NANO KOREA 2021
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EDUCATION

Doctoral Degree, University of Wisconsin – Madison, 2007
Master's Degree, University of Wisconsin – Madison, 2003
Bachelor's Degree, Southeast University, 1997

PROFESSIONAL ACTIVITIES

Advisory Board:

- *Neuromorphic Computing and Engineering (IoP): Senior Advisory Panel*
- *ADVANCED INTELLIGENT SYSTEMS (Wiley): Executive Advisory Board*
- *ADVANCED MATERIALS TECHNOLOGIES (Wiley): International Advisory Board*
- *SMALL STRUCTURE (Wiley): International Advisory Board*

Editorial Board: *SCIENTIFIC REPORTS, FRONTIERS IN NEUROSCIENCE*
Conference Chairs: The 8th and 10th IEEE Nanotechnology Symposiums on "Emerging Non-volatile Memory Technologies" 2012, and "2D Devices and Materials" 2014, respectively;
Conference co-Chair: The IEEE International Conference on Future Computing, 2017, 2018, 2019.

AWARD AND HONORS

- **Winner of UMass Spotlight Scholar (2017).**
- **Nominee for Samuel F. Conti Faculty Fellowship Awards (2018).**
- **Oversea review expert of CAS (2018).**
- **NVMTS2019 Best poster award. (2019).**
- **UMass Amherst Distinguished Faculty Lecturer (2019).**
- **UMass Chancellor's Medal (highest honor of UMass, 2019).**
- **Best paper in *Advanced Materials Technologies* 2019, Wiley.**

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- **Clarivate™ Highly Cited Researchers in the field of Cross-Field (2020).**

MAIN SCIENTIFIC PUBLICATION

- Z. Wang, H. Wu, G. Burr, C. S. Hwang, K. L. Wang, Q. Xia* and **J. Joshua Yang***, "Resistive switching materials for information processing", *NATURE REVIEW MATERIALS* **5**, 173-195 (2020).
- P. Lin, C. Li, Z. Wang, Y. Li, H. Jiang, W. Song, M. Rao, Y. Zhuo, N. K. Upadhyay, M. Barnell, Q. Wu, **J. Joshua Yang*** and Q. Xia*, "Three-dimensional memristor circuits as complex neural networks", *NATURE ELECTRONICS* **3**, 225–232 (2020).
- P. Yao, H. Wu*, B. Gao, J. Tang, Q. Zhang, W. Zhang, **J. Joshua Yang**, H. Qian, "Fully hardware-implemented memristor convolutional neural network", *NATURE* 577, 641 (2020).
- J. H. Yoon, J. Zhang, P. Lin, N. Upadhyay, P.Yan, Y. Liu,* Q. Xia, and **J. Joshua Yang***, "A Low-Current and Analog Memristor with Ru as Mobile Species", *ADVANCED MATERIALS* **32**, 1904599 (2020).
- X. Zhang, Y. Zhuo, Q.Luo, Z. Wu, R. Midya, Z. Wang, W. Song, R.Wang, N. K. Upadhyay, Y. Fang, F. Kiani, M. Rao, Y. Yang, Q. Xia, Q. Liu*, M. Liu*, and **J. Joshua Yang***, "An artificial spiking afferent nerve based on Mott memristors for neurorobotics" *NATURE COMMUNICATIONS* **11**, 51 (2020).
- Z. Wang, C. Li, P. Lin, M. Rao, Y. Nie, W. Song, Q. Qiu, Y. Li, P. Yan, J. P. Strachan, N. Ge, N. McDonald, Q. Wu, M. Hu, H. Wu, R. S.Williams, Q. Xia*, **J. Joshua Yang***, "In situ training of feedforward and recurrent convolutional memristor networks", *NATURE MACHINE INTELLIGENCE* **1**, 434 – 442 (2019).
- Q. Xia* and **J. Joshua Yang***, "Memristive crossbar arrays for bio-inspired computing", *NATURE MATERIALS* **18**, 309-323 (2019).
- Z. Wang, C. Li, W. Song, M. Rao, D. Belkin, Y. Li, P. Yan, H. Jiang, P. Lin, M. Hu, J. P. Strachan, N. Ge, M. Barnell, Q. Wu, A. G. Barto, Q. Qiu, R. S. Williams, Q. Xia, and **J. Joshua Yang***, "Reinforcement learning with analogue memristor arrays", *NATURE ELECTRONICS* **2**, 115-124 (2019).
- C. Li, Z. Wang, M. Rao, D. Belkin, W. Song, H. Jiang, Y. Li, P. Lin, M. Hu, N. Ge, J. P. Strachan, M. Barnell, Q. Wu, R. S. Williams, **J. Joshua Yang***, and Q. Xia*, "Long short-term memory networks in memristor crossbars", *NATURE MACHINE INTELLIGENCE* **1**, 49-57 (2019).
- E. J Fuller, S. T Keene, A. Melianas, Z. Wang, S. Agarwal, Y. Li, Y. Tuchman, C. D. James, M. J. Marinella, **J Joshua Yang**, A. Salleo*, A A. Talin*, "Parallel programming of an ionic floating-gate memory array for scalable neuromorphic computing", *SCIENCE* **364**, 570-574 (2019).
- J. H. Yoon, Z. Wang, K. M. Kim, H. Wu, V. Ravichandran, Q. Xia*, C. S. Hwang and **J. Joshua Yang***, "An Artificial Nociceptor Based on a Diffusive Memristor", *NATURE COMMUNICATIONS* **9**, 417 (2018).
- Z. Wang, S. Joshi, S. Savel'ev, W. Song, R. Midya, Y. Li, M. Rao, P. Yan, S. Asapu, Y. Zhuo, H. Jiang, P. Lin, C. Li, J. H.. Yoon, N. K. Upadhyay, J. Zhang, M. Hu, J. P. Strachan, M. Barnell, Q. Wu, H. Wu, R. Stanley Williams*, Q. Xia*, and **J. Joshua Yang***, "Fully memristive neural networks for pattern classification with unsupervised learning", *NATURE ELECTRONICS* **1**, 137-145 (2018).
- Z. Wang, M. Rao, J.-W. Han, J. Zhang, P. Lin, Y. Li, C. Li, W. Song, S. Asapu, R. Midya, Y. Zhuo, H. Jiang, J. H. Yoon, N. K. Upadhyay, S. Joshi, M. Hu, J. P.

