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Superconducting Diode Effect in Rashba Nanowires

26/03/2025 - [Stacey Lecture Theatre 2 \(SLT2\)](#)

The superconducting diode effect (SDE) enables superconducting devices to preferentially conduct current in one direction, offering exciting possibilities for quantum technologies. In this talk, I will discuss the SDE in Rashba nanowires, focusing on the interplay between broken symmetries, spin-orbit coupling (SOC), and external magnetic fields. Using a self-consistent Bogoliubov de-Gennes approach, I will demonstrate how these factors can drive highly efficient SDE. Remarkably, advanced forms of SOC can induce SDE even without specific magnetic field configurations, offering a novel way to probe material properties. I will also present a detailed phase diagram that unveils the emergence of the Fulde-Ferrell-Larkin-Ovchinnikov (FFLO) superconducting state. These insights pave the way for optimizing nanoscale superconducting devices, bridging theoretical predictions with practical applications in next-generation energy-efficient electronics.