORD UNIVERSITY, Stanford, CA Electrical Engineering Department <i>Postdoctoral Research Fellow</i> Experimental research on computing devices using magnetic and low dimensional materials One of three postdocs helping lead 25-student group Visiting research scientist at the University of California, Berkeley Advisors: H.-S. Philip Wong, Sayeef Salahuddin	Aug. 2015 – July 2017
MASSACHUSETTS INSTITUTE OF TECHNOLOGY, Cambridge, MA <i>Graduate Research Fellow cross-registered at Harvard and MIT</i> Study of physical properties of nanoscale magnetic materials and applications for energy-efficient logic devices and circuits Advisors: Marc A. Baldo, Caroline A. Ross	May 2010 – July 2015
APPLIED MATERIALS VARIAN, Gloucester, MA <i>R&D Consultant</i> Built models to study behavior of ion-implanted magnetic tunnel junctions	May 2013 – Jan. 2014
EWHA WOMANS UNIVERSITY, Seoul, South Korea <i>Research Assistant</i> Set up the Institute for the Early Universe labs through the South Korea World Class University Project	Feb. 2009 – April 2009
UNIVERSITY OF AUCKLAND, Auckland, New Zealand <i>Research Assistant</i> Studied quantum chaos in Bose-Einstein Condensate cold atom optical traps	Jan. 2008 – July 2008
UNIVERSITY OF PENNSYLVANIA, Philadelphia, PA <i>American Association of Physicists in Medicine Research Fellow</i> Developed 3D digital x-ray technology for early detection of breast cancer	May 2007 – Aug. 2007
LAWRENCE BERKELEY NATIONAL LABORATORY, Berkeley, CA <i>Research Assistant</i> Cosmology research to obtain accurate temperature and polarization maps of the Milky Way galaxy	Sept. 2005 – May 2007

SELECTED GRANTS & AWARDS

NSF-CAREER: Faculty Early Career Development Program "CAREER: Capturing Biological Behavior in Three-Terminal Magnetic Tunnel Junction Synapses and Neurons for Fully Spintronic Neuromorphic Computing" Total Award: \$404,226	March 2020 – Feb. 2025
DOE-Sandia National Laboratory, Laboratory Research: Laboratory Directed Grant Total Award: \$70,000	Oct. 2019 – Sept. 2020
NSF-CISE-Foundations of Emerging Technologies Grant, "Integrated Spintronic Synapses and Neurons for Neuromorphic Computing Circuits – I(SNC) ² " Total Award: \$500,000	June 2019 – May 2022
DOE-Sandia National Laboratory, "Integrated Nonvolatile Memory and Logic Based on Magnetic Devices for Radiation Hard Computing" Total Award: \$340,000	Oct. 2018 – Sept. 2021
Best Student Poster Award, Texas Advanced Computing Center (TACC) 2018 Symposium	Sept. 2018
NSF Materials Research Science and Engineering Center UT Austin Seed Funding Grant, "Measuring and Controlling Spin in Strong Spin-Orbit Coupling Low-Dimensional Materials" Total Award: \$150,000	July 2018 – June 2020
Department of Energy Office of Science Graduate Research Fellowship	May 2010 – Sept. 2013

TEACHING

UT Austin EE302 "Introduction to Electrical Engineering" Freshman introductory course to EE	Aug. 2019 – Dec. 2019
UT Austin EE334K "Quantum Theory of Electronic Materials" Junior undergraduate course as part of Materials Science minor for EE undergraduates	Jan. 2019 – May 2019
UT Austin EE396V "Magnetic Materials and Devices" Designed new graduate-level course and taught to 25 students	Sept. 2017 – May 2020

