Jianhua (Joshua) Yang

Department of Electrical and Computer Engineering
University of Southern California
Office: 3737 Watt Way, PHE 608
Los Angeles, CA 90089-0271, USA

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Employment Experience:

Professor, Aug. 2020
The Department of Electrical and Computer Engineering
Co-director, The Institute for the Future of Computing
University of Southern California

Professor, 2015-2020
The Department of Electrical and Computer Engineering
University of Massachusetts, Amherst

Principal Researcher, 2012-2015
Responsibility: Leading the materials and device team
Senior Researcher, Researcher, Research Associate (post-doctoral), 2007-2012
Hewlett-Packard Labs, Palo Alto, CA

Education:

Ph. D., M.S., Materials Science Program (multidisciplinary program with ECE, MSE, ME, Physics, Chemistry and Biology) 2007
University of Wisconsin – Madison
Advisor: Y. Austin Chang (Deceased, NAE)
Thesis: Engineering and Characterizing Nanoscale Multilayers for Magnetic Tunnel Junctions (MTJs)

B.S. Mechanical Engineering, 1997
Southeast University, Nanjing, China

Selected publications:
(*corresponding author; full list: https://scholar.google.com/citations?user=9Oaf_cUAAAAJ&hl=en)

1. 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, review).
2. 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).
3. Y. Zhang, Z. Wang, J. Zhu, Y. Yang, M. Rao, W. Song, Y. Zhuo, X. Zhang, M. Cui, L. Shen, R. Huang, **J. Joshua Yang***, "Brain-inspired computing with memristors: Challenges in devices, circuits, and systems", *APPLIED PHYSICS REVIEW* **7**, 011308 2020.

4. X. Li, J. Tang, Q. Zhang, B. Gao, **J. Joshua Yang**, S. Song, W. Wu, W. Zhang, P. Yao, N. Deng, L. Deng, Y. Xie, H. Qian, H. Wu, "Power-efficient neural network with artificial dendrites" *NATURE NANOTECHNOLOGY* **15**, 776-782 (2020).
5. T. Fu, X. Liu, H. Gao, J. E Ward, X. Liu, B. Yin, Z. Wang, Y. Zhuo, D. JF Walker, J Joshua Yang, J. Chen, D. R Lovley, J. Yao, "Bioinspired bio-voltage memristors", *NATURE COMMUNICATIONS* **11**, 1861 (2020).
6. C.Wang, S.Liang, S. Wang, P. Wang, Z. Li, Z. Wang, A. Gao, C. Pan, C. Liu, J. Liu, H. Yang, X. Liu, W. Song, C. Wang, X. Wang, K. Chen, Z. Wang, K. Watanabe, T. Taniguchi, **J. Joshua Yang*** and Feng Miao*, "Gate-tunable van der Waals heterostructure for reconfigurable neural network vision sensor*"* *SCIENCE ADVANCES* **6**, eaba6173 (2020).
7. 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).
8. 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).
9. 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).
10. F. Cai, S. Kumar, T. Van Vaerenbergh, R. Liu, C. Li, S. Yu, Q. Xia, J. Joshua Yang, R. Beausoleil, W. Lu, J. P. Strachan, N "Power-efficient combinatorial optimization using intrinsic noise in memristor Hopfield neural networks", *NATURE ELECTRONICS* **3**, 409-418 (2020).
11. M. Rao, Z. Wang, C. Li, H. Jiang, R. Midya, P. Lin, D. Belkin, W. Song, S. Asapu, Q. Xia, and **J. Joshua Yang***, "Learning with Resistive Switching Neural Networks", *IEDM* **35.4**, 835-838 (2019, invited paper).
12. X. Zhang, Z. Wang, W. Song, R. Midya, Y. Zhuo, R.Wang, M. Rao, Q. Xia, **J. Joshua Yang***, Qi Liu*, and M. Liu*, "Experimental Demonstration of Conversion-based SNNs with 1T1R Mott Neurons for Neuromorphic Inference", *IEDM* **06.7** 134-137 (2019).
13. J. Tang, F. Yuan, X. Shen, Z.Wang, M. Rao, Y. He, Y. Sun, X. Li, W. Zhang, Y. Li, B. Gao, H. Qian, G. Bi, S. Song, **J. Joshua Yang*,** H. Wu*, "Bridging Biological and Artificial Neural Networks with Emerging Neuromorphic Devices: Fundamentals, Progress, and Challenges", *ADVANCED MATERIALS* **31**, 1902761 (2019, invited review).
14. 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).
15. W. Chen, C. Dou, K. Li, W. Lin, P. Li, J. Huang, W. Wei, J. Wang, C. Xue, Y. Chiu, Y. King, C. Lin, R. Liu, C. Hsieh, K. Tang, **J. Joshua Yang**, M. Ho, and M. Chang, "CMOS-integrated memristive non-volatile computing-in-memory for AI edge processors", *NATURE ELECTRONICS* **2**, 420 – 428 (2019).
16. R. Midya, Z. Wang, S. Asapu, X. Zhang, M. Rao, W. Song, Y. Zhuo, N. Upadhyay, Q. Xia*, and **J. Joshua Yang***, "Reservoir Computing using Diffusive Memristors", *ADVANCED INTELLIGENT SYSTEMS* **1**, 1900084 (2019, invited).
17. Q. Xia* and **J. Joshua Yang***, "Memristive crossbar arrays for bio-inspired computing", *NATURE MATERIALS* **18**, 309-323 (2019, review).

