SLAC COLLOQUIUM SERIES

Spins, Bits, and Flips: Essentials for High-Density Magnetic Random-Access Memory

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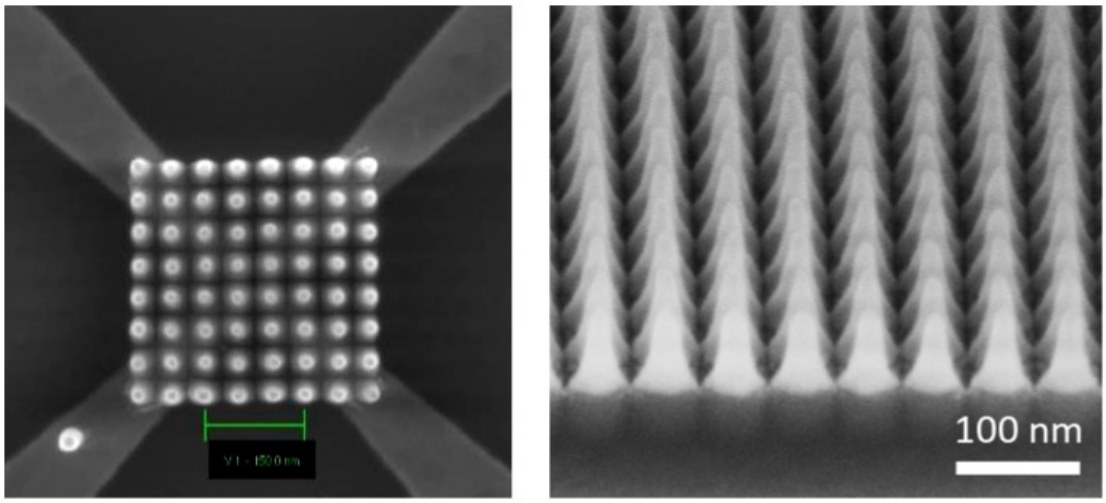
Abstract:
The magnetic tunnel junction (MTJ), a device comprised of two ferromagnetic electrodes with a thin (~1nm) insulating tunnel barrier in between, was first proposed in a Ph.D. thesis by Michel Jullière in 1975 and reached widespread commercialization nearly 30 years later as the read sensor in hard disk drives. MTJs became essential for data storage in consumer laptop and desktop computers, early-generation iPods, and now in data centers that store the information in "the Cloud." The application of MTJs has expanded even further to spin-transfer torque MRAM as a replacement for embedded flash memory. Innovation in MTJs continues in order to deliver faster, high-density MRAM that can support last-level cache and in-memory computing.

In this talk, I will describe the seminal discoveries that enabled MTJs for pervasive use in hard disk drives and MRAM. As the demand for faster and higher density memory persists, still more breakthroughs are needed for MTJs contained in device pillars (or bits) with <50nm diameter. I will describe the magnetic properties of MTJs that are essential for high-performance MRAM. In addition, I will describe an innovative nanofabrication process for achieving dense arrays of MRAM bits with 50nm full pitch.



50 nm full pitch arrays of STT-MRAM bits

June 6 , 2022 | Zoom | 3:30 pm - 4:30 pm