SERVICE

Exhibits Chair, 2020 Intermag Conference, Montreal, Canada Organizing sponsors and exhibits for leading international conference in magnetism	2019 – 2020
Conference organizer, 11 th Annual MRAM Global Innovation Forum Interfaced with over 275 attendees for the premier meeting on MRAM innovation	2019
Editorial review board member, IEEE Magnetics Letters	2019 – 2021
Program committee member for 2019 Device Research Conference, Ann Arbor, MI	2019 – 2022
University of Texas IEEE Graduate Students Chapter Advisor	2019 – 2020
Program committee member for 2019 Magnetism and Magnetic Materials Conference, Las Vegas, NV	2019
Program committee member for 2019 joint Magnetism and Magnetic Materials – Intermag Conference, Washington D.C.	2018 – 2019

Developed hands-on demo on nanotechnology for Introduce a Girl to Engineering Day at UT Austin, impacting > 500 K-8 students	2018 – 2020
Mentor for women in engineering at UT Austin	2018 – Present
Participate in numerous outreach and mentoring events including panels, lunches, and seminars aimed at supporting women in engineering students	
International Conference on Magnetism Session Chair	2018
IEEE Magnetics Society Administrative Committee Member	2017 – Present
Serving on the AdCom of my IEEE society, first as a non-voting representative to the IEEE Nanotechnology Council, and now as an elected voting member	
Magnetism and Magnetic Materials Conference Session Chair	2017
Proposal reviewer for NSF EPMD, SHF, and DMR	2016 – Present
Journal reviewer for Nature, Nature Electronics, Applied Physics Letters, IEEE Transactions on Magnetics, Electron Device Letters, Journal of Magnetism and Magnetic Materials, Physica Scripta, and Korean Journal of Chemical Engineering	2015 – Present

PUBLICATIONS & PATENTS

1. C. Cui, O. G. Akinola, N. Hassan, C. H. Bennett, M. J. Marinella, J. S. Friedman, and **J. A. C. Incorvia**. "Maximized lateral inhibition in paired magnetic domain wall racetracks for neuromorphic computing." *Under review*. arXiv:1912.04505.
2. F. Kenarangi, X. Hu, Y. Liu, **J. A. C. Incorvia**, J. S. Friedman, I. Partin-Vaisband. "Exploiting dual-gate ambipolar CNFETs for scalable machine learning classification." *Under review*. arXiv: 1912.04068.
3. T. P. Xiao, C. H. Bennett, X. Hu, B. Feinberg, R. Jacobs-Gedrim, S. Agarwal, J. Brunhaver, J. S. Friedman, **J. A. C. Incorvia**, and M. J. Marinella. "Energy and performance benchmarking of a domain wall-magnetic tunnel junction multibit adder." *IEEE Journal of Exploratory Solid-State Computational Devices and Circuits*. (2019). <DOI 10.1109/JXCDC.2019.2955016>.
4. C. H. Bennett, N. Hassan, X. Hu, **J. A. C. Incorvia**, J. S. Friedman, M. J. Marinella. "Semi-supervised learning and inference in domain-wall magnetic tunnel junction (DW-MTJ) neural networks." *Proc. SPIE 11090, Spintronics XII*, 110903I (2019). <DOI 10.1117/12.2530308>.
5. W. H. Brigner, N. Hassan, X. Hu, L. Jiang-Wei, O. G. Akinola, F. Garcia-Sanchez, M. Pasquale, C. H. Bennett, **J. A. C. Incorvia**, and J. S. Friedman, "Magnetic domain wall neuron with intrinsic leaking and lateral inhibition capability," *Proc. SPIE 11090, Spintronics XII*, 110903K (2019). <DOI 10.1117/12.2528218>.
6. O. G. Akinola, X. Hu, C. H. Bennett, M. Marinella, J. S. Friedman, and **J. A. C. Incorvia**. "Three-terminal magnetic tunnel junction synapse circuits showing spike-timing-dependent plasticity." *IOP Journal of Physics D: Applied Physics* 52, 49 (2019). <DOI 10.1088/1361-6463/ab4157>.
7. W. H. Brigner, N. Hassan, L. Jiang-Wei, X. Hu, D. Saha, C. H. Bennett, M. J. Marinella, **J. A. C. Incorvia**, F. Garcia-Sanchez, and J. S. Friedman. "Shape-based magnetic domain wall drift for an artificial spintronic leaky integrate-and-fire neuron." *IEEE Trans. On Electron Devices* (2019). <DOI 10.1109/TED.2019.2938952>.
8. X. Hu, A. Timm, W. H. Brigner, **J. A. C. Incorvia**, and J. S. Friedman. "SPICE-only model for spin-transfer torque domain wall MTJ logic." *IEEE Trans. On Electron Devices*. 66, 2817–2821 (2019). <DOI 10.1109/TED.2019.2912756>.
9. W. H. Brigner, X. Hu, N. Hassan, C. H. Bennett, **J. A. C. Incorvia**, F. Garcia-Sanchez, and J. S. Friedman. "Graded-anisotropy-induced magnetic domain wall drift for an artificial

