

# NANO KOREA 2018

## July 10~13, KINTEX, Korea

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### Geoffrey W. Burr

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#### EDUCATION

California Institute of Technology	Ph.D	Electrical Engineering	1996
California Institute of Technology	MS	Electrical Engineering	1993
University at Buffalo	BS	Electrical Engineering	1991

#### PROFESSIONAL ACTIVITIES

- Science & Technology Dept., IBM Research – Almaden, USA  
*Principal Research Staff Member* (Sept 2014 – present)  
*Research Staff Member* (July 1999 – Sept 2014)  
*Visiting Scientist* (Jan 1996 – July 1999)
- CNRS (Centre National de la Recherche Scientifique), Besançon, France  
*Invited Professor (Chercheur Associé)* (Dec 2006 – Jan 2007, May – July 2007)

#### AWARDS AND HONORS

- IEEE Senior Member (2013)
- IBM Outstanding Technical Achievement Award (2013)
- Eta Kappa Nu Outstanding Young Electrical Engineer, Honorable Mention (2004)
- Eta Kappa Nu Outstanding Electrical Engineering Senior in the U.S. (1991)
- Eta Kappa Nu Outstanding Electrical Engineering Junior in the U.S. (1990)

#### MAIN SCIENTIFIC PUBLICATION

- 16 book chapters
- 18 invited papers, including:
  - P. Narayanan, A. Fumarola, ... and G. W. Burr, “Towards on-chip acceleration of the backpropagation algorithm using non-volatile memory,” *IBM Journal of Research and Development*, special issue on "Deep Learning," **61**(4/5), 1-11 (2017).
  - G. W. Burr, R. M. Shelby, et al., “Neuromorphic computing using non-volatile memory,” *Advances in Physics X*, **2**(1), 89-124 (2017).
  - G. W. Burr, S. Kim, et al., “Recent progress in Phase change memory technology,” *IEEE Journal on Emerging and Selected Topics in Circuits and Systems*, **6**(2) 146-162 (2016).
  - G. W. Burr, R. M. Shelby, et al., “Experimental demonstration and tolerancing of a large-

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scale neural network (165,000 synapses), using phase-change memory as the synaptic weight element,” *IEEE Transactions on Electron Devices*, special issue commemorating the 60th anniversary of IEDM, **62**(11), 3498-3507 (2015).

- R. S. Shenoy, G. W. Burr, et al., “Invited Review: MIEC (Mixed-Ionic-Electronic-Conduction)-based access devices for non-volatile crossbar memory arrays,” *Semiconductor Science and Technology*, **29**(10), 104005 (2014).
- G. W. Burr, R. S. Shenoy, et al., “Access devices for 3-D crosspoint memory,” *Journal of Vacuum Science & Technology B*, **32**(4), 040802 (2014).
- G. W. Burr, M. J. Breitwisch, et al., “Phase change memory technology,” *Journal of Vacuum Science & Technology B*, **28**(2), 223-262 (2010).
- G. W. Burr, B. N. Kurdi, J. C. Scott, C. H. Lam, K. Gopalakrishnan, and R. S. Shenoy, “An overview of candidate device technologies for Storage-Class Memory,” *IBM Journal of Research and Development*, **52**(4/5), 449-464 (2008).
- S. Raoux, G. W. Burr, et al., “Phase change Random Access Memory - A Scalable Technology,” *IBM Journal of Research and Development*, **52**(4/5), 465-480 (2008).
- 50 submitted journal articles, including:
  - B.-S. Lee, G. W. Burr, R. M. Shelby, S. Raoux, C. T. Rettner, S. N. Bogle, K. Darmawikarta, S. G. Bishop, and J. R. Abelson, “Observation of the role of subcritical nuclei in crystallization of a glassy solid,” *Science*, **326**(5955), 980-984 (2009).
- 89 invited talks
- 16 presentations at *IEDM* or *VLSI Technology Symposium*, including:
  - G. W. Burr, P. Narayanan, et al., “Large-scale neural networks implemented with nonvolatile memory as the synaptic weight element: comparative performance analysis (accuracy, speed, and power),” invited talk, Neuromorphic Focus Session, *IEEE International Electron Devices Meeting (IEDM 2015)*, T4.4, December 2015.
  - G. W. Burr, K. Virwani, et al., “Large-scale (512kbit) integration of Multilayer-ready Access-Devices based on Mixed-Ionic-Electronic-Conduction (MIEC) at 100% yield,” *2012 Symposium on VLSI Technology*, T5-4, June 2012.
  - Y. C. Chen, C. T. Rettner, et al., “Ultra-Thin Phase-Change Bridge Memory Device Using GeSb,” *IEEE International Electron Devices Meeting (IEDM 2006)*, paper 30p3, December 2006.
- 29 conference proceedings articles
- 93 contributed conference presentations
- 20 U.S. patents (+ 7 pending)

### **RESEARCH INTERESTS**

- Prior work in holographic data storage, photon echoes, computational electromagnetics, nanophotonics, computational lithography, phase-change memory, storage class memory, and novel access devices based on Mixed-Ionic-Electronic-Conduction (MIEC) materials
- Current interests: non-volatile memory, cognitive computing, artificial intelligence (AI).