18. 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).
19. 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).
20. W. Sun, B. Gao, M. Chi, Q. Xia*, **J. Joshua Yang*,** H. Qian, H. Wu*, "Understanding memristive switching via in-situ characterizations and device modeling", *NATURE COMMUNICATIONS* **10**, 3453 (2019).
21. 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).
22. F. Cai, S. Kumar, T. Van Vaerenbergh, R. Liu, C. Li, S. Yu, Q. Xia, J. Joshua Yang, R. Beausoleil, W. Lu, J. P. Strachan, N "Power-efficient combinatorial optimization using intrinsic noise in memristor Hopfield neural networks", *NATURE ELECTRONICS* **3**, 409-418 (2020).
23. 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).
24. 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).
25. 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).
26. 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).
27. 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).
28. M. Wang, S. Cai, C. Pan, C. Wang, X. Lian, K. Xu, Y. Zhuo, **J. Joshua Yang**[*], P. Wang[*], F. Miao[*], "Robust memristors based on layered two-dimensional materials", *NATURE ELECTRONICS* **1**, 130-136 (2018).
29. H. Jiang, C. Li, R. Zhang, P. Yan, P. Lin, Y. Li, **J. Joshua Yang**[*], D. Holcomb[*], and Q. Xia*, "Provable Key Destruction with Large Memristor Crossbars", *NATURE ELECTRONICS* **1**, 548-554 (2018).
30. 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).
31. S. Pi, C. Li, H. Jiang, W. Xia, H. Xin, **J. Joshua Yang**, and Q. Xia[*], "Memristor crossbar arrays with 6-nm half-pitch and 2-nm critical dimension", *NATURE NANOTECHNOLOGY* **14**, 35-39 (2019).
32. M. Hu, C. E. Graves, C. Li, Y. Li, N. Ge, E. Montgomery, N. Davila, H. Jiang, R. S. Williams, **J. Joshua Yang***, Qiangfei Xia*, and John Paul Strachan*, "Memristor-based analog computation and neural network classification with a dot product engine", *ADVANCED MATERIALS* **29**, 1705914 (2018).
33. Z. Wang, M. Rao, R. Midya, S. Joshi, H. Jiang, P. Lin, W. Song, S. Asapu, Y. Zhuo, C. Li, H. Wu[*], Q. Xia[*], and **J. Joshua Yang*,** "Threshold Switching of Ag or Cu in dielectrics: Materials, Mechanism, and Applications", *ADVANCED FUNCTIONAL MATERIALS* **28**, 1704862 (invited feature article, 2018).
34. **J. Joshua Yang**[*] and Q. Xia[*], "Battery-like artificial synapses", *NATURE MATERIALS* **16**, 396-397 (2017). (News & Views)
35. 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).
36. J. H. Yoon, J. Zhang, X. Ren, Z. Wang, H. Wu, Z. Li, M. Barnell, Q. Wu, L. J. Lauhon, Q. Xia and **J. Joshua Yang***, "Truly Electroforming-Free and low- Energy Memristors with Pre-conditioned Conductive Tunneling Paths", *ADVANCED FUNCTIONAL MATERIALS* **27**, 1702010 (2017).
37. H. Jiang, D. Belkin, S. Savel'ev, S. Lin, Z. Wang, Y. Li, S. Joshi, R. Midya, C. Li, M. Rao, M. Barnell, Q. Wu, **J. Joshua Yang***, Q. Xia[*], "A novel true random number generator based on a stochastic diffusive memristor", *NATURE COMMUNICATIONS* **8**, 882 (2017).
38. C. Li, L. Han, H. Jiang, M. Jang, **J. Joshua Yang**, H. L. Xin and Q. Xia[*], "3-Dimensional Crossbar Arrays of Self-rectifying Si/SiO2/Si Memristors", *NATURE COMMUNICATIONS* **8**, 15666 (2017).
39. Ch. Wu, T. W. Kim, H. Y. Choi, D. U. Lee, D. R. Strukov and **J. Joshua Yan**g, "flexible 3D artificial synapse networks with correlated learning and trainable memory capability", *NATURE COMMUNICATIONS* **8**, 752 (2017).
40. Ch. Wu, T. W. Kim, T. Guo, F. Li, D. U. Lee, and **J. Joshua Yang**, "Mimicking classical conditioning based on a single flexible memristor", *ADVANCED MATERIALS* **29**, 1602890 (2017).
41. B. J. Choi, J. Zhang, K. Norris, G. Gibson, K. M. Kim, W. Jackson, M. Zhang, Z. Li, **J. Joshua Yang***, and R. Stanley Williams[*], "Trilayer Tunnel Selectors for Memristor Memory Cells", *ADVANCED MATERIALS* **28**, 356-362 (2016).
42. B. J. Choi, A. C. Torrezan, J. P. Strachan, P. G. Kotula, A. J. Lohn, M. J. Marinella, R. S. Williams[*] and **J. Joshua Yang***, "High-speed and low-energy nitride memristors", *ADVANCED FUNCTIONAL MATERIALS* **26,** 5290-6296 (2016).
43. B. J. Choi, A. C. Torrezan, K. J. Norris, F. Miao, J. P.Strachan, M.-X. Zhang, D. A. A. Ohlberg, N. P. Kobayashi**, J. Joshua Yang,*** and R. S. Williams, "Electrical performance and scalability of Pt dispersed SiO2 nanometallic resistance switch", *NANO LETTERS* **13**, 3217 (2013).
44. **J. Joshua Yang**[*], Dmitri B. Strukov and Duncan R. Stewart, "Memristive devices for computing", *NATURE NANOTECHNOLOGY* **8**, 13 (2013).
45. **J. Joshua Yang***, M.-X. Zhang, M. D. Pickett, F. Miao, J. P. Strachan, W. Li, W. Yi, D. A. A. Ohlberg, B. J. Choi, W. Wu, J. H. Nickel, G. Medeiros-Ribeiro and R. Stanley Williams,

"Engineering nonlinearity into memristors for passive crossbar applications", *APPLIED PHYSICS LETTERS* **100**, 113501 (2012).

46. F. Miao, J. P. Strachan, **J. Joshua Yang*,** M.-X. Zhang, I. Goldfarb, A. C. Torrezan, P. Eschbach, R. D. Kelley, G. Medeiros-Ribeiro and R. S. Williams **"**Anatomy of a nanoscale conduction channel reveals the mechanism of a high-performance memristor", *ADVANCED MATERIALS* **23**, 5633 (2011).
47. 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).
48. **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).
49. **J. Joshua Yang**, J. Borghetti, D. Murphy, D. R. Stewart and R. S. Williams "A family of electronically reconfigurable nanodevices", *ADVANCED MATERIALS* **21**, 3754 (2009).
50. **J. Joshua. Yang**, F. Miao, D. Ohlberg, D. Stewart, R. S Williams "Electroforming mechanism of metal/oxide/metal memristive switches", *NANOTECHNOLOGY* **20**, 215201(2009).
51. **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).

Patents:

118 Granted patents (see detailed publication list) and **60** pending patents (documents available upon request) with USPTO**.** Two patents on MRAM were licensed by Intel for **millions of dollars** through UW-Madison and the patents on ReRAM/Memristor were **transferred** to memory manufacturers, National Labs and startup companies for product development. The patents at UMass on Machine Learning Accelerators led to a fast-growing startup company I co-founded in 2018, which has about 20 employees already and raised about **$12M** and with **$30M** in the pipeline.

Selected Invited Talks: (from **over 140** invited talks)

1. "ARL Artificial Intelligence Tech Forecasting virtual workshop", 2021, **Discussion Lead** of *Edge Computing*.
2. "AI-Devices to systems: Resistive Switching Materials and Devices for Bio-Inspired Computing", **2021 VLSI-TSA (short course)**, April 2021, Hsinchu, Taiwan.
3. "Memristive Devices for Bio-Inspired Computing", International **Union of Materials Research Societies – International Conference in Asia 2021** (IUMRS-ICA 2021) Oct. 2021, Jeju Island, Korea. **(Plenary)**
4. "Engineering Mobile Species in Resistive Switches for Computing", **The 3rd International Symposium on Memory Devices for Abundant Data Computing**, May 2021, Hong Kong. **(Plenary)**
5. "Memristive Materials and Devices for Neuromorphic Computing", **The 19th International Nanotech Symposium & Exhibition** (NANO KOREA 2021), Jul. 2021, KINTEX, Korea. **(Plenary)**
6. "Computing with memristive dynamics", **The first International Conference on Neuromorphic Computing (ICNC2021),** Oct. 2021, Wuhan, China. **(Keynote)**
7. "The fusion of digital and analog: Opening new horizons in ICT, AI, and IOT", **4th International Conference on Memristive Materials, Devices & Systems (MEMRISYS)**, Nov. 2021, Tsukuba, Japan. **(Keynote)**