- spintronic leaky integrate-and-fire neuron." *IEEE Journal on Exploratory Solid-State Computational Devices and Circuits*, 5, 1, (2019). <DOI 10.1109/JXCDC.2019.2904191>.
10. E. Barre, **J. A. C. Incorvia**, S. H. Kim, C. McClellan, E. Pop, H. -S. P. Wong, and T. Heinz. "Spatial separation of carrier spin by the valley Hall effect in monolayer WSe₂ transistors." *Nano Letters* 19, 2, 770-774 (2019). <DOI 10.1021/acs.nanolett.8b03838>.
 11. N. Hassan, X. Hu, L. Jiang-Wei, W. H. Brigner, C. H. Bennett, O. G. Akinola, **J. A. C. Incorvia**, and J. S. Friedman. "Magnetic domain wall neuron with lateral inhibition." *Journal of Applied Physics* 124:15, 152127 (2018). <DOI 10.1063/1.5042452>.
 12. C. H. Wang, **J. A. C. Incorvia**, C. McClellan, A. C. Yu, M. J. Mleczko, E. Pop, and H. -S. P. Wong. "Unipolar n-type black phosphorus transistors with low work function contacts." *Nano Letters* 18, 5 (2018). <DOI 10.1021/acs.nanolett.7b05192>.
 13. S. Fujii, **J. A. C. Incorvia**, F. Yuan, S. Qin, Y. Chai, and H. -S. P. Wong. "Scaling the CBRAM switching layer diameter to 30 nm improves cycling endurance." *IEEE Electron Device Letters* 39, 23-26 (2018). <DOI 10.1109/LED.2017.2771718>.
 14. S. A. Siddiqui, S. Dutta, **J. A. Currivan-Incorvia**, C. A. Ross, and M. A. Baldo. "Effects of magnetostatic interactions on stochastic domain wall motion in sub-100 nm wide wires." *IEEE Magnetics Letters* 9 (2017). <DOI 10.1109/LMAG.2017.2783354>.
 15. S. Dutta, S. A. Siddiqui, **J. A. Currivan-Incorvia**, C. A. Ross, and M. A. Baldo. "The spatial resolution limit for an individual domain wall in magnetic nanowires." *Nano Letters* 17, 5869-5874 (2017). <DOI 10.1021/acs.nanolett.7b03199>.
 16. L. Ling, Z. Zhu, T. Wang, **J. A. Currivan-Incorvia**, A. Yoon, and H. -S. P. Wong. "BEOL compatible graphene/Cu with improved electromigration lifetime for future interconnects." *International Electron Devices Meeting (IEDM)* (2016). <DOI 10.1109/IEDM.2016.7838383>.
 17. J. Zhang, S. A. Siddiqui, P. Ho, **J. A. Currivan-Incorvia**, L. Tryputen, E. Lage, D. C. Bono, M. A. Baldo, and C. A. Ross. "360° domain walls: stability, magnetic field and electric current effects." *New Journal of Physics* 18, 053028 (2016). <DOI 10.1088/1367-2630/18/5/053028>.
 18. **J. A. Currivan-Incorvia**, S. Siddiqui, S. Dutta, E. R. Evarts, J. Zhang, D. Bono, C. A. Ross, and M. A. Baldo. "Logic circuit prototypes for three-terminal magnetic tunnel junctions with mobile domain walls." *Nature Communications* 7, 10275 (2016). <DOI 10.1038/ncomms10275>.
 19. **J. A. Currivan-Incorvia**, S. Siddiqui, S. Dutta, E. R. Evarts, C. A. Ross, and M. A. Baldo. "Spintronic logic circuit and device prototypes utilizing domain walls in ferromagnetic wires with tunnel junction readout." *International Electron Devices Meeting (IEDM)*, 32-6 (2015). <DOI 10.1109/IEDM.2015.7409817>.
 20. **J. A. Currivan-Incorvia**, M. A. Baldo, and C. A. Ross. "Low energy magnetic domain wall logic device." US Patent 13/676,656. Filed 14 Nov. 2012, issued 08 Dec. 2015.
 21. S. Dutta, S. A. Siddiqui, **J. A. Currivan-Incorvia**, C. A. Ross, and M. A. Baldo. "Micromagnetic modeling of domain wall motion in sub-100-nm-wide wires with individual and periodic edge defects." *AIP Advances* 5, 127206 (2015). <DOI 10.1063/1.4937557>.
 22. J. Zhang, P. Ho, **J. A. Currivan-Incorvia**, S. A. Siddiqui, M. A. Baldo, and C. A. Ross. "Edge-modulated perpendicular magnetic anisotropy in [Co/Pd]_n and L10-FePt thin film wires." *Applied Physics Letters* 107, 182408 (2015). <DOI 10.1063/1.4935104>.
 23. C. C. Kathrein, W. Bai, **J. A. Currivan-Incorvia**, G. Lontos, K. Ntetsikas, A. Avgeropoulos, A. Böker, L. Tsarkova, and C. A. Ross. "Combining graphoepitaxy and electric fields towards uniaxial alignment of solvent-annealed poly(styrene)-b-poly(dimethylsiloxane) block copolymers." *Chemistry of Materials*, 150915103728004 (2015). <DOI 10.1021/acs.chemmater.5b03354>.
 24. J. Zhang, **J. A. Currivan-Incorvia**, L. Tryputen, P. Ho, M. A. Baldo, and C. A. Ross. "Effects of edge taper on domain wall structure and current-driven Walker breakdown in a