Strachan, M. Barnell, Q. Wu, H. Wu, Q. Qiu, R. S. Williams, Q. Xia*, and **J. Joshua Yang***, "Capacitive neural network with neuro-transistors", *NATURE COMMUNICATIONS* **9** 3208 (2018).

- C. Li, M. Hu, Y. Li, H. Jiang, N. Ge, E. Montgomery, Z. Li, J. P. Strachan*, P. Lin, W. Song, Z. Wang, M. Barnell, Q. Wu, R. S. Williams, **J. Joshua Yang***, Q. Xia*, "Analogue signal and image processing with large memristor crossbars", *NATURE ELECTRONICS* **1**, 52-59 (2018).
- C. Li, D. Belkin, Y. Li, P. Yan, M. Hu, N. Ge, H. Jiang, E. Montgomery, P. Lin, Z. Wang, J. P. Strachan, M. Barnell, Q. Wu, R. S. Williams, **J. Joshua Yang***, and Q. Xia*, "Efficient and self-adaptive in-situ learning in multilayer memristive neural networks", *NATURE COMMUNICATIONS* **9**, 2385 (2018).
- Z. Wang, S. Joshi, S. E. Savel'ev, H. Jiang, R. Midya, P. Lin, M. Hu, N. Ge, J. P. Strachan, Z. Li, Q. Wu, M. Barnell, G-L Li, H. L. Xin, R. S. Williams, Q. Xia, and **J. Joshua Yang***, "Memristors with diffusive dynamics as synaptic emulators for neuromorphic computing", *NATURE MATERIALS* **16**, 101-108 (2017).
- R. Midya, Z. Wang, J. Zhang, C. Li, S. Joshi, H. Jiang, P. Lin, K. Norris, N. Ge, Q. Wu, M. Barnell, Z. Li, R. S. Williams, Q. Xia*, and **J. Joshua Yang***, "Anatomy of Ag/hafnia based selectors with 10^{10} nonlinearity", *ADVANCED MATERIALS* **29**, 1604457 (2017).
- **J. Joshua Yang***, Dmitri B. Strukov and Duncan R. Stewart, "Memristive devices for computing", *NATURE NANOTECHNOLOGY* **8**, 13 (2013).
- J. Borghetti, G. S. Snider, P. J. Kuekes, **J. Joshua Yang**, D. R. Stewart and R. S. Williams "'Memristive' switches enable 'stateful' logic operations via material implication", *NATURE* **464**, 873 (2010).
- **J. Joshua Yang***, M.-X. Zhang, John Paul Strachan, Feng Miao, Matthew D. Pickett, Ronald D. Kelley, G. Medeiros-Ribeiro, R. Stanley Williams "High switching endurance in TaOx memristive devices", *APPLIED PHYSICS LETTERS* **97**, 232102 (2010).
- **J. Joshua. Yang**, F. Miao, D. Ohlberg, D. Stewart, R. S Williams "Electroforming mechanism of metal/oxide/metal memristive switches", *NANOTECHNOLOGY* **20**, 215201(2009).
- **J. Joshua Yang**, M. D. Pickett, X. Li, D. A. A. Ohlberg, D. R. Stewart, and R. S. Williams "Memresistive switching mechanism for metal/oxide/metal nano-devices" *NATURE NANOTECHNOLOGY* **3**, 429 (2008).

RESEARCH INTERESTS

Post-CMOS materials and devices to enable non von Neumann hardware, architecture and algorithms. Current projects include:

- *Neuromorphic / Synaptic computing using memristive devices with diffusion dynamics to implement neuroscience principles;*
- *Hardware accelerators to efficiently implement Artificial Intelligence and Machine Learning using analog resistive switching devices;*
- *High performance Non-volatile memories using emerging materials and devices.*