Northwestern | McCORMICK SCHOOL OF ENGINEERING

Materials Science and Engineering

COHEN Lecture

David A. Muller

Professor
Applied and Engineering Physics
Cornell University

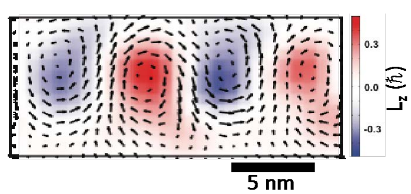
Tuesday, May 30th

4:00pm, Pancoe -Abbott Auditorium

Reception to follow in Willens Wing

New Science enabled by measuring the probability current flow of an atomic-scale electron beam

Complete information about the scattering potential of a sample is in principle encoded in the distribution of scattered electrons from a localized beam propagating through it. A new generation of high-speed, momentum-resolved electron microscope detectors brings us closer to realizing this general goal and in doing so enable new imaging modes spanning sub-Angstrom to multi-micron length scales. This enables not only measurements of probability current flow that can be used to map electric and magnetic fields at high spatial resolution, but also the orbital angular momentum of an electron beam to record torque transfer. We apply these methods and a new high-dynamic range detector developed at Cornell to imaging arrays of ferroelectric polarization vortices in PbTiO3/SrTiO3 superlattices. From the asymmetry in probability current flow, we show the vortices are chiral, with a non-trivial axial component. The detector has also proved useful for a wide range of quantitative applications including the imaging of strain fields in 2D materials, high-dose-efficiency biological imaging, and super-resolution imaging by ptychography.



Bio: David Muller is a professor of Applied and Engineering Physics at Cornell University, and the co-director of the Kavli Institute at Cornell for Nanoscale Science. He is a graduate of the University of Sydney, received a PhD from Cornell University and worked as a member of the technical staff at Bell Labs for six years before returning as faculty to Cornell. His current research interests include the development of a new generation of high-speed imaging electron detectors, and the atomic-scale control and characterization of matter for applications in energy storage and conversion.