

Title: Silicon-based low-dimensional electronic devices: fabrication, characterization, and their physical behavior in the quantum regime

Abstract: Low-dimensional electron systems in silicon have been of great importance to both engineers and condensed-matter physicists. Silicon metal-oxide-semiconductor field-effect transistors, for example, are not only one of the fundamental building blocks of modern electronics but also the system in which the quantum Hall effect and the two-dimensional metal-insulator transition were discovered. In this talk, I will discuss my recent experimental work on several next-generation silicon-based low-dimensional electron systems, including high-mobility Si/SiGe field-effect transistors, foundry-fabricated Si/SiGe single-electron transistors, and a single donor in silicon. The fabrication processes and electrical characterization of these novel devices as well as their intriguing physical behavior in the quantum regime will be presented. The electrical properties of these devices show much promise for a variety of potential applications ranging from high-speed cryogenic electronics to solid-state quantum computing.