DOCTORAL

DEFENSE

Electronic Properties in Nanowire-Based Complex Oxide Devices

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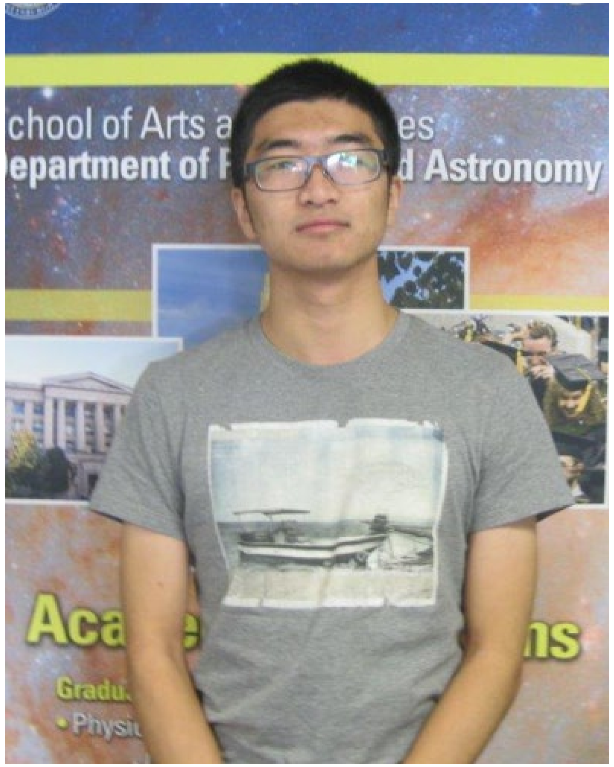

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Abstract: A wide range of novel electronic properties have been observed in nanodevices with a reduced dimension at the $LaAlO_3/SrTiO_3$ interface thanks to c-AFM lithography. In this dissertation, electronic properties at the $LaAlO_3/SrTiO_3$ interface are studied with nanowire-based devices. Frictional drag between coupled nanowires is studied at the high magnetic field and superconducting regimes. In both high magnetic field and superconducting regimes, the drag resistance is insensitive to the separation between nanowires, which suggests the dominant electron-electron interaction is non-Coulombic in nature. The frictional drag in the superconducting regime suggests a reduced dimension in the superconducting nanowire due to the 1D nature of the superconductivity at the $LaAlO_3/SrTiO_3$ interface. Frictional drag involving one electron waveguide is studied and shows a correlation with the subband structure of the electron waveguide when the electron waveguide is used as the drag wire. We discuss possible directions for the frictional drag with electron waveguides. Thermal transport experiments can provide additional insights into electronic properties at the interface. We measure the thermopower in the electron waveguide which exhibits quantized ballistic transport and the Pascal liquid phase. The thermopower can be described by the Mott relation and exhibits a different temperature dependence when the electron waveguide is at a conductance plateau. Our thermopower experiment paves the way for quantized thermal transport studies of emergent electron liquid phases in which transport is governed by quasiparticles with charges that are integer multiples or fractions of an electron.