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Charge injection and transport in nanowires

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Semiconductor nanowires show promise in electronic, optoelectronic, and sensing devices. To realize this promise, a fundamental understanding of charge injection and electronic transport in these novel nanomaterials is necessary. In this presentation, I will discuss recent work that couples experiment and theory to address this topic. For example, in GaN and InAs nanowires, we achieve efficient charge injection and find that space-charge-limited currents are unusually strong. In contrast, charge transport across individual Au-nanoparticle/Ge-nanowire interfaces is injection-limited, and surprisingly, the conductance increases with decreasing nanowire diameter due to a dominance of electron-hole recombination. Furthermore, we find that transport in GaAs nanowires is governed by charge traps, which can be activated to reveal the nature of the charge injection at the contacts. More generally, our results indicate that a broad range of electronic transport regimes can be observed in semiconducting nanowires depending on the particular material system and growth process.