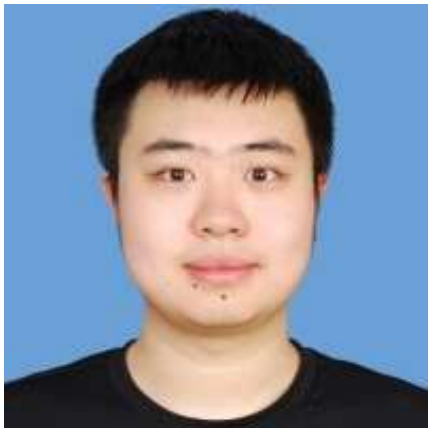
UCONN
COLLEGE OF ENGINEERING
ELECTRICAL & COMPUTER ENGINEERING

ECE Fall 2024 Colloquium Series



Friday, November 22, 2024
11:15 am ITE 336
(Refreshments in ITE 301 at 11 am)

Ultra-Scaled Energy-Efficient Electronics

Dr. Yanjie Shao

Abstract:
Microelectronic technology has been the backbone of the "digital" revolution in the past 60 years. Recently, with the explosive growth of artificial intelligence and Internet-of-Things, developing electronics with high performance, maximum energy efficiency and minimum footprint is of urgent need. In pursuing this, two approaches are attractive: (1) low-voltage electronics and (2) on-chip rich functionality integration. In this talk, we will show our latest research on these two avenues. First, we target a supply voltage ≤ 0.3 V by exploiting quantum-mechanical tunneling in a broken-band heterojunction semiconductor system (GaSb/InAs). We will show that a combination of sub-thermionic turn-on, high drive current and ultimate footprint scalability can be achieved simultaneously in a vertical-nanowire tunneling transistor configuration. At 0.3 V, a significant performance boost over state-of-the-art CMOS technology is demonstrated. Second, we aim to develop a versatile high-density back-end-of-the-line (BEOL) electronic and memory platform by employing amorphous oxide semiconductors. By utilizing plasma-enhanced atomic-layer deposition (PEALD), we synthesize enhancement-mode BEOL transistors with record performance. Furthermore, we integrate ferroelectric (FE) hafnium-zirconium-oxide (HZO) as a nonvolatile memory component, fabricate active-area-scaled FE transistors, and study FE switching behavior down to the single domain level. Finally, we will briefly discuss the possible origin of FE fatigue in oxide-based FE transistors.

Bio:
Yanjie Shao is currently a postdoctoral researcher at Microsystems Technology Laboratories (MTL), Massachusetts Institute of Technology (MIT). He obtained a B.S. degree from University of Science and Technology of China (USTC) at 2019, a S.M. degree from MIT at 2021, and a Ph.D. degree from MIT in 2023. His research interests include emerging semiconductors and dielectrics, nanoelectronics, and AI hardware. He is a recipient of 2023 Intel Outstanding Researcher Award.

https://www.mtl.mit.edu/