

# Benjamin W. Walker

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## EDUCATION

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<b>Polytechnique Fédérale de Lausanne (EPFL) / Grenoble-INP / PoliTo</b> <i>M.S. in Micro and Nanotechnologies for Integrated Systems</i>	May 2023 - May 2025
<b>The University of Texas at Dallas</b> <i>B.S. in Physics and B.S. Electrical Engineering, Minor in Nanotechnology</i>	May 2019 - May 2023 GPA: 3.93
<b>Northwestern State University</b> <i>Associate's of General Studies</i>	May 2017 - May 2019 GPA: 3.85
<b>Louisiana School for Math, Science, and the Arts (LSMSA)</b> <i>High School Diploma</i>	May 2016 - May 2019 GPA: 3.93

## FELLOWSHIPS

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<b>National Science Foundation Graduate Research Fellowship Program</b> <ul style="list-style-type: none"><li>Three years of full PhD funding with a \$37,000 annual stipend</li></ul>	March 2023
<b>McDermott Fellowship Program</b> <ul style="list-style-type: none"><li>4-Year annual \$10,000 discretionary research stipend and \$36,000 for 4th year of PhD funding</li></ul>	March 2023
<b>Barry Goldwater Scholarship</b> <ul style="list-style-type: none"><li>Most prestigious award for an undergraduate researcher from my work in skyrmion logic devices</li></ul>	March 2022
<b>National Merit Scholarship</b> <ul style="list-style-type: none"><li>Received full-ride scholarship at UT Dallas plus housing and \$28,000 in stipends</li></ul>	March 2019

## PATENTS

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- B. W. Walker**, A. E. Edwards, X. Hu, and J. S. Friedman, Near-Landauer Reversible Skyrmion Logic with Voltage-Based Propagation, *U.S. Patent Application No. 63/480,374* (Filed: 01-18-2023)

## PROFESSIONAL EXPERIENCE

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<b>Research Assistant</b> <i>University of Texas at Dallas - NeuroSpinCompute Laboratory</i> <ul style="list-style-type: none"><li>Leading a team of undergraduate researchers to design and optimize skyrmion circuits, achieving thus far a <math>10\times</math> reduction in energy consumption</li><li>Developing novel approaches to micromagnetic-based reservoir computing, which use machine learning to optimize device structure</li></ul>	May 2023 – Present Richardson, TX
<b>Research Intern</b> <i>Université Paris-Saclay - Integnano Laboratory</i> <ul style="list-style-type: none"><li>Developed an STT-MRAM inference array which utilizes a novel write-in-series approach to reduce transistor overhead and minimize energy for compute-in-memory applications</li><li>Analyzed the performance of the array to ensure an error rate of fewer than 1 per 10,000</li></ul>	May 2024 – August 2024 Palaiseau, France
<b>Undergraduate Research Assistant</b> <i>University of Texas at Dallas - NeuroSpinCompute Laboratory</i> <ul style="list-style-type: none"><li>Invented a novel skyrmion logic device that uses voltage-controlled magnetic anisotropy (VCMA) to control skyrmion propagation and synchronization, which reduces power consumption by over <math>100\times</math></li><li>Designed large-scale reversible skyrmion logic circuits, which demonstrate efficient pipelining and maintain efficiency at scale</li></ul>	Oct 2019 – May 2023 Richardson, TX
<b>Hardware Engineering Intern</b> <i>Microsoft - Physical Design Team</i> <ul style="list-style-type: none"><li>Helped develop a custom floorplanning step by pre-placing standard cells and buffers and pre-routing trunks on high-speed critical buses to achieve flop to flop reach in several millimeters</li><li>Created an interpreter between Innovus and Fusion Compiler (FC) for our TCL Physical Design scripts, aiding my team's translation effort and improved its efficiency by 50%</li></ul>	May 2022 – July 2022 Raleigh, NC

## Visiting Researcher

Jan 2022 – April 2022

Universidad de Salamanca - Simulación de Nanoestructuras Magnéticas (SINAMAG)

Salamanca, Spain

- Designed voltage-driven reversible skyrmion logic circuits to reduce energy consumption with Mumax3
- Parametrically modelled and optimized micromagnetic devices in COMSOL to increase electrical efficiency by 70%

## MRSEC Research Experience for Undergraduates

May 2021 – Aug 2021

University of Texas at Austin - Integrated Nano Computing Lab

Austin, TX

- Fabricated and validated WSe<sub>2</sub>-based devices via electron beam lithography (EBL), atomic force microscopy (AFM), and magneto-optic Kerr effect (MOKE) imaging

## Electrical Engineering Intern

Jan 2021 – Aug 2021

University of Texas at Dallas - Texas Analog Center for Excellence

Richardson, TX

- Helped design a spin transfer torque (STT) memristor-based neuromorphic chip, collaborating with graduate students
- Verified aspects of device's logical operation via Verilog to prepare tapeout for foundry