- ferromagnetic thin film wire." *IEEE Magnetism Letters* 6, 3500204 (2015). <DOI 10.1109/LMAG.2015.2402113>.
25. P. Ho, J. S. Zhang, **J. A. Currivan-Incorvia**, D. C. Bono, and C. A. Ross. "Field and current driven magnetic domain wall motion in disordered A1-FePt nanowires." *IEEE Magnetism Letters* 6, 3000104 (2015). <DOI 10.1109/LMAG.2015.2392079>.
 26. **J. A. Currivan**, S. Siddiqui, S. Ahn, L. Tryputen, G. S. D. Beach, M. A. Baldo, and C. A. Ross. "Polymethyl methacrylate / Hydrogen silsesquioxane bilayer resist electron beam lithography process for etching 25 nm wide magnetic wires." *Journal of Vacuum Science and Technology B* 32.2, 021601 (2014). <DOI 10.1116/1.4867753>.
 27. C. Tello, T. Villela, S. Torres, M. Bersanelli, G. F. Smoot, I. S. Ferreira, A. Cingoz, J. Lamb, D. Barbosa, D. Perez-Becker, S. Ricciardi, **J. A. Currivan**, P. Platania, and D. Maino. "The 2.3 GHz continuum survey of the GEM project." *Astronomy & Astrophysics* 556, A1 (2013). <DOI 10.1051/0004-6361/20079306>.
 28. A. Ullah, S. K. Ruddell, **J. A. Currivan**, and M. D. Hoogerland. "Quantum resonant effects in the delta-kicked rotor revisited." *European Physical Journal D* 66, 315 (2012). <DOI 10.1140/epjd/e2012-30171-8>.
 29. **J. A. Currivan**, Y. Jang, M. D. Mascaro, M. A. Baldo, and C. A. Ross. "Low energy magnetic domain wall logic in short, narrow ferromagnetic wires." *IEEE Magnetism Letters* 3, 3000104 (2012). <DOI 10.1109/LMAG.2012.2188621>.
 30. S. Yoon, Y. Jang, C. Nam, **J. A. Currivan**, B. K. Cho, and C. A. Ross. "Magnetic frustration in circular arrays of dipoles." *IEEE Magnetism Letters* 3, 4000104 (2012). <DOI 10.1109/LMAG.2011.2180704>.
 31. A. K. Carton, S. C. Gavenonis, **J. A. Currivan**, E. F. Conant, M. D. Schnall, and A. D. A. Maidment. "Dual-energy contrast-enhanced digital breast tomosynthesis – a feasibility study." *British Journal of Radiology* 83, 344-350 (2010). <DOI 10.1259/bjr/80279516>.
 32. **J. A. Currivan**, A. Ullah and M. D. Hoogerland. "The initial velocity dependence of the quantum resonance in the delta-kicked rotor." *Europhysics Letters* 85.3 (2009). <DOI 10.1209/0295-5075/85/30005>.
 33. A. K. Carton, **J. A. Currivan**, E. Conant, and A. Maidment. "Temporal subtraction versus dual-energy contrast enhanced digital breast tomosynthesis: a pilot study." In *Digital Mammography* Vol. 5116 (ed. E.A. Krupinski) 166-173 (Springer-Verlag Berlin, Heidelberg, Germany, 2008). <DOI 10.1007/978-3-540-70538-3_24>.

