

PhD students and Post-Doc graduated :

Sanchit Deshmukh, PCM, Apple
Raisul Islam, RRAM/PCM physics, TSMC
Chris Neumann, PCM, Intel
Kye Okabe, PCM, job TBD

Journal Publications :

1. S. Qin, Z. Jiang, H. Li, S. Fujii, D. Lee, S. S. Wong, and H. -S. P. Wong, "Next Generation Ultra-High-Density 3D Vertical Resistive Switching Memory (RSM) —Part I: Accurate Modeling of a Novel 3D Vertical RSM," *IEEE Transactions on Electron Devices* (to appear).
2. Z. Jiang, S. Qin, H. Li, S. Fujii, D. Lee, S. S. Wong, and H. -S. P. Wong, "Next Generation Ultra-High-Density 3D Vertical Resistive Switching Memory (RSM) —Part II: Design Guidelines for Device, Array, and Architecture," *IEEE Transactions on Electron Devices* (to appear).
3. K. L. Okabe, A. Sood, E. Yalon, C. M. Neumann, M. Asheghi, E. Pop, K.E. Goodson, and H.-S. P. Wong, "Understanding the switching mechanism of interfacial phase change memory," *Journal of Applied Physics* 125, 184501 (2019).
<https://doi.org/10.1063/1.5093907>
4. Z. Wang, S. Kumar, R. S. Williams, Y. Nishi, H.-S. P. Wong, "Intrinsic limits of leakage current in self-heating-triggered threshold switches," *Appl. Phys. Lett.*, Vol.114, Issue 18, 2019. DOI: 10.1063/1.5089261
5. Y. Zhao, P. Huang, Z. Zhou, C. Liu, S. Qin, L. Liu, X. Liu, H.-S. P. Wong, J. Kang, "A Physics-Based Compact Model for CBRAM Retention Behaviors Based on Atom Transport Dynamics and Percolation Theory," *IEEE Electron Device Letters*, Vol 40, No. 4, pp. 647 – 650, April , 2019. DOI: 10.1109/LED.2019.2901754
6. B. Q. Le, A. Grossi, E. Vianello, T. Wu, G. Lama, E. Beigne, H.-S. P. Wong, S. Mitra, "Resistive RAM with multiple bits per cell: Array-level demonstration of 3 bits per cell," *IEEE Transactions on Electron Devices* 66 (1), 641-646 (2019)
7. X. Zheng, R. Zarcone, D. Paiton, J. Sohn, W. Wan, B. Olshausen and H.-S. P. Wong, "Error-Resilient Analog Image Storage and Compression with Analog-Valued RRAM Arrays: An Adaptive Joint Source-Channel Coding Approach," 2018 IEEE International Electron Devices Meeting (IEDM), San Francisco, CA, 2018, pp. 3.5.1-3.5.4. doi: 10.1109/IEDM.2018.8614612
8. R. Islam, H. Li, P.-Y. Chen, W. Wan, H.-Y. Chen, B. Gao, H. Wu, S. Yu, K. C. Saraswat, and H.-S. P. Wong, "Device and materials requirements for neuromorphic computing," *Journal of Physics D: Applied Physics*, vol. 52, no. 11, pp. 113001. doi: 10.1088/1361-6463/aaf784. (invited)
9. R. Yang, H. Li, K. Smithe, T. Kim, K. L. Okabe, E. Pop, J. Fan, and H.-S. P. Wong, "Ternary content-addressable memory with MoS₂ transistors for massively parallel data search," *Nature Electronics*, Vol. 2, pp. 108 – 114 (2019).
10. C. M. Neumann, K. L. Okabe, E. Yalon, R. W. Grady, H.-S. P. Wong, and E. Pop, "Engineering thermal and electrical interface properties of phase change memory with monolayer MoS₂," *Applied Physics Letters*, vol. 114, pp. 82103. doi: 10.1063/1.5080959