## JOURNAL PUBLICATIONS

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1. X. Hu, C. Cui, S. Liu, F. Garcia-Sanchez, W. H. Brigner, **B. W. Walker**, A. J. Edwards, T. P. Xiao, C. H. Bennett, N. Hassan, M. P. Frank, J. A. C. Incorvia, and J. S. Friedman, Magnetic Skyrmions and Domain Walls for Logical and Neuromorphic Computing, *Neuromorphic Computing and Engineering*, Mar 2023, doi: 10.1088/2634-4386/acc6e8
2. **B. W. Walker**, F. Garcia-Sanchez, A. J. Edwards, X. Hu, M. P. Frank, F. Garcia-Sanchez, J. S. Friedman, Near-Landauer Reversible Skyrmion Logic with Voltage-Based Propagation, *ArXiv Condensed Matter*, Jan 2023, doi: 10.48550/arXiv.2301.10700
3. X. Hu, **B. W. Walker**, F. Garcia-Sanchez, A. J. Edwards, P. Zhou, J. A. C. Incorvia, A. Paler, M. P. Frank, J. S. Friedman, Logical and Physical Reversibility of Conservative Skyrmion Logic, *IEEE Magnetics Letters*, May 2022, doi: 10.1109/LMAG.2022.3174514
4. **B. W. Walker**, C. Cui, F. Garcia-Sanchez, J. A. C. Incorvia, X. Hu, and J. S. Friedman, "Skyrmion Logic Clocked via Voltage- Controlled Magnetic Anisotropy" *Applied Physics Letters*, May 2021, doi: 10.1063/5.0049024

## CONFERENCE PUBLICATIONS AND PRESENTATIONS

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1. **B. W. Walker**, F. Garcia-Sanchez, A. J. Edwards, X. Hu, M. P. Frank, F. Garcia-Sanchez, J. S. Friedman Near-Landauer Reversible Skyrmion Logic with Voltage-Based Propagation, *Government Microcircuit Applications & Critical Technology Conference*, Mar. 2023.\*
2. X. Hu, **B. W. Walker**, F. Garcia-Sanchez, P. Zhou, J. A. C. Incorvia, A. Paler, M. P. Frank, J. S. Friedman, Logical and Physical Reversibility of Conservative Skyrmion Logic, *Government Microcircuit Applications & Critical Technology Conference*, Mar. 2022.
3. **B. W. Walker**, B. W. Walker, C. Cui, F. Garcia-Sanchez, J. A. C. Incorvia, X. Hu, J. S. Friedman, Conservative Skyrmion Logic with Voltage-Controlled Magnetic Anisotropy Synchronization, *Joint IEEE International Magnetics Conference & Conference on Magnetism and Magnetic Materials*, Jan. 2022.\*
4. **B. W. Walker**, C. Cui, F. Garcia-Sanchez, J. A. C. Incorvia, X. Hu, and J. S. Friedman, Skyrmion Logic with Voltage-Controlled Magnetic Anisotropy Clocking *Texas Analog Center for Excellence Symposium*, Oct. 2021\*
5. X. Hu, M. Chauwin, F. Garcia-Sanchez, **B. W. Walker**, N. Betrabet, J. A. C. Incorvia, A. Paler, C. Moutafis, J. S. Friedman, Skyrmion Logic System for Large-Scale Reversible Computing, *IEEE International Conference on Nanotechnology*, Jul. 2021 (invited).
6. **B. W. Walker**, C. Cui, F. Garcia-Sanchez, J. A. C. Incorvia, X. Hu, and J. S. Friedman, "Voltage Controlled-Clocked Skyrmion Logic Synchronizers," *International Conference on Nanomagnetism and Spintronics (Solitons and Skyrmion Magnetism)*, Jun. 2021\*

\*Presented In-Person

## POSTER PRESENTATIONS

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1. **B. W. Walker**, F. Garcia-Sanchez, A. J. Edwards, X. Hu, M. P. Frank, F. Garcia-Sanchez, J. S. Friedman, Near-Landauer Reversible Skyrmion Logic with Voltage-Based Propagation, *Undergraduate Research Day at the Texas Capitol*, Apr. 2023
2. **B. W. Walker**, A. J. Edwards, F. Garcia-Sanchez, M. P. Frank, and J. S. Friedman "Low-Dissipation Conservative Skyrmion Logic with Voltage-Based Propagation," *University of Texas at Dallas Undergraduate Research Scholar Awards*, Apr. 2022

3. **B. W. Walker**, X. Li, and J. A. C. Incorvia, "Fabrication and Analysis of WSe<sub>2</sub>-based Electronic Devices," *MRSEC REU Poster Presentation*, Jul. 2021
4. **B. W. Walker**, C. Cui, F. Garcia-Sanchez, J. A. C. Incorvia, X. Hu, and J. S. Friedman "Skyrmion Logic Clocked via Voltage-Controlled Magnetic Anisotropy," *University of Texas at Dallas Undergraduate Research Scholar Awards*, Apr. 2021

#### MISCELLANEOUS AWARDS

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<b>Pacific Crest Trail Thru-Hiker:</b> Hiked 2000+ miles from Mexico to Canada	August 2023
<b>Undergraduate Research Scholar Award:</b> Accepted for presentation at UT Dallas	April 2021/2022/2023
<b>Patti Henry Pinch Scholarship:</b> UTD Funding for 2023 GOMAC Tech Presentation	March 2023
<b>TxACE Best Poster Award:</b> Presented research and won against 30 graduate students	October 2021
<b>Colorado Trail Thru-Hiker:</b> Hiked 500 miles from Denver to Durango, Colorado	August 2021
<b>First Place CometHack:</b> Our thermostat project won first prize	April 2021
<b>National Youth Science Foundation Delegate:</b> Louisiana's State Representative	May 2019
<b>Hall of Fame:</b> Highest honor for my high school (analogous to valedictorian)	May 2019
<b>Eagle Scout:</b> Boy Scouts of America's highest honor	July 2016