

“SPINTRONICS/BRK/ECE Seminar”

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WANG, ROOM 1004

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Nano MTJs for Emerging Computing Paradigm

Abstract: The conventional scaling of today’s silicon-CMOS technology cannot satisfy the performance and energy-efficiency needs of abundant-data applications such as deep learning, as they require real-time analytics on enormous quantities of user data. Therefore, research is essential on novel computing hardware to tackle the fundamental limitation of either the conventional semiconducting materials or von Neumann computing architecture. The nano MTJ (nanoscale magnetic tunnel junction) possesses the great potential to advance the emerging computing paradigm due to its excellent scalability, tunability and compatibility, alongside the intrinsic benefits in high-speed and low-power operation originating from the fundamentals of nanomagnetism. In this talk, cutting-edge spintronics research with nano MTJ is introduced as a novel device platform for embedded memory (STT-MRAM) and neuromorphic computing (spintronic synapses and neurons) applications. For STT-MRAM, some pioneering works on improving the manufacturability of nano MTJ as well as understanding the spin-dependent transport in nanomagnets are presented. For neuromorphic computing, a novel experimental approach to the reconfigurable spintronic synaptic element is demonstrated by using the perpendicular MTJ. The other recent research projects of the UTSA Nanoelectronics Laboratory, including the development of all-spin logic based on 2D materials, are also discussed briefly.

Bio: Dr. Ahn is currently an Assistant Professor of Electrical Engineering (EE) at The University of Texas at San Antonio (UTSA). Previously, he served as a Senior Panel Process Engineer at Apple, Inc. (Cupertino, CA) and as a post-doctoral researcher at Stanford University. He received his Ph.D. in EE at Stanford University in 2015, under the supervision of Prof. H.-S. Philip Wong. He joined Stanford in 2010, after a 3-year research career on the STT-MRAM technology with the Korea Institute of Science and Technology (KIST) in Seoul, Korea. He received the B.S. and M.S. degrees in EE from the Korea Advanced Institute of Science and Technology (KAIST) in Daejeon, Korea, in 2005 and 2007, respectively. In 2004, Dr. Ahn studied Electrical and Computer Engineering at Purdue University as an exchange senior student. He is the author of over 50 peer-reviewed research journal and conference papers and wrote one book chapter of Emerging Nanoelectronic Devices. Dr. Ahn has been the recipient of numerous awards (over \$700K) and honors, including the AFOSR grant in Quantum Electronic Solids (2019), the John Bardeen Research Award for Excellence in Nanodevice Research (2014), and the Best Summer Research Intern Award by T.-C. Chen at IBM T. J. Watson (2013). He is currently serving as the EE concentration chair for Electronic Materials and Devices at UTSA, and the technical committee member for IEEE Electron Devices Society (EDS) optoelectronic devices.