11. Dependent Contact Resistance to Non-Volatile Memory Materials," IEEE Trans. Elec. Dev. 66, 3816-3821 (2019)
12. C.M. Neumann, K.L. Okabe, E. Yalon, R.W. Grady, H.-S.P. Wong, E. Pop, "Engineering Thermal and Electrical Interface Properties of Phase Change Memory with Monolayer MoS₂," Appl. Phys. Lett. 114, 082103 (2019)
13. R. Yang, H. Li, K.K.H. Smithe, T.R. Kim, K. Okabe, E. Pop, J.A. Fan, H.-S.P. Wong, "Ternary Content-Addressable Memory with MoS₂ Transistors for Massively Parallel Data Search," Nature Electronics 2, 108-114 (2019)
14. E. Yalon, I.M. Datye, J.-S. Moon, K.-A. Son, K. Lee, E. Pop, "Energy-Efficient Indirectly-Heated Phase Change RF Switch," IEEE Electron Dev. Lett. 40, 455-458 (2019)
15. M. Lanza, H.-S.P. Wong, E. Pop, D. Ielmini, D. Strukov, B.C. Regan, L. Larcher, M.A. Villena, J.J. Yang, L. Goux, A. Belmonte, Y. Yang, F.M. Puglisi, J. Kang, B. Magyari-Köpe, E. Yalon, A. Kenyon, M. Buckwell, A. Mehonic, A. Shluger, H. Li, T.-H. Hou, B. Hudec, D. Akinwande, R. Ge, S. Ambrogio, J.B. Roldan, E. Miranda, J. Suñe, K.L. Pey, X. Wu, N. Raghavan, E. Wu, W.D. Lu, G. Navarro, W. Zhang, H. Wu, R. Li, A. Holleitner, U. Wurstbauer, M. Lemme, M. Liu, S. Long, Q. Liu, H. Lv, A. Padovani, P. Pavan, I. Valov, X. Jing, T. Han, K. Zhu, S. Chen, F. Hui, Y. Shi, "Recommended methods to study resistive switching devices," Adv. Electron. Mater. 5, 1800143 (2019).
16. K.L. Okabe, A. Sood, E. Yalon, C.M. Neumann, M. Asheghi, E. Pop, K.E. Goodson, H.-S.P. Wong, "Understanding the Switching Mechanism of Interfacial Phase Change Memory," J. Appl. Phys. 125, 184501 (2019).
17. Aravindh Kumar, Raisul Islam, Dipankar Pramanik, Krishna Saraswat, "On the Limit of Defect Doping in Transition Metal Oxides," J. Vac. Sci. & Tech. A 37, 021505 (2019).
18. Lauren J. Riddiford, Jacob J. Wissler, Satoru Emori, Peng Li, Debangsu Roy, Egecan Cogulu, Olaf van 't Erve, Yong Deng, Shan X. Wang, Berend T. Yonker, Andrew D. Kent, and Yuri Suzuki, "Efficient Spin Current Generation in Low Damping Mg(Al,Fe)2O₄ Thin Films", Appl. Phys. Lett. 115, 122401, 2019.

Conference Publications:

1. E.R. Hsieh, M. Giordano, B. Hodson, A. Levy, S.K. Osekowsky, R.M. Radway, Y.C. Shih, W. Wan, T. F. Wu, X. Zheng, M. Nelson, B.Q. Le, H.-S.P. Wong, S. Mitra, and S. Wong, "High-Density Multiple Bits-per-Cell 1T4R RRAM Array with Gradual SET/RESET and its Effectiveness for Deep Learning," International Electron Devices Meeting (IEDM), 2019 (to appear)
2. Xiang Li, Mahendra DC, Wilman Tsai, Shy-Jay Lin, Shan X. Wang, Yu-Ching Liao, Azad J. Naeemi, and Chengyang Yao, "Materials Requirements of High-Speed and Low-Power Spin-Orbit-Torque Magnetic Random-Access Memory", The International Conference on Magnetism and Magnetic Materials (MMM), Las Vegas, November 4-8, 2019.
3. Shan X. Wang, Chong Bi, Xiang Li, Telem Simsek, et al., "Interfacial engineering of SOT-MRAM," 4th International Workshop on Spintronics Memory and Logic (SML), Beijing, May 22-24, 2019.
4. Chong Bi, Shy-Jay Lin, Xiang Li, Telem Simsek, M. Song, Wilman Tsai, and Shan X. Wang, "Interfacial engineering of SOT-MRAM to modulate atomic diffusion and enable PMA stability >400 C," International Symposium on VLSI Technology, Systems and Applications (VLSI-TSA), Hsinchu, Taiwan, April 22-25, 2019.
5. H. Li, P. Raina, and H.-S. P. Wong, "Neuro-inspired computing with emerging memories: where device physics meets learning algorithms," SPIE Spintronics XII, vol. 11090, 2019.

6. H. Li, M. Bhargava, P. Whatmough, and H.-S. P. Wong, "On-chip memory technology design space explorations for mobile deep neural network accelerators," Design Automation Conference (DAC), 2019.
7. J-S. Moon, H.-C. Seo, K.K. Son, E. Yalon, K. Lee, E. Flores, G. Candia, E. Pop, "Reconfigurable Infrared Spectral Imaging with Robust Phase Change Materials," SPIE-DCS, Apr 2019, Baltimore MD.
8. J. Zheng, A. Khanolkar, P. Xu, S. Colburn, S. Deshmukh, J. Myers, J. Frantz, E. Pop, J. Hendrickson, J. Doylend, N. Boehler, A. Majumdar, "Non-volatile quasi-continuously programmable silicon photonics using phase-change materials," SPIE Photonics West, Feb. 2019, San Francisco CA.