8. *Nature Conference* on Neuromorphic Computing 2019, "*Tutorials on Neuromorphic computing*" (*J. Joshua Yang* UMass: Materials/Devices, *Bill J. Dally* Stanford: Architecture/Algorithms, *Simon Laughlin* U. Cambridge: Neuroscience), Beijing, China. **(Invited Tutorial)**
9. *Nature Conference* on Neuromorphic Computing 2019, "*Neuromorphic computing with dynamics of diffusive memristors*", Beijing, China. **(Invited Talk)**
10. *The IEEE International Electron Devices Meeting (IEDM)* 2019, San Francisco, USA. **(Invited)**
11. *APS 2020 March meeting* "Materials and devices for neuromorphic computing". **(Invited)**
12. *Gordon Research Conference on Multifunctional Materials and Structures* 2020, Ventura CA. **(Invited)**
13. *International Conference on Memristive Materials, Devices & Systems (MEMRISYS)* 2019, Dresden, Germany. **(Plenary)**
14. *Nature Conference* on Flexible Electronics-Visions of a Flexible Future 2018, Xi'an, China. **(Keynote)**
15. *International Conference on Neuromorphic Systems (ICONS)* 2018, Knoxville, TN. **(plenary)**
16. *MRS Spring meetings, 2014, 2017, 2020* **(invited talks)**; *MRS Fall meetings, 2014, 2015, 2016, 2017* **(Invited talks)**
17. *International Conference on Memristive Materials, Devices & Systems (MEMRISYS)* 2018, Beijing, China (2018). **(Keynote)**
18. *International Emergent Memory Symposium (IEMS)* 2018, Ji'an, China. **(plenary)**
19. *The 6th Memristor and Memristive Symposium* 2018, Budapest, Hungary. **(plenary)**
20. *International Conference on Memristive Materials, Devices & Systems (MEMRISYS)* 2017, Athens, Greece. **(Plenary)**
21. *International Symposium on Memory Devices for Abundant Data Computing* 2017, *Hongkong.* **(Plenary)**
22. *Advances in ReRAM: Materials and Interfaces* 2015, Crete, Greece. **(Keynote)**
23. *China Semiconductor Technology International Conference (CSTIC)* 2016, Shanghai, China **(Keynote)**
24. *The IEEE International Symposium on Circuits and Systems (ISCAS)* 2014, Melbourne, Australia. **(Keynote)**
25. *The 224th Electrochemical Society Meeting* 2013, *ULSI Process Integration Symposium.*, CA. **(Keynote)**
26. *Special Lecture, AirForce Research Lab,* Rome, NY (2013). **(Chief Scientist Lecture Series)**
27. *The 11th IEEE Non-Volatile Memory Technology Symposium (NVMTS)* 2011, Shanghai, China. **(Keynote)**

Academic 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*
- *THE INTERNATIONAL CONFERENCE ON ELECTROCERAMICS: International Advisory Board*

- *The 3rd INTERNATIONAL CONFERENCE on EMERGING MATERIALS, TECHNOLOGIES AND APPLICATIONS FOR NON-VOLATILE MEMORY DEVICES: 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.
Conference co-Chair: "The 3rd international conference on emerging materials, technologies and applications for non-volatile memory devices", Salsomaggiore Terme, Italy, June 2017.

Symposium co-chairs:

1. "Non-volatile Memory" in The IEEE International Electron Devices Meeting (IEDM) 2014;
2. "Memristors" in the Electrochemical Society (ECS) Meeting, 2017;
3. "Ionics of memrsitor/resistive switches" in 21st Solid State Ionics (SSI), 2017;
4. "Memristive devices - from fundamentals to applications" in International Materials Research Congress (IMRC), 2017;
5. "Emerging Materials, Technologies and Applications for Non-volatile Memory Devices" in CIMTEC 2018;
6. "Oxide Memristors" symposium at the 236th ECS Meeting, (2019);
7. "Progress in Neuromorphic Computing Materials, Devices and Systems" symposium at MRS Fall Meeting (2020);
8. "Fundamental Mechanisms and Materials Discovery for Brain-Inspired Computing - Theory and Experiment" symposium at MRS Spring Meeting (2020).

Program/technical committees:

1. The founder Chair of IEEE Neuromorphic Computing Technical Committee (2021- present)
2. The EMN Meeting on Surface and Interface, 2016
3. The IEEE International Electron Devices Meeting (IEDM), 2014, 2015.
4. 5th International Conference on Smart and Multifunctional Materials, Devices, Structures in CIMTEC 2016. (International Advisory Board)
5. The IEEE Silicon Nanoelectronics Workshop (SNW) 2014
6. The IEEE Non-Volatile Memory Technology Symposium (NVMTS). 2011-2017
7. The International Conference on Advances in Circuits, Electronics and Micro-electronics, 2018.
8. Elected officer, The IEEE Nanotechnology Council (SF and Bayarea) 2011-2014

Guest Editors for journal special issues:

- "Non-volatile memory based on nanostructures" (*NANOTECHNOLOGY* special issue, 2011);
- "Memristive and resistive devices and systems" (*APPLIED PHYSICS A*, 2011);

- "Solid-state Memristive Devices and Systems" (IEEE Journal on Emerging and Selected Topics in Circuits and Systems, 2015);
- "Memristive Materials and Devices" (*ADVANCED ELECTRONIC MATERIALS*, 2018);
- "Materials for Neuromorphic Computing" (*NANOTECHNOLOGY*, 2019);
- "Memory Devices and Technologies for the Next Decade" (*IEEE TRANSACTIONS ON ELECTRON DEVICES*, 2019).
- "Memristive Neuromorphics: Materials, Devices, Circuits, Architectures, Algorithms and Their Co-Design" (*FRONTIERS IN NANOTECHNOLOGY*, 2020).
- "2D materials for neuromorphic computing" (Neuromorphic Computing and Engineering, 2021).
- "Neuromorphic Computing: from materials to applications" (Advanced Materials, 2021)

- **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).**
- **Best paper in *Advanced Materials Technologies* 2019, Wiley.**
- **UMass Chancellor's Medal (highest honor of UMass, 2020).**
- **Clarivate™ Highly Cited Researchers in the field of Cross-Field (2020, 2021).**
- **Founder Chair of IEEE Neuromorphic Computing Technical Committee. (2021)**
- **Powell Faculty Research Award, Powell Foundation (2021).**
- **IEEE Fellow (2022)**

Detailed lists:

- **>172 refereed papers**
- **119 Granted Patents**
- **>140 invited/keynote/plenary talks**
- **>33,000 citations**
  https://scholar.google.com/citations?user=9Oaf_cUAAAAJ&hl=en&oi=sra

Peer-reviewed papers (* indicates corresponding author**):**

Papers after joining Academia:

Journal papers

1. Y. Zhuo, R. Midya, W. Song, Z. Wang, S. Asapu, M. Rao, P. Lin, H. Jiang, Q. Xia, R. S. Williams, **J. Joshua Yang***, "A Dynamical Compact Model of Diffusive and Drift Memristors for Neuromorphic Computing", *ADVANCED ELECTRONICS MATERIALS*, under review (2021, invited paper).
2. Q. Shao, Z.Wang, S. Fukami, D. Querlioz, Y. Zhou, **J. Joshua Yang**, Y. Chen, L. O. Chua, "Spintronic memristors for computing", *NATURE REVIEW PHYSICS* (2021, invited review).
3. R. Midya, **J. Joshua Yang**, Q. Xia, "Reservoir Computing", *NATURE MATERIALS*, views & news (2021).
4. P. Yao, **J Joshua Yang*,** "Deep Learning", chapter in "2021 Roadmap on Neuromorphic Computing and Engineering", *NEUROMORPHIC COMPUTING AND ENGINEERING*, Accepted (2021).
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21. United States Patent USPTO US8,450,711, 2013, "Semiconductor memristor devices" R. S. Williams, **J. Joshua Yang**, D. R. Stewart.
22. United States Patent USPTO US8,455,852, 2013, "Controlled placement of dopants in memristor active regions" N. J. Quitoriano, P. J. Kuekes, **J. Joshua Yang**.
23. United States Patent USPTO US8,487,289, 2013, "Electrically actuated device" **J. Joshua Yang,** M. Zhang, G. Medelros-Ribeiro.
24. United States Patent USPTO US 8,525,146, 2013, "Electrical circuit component" W. Wu, M. D. Pickett, **J. Joshua Yang**, Q. Xia, G. Medeiros Ribeiro.
25. United States Patent USPTO US8,525,553, 2013, "Negative differential resistance comparator circuits" M. D. Pickett, **J. Joshua Yang**, M. Zhang.
26. United States Patent USPTO US8,519,372, 2013, "Electroforming-free nanoscale switching device" **J. Joshua Yang**, S.-Y. Wang, R. S. Williams, A. Bratkovski, G. Medeiros Ribeiro.
27. United States Patent USPTO US8,530,873, 2013, "Electroforming free memristor and method for fabricating thereof" **J. Joshua Yang**, G. Medeiros Ribeiro, R. S. Williams.
28. United States Patent USPTO US8,546,785, 2013, "Memristive device" **J. Joshua Yang**, F. Miao, W. Wu, S.-Y. Wang, R. S. Williams.
29. United States Patent USPTO US8,575,585, 2013, "Memristive device" **J. Joshua Yang**, Q. Xia, A. A. Bratkovski.

30. United States Patent USPTO US8,570,138, 2013, "Resistive Switches" **J. Joshua Yang**, D. B. Strukov, S. Y. Wang.
31. United States Patent USPTO US8,586,959, 2013, "Memristive switch device" M. D. Pickett, **J. Joshua Yang,** D. B. Strukov.
32. United States Patent USPTO US8,587,985, 2013, "Memory array with graded resistance lines" **J. Joshua Yang**, J. P. Strachan, W. Wu, Janice H. Nickel.
33. United States Patent USPTO US8,710,483 B2, 2014, "Memristive junction with intrinsic rectifier" J. Joshua Yang, J. P. Strachan, M. D. Pickett.
34. United States Patent USPTO US8,710,865, 2014, "Field-programmable analog array with memristors" **J. Joshua Yang**, M. S. Qureshi, G. Medeiros-Ribeiro, R. S. Williams.
35. United States Patent USPTO US8,711,594, 2014, "Asymmetric switching rectifier" M.-X. Zhang, **J. Joshua Yang**, R. S. Williams.
36. United States Patent USPTO US8,737,113, 2014, "Memory resistor having multi-layer electrodes" **J. Joshua Yang**, W. Wu, R Gilberto-Ribeiro.
37. United States Patent USPTO US9,018,083 B2, 2014, "Electrically actuated device and method of controlling the formation of dopants therein" **J. Joshua Yang**, D. Stewart, P. J. Kuekes, W. M. Tong.
38. United States Patent USPTO US8,767,438, 2014, "Memelectronic Device" **J. Joshua Yang**, B. J. Choi, M. -X. Max Zhang, G. Medeiros-Ribeiro, R. S. Williams.
39. United States Patent USPTO US8,766,231, 2014, "Nanoscale Electronic Device with Barrier Layers" Wei Yi, **J. Joshua Yang**, G. Medeiros-Ribeiro.
40. United States Patent USPTO US8,779,409, 2014, "Low energy memristors with engineered switching channel materials" **J. Joshua Yang**, M.-X. Zhang, G. Medeiros-Ribeiro, R. S. Williams.
41. United States Patent USPTO US8,779,848, 2014, "Two terminal memcapacitor device" M. D. Pickett, J. Borghetti, **J. Joshua Yang**.
42. United States Patent USPTO US8,891,284, 2014, "Memristors based on mixed-metal-valence compounds" R. S. Williams, **J. Joshua Yang,** M. D. Pickett, G. Medeiros-Ribeiro, J. P. Strachan.
43. United States Patent USPTO US8,809,158, 2014, "Device having memristive memory" M. D. Pickett, **J. Joshua Yang,** G. Medeiros-Ribeiro.
44. United States Patent USPTO US8,829,581, 2014, "Resistive memory devices" S. Y. Wang, **J. Joshua Yang,** A. A. Bratkovski, R. S. Williams.
45. United States Patent USPTO US8,923,034, 2014, "Multi-level memory cell with continuously tunable switching" Y. Wei, F. Miao, **J. Joshua Yang**.
46. United States Patent USPTO US8,872,153, 2014, "Device structure for long endurance memristors" **J. Joshua Yang,** M.-X. Zhang, R.S. Williams.
47. United States Patent USPTO US8,882,217, 2014, "Printhead assembly including memory elements" P. V. Lea, G. M. Ribeiro, M. D. Pickett, **J. Joshua Yang**.
48. United States Patent USPTO US8,879,300, 2014, "Switchable two-terminal devices with diffusion/drift species" **J. Joshua Yang**, W. Wu, Q. Xia.
49. United States Patent USPTO US8,878,342, 2014, "Using alloy electrodes to dope memristors" N. J. Quitoriano, D. Ohlberg, P. J. Kuekes, **J. Joshua Yang**.
50. United States Patent USPTO US8,890,106, 2014, "Hybrid circuit of nitride-based transistor and memristor" **J. Joshua Yang**, G. Medeiros-Ribeiro, B. J. Choi, R. S. Williams.
51. United States Patent USPTO US8,912,520, 2014, "Nanoscale switching device" **J. Joshua Yang**, M. D. Pickett, G. Medeiros-Ribeiro.
52. United States Patent USPTO US8,921,960, 2015, "Memristor cell structures for high density arrays" **J. Joshua Yang**, M. X. Zhang, G. Medeiros-Ribeiro, R. S. Williams.
53. United States Patent USPTO US9,082,533, 2015, "Memristive element based on hetero-junction oxide" **J. Joshua Yang**, M. X. Zhang, R. S. Williams.
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61. United States Patent USPTO US9,082,972 B2, 2015, "Bipolar resistive switch heat mitigation" J. P. Strachan, G. Medeiros Ribeiro, **J. Joshua Yang**, W. Yi.
62. United States Patent USPTO US9,196,354, 2015, "Memory resistor adjustment using feedback control" J. P. Strachan, J. Borghetti, M. D. Pickett, G. Ribeiro, **J. Joshua Yang**.
63. United States Patent USPTO US9,184,213, 2015, "Nanoscale switching device" **J. Joshua Yang,** D. B. Strukov, W. Wu.
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66. United States Patent USPTO US9,171,613, 2015, "Memristors with asymmetric electrodes" A. M. Bratkovski, **J. Joshua Yang**, S.-Y. Wang, M. Stuke.
67. United States Patent USPTO US9,165,645, 2015, "High-reliability high-speed memristor" F. Miao, **J. Joshua Yang**, J. P. Strachan, W. Yi, G. Medeiros-Ribeiro, R S. Williams.
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72. United States Patent USPTO US9,331,278 B2, 2016, "Forming memristors on imaging devices" **J. Joshua Yang**, N. Ge, Z. Li, M. X. Zhang.
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77. United States Patent USPTO US9,558,869, 2017, "Negative differential resistance device" **J. Joshua Yang**, M. Zhang, R. S. Williams.
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80. United States Patent USPTO US9,776,400 B2, 2017, " Printhead with a number of memristor cells and a parallel current distributor" N. Ge, **J. Joshua Yang**, Z. Li.
81. United States Patent USPTO US9,701,115 B2, 2017, "Printheads having memories formed thereon" **J. Joshua Yang,** N. Ge, Z. Li.
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83. United States Patent USPTO US9,793,473, B2, 2017 "Memristor structures" S. Y. Wang, **J. Joshua Yang**, M. M. Zhang, A. M. Bratkovski.
84. United States Patent USPTO US9,885,937 B2, 2018, "Dynamical optical crossbar array" **J. Joshua Yang**, A. M. Bratkovski, D. A. Fattal, M. Zhang.
85. United States Patent USPTO US9,870,822 B2, 2018, "Non-volatile memory element with thermal-assisted switching control" G. Ning, **J. Joshua Yang**, Z. Li.
86. United States Patent USPTO US9,947,405 B2, 2018 "Memristive dot product engine with a nulling amplifier" J. P. Strachan, G. E. Montgomery, N. Ge, M. Hu, **J. Joshua Yang**.
87. United States Patent USPTO US9,911,789 B2, 2018 "1-Selector n-Resistor memristive devices" **J. Joshua Yang,** G. Gibson, Z. Li.
88. United States Patent USPTO US9,911,490 B2, 2018 "Memory controllers" N. Ge, **J. Joshua Yang,** F. Perner, J. H. Nickel.
89. United States Patent USPTO US9, 889,659 B2, 2018 "Printhead with a memristor" N. Ge, **J. Joshua Yang,** M. Zhang.
90. United States Patent USPTO US9,934,852 B2, 2018 "Sensing an output signal in a crossbar array based on a time delay between arrival of a target output and a sneak output" K. M. Kim, N. Ge, **J. Joshua Yang**.
91. United States Patent USPTO US9, 911,915 B2, 2018 "Multiphase selectors" **J. Joshua Yang**, Y. Jeon, H. S. Cho.
92. United States Patent USPTO US9,934,849 B2, 2018 "Asymmetrically selecting memory elements" K. M. Kim, **J. Joshua Yang**, Z. Li.
93. United States Patent USPTO US9, 911,788 B2, 2018 "Selectors with oxide-based layers" **J. Joshua Yang**, Ning Ge, Zhiyong Li.
94. EP 2,842,163 B1, 2018 "Nonlinear memristors" **J. Joshua Yang**, M. Zhang, M. D. Pickett, R. S. Williams.
95. United States Patent USPTO US10, 026,896 B2, 2018 "Mutilayered Memristors" W. Jackson, **J. Joshua Yang**, K. M. Kim, Z. Li.
96. United States Patent USPTO US10, 026, 477 B2, 2018 "Selector relaxation time reduction" **J. Joshua Yang**, N. Ge, J. P. Strachan, G. Gibson, W. Jackson.
97. United States Patent USPTO US10, 026, 894 B2, 2018 "Memristors with oxide switching layer" N. Ge, **J. Joshua Yang**, M. Zhang, K. Samuels.
98. United States Patent USPTO US10, 008, 264 B2, 2018 "Memristor corss-bar array for determining a dot product" N. Ge, **J. Joshua Yang**, J. P. Strachan, M. Hu.
99. United States Patent USPTO US10, 056, 142 B2, 2018 "Generating a representative logic indicator of grouped memristors" N. Ge, **J. Joshua Yang**, Z. Li, R. S. Williams.
100. United States Patent USPTO US10, 076, 904 B2, 2018 "Integrated circuit devices comprising memristors" **J. Joshua Yang**, N. Ge, Z. Li.
101. United States Patent USPTO US10, 096, 651 B2, 2018 "Resistive memory devices and arrays" **J. Joshua Yang**, N. Ge, k. Samuels, M. Zhang.
102. United States Patent USPTO US10, 074, 695 B2, 2018 "Negative differential resistance (NDR) device based on fast diffusive metal atoms" **J. Joshua Yang**, R. S. Williams, M. Zhang, Z. Li.
103. United States Patent USPTO US10, 186, 660 B2, 2018 "Memristor device" Q. Xia, H. Jiang, **J. Joshua Yang**.
104. WO EP US KR TW TWI622989B, 2019, "Temperature compensation circuits" N. Ge, **J. Joshua Yang**, M. Hu, J. P. Strachan.

105. WO US TW TWI611403B, 2018, "A resistive random-access memory in printed circuit board" N. Ge, V. Nguyen, **J. Joshua Yang**, C. Hua, L. Warnes, D. B Fujii
106. WO US US20180075904A1, 2018, "Memristive crossbar array having multi-selector memristor cells" N. Ge, **J. Joshua Yang**, Z. Li, R. S. Williams
107. WO US US20180017870A1, "Dynamic logic Memcap" N. Ge, Z. Li, **J. Joshua Yang**, R. S. Williams
108. US10,181, 349 B2, "Nonvolatile memory cross-bar array" N. Ge, **J. Joshua Yang**, J. P. Strachan, M. Hu
109. US10, 643, 697 B2/US10, 109, 348, B2, "Double bias memristive dot product engine for vector processing" M. Hu, **J. Joshua Yang**, J. P. Strachan, N. Ge
110. US10, 147, 762 B2, "Protective elements for non-volatile memory cells in crossbar arrays" M. Zhang, **J. Joshua Yang**, R. S. Williams
111. US10, 580, 473 B2, "Memcapacitive cross-bar array for determining a dot product" N. Ge, J. P. Strachan, **J. Joshua Yang**, H. Miao.
112. EP2997597B1, 2018, "Nanochannel array of nanowires for resistive memory devices" S.-Y. Wang, **J. Joshua Yang**.
113. US10, 319, 441 B2, "Nonvolatile memory cross-bar array" N. Ge, **J. Joshua Yang**, J. P. Strachan, H. Miao.
114. US10, 325, 655 B2, "Temperature compensation circuits" N. Ge, **J. Joshua Yang**, H. Miao, J. P. Strachan.
115. US10, 262, 733 B2, "Memristive dot product engine for vector processing" **J. Joshua Yang**, H. Miao, J. P. Strachan.N. Ge.
116. US10,580,473 B2, "Memcapacitive cross-bar array for determining a dot product" **J. Joshua Yang**, N. Ge., J. P. Strachan, **J. Joshua Yang**, H. Miao.
117. US10, 741, 759 B2, "Diffusive memristor and device for synaptic emulator" **J. Joshua Yang**, Q. Xia, M. Mclean, Q. Wu, M. Barnell.
118. US10, 740, 672 B2, "Capacitive artificial neural networks" **J. Joshua Yang**, Q. Xia, Z. Wang, Q. Wu, M. R. Mclean.
119. United States Patent USPTO US11, 126, 403 B2, 2021 "True random number generator (TRNG) circuit using a diffusive memristor" **J. Joshua Yang**, Q. Xia, H. Jiang.

Invited/Plenary/Keynote Talks:

International conferences:

1. *The 10th Non-volatile memory technology symposium (NVMTS09)* 2009, Portland, Oregon.
2. "Oxide based memristive nanodevices" 2009, **International Conference on Communications, Circuits and Systems 2009 (ICCCAS 2009)** San Jose, California.
3. "Metal/oxide/metal memristive devices" 2009, **The 7th International Conference on Advanced Materials and Devices (ICAMD)** 2009, Jeju island, KOREA.
4. "Engineering control and applications of oxide based nano-switches", 2010, **International Symposium on Integrated Functionalities (ISIF)** 2010, San Juan, Puerto Rico.
5. "Engineering control over device properties of memristors for immediate applications", **Julius Springer Forum on Applied Physics** 2010, Stanford University, CA.
6. "Promises and challenges of Memristive switches", **11th Non-Volatile Memory Technology Symposium** 2011, Shanghai, China. **(Keynote)**
7. "Oxide based memristive devices", **IEEE International Conference on Solid-State and Integrated Circuit Technology** 2012, Xi'an, China.
8. "TaOx based memristive devices", **12th Non-Volatile Memory Technology Symposium** 2012, Singapore.

9. "Memristive nanodevices for computing", **The 57th International Conference on Electron, Ion, Photon Beam Technology and Nanofabrication (EIPBN)** 2013, Tennessee.
10. "Memristive Devices for Computing", **The 224th Electrochemical Society Meeting** 2013, *ULSI Process Integration Symposium*, San Francisco, California. **(Keynote)**
11. "Memristive Nanodevices", **Nano and Giga** 2014, Phoenix, Arizona.
12. "Challenges and Materials Solutions for Memristive Devices (ReRAM)", **MRS Spring** 2014, San Francisco, California.
13. "The material perspective ReRAM" **The IEEE International Symposium on Circuits and Systems (ISCAS)** 2014**,** FEST 2014, Melbourne, Australia. **(Keynote)**
14. "Tutorial on Memristive devices" **the 29th Symposium on on Microeletronics Technology and Devices** 2014 *(SBMICRO 2014, Chip in Aracaju)*, Aracaju, Brazil.
15. "Challenges and solutions of memristors for Neuromorphic Computing" **the International Symposium on Neuromorphic Systems and Cyborg Intelligence** 2014, Hangzhou, China.
16. "Materials Perspective of Memristive Devices", **IEEE International Conference on Solid-State and Integrated Circuit Technology** 2014, Guilin, China**.**
17. "Challenges and Solutions for Memristive Devices", **The AVS 61st International Symposium & Exhibition** 2014, Baltimore, Maryland.
18. "RRAM tutorial", **MRS Fall Meeting** 2014, Boston, Massachusetts.
19. "Memristive Devices (ReRAM): Challenges and Possible Solutions", **MRS Fall Meeting** 2015, Boston, Massachusetts.
20. "Promises and challenges of memristive devices", **15th International Conference On Nanotechnology** 2015, **(IEEE Nano 2015),** Rome, Italy.
21. "Memristive nanodevices for computing - challenges and solutions", **China Semiconductor Technology International Conference 2015 (IEEE CSTIC 2015)** 2015, Shanghai, China.
22. "Challenges and possible solutions for memristive devices", **15th Non-Volatile Memory Technology Symposium (IEEE NVMTS 2015)** 2015, Beijing, China.
23. "Engineering interfaces for memristive devices", **the 43rd Conference on the Physics and Chemistry of Surfaces and Interfaces (PCSI-43)** 2016, Palms Springs, CA.
24. "Materials issues in memristive devices", **145th TMS annual meeting** 2016, Nashville, Tennessee.
25. "Different applications of memristors enabled by selector devices", **China Semiconductor Technology International Conference (CSTIC)** 2016, Shanghai, China. **(Keynote)**
26. **J. Joshua Yang**, "Memristor Mate devices", **International Workshop on Information Storage/10th International Symposium on Optical Storage (IWIS/ISOS 2016)** 2016, Changzhou, China. **(Keynote)**
27. "A versatile two-terminal device enables different applications of resistance switches" **The IEEE International Symposium on Circuits and Systems (ISCAS)** 2016, Montréal, Canada.
28. "Challenges and solutions for memristors used for memory and neuromorphic computing", **16th Non-Volatile Memory Technology Symposium (IEEE NVMTS 2016)** 2016, Pittsburg, Pennsylvania.
29. "Engineered materials for memristor mate" **International Conferences on Modern Materials and Technologies (CIMTEC)** 2016, Perugia, Italy.
30. "Engineered materials for memristor mate" **58th Electronic Materials Conference (EMC)** 2016, Newark, Delaware.
31. "non-volatile memories" **230th Meeting of Electrochemical Society (ECS)** 2016, Honolulu, Hawaii.
32. "Memristors with diffusive relaxation dynamics for neuromorphic computing", **IEEE 13th International Conference on Solid-State and Integrated Circuit Technology (ICSICT)** 2016, Hangzhou, China.
33. "Memristors with diffusive relaxation dynamics for neuromorphic computing" **16th Non-Volatile Memory Technology Symposium** 2016, Pennsylvania, USA.
34. "Emerging Materials and Technologies for Nonvolatile Memories", **MRS Fall Meeting** 2016, Boston, Massachusetts.

35. "Challenges and solutions for memristors used for memory and neuromorphic computing", **MRS Spring Meeting** 2017, Phoenix, Arizona.
36. "Challenges and solutions for memristors used for memory and neuromorphic computing", **Collaborative Conference on Materials Research (CCMR)** 2017, Jeju Island, South Korea.
37. "Diffusive memristors for future computing", **China Semiconductor Technology International Conference (CSTIC)** 2017, Shanghai, China. **(Keynote)**
38. "Diffusive Memristors*"* **1st International Conference on Memristive Materials, Devices & Systems (MEMRISYS)** 2017, Athens, Greece. **(Plenary)**
39. "Diffusive Memristors for Computing", **The 21st International Conference on Solid State Ionics (SSI-21)** 2017, Padua, Italy.
40. **"**RRAM/memristor for computing" **International Symposium on Memory Devices for Abundant Data Computing** 2017, Hongkong **(Plenary).**
41. "Diffusive Memristors as Artificial Synapses and Neurons for Neural Networks", **MRS Fall Meeting** 2017, Boston, Massachusetts.
42. "Diffusive memristor as an oscillatory neuron for brain inspired computing", **XXVI International Materials Research Congress** 2017, Cancun, Mexico.
43. "Bio-inspired computing with memristive devices", **Neurotalk** 2018, Bangkok, Thailand.
44. "Neuromorphic computing with memristive devices and arrays", **Compound Semiconductor Week (CSW2018)** 2018, MIT, Cambridge, USA.
45. "Diffusive memristor for computing", **The IEEE International Symposium on Circuits and Systems (ISCAS)** 2018, Florence, Italy.
46. "Diffusive Memristors for computing*"*, **International Conference on Memristive Materials, Devices & Systems (MEMRISYS)** 2018, Beijing, China. **(Keynote)**
47. "Neuromorphic computing with memristors", **Nature Conference** on Flexible Electronics-Visions of a Flexible Future 2018, Xi'an, China. **(Keynote)**
48. "Experimental demonstrations of unconventional computing with memristive devices", ***special session on memristors*** in the **International Conference on Neuromorphic Systems** 2018, Knoxville, Tennessee.
49. "Bio-inspired computing with memristive neural networks", **the International Conference on Neuromorphic Systems** 2018, Knoxville, Tennessee. **(plenary)**
50. "Memristive materials and applications", **The 3rd International Conference on New Material and Chemical Industry (NMCI)** 2018, Sanya, China (2018). **(Keynote)**
51. "Unconventional computing with memristive devices and arrays" **AiMES** 2018, Cancun, Mexico.
52. "Unconventional computing with memristive neural network", **China Semiconductor Technology International Conference (CSTIC)** 2018, Shanghai, China.
53. "Unconventional computing with memristive devices and arrays" **ACS Presidential Symposium** 2018**,** 256th ACS National Meeting, Boston, MA.
54. "Neuromorphic computing with memristive devices and arrays" **Solid State Devices and materials** 2018**,** Tokyo, Japan.
55. "Diffusive memristor for computing", **The 6th Memristor and Memristive Symposium** 2018, Budapest, Hungary. **(plenary)**
56. "Unconventional computing with resistive switching devices", **International Emergent Memory Symposium (IEMS-2018)** 2018, Ji'an, China. **(plenary)**
57. "Computing with memristive devices and arrays", **China Semiconductor Technology International Conference (CSTIC)** 2019, Shanghai, China.
58. "In Situ Learning with Memristive Neural Networks: Supervised, Unsupervised, Reinforcement", **International Nanodevices and Computer Conference (INC)** 2019**,** Grenoble, France.
59. "Memristive devices for brain-inspired computing", **15th IEEE International Conference on Electron Devices and Solid-State Circuits (IEEE EDSSC 2019)** 2019, Xi'an, China.

60. "In Situ Learning with Memristive Neural Networks: Supervised, Unsupervised, Reinforcement", **International Conference on Memristive Materials, Devices & Systems (MEMRISYS)** 2019, Dresden, Germany. **(Plenary)**
61. "Computing with memristive devices and arrays", **236th Meeting of the Electrochemical Society (ECS 2019),** Atlanta, Georgia**.**
62. "Tutorials on Neuromorphic computing", **Nature Conference on Neuromorphic Computing** 2019, Beijing, China. **(Invited Tutorial)**
63. "Neuromorphic computing with dynamics of diffusive memristors", **Nature Conference on Neuromorphic Computing** 2019, Beijing, China.
64. "Learning with Resistive Switching Neural Networks", **The IEEE International Electron Devices Meeting (IEDM)** 2019, San Francisco, USA.
65. "Materials and devices for neuromorphic computing", **APS March meeting** 2020, Denver, Co.
66. "Memristive materials and devices for unconventional computing", **MRS Spring meetings** 2020, Phoenix, Arizona.
67. "Memory Devices for Abundant Data Computing" **The 3rd International Symposium on** 2020, Hong Kong. **(Plenary)**
68. "Brain-inspired Neuromorphic Networks", **Gordon Research Conference on Multifunctional Materials and Structures,** Jan. 2020, Ventura CA.
69. "Computing with memristive devices and arrays", **The 6th International Conference on Electronic Materials and Nanotechnology for Green Environment (ENGE 2020)** Nov. 2020, Jeju, Korea.
70. "Memristive devices and arrays for neuromorphic computing", **The 13th IEEE International Conference on Solid-State and Integrated Circuit Technology (ICSICT),** Nov. 2020, Kunming, China.
71. "Memristive devices and arrays for neuromorphic computing", **The 11th International Green and Sustainable Computing Conference (IGSCC)**, Oct. 2020, online, USA.
72. "Memristive materials and devices for unconventional computing", **The 238th Meeting of The Electrochemical Society (ECS),** Oct. 2020, Honolulu, Hawaii.
73. "Resistive and capacitive crossbar arrays for neuromorphic computing", **Design Automation Conference (DAC) 2020**, Jul. 2020, San Francisco, California.
74. "Memristive materials and devices for unconventional computing", **The 78th Device Research Conference (DRC)**, Jun. 2020, Columbus, Ohio.
75. "Computing with memristive and memcapacitive devices", **MRS Fall meetings** 2020, Boston, Massachusetts.
76. "Memristive devices and arrays as AI hardware", **The 67th Annual AVS International Symposium (AVS67)** Oct. 2020, Denver, Colorado.
77. "AI-Devices to systems: Resistive Switching Materials and Devices for Bio-Inspired Computing", **2021 VLSI-TSA (short course)**, April 2021, Hsinchu, Taiwan.
78. "Memristive Devices for Bio-Inspired Computing", International **Union of Materials Research Societies – International Conference in Asia 2021** (IUMRS-ICA 2021, **Plenary**) Oct. 2021, Jeju Island, Korea.
79. "Engineering Mobile Species in Resistive Switches for Computing", **The 3rd International Symposium on Memory Devices for Abundant Data Computing**, May 2021, Hong Kong. **(Plenary)**
80. "Memristive Materials and Devices for Neuromorphic Computing", **The 19th International Nanotech Symposium & Exhibition** (NANO KOREA 2021), Jul. 2021, KINTEX, Korea. **(Plenary)**
81. "Memristive Devices and Arrays as AI Hardware", **The AVS 67th International Symposium & Exhibition** Oct. 2021, Charlotte, NC.

82. "Computing with memristive dynamics", **The first International Conference on Neuromorphic Computing (ICNC2021),** Oct. 2021, Wuhan, China. **(Keynote)**
83. "The fusion of digital and analog: Opening new horizons in ICT, AI, and IOT", **4th International Conference on Memristive Materials, Devices & Systems (MEMRISYS)**, Nov. 2021, Tsukuba, Japan. **(Keynote)**
84. "Memristive devices and arrays for computing", **The International Conference on Computer-Aided Design (ICCAD),** Workshop on Hardware and Algorithms for Learning On-a-chip, Nov. 2021, online.

International workshops:

85. The memristor at age 40", 2010, **International Symposium on Materials for Enabling Nanodevices**, UCLA, California. （**Plenary talk**）
86. "Applications and property engineering of memristive nanodevices", 2010, **Advances in nonvolatile memory materials and devices**, *Suzhou*, China.
87. "Recent progress on oxide based memristive devices in HP", 2011, **Non-volatile memories worshop**, University of California - San Diego, California.
88. "Oxide based memristive devices", 2011, **Frontier of Functional-Oxide Nano Electronics workshop,** Tsukuba, Japan.
89. "TaOx Memristive Nano-devices: Mechanism, Applications and Challenges", 2012, **Advanced Memory Workshop,** NCCAVS Thin Film Users Group, California.
90. "The Memristor" *LASERION international workshop*, 2013, Munich, Germany.
91. "Memristive Devices for Computing" **Global Forum on Nanoelectronic Manufacturing***: From Materials to Systems*, 2014 Mumbai, India.
92. "Memristive nanodevices for computing - challenges and solutions", **International workshop Advances in ReRAM:** *Materials and Interfaces 2015*, Crete, Greece. **(Keynote)**
93. "Experimental demonstration of analog computing and neuromorphic computing with memristor crossbar arrays" **Energy Consequences of Information Workshop**, 2017 Santa Fe, New Mexico.
94. "Unconventional computing using neural network based memristors", 2017, **The 2017 Stephen and Sharon Seiden Frontiers in Engineering & Science Workshop:** *"Beyond CMOS: From Devices to Systems"*, Haifa, Isreal.
95. "Memristive devices for neuromorphic computing", **the 2017 APS/CNM Users Meeting**, 2017, Argonne National Labs, Illinois.
96. "Experimental demonstration of analog computing and neuromorphic computing with memristor crossbar arrays", **2017 Energy Consequences of Information (ECI),** 2017, Santa Fe, New Mexico.
97. "Diffusive Memristor based Neural Networks", 2017, **International Workshop on Future Computing (IWoFC)**, Beijing, China. **(Keynote)**
98. "Challenges and possible solutions for RRAM based computing", 2017, **the 7th International Workshop on Resistive Switching Memory**, Leuven, Belgium.
99. "Opportunities and Challenges of Memristive Electroceramics for Computing", 2017, **Frontiers In Electroceramics Workshop**, MIT, Massachusetts.
100. "Resistive/memristive switching devices for computing", 2017, **IEEE-IRDS Beyond CMOS Workshop**, Albuquerque, New Mexico.
101. "Resistive and Capacitive Neural Networks Enabled by Diffusive Memristors", 2018, **International Workshop on Future Computing (IWoFC)**, Beijing, China. **(Keynote)**
102. "Artificial Synapses and Neurons Driven by Thermodynamics", 2019, **CCC Thermodynamic Computing workshop**, Honolulu, Hawaii. （**Plenary talk**）
103. "Computing with Memristive and Memcapacitive Devices", 2019, **Inaugural Chua Memristor Institute Conference (ICMIC 2019)**: Theory, Device, and Applications, Wuhan, China （**Plenary talk**）

104. "Materials challenges and solutions of memristive devices for computing", **NREL workshop on neuromorphic computing**, NREL, Denver.
105. "Engineering Memristors for Neuromorphic Computing", 2021, The 17th IEEE International Workshop on Cellular Nanoscale Networks (**CNNA 2021**), Catania, Italy.
106. "ARL Artificial Intelligence Tech Forecasting virtual workshop", 2021, Discussion Lead of Edge Computing.

Seminars:

107. "Resistance Memory Nanoelectronics", May/2009, *Invited Lecture*, **UCSC-NASA Ames Research Center**, Mountain View, California.
108. "Oxide based memristive junctions: switching, forming and device family", 2009, *Seminar*, **University of California, Santa Cruz**, California.
109. Seminar, 2009, Seoul National University, Korea.
110. "Memristive Nanodevices", 2010, *Seminar*, **Peking University**, Beijing, China.
111. "Oxide based nanoswitches", 2010, *Seminar*, **Chinese Academy of Science**, Beijing, China.
112. "Memristors in Computing: Promises and Challenges", 2011, *seminar*, **IEEE Computer Society**, San Jose California.
113. "Metal oxide based nonvolatile memories - promises and challenges", 2011, **IEEE Electronic Device Society**, Santa Clara, California.
114. "Memristive Nanodevices: mechanism, promises and challenges", 2012, *Seminar*, **University of Pittsburgh**, Pittsburgh, Pennsylvania.
115. "Oxide based Memristive Nanodevices", 2012, *Seminar*, **Michigan State University**, East Lansing, Michigan.
116. "Mermistor technology development", 2012, *seminar*, **Finisar corp**. Sunnyvale California.
117. "Memristive Nanodevices: Mechanisms, Applications and Challenges", 2012, **IEEE SINGAPORE REL/CPMT/ED CHAPTER**, Singapore.
118. "Memristive Devices for Computing", 2013, **IEEE SCV Electron Devices Society**, Santa Clara, California.
119. "Memristive nanodevices: mechanisms, promises and challenges", 2013, *seminar*, **University of California, Berkeley**, California.
120. *Special Lecture*, **AirForce Research Lab**, Rome, New York (2013). **(Chief Scientist Lecture Series)**
121. "Memristive materials and Devices", 2014, *Seminar*, **Tsinghua University**, Beijing, China.
122. "Resistance switching: applications, mechanisms and challenges", 2015, *Seminar*, **HGST**, San Jose, California.
123. "Challenges and solutions for memristors used for memory and neuromorphic computing", 2016, seminar, **Chinese Academy of Science**, Beijing.
124. "Memristor applications enabled by selectors", 2016, seminar, **Tsinghua University**, Beijing.
125. "Diffusive memristor as synaptic emulators for neuromorphic computing", 2016, seminar, **Peking University**, Beijing.
126. "Memristors for computing", 2017, seminar, **Huazhong University of Science and Technology**, Wuhan, China.
127. "Memristive devices for computing: applicsations, challenges and possible solutions", 2017, seminar, **SUSTC**, Shenzhen, China.
128. "Memristive devices for computing", 2017, Micro-Nano Seminar Series, **MIT**, Cambridge.
129. "Bio-inspired computing with memristors" 2018, **Zhengzhou University**, Zhengzhou, China.

130. "Unconventional computing with memristors" 2018, **Peking University**, Beijing, China.
131. "Bio-inspired computing with Memristor" 2018, Brain and Intelligence summer school of **Tsinghua University**, Beijing, China.
132. "Unconventional computing with memristive devices and arrays", 2018, Northwestern MRSEC Seminar, **Northwestern University**, USA.
133. "Unconventional computing with memristive devices and arrays", 2018, **NIST**, Gaithersburg, Maryland.
134. "Neuromorphic computing with memristor crossbar arrays", 2018, Applied Physics colloquium, **Harvard University**, Cambridge.
135. "Bio-inspired computing with memristive devices", 2018, MechE Colloquium, **MIT**, Cambridge.
136. "Challenges and Opportunities for Memristive Devices Used for Bio-inspired Computing", 2019, **AirForce Rsearch Labs (AFRL)**, Dayton, Ohio.
137. "Bio-inspired Computing with Memristive Devices", 2019, Neuromorphic Computing Forum, **Samsung**, Korea.
138. "Neuromorphic Computing with Memristive Devices", 2019, **Oak Ridge National Lab (ORNL)**, Oak Ridge, Tennessee.
139. "Computing with Memristive Devices and Arrays", 2021, Frontiers in Materials Lecture Series at **Pacific Northwest National Laboratory (PNNL)**, Richland, Washington.
140. "Computing with Memristive Devices and Arrays", 2021, **Distinguished Seminar at Northwestern University**, Evanston, IL.
141. "Memristive Materials for Computing", Quantum Materials and Devices Seminar, 2021, **Harvard University**, Cambridge.
142. "Memristive devices for computing" monthly colloquium of the Collaborative Research Center 1461 on Neurotronics_Bio-inspired Information Pathways, **Kiel,** Germany
143. "Memristive Materials and Devices for Neuromorphic Computing", 2021, Materials for the Future Seminar Series, National **University of Singapore.**
144. "Neuromorphic Computing with Memristive Devices", 2021, IEEE MTTS/PHOS seminar.