INVITED PRESENTATIONS

1. Materials Research Society (MRS) Spring Meeting, Phoenix, AZ, April 2020
2. Harvard University School of Engineering and Applied Sciences seminar, Cambridge, MA, Oct. 2019
3. University of Minnesota Dept. of Chemical Engineering and Materials Science seminar, Minneapolis, MN, Sept. 2019
4. SPIE Nanoscience + Engineering Conference, San Diego, CA, Aug. 2019
5. ComET Symposium on Future of Computing Keynote Speaker, University of Texas at Dallas, Dallas, TX, May 2019
6. UT 2019 Workshop on Neuromorphic Computing, University of Texas at Austin, Austin, TX, April 2019
7. Sandia National Lab Seminar Speaker, Albuquerque, NM, April 2019
8. Silicon Labs seminar, Austin, TX, March 2019
9. Magnetism and Magnetic Materials / Intermag Conference, Washington, DC, Jan. 2019
10. University of New Hampshire Dept. of Physics seminar, Durham, NH, Nov. 2018
11. University of Texas at Austin Dept. of Physics condensed matter seminar, Austin, TX, Sept. 2018
12. International Conference on Magnetism, San Francisco, CA, July 2018

13. Johns Hopkins Dept. of Materials Science and Engineering seminar, Baltimore, MD, Jan. 2018
14. NSF Energy Efficient Electronics Science Center Retreat, Cambridge, MA, Sept. 2017
15. Western Digital, San Jose, CA, June 2017
16. UC San Diego Center for Memory and Recording Research Review, San Diego, CA, May 2017
17. Caltech Young Investigator Lecturer in Engineering, Pasadena, CA, May 2017
18. NSF Energy Efficient Electronics Science Center seminar, Berkeley, CA, March 2017
19. Carnegie Mellon University Year of Women research seminar, Pittsburg, PA, Oct. 2016
20. NSF Energy Efficient Electronics Science Center External Review, Berkeley, CA, Oct. 2016
21. Applied Materials, Santa Clara, CA, April 2016
22. Stanford Electrical Engineering, Stanford, CA, April 2016
23. Applied Materials Varian, Gloucester, MA, April 2015
24. Intel, Hillsboro, OR, Nov. 2014
25. National Institute of Standards and Technology, Boulder, CO, Aug. 2013
26. Applied Materials Varian, Gloucester, MA, April 2013
27. Joint European Magnetic Symposia, Parma, Italy, Sept. 2012
28. Physics Department seminar at Bogazici University, Istanbul, Turkey, Nov